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Influences of policy learning, transfer, and post transfer learning in the development of China's wind power policies

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I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature:.………………………………………

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UNIVERSITY OF SUSSEX

Jenny Lieu, Doctor of Philosophy

INFLUENCES OF POLICY LEARNING, TRANSFER, AND POST TRANSFER LEARNING IN THE DEVELOPMENT OF CHINA'S WIND POWER POLICIES

Abstract

China's renewable energy (RE) sector is developing rapidly, driven by growing energy needs, increased awareness of climate change, and heightened concerns for environmental degradation caused by the country's industrialisation process over the past decades. The Chinese government has been dedicated to the development of its RE industry and has engaged extensively in drawing lessons from abroad and applying these lessons to its own experiences in the post transfer learning process to develop policies that have contributed to the development of the largest wind power sector in the world.

This thesis provides a perspective of how China, a 'socialist market economy', has applied primarily market mechanisms from liberalised market systems found in Western Europe and the United States to develop its domestic wind power sector. Having similar economic, political and cultural value systems is not necessarily a prerequisite to policy learning; rather policy objective compatibility is a more important criterion when drawing and transferring lessons.

The objective of this thesis is to analyse how the policy learning from abroad, policy transfer and the post transfer process has influenced the development of wind power policies in China through the application of a framework to analyse the policies. The framework was specifically developed for this thesis and was largely based on policy learning and policy transfer concepts as well as general learning literature. Using the wind power policies in China as a case study, this thesis identifies elements of policy learning from abroad and examines how transferred policies have been applied in *first level policies* that are top-level coordinating policies (e.g. mid- to long-term strategies and frameworks) as well as *second level policies*, with specific objectives focusing on diffusion and adoption (e.g. renewable energy policy instruments). Overall, studying policy learning from abroad, policy transfer and the post transfer process contributes to understanding how learning across political boarders contributes to the domestic policy formation and implementation process.

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Acronyms

BauGB - Federal Building Code

BIREC - Beijing International Renewable Energy Conference

BMU - German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

BMZ - Federal Ministry for Economic Cooperation and Development

BOE - Billion tons of oil equivalent

Bbl/d - Barrels per day

CDU - Christian Democratic Union

CEPRI - China Electric Power Research Institute

CPC - Communist Party of China

CPEC - Coal and Electricity Price Co-move

CRESP - China Renewable Energy Scale-Up Program

CRS - Center for Resource Solutions

CSEP - China Sustainable Energy Program

CSU - Christian Social Union

CWPP - China Wind Power Research and Training Project

DOE - United States Department of Energy

EC - European Commission

EEG - Erneuerbare-Energien-Gesetz (Renewable Energy Source Act)

EPAct - The Energy Policy Act

EU - European Union

EWG - exempt wholesale generators

FERC - the Federal Energy Regulatory Commissions

FFL - Fossil Fuel Levy

FITs - Feed-in tariffs

FTAs - Fuel and Transportation Add-ups

FYP - Five Year Plan

GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit

GW - Gigawatt

GWEC - Global Wind Energy Council

GDP - Gross Domestic Product

IPPs - Independent power producers

IREDP - Integrated Rural Energy Development Programme

kWh - Kilowatt hour

LVRT - Low Voltage Ride Through

MEP - The Ministry of Environment Protection

MLDP - Medium and Long Term Development Plan

Mtoe - Million tonnes of oil equivalent

MJ - Million joules

MMP - Mandated Market Policy

MMS - Mandated Market Share System

MoC - Ministry of Construction

MOE - Ministry of Energy

MOEP - Ministry of Electric Power
MOF - Ministry of Finance
MOST - The Ministry of Science and Technology
Mtce - million tonnes of coal equivalent
MW - Megawatts
MWh - Megawatt hour
MWREP - Ministry of Water Resources and Electric power
NDRC - National Development and Reform Commission
NEA - National Energy Administration
NELG - National Energy Leading Group
NESP - National Energy Strategy and Policy 2020
NFFO - The Non-Fossil Fuel Obligation
N_2O - Nitrous oxide
NPC - National People's Congress
OECD - Organisation for Economic Co-operation and Development
OPEC - Organization of Petroleum Exporting Countries
PCTCs - Power Coordination and Transaction Centre
PURPA - The Public Utility Regulatory Policy Act
QF - Qualifying facilities
RE - Renewable energy
REDF - Renewable Energy Development Fund
R&D - Research and development
REC - Renewable energy credit-trading programme
REL - Renewable Energy Law
RES - Renewable energy sources
RMB - Renminbi
RO - Renewables Obligation
RPS - Renewable portfolio standard
SASAC - State-owned Assets Supervision and Administration Commission
SEO - State Energy Office
SEPA - State Environmental Protection Administration
SERC - State Electric Regulatory Commission
SETC - State Economic and Trade Commission
SCNPC - Standing Committee of the National People's Congress
SDPC - State Development and Planning Commission
SGCC - State Grid Corporation of China (SGCC)
SOE - State-owned enterprises
SOU - State-owned utility
SPC - State Power Corporation
SPD - Social Democratic Party of Germany
StrEG - the Feed-in Law
WERT - Wind Environment Research & Training Centre

Other information:

Currency Table: Currency exchange based on the GBP: Average exchange rate from January 2009 to December 2011

Currency	Equivalent to in GBP
RMB	0.0951
USD	0.6370
EUR	0.8723

Source: values taken from Oanda historical exchange rates http://www.oanda.com/currency/historical-rates

Chinese names are written in the following order: first (given) name then surname with the exception of leaders in China, whose names are written as popularly known (surname and given name).

Chapter 1 - Introduction

1.1 What is policy learning from abroad and policy transfer?

Defining the concepts

Incidences of policy transfer has been increasing in light of globalisation, the rise of international organisations, increased opportunities for information exchange, and shifts in public policy from a national political system to a globalised system (Parson, 1996 qtd. in Dolowitz and Marsh, 2000; Marsden and Stead, 2011; Bulmer et al. 2007, p. 5). Over the past decades, governments have been engaging in the *policy learning* process and have actively drawn examples from external governments with the motive of transferring the lessons to their home environment. The process of lesson drawing from abroad is intentional, requiring extensive research and does not include the passive diffusion of knowledge based on previous experience or the incidental movement of policy makers from one region or organisation to another (Rose, 2005).

Policy learning from abroad can lead to *policy transfer*, where incremental or fundamental policy changes occur at a multi-level and multidisciplinary context within the home country (Evans and Davies, 1999). In essence, policy transfer occurs when the policy lessons are "used in the development of policies, administrative arrangements and institutions in another time and/or place" (Dolowitz & Marsh, 1996, p. 344). Once policies from abroad are implemented at home, they are often adjusted and adapted to the unique local conditions and become a part of the *post transfer learning process*. Policies evolve in the post transfer learning process, partly as a blend of domestic policy development and lessons from abroad, since policy lessons may continue to be drawn externally to address emerging issues.

Relevance of policy learning and transfer

Studying policy learning from abroad and policy transfer recognises that policy making is not strictly an isolated domestic process and can help provide a better understanding of how learning across political boarders can influence domestic policy formation and implementation. Policy makers can benefit by drawing from an external pool of efficacious policies for best practices or they can draw lessons to avoid ineffective policies. Although policy lessons cannot be directly copied and applied, lessons from abroad can provide a reference point for addressing domestic issues.

Drawing lessons across boarders can promote cooperation in addressing global issues such as climate change. Countries at a less advanced stage in their low carbon policy development can draw lessons from countries at the forefront of designing and implementing policies to reduce green house gas emissions, such as policies that promote renewable energy (RE). Transferred

policies can then be adjusted to account for the local context including development goals, environmental conditions, the national energy mix, RE resource potential, as well as infrastructure and institutional support structures.

Mainstream study of policy learning and transfer

Evan states that the success of lesson-drawing will depend if the policies from abroad are "compatible with the value system of the recipient organization, culturally assimilated through comprehensive evaluation and, in addition, builds on existing organizational strengths" (2004, p. 467). Due to the reasons of compatibility, the majority of studies on policy learning and transfer since the 1980s have primarily focused on western countries or OECD countries with similar ideologies, particularly between the United States and Britain (Dolowitz et al, 1999). The trend has been gradually changing since the mid 2000s with some studies examining policy learning and transfer among Asian countries as well as between Asia and the west (Wang 2010; Kwon, 2009).

A majority of policy learning and transfer studies focus on presenting incidences and evidence of transfer and are descriptive when exploring policy transfer between countries but do not discuss the process systematically (Dolowitz, and Marsh, 2000). Generally studies are empirically based with limited reference to policy transfer concepts and seldom examine the impact of policy learning and transfer within the domestic context, also known as the post transfer process.

Studying policy learning and transfer in this thesis

This thesis aims to examine policy learning and transfer beyond OECD borders and studies the process of policy learning and transfer as well as post transfer learning based on a framework drawn from policy learning and policy transfer concepts and general learning literature. The thesis also provides evidence that policy lessons do not necessarily need to be drawn from countries and regions with similar policy goals (i.e. addressing climate change) but lesson learning and policy transfer can occur between countries with differing political structures and at varying levels of social and economic development. More specifically, studying policy learning and transfer in China gives a perspective on how a "socialist market economy"[1] has applied policies primarily from western market systems and also emphasises the importance of examining the post transfer process in which transferred policies are adapted and modified according to the domestic context.

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[1] "socialist market economy" is defined as an economic system that combines state ownership and the market allocation of resources (Feng, 2008; Gregory & Stuart, 2003).

1.2 Applying policy learning from abroad and policy transfer concepts to analyse China's renewable energy and wind power policies

RE and Wind power policies: a context for studying policy learning and transfer

China is an interesting and dynamic country to examine the phenomenon of policy learning and transfer within the RE area. It has engaged extensively in drawing lessons from abroad and has applied these lessons along with its own experiences to develop a myriad of policies that have enable the unparalleled development of its wind power sector. Policies implemented in the RE and wind power sector are an amalgamation of policies from other countries that have been adjusted and adapted into China's context.

Wind power development in China has experienced unprecedented growth over the past years, placing it among the top wind power markets in the world. By 2010, China had the largest installed wind power capacity of 44,733 MW, surpassing the United States, which had an overall installed capacity of 40,180 MW (CWEA, 2010; GWEC, 2011). The present status of the Chinese wind power sector is a combined result of policy and market initiatives carried out over the past decades; but significant and sustained growth has occurred only since the mid 2000s with the development of dedicated RE and wind power policies based on lessons drawn from abroad.

Learning from abroad

In the case of China's RE policy framework, its adoption of market-based mechanisms and instruments largely stem from Western Europe and the United States (referred to as western countries in this thesis). Drawing lessons from the west is particularly interesting considering the large differences in economics, politics and culture. China is at a different economic and RE policy development stage compared to western countries and has the advantage of learning from the successes or failures of other countries that have already experienced a certain economic or policy pathway. According to Dolowitz and Marsh (1996), learning from other countries result in time and resource savings. In theory, costly mistakes can be avoided and the best policy practices can be implemented. If a country lacks the supporting institutional systems in its energy sector, it may also look towards other country examples to set up the necessary institutions or the government may adjust the policies from abroad to fit the existing system structure.

Motivations for engaging in policy learning and transfer

There are elements of internal and external forces that encourage China to voluntary seek best practice policies from abroad or that pressurises China to adopt and implement particular policies. One driving motivation is to diversify its energy mix to include RE, which will help

improve energy security, particularly with uncertainties surrounding oil and gas resources from politically unstable countries. Increasing the share of RE also decreases dependence on coal, the largest source of carbon emissions, and a major source of air pollution and contributor to acid rain. In the first part of the 1990s, China's carbon emissions accounted for over 90 percent of the global increases. The alarming increase has raised the attention of the international community to pressurise China into reducing emissions (Zhang, Wang, Zhuang, Hamrin, & Baruch, 2001). Other forms of external pressures may stem from international organisations pushing their policy agenda through directly funding RE projects in China or indirectly placing pressure by funding studies to implement a specific type of policy mechanism or regulatory body.

Overall, this thesis contributes to expanding the geographical scope of policy learning and policy transfer studies outside of OECD countries and also illustrates that similar value systems are not necessarily a prerequisite to policy learning; rather, policy objective compatibility is a more important criterion when drawing and transferring lessons. China has also drawn RE policy lessons from western countries with different political and economic structures, thus challenges the notion that lessons should be drawn from countries with similar contexts. The transfer of RE and wind power policies do not fundamentally change the existing political ideology but builds or adjusts energy policy and institutional structures. China may be a centrally planned state in terms of it political decision making process but its industry and business functions with some elements of competition in the market, which provides a platform for China to adopt market-based mechanisms in its RE sector.

1.3 Organisation of the thesis

The objective of the thesis is to analyse how policy learning from abroad, transfer and post transfer process has influenced the development of RE and wind power policies in China. The scope of the thesis will cover RE policies through a multi-level policy analysis based on the policy function of coordination, diffusion and adoption with an emphasis on the wind power policies. This thesis is organised into four sections.

The first section begins in Chapter 2: "Background to China's Energy Structure and Renewable Energy Policy" . The chapter sets the context for studying the policy transfer process by providing an overview of China's current energy status, market structure, the political economy, as well as a historical review of key energy and RE policies and institutions.

The second section, comprising of Chapters 3 and 4, contains the literature review, the research questions and theoretical framework. Chapter 3, "Literature Review and Framework Introduction" summarises concepts and definitions found in policy learning and transfer

literature and discusses the limitations and gaps with existing policy learning and transfer studies. A framework is drawn up comprising of five main questions. The first four questions are based on Dolowitz and Marsh's (2000) policy transfer framework: "Why is China drawing lessons from abroad?" "What policies are transferred?" "From which countries are the policies drawn from and who are the key actors in the policy transfer process?" "How are policies transferred?"

The last question, "how are transferred policies implemented in China?" introduces the component of post policy transfer learning which studies the impact of transferred policies at the first policy and second policy level in China. First level policies are high-level policies that provide a broad outline of energy and RE strategies, objectives and targets. Second level policies are detailed policy instruments that assist in implementing first level policy objectives. Chapter 4: "Research Questions and Methodology" discusses how the framework introduced in Chapter 3 answers the research question and outlines the main methodologies applied in the study. The research design is based on a case study approach that examines two units of analysis and is carried out using qualitative methods based on interviews and secondary literature supported by quantitative data. The overall case study explores the development of China's wind power policies and the units of analysis within the wind power case study are: first level macro economic and RE and grid policies, as well as second-level policies for technical grid codes, electricity end-users, and RE generators.

The third section, discussed in Chapter 5: "Influential Renewable Energy Policies from Abroad", provides additional context by identifying key RE policy instruments and presents information of specific energy and RE policies from four jurisdictions: the European Union, the United States, the United Kingdom and Germany.

The fourth section consists of Chapters 6 to 8, the empirical chapters that apply the framework questions. These chapters are organised into the two units of analysis. First level policies are studied in Chapter 6 and second level policies are explored in Chapters 7 and 8. These chapters provide evidence of policy learning from abroad using interview content and secondary literature and also examines post transfer learning.

Chapter 6: "First Level Renewable Energy Policy Implementation in China" introduces China's energy and supervisory institutions influenced by learning from the U.S. as well as target setting in China's Renewable Energy Law (REL) and the Medium and Long Term Development Plan (MLDP), which draws from European Union learning experiences.

Chapter 7: "Second Level Policies (Part 1): End-user Tariffs and Grid Connection Codes" examines China's grid technical standards at the second policy level based on learning examples

from the U.S. and Germany. Further experiences are also drawn from Germany's policy lessons for electricity end-user tariff policies to fund RE grid connection at the second policy level.

Chapter 8: "Second Level Policies (Part 2): Mandated Market Share (MMS), Tendering Policies and Feed-in Tariffs for Wind Power" studies economic incentive at the second level including RE quotas for electricity generators and grid companies, which are policies that have been influenced by policy lessons from the United States. Tariff subsidies are the main policy instruments at the second policy level that promote wind power development. Tariff subsidies have been set through three methods in China. The first method of setting wind tariffs (1994 to 2009) was determined by the government who assigned tariff prices to every wind power project. The government tariffs were replaced in 2009 with fixed feed-in tariffs consisting of four prices determined by the wind resources. These forms of tariff setting have been based on Germany's policy lessons. The third method of setting wind tariffs ran in conjunction with the government tariff and was established through concession projects (2003 to 2008) and was influenced by policy lessons from the United Kingdom.

Chapter 9: "Conclusions: Reflections and Lessons" provides an explanation of how the framework was applied in the study and summarises the main discussions in Chapters 2 to 8. Policy lessons and reflections are also presented along with the main contributions of the studies. The thesis concludes with additional areas to examine and some final thoughts to take away in the area of policy learning from abroad, policy transfer and post transfer learning.

Chapter 2 - Background to China's Energy Structure and Renewable Energy Policy

This chapter provides the context for studying China's energy and renewable energy (RE) sector. The first section presents a snapshot of China's present energy status and wind power sector. The next two sections in this chapter give a historical overview of China's electricity sector and the development of the first and second level RE policies as well as an overview of the grid policy development. The final section introduces the political party system and discusses some of the major institutions that oversee, support, and monitor the energy and RE sector.

2.1 China's current energy status

China's rise in energy consumption has been fuelled by impressive economic growth over the past decade. In 2000, China's real GDP growth rate was 8 percent, and by 2012, its growth rate was at 10.3 percent (CIA 2001; 2011). In 2005, China's energy consumption was forecasted to surpass the U.S. by 2020 (IEA, 2005); but by 2009, China had already become the largest energy consumer in the world with an energy consumption of 2.25 billion tons of oil equivalent (BOE), exceeding the United States by 0.4 percent (2.17 BOE) (IEA, 2010)[2].

As China's GDP and energy consumption continues to increase, the government has been reforming its development path by setting stringent goals in its National Energy Strategy and Policy 2020 (NESP) to quadruple its GDP before 2020 while only increasing its energy consumption by two-folds. In its 12th Five Year Plan[3] (FYP) (2011-2015) for energy and industry, the Chinese government has set binding targets to decrease energy intensity by 16 percent per unit of GDP over the FYP period in addition to cutting carbon emissions per unit of GDP by 17 percent from 2010 levels. Other plans included a reduction of major pollutions such as sulphur dioxide by 8 percent as well as ammonia nitrogen and nitrogen oxide by 10 percent from 2010 levels (12th FYP, 2011). In terms of China's energy mix, non-fossil fuel resources (including renewable energy (RE) and nuclear energy) are expected to comprise 11.4 percent of the primary energy consumption by 2015, up from the 8.3 percent target set in 2010.

The Chinese government has been promoting the clean energy market and encouraging investments in the sector. Clean energy investments have amounted to 200 billion RMB in 2009, which is the largest amount invested by any country worldwide. Energy and

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[2] China's 2010 National Bureau of Statistics report asserted that its energy consumption was in fact 2.132 BOE (Xinhua, 2010).

[3] China's Five-Year Plans are economic and industrial development strategies implemented consecutively every five years since 1953.

environmental industries alone reportedly created 27 million jobs and generated 1.7 trillion RMB or 2.84[4] percent of China's overall GDP in 2009 (China Daily, 2010; CIA, 2010).

2.1.1 China's energy mix

China's dependence on coal is one of its greatest hindrances to clean energy production and provides nearly 79 percent of primary energy sources in 2009 (as indicated in Figure 2.1). In order to lower the reliance on coal, China intends to reduce coal consumption to less than 60 percent of the primary sources by 2020 (Sinton et al., May 2005).

Figure 2.1 China's energy fuel mix: share of total primary energy supply in 2009
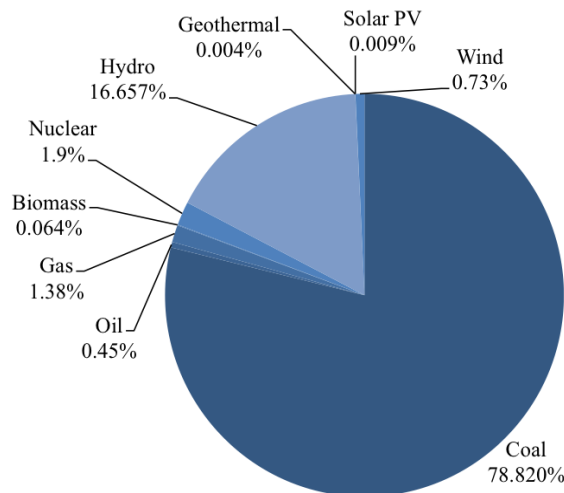
Source: OECD/IEA, 2009

Aside from coal, China is also heavily reliant on oil and is the second largest oil consumer with an estimated consumption of 9.8 million bbl/d of oil in 2011. Additionally, China's oil consumption growth alone amounted to half of the global oil consumption growth in 2011 (EIA, 2012). The country's strong dependence on oil poses energy security risks and can hamper its economic growth due to oil price fluctuations and supply uncertainties. As a result, the government has made significant strides to develop the alternative energy market including nuclear power and RE.

Over the past decade, the mix of alternative energy has steadily increased to address energy security and environmental issues. The alternative energy sector, particularly RE, is viewed as a key sector to developing a clean and sustainable economy. As seen in Figure 2.2, the alternative

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[4] China's GDP: 8.748 trillion USD (CIA, 2010) *6.84 (average 2009 interbank exchange rate; Source: Oanda http://www.oanda.com/currency/historical-rates = 59.8 trillion RMB.

Percentage of energy and environment investments contribution to China's GDP: 1.759.8 trillion RMB/59.8 trillion RMB= 2.84%

energy comprised 2 percent of the overall energy use in 1995 and by 2009 the share grew to 3.7 percent.

Figure 2.2 Share of alternative energy in the overall energy use, 1995-2009

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
% Alternative energy*	2.0%	1.9%	2.0%	2.1%	2.1%	2.3%	2.8%	2.9%	2.9%	3.0%	3.1%	3.1%	3.3%	3.6%	3.7%
■ Alternativ energy*	21	21	22	23	23	25	31	34	39	47	53	57	65	76	84
■ Energy use*	1,047	1,085	1,087	1,086	1,086	1,095	1,091	1,182	1,345	1,568	1,696	1,854	1,964	2,117	2,257
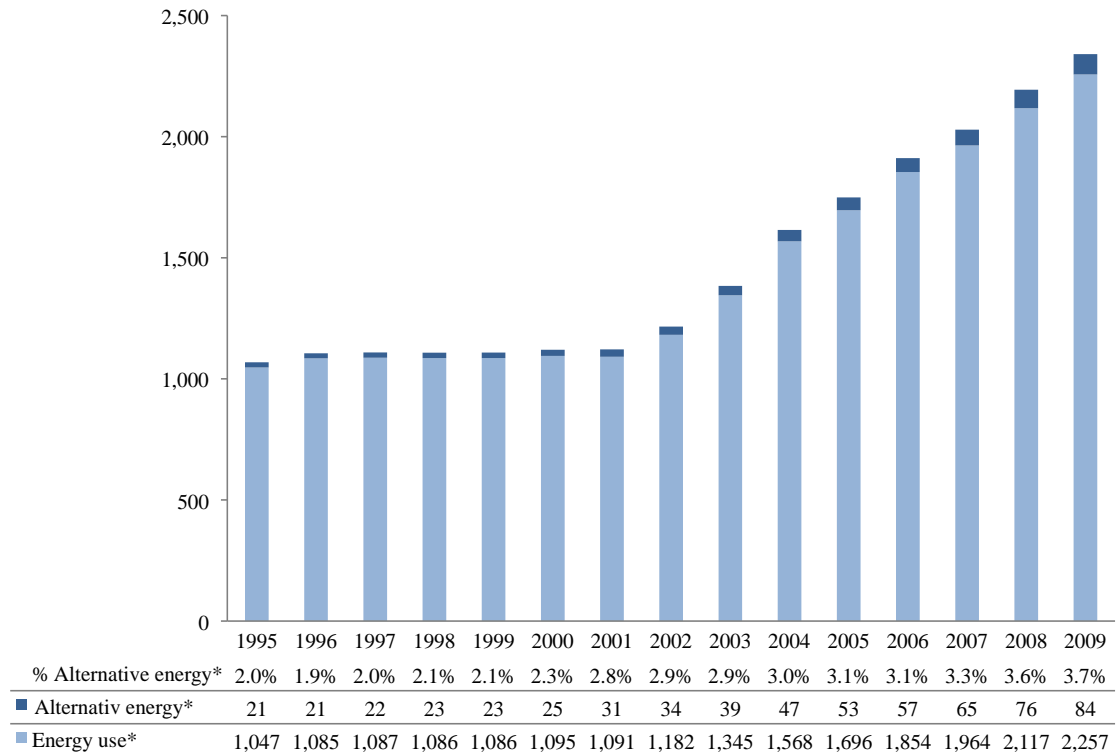
* kt of oil equivalent

Source: World Bank, 2012

According to China's official figures, the growth in its alternative energy generation outpaced the United States in 2009. China also boasts the largest hydropower installed capacity and the most rapidly developing wind power generation sector in the world (Xinhua, 2010).

Within the area of electricity generation, RE makes up 17.5 percent of the overall electricity mix in 2009 (People's Daily Online, 2010), as seen in Figure 2.3. However, when hydropower is excluded, renewable energy sources (RES) only comprise 0.45 percent of the total electricity generation, a significantly smaller share of the overall electricity generation mix.

Figure 2.3 China's electricity generation mix, 2009*
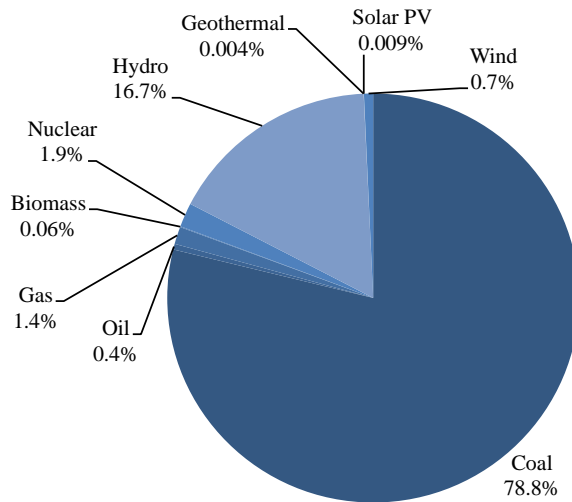
* Percentage of the total electricity generated in 2009: 3,695,928 GWh

Source: OECD/IEA, 2009

Despite the fact that RE only represents a small percentage of China's overall electricity mix compared to fossil fuels, China's decision to develop RE (excluding hydropower) has significant implications due to the sheer size of its electricity market, which produces and consumes the most electricity in the world (CIA, 2012). Developing China's RE sector can open considerable opportunities for carbon emission reductions and market opportunities for both local and global energy players.

2.2 Revisiting the past: an overview of China's electricity industry, market and pricing development

The expansion of electricity generation in China was developed on an ad hoc basis in the late 1880's. During this period, electricity generators were imported from abroad and the first power plant was installed by the British in 1882. Later, more generators were installed primarily to serve the royal family in Beijing, wealthy urban dwellers, and to provide electricity for city street lamps. Gradually foreign investors and governments built basic local grids in large cities including Shanghai and Wuhan. Towards the late 1800s and the early 1900s, the development of the electricity system almost halted and failed to reach the rural regions due to wars and political unrest. The situation improved in the latter half of the twentieth century when the Communist Party took over in 1949 and the electricity sector began to develop again. The state's priority was to quickly expand the electricity sector across the country in order to fuel heavy industries and improve electricity access (Yang, 2006).

From 1949 until 1978, the economy was managed by the state and the electricity sector consisted of a vertically integrated state-owned utility (SOU). All investments, resource and pricing decisions were determined centrally. Separate electricity generation prices, transmission and distribution prices as well as grid access charges did not exist since the entire system was owned and operated by the state. The government developed regional and local grids through large centralised electricity projects. Decentralised rural projects and plants were eventually joined with the regional grids (Ma & He, 2008).

2.2.1 Electricity pricing from the 1960s to the 1990s

Retail electricity prices were established according to catalogue prices based on operation costs and published in the 1965 Electricity and Heat Prices Catalogue. The prices were later revised in 1975 by the Ministry of Water Resources and Electric power (MWREP) who was responsible for overseeing the industry. The MWREP was later disbanded in 1979 into the Ministry of Electric Power (MOEP) and the Ministry of Water Resources (Ma & He, 2008). Other then the price adjustment in 1975, electricity prices remained virtually constant throughout the remainder of the 1970's. The low prices were problematic as utilities charged nominal end-user tariffs that did not cover generation and transmission costs. The utilities needed to borrow from state banks or required funding from the government in order to continue operations. By the mid 1980's the government permitted electricity prices to increase in order to account for the rising transportation and fuel costs (Lam, 2004). Consumer pricing policies have evolved over time from a low government controlled price to one that attempts to better reflect the costs of production without compromising consumers' right to electricity access.

As the economy began to undergo market reforms in a number of sectors during the late 1970s, the electricity sector lagged behind and only began to reform in 1985. Throughout the next twenty years, the development structure in the electricity sector remained relatively intact, as the energy sector was one of the last remaining segments of the strict centrally planned economy (Yang, 2006).

While economic reforms were underway, energy institutions also evolved. By 1988 the previous ministries of coal, oil and nuclear were dissolved and a new Ministry of Energy (MOE) was formed. Later the MOE would disband and the Ministry of Electric Power would reform again in 1993. The frequently changing central institutions were accompanied by major reforms in the electricity sector. In 1985, the State Council released an important key policy report "Interim Provision on Promoting Fund-Raising for Electricity Investment and Implementing Multiple Electricity Prices", prompting changes in several major areas including:

- a separation of duties between the government and business (occurred later in 1997);
- the creation of provincial Electricity Power Bureaus and the empowerment of local

- governments to oversee the power sector and formulate local policies;
- the formulation of policies to attract local and foreign private investors; and
- the establishment of new 'guided prices' for independent power producers (IPPs) (Ma & He, 2008).

With the introduction of independent power producers, the market reformations helped to advance the development of electricity generation, including RE generators, and largely alleviated major power shortages. However, the state-owned utility and IPPs dual guided prices created several problems. IPP prices varied significantly due to investment differences in capital and costs. Meanwhile retail catalogue prices remained the same but generation costs rose quickly.

Consequently, the State Planning Commission established the Fuel and Transportation Add-ups (FTAs), a flexible surcharge released annually that was added on top of catalogue prices to account for the fluctuating costs of coal and transportation. Another surcharge of 0.02 RMB/kWh (the "two-cent" policy) was set in 1988 for the Power Construction Fund to finance and develop the electricity system. The additional tariff was placed on industrial end-users from 1987-1996, but households and some high intensity electricity industries were exempt from the "two-cent" policy. Local governments collected the tariff and the funds were used to build power plants (Lam, 2004). Generation plants built after 1992 and financed by investors without government support were permitted to increase prices to reflect the cost of debt repayment, allowing generating facilities to repay loans.

A "multi-tier pricing" mechanism was created with old and new generating prices along with varied prices for end-users (Lam, 2004). "Cross-subsidisation" also occurred within the end-users tariffs pricing. Commercial electricity end-users cross-subsidised other end-user groups by paying a tariff that was around 70 percent higher than the average for residential and industrial consumers (NDRC, 2005). The changes in electricity pricing set the stage for RE electricity generation. The "two-cent" policy was an early example of spreading electricity generation costs over a selective group while the debt based[5] and operating period tariff attempted to rectify low consumer tariff and profitability issues. The pricing mechanism would serve as a basis in the electricity market where RE generators would have to deal with existing pricing issues as well as new pricing policies set under new legislation.

Later in 1993 the catalogue and FTA prices were joined into a single price, which was revised

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[5] The debt repayment tariff was revised after 1998 to an "operating period tariff" where tariffs continued to be based on debt repayment but at a rate that did not allow for uncharacteristically high profits from conventional energy generation. The operating period tariff still enabled generation plants to earn a reasonable profit and also lowered power grid tariffs in some regions.

according to costs. By 2000, the surcharge was combined into the catalogue prices. Yet another surcharge of 0.003 RMB/kWh was set in 1992 to fund the Three Gorges Construction project, which was subsequently increased to 0.004RMB/ kWh in 1994, 0.007RMB/ kWh in 1996 and 0.015RMB/ kWh in 2000. Apart from the surcharges and catalogue prices, local governments began to apply additional surcharges, creating a web of prices and a bureaucratic processes. Other issues evolved in the dual system with the SOU and IPPs. As a monopoly, the SOU controlled the transmission and distribution systems and IPPs did not have equal access to downstream transmission and distribution networks. Additionally, the double pricing system did not incentivise the vertically integrated SOU or IPPs to increase efficiency and lower prices, leading to inflated consumer prices (Ma & He, 2008).

2.2.2 Energy sector reforms: the late 1990s

The market reformation over the past several decades gradually transformed China's economy. The 14th Party Congress of the Chinese Communist Party in 1992 declared that the ultimate objective of the economic reform was to establish a "socialist market economy", simplistically defined as an economic system that merges state ownership and the market allocation of resources (Feng, 2008; Gregory & Stuart, 2003). Later in 2003, the Third Plenary Session of the 16th Central Committee, the Chinese Communist Party announced the establishment of the basis for a socialist market economy in the "Decision on Some Issues Relating to the Perfecting of the System of the Socialist Market Economy in China." The aim was to "perfect the basic economic system, keeping public ownership as the mainstay of the economy and allowing diverse forms of ownership to develop side by side" (Feng, 2008, p. 158). The intention in the 2003 Decision was to create a "unified, open, competitive, ordered, and modern market economy system" while maintaining to "perfect the macro-control system" over areas of the economy such as planning and administration, fiscal policy, land use, and industrial policy including energy policy (Feng, 2008, p.158) (section 2.6 provide details on the socialist market economy).

The energy sector, although has undergone market reform later than other sectors, is not fully liberalised and is still dominated by state-owned enterprise, which has limited the extent of the private market participation. Major market reforms in the electricity sector were initiated with the enactment of the 1996 Electricity Law until 2002, solidifying the regulatory environment for IPPs. The law protected investor property and established investors' rights for the first time. Additionally, structural changes in the electricity sector resulted in a separation of government functions from commercial functions (as previously stated above in the 1985 policy report "Interim Provision on Promoting Fund-Raising for Electricity Investment and Implementing Multiple Electricity Prices") as well as a separation of state owned electricity generation from the utilities (distribution and transmission). An emphasis was also placed on the environment,

obliging electricity generators to reduce emissions by investing in RE. Overall the Electricity Law was a platform for forming policies to encourage competition and price reforms (Feng, 2008; Andrews-Speed & Dow, 2000).

The Ministry of Electric Power was disbanded in 1998 only after reforming in 1993 and its business and administrative tasks were separated. The business operations were taken up by the State Power Corporation (SPC), which operated like a "western style holding company" with subsidiaries that carried out the generation and transmission activities over the country (Cherni & Kentish, 2007, p. 3618). Government administrative duties were carried out by the newly established State Economic and Trade Commission (SETC), the State Development and Planning Commission (SDPC), and the Ministry of Finance (MOF). SETC was created to manage the electricity sector and was in charge of establishing regulations, enforcement as well as overseeing the demand and supplies within the utilities. At the strategic level, SDPC's duties were to devise plans, power construction projects, and oversee funding and policies related to pricing. The MOF managed the financial aspect of the industry and carried out monitoring and enforcement duties (Yeoh & Rajaraman, 2004). The separation of the government administrative responsibilities and the business operations helped establish the institutional foundation for a more competitive-based market (governing institutions will be discussed further in section 2.7).

On the other hand, the structural reforms did not change the monopoly that previously existed with the SOU. The State Power Corporation continued to dominate the electricity generation market and nearly all of the transmission and distribution systems until they were unbundled in 2002 (Ma & He, 2008). In an attempt to disband the monopoly, the government split the SPC into the following:

- "Big Five" generation companies: Huaneng Group, Huadian Power, Guodian Power, Datang Power Group and China Power Investment Company; and
- two grid companies, the State Power Grid and the South Power Investment Company. The State Grid was further divided into five regional grids with a total of twenty-four provincial electricity companies (SGCC, 2010).

Although the grid companies still monopolised the transmission and distribution of electricity, the split separated the electricity supply and generation functions with the aim of creating competition among generation companies, which would have less than 20 percent of the overall market (Yeoh & Rajaraman, 2004). Both public and private IPPs were able to participate within the electricity generation market and compete with the five major generation companies.

Figure 2.4 provides a geographic coverage of the regional grids in China while Figure 2.5 illustrates the market structure and participants in electricity generation and transmission as well as the end-user groups.

Figure 2.4 Chart of the regional grids in China

Source: Wang & Chen, 2010

Figure 2.5 Electricity market participants, 2006
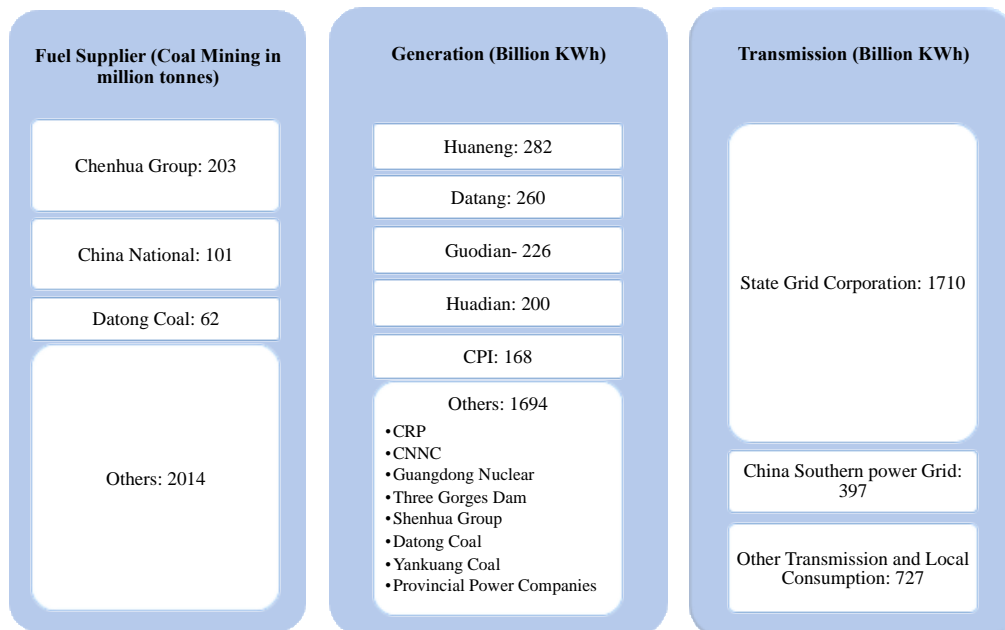
Source: Rosen & Houser, 2007

As seen in Figure 2.5, the present electricity market, transmission and distribution activities are still dominated by the State Grid while the generation market has become more competitive and

fragmented.

With the establishment of the competitive generation market, the State Electric Regulatory Commission (SERC) was formed in 2003 as a market regulator in the power sector and is responsible for issuing licenses for plants that meet environmental regulations. Additionally, SERC is also responsible for revising the Electricity Power Law and forming regulation concerning competition (Yeoh & Rajaraman, 2004).

In the early 2000s, new pricing policies were formed in the "Scheme of the Reform of Electricity Prices for 2002 and 2003" as well as in the "Procedures for Implementation of the Reform of Electricity Prices for 2005". The two pricing schemes set "operational period prices" and "yardstick prices" (Ma & He, 2008, p. 1701) and were applied in areas that did not have a competitive wholesale market. Other areas that underwent market reforms implemented a competitive wholesale transaction system[6]. Retail prices, on the other hand, were set in a catalogue and segregated into five categories. Household electricity prices were based on "a unit-price scheme" for urban households and agricultural users and a "two-component price scheme" was established for the industrial and commercial end-users. Prices were further differentiated in 2004 in the "Notice on Refining the Policy of differentiated Electricity Prices", which increased electricity prices for energy-intensive users (Ma & He, 2008).

Responding to the constrained power supply since 2002, prices continued to rise, reflecting the increasing energy demand and higher costs of coal. The Chinese government responded by implementing the Coal and Electricity Price Co-move (CPEC) policy to tie in electricity prices with coal prices as well as to ensure electricity retails prices were in line with generation prices. If coal prices moved more than 5 percent, the NDRC would adjust the prices to ease price volatilities and pricing pressure between the catalogue prices and rising coal prices. The cost of the adjustment would be passed to selected electricity end-users but household electricity prices would remain stable unless agreed by a public hearing. The CPEC policy was also crucial in creating market mechanisms for the wholesale and retail electricity sector. Power Coordination and Transaction Centres (PCTCs) were established for the wholesale electricity market and generation plants bid in the PCTC market in order to access the grid. Initially the CPEC market aimed to be completed in 2005 but due to frequent power shortages since the early 2000s, completion has been delayed. During the latter half of the 2000s, pilot projects were carried out in the Northeast, Eastern and Southern regions of China (Ma & He, 2008).

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[6] Wholesale prices were segregated into a capacity price (the theoretical maximum volume of electricity supplied) set by the government while the market determined the volume price (the actual price for the volume of electricity purchased).

Overall, the market pricing and structural reforms as well as the establishment of the Electricity Power Law has been essential for establishing the policy foundation for developing the RE sector which began to thrive as a result of government initiatives, market mechanisms, and policies. However, it should be noted that China's socialist market economy differs from the typical market economy observed in western democracy. Although there have been efforts to move towards a liberalised market economy, the government continues to maintain tight control of key sectors and limits competition and private ownership, both crucial elements of a market economy.

The next section gives an overview of China's Five Year Plans and the development of renewable energy policies.

2.3 China's Five Year Plan

When the People's Republic of China was established in 1949, the Communist party did not have the background and knowledge for "technological modernisation" as observed in some western countries, thus Mao Zedong drew on Soviet experience both in the area of policies and technologies. The Soviet FYPs were first introduced in 1928 and led to economic growth through the exploitation and development of natural resources including coal and oil. From the 1940 to 1970, the fossil fuel production in the Soviet Union increased by around five folds from 235 million tonnes to 1,200 (Papp, 1979).

By the early 1950s, China was recuperating from the civil war and looked towards the Soviet Union's 1930s "national building" model, which was particularly attractive compared to the western market economies that struggled with the Great Depression during that period (Lin, Cai, & Li, 1996). But under Mao Zedong's rule, ties were cut with the west and many western businesses, missionaries and teachers were forced out of China. As influence from the west diminished, the Soviet Union became the dominating foreign influence during the 1950s. Their scientists, technicians, and engineers contributed to the development of China's new heavy industries that were supplied by equipment and plants from the Soviet Union (Library of Congress, 2011; Mitter, 2008).

China implemented its 1st FYP from 1953-1957 and followed the Soviet model which promoted industrialisation. During the first FYP, raw coal extraction increased by almost 200 percent from 66.5 Mtoe in 1952 to 130.7 Mtoe in 1957 and crude oil grew from 0.4 Mtoe to 1.5 Mtoe by over 100 percent. Electricity generation overall increased from 7.3 GWh in 1952 to 19.3 GWh in 1957 (Smil, 2003). However, the development and economic growth was achieved at the cost of agricultural and social development. The government presently admits that the "agricultural production couldn't keep pace with industrial production" and that the "socialist

transformation was pushed forward too quickly, which left long-lasting after-effects" (China.org.cn, n.d.).

The Chinese government had strong political ties with the Soviet Union during that period and relied heavily on Soviet financial and technical support. The Chinese leadership also faced immense pressure to catch up with western countries. In fact, one of the goals noted in the Great Leap Forward was to surpass the United Kingdom's industrial capabilities within 15 years (Mitter, 2008). Achieving these plans required implementing efficient policies, and during the 1st FYP period, the FYP proved to be effective in promoting economic growth.

Sino-Soviet ties began to deteriorate from the mid-1950s as a result of diverging political views. Consequently, Mao refocused his efforts on self-reliance and implemented the Great Leap Forward (1957-1962), a plan to significantly increase the country's industrial capacity, particularly in coal, steel, and electricity. Mao hoped to achieve these ambitions in the second FYP (1958-62) and focused on heavy industries, which resulted in a seriously lagging agricultural sector. The Great Leap Forward was a "monumental failure" (Mitter, 2008, p. 58.) that led to widespread famine rather than economic prosperity. China continued to remain isolated from the rest of the world until after Mao's death. Deng Xiaoping succeeded Mao in 1978 and gradually opened its doors, providing a platform for economic and political cooperation as well as policy learning and knowledge exchanges from other countries.

The subsequent 3rd (1966-1970) and 4th (1971-1975) FYP worked on developing the agriculture sector. In order to support industrial growth, the 5th (1976-1980) FYP redirected attention on the heavy industry, such as steel production, and focused on the energy sector in the area of petroleum, coal, oil and gas. The 6th FYP (1981-1985) continued to concentrate on economic development and it was not until the 7th FYP (1986-1990) when social development goals became a central component. In the 8th (1991-1995) to the 9th (1996-2000) FYPs, modernisation plans were introduced, opening up markets to competition while the 10th FYP (2001-2005) sought to increase economic wealth and reduce unemployment.

The FYPs gradually evolved from a strategy based on the Soviet model of heavy industrialisation to a framework that considered a broader concept of development and has had implications in the wind power sector. From the 11th FYP (2006-2010) onwards, the name was changed to Five-Year Guidelines for National Economy and Social Development (still commonly referred to as the 11th Five Year Plan). In principal, the name change signified a move away from the economic-centric and "strategic programming" structure, characteristic of the Soviet influence, towards a "human-oriented reform with a focus on scientific development that would aim at "putting people first, setting up a sustainable development concept, advancing the economic society's and [supporting] people's all-round development" (Gov.cn, 2005). The

11th and 12th FYP also placed a strong emphasis on social development, environmental protection and improved energy efficiency. The altered focus in the 11th and 12th FYP reflects the growing recognition that economic development occurred at the expense of environmental degradation. Geping Qu, president of the China Environmental Protection Foundation stated that China's previous model of placing economic growth as the priority and addressing environmental pollution as a secondary concern has led it to its current environmental state (Gov.cn, 2006). The changes of priorities in the past decades indicate (on a formal level) that decisions makers are learning and adjusting development goals to integrate energy and environmental objectives as a part of the national economic and social development plans.

The following section examines the development of the RE policies with an emphasis on China's renewable energy policies.

2.4 Overview of China's renewable energy policy
2.4.1 Early development period in the rural regions

During the mid-twentieth century in China, the main objective of RE development was to provide electricity in impoverished rural areas. Subsidies for RE and the improved biomass stoves programme were implemented as early as the 1950s through to the 1960s. During this period, the state set aside special funds for small hydro projects by supporting water construction and conservation activities in the rural area. In the 1970s, the government provided subsidies for RE electricity producers in the rural regions as well as to expand biogas, fuel wood, and coal-saving technologies in these areas. There was a strong emphasis to promote small-scale hydropower and biomass. By the 1980s, the state pushed forward rural economic reforms and increased financial support through grants, loans and subsidies for small hydropower to meet growing electricity demands in the rural regions. In 1983, the State Council appointed the Ministry of Water Resources to oversee the Small Hydro Power Programme in order to provide energy for one hundred counties without electricity. Six years later, over 88 of the 100 counties installed 100W of electricity per capita. Another project, the Warm Spring Programme supported small hydro projects often less then 100kW and was targeted at households and small businesses. The small-scale hydro programme built an installed capacity of 16 GW, which contributed to a sizable portion of the rural electricity needs (UNDESA, 2003).

RE was developed on a larger scale during the 1980s when the Ministries of Agriculture, Forestry and Waste Resources implemented the Integrated Rural Energy Development Programme (IREDP). IREDP was a part of the Rural Economic Development Plan that offered inexpensive energy alternatives to facilitate economical and social development in rural communities. Biomass was viewed as an important means of addressing energy needs in the

rural regions, although other RE technologies were also promoted, including solar thermal installations, biogas and wind power. The IREDP focused on biomass to create a self-reliant rural energy sector. It replaced the previous Improved Stoves Programme that began in the 1950s, and continued to further the distribution of biomass stoves. Large-scale forests farms were planted to ensure a steady supply of wood, and improved biomass stoves were distributed on a mass scale. Initially, the programme was carried out in three counties and eventually expanded to over one hundred counties through the 8th FYP period (1991-1995). From 1982 to 1992, improved stoves were installed in over 129 million households in rural regions, or 50 percent of all rural households (Smith, Gu, Huang, & Qiu, 1993). By 1994, the number of improved stoves distributed increased to 150 million (Bhattarai, 1995; UNDESA, 2003).

2.4.2 Towards a national renewable energy outlook

Throughout the 1950s to the 1980s, RE development was mostly limited to rural regional programmes while in the early and the mid-90s, the Chinese government began to view RE as a part of its national energy strategy and formulated industry-specific policies to promote RE. In 1994, the former Ministry of Electricity implemented the first RE grid connection policy "Management on Joint Operation of Wind Energy Power Plant" during the initial development of the wind power market. The policy stated that the utilities should assist with wind power grid connection by setting up the necessary transmission lines to the nearest substation. In addition to grid connection, utilities were required to purchase all wind-generated electricity at a set tariff, a premium price set above the average electricity price. The extra costs were spread across the national grid power company (Zhang 2009). Guaranteed grid connection along with the premium tariffs installed some confidence in the market and prompted some investors to participate in the generation market. But growth in the wind power market was still limited, partly as a result of the ambiguous supporting policies. Additionally, government guided tariffs were also established in 1994 to promote wind power generation. The prices were set according to the total power generation costs and loans plus a "reasonable" profit. Eventually, the State Planning Commission based the average tariff for wind power on the turbine operation period with a loan payment over a period of fifteen years (Liu, 2007).

In the same year, 1994, the State Council issued the "White Paper on Population, Environment and Development in the 21st Century" as a response to the United Nations Conference on Environment and Development in 1992 (Rio Earth Summit). The white paper discussed RE medium and long-term economic and social development plans, which marked the first time RE development was addressed at the national level. In 1995, the "Programme on New and Renewable Energy Development in China, 1996-2010" was implemented following the recommendations from the white paper. The State Planning Commission (now the National

Development and Reform Commission, NDRC), Economic and Trade Commission and the Science and Technology Commission (now the Ministry of Science and Technology, MOST) collaborated to implement the goals of incorporating RE into the national economic development plans. Targets were established to promote RES including increasing biogas supplies to households, increasing solar energy and electricity from small hydro, as well as increasing wind and tidal power capacity (WRI, 2009). In order to achieve the targets, the programme was divided into two phases. The first phase focused on developing more mature technologies while greater research and development was carried out for less-mature technologies with the aim at eventual commercialisation. The programme's second phase focused on making newer technologies available at a larger scale.

There were also other RE programmes running alongside the New and Renewable Energy Development programme during the 9th FYP (1996-2000), including the Brightness Programme. The programme was implemented in 1998 shortly after the International Brightness Programme, which ran from 1996 until 1999 and was initiated in the 1996 World Solar Summit held in Zimbabwe. The programme aimed to provide electricity access to 23 million farmers and pastoralists in rural and remote locations, and set a target of 100 watt per capita by 2010. The target was to be achieved by decentralised wind and solar PV installations, a more cost effective solution compared to diesel generators and connecting the households to the grid. Furthermore, meeting this target would provide electricity to 77 percent of the population in 1999 without electricity access. The programme extended to the 10th FYP (2001-2005) and the State Council set aside 400 million RMB to provide electricity access in villages and households throughout Gansu, Qinghai, Inner Mongolia, Tibet, and Xinjiang. Foreign monetary and technical support also contributed to the widespread electrification. For instance, the Dutch government provided financial grants for the Xinjian programme and the German government offered financial and technical support for solar PV village systems. The collaborative national and international efforts led to electricity access for over 1.78 million households by 2004 (Wang, 2009; NREL, 2004; CREIA, 2004; Ma, 2004).

In the late 1990s, support for RE development extended beyond providing electricity for the unconnected in the rural regions. The State Development and Planning Commission (SDPC) (renamed in 1998 from the State Planning Commission), promoted the RE market by creating a demand for wind power and organised competition in the market. The SDPC and the Ministry of Science and Technology also reinstated the grid's obligation in 1999 to purchase RE electricity in the "Notice on Further Supporting Renewable Energy" (Zhang, et al., 2009). Additionally, measures were set to ensure that local technical knowledge and industry were developed alongside foreign investments in the wind power sector. For instance, approved wind power projects were required to meet a 40 percent local content rule; thus, joint venture

companies were formed with international and local investors. The programme helped to develop local manufacturing capabilities for 600 kW and 660 kW wind turbines (NREL, 2004; Xia & Song, 2009). The Ministry of Science and Technology (MOST) provided grants of 60 million RMB and the Ministry of Agriculture offered subsidies for pilot projects and training (Li, Song, & Hu, 2004).

The general focus on environment and sustainable development in the 1990s included the development of RE sources such as wind, solar, and biomass power. The support mechanisms shifted from subsidies to tax reductions/exemptions, pricing, and guarantees for credits. The programmes, targets and incentives contributed to elevating RE as a significant part of China's overall energy objectives in 2001. The State Economic and Trade Commission (SETC) drew up the 10th FYP (2001-2005), and emphasized sustainable development as well as the commercialisation of new and renewable energy.

The 10th FYP was a significant framework in a number of areas. To begin with, there was a strong emphasis on environmental protection to achieve sustainable development goals. The 10th FYP was also the first FYP plan to be implemented within the "socialist market economy" while the previous 6th to 9th FYPs were transition strategies. (Li, Song, & Hu, 2004). The 10th FYP highlighted energy issues as one of the strategic areas in shaping the future of China's economy (CCICED, 2000). According to the plan "the production capacity of solar energy, wind energy, and geothermal energy should be increased" (qtd. in NREL, April 2000). In order to promote RE, the plan provided recommendations for programmes such as building small-decentralised hydro plants, developing wind power and solar PV, and supporting existing efforts to increase electricity access for rural regions.

As part of the 10th FYP, the Brightness Programme was carried forward from the 9th FYP to further rural electrification efforts. The Township Electrification Programme was developed as an extension of the Brightness programme with the first phase carried out from 2001-2003. The objective was to provide 1 million people with electricity in 1,065 townships covering twelve provinces and municipalities. The target was to be achieved through the installation of 20 MW of solar PV in 688 townships and 264 MW of small-scale hydro in 377 townships. The second phase (2006-2010) aimed to provide 1,000 towns or 20,000 villages with electricity in the Western region. Over the past years, the Electrification Programme helped grow domestic solar PV production. The Electrification Programme was not only the first time China applied stand-alone electricity generation systems at a mass scale in rural regions, but the programme was also one of the world's largest rural electrification schemes (CREIA, 2004; NREL, 2004; Jubinsky, 2009).

Other plans were also initiated including the "Ride the Wind" programme, which propelled the development of the wind power sector by supporting local wind turbine manufacturing and engaging foreign companies in pilot projects (NREL, April 2004). The State Development and Planning Commission initiated the wind programme from projects previously developed during the 9th FYP. As a result of the local content requirement that was previously set, joint ventures were created with Chinese and foreign firms, which promoted technology transfer in the wind turbine-manufacturing sector (Xia & Song, 2009). In 2003 the National Development and Reform Commission (NDRC, initially the SDPC) established the national wind concessions to commercialise the wind power sector and increased the domestic manufacturing capabilities. Meanwhile, set tariffs established in 1994 were still applied for non-concession wind projects and ran congruently with concession-based tariffs. The concession projects were carried out in five rounds from 2003-2008 and bidders were selected according to various criteria such as price, local content, financial plans and technical specifications (CREIA et al., 2007; CREIA & WWF, 2008; CWEA, 2010) (concessions projects are discussed further in Chapter 8.2: "Policy learning: competitive tended and local content policy).

In 2005, the ''Measures for the Operation and Management of CDM Projects in China'' was enacted, allowing Clean Development Mechanisms projects under the Kyoto Protocol to be developed in China. Previously, China signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and ratified the Kyoto Protocol in 2002. In 2004, the government set up the necessary Designated National Authority to approve CDM projects. When the Kyoto Protocol entered into force in 2005 and became an international binding treaty, China was ready to support CDM projects (Lewis, 2010). By the end of the first quarter in 2009, China approved 1,766 CDM projects, of which 19 percent were wind power projects. CDM projects make up a sizable percentage of wind power projects and accounts for 95 percent of the overall non-concession projects (Zhang, Chang, Huo, & Wang, 2009).

Wind power and RE continued to develop along with CDM projects under the 11th FYP Plan (2006-2010) where energy and environmental goals became an increasing priority in China's development objectives. As one of the ambitious targets in the FYP, China aimed to grow the per-capita GDP fourfold by 2020 as compared to 2000. Concurrently, China aimed to decrease energy consumption by 20 percent by 2010, and to reduce total emissions of major pollutants by 10 percent (based in 2005 levels). The 11th FYP hoped to align energy, economic, social and environment goals to achieve overall development goals (SCIO, 2007; REN 21, 2009).

Although many provinces met the energy intensity goal, some provinces such as Guangdong province did not meet its target due to the government's economic stimulus plan to increase production which subsequently increased energy intensity (Ma, 2011). Difficulties in reaching

the previous FYP energy intensity goals resulted in lowered goals for the 12th FYP. The 12th FYP spanning over the 2011-2015 period includes plans to reduce energy intensity by 16 percent per unit of GDP (compared to the previous 20 percent goal), raise non-fossil fuel energy to 11.4 percent of the overall energy use by 2015 and decrease carbon intensity by 17 percent per unit of GDP (Lewis, 2011).

Progress in RE and wind power beyond the 11th FYP was outlined by the development direction in the 12th FYP (2011-2015). The drafting of the 12th FYP was unique from the previous FYPs, as it was the first time China officially invited international experts along with local experts to exchange knowledge. The NDRC held a seminar in early 2010 with participants from international organisations such as the Asian Development Bank and the United Nations Development Programme; local organisations such as China Society of Macroeconomics; and think tanks and members from academia including Harvard University. Local and international policy agents attended the seminar and there were discussions on topics such as promoting sustainable growth as well as reassessing economic, environmental, and social performance within the FYPs. Furthermore, it was a recognized that China "badly need[ed] to make substantial progress in shifting its development pattern by improving policies and deepening reforms" (People's Daily Online, 2010).

The 12th FYP was the first FYP to set binding carbon emissions reduction targets and introduced an "index evaluation system" for setting provincial carbon targets to ensure compliance. Alternative energy, including RE, was also identified as one of the seven keys sectors of China's new industrial strategy (Seligsohn & Hsu, 2011; Ng, 2011).

2.4.3 A milestone: the Renewable Energy Law

With decades of experience formulating and implementing RE policies as well as wind and rural electrification programmes, China implemented the Renewable Energy Law (REL) in 2006. The REL was formed "in order to promote the development and utilisation of RE, improve the energy structure, diversify energy supplies, safeguard energy security, protect the environment, and realise the sustainable development of the economy and society" (Chapter 1, Article 1). As the first comprehensive policy for RE, the REL served as an overarching framework for the industry, covering onshore and off-shore wind, solar, water, geothermal, and biomass, but excluded the low-efficient energy forms of biomass such as burning straw, firewood or other organic materials.

The enactment of the REL was a significant step in elevating the RE sector as the preferred means of developing the energy, manufacturing and high-tech sector. The legislation also provided the basic components to formulate more detailed policies covering twelve areas:

hydropower, RE resource study and technical regulation; medium and long-tem targets; RE development and planning guidance for the industry; grid tariff policy; cost-sharing; special development funds; fiscal policies for RE development in rural regions; financial subsidies and incentive tax policies; solar energy use in buildings; technical standards; and grid connection details (CREIA et al., 2007).

Grid connection was an important aspect discussed in the REL and reinforced the grid obligations established in the 1990s. Chapter 4, Article 14 of the REL stipulated that:

> "Grid enterprises shall enter into grid connection agreement with renewable power generation enterprises […] and buy the grid-connected power produced with renewable energy within the coverage of their power grid, and provide grid-connection service for the generation of power with renewable energy"

The three obligations of mandatory grid connection, purchase, and service assistance clearly placed responsibilities on the utilities and the compliance was theoretically reinforced by a penalty. The REL specified that if the grid power company "fail[s] to purchase renewable power in full, which results in economic loss to the renewable power generation enterprises, such power grid enterprises shall be liable for compensation." In such a case, the State Electricity Regulatory Commission (SERC) would order the utilities to comply within a fixed time period. If the utilities refused, they were given "a fine of less than the economic loss of the renewable power generation enterprises" (REL, Chapter 7, Article 29).

The REL also established an end-user mandatory surcharge (tariff) to spread the incremental cost of RE generation, including costs incurred from grid connection. Chapter 5, Article 20 stated: "the excess between the expenses that power grid enterprises purchase renewable power […] and the expenses incurred in the purchase of average power price generated with conventional energy shall be shared in the selling price." The Pricing Department at the national level determined the particulars of the methods. Additionally, grid connection expense related to the purchase of RE was passed onto the end-user selling price (Chapter 5, Article 21).

Selected government bodies oversaw the new regulations and technological standards in the REL. At the regulatory level, the NDRC was responsible for the process of establishing financial subsidies and tax incentives for RE development. The NDRC's Pricing Department was responsible for setting prices for RE generators on the basis of a "reasonable" and "economic" rate adjusted accordingly to reflect technological development (REL, Chapter 5, Article, 19). The Pricing Department, as stated above, approved the extra surcharge and was responsible for the redistributions of the funds according to RE investments. Provincial grid companies collected the extra surcharge to pay for the RE tariffs and any surplus or deficits were balanced nationally through trading fixed quotas (Article 6 and Article 8). For example,

provinces with total surcharge revenues *less* than the amount required to purchase RE electricity tariffs would sell the difference to meet the quota for the surcharge. Similarly, if a province's total surcharge revenue was *larger* than the expenditures for the RE tariff, the province would purchase the difference to balance the surcharge receivable with the RE tariff payable.

The REL provided the framework for RE development and planning, grid connection and cost sharing, but in practice there were problems with implementation. Consequently, the REL was amended in 2010 to address several major RE issues particularly in the wind power sector. These included enforcing mandatory grid connection and ensuring timely connection of RE generators to the grid, as well as addressing the issues of inefficient RE electricity generation, partially a result of RE targets set according to installed capacity instead of electricity generated (CWPC, 2012). These issues will be explored further in Chapters 6 and 7.

2.4.4 Supplementary legislation

In addition to the obligations set in the REL, further details regarding grid responsibilities were established in Chapter 2 of a supplementary legislation "Relevant Regulations on the Administration of Power Generation from Renewable Energy" (NDRC Energy No. 13, 2006). These responsibilities include: initiating research into grid design in accordance to planning requirements; carrying out grid construction and upgrades to meet the needs of RE in order to maximise the power generation uptake; and ensuring proper metering and collection of RE power statistics. There were also supplementary pricing legislations passed based on the REL that promoted development, including the "Provisional Administrative Measures on Pricing and Cost Sharing for Renewable Energy Power Generation (NDRC Price No.7, 2006). Tariffs for RE were established accordingly (see Table 2.1) in the provisions.

Table 2.1 Renewable energy tariffs

Government fixed prices	
Biomass	Article 7: "the State Council shall set yardstick tariff by region and the price standard shall be the addition of yardstick feed-in tariff for desulphurisation coal-fired generating units in 2005 in respective provinces […] and [the] subsidy price."
Solar, ocean & geothermal	Article 9: "the price standard shall be determined in the principle of reasonable costs plus reasonable profits by the price authorities of the State Council."
Guidance price	
Wind power	Article 6: "The Guidance Price of the Government applies to the feed-in tariff for wind power projects and the pricing standards will be determined through bidding by the price authorities of the State Council."
Biomass	Article 8: "For biomass power generation projects with feed-in tariff set through investor bidding, the guidance price of the government shall apply, i.e. the price of the bid winner which shall not be higher than the local yardstick tariff."

Source: NDRC Price 9, No.7, 2006

Separate pricing standards were restated in the provisions and tariffs for RE power generation were categorised into *government fixed price* and the *guidance price* through competitive tendering, and was approved by the government. The provincial Pricing Bureau determined the fixed prices for non-concession projects while the guidance price for concession projects were set through competitive tendering. Biomass pricing was determined by two pricing categories while solar, marine and geothermal were based on fixed government prices. The legislation only stated the guidance pricing policies for wind power generators but did not state the government fixed tariff price for wind power.

2.4.5 Renewable energy pricing policies in practice

The REL along with other support legislation have set the regulatory framework to promote RE by stipulating feed-in tariffs and tendering policies as RE pricing mechanisms. Both pricing policies have been used for the biomass, solar power and wind power sector in China. Table 2.2 outlines the prices mechanisms applied in the selected RE technologies.

Table 2.2 Set pricing for renewable energy in China (2007-2011)

RE Source	Pricing Mechanism	Prices (RMB/kWh)
Biomass	Feed-in tariff (2007)	Price of coal (~ 0.25-0.44) + 0.25 decreases by 2% per year from 2010
	Feed-in tariff (2010)	0.75
Solar PV & Thermal	Tariff (2007)	Project based on government approval
	Competitive tendering (1st 2009 Project)	1.09
	Competitive tendering (2009-2010)	0.73-0.99
	Feed-in Tariff (2010)	1.15 (projects approved before July 1, 2011)
		1.0 (projects approved after July 1, 2011)
Wind	Concession projects (2003- 2007)	0.38 - 0.56
	Government approved pricing (2006)	0.4 - 0.98
	Feed-in tariff (2009)	0.51 - 0.61

Source: China Statistical Bureau, Source; Li, Gao, Shi, Shi, & Ma, 2007; Shi, 2008; CRESP, 2009; Chua, 2011; CGTI, 2011

Fixed feed-in tariffs have been set for biomass energy based on 2005 local prices of coal ranging from 0.25-0.44 RMB/kWh plus a fixed subsidy of 0.25 RMB/kWh. Subsidies are restricted to biomass projects that utilised less than 20 percent of conventional sources to generate energy. Undifferentiated tariff rate posed several problems, as there were costs differences for the energy source. Fixed rates led to the uneven development of the biomass sector, and gave preferential treatment to low-cost fuel sources, particularly since the subsidy decreased in 2010 by 10 percent each year (CREIA et al., 2007). But in 2010, the tariff for biomass was increased to 0.75RMB/kWh to promote growth in the biomass sector, which has been relatively stagnant in the past several years (CGTI, 2011).

China has a strong solar PV manufacturing sector, but the majority of solar panels were exported. For instance, in 2007, over 95 percent of the solar panels produced in China were exported (Wong, 2008). However, the high export rate is changing. In 2009, global demand for Chinese manufactured solar panels dramatically dropped due to the global economic downturn and adjustments to lower solar power tariffs in Europe. The Chinese government implemented the Golden Sun and Solar Roof subsidy programmes in 2009 in order to support the solar power sector and subsidised up to 50 percent of project costs for special zones in eastern China. In 2009, the government announced a bid for a 10 MW project in Dunhuang, Gansu province and the NDRC approved the winning bid price at 1.09 RMB/KWh (Blumental, Carano, & Berberian, 2009), a price that provided a signal to the market on the intended national tariff price. There was an anticipation that the government would announce a nation-wide tariff but this did not occur immediately. In 2010, concession bidding rounds began for four projects with a total capacity of 40 MW in the Ningxia autonomous region and an interim tariff of 1.15 RMB was set (IEA, 2010). In the latter half of 2010, the government initiated a second concession round of 13 projects with a capacity of 280 MW and tariffs ranging from 0.73 RMB/KWh to 0.99 RMB/KWh. Nation-wide feed-in tariffs for solar power were finally announced in August 2011. Projects approved prior to July 1 or completed by the end of 2011 were granted a tariff of 1.15 RMB/KWh and projects approved after July 1 would be awarded a tariff of 1.0 RMB/KWh (Chua, 2011).

In the past two decades there have been several pricing policies for the wind power sector, beginning with government guided tariffs, then moving towards concession based tariffs and eventually differentiated fixed tariffs based on wind resources. Government guided tariffs have been implemented since 1994 (Liu, 2007) and established according to the total power generation costs and loans plus a reasonable profit. Tariffs price based on individual projects vary between 0.4-0.98 RMB/KWh. From 2003 to 2008, the government initiated five competitive bidding rounds with tariff prices ranging from 0.38-0.56RMB/KWh. Since 2009, four benchmark tariffs were set based on wind resources ranging from 0.51-0.61 RMB/KWh (CRESP, 2009). Chapter 8 will discuss wind power generation pricing policies more specifically in the context of policy learning and transfer.

The blend of strong policy support and abundant wind resources makes China one of the most attractive regions in the world for developing wind power. The potential is immense and China has only exploited around 2 percent of its overall wind energy resources since 2009 (Li, Shi, & Gao, 2010). The wind energy market expanded as a result of electricity market reforms that date back to the mid-1990s and subsequent policy and market influences that have evolved in the last two decades.

2.4.6 The Medium and Long-term Development Plan for renewable energy

While supplementary legislation provided some implementation details, the Medium and Long-term Development Plan for Renewable Energy (MLDP) in 2007 was a strategy that provided more specific national RE objectives. The development strategy established a target for RE alone to make up 10 percent of the total primary energy consumption by 2010 and 15 percent by 2020. Meeting the RE targets would require the full deployment of economical and mature technologies including hydropower, biomass and solar thermal in addition to supporting the development of the wind, biomass and solar PV (3.2, paragraph 1). The MLDP also set targets for each RE technology and emphasised the need to continue with RE efforts in rural electrification to ensure environmental protection and to increase the standard of living by improving social and economic conditions. China also intended to expand its domestic manufacturing and technology capabilities and to internally source the needed RE equipment by building a local manufacturing industry based on domestic technologies.

The MLDP plan also gave an important policy indication that the Mandated Market Share (MMS) policy would be implemented and enforced for the grid and energy generators. A RE target was already established for major grid companies (the State Grid and Southern China Grid) who were required to have 1 percent of their overall share of power generated from non-hydro RE sources by 2010 and 3 percent by 2020. Electricity generators with a capacity over 5 GW were required to have 3 percent of the overall self-generating capacity by 2010 and 8 percent by 2020 (MLDP, Chapter 5, Paragraph 1).

2.4.7 Renewable energy targets

As an economic giant, China's RE strategy will have a considerable financial and environmental impact globally. China is already leading in RE production and equipment manufacturing. For instance, in 2005, China had an installed capacity of 120 GW from RE. Over 95 percent (115 GW) of the RE was produced through hydropower, positioning the country as the largest hydropower generator in the world. More than 70 percent (80GW) of the RE was produced by large hydropower projects, which has been highly controversial due to external social and environmental impacts (Greenwood, Hohler, Liebreich, Sonntag-O'Brien, & Usher, 2007). Excluding hydropower from the energy mix significantly reduces China's RE production. Table 2.3 lists the RE production in 2006 and the established future targets as of 2010.

Table 2.3 China's renewable energy targets as of 2010

Target	2006 Installed Capacity	2010 Target*	2010 Installed capacity	2020 Target
Hydro power	130 GW	190 GW	213 GW	300 GW
Wind power	2.6 GW	5 GW	44.7 GW	30 GW (150 GW proposed)
Biomass power	2 GW	4 GW	3.2 GW	30 GW
Solar PV	0.08 GW	0.3 GW	2.6 GW	1.8 GW (50 GW proposed)
Total share of primary energy**	8%	10%	9.1%	20%

*Based on the Medium and Long Term Development Plan ** Including large hydropower

Sources: Actual 2006 per Martinot and Li 2007; targets per NDRC, Medium and Long-term Development Plan RE in China, September 2007; RenewableEnergyWorld.com, 2011, China Briefing, 2011, The Climate Group, 2011

China has met most of its RE targets prior to the deadlines but did not meet its overall 10 percent RE target by 2010, falling short by less than 1 percent due to the biomass sector. By 2007, the 5 MW wind power target set for 2010 in the year 2006 was exceeded by 866 MW. New targets have been set since 2008 and in 2010 and preliminary wind power targets were set for 2020 to reach 150 GW (REN21, 2011) (See Chapter 6, Table 6.1 for further details on wind power targets). Solar power has also surpassed its 2010 target by over 2 GW (China Briefing, 2011) and anticipates to exceed the 3GW target in 2012 (Energy China Forum, 2011). The Energy Research Institute of the National Development and Reform Commission announced an increased solar power capacity target to 10 GW by 2015 and 50 GW by 2020 (China Briefing, 2011). The Chinese government has set new RE targets in the 12th FYP (2011-2015), which requires 11.4 percent of all primary energy consumptions to be derived from non-fossil fuel by 2015. By 2020, the share is expected increase to 20 percent (The Climate Group, 2011).

The cumulative policies, targets, and objectives initiated as early as the 1950s have helped China expand its RE sector from a programme with a primary focus on rural electrification to a fast growing industry nation-wide. The policies discussed in this section consist of the main policies that have shaped China's RE sector. These policies are continually revised and new policies are implemented along with changes in the local and global environmental. Although much of the credit in China's RE development is due to its own rigorous planning and implementation process, foreign technical, financial, policy, and institutional support have contributed to the fast growing sector. The following section will provide a more specific account of the wind power sector.

2.5 Growth of China's wind power sector

Policies in the 9th (1996-2000) to 10th FYP (2001-2005) provided the initial demand for wind turbine prompting the start of a local RE technology manufacturing industry that developed only in a few decades with the collaboration of foreign expertise and technological transfer. The rapid growth in China's wind power installation was not only a by-product of technology transfer but also a result of the FYP. The heavy industrial focus of the FYPs in the 1960s to mid-1980s shifted to FYPs that included broader development goals such as rural electrification targets primarily met by renewable energy sources (RES). The scaling up of rural electrification programmes helped develop a domestic market for manufacturing wind turbines and wind farms that continued to expand as China moved towards a market oriented economy. The FYP along with other RE macro-level policies contributed to the rapid increase in wind installed capacity.

Figure 2.6 plots the wind power installed capacity from 1990 to 2010 and the corresponding first level FYPs and RE policies over the period.

Li et al, (2007) identified three distinct phases in the wind power sector. The first 'demonstration phase' (1986-1993) falls in the 8th FYP time period (1991-1995). During this initial phase, the wind power sector focused on small pilot wind projects and was financed through overseas grants and loans. The Chinese government provided limited policy support by investing in wind farms and wind turbines as well as through financial incentives such as investment subsidies set up in 1987 for rural energy including wind power (Zhang 2009). The uneven capacity growth rate between 1990-1993 can be attributed to the fluctuation of foreign and domestic financial support, the lack of consistent macro policy support and a low installed capacity base that distorted the growth rate (Li, Gao, Shi, Shi, & Ma, 2007).

The erratic growth rate is carried forward to the beginning of the 'industrialisation phase' (1994 to 2003) spanning over the 8th and 9th FYP, where high growth spikes of over 100 percent were observed in 1995 and 1996. The growth in these years is partly a result of the "Management on Joint Operation of Wind Energy Power Plant" policy implemented in 1994 (discussed in 2.4.2). This was the first major macro-level policy on mandatory grid connection for RE that guaranteed the uptake of wind power electricity by the grid. This policy contributed to increased investor confidence in the market and led to increased investments in the wind power sector.

Figure 2.6 Wind power capacity and renewable energy policies

	First stage (1986-1993)	Second stage (1994-2003)	Third stage (2004- present)

REL (2006)

11th 5-Year Plan (2006-2010)

MLDP (2007)

10th 5-Year Plan (2001-2005)

9th 5-Year Plan (1996-2000)

8th 5-Year Plan (1991-1995)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
AIC (MW)		1	10	3	9	23	41	91	54	44	76	56	68	98	197	503	1333	3267	6154	13786	18928
TIC (MW)	4	5	15	17	26	38	79	170	224	268	344	400	468	567	764	1266	2599	5866	12020	25805	44733
AGR (%)	20%	196%	18%	54%	44%	108%	115%	32%	20%	28%	16%	17%	21%	35%	66%	105%	126%	105%	115%	73%	

AIC: Annual installed capacity; TIC: Total installed capacity; AGR: Average growth rate based on total installed capacity

Source: Li Jun Feng, 2006;CWEA, 2010

The average growth rate for the entire second phase was 46 percent in the mid to latter part of the second wind power stage (1998-2003) and exhibited a lower but more consistent growth rate of 22 percent. A part of the more consistent growth can be attributed to the implementation of the 9th FYP (1996-2000). The 9th FYP was one of the early significant macro level policies that incorporated RE and more specifically wind power programmes including "Ride the Wind" (discussed in 2.4.2). Wind power provided off-grid electricity for rural areas and a solution for decentralised electricity generation. Although the installed capacity continued to steadily increase in the second stage, growth was limited due to ambiguous policies. Additionally, the entire electricity supply structure underwent changes towards a more competitive market-based model and wind power generation was still economically uncompetitive relative to fossil fuels (Li, Gao, Shi, Shi, & Ma, 2007). The 10th FYP was carried forward from the end of the second phase to the third wind power generation phase (2004-2009). The FYP placed a strong emphasis on energy and environmental issues and also encouraged the development of RE. As a part of the 10th FYP, the "Ride the Wind" programme was extended to promote the local wind power manufacture sector.

The wind power sector began to experience rapid growth in the third stage. This period is described as the 'scaling-up and domestic production stage' (Li, Gao, Shi, Shi, & Ma, 2007) and boasted an average installed capacity growth rate of around 89 percent during the 2004–2010 period. In terms of MW capacity, China had a total wind power installed capacity of 764 MW in 2004. By 2010, the capacity grew a significant 5755 percent to 44,733 MW. At the global level, China had the tenth largest installed wind capacity by the end of 2005. In only five years, China rose to the top with the largest wind installed capacity in 2010 (the United States and Germany ranked second and third respectively) (GWEC, 2010). The consistent growth observed at the end of the second phase and the start of the third wind power phase is primarily a result of setting more defined first level policies to promote the wind power industry in the 10th FYP.

From 2006 onwards, the 11th FYP continued to play an important role in shaping the national energy objectives and improving the RE policy and market environment. As a macro level policy, the 11th FYP set stringent targets to reduce carbon emissions intensity as well as to ensure that energy supplies could satisfy the demands required for economic and social development (REN 21, 2009). For instance in the 11th FYP, the Chinese government pledged to decrease energy intensity by 20 percent per unit of GDP over the 2006-2010 period compared to the 2005 baseline. Other ambitious plans included cutting emissions by 10 percent and reducing nitrous oxide (N_2O) emission in 2010 to 2005 levels, which was achieved earlier than planned (Sinton et al., May 2005; REN 21, 2009; People's Daily Online, 2010)

According to above Figure 2.6, the annual growth rate alone for the 2006-2010 period averaged at 105 percent, indicating that wind power installed capacity was experiencing a rapid expansion during the 11th FYP. The focus on diversifying the energy mix and investing in clean energy options, including RE, became a crucial focus for achieving macro-level goals including addressing energy and resource shortages, reducing carbon emissions, building an environmentally friendly society, and developing more technologically advanced industries (Gov.cn, April 2006).

Since 2006, wind power capacity has grown over 100 percent annually until 2010 when the growth rate dropped to around 70 percent. Over the next decade China is anticipating to install between 15-20 GW of wind power capacity annually according to a statement made by the Chinese Renewable Energy Industries Association in December 2010 (Xu, 2010). However, grid connection issues present the largest barrier in the expansion of wind power connected electricity in China. Grid construction has not caught up with the unprecedented growth in the wind power sector; consequently a high percentage of wind power generation facilities have not been connected to the grid. As indicated in Table 2.4, between 26 to 31 percent of wind farms remained unconnected to the grid during the 2008-2010 period.

Table 2.4 Wind Power Grid Connected Capacity in MW (2008-2010)

Year	Total Installed Capacity	Total Grid Connected	Total Unconnected	Percent Connected
2008	12,150	8,940	3,210	74%
2009	25,805	16,130	9,675	63%
2010	44,733	31,070	13,663	69%

Source: China Securities News, qtd. in China Energy Net, 2009; Energychinaforum.com, 2010, Wind Power Monthly, 2010; Chinese Wind Energy Association, 2010a; Hexun News 2010; Hexun News, 2011

Putting the statistics into perspective, in 2008, 2009 and 2010, the newly installed capacity for wind power was 6,154 MW, 13,786 MW and 18,928 MW respectively (see Figure 2.6). The share of unconnected wind power is alarming as the unconnected capacity from 2008 to 2010 amounts to nearly 70 percent of the newly installed annual wind power capacity during the three years. Lagging infrastructure development and technical challenges in accepting large influx of intermittent electricity from wind generators have been aggravating grid connection problems. But some of the underlying issues are beyond the physical infrastructure and are institutional and policy related. The energy institutions overseeing and monitoring grid activities face challenges that prevent them from fully carrying out their activities and implementing policy objectives (energy institutions are discussed later in section 2.6). There is also a skewed preference towards wind power generation side policies with limited emphasis on grid

transmission, creating an imbalanced development in the electricity sector. The next section will provide a discussion of grid related issues.

2.6 Grid infrastructure challenges and the mismatch of electricity demand and wind power electricity supply

There are physical limitations to grid infrastructure development due to the intensive growth in wind power generation and an overall increase in generating capacity in the energy sector. Lagging grid infrastructure development is a serious problem and a large proportion of wind farms in concentrated regions are left without the infrastructure to deliver electricity to the end-users. Providing sufficient electricity supply to consumers can be challenging since power sources are often located far from the demand base. For instance, regions with rich wind resources and coal are located in the north, while hydropower resources are mainly in the west. The economic regions, on the other hand, are located in eastern and southern areas (Ip & Chu, 2010).

The long distance between the supply and demand requires the development of extensive transmission and distribution systems. The mismatch between supply and demand has contributed to power cuts in the past decade since the grid was unable to provide sufficient supply during peak demand, especially from industries. For instance in 2003, there was an electricity supply shortage of around 10,000 MW during the summer, which led to blackouts in 18 provinces and disrupted production. Over 1,000 businesses in Shanghai were ordered to suspend their operations during peak times and on hot days (Yeh & Lewis, 2004). Delivering electricity from wind rich resource regions to high energy demand regions is a serious challenge with the lagging grid infrastructure. Figure 2.7 illustrates that some provinces with the highest wind power generation are located far from the provinces with high electricity consumption.

Transporting wind-power generated electricity between provinces can be problematic since transmissions lines and substations belong to the State Grid but the infrastructure, is managed by different provincial or municipal grid companies that function separately and are often reluctant to take on the added burden of connecting wind power. For instance, the World Bank and Global Environment Facility initiated the "China Renewable Energy Development Project" in 1998 and planned to build a 100MW wind farm in the Inner Mongolia region. As a small grid company, the Inner Mongolia Utility Corporation did not have the scale to solely invest in the project and was unable to fully utilise the energy generated from the wind farm; thus, they needed to sell the excess energy to neighbouring provinces. North China's regional power company initially agreed to purchase the excess power but it was later divided into three separate provincial utilities and operated independently based on commercial principals. The provincial grids refused to sign the power purchase agreements to pay higher tariffs for wind

power electricity and the project was later abandoned in 2000 (Liu, Gan, & Zhang, 2002; Martinot, 2001). The projects failed as a result of the inability to make use of excess electricity supply generated by the wind farm in Inner Mongolia as well as changes in grid company structures.

Figure 2.7 Map of Top Wind Generators and Electricity Consumers in China
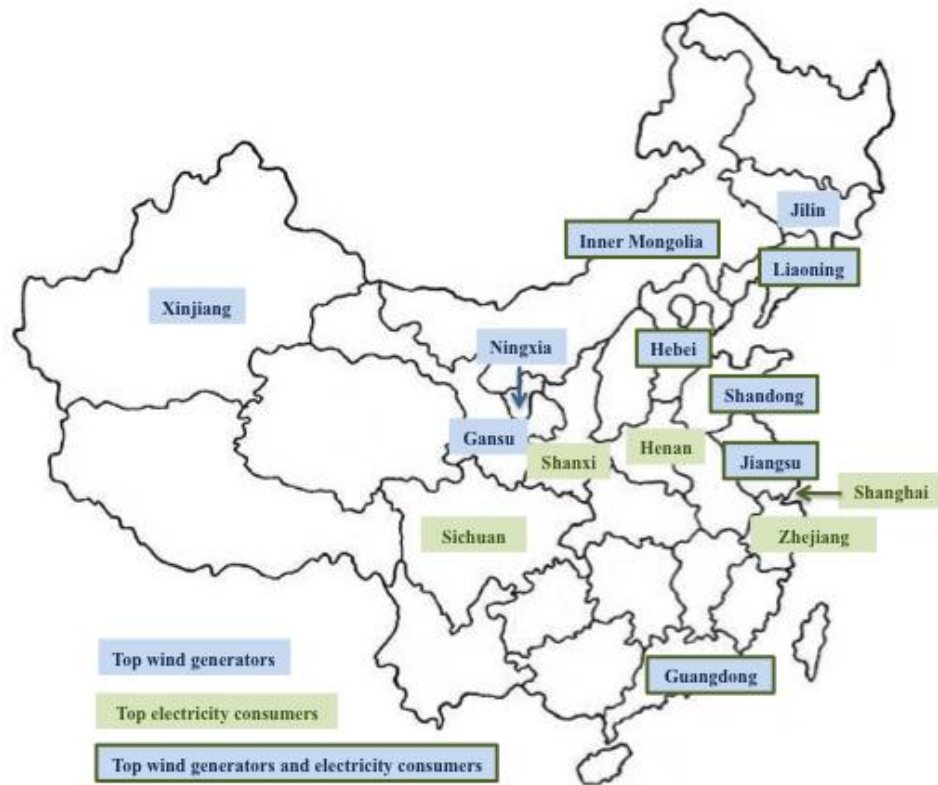
Source: Own interpretation of stats from Pengfei, 2007; National Bureau Of Statistics, 2006

Despite the infrastructure limitations, wind power projects continued to be developed in the Inner Mongolia region since 2000; however, the severely lagging grid development in Inner Mongolia has been hampering further wind power development. Around 75 percent of the province's wind power remained unconnected in 2011, deterring investments in the area. Wind power investors are moving to regions with more developed electricity networks in Central and Eastern China including Hubei, Anhui, Hunan, and Jiangxi, even though these regions may have lower wind resources compared to Inner Mongolia (Song, 2011).

2.6.1 Grid policy development

China has been dealing with its grid issues primarily on an as-needed basis and the ad hoc approach has only begun to change in the latter half of 2000s. The government's policy and planning approach does not necessarily indicate a lack of foresight but rather reflects the step-by-step approach of policy making in China stemming from the reform process. China's market transition process is conveyed as a "trial and error" or "piecemeal, partial, incremental" process

(Lin C.Z. 1989, qtd. in Fischer, 2010, p. 302; Lin, Cai, & Li, 1996). One reason for the trial and error and gradual approach could be attributed to unchartered territories and uncertainties of the market reformation process. The trial and error approach or "experimental regulation" (Heilmann, 2007, p. 6) has been a part of China's policy making process since 1985 when the National People's Congress (NPC), the national legislature, granted the central government the authority to draft interim regulations for economic reforms without requiring the NPC's approval. Since then, the government has passed thousands of regulations, a policy making process is known as "a form of quasi-law". These quasi-laws are amended and formalised into legislation after gaining adequate experience (Heilmann, 2007). The gradual changes in policies allow policy makers to correct mistakes and make adjustments according to the market condition. According to Ma and He, this "gradualism approach" towards reforms is expected to create a more "consistent and stable regulatory regime" (Ma and He, 2008, p. 1708).

The incremental approach in the power sector did not proceed like the market reform process that allowed for more incremental policy corrections. China's power sector experienced unprecedented growth and its national energy demand grew at a much more rapid pace than anticipated in the past decades due to the rapid economic development, and has brought about significant challenges in policy making. The increased demand led to power shortages and the government responded by encouraging new generating capacity through local level government investments and private investments (Yeh & Lewis, 2004). RE power generators were provided incentives (discussed in Chapter 8) to generate electricity. These new investments and growth in the wind power sector have contributed to additional generating capacity and the large percentage of unconnected wind power has drawn greater attention to the severity of grid infrastructure issues.

In the power sector, the 'trial' approach is a reactive action on the government's part to address the increased demand by increasing electricity generation, drawing the attention away from needed investments in grid infrastructure. This 'error' on generation-centric policies has been recognised and there are changes in both policy and investment strategies for grid development.

Beginning from 2007, the focus has been shifting from heavy investments in the generation side to increased investments in the grid, as seen in Figure 2.8. But in 2010, grid investments decreased partly due to uncertain national grid strategy (Qu, 2011). However, a clear longer term strategy was announced for the 12th FYP (2011-2015). The State Grid announced plans to invest over 500 billion RMB to modernise the grid and to build 40,000 kilometres of ultra-high voltage transmission lines (Bi, 2011).

Figure 2.8 China's investments in electricity generation and grid infrastructure in millions RMB (2006-2010)

	2006	2007	2008	2009	2010
■Grid	211	245	289	384.7	341
■Generation	312	304.0	288	371.1	364.1
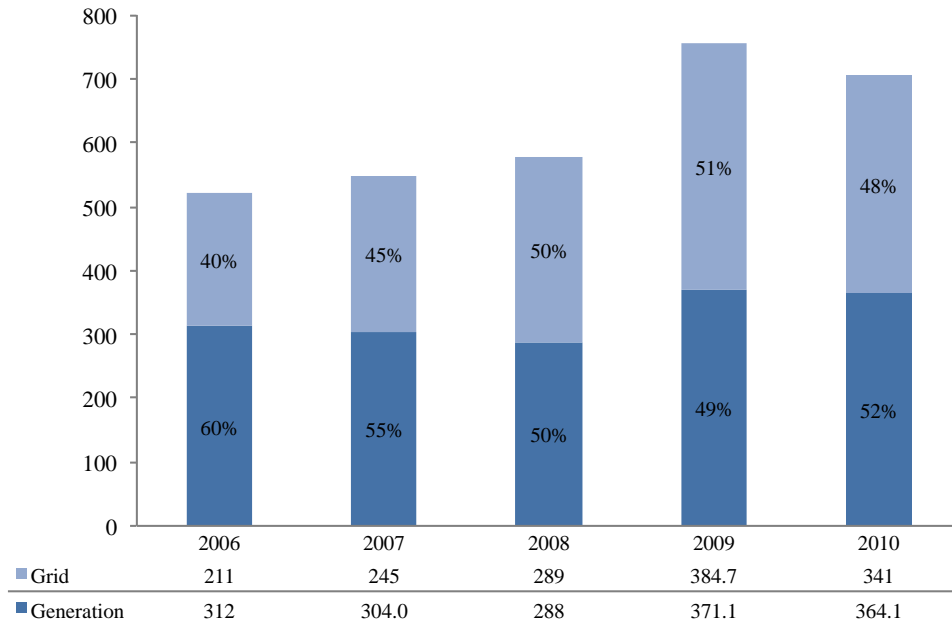
Source: KPMG, 2009; China Electricity Council, 2011

Investing in state of the art ultra-high voltage transmissions system is one of the means through which the Chinese government is addressing the issue of integrating large-scale wind farms into the grid. This will not only improve the uptake of large-scale wind power electricity but also will also increase transmission efficiency and grid stability. Compared to the conventional 138-765 kV transmission lines, the long-distance ultra-high voltage AC (1000 kV) and ultra-high voltage DC (+/-800 kV) transmission lines minimises transmission power loss and improves grid stability. The ultra-high voltage transmission system is the first of its kind to be constructed in the world and signifies a transition into advanced grid infrastructure development (Polaris Power Wind Power News, 2011).

China has already designed and constructed an ultra-high voltage (1000kV) pilot project in the northern province of Shanxi, crossing over Henan to the city of Jingmen in Hubei, a province in central China. The pilot project began operations in 2009 and by 2010 was estimated to save 3.6 million tonnes of coal by transporting thermal power generated in Shanxi province to the Central China Grid throughout the dry season (Qu, 2011). The investments in advanced grid infrastructure and policy intentions outlined in the 12th FYP signify a change towards a world-leading prospective strategy. In fact, China is ahead of the US in building ultra-high voltage transmission lines (CEC, 2009).

On the other hand, China frequently drew lessons from abroad for experience but in the case of its grid infrastructure, "there is no readily available foreign experience to borrow when building

a UHV AC network" (Qu, 2011). China will be a pioneer along with the Japanese to develop ultra-high voltages technology, and if successful in its deployment, the State Grid may look abroad for equipment supply opportunities in the U.S., Mexico and Russia (CEC, 2009; Qu, 2011).

Investing in the state of the art technology partly addresses grid connection issues but other aspects, such as supporting institutions and policies that promote grid integration with a variety of energy sources, also needs to be considered (discussed in Chapter 6 and 7). Thus in the area of grid policy development, China continues to collaborate with other countries to establish the needed institutions and to address grid integration issues within its own political and economic context.

In order to have a better understanding of the political and economic context, the next section gives an overview of China's political party system which influences the policy making process, institutions and all areas of the economy including the energy sector.

2.7 The political party system

This section will briefly highlight the importance of the Communist Party of China (CPC), within the general political economy. Formally, China's political system functions as a "multi-party cooperation system under the leadership of the CPC with the CPC holding power and the other eight parties participating fully in state affairs"[7]. According to China's official sources, the CPC and eight parties function "on the principle of 'long-term coexistence, mutual supervision, treating each other with sincerity and sharing each other's weal and woe' ". The government claims that "the CPC and the eight democratic parties work hand in hand in developing socialism with Chinese characteristics" (Information Office of the State Council, 2007).

China's system differs from the multiple party systems adopted in Western countries and the one party system found in other countries. While there is an official multi-party system, in practice "the only one that matters is the Communist Party" (Lunn, et al., 2006, p. 16). The CPC retains the true political power and the party's influence is present at all level of government. Most of the NPC delegates are also CPC members, since party membership is a prerequisite for success in politics. The influence of the CPC extends beyond the political system with a number of businessmen and women registered as members (Lunn, et al., 2006). In 2010, there were over 80 million party members, of which only approximately 8 percent were government and CPC employees while 23 percent were from the business community (Chinatoday.com, 2011).

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[7] These "democratic parties" include the Revolutionary Committee of the Chinese Kuomintang, China Democratic League, China National Democratic Construction Association, China Association for Promoting Democracy, Chinese Peasants and Workers Democratic Party, China Zhi Gong Dang, Jiu San Society and Taiwan Democratic Self-Government League (Information Office of the State Council of the People's Republic of China, 2007).

Engaging private business individuals and elites in the CPC is part of Jiang Zemin's [8], "Three Represents Campaign" announced in 2001 that involved "advanced productive forces, the orientation of China's advanced culture, and the fundamental interests of the overwhelming majority of the people (Jia, 2004, p. 261). Drawing in capitalists and elites helped the CPC to further establish its authority by including parts of the modernised society into its "ideological orthodoxy" (Jia, 2004, p. 272).

The CPC consists of the Party Congress and its Central Committee, the Political Bureau of the Central Committee and its Standing Committee, the Secretariat, and two other commissions, as seen in Figure 2.9.

Every five years the CPC holds a *Party Congress* to discuss major party issues. When the Party Congress is not in session, its *Central Committee* elected by the CPC's Party Congress, implements the decisions and meets in a plenary session on an annual basis, at a minimum. The *Political Bureau* and its *Standing Committee* are elected by the Central Committee during the plenary sessions and are responsible for implementing the decisions of the Central Committee when it is not in session. The Political Bureau Standing Committee is the most authoritative decision-making body in China and is comprised of the top seven leaders of the CPC, who in practice have the greatest decision making power. The *General Secretary of the Central Committee*, Xi Jinping, is the head of the CPC as of November 2012 and is also the head of State (International Department of Central Committee of CPC, 2007; Xinhuanet, 2012).

The CPC functions under a 'democratic centralism' model where the power is held by the Political Bureau Standing Committee and the General Secretary of the Central Committee. This 'democratic centralism' indicates that the leading organisations within all levels of the CPC are determined by an election. A hierarchy exists in the party were individual party members are subordinate to the organisation, while the minority is subordinate to the majority, the lower party to the higher party organizations, and organisations and party members are subordinate to the CPC and the Central Committee of the Party (International Department of Central Committee of CPC, 2007).

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[8] Jiang, Zemin was the CPC's General Secretary of the Central Committee from 1989 to 2002.

Figure 2.9 The Communist Party of China

Party Congress of the CPC (2,217 delegates)

The Central Committee of the CPC (371 members)

General Secretary of the Central Committee, Hu Jintao

Standing Committee of the Political Bureau (9 members)

Political Bureau of the Central Committee (25 members)

Secretariat of the Central Committee

Departments:
Organisation Department
Propaganda Department
United Front Department
General Office
Central Politics and Law Committee
Internal Liaison Department

Committees:
Provincial Committees
City Committees
County Committees
Township Committees
Village Committees

Central Military Commission headed by Hu Jintao

Leading Groups:
Economics
Public Security
Rural Affairs
Party Building
Propaganda and Thought Work
Others

Central Discipline Inspection Commission

Source: Content compiled from International Department of Central Committee of CPC, 2003; People's Daily, 2007; McGregor, 2010

The elections may somewhat resemble a 'democratic' process but only CPC members can elect delegates to the CPC's Party Congress. The CPC's Party Congress in turn, elects the member of the Central Committee who then selects the Political Bureau and its Standing Committee (Lunn, Lalic, Smith, & Taylor, 2006). The inner workings of the CPC is important to the overall function of the government in China and is the central power present at all geographic and governance levels and all areas of the economy and society. The relationship between the CPC and government is in fact a "delegation relationship" where the party is the "principal" and government agencies are the "diverse agents" that implement its orders. For instance, local party committees can provide access to resources for local administrative bureaus. This could include bank credit that would be difficult to obtain (Opper, Wong, & Ruyin, 2002). In fact, some argue that a primary reason the CPC is able to hold a powerful position inside politics, aside from "discipline and coercion", is through such arrangements or "incentive compatible arrangements" where the official interests are aligned with the party's wishes (Shevchenko, 2004, p. 174).

Political and economic power is closely tied in China and while this has enabled corruption, it has also provided a strong incentive for officials to comply with the party, at least at a level to secure their positions. For instance, political status offered economic opportunities during the period of market fiscal reforms in the 1980s. For this reason, the party's authority remained relatively unchallenged since the ability for party members and administration organisations to participate in "entrepreneurial activities" during the reformation period were dependent on their rank within the party (Shevchenko, 2004).

China's current economy is a hybrid of central planning and the opening up of markets. The "socialist market economic system" is a "dual track approach" (Opper, Wong, & Ruyin, 2002) where the government retains major resources through its state-owned enterprises (SOEs) that produce around 60 percent of the country's GDP, but also allows the private markets and industries to run in parallel.

China's industries can be categorised into three tiers. First tier industries are managed by the State-owned Assets Supervision and Administration Commission (SASAC). These are usually natural monopolies and are comprised of large SOEs and other government run companies in key industries such as transportation (automotive, rail and aviation), construction, banking, telecoms, metals (e.g. steel, aluminium), as well as electricity and power (Sanders, 2010). Three companies in China's electricity and power sector, Sinopec Group, China National Petroleum and the State Grid, were ranked among the top ten largest companies in the world by Fortune Magazine in 2011 (CNN Money, 2011). The CPC appoints the manager of these strategic large firms, some of which are at the ministry level. Smaller first tier firms can be partially owned by the private sector and the managers for these smaller firms are appointed by the SASAC. This

arrangement allows companies to draw in private capital, but also offers some market protection and helps prevent "asset looting" at the state level.

The second tier is the "most dynamic group of firms" and consists of medium sized companies competing in the market. These firms can be domestic start-up companies formed from foreign investments, or derived from tier one companies. Examples include consumer electronics, other high-tech sector, or even the automotive and telecoms firms, which spans across the first and second tiers. The third tier is made up of private, small-scale town and village enterprises. These firms are present in the low-tech sector and tend to form clusters in certain regions (Sanders, 2010).

This thesis will cover tier one electricity and grid companies as well as tier two wind power generation companies. Having provided an overview of the CPC and its influence on the political economy, the next section gives an overview of the major governing institutions and non-governmental organisations that are involved in or are responsible for overseeing RE.

2.8 Governing institutions for renewable energy implementation

Governing institutions and civil organisation play an important role in formulating and implementing RE policies. There is a labyrinth of governing bodies in China that form the energy and RE institutional framework. The central government establishes national regulations in the areas of pricing, cost-sharing, taxation and project approval procedures. The stipulations serve as a general guide to support provinces in the implementation stage and provincial governments are required to set more specific provisions aligned with the national objectives. The additional provisions address areas including: provincial management support for RE technologies, financial assistance for pilot projects, and other additional privileges such as access to land (CREIA et al., 2007). Implementation plans can differ considerably from province to province due to the wide discrepancies of resources, industry capacity and energy demand.

In addition to government institutions, civil society is also involved with implementing RE plans and strategies. Figure 2.10 illustrates the main state institutions and civil institutions in China's energy and RE institutional framework that contribute to the supervision and implementation of the RE regulations and strategies. The roles are summarised below:

- *The State Council* carries out a supervisory role;
- *Administrative departments* focus on implementation and supervision; and
- *Civil society* assists in implementing and supervising policy goals and consists of RE industry associations, academic groups and organizations, and civil environmental protection organisations.

Figure 2.10 Major institutions in the energy and renewable energy framework
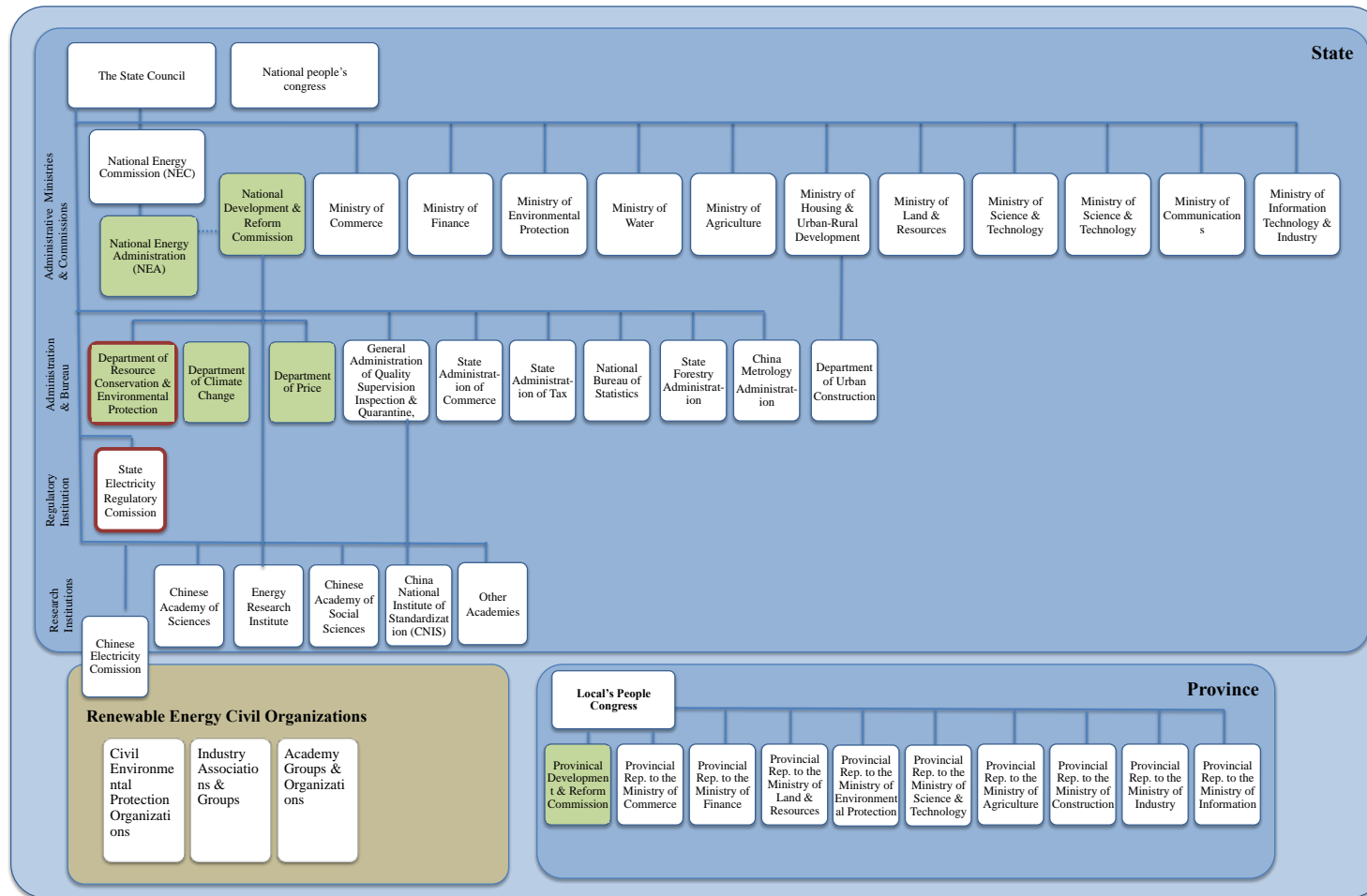
Red outline- SERC watchdog of power sector and Ministry of Environmental Protection- watchdog of environmental sector; green shaded boxes: key energy institutions related to the NDRC

Source: Own diagram with input from researchers at Tsinghua University in 2009, the Central People's Government of The People's Republic of China, 2008; Li, Shi, Wang, & Wang, 2007

2.8.1 The State Council and administrative departments

The National People's Congress (NPC) is the legislature, the highest state body and is sanctioned by the Constitution of People's Republic of China (1982) to enact laws. The Communist Party, however, presides over all levels of the NPC. The Constitution sets the foundation for the NPC to establish the Legislation Law in 2000, which standardised and improved the legislative system (The Central People's Government of the People's Republic of China, 2009). The Constitution and the Legislative Law form the basis of the rule of law in China (Shi, 2006).

Under the direction of the NPC, the State Council is responsible for enacting administrative legislation and implementing laws. The State Council's authority is founded by the Constitution and the Legislative Law, enabling the administrative authority to perform its functions through various ministries and bodies. Within the context of the REL, the State Council has three major components: ministries and the corresponding departments; regulatory institutions; and organisations. The overarching laws, regulations and decisions fall under the responsibility of the State Council. If an area lies in the responsibility of two or more of its administrative bodies, the relevant body can request the State Council to individually enact the administrative regulation or jointly enact regulations with the State Council.

The National Development and Reform Commission

The *National Development and Reform Commission* (NDRC) is the highest planning Ministry that establishes and forms economic and social development strategies, including RE issues. The responsibilities are distributed among four departments within the NDRC including the National Energy Administration (NEA), the Department of Price, the Department of Industry, and the Department of Resource Conservation & Environmental Protection (see Figure 2.10 for the institutions in shaded green).

The Department of Price within the NDRC sets RE pricing and fee details while the Department of Industry coordinates industrial activities such as assisting in the diffusion of key industrial equipment and developing new and existing industries. The Department of Resource Conservation & Environmental Protection coordinates the larger environment, energy, societal and economic issues such as environmental protection, energy conservation and emissions reductions (NDRC, 2008).

Energy Institutions

In 2008 the government authorised the formation of the National Energy Commission (NEC) and the National Energy Administration (NEA), China's present energy institutions (Central People's Government of the People's Republic of China, 2008). The NEC replaced the NEGL

(National Energy Leading Group) as the coordinating body and the NEA took over the State Energy Office's responsibilities as the administration body (Zhang & Lee, 2008; Xinhua News Agency, 2008).

The *National Energy Administration* (NEA) was formed as a vice-ministerial body in July 2008 as an effort to centralise and improve energy management activities. Its main activities include establishing and implementing energy development plans, taking an administrative role in the energy sector, supporting research and development activities such as the promotion of RE technologies, as well as engaging with the global environmental protection and climate change dialogue (NDRC, 2008). The NEA is expected to harmonise energy related activities as well as to improve the administration and implementation of RE policy. However, energy related issues are still spread over a number of governmental bodies and the NEA does not have a ministry status or the authority to harmonise the energy sector (Downs, 2008).

The NEC was formally established in 2010 and is headed by Premier Wen Jiabao while its everyday activities are managed by a vice-director. The NEC coordinates the various government bodies involved in energy issues and oversees energy strategies. The NEC committee is composed of 21 members, which include ministers and members from the NEA, NDRC, SERC (State Electricity Regulatory Commission), and the Ministry of Science and Technology, Land and Resources, Environmental Protection, Water Resources, Commerce, State Security, Foreign Affairs and the People's Bank of China. This body was intended to be a 'Super Ministry' that involves both energy and environment institutions as well as the military and central bank. The NEC was placed directly under the government's State Council, the first time a high-level coordination has not been directly under the Central Committee of the CPC. This placement gives "a clear indication of the rise of power of the government" (Bo, 2010, p. 7). There are sceptics that claim, "if coordination is all it's [NEC] doing, and if the heavy lifting continues to be carried out by the NDRC and NEA, then the NEC is hardly a 'Super Ministry' " (Wong, 2010). For instance, the NDRC's Pricing Bureau still holds power over pricing, which is the NDRC's "main instrument of macroeconomical control" (Downs, 2008, p. 44). Retaining power over energy pricing enables the NDRC to ensure that another government body cannot adjust prices that contradict the NDRC's overarching goals including inflation control (Downs, 2008).

Several energy institutions have been formed and dissolved since the 1990s. Competing powers between government bodies and overlapping responsibilities has been a recurring issue in China's energy sector and has contributed to the dissolving of the former Energy Ministry in 1993. The Energy Bureau was later established in 2003 under the NDRC with the intent to streamline energy activities within the government. It was subsequently disbanded and replaced

by the NEA and NEC. The former Energy Bureau was a small organisation of around 30 employees and had limited authority and resources, which presented challenges in fulfilling its tasks. In 2005, the NELG lead by Premier Wen Jiabao was created under the State Council as a coordination and advisory body. The State Energy Office (SEO) was also created in 2005 to implement energy strategy. The NELG and the SEO had difficulties coordinating the ministries and state owned energy companies and consequently, the energy-related duties were dispersed over a range of ministries of similar ranking. For instance, energy issues were overseen by the NDRC, SERC, and the Ministry of Commerce. The division of power impeded energy policy implementation due to inefficiencies and conflicting interests amongst the various departments (Zhang & Lee, 2008).

Other Governmental Bodies

Aside from the NDRC, other ministries at the administrative level supervise RE issues. For instance, *The Ministry of Finance* (MoF) oversees economic incentive programmes, collects fees, levies and taxes while the Ministry of Construction is responsible for technical building codes for RE installations (CREIA et al., 2007; Rosen & Houser, 2007).

The Ministry of Environment Protection (MEP), China's environmental watchdog, is another administrative body indirectly involved in the development of RE policy. The MEP was formerly known as the State Environmental Protection Administration (SEPA) before the agency was elevated to a ministerial level in March 2008. The change was instigated to harmonise environmental standards and enforce regulations previously ignored by local industries and politicians. The State Council also intends to increase MEP's authority over local environmental bureaus as well as environmental issues. The Ministry's greater influences over environmental matters are likely to create dissent with local governments who oppose the closure of factories on environmental grounds, as it reduces tax revenue. However, MEP's involvement in local and regional issues is likely to encourage RE development by promoting environmentally friendly projects and rejecting energy intensive, polluting projects that do not adhere to national standards (Goldman, 2008).

The State Electricity Regulatory Commission (SERC)[9] was established directly under the State Council in 2002 as China's first industrial regulator. It was appointed to administer the new supplementary regulation passed towards the end of 2007. SERC manages national electricity issues while exercising authority over regional supervisory bodies. Its main responsibilities also include: monitoring and facilitating obligations in the power sector to purchase RE according to

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[9] Updated developments: According to the State Council's announcment in March 2013, SERC will be dissolved and its activities will be taken up by the NEA, which will be restructured to streamline the administration and regulatory actvitities (Xinhua, 2013).

the REL; unifying regulatory and administrative systems; forming electricity laws and enforcing energy and environmental regulations; monitoring market operations; and creating technical industry standards. SERC is also indirectly involved in pricing issues and can recommend adjustments to the Department of Price (SERC, 2008). In practice, SERC has limited authority as the NDRC has not granted the regulator full authority to set prices and approve new generating capacity (Wang & Chen, 2009).

Chapter 6 will examine the role of energy institutions and monitoring bodies in the wind power sector within the policy learning and post transfer learning context.

2.8.2 Regional authorities and non-governmental institutions

The People's Congress and the local standing committees, presided by the State Council, govern the provinces. Provincial authorities can establish localised regulations, given that the regulations abide by existing constitutional and state laws. Since energy demand and the availability of RES differ in each region, laws need to be tailored in order to drive the local development. Civil organisations are growing in importance as supervisory bodies in the deployment of RE strategies. Examples of civil organisations are listed in Figure 2.11.

Figure 2.11 Table: Civil renewable energy organizations

Renewable Energy Industry	Academic Association and Groups	Civil Environmental Protection Organizations
▪ Chinese Renewable Energy Industry Association ▪ All-China Federation of Industry & Commerce ▪ Solar Thermal Utilization Association ▪ Solar Photovoltaic Association ▪ China Wind Energy Association ▪ Biomass Energy Association ▪ China Rural Energy Industry Association ▪ China Energy Enterprise Management Association ▪ China Society for Hydro Power Engineering	▪ Institute of Energy & Environmental Economics, Tsinghua University ▪ China Energy Research Society ▪ Chinese Society for Environmental Sciences ▪ China Energy Conservation Association ▪ China Resource Recycling Association ▪ Chinese Renewable Energy Society ▪ Guangzhou Institute of Energy Conversion ▪ Development Research Centre of the State Council	▪ China Association of Environmental Protection Industry ▪ Environment Education Center of Beijing Earth Village ▪ Friends of Nature ▪ China Agriculture Environmental Protection Association

Source: Li, Shi, Wang, & Wang, 2007

Although NGOs must register with the Ministry of Affairs and adhere to reporting requirements or face restrictions in it activities, this has not prevented NGOs from driving the RE industry. They help mobilise participation in society and actively support the development of wind, solar, biomass, and biogas while cautioning the quick expansion of hydropower due to the ecological impact.

Civil bodies are generally classified as RE industry organisations, academic groups and organisations as well as civil environmental protection organisations. These institutions and groups have contributed in a number of areas in the RE sector. Research institutions have assisted with drafting the REL in the areas of planning, formulating regulations and technical standards. Industry associations also play an important role in R&D for RE technologies and participate in the diffusion of information at the industry level. Similarly, civil protection and environmental groups increase societal awareness through educating the general public and campaigning for environmental and societal causes (Li, Shi, Wang, & Wang, 2007).

2.9 Chapter 2 summary

This chapter established the context for the research and sets out to explain the significance of studying RE in China. The descriptive historic overview of the energy and RE sector provided the background for the wind power case study. The background also served as a policy scan exercise to identify key policy instruments and institutions, and formed a basis for the further investigation of policy learning and transfer evidence.

Overall China's government and non-government institutions play an essential role in formulating, advising, and implementing RE policies. Since the early 1950s, the Five Year Plans, and other programmes and policies were established by the central government to provide electricity for the general population at affordable rates that would support economic growth. RE policies were initially aimed at improving electricity access to rural communities but as the energy sector underwent market liberalisation in the 1980s, opportunities appeared for independent power producers, which also included RE generators in the electricity market. RE gradually became an important part of overall energy planning and closely tied to state economic and development plans.

The central government sets macro-level RE targets while other national governmental bodies such as the National Development and Reform Commission and the Ministry of Finance oversee general macroeconomic issues as well as energy related issues. Other government bodies, such as State Electric Regulatory Commission and the National Energy Commission and the National Energy Administration, were created over the past decades specifically to oversee the energy sector. Gradually, non-governmental institutions were established in response to growing industry needs, liaising between policy makers and RE companies. Government and non-government institutions and policies have promoted RE in China, helping to create a leading global wind power industry.

Before exploring policy learning, transfer and post policy transfer learning in the wind power sector, the following chapters will present the theoretical basis and framework for this thesis. The next chapter provides a literature review of policy learning and transfer concepts.

Chapter 3 - Literature Review & Framework Introduction

This chapter introduces policy learning from abroad and policy transfer literature and proposes a framework to apply the concepts to this thesis. The first section, 3.1, discusses policy studies that predate policy transfer concepts beginning with comparative policy and policy diffusion studies and eventually examines learning types in the policy process, policy change, political learning and policy learning. The term lesson drawing is also introduced as the concept that links policy learning with policy change, an essential component of policy transfer. The second part of this chapter, 3.2, presents some of the issues and gaps in the literature and the remaining sections 3.3 to 3.9 proposes a policy learning and transfer framework specifically for this thesis developed from some of the key concepts discussed in the literature.

3.1 Explaining policy learning and policy transfer

3.1.1 Origins of policy transfer

The concept of policy transfer was developed over time as a branch of *comparative politics literature*. Prior to 1940, comparative studies examined formal government institutions and focused primarily on the state, while in the 1940s the studies expanded to include the interaction between the state and society. Several decades later in the 1960s comparative policy analysis became a focal point of comparative studies and its process, known as policy diffusion (Dolowitz and Marsh, 1996). Diffusion studies examined "how innovations, policies, or programs spread from one governmental entity to another" (Newmark, 2002. p. 153). The majority of the literature initially focused on policy diffusion in the federal system of the United States as seen in Nelson Polsby's (1984) study on post war science and foreign and domestic policy. Policy diffusion was explained through time, geographic proximity and resources. For instance, Jill Clark (1985) studied the timing and rate of adoption for American state policies and programmes, while Jack Walker's work (1969) on geographic proximity discussed "the process of diffusion of ideas for new services or programs" (p. 881), and Walker (1969) studied the role of resources on policy innovation in American states. The study of the policy diffusion primarily examined rates of change, characteristics of the innovator and adopter, and diffusion patterns for various types of innovations but neglected to consider variations in policy content (Clark, 1985). As a result of the gap in policy diffusion studies, there was a shift towards other dimensions of comparative policy analysis.

In the 1970s, *comparative policy studies* moved towards public policy comparison and its corresponding content. Public policies at the national level were described as large programmes such as healthcare plans and national security programmes. Similar policies were compared across various countries and examined "if particular policies' patterns transcended individual nations" (Deleon and Resnick-Terry, 1999, p. 10). From the onset, comparative policy studies

concentrated on policy patterns, development and implementation of corresponding systems in North America and Western Europe, and in areas such as health and urban policy (Heidenheimer, 1985, p. 445). Comparative policy analysis essentially created a platform where economists, historians, as well as sociologists could learn from each other (Heidenheimer, 1985, p. 445). The learning dialogue developed into lesson learning and policy transfer, braches of studies under the broader comparative policy area (Dolowitz and Marsh, 1996).

Some of the major discussions in the area of lesson learning are explained through various terminologies. The first group of terms explains the learning that occurs in policies through the perspectives of *'political learning'* (Heclo, I974), *'policy change'* (Heclo, I974; Hall 1988) *'policy learning'* (May, 1992), and *'policy-oriented learning'* (Sabatier, 1998). The second group of terms discuss policy learning in the context of policy transfer as seen in Rose's explanation of *'lesson-drawing'* (Rose, 1993), as well as Evans & Davies (1999) and Dolowitz and Marsh's (1996) definition of *'policy transfer'*.

This thesis will apply concepts from Heclo's explanation of policy change, Rose's definition of policy learning from abroad, and Evans and Davies as well as Dolowitz and Marsh's explanation of policy transfer. The terms political learning, and policy-oriented learning will not be applied in this thesis, as both concepts refer to learning in the general policy process and not specifically to policy learning from abroad in the policy transfer process. However, the terms political learning and policy-oriented learning will be discussed to provide context to the overall discussion of policy learning and transfer.

3.1.2 Learning types and policy change

Hugh Heclo (1974) described *political learning* as a "less conscious activity" and is the government's response to change in the environment or society (quoted in Bennett and Howlett, 1992, p. 276). He further states that: "learning can be taken to mean a relatively enduring alteration in behaviour that results from experience; usually this alteration is conceptualised as a change in response made in reaction to some perceived stimulus" (Heclo, 1974 qtd. in Bennett and Howlett, 1992). Learning can lead to two general types of policy changes, which Heclo describes as "incremental changes" or the "trial and error process of policy innovation and change" (qtd. in Bennett and Howlett, 1992, p. 285). The incremental change is known as *classic conditioning,* which is a routine part of policy making where underlying policies are not drastically changed but are adjusted to address societal issues. If new problems occur, solutions are drawn upon similar, well-founded policies. *Instrumental conditioning* is a type of trial and error process based on examining, critiquing and learning lessons from previous experiences. The policy makers' response and actions are usually less predictable than in classic conditioning (Heclo, 1974 qtd. in Bennett and Howlett, 1992).

Unlike Heclo, who defines political learning as a less deliberate action, Peter Hall (1988) argues that learning is a "deliberate attempt to adjust the goals or techniques of policy in the light of the consequences of past policy and new information so as to better attain the ultimate objects of governance" (qtd. in Bennett and Howlett, 1992, p. 276). Hall states that learning is a result of adapting to changes external to the policy environment and can stem from the standard policy making process, which may potentially lead to policy change. Hall describes three types of policy change in policymaking that focus on domestic programme learning experiences. *First order change* in policy shows attributes of "incrementalism, satisficing, and routinized decision-making" (Hall, 1993, p. 280) that commonly arise in the policy process. It is the basic form of policy learning and occurs with the introduction of new knowledge and experiences. The newly acquired knowledge can lead to the adjustment of instrument details but fundamental policy objectives and instruments remain unchanged. *Second order change* is more deliberate and tactical and "may move one step beyond in the direction of strategic action" (Hall, 1993, p. 280). Instrument details or the policy instrument itself is revised based on past experiences but policy goals remain intact. *Third order change* occurs when the policy elements, instruments and goals are altered according to previous experiences (Hall 1993). A shift in the 'policy paradigm' occurs in third ordered learning that often disturbs the present political goals and objectives. Hall defines the 'policy paradigm' as changes in the main set of policy ideas that defines the 'discourse' within the process of policy making (Hall, 1989, qtd. in Bennett and Howlett, 1992).

This thesis will not refer to Heclo's definition of political learning, since it omits the conscious aspect required in policy learning from abroad (discussed later in 3.1.4 and 3.1.5). Instead, the concepts for policy learning will be drawn from literature relevant to the environmental sector (see Glasbergen, 1996 in 3.5.2). Although Hall's concept of policy change can be a useful means of describing changes that occur in policy learning, this thesis will not focus on the types of policy changes but broadly explores policy change as a part of the policy transfer process (explained later in 3.1.4). However, Hall's definition of a 'policy paradigm' will be applied to explain major changes in policy objectives, as seen in conceptual learning (discussed later in 3.5.1). The next section 3.1.3 explores how other authors define political and policy learning and leads to the discussion of lesson drawing from abroad (explained in 3.1.4), a component of the policy transfer process (explained in 3.1.5).

3.1.3. Political and policy learning

Learning in the policy domain is often described using terminology that is not necessarily interchangeable. As seen in the previous section, Heclo discusses *political learning* as the government's responses to a stimulus that could result in policy changes. Other authors differentiate between the terms political learning and policy learning. For instance, Heclo uses

the term *political learning* while Hall uses the term *policy learning* to describe the role of learning in the policy making process. Peter May (1992) makes a clear distinction between *political learning* and *policy learning*. He emphasises that while *political learning* deals with "lessons about manoeuvring within and manipulation of policy processes in order to advance an idea or problem", *policy learning* "is concerned with lessons about policy content - problems, goals, instruments, and implementation designs" (May, 1992, p. 340). May explains that *political learning* occurs inside "advocacy coalitions", which are comprised of individuals or interests groups that advocate their positions in attempt to influence the policy process. May further notes that *political learning* can result in a more "sophisticated advocacy of particular proposals and problems" (May, 1992, p. 340) and can also lead to *policy learning.*

Policy learning defined by May involves learning between two or more advocacy groups and can result in a common understanding among the advocacy groups "of the viability of policy interventions and goals" (May, 1992, p. 340). May identifies *instrumental learning* as a part of policy learning that deals with general lessons on 'policy tools' and is not necessarily confined to lessons for the sole purpose of achieving results.

Paul Sabatier provides a broader definition of *policy-oriented learning* based on Heclo's concepts of political learning and describes it as the "alterations of thought or behavioural intentions which result from experience and which are concerned with the attainment (or revision) of policy objectives" (1998, p. 133). Sabatier's discussion of policy-oriented learning underlines the importance of prolonged changes in perceptions and intended actions that lead to policy reforms. That is, learning results from a number of factors including the combined result from perceptions of external events (also mentioned in Heclo's political learning) and gaining greater understanding of the problem parameters and issues impacting it (Sabatier, 1998).

There are numerous definitions describing learning in policy making but Bennett and Howlett (1992) claim that the diverging views of these learning types do not contradict. They describe learning "as complex, multi-tiered phenomenon which can affect either decision-making organizations and processes; specific programs and instruments used to implement policy; and/or the ends to which policy is developed, and [...] that the agent of each type of learning will be different" (Bennett & Howlett, 1992, p. 289).

Bennett and Howlett (1992) provide a definition for policy learning and do not directly refer to policy transfer but make the connection to policy change as seen in the work of Heclo, Hall, May, Glasbergen and Sabatier. However, Heclo, Hall, May, Glasbergen and Sabatier do not clearly connect policy learning to policy transfer but discuss policy learning as a part of the wider policy process which may or may not result in policy change. But policy change as a result of learning is one of the essential components of the policy transfer process. Policy

change, along with another essential component of learning from an external source, indicates that policy learning has led to the transfer and the adaptation of the policies. Without the element of policy change and policy learning from an external source, policy learning remains as a part of the general policy making process and does not translate to policy transfer. For this thesis, policy change is one of the key elements in policy learning from external sources that leads to policy transfer and consequently post policy transfer, which is comprised of learning experiences based on the transferred policies and on the domestic experience. For this thesis, policy learning from abroad and its associated concepts of lesson drawing, explained in the next section, will be applied to discuss China's experience of learning about policy content and instruments across boarders.

3.1.4 Lesson drawing: the link to policy learning and transfer

Policy learning concepts are not always linked to policy transfer, a necessary aspect of policy transfer. Richard Rose makes a clear connection of these two concepts in his explanation of *lesson drawing* based on learning lessons from "elsewhere". In addition to linking the concept of policy learning to policy transfer, Rose also includes another dimension of learning from an external environment. He defines a policy lesson as "a detailed cause-and-effect description of a set of actions that government can consider in the light of experience elsewhere, including a prospective evaluation of whether what is done elsewhere could someday become effective here" (Rose, 1993, p. 27).

In other words, drawing lessons from abroad can be a valuable, ex-ante exercise that can give a government an indication of possible policy outcomes. Based on one of Rose's explanations, "policy can refer to the programmes that government uses to realise the policy intentions that politicians declare" (2005, p .16). Rose states that policies are comprised of *programmes,* the basic "stock in trade of policy analysis" or the "how" of public policy development in which programmes are drawn based on how other countries have dealt with similar issues (Rose, 2005, p. 16). More simplistically, Rose states that programmes are the tangible measures that provide direction and help manage government resources (e.g. funds, human resources and organisations) and government related activities (laws) to achieve set objectives. In the context of this thesis, programmes refer to the policy measures and instruments used to deliver policy objectives.

Rose includes the additional component of learning from an external environment in his definition of a lesson. He states that "a lesson is a distinctive type of programme, because it draws on foreign experience to propose a programme that can deal with a problem confronting national policymakers in their home environment […] It is a practical, nuts and bolts outline of the means as well as the ends of policy. It identifies the laws, appropriations, and personnel and

organisational requirements needed for a programme to be put into effect" (Rose, 2005, p. 22). A lesson has an "empirical base"" used to examine and evaluate a certain policy in effect somewhere else and "does more than simply endorse what another government does. It adapts what is done elsewhere into a programme [policy] that can be applied by government at home" (Rose, 2005, p. 16). In order to apply lessons, the policy makers must identify the root cause of the problem. Rose emphasises that diagnosing the problem is important to identify the necessary measures for improvements, but the specific "prescription drawn from foreign experience must be hedged with qualifications about success" (Rose, 2005, p.16). For this reason, policy lessons must have a measurable empirical base where the home government can evaluate the extent to which the lesson's success may be applied locally. Rose essentially states that a programme is a specific measure set out to achieve an objective. In this thesis, a distinction will not be made between a policy and a programme. The generic term, 'policy' will be used to describe both the policy and programme and their specific measures.

Lesson-drawing therefore, is a deliberate and calculated process, which "does not share the deterministic assumption of diffusion studies that all countries will sooner or later adopt a more or less similar programme in response to a common stimulus" (Rose 2005, p. 21–24). The process of lesson drawing is intentional, which requires extensive research and does not include drawing passively on previous experience or the incidental movement of policy makers from one region or organisation to another. The objective is to actively draw examples from external governments with the intent of applying the lessons within the home environment.

For this thesis, *policy learning* from abroad and its associated concepts of *lesson drawing* from abroad will be discussed as *a part* of the *policy transfer process*. Although policy learning can be generally applied as a part of the overall policy making process, this thesis will focus on the type of policy learning from abroad that is specifically aimed at contributing to the policy transfer process. The term policy learning from abroad will be used in this thesis to describe China's experience of learning about policy contents and instruments across borders with the intent of applying the policy lessons in its home environment. Table 3.1 provides an explanation of the three concepts that will be applied in this thesis: policy learning from abroad, policy transfer and post transfer learning.

Table 3.1 The policy learning, transfer and post transfer learning process

Concept	Definition	What occurs in the process?	Origin of lessons where implementation occurs
Policy learning from abroad	The learning process of *actively* drawing *policy lessons* from *external* sources with the *intent* of applying the lessons within the *domestic* context.	Policy lessons are drawn from abroad, consisting of best practice examples or lessons to avoid	Policy lessons stem from external sources in other countries or regions
Policy transfer	Occurs when *policy lessons* from *external* sources are *implemented* in the *domestic* context.	Policy lessons from abroad are implemented	Implementation occurs in the domestic policy environment
Post transfer learning	Occurs when transferred policies *evolve* in the home environment based on policy lessons from *external* sources and experiences gained within the *domestic* context.	Policies are adjusted according to the domestic context	Policy lessons are drawn from abroad and from domestic experiences as a part of the continuous learning process

3.1.5 Policy transfer

Mark Evans and Jonathan Davies apply Rose's definition of *lesson drawing* (which requires active learning from external environments), to define *policy transfer* as an "action-oriented intentional activity" (1999). They clearly state that policy transfer is not a model that tracks the normal process of knowledge dissemination. Rather, it focuses on the clear policy changes that occur in a multi-level and multidisciplinary context. Evans and Davies identify several aspects of policy transfer analysis:

- It is a framework for *policy change* focusing on the *process* of change;
- It clearly identifies *'remarkable phenomena'* that cannot be explained under the normal home policy conditions; and
- There is an assumption that policy transfer involves an *international aspect*, which is likely to be 'remarkable' and unexplained by other models.

The emphasis on the international content involves the active transfer of knowledge from an external source resulting in policy transfer. The external aspect can also refer to different levels of governance, for example, learning from the regional to national level, as described in section 3.6, Figure 3.3: "Evan and Davies' policy transfer pathways".

Some of the most well known concepts of policy transfer are developed by Dolowitz and Marsh, who have been at the forefront of the British political science scene in establishing a comprehensive policy transfer theory (Evans, 2009). They combined policy learning, lesson drawing, and policy transfer into a single, broader concept:

"policy transfer, emulation and lesson drawing all refer to a process in which

> knowledge about policies, administrative arrangements, institutions etc. in one time and/or place is used in the development of policies, administrative arrangements and institutions in another time and/or place" (Dolowitz & Marsh, 1996, p. 344)

Policy transfer and lesson drawing is the general process of applying knowledge from one setting to another setting, but Dolowitz and Marsh make a distinction between the drivers of policy transfer and lesson drawing. They regard lesson drawing as a voluntary act in which policy makers take on positive lessons from another country and apply it into their own systems or learn from the mistakes of negative lessons. Policy transfer covers voluntary lesson drawing but also includes some coercive action when one government or a super-national institution applies pressure on another government to implement a certain policy (1996). Examples of coercive policy transfer are provided later in section 3.4.2.

Understanding why policy transfer occurs is one of the first steps in analysing policy transfer. Dolowitz and Marsh developed a framework that can be used as a guideline, in whole or in part (see Figure 3.1) to analyse the process of policy transfer by first asking the question 'why' policy transfer occurs. The framework presents eight areas to analyse the policy transfer process: 1. Why transfer? 2. Who is involved in transfer? 3. What is transferred? 4. From where? 5. Degrees of transfer; 6. Constraints on transfer; 7. How to demonstrate policy transfer; and 8. How transfer leads to policy failure.

Dolowitz and Marsh's framework includes the various forms of transfer (for example voluntary and coercive transfer) as well as national and international learning. The column "how to demonstrate policy transfer" identifies the platforms where evidence of policy transfer is found while the last question includes an evaluation dimension "how transfer leads to policy failure". The question does not necessarily imply that policy transfer will always lead to policy failure but "that policy transfer can, and often does, lead to policy failure" (2000, p. 6). Evaluating why policy transfer is unsuccessful may be useful to identify components for successful transfer. Dolowitz and Marsh define success as reaching the objectives that the government established during the policy transfer process as well as how 'key actors' within a policy area 'perceive' success.

Since the research emphasis will not be on policy evaluation, this thesis will discuss the policy learning and transfer process (in section 3.3) by examining how transferred policies are implemented in China, rather than focus on whether transfer has led to policy failure. Additionally, policy evaluation requires additional data, indicators and analysis, which is beyond the scope of this thesis. The other questions in the framework that will be used in this research are: Why transfer? Who is involved in transfer? What is transferred? From where? Further examination of these framework questions will be discussed in Chapter 4.

Figure 3.1 Table: Dolowitz and Marsh's policy transfer framework

Why Transfer? Continuum — Want To.............Have To			Who Is Involved in Transfer?	What Is Transferred?	From Where			Degrees of Transfer	Constraints on Transfer	How To Demonstrate Policy Transfer	How Transfer leads to Policy Failure
Voluntary	Mixtures	Coercive			Past	Within-a Nation	Cross-National				
Lesson Drawing (Perfect Rationality)	Lesson Drawing (Bounded Rationality)	Direct Imposition	Elected Officials	Policies (Goals) (content) (instruments)	Internal	State Governments	International Organizations	Copying	Policy Complexity	Media (Newspaper) (Magazine) (TV) (Radio)	Uniformed Transfer
International Pressures			Bureaucrats Civil Servants	Programs	Global	City Governments	Regional State Local Governments	Emulation	Past Policies	Reports	Incomplete Transfer
(Image) (Consensus) (Perceptions)										(Commissioned) (uncommissioned)	
Externalities		Pressure Groups	Institutions			Local Authorities		Mixtures	Structural Institutional Feasibility	Conferences	Inappropriate Transfer
Conditionality		Political Parties	Ideologies					Inspiration		Meetings/ Visits	
(Loans) (Conditions Attached to Business Activity)									(Ideology) (cultural proximity) (technology) (economic) (bureaucratic)		
Obligations		Policy Entrepreneurs/ Experts	Attitudes/ Cultural Values						Language	Statements (written) (verbal)	
			Consultants Think Tanks Transnational Corporations Supranational Institutions	Negative Lessons			Past Relations				

Source: Dolowitz & Marsh, 2000

3.2 Issues and gaps in policy learning and transfer literature

Policy transfer, a branch of comparative policy studies, is still a relatively new area of research that requires refining. There continues to be a lack of clarity in maintaining a consistent taxonomy, identifying components of the transfer process and understanding the overall process of policy transfer as well as discussing how transferred policies are applied in the home environment.

Taxonomy inconsistency

A more consistent definition of policy learning from abroad in relation to policy transfer is required in the literature. The "all-encompassing" (Bennett & Howlett, 1992, p. 189) description of policy learning often groups together government learning (process-related concepts), lesson drawing (instruments) and social learning (ideas). Bennett and Howlett's classification can also be problematic as "process related concepts" are not only restricted to "government learning" and can in fact be a component of "lesson drawing" that include the process of implementing a policy instrument. Furthermore, Bennett and Howlett, along with Heclo, Hall, May, Glasbergen and Sabatier (as mentioned in 3.1.3), do not make a direct link to policy learning and transfer but describe a general type of learning in the policy making process. However, there is little consistency even within the broader policy learning literature. Bennett and Howlett argue that the "learning types" should be more consistently described as a separate process, as well as "what" is learnt, and "to what effect" (1992, p. 289).

Additionally, some authors equate drawing lessons to policy change, implying that drawing lessons leads to policy transfer. For instance, Rose states that a lesson "adapts what is done elsewhere into a programme that can be applied by government at home" (2005, p. 16). Dolowitz and Marsh (1996) also maintain that "lesson drawing implies that political actors or decision makers in one country draw lessons from one or more other countries, which they then apply to their own political system" (1996, p. 344). Describing lesson drawing as the application of knowledge assumes that learning automatically leads to change, but this is not always the case. Dolowitz and Marsh recognise this and state:

> "in many cases, lessons are drawn from other places or times which do not result in policy or institutional change. So, for example, in some cases a negative lesson may be drawn about how not to proceed" (1996, p. 344).

A negative lesson may not directly lead to policy change, but the lesson may have an impact on policy making in the home country and steer policy makers into another direction. But since policy transfer did not occur, the impact of the a negative lesson may not be evident in the home environment.

The discussion of policy transfer is also unclear in the literature. This ambiguity seen in policy transfer arises from the absence of a defined policy transfer theory. Evans and Davies claim that: "policy transfer analysis does not have full explanation and theory status. This would require the development of a causal model based upon a series of propositions which may be validated or falsified by evidence" (1999, p. 364). Since a standard theory does not exist, policy transfer approaches and definitions vary widely. They assert that "policy transfer analysts do not have the benefit of a common idiom or a unified theoretical or methodological discourse from which lessons can be drawn and hypotheses developed" (1999, p. 361). One of the reasons why a unified policy transfer theory does not exist is that the processes cannot be easily documented. This is due to the large range of actors involved and the complex formal and informal interaction between actors as well as the high degree of implicit knowledge exchanged that often remains undocumented. Tracking the entire process of policy transfer is not straightforward and requires extensive resources and time to determine the actors involved and the interactions that occur between the actors.

Although the policy transfer process is arguably unique in every case (Dolowitz, 2000), the policy transfer process may still be systematically analysed. For instance, Dolowitz and Marsh established a flexible framework with questions that guided the policy transfer analysis in this thesis. Specifically, this thesis recognises that the framework is only a broad guideline for analysing policy transfer in China and does not seek to design a "one size fit all" analysis framework.

On the contrary, some authors claim that too much emphasis is placed on creating a solid framework to examine a fluid policy process that does not require complex theories and conceptualisation. Bennett and Howlett argue that policy transfer is excessively "overtheorized and underapplied" (1992, p. 289). That is, policy transfer is explained systematically as a part of the policymaking process but policymaking, as Charles Lindblom (1959) described, is "at best a very rough process" (1959, p. 86). Learning does not necessarily occur in a deliberate manner and may arise more frequently from trial and error, which "is a more common basis for learning than systematic policy evaluation or experimentation" (May, 1992, p. 333). Learning can be more spontaneous where trial and error learning is part of the process of "muddling through" in policy making (quoted in May 1992, p. 333). Evans and Davies also argue that the process of seeking lessons from abroad "in a search for policy ideas […] is quite often an ad hoc process characterized by trial and error" (1999, p. 377). Even though the learning that occurs in policy transfer may be ad hoc, there is an active and deliberate attempt to seek lessons in the policy transfer process.

Analysing the policy transfer process

The policy transfer process can be difficult to identify and analyse. Dolowitz, and Marsh (2000) claimed that most studies did not analyse and explain the transfer process in a systematic manner and were rather descriptive when discussing ideas and policies transfer between countries. That is, policy transfer studies largely concentrated on presenting incidences of transfer or focused on explaining why transfer occurs. For instance, Bennett's (1991) study on "How States Utilize Foreign Evidence" described how the U.S. Freedom of Information Act was applied in Canada but was rejected in the UK and largely focused on why countries engaged in policy learning as well as the conditions for learning. Benettt's study can be credited for providing evidence of how the policy learning process occurred, a less common practice in early policy transfer literature. However, the evidence was anecdotal and lacked a systematic analysis and an overarching framework. May's (1992) study largely ignored the policy learning and transfer process and instead, focused on presenting evidence of policy learning and failure through providing examples of various American policies in the social, health, waste management and energy sector. The absence of a systematic analysis of the policy learning and transfer process was likely due to a lack of consistent terminology and framework in policy learning and transfer literature, which was later introduced in Dolowitz and Marsh's (2000) policy transfer framework.

Since the early 2000s, there has been increased attention on analysing the policy transfer process, as seen in Rose's work. He developed a three stage approach to lesson drawing beginning with the initial preparation phases for "drawing lessons", "venturing abroad" to seek for policy lessons, and "returning home" to apply the lessons (Rose, 2007). There are also empirical studies carried out by Bulmer, Dolowitz, Humphreys and Padgett that examine "how European Union institutions structure and mediate the processes of policy transfer" in the utilities sector (Bulmer et al. 2007, p. 9).

While there are more efforts concentrated in gaining a better understanding of the policy transfer process, there are gaps in studying how policy learning impacts policy outcomes. Marsden and Stead's (2011) scan of policy transfer literature in the transportation sector argues that there are limited studies that examine "how policy transfer works" and to date, studies have not connected learning to policy outcomes (2011, p. 499). Policy learning literature is "relatively weak in its ability to fully demonstrate transfer" and studies do not evaluate results, that is, give sufficient proof on whether policies transferred have been successful. Evaluating the success or failure of policy transfer (mentioned in the last question of Dolowitz and Marsh's policy transfer framework in Figure 3.2) requires studies to monitor the policy learning to the policy implementation process.

There are a limited number of studies that follow through the process in a systematic manner despite the increasing number of studies in policy transfer. One example is Marsden and Stead's study (2011) that examined policy transfer based on Dolowitz's and Marsh's framework (2000). Of the thirteen studies they examined in their literature review of the transport sector, only four studies tracked the policy transfer process. These studies included the adoption of the Bus Rapid Transit systems in Beijing, Jakarta, and Seoul (Matsumoto, 2007); transferring transport infrastructure policies in Denmark and Netherlands (De Jong and Edelenbos, 2007); investigating reform strategies in the Germany and the UK rail market; and exploring options for road tolls in Norway's cities (Lodge, 2003; qtd. in Marsden and Stead, 2011, p. 496).

Evans and Davies also noted that there could be exaggerated claims about the nature and extent of particular policy transfer examples and have proposed several steps to validate policy transfer. One of the steps includes searching for evidence of non-transfer. They have defined non-transfers as follows:

"Elements of an idea or a programme which are found to have been borrowed from domestic antecedents or which are innovative can be described as non-transfers. Parts of an original idea or programme discarded or filtered out by the subject/agent are also non-transfers" (1999, p. 382).

Problems arise from identifying non-transfer elements since the explanation does not describe what policy transfer is but rather, what it is not. Finding the exceptions in order to define policy transfer can prove to be challenging due to the unique elements of each policy learning and policy transfer case. Additionally, the definition does not consider that domestic antecedent or innovations in policies may have originated from transferred policies and have been adjusted to suit the domestic setting.

Impact of policy transfer from abroad

There is a limited discussion on the impact of transferred policies from abroad in the recipient country. Transferred policies are likely to change according to the domestic learning experience and may result in policy innovations that are distinct from the original policy and these transferred policies are often viewed as a part of the national policy environment. For instance, Rose states that "[o]nce a lesson is implemented, a lesson is no longer a foreign import; instead, its evolution is now an integral part of the dynamics of national society and politics" (Rose, 2005, p. 134). But transferred policies applied in the home environment are not strictly home-grown policies. Sometimes adapted policies may change as a result of what Rose describes as "feedback from society" (2005, p. 135). If programs are satisfactory then they can be "routinised" but if programs are unsatisfactory, policy makers may need to correct, reconstruct, or abandon the policy. Although Rose discusses this policy refinement process as domestic

incidences, this may not apply in all cases. Policy makers may continue to look abroad to understand why policies at home are not experiencing the expected outcomes observed in other countries. Thus policy outcomes evolving from transferred policies should be discussed as a part of the *post policy transfer process,* an area that is further developed in this thesis to explain how transferred policies are applied in the home environment. Post policy transfer takes into consideration the continuous interactions with the policy transfer agents from home and abroad. But even if policy transfer agents do not continue to interact with the community after policies are adapted, the transferred policies are imports and are not strictly domestic policy learning experiences.

Rose also argues that policies from abroad will likely have a different impact in the home environment and may be altered according to the internal experience: "when feedback shows that a programmes works differently in practice than on the drawing board, policymakers must make adaptations. With the passage of time, both the programme and its political support alter" (2005, p. 134). The aspect of post policy transfer learning needs to be considered in the discussion of the policy transfer process since policy learning does not abruptly stop after transfer occurs. Dolowitz (2009) recognised the continuation of learning beyond the policy transfer process and stated that:

> "future policy transfer studies […] will need to take a much broader view of policy transfer and policy making. For, while most existing studies examine policy transfer as if it ends with the passage of a policy, in reality it is more likely to exist as a cycle, in which lessons are being drawn and information is being integrated in a continuous fashion as new actors become involved and policies develop once implemented" (Dolowitz, 2009, p. 329).

Policy learning occurs first through drawing lessons from abroad and these policies are later transferred into the domestic environment in the policy transfer process. But once the policies have been transferred, there is a feedback learning (referred to by Rose, 2005) that occurs in the post transfer learning process.

3.2.1 Limitations of policy transfer analysis

The study of policy transfer is largely a qualitative exercise that requires thorough analysis covering only a fixed number of cases at a given point in time. Each case of policy transfer is unique including the evidence of what is transferred, the actors involved, and how the transfer takes place. There is no exact method to search for evidence of how knowledge is obtained (obtaining knowledge is discussed later in 3.8.2) and how it leads to the implementation of policies in the home environment; thus the method is not easily generalised.

Additionally, the majority of policy transfer cases have been traditionally concentrated among

western democratic countries (Evans & Davies, 1999). Rose (1993) claims that the narrow focus on the western world is a concerning issue, as there is "an implicit first world, second world and third world division" (qtd. in Stone, 1999, p. 57). He notes that the focus on lesson-drawing cases in North America, the European Union or certain Commonwealth nations could be a result of conveniences such as common languages and similar mind-sets.

There is a large number of policy transfer examples between Britain and the United States but the incidences are often one-sided with Britain drawing lessons from the U.S. since the 1980s. According to Dolowitz et al (1999), Britain is generally a supporter of American policies and the two countries also share similar ideologies (Dolowitz et al., 1999, p. 728). Both countries are English speaking and as a federal state, the U.S. has a diversity of experience for Britain to draw from. For instance, Dolowitz, Hulme, Nellis and O'Neil's studies (2000) examine the role of transferring American policies to Britain in healthcare, social services, education and law. In their study, Dolowitz et al. note that the UK drew lessons from welfare child support policies in the U.S. for reasons including "shared ideological values" between the Regan and Thatcher government and because both countries faced similar problems in their administrations (2000, p. 39).

Policy transfer studies are beginning to venture beyond Western borders towards the latter half of the 2000s as seen in Sloam's study (2006), which explored the extent that Eastern European social democracy was used as a transfer model for successors of the communist parties in Central and Eastern Europe. He claims: "[i]n determining the source of the transfer for political parties geographical location, cultural affinity and ideological closeness are of key importance in prompting transfer to take place" (Sloam, 2006, p. 81). Although policy transfer is examined beyond western European countries, there is still a tendency for western scholars to examine policy transfer between western nations or OECD countries and limited case of transfer between other regions such as Latin America and Arab nations. There was interest in examining Asian countries pre-1997 due to the rise of Asian economies but this declined for some time with the Asian financial crisis (Stone, 1999, p. 57). The trend is reversing again due to their stronger economic performance and the rising influence of Asian countries. For instance Kwon (2009) explores the rationale of policy learning and transfer in Japan, Korea and Taiwan's health insurance programmes that occurs between the three countries as well as from Western countries.

Some other studies of policy learning in Asian countries have emerged that transcend political, geographical, cultural and ideological proximity. Such examples include Rui Wang's (2010) study on lesson drawing in China's transport sector from foreign examples in the East and West including London and Singapore's congestion charge, Singapore's vehicle quota scheme and its

park and ride programme, as well as Mexico City's driving bans (Wang R., 2010). The study, however, is empirically based with limited reference to policy transfer concepts. More coverage of regions and political realms are needed to contribute to policy transfer literature and to evaluate its role in national and international policymaking process. There is a move away from primarily studying policy transfer in Western democratic nations and towards empirical studies of policy transfer in emerging and developing nations; but more effort is needed to apply policy transfer concepts in a systematic manner to complement the empirical studies carried out beyond western democratic countries.

3.3 Applying policy transfer concepts to this thesis

Based on the policy learning and transfer concepts discussed and the gaps identified in the literature, this thesis provides evidence of *lesson drawing/policy learning* from abroad, *policy transfer* and the seldom discussed *post-policy transfer learning*.

In this thesis, the terms *lesson drawing* and *policy learning* from abroad are used synonymously and are defined as the learning process specifically where lessons are drawn from one or more external political region(s) with the objective of applying lessons in the internal political region or learning from negative lessons. *Policy transfer* is defined as a calculated and deliberate attempt, either voluntary or involuntary, to adopt external policy lessons. *Post policy transfer learning* occurs when transferred policies are implemented and/or altered as a result of learning from abroad and/or from domestic policy learning.

These concepts can form the basis of policy transfer analysis in China's RE sector by raising several questions:

Policy learning and policy What is being transferred from abroad and from where and who are
transfer: the policy agents responsible for learning?

                   How are policies (knowledge) transferred?

Post transfer learning: How are transferred policies applied in the domestic context?

The following sections will provide a framework on how this research analyses the policy transfer process in China's RE sector, as illustrated in Figure 3.2

Figure 3.2 Table: Policy transfer and post transfer learning framework

① **WHY?**
- From voluntary transfer towards coercive transfer

② **WHAT?**

A. **Type of policy content:**

Hard Transfer
- Policy goals
- Content & instruments
- Programs
- Institutions

Soft Transfer
- Ideologies
- Ideas
- Attitudes

B. **Type of policy learning process:**

Technical learning
- Incremental changes

Conceptual learning
- Redefining policy goals and new policy paradigms

③ **FROM WHERE & WHO? (Agents of Transfer)**

- Local/national/international
- Civil servants
- Government & non-government organizations & institutions
- Policy experts
- Consultants
- Pressure groups
- Think tanks/academia
- Corporations

④ **HOW ARE LESSONS TRANSFERRED?**

1. Systematic study
2. Observation
3. Interaction
4. Experience

⑤ **HOW ARE TRANSFERRED POLICIES IMPLEMENTED IN CHINA'S POLICY LEVELS?**

Policy Function

Coordination

Diffusion & Adoption

Localised adaptation

First Level Policy
- National Goals and RE targets
- 5 Year Plans
- RE Law

Second Level Policy
- Specific RE regulations, objectives and development plans
- Industry policies & standards

Third Level Policy
- Provincial goals
- Regional RE objectives
- Local/practical incentives and program
- Managerial guidelines

Source: Own rendition based on Dolowitz and Marsh, 2000;Evans and Davies,1999; Glasbergen,1996; Rose, 2005; Kemp and Weehuizen, 2005; Hayek, 1945 Dopfer et al, 2004; NREL, 2004

The discussion will be structured according to the policy transfer concepts based on: Dolowitz and Marsh' previously discussed policy transfer framework questions, agents of transfer, and policy categories (Figure 3.1: Dolowitz and Marsh's policy transfer framework), as well as other author's concepts which will be discussed in detail below including Evans and Davies' (1999) types of transfer; Rose's (2005) concept of lesson drawing, Kemp and Weehuizens' four learning types; and Hayek's knowledge base economy (1945) and the multi level discussion by Dopfer et. al (2004) and the NREL's categorisation of renewable energy policy levels (National Renewable Energy Laboratory, 2004).

The "why" questions examine the motivations of engaging in policy transfer, which could be a result of voluntary or involuntary transfer while the "what" questions examine the *types of policies* that are studied in lesson drawing identified by Evans and Davies as well as "what" *type of policy learning process* has taken place, as defined by Pieter Glasbergen (1996).

The "from where and who" questions searches for evidence of policy learning from countries and specific actors and is drawn from Dolowitz and Marsh's framework classification.

The question "how policies are transferred" is based on Kemp and Weehuizens' explanation of how knowledge is transferred. The last component of the framework examines how transferred policies are implemented in the home environment by analysing the policies at the first, second and third policy level (this thesis will not examine the third policy level). The policy levels are defined according to their policy function based on the concepts of Hayek's knowledge base economy.

3.4 "Why" policy transfer?

Evans' explanation for engaging in policy transfer is that it is "a theory of policy development that seeks to make sense of a process or set of processes in which knowledge about institutions, policies or delivery systems at one sector or level of governance is used in the development of institutions, policies or delivery systems at another sector or level of governance" (Evans 2009, p. 243-244). Transferring the "set of knowledge" and "delivery systems" from one nation to another can be driven by different motivations. Understanding the motivation of why policy transfer occurs is the first question that appears in Dolowitz and Marsh's policy transfer framework (Figure 3.1). Exploring this question helps establish the policy transfer setting by identifying the drivers for actors to engage in policy learning, which can occur on a continuum ranging from voluntary to coercive pressures.

The following section will discuss Dolowitz and Marsh, Evans and Davies, Bennett, and Rose's views of why policy lessons are drawn through exploring voluntary, indirect and direct coercive, and negotiated transfer.

3.4.1 Voluntary policy transfer

Dolowitz and Marsh (1996) state that voluntary policy transfer takes place when political actors willingly choose to apply policy lessons. They also define this as lesson drawing (see section 3.1.4). The main motivation for drawing policy lessons is to improve the domestic policy situation. Rose states that if home policies are working well, the "established routine" can continue without the need for policy lessons but when the routine fails to provide suitable solutions, policy makers look for lessons. An acknowledgment of dissatisfaction indicates that there are problems with existing policies and policy makers must first define the problem before engaging in voluntary policy transfer (Dolowitz, 2000, p. 14). Colin Bennett presents five motives for policy makers to voluntarily engage in drawing policy lessons that include:

> "to put an issue on an institutional agenda; to mollify political pressure; to emulate the actions of an exemplar; to optimize the search for the best policy; and to legitimate conclusions already reached" (1991, p. 33).

The political motives for seeking policy lessons from aboard can help justify the implementation of a particular policy at home or ease certain pressures since opinions and examples from a third party may be perceived as being more 'objective'. Furthermore, identifying best practices can help policy makers at home to apply already proven solutions and potentially receive greater political support.

3.4.2 Coercive transfer

On the opposite end of the policy transfer spectrum, coercive transfer occurs when "one government or supra-national institution pushes or forces, another government to adopt a particular policy" (Dolowitz & Marsh, 1996). The pressure to adopt a certain policy may occur either directly or indirectly.

Indirect coercive transfer commonly occurs when there are interdependencies arising from externalities that lead to a common action. For instance, countries bordering the same body of water may be pressured to work together when dealing with marine pollution. The term indirect coercive transfer used by Dolowitz and Marsh gives a negative connotation to the forces driving policy transfer, but this is not always the case. For instance, Bennett discusses "policy responses as the by-product of wider socio-economic or technological forces" (April 1991, p. 31). Countries at similar levels of development facing similar problems may look to each other for solutions. Also, the rapid development of technology may push policy makers to seek experiences from other countries dealing with similar development paths (Bennett, April 1991). External pressure to conform to international policy norms can be a strong indirect force. Bennett explains this rationale as "they've got one, we ought to have one too". Countries do not want to be "left behind" and this "generate[s] a sense of inevitability and urgency. The more

countries that can be cited as "ahead of us" the more plausible is the argument that legislation is desirable" (April 1991, p. 43-44)". A number of external forces can push a country to apply policies that it may not necessarily consider if interdependencies were eliminated.

Another type of pressurised transfer is *direct coercive transfer,* which occurs when a government or institution forcefully pushes another to implement a policy. Coercive policy transfer is not common between governments but does occur with supra-national institutions such as the EU, World Bank and International Monetary Fund who tend to exercise their influences. Transnational companies may also play a role in coercing governments to adopt policies favouring their business activities. If governments refuse to adopt or reject certain policies, the transnational firms may threaten to leave the country and can prevent the adoption of stricter environmental codes. The forced transfer is not necessarily negative from the environmental perspective if regulations promote sustainable development. For instance, the EU may oblige certain member states to adapt environmental regulations that are more stringent than existing regulations at a national level (Dolowitz & Marsh, 1996).

Additionally Dolowitz (2009) makes reference to post transfer learning as part of the discussion of coercive transfer. He states that coercive transfer is "less […] about learning than force and power" (Dolowitz, 2009, p. 320) and that if any learning takes place, it would likely occur after policies are implemented in the post transfer process. There is no discussion about post transfer learning related to voluntary transfer but there is a recognition that policy learning does not end once a policy is implemented.

In this thesis, the post transfer learning discussion will not be restricted to the discussion of coercive transfer but will be considered as a general part of the policy learning and transfer process. Also, coercive pressures from transnational companies do not play a discernable role in policy learning and transfer in China's wind power sector. Thus the general term *coercive transfer* will be applied to explain the external forces in varying degrees that both directly and indirectly push a country to adapt certain policies from abroad.

3.4.3 Negotiated transfer

Voluntary transfer and coercive transfer are on polar ends of the policy transfer spectrum. At the middle of the spectrum is a moderate form – negotiated transfer exhibiting both voluntary and coercive traits. Dolowitz and Marsh (1996) argue that policy transfer is likely to display some aspects of willing and forced components. Returning to the example of the EU, member states voluntarily join the EU and when a directive is established, member states are expected to comply within a negotiated timeframe as directives are enforced by the EU Court of Justice. Similarly, any country that is a member of a regional or international organization, such as the World Trade Organization, is expected to adhere to the treaty rules and apply policies to ensure

that the rules are enforced.

There is a wide range of definitions used to describe policy transfer. For this thesis, the term *lesson drawing* will be used to describe voluntary policy transfer and the term *policy learning or transfer* will be used to describe the overall process of policy learning with both components of voluntary and coercive transfer.

3.5 Identifying the "what" in policy learning

Policy transfer consists of learning by examples – but what policy contents are transferred and what are the types of policy learning processes?

3.5.1 What policy content is transferred?

Evans and Davies provide two relatively simplified classifications of "objects of transfer" or contents of policy transfer which include: soft transfer, consisting of "ideas, concepts and attitudes"; and hard transfer, which deal with "programs and implementation" (1999, p. 382). They do not discuss the types of transfer in depth and broadly state that soft transfer consists of ideologies and political style and culture (Evans and Davies, 1999, p. 379). Similarly, Stone (2004) describes soft transfer "as the spread of norms and knowledge" (Stone, 2004, p. 546). Adrian Smith also refers to soft and hard measures in his discussion of governance levels in England's renewable energy sector (examined further in section 3.9.1). Smith describes "soft measures" in the context of governance as "sharing views, building networks, etc." and "harder measures" as "implementing targets, making investments, reforming institutions and infrastructures" (Smith, 2007, p. 6269). For this thesis, soft transfer will be defined as ideas, concepts attitudes and norms (Evans and Davies, 1999; Stone 2004).

Both aspects of hard and soft transfer can be present in policy learning (different types of policy learning are defined by Glasbergen in the next section 3.5.2). But the distinction between soft and hard transfer are not always clear. For instance, studying the role of policy learning in policy institutions as a form of technical learning involves understanding an organisation's functions and structures. It also involves some soft learning such as understanding the institutional culture and dynamics. The "content of transfer" discussed for this thesis largely consists of hard transfer related to policy instruments and interventions as discussed in the next section.

Learning about specific policy instruments is the main component of hard transfers that will be examined. This thesis will draw on Weimer & Vining's (1992) classification of generic policies: 1) freeing, facilitating, and stimulating markets; 2) taxes, subsidies to alter incentives; 3) establishing rules; and 4) nonmarket mechanisms. Weimer & Vining define these generic policies as "the various types of actions that government can take to deal with perceived policy

problems" and are usually customised to address specific policy issues (Weimer & Vining, 1992, p. 144).

Table 3.2 provides a summary of these four generic policy types.

Table 3.2 Generic policies and interventions

Market interventions	
▪ Freeing markets	▪ Deregulation, legalisation and privatisation
▪ *Facilitating markets*	▪ *Allocating existing goods (i.e. property rights), creating marketable goods (tradable permits, financial instruments)*
▪ *Simulating markets*	▪ *Auctions*
Incentives	
▪ Supply-side taxes	▪ Output taxes, tariffs (tax on imports)
▪ *Supply-side subsidies*	▪ *Grants, tax deductions*
▪ *Demand-side taxes*	▪ *Commodity taxes and user fees*
▪ Demand-side subsidies	▪ Subsidies consumption of specific goods, consumer voucher
Command and Control	
▪ *Establishing Rules*	▪ *Framework rules, civil and criminal laws*
▪ *Regulations*	▪ *Price regulations, quantity regulation (quotas or bans)*
Non-market interventions	
▪ *Nonmarket mechanisms*	▪ *Direct supplies of good or services through government bureaus and agencies, independent government agencies, government corporations,* special districts/economic zones, contracting out (i.e. construction for military material)

Source: Extracted components from Weimer & Vining, 1992, p. 144-187 (additions made to policy headings)

The italicised policies in policy groups 1 to 4 relevant for this thesis are:

- applying market interventions (OECD, 2001) through facilitating markets, stimulating markets, and supply-side subsides;
- economic incentives that are "economic instruments of cost internalisation" including: user fees to internalise externalities and pricing goods and services appropriately;
- command and control policies that deal with "permissions, prohibition, standard setting and enforcement" (OECD, 2001) which includes: establishing regulations to enforce certain behaviours; and
- implementing non-market intervention to supply goods and services through government agencies.

Facilitating markets involves creating a functioning market such as allocating existing goods or creating new marketable goods, which include tradable permits. *Stimulating market* policies may be necessary in situations where efficient markets are not functioning. The government can stimulate the market process by facilitating a process where goods and services are allocated

through auctions. *Supply-side subsidies* are a means of increasing the supply of goods by providing direct subsides to suppliers. Aside from policies that incentivise certain behaviours, user fees (commonly in the form of taxes) can be applied to raise revenues for redistribution. *Demand-side* user fees are charged to end-user consumers and the proceeds can be redistributed to help fund the cost of producing a good. A form of non-market mechanisms include establishing *rules and regulations* as a means of imposing or preventing certain behaviours through framework laws, pricing regulations, etc. Another *non-market mechanism* includes "government provision of goods through public agencies" (Weimer & Vining, 1992, p. 178). Some examples are government bureaus that directly provide goods and services such as construction and public works, technical assistance, research and testing health care and social services. Independent agencies can also provide services through government corporations (government ownership) for water, gas and electricity. These policies and government organisations will be discussed in greater detail in Chapter 5 within the context of RE policy.

These classifications above do not include 'other' categorisations such as *information and education instruments* involving different levels of support from the government. Several common forms involve education and training for the general public, media or specific groups; industry reporting requirements, information disclosure for the public such as reporting on pollution; and labelling and certifying products. Another type of policy is "self-regulation, voluntarism and moral suasion" that may or may not involve the government and can be initiated by industry, businesses or individuals (Twomey, 2010; IEA, 2010). For the purpose of this research, these other policy classifications will not be examined or only briefly explored (in the case of information and education instruments). More detailed RE instruments categorised under Weimer & Vining's definitions will be discussed in Chapter 5, section 5.2.

3.5.2 What are the types of policy learning processes?

Pieter Glasbergen (1996) describes policy learning as a type of *technical learning* about policy instruments along with another form of learning known as *conceptual learning* within the environmental context. He states that:

> "Technical learning consists of a search for new policy instruments in the context of fixed policy objectives. Change occurs without fundamental discussion of objectives or basic strategies. Policy makers respond to demands for change with "more of the same" kinds of solutions that they adopted in first responding to environmental problems: more regulation, oversight, and enforcement.
>
> Conceptual learning is a process of redefining policy goals and adjusting problem definitions and strategies. Policy objectives are debated, perspectives on issues change, strategies are reformulated. New concepts (pollution prevention, ecological

modernization, sustainability) enter the lexicon" (Glasbergen quoted in Fiorino, 2001, p. 324).

Generally, technical learning does not challenge the basic concepts, designs and activities of a policy objective or strategy while conceptual learning requires a re-evaluation of current practices and leads to a policy paradigm shift from the main set of policy idea. In this thesis both technical and conceptual learning will be explored in the policy learning process.

3.6 From "where"?

Dolowitz and Marsh identify three levels of governance where actors draw policy lessons from the local, national and international level. At the local and national level, actors can learn from their past experiences as well as from each other. Actors can also seek policy lessons from other countries, not only at the broader state level but also lower government level. Evans and Davies (1999) provide another classification of the different governance levels using the "five levels of political spatiality" (1999, p. 368), which include the local, regional, national, international and transnational level. Figure 3.3 illustrates the possible pathways where policy transfer can occur.

Figure 3.3 Evan and Davies' policy transfer pathways
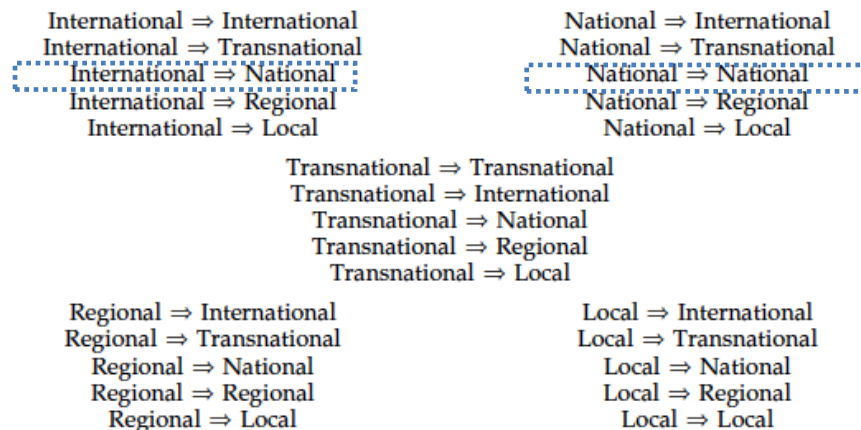
Source: Evans and Davies, 1999, p. 368

The transfer pathway diagram indicates that learning can occur within and across the geographical boundaries as well as from the higher governmental level to the lower governmental level and vice versa. This thesis will focus on two transfer pathways when analysing the policy transfer and post-transfer learning process in China's RE sector. The 'international to national' pathway will be examined for policy learning; and for post transfer learning, the 'national to national' pathways will primarily be explored. Identifying where policy lessons are transferred from is useful in providing a context for the actors involved in the process. Merely identifying a policy actor as a 'civil servant' provides little information on the actor's role in the transfer process, as compared to the civil servant described as a researcher working in the national research energy institution seeking policy lessons from another national

level body. The added detail provides the background required to understand the objective of policy learning from abroad.

3.7 Identify the "who" in policy learning

In order to facilitate the learning process, agents or actors are a necessary vessel for policy transfer. Dolowitz emphasised the importance of actors, stating: "once the object of transfer has been clarified, the agents or agents of transfer need to be established. It is essential to establish the agents of transfer because policy transfer must be a conscious process" (Dolowitz, 2000, p. 33). Government actors are a vital part of facilitating policy learning that leads to policy transfer. For this thesis, the term 'government' is applied broadly to include politicians, policy makers and civil servants. Rose states that elected officials are the most crucial actors in the transfer process and since they provide leadership in public policy, their support is needed to validate and approve new programs (Rose, 1993). In China, officials are referred to as deputies to the National People's Congress (NPC) and are elected, in principle. Deputies at the county, district, and town levels are directly elected by registered voters (China.org.cn., n.d.). However, candidates are largely endorsed by the Communist Party (CPC). The process is closely monitored and determined by an election committee and a consulted small group of voters that support the CPC objectives (McCormick, 1990). Deputies above the county level are indirectly elected by the deputies from the level below (China.org.cn., n.d.). This internal election process allows the NPC, and consequently, the CPC to retain authority over the elections of higher deputies. Thus deputies, though theoretically elected, are often already supporters of the CPC and will implement policies or meet targets set by the NPC in line with the CPC goals.

Although the government may have direct influence on policy learning and transfer, there are many other policy agents involved in the process of learning. Dolowitz and Marsh identify other non-government actors including policy experts, consultants, pressure groups, think tanks, academia, corporations as well as non-governmental national and international organisations and institutions. These government and non-government policy agents are responsible for establishing interactions between the agents with policy expertise from abroad and the agents of learning. Knowledge exchange may be in the form of implicit or explicit knowledge. Agents can organise conferences, seminars and fact-seeking assignments to facilitate an exchange of implicit knowledge or commission policy recommendation reports to provide advice on drafting legislation (Evans & Davies, 1999).

Other regional or transnational organisations such as the Organisation for Economic Co-operation and Development (OECD), and Asian Development Bank as well as the World Trade Organization (WTO) are important policy agents that can add to the knowledge base of policy learning and influence the transfer or policies. Finally, the media can act as a policy agent that

shares information and draws parallels between similar policies. The timely source of information from the media can help policy agents to keep up with recent developments (Stone, 1999). In the case of China, the main media channels are primarily monitored or owned by the CPC and thus most content is government-endorsed and information can be restricted. But in the area of energy policy development, information is often released in a timely manner, as observed throughout the course of this research.

Identifying elements of policy transfer requires actors to be aware of the policies from abroad. There needs to be evidence that the actors have access to the knowledge since merely identifying that the home policies are similar to policies implemented abroad is not sufficient to prove that policy learning and transfer has occurred. After the actors have been identified, evidence of policy transfer can then be provided (Dolowitz, 2000). Overall policy agents are a vital component of lesson drawing as they are the carriers and recipients of knowledge.

3.8 'How' are lessons transferred?

A single framework illustrating how policy transfer occurs does not exist since each country learns and implements policies uniquely. There are, however, various explanations describing the approaches that can lead to policy transfer. Bennett states that policy transfer occurs with the "export of knowledge" since knowledge is the component facilitating policy learning (Bennett, 1991, p. 32). Johnson and Lundvall examine the importance of implicit and explicit knowledge while Kemp and Weehuizen examine how actors are involved in transferring this knowledge across borders.

3.8.1 Obtaining knowledge as a part of policy learning

Obtaining knowledge is the first step of policy learning. However, as previously stated, having mere knowledge of a policy does not give rise to policy transfer. Bennett makes the distinction between "knowledge of a foreign program, utilization of that knowledge, and the adoption of the same program" (Bennett, 1991, p. 32). Utilising the knowledge of a policy from abroad results in the transfer of a particular policy. There should also be evidence that policy implementation resulted from having knowledge of the programme. He argues that the diffusion or spread of a policy does not equate to knowledge diffusions, or the deliberate act of gaining knowledge (Bennett, 1991).

Knowledge can be obtained from the originating country through implicit and/or explicit learning, which illustrates the learning process when drawing policy lessons. There are diverging views of implicit learning but the conventionally accepted definitions state that "implicit learning is the capacity to learn without awareness of the products of learning" (Frensch and Rünger, 2003, p.14). In an explicit learning process, there is a "conscious awareness of regularity" when exposed to "environmental regularity" (2003, p.15). The view of

learning without awareness dates back to Arthur Reber's (1960) studies on grammar-related tasks, which identified that learning occurred even though it could not be verbally communicated (qtd. in Frensch and Rünger, 2003). However, studies in the early 21st century questioned if implicit learning "proceeds automatically without the use of attentional resources" (2003, p. 17), that is, resources that potentially raises awareness to the process of learning. In fact, implicit learning can be based on learning mechanisms, or any means that facilitate the process of learning.

The learning mechanisms in which knowledge can be obtained can be generally categorised through systematic learning (learning by studying/learning), observation (learning by observing), interaction (learning by interacting) and experience (learning by doing/using) (Kemp & Weehuizen, 2005). These methods of learning or obtaining knowledge are used to describe how individuals learn and are also applicable to how policy actors or governments learn. For this thesis, learning will be defined in relation to policy learning and transfer. The four methods of obtaining knowledge in the learning process can be placed on a continuum with explicit learning on one end and implicit knowledge on the other end as illustrated in Figure 3.4.

Figure 3.4 Learning mechanisms for obtaining knowledge
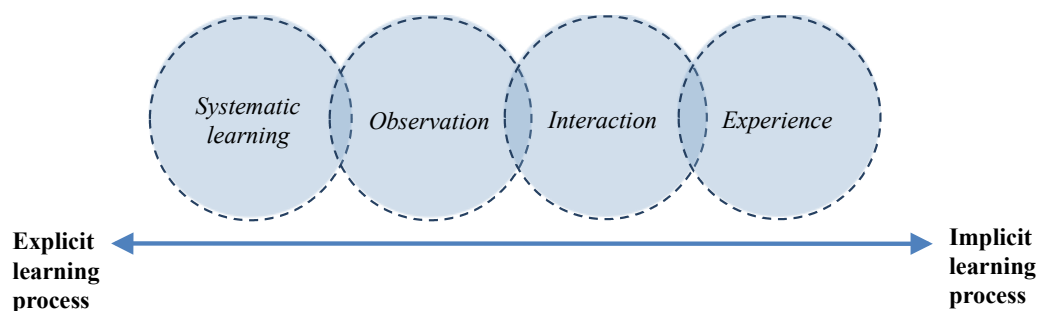
Source: Own interpretation of Kemp & Weehuizen's (2005) learning types

The diagram illustrates the extent to which each learning mechanism possesses explicit and implicit learning characteristics. The continuum emphasises that the explicit and implicit learning process is not clearly defined for each type of learning mechanism. To some extent, each learning mechanism has elements of both implicit and explicit learning. The diagram illustrates a linear view but in the policy learning process, obtaining knowledge does not occur in any particular order and there is no set number of learning mechanisms required for policy learning. Also, as seen in the diagram, the arrows move in both directions indicating that explicit learning can lead to implicit learning and vice versa. For example, interactions in the policy learning process can raise some questions regarding how certain policies instruments were drafted and implemented and lead policy actors to engage in systematic learning in order to further examine the policy in question.

The learning mechanisms in which knowledge is obtained in the policy learning process should not be confused with other terms such as tacit and codified knowledge. Tacit and codified knowledge relate to the learning content while implicit and explicit learning refers to the overall process of learning. Tacit knowledge can be confused with implicit learning, as it has been commonly described as a type of knowledge where "we can know more than we can tell" (Polanyi, 1967, p. 4). Codified knowledge can be referred to as "structured data and the necessary instruction for its processing' and as 'knowledge reduced to symbolic representations'" (Johnson & Lundvall, 2001, p. 4). There are disagreements on the definition of codified and tacit knowledge. For instance, Johnson and Lundvall argue that "there is a category of knowledge that is codified but not articulate". For instance, knowledge can be articulated through social communication and can be codified to a certain degree (2001, p. 5).

For this thesis, the broader definitions of tacit and codified knowledge will not be used to describe the content of learning. The content for policy learning is answered in the "what" question (see previous section 3.5) and relates to specific content in environmental policy learning consisting of technical learning about policy instruments (see 3.1.3) and conceptual learning about new policy concepts and strategies. The mechanism for obtaining knowledge in this thesis will be identified as having both elements of explicit and implicit learning processes to varying degrees. The next part discusses the various types of learning mechanisms in greater detail.

Systematic learning is a general method of gaining knowledge by methodologically studying examples based mainly on explicit knowledge and provides the groundwork for policy learning. This includes investigating policy instruments in other countries as well as studying policy problem and objectives in the home country and other countries (May, 1992). In this thesis, systematic learning primarily involves desk studies mostly based on explicit knowledge with limited direct interaction between actors.

Observation can be either direct or indirect and involves gaining a mix of explicit and implicit knowledge. Indirect policy learning includes lesson drawing from "indirect policy experiences" (Rose, 1991, qtd. in May 1992). Anne Schneider and Helen Ingram (1988) recognises this as "pinching of ideas" (qtd. in May, 1992, p. 333). Indirect policy learning can be a fragmented and experimental means of drawing lessons from various countries and policy areas and at various times. However, when lessons are observed from a distance, the context of the policy lessons may not be fully understood and this can lead to drawing incorrect conclusions and applying the wrong solutions in the home environment (May, 1992). The implicit aspect of observation studies includes direct observation of the policy in practice within the observed country. Actors from the domestic country can directly observe the impact and outcomes of the

policy lessons but there is a blurred line between direct observation and interaction, as direct observation can lead to interaction.

Interactions between the domestic policy makers and external governments or institutions can help to bring in new perspectives. The interaction can be an explicit and direct exchange of knowledge and may occur through various means such as working tour groups, seminars, workshops, and joint research projects (Hauknes & Koch, 2003). The interaction between the domestic actors and the external actors does not necessarily imply that policy transfer will occur. However, the exchange of knowledge can happen at a deeper level and implicit knowledge can be shared. Face to face interaction allows for domestic actors to learn about attitudes, perspectives and implicit process relating to policy implementation which otherwise would not be gained through indirect observation and systematic desk studies.

Learning by experience occurs when the knowledge gained through learning is applied in the domestic setting in the post policy transfer process. Gaining domestic experience based on policy lessons from abroad leads to acquiring implicit knowledge, which becomes unique to the home country and is a part of the post transfer learning process. Policies from abroad may be adjusted to fit the domestic context and may also be revised as more experience is gained. Policy learning can occur as a result of a "continuous improvement" process, which occurs through learning by practice and this "generates capabilities and competences that are operational and experience-based" (Hauknes & Koch, 2003). The continued learning experiences create a changing policy culture that influences policy plans, objectives, implementation as well as the responsibilities among governmental bodies (Hauknes & Koch, 2003).

3.9 Post transfer learning; three-level policy analysis

As stated in section 3.2, "Issues, and gaps", post policy transfer learning is not commonly discussed as part of the policy transfer process and is often treated as a separate domestic learning process. In practice, learning continues after policies are transferred and the home government will often adjust the policies from abroad in response to the domestic conditions.

Governance and planning

One means of discussing post transfer learning is to explain how policy is planned and implemented within the national governance structure. Fredrick Hayek (1945) provides an explanation of "planning" as " […] interrelated decisions about the allocation of our available resources" (1945, p. 520) in which knowledge is utilised and dispersed. He states that some key questions to consider include "who" will be involved in the planning and "how" will the planning be carried out. In other words, "whether planning is to be done centrally, by one

authority for the whole economic system, or is to be divided among many individuals" (1945, p. 520-521). In a centrally planned system, the country's economic structure is directed by a single plan while on the opposite end of the spectrum, planning is decentralised and carried out by a number of people in a competition-based economy.

Hayek further claims that there is a middle ground where planning is carried out by monopolies, which are essentially "organised industries" (1945, p. 521). When classifying China under Hayek's planning structure, the economic system falls under both aspects of economic structure. China's political structure is centrally planned, yet its economy has characteristics of a market economy with some private firms that operate along side with state-owned monopolies, particularly in the energy sector. Although there are elements of the market economy, all major aspects of the political economy are planned and overseen by the government (see Chapter 2, section 2.5).

Another way of illustrating the planning process without associating it to a political or planning system is to consider Hayek's wider explanation of planning as a dispersion of knowledge known as the "knowledge base of the economy". The dispersion of knowledge at the individual level occurs at the micro level, while the knowledge diffusion and adoption occurs at the meso level and the coordination of knowledge occurs at the macro level (Dopfer, 2011). Hayek's knowledge base of the economy can be applied to policy implementation across the three policy levels. At the macro level, policy is coordinated, and the middle level, policy is diffused and adopted while at the localised level, policy is widely applied. The distinction of various policy levels is one means of analysing post transfer learning by examining how policies evolve throughout different policy levels (macro, meso, and micro level). Analysis at the macro level addresses the "broader questions concerning the distribution of power within contemporary society" while the meso-level "deals with the role of interests and levels of government in relation to particular policy decisions" (Evans & Davies, 1999, p. 363). The meso level connects the macro and micro level and takes into consideration both macro and micro-level influences.

Another means of discussing the various levels is through a multi-governance definition based on governance levels. Adrian Smith (2007) applies the multi-governance concept into the RE sector in England at the national, regional and local governmental level. Table 3.3 shows the governance capabilities at the each level.

Table 3.3 "The multi-level governance of renewable energy"

Central Government:
▪ Market creation and support
▪ Promote technology development
▪ Planning guidance
▪ Network and market regulation
▪ Large investments
▪ Other support programmes
Regional government (and regional energy networks)
▪ Regional targets and strategies
▪ Regional Spatial Strategy
▪ RES: facilitate clusters and supply chains
▪ Regional R&D centres and energy agencies
▪ Partnerships and networks
Local government
▪ Land use planning
▪ Local development frameworks
▪ Energy Advice centres
▪ Supporting local initiatives

Source: Smith, 2007, p. 6269

At the national level, the UK government is responsible for promoting RE technology through policies such as the Renewable Obligations (discussed in Chapter 5, section 5.3.5) that create a market as well as investing and building the needed infrastructure. The networks in this level involve government and business organisations such as the Department of Energy and Climate Change, OFGEM (the gas and electricity regulator), and large-scale energy utilities. Within the local level of governance, local planning falls under the direction of the regional and national levels. Projects are established at the local governance level and energy firms require local permission to develop projects. The regional governance and energy networks liaise between the macro and micro level by "shar[ing] experience between local councils who are pioneering, struggling or indifferent towards renewable energy. They can feedback lessons to the centre, while translating general policy goals into more defined strategies closer to the ground" (Smith, 2007, p. 6270).

The multi-level governance framework can be difficult to apply in China's case where governance at the local level varies greatly. Multi-level governance will not be used to analyse policy learning and transfer in this thesis since the analysis in this thesis is not strictly categorised according to the governance levels. Rather, explaining policy learning from abroad and policy transfer using a policy level classification will be more useful in examining the development of China's RE and wind power policies.

3.9.1 Multi-level policy analysis in China

One possibility for analysing China's RE sector is through a multi-level policy analysis, which takes the policy function at each level into consideration and would not require a strict governance distinction. The movement of policy between western countries and China can be examined at the policy functional level in which specific policies are implemented. Applying Hayek's knowledge base economy, the levels of policy will be classified according to functional purpose: *coordination, diffusion and adoption,* as well as *practical application and implementation*. The policies will be categorised through a multi-level policy framework consisting of first, second, and third level policies (the three level policy terminologies are taken from NREL, 2004, Renewable Energy Policy in China: Overview). This categorisation also considers the various jurisdiction levels that are present across each policy level but are not strictly defined by the jurisdiction level (i.e. national, provincial, municipal jurisdictions).

First level policies comprise of macro-level policies that *coordinate*. Top-level policies include general strategies and objectives, often focusing on establishing goals and setting medium or long-term plans. The policy function at this level is to create an overarching framework that is implemented later through lower level policies. High-level policies are drawn up and coordinated by the policy elites in national ministries, departments, and other cooperating top-level institutions. In China, top-level policies are set by the Central government in conformity with the Communist Party goals and consist of general RE targets and medium to long-term strategies.

Second level policies focus on *diffusion and adoption* and include specific RE guidelines and support mechanisms and instruments. This includes establishing incentive programmes for RE such as feed-in tariffs and tradable quotas (specific instruments discussed in Chapter 5 section 5.2). Second level policies in China typically stem from first level polices and are vital in implementing RE objectives. The Central government is primarily responsible for policies at this level and may work on diffusion and adoption of policies with corresponding provincial ministries and institutions.

Third level policies (not examined in this thesis) deal with the *practical application and implementation* of detailed policies specifically adapted to localised environments, which can include the municipal, county and provincial jurisdictions. The third policy level also borrows from Dopfer's (2011) discussion of the meso trajectory in which adaptation at the micro level occurs by adjusting to the variances observed in the local environment. Third level policies in China also consist of local incentive programmes and guidelines at the managerial level for firms. The policies introduced in Chapter 2 are categorised in the timeline of first and second level policies in Table 3.4.

Table 3.4 Timeline of first and second level energy policies

	FIRST LEVEL POLICIES	SECOND LEVEL POLICIES
1950		Biomass Improved Stoves Program (1950-1960)
1960		
1970		Subsidies for RE producers for biogas, wood & coal saving technologies (1970)
1980		Small scale hydro program for rural areas (1980)
1990		
1991	Eight Five-Year Plan: (1991-1995)	
1992		
1993		Management on Joint Operation of Wind Energy Power Plant (1994) Wind feed-in tariffs (1994)
1994	White Paper on Population, Environment & Development (1994)	
1995	Electric Power Law (1995)	Program on New & Renewable Energy Development in China for 1996-2010 (1995)
1996	Ninth Five-Year Plan: (1996-2000)	Ride the Wind Program (1996)
1997		The Brightness Program (1996)
1998		
1999		Notice on Further Supporting Renewable Energy (1999)
2000		
2001	Tenth Five-Year Plan (2001-2005)	Township Electrification Program Phase 1 (2001-2003)
2002		
2003		National Wind Concession Program (2003-2008)
2004		
2005		CDM Projects (2005-present)
2006	Eleventh Five-Year Plan (2006-2010) Renewable Energy Law (2006)	Township Electrification Program Phase 2 (2006-2010)
2007	Medium and Long-term Development Plan for Renewable Energy (2007)	
2008		
2009		
2010	Amended Renewable Energy Law (2010)	

A multi-level policy analysis of policy transfer in China's RE policy is useful in differentiating policy functions (coordination, diffusion/adoption, and application/implementation) and separately examining how policy learning has influenced the development of domestic policies at the three levels.

This thesis will only study first and second level policies. The study of policy learning and transfer at the third policy level is beyond the scope of this thesis since the local level not only includes firms but also consists of provinces, autonomous regions, independent municipalities and special administered regions and would require significant additional research to analyse policies at this level.

3.10 Chapter 3 summary

Policy learning and transfer concepts have gradually evolved since the 1970s from loosely held concepts that were narrowly applied in western nations. Currently, these concepts are beginning to take a more coherent form and are broadening to countries beyond the west. Rose has established the concept of lesson drawing, linking the varied ideas of policy learning to policy transfer.

Having set the platform for discussing the policy learning process, this chapter presents a compilation of policy learning and transfer literature and proposes a framework that is explored in Chapter 4. The framework is based on various authors discussed in this literature review chapter.

Table 3.5 lists the five questions posed in the framework and the corresponding concepts taken from the respective authors. Different authors provided clearer or more detailed explanations of policy learning and/or transfer concepts; thus, several explanations from separate authors were merged to create a comprehensive framework covering the post transfer learning process.

Table 3.5 Concepts applied in framework questions

Framework question	Concept	Author
1. Why?	▪ Indirect coercive transfer ▪ Lesson drawing ▪ Voluntary transfer, coercive and negotiated transfer	▪ Bennett, April 1991 ▪ Rose, 2005 ▪ Dolowitz & Marsh, 1996
2. What?	▪ Classification of transfer types: hard transfer and soft transfer ▪ Policy categories (policy goals, content & instruments, programs, institutions, ideologies and attitudes ▪ Policy learning types: technical and conceptual learning	▪ Evans and Davies, 1999 ▪ Dolowitz & Marsh, 2000 ▪ Glasbergen, 1996
3. From where and whom?	▪ Policy transfer pathways ▪ Agents of transfer	▪ Evans and Davies, 1999 ▪ Dolowitz & Marsh, 2000
4. How are lessons transferred?	▪ Grouping of how learning occurs (how knowledge is obtained through learning mechanisms: systematic learning, observation, interaction and experience)	▪ Kemp and Weehuizen, 2005
5. How are transferred policies implemented?	▪ Policy learning leads to policy changes and innovations ▪ Knowledge base economy-how policy is disseminated	▪ Hugh Heclo, I974 ▪ Hayek, 1945, Dopfer, 2004

Questions one to three gather evidence for policy learning by identifying "what" policy lessons were drawn, the type of policy learning, and "from where" the lessons were drawn. These questions were adapted from Dolowitz and Marsh's policy transfer framework and

supplemented with definitions and additional explanations from Bennett, Rose, and Evans and Davies and Glasbergen.

Question four applies Kemp and Weehuizen's description of how individuals learn and the concepts were taken outside of policy learning and transfer literature. Question 4 searches for evidence of how policy actors engage in policy learning and can lead to two main conclusions:

- policy actors have engaged in lesson drawing and there is *no apparent evidence* of the lessons transferred and implemented in the domestic environment; or
- policy actors have engaged in lesson drawing and there *is evidence* of the lessons being transferred and implemented in the domestic environment.

In the first conclusion, policy transfer likely did not occur or there was little or no traceable evidence indicating that policy learning from abroad led to policy transfer. The second conclusion reveals that policy learning from abroad results in policy transfer and will have an impact on the domestic environment. This leads to the fourth and fifth question on policy transfer and post-transfer learning, which make up the majority of the empirical study.

Question five draws from the early work of 'political learning' from Heclo, which recognises that policy learning can lead to policy changes and/or policy innovation. The learning that occurs after policies are transferred, that is post transfer learning, has often been neglected or treated as a separate component of the policy learning and transfer process. Question five examines how transferred policies have been altered and implemented in the domestic context using a multi-level policy analysis consisting of the first, second and third policy levels; however, only the first and second policy levels are examined in the thesis. The policy levels are defined by its policy function, a categorisation synthesised from Hayek's and Dopfer's discussion on utilising knowledge in 'economic planning' where coordination occurs at the first level and diffusion and adoption occurs at the second level. These concepts are applied to explain the broad macro-level economic and energy plans at the first level and specific policy mechanisms at the second level in China's renewable energy sector.

The next chapter discusses the research questions, conceptual framework and methodology applied in the thesis.

Chapter 4 - Research Questions and Methodology

Policy learning and transfer is becoming a more frequently examined phenomenon with increasing numbers of studies analysing the process. Studying the learning and transfer process is important for understanding why policy transfer occurs, what is being transferred, who is involved in the transfer and how policies are transferred; but often the impact of transferred policies is overlooked. This chapter introduces a research method to examine the policy learning and transfer process and the impact of transferred policies. The policy transfer and post-transfer learning framework introduced in Chapter 3 will be discussed in this chapter and applied to study renewable energy (RE) policies in China with the wind power sector as a case study.

4.1 Research question

China's RE sector is a rapidly developing industry driven by growing electricity needs, an increased awareness of climate change issues, and heightened concerns for environmental degradation caused by the country's industrialisation process. The Chinese government has made a dedicated effort to develop its RE industry and has been drawing lessons and best practices from western countries. After the policy learning process, the government has a monumental task of implementing policies from abroad in the home environment. The discussion of policy transfer and implementation is addressed in the research question posed in Chapter 3, concerning the development of China's RE policies: "what renewable energy policy lessons has China drawn from abroad and how have these transferred policies been implemented in China's wind power sector?"

4.2 Conceptual framework

Dolowitz states: "in order to use policy transfer as an explanatory variable, one also needs to understand and explain the process of transfer […]" by "[…] focusing on the questions which form the basis of the policy transfer framework" (Dolowitz et. al, 2000, p. 11). These objectives are further explored through questions developed in a framework based on existing literature and on the empirical studies (see Figure 3.1: Dolowitz and Marsh's policy transfer framework).

The framework applied in this thesis is divided into two sections (see Figure 4.1: Policy transfer and post transfer learning framework).

Figure 4.1 Policy transfer and post transfer learning framework

① **WHY?**
- From voluntary transfer towards coercive transfer

② **WHAT?**

A. Type of policy content:

Hard Transfer
- Policy goals
- Content & instruments
- Programs
- Institutions

Soft Transfer
- Ideologies
- Ideas
- Attitudes

B. Type of policy learning process:

Technical learning
- Incremental changes

Conceptual learning
- Redefining policy goals and new policy paradigms

③ **FROM WHERE & WHO? (Agents of Transfer)**

- Local/national/ international
- Civil servants
- Government & non-government organizations & institutions
- Policy experts
- Consultants
- Pressure groups
- Think tanks/ academia
- Corporations

④ **HOW ARE LESSONS TRANSFE RRED?**

1. Systematic study
2. Observation
3. Interaction
4. Experience

⑤ **HOW ARE TRANSFERRED POLICIES IMPLEMENTED IN CHINA'S POLICY LEVELS?**

Policy Function

Coordination

Diffusion & Adoption

Localised adaptation

First Level Policy
- National Goals and RE targets
- 5 Year Plans
- RE Law

Second Level Policy
- Specific RE regulations, objectives and development plants
- Industry standards

Third Level Policy
- Provincial goals
- Regional RE objectives
- Local/practical incentives and program
- Managerial guidelines

* Grey font- areas not discussed or briefly discussed in the thesis

Source: Own rendition based on Dolowitz and Marsh, 2000;Evans and Davie,1999; Glasbergen (1996); Rose, 2005; Kemp and Weehuizen, 2005; Hayek, 1945 ; Dopfer et al, 2004; NREL, 2004

The first part of the framework explores the types of lessons China has been drawing from abroad and systematically organises the evidence of policy transfer by answering the "why", "what" "from where and who" questions. The second part of the framework explores "how" China has applied policies from abroad in its post-transfer learning process at various policy levels.

Reiterating Dolowitz and Marsh's frameworks described in Chapter 3, the questions provide a step-by-step approach to examining the policy transfer process: "What is policy transfer? Who transfers policy? Why is there policy transfer? What is transferred? […] From where are lessons drawn?" (Dolowitz & Marsh, 1996). These questions highlight the key factors of lesson drawing and policy transfer and can be revised to address the scope of this research:

Question 1:   Why is China drawing lessons from abroad?

Question 2:   What types of policy contents are transferred and what types of policy learning processes are involved?

Question 3:   From which countries are the policies drawn from and who are the key actors in the policy transfer process?

Question 4:   How are the lessons (knowledge) transferred?

Question 5:   How are transferred policies implemented in China?

The five questions fall into three types of research categories: exploratory, descriptive, and explanatory questions (Yin, 2003). Exploratory questions consist of 'what' queries to investigate ideas, events, or phenomena. The purpose of exploratory questions is to develop a foundation of knowledge in order to engage in further detailed explanatory research rather than to test a theory. Descriptive questions such as "who" and "where" examines a phenomenon in greater detail when compared to exploratory questions by describing and investigating the significance of the characteristics studied. "How" and "why" questions are typical found in explanatory research. Explanatory research questions are developed from descriptive research but extend beyond a mere account and description of the subject under study and focuses on analysing and drawing relationships within a phenomenon (Thames Valley University, 2008).

A research study is unlikely to fall neatly into one particular research category; instead, a study may involve two or more types of research questions. In this thesis, the three varieties of research questions are applied to gain a clearer understanding of policy learning, transfer and post transfer learning in China's RE policy framework. The above five questions are categorised into the respective typology:

Exploratory Questions:	Question 1: Why is China drawing lessons from abroad (or what is the rationale for drawing lessons from abroad?) Question 2: What types of policy contents are transferred and what types of policy learning processes are involved?

Descriptive Question:	Question 3: From which countries are the policies drawn from and who are the key actors in the policy transfer process?
Explanatory Question:	Question 4: How are the lessons transferred?
Mixed: *(explanatory descriptive)* &	Question 5: How are transferred policies implemented in China?

The first exploratory question helps to explain China's rationale for drawing policy lessons. The question begins with a "why" but is not an explanatory question that requires descriptive research but is essentially asking: "what is the rationale" for policy transfer in China? But the wording "why policy transfer" is retained from Dolowitz and Marsh's framework to maintain consistency of the broadly accepted language used in policy transfer. Identifying the drivers behind policy transfer builds a platform for further research in this thesis since the question frames the research. For instance, if China's main objective for lesson drawing is to catch up with the global RE policy trends, coercive transfer would be considered since external forces impact policy decisions. On the other hand, voluntary policy transfer would be a central theme if there were active intentions for policy agents to draw lessons from abroad to help address similar issues at home.

The second question is also an exploratory query that helps identify the policy content drawn from abroad and the type of policy learning process. Policies drawn from abroad can be categorised into two forms: hard or soft transfer policies (as discussed in Chapter 3, section 3.5). Hard transfer consists of specific policy goals, contents, instruments, and institutions while soft transfer policies involve more abstract concepts such as ideologies, attitudes and ideas (Dolowitz, 2000). As noted in Chapter 3, the empirical research primarily focuses on hard transfer, specifically policy instruments but this does not indicate that soft transfer is not relevant in the policy transfer process, as some ideas and attitudes towards RE are embedded along. This thesis does not discuss ideological discussions and attitudes separately but when relevant, soft transfer issues are briefly mentioned to provide context. Additionally the policy learning process can involve technical learning, which does not challenge existing objectives as well as conceptual learning, which can lead to a change in policy paradigms. Both technical and conceptual learning can involve hard or soft transfer elements (Glasbergen, 1996). Overall, answering the exploratory questions requires a retrospective examination of China's RE framework, which begins the process of segregating policies formed by domestic experience and those adapted from aboard.

Question 3 is descriptive and identifies the origins where policies are drawn from and helps to provide a clearer sense of relationships formed between the two countries resulting in policy transfer. This discussion leads to the sub-question of identifying the key actors responsible in

the learning process. Policy transfer agents are responsible for the dissemination of knowledge and their involvement in the learning process leads to the next question of how these policies are transferred.

Question 4 provides an explanatory inquiry that examines how transferred policies are adapted in China. Answering this question requires providing evidence of how policy actors obtain knowledge from abroad and transfer selected policies from certain countries. For instance, policy actors can draw policy lessons through systematic studies, observations, interaction or experience (see Chapter 3, Figure 3.4: Learning mechanisms for obtaining knowledge). Answering this question requires looking for the mediums in which policy transfer evidence are documented, such as in media, reports, conference meetings, government statements etc. (Dolowitz & Marsh, 2000).

The last question is a mix of explanatory and descriptive elements that explore how transferred policies are applied in China's policy levels. The descriptive component involves grouping the policies according to its policy function at the first and second policy level. Once the policy levels have been determined, the impact of policies from abroad is examined using the wind power sector as a case study. Answering the above questions requires a methodology where qualitative approaches supported by quantitative data within a case study research design.

4.3 Methodology

Case studies are a method of analysis that "focuses its attention on a single example of a broader phenomenon" (Gerring, 2004). This thesis is analysed through a case study approach with wind power policies representing a single technological sector in China's RE industry that is influenced by policy learning and transfer.

Figure 4.2 illustrates the research design applied in the thesis and includes a case study research with two units of analysis that examines the first policy and second policy level. The data is collected using a qualitative research design supported by quantitative evidence.

Figure 4.2 Research design
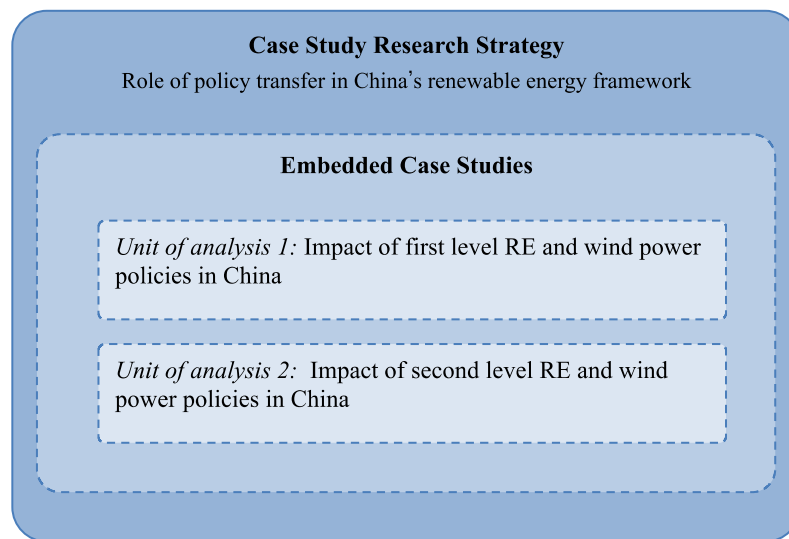
The case study research approach is an "all-encompassing method" (Yin, 2003) that allows for the detailed empirical study within China's context. Due to the extensive breadth of the RE sector, wind power is selected among other RE sectors for a single study case with multiple units of analysis. The case is examined through a qualitative approach and includes observations, interviews, and documents and visual materials supported by quantitative data. The next part provides details on the research design.

4.3.1 The case study research design

Gerring defines a case study as "an intensive study of a single unit for the purpose of understanding a larger class of (similar) units" where the unit is "a spatially bounded phenomenon" (Gerring, 2004, p. 342). Case studies also examine a group of characteristics for observable patterns and structures "diachronically" over a non-linear time frame. The analysis allows for an in depth study of a "strategic" sample as opposed to a random sampling typical of a survey design studies (Verschuren, 2003). The strategic unit of study in this thesis is RE policy in China and the phenomenon examined is policy learning and transfer using lessons drawn from Germany, the United Kingdom, and the United States.

The case study methodology is especially relevant for the empirical investigation of a current phenomenon in a real-life situation where the relationship between the phenomenon and context is ambiguous (Yin, 1981). In the case of China's RE policy, the phenomenon of policy learning and policy transfer as well as the application of lessons in the context of the local environment is not explicit. When boundaries are blurred, case studies can provide the required foundation to study "knowledge utilisation" (Yin, 1981, p. 99, qtd. in Yin, 2003) to help understand how knowledge is applied by decisions-makers within an obscure policy environment.

Lesson drawing requires an accumulation of knowledge over a period of time that can be employed in the decision and policy-making process. Identifying the specific policies adapted from abroad may be challenging, as the exact learning time frame can be unclear and the application of policies may be difficult to measure. The case study approach provides a broad and flexible framework that takes into account the often-ambiguous components of policy learning from abroad and the policy transfer process.

In addition to addressing the research needs of a broader phenomenon, case studies can be designed as a single case or as more detailed and complex multi-dimensional cases. Figure 4.3 illustrates various types of case study designs including single case, (holistic or embedded) design and multiple case (holistic or embedded) designs.

Figure 4.3 Case study designs

Source: COSMOS Corporation qtd. in Yin 2003, p. 40
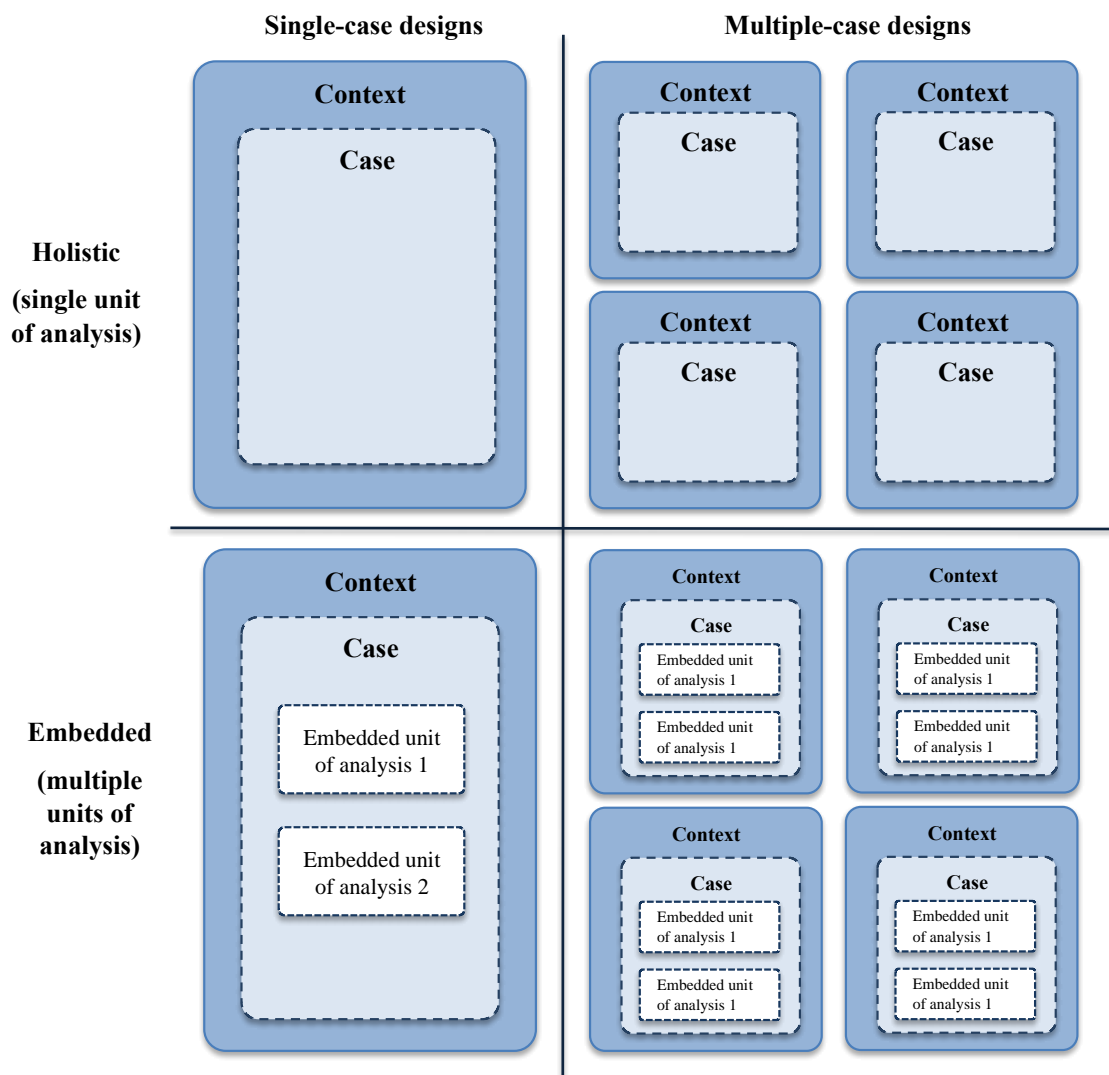
Each of the designs examine the "contextual conditions" relative to the case but the "boundaries" of the context and case are not always clear (Yin, 2003, p. 39). Beginning with the first case design, the single case study functions in a similar way as a single experiment. A single case study approach may have a "holistic design" with "no logical subunits" that focuses on the overall aspect of the case or an "embedded design" with "a set of subunits" which has multiple units of analysis in the study (Yin, 2003, p. 45).

An embedded case study can account for a greater number of elements in a phenomenon and can also be studied in depth since there is more than one unit of analysis and emphasis is placed on one or more subunits (Yin, 2003). For instance, a single case study may examine the overall role of the United States Department of Energy (DOE) in overseeing the country's energy issues. In an embedded design, the study may examine the DOE's role to tackle the countries energy issues but with greater focus on the subunits, such as the DOE's contribution to innovation and research or through its support of energy efficiency programmes. For this thesis the "embedded units of analysis" will simply be referred to as units of analysis.

The single-case study may be used as a flexible research design to study a particular phenomenon but there are limitations to a single case study. For instance, findings may be skewed or lack generalisability as a result of some unique or "artifactual condition" specific to the case (Yin, 2003, p. 54). Additionally, single-case studies may not be sufficient for a research design if duplication is required. Multiple-case design addresses some of the challenges found in the single-case study. The replication of two or more cases adds to the robustness of research findings by helping to understand how units or programmes functions in various conditions (Stake, 2006). Furthermore, the findings resulting from two or more independent case studies are more convincing than a single study. However, additional planning is required to conduct multiple-case studies compared to single cases, as this design requires considerable time and resources. Each case should have a clear objective and address the larger research questions in order not to diverge from the purpose of the study (Yin, 2003). While single and multiple case studies may differ in its' extensiveness and scope, both designs are defined as "variants within the same methodological framework" (Yin, 2003, p. 46).

China's RE policy is studied using *a single case study design* with *multiple units of analysis.* Analysing these examples or subunits requires a research case study design, which focuses on extracting and examining one or more units of analysis within each individual case study. The single longitudinal case study enables for a top-level analysis of how transferred polices have impacted the wind power sector over a time period while the multiple units of analysis focuses on how policy transfer has impacted wind power generators, the utilities (the grid) and electricity end-users.

Within the scope of this research, the case study examines how specific policies from abroad have influenced the development of the wind power sector at a multi policy level as described in Chapter 3. Each case draws on examples at the first and second level while the third level is deliberately left out.

4.3.2 Qualitative method

There are certain assumptions that are generally present (but not limited) to qualitative methods that are recognised in qualitative research method literature in the late 1980s and early 1990s. Some of the qualitative research assumptions involve the type of data collected and the focus of the research. For instance the research focus can be largely dependent on participations' experiences and the data collected is often reported in words or through narrative descriptions. Qualitative research data collection methods often include observation, interviews as well as obtaining information from documents and audio visual materials. Observations can involve the researcher as a known or unknown participant or as an observer who does not participate in the research. Interviews can consist of face-to-face, telephone or group interviews (Creswell, Clark, & L., 2006).

The qualitative data gathered in this research consists of narrative descriptions, which are written or spoken descriptions of information and is gathered through observation and a non-participatory approach. This involves primary face to face interviews and secondary written sources that help to answer the exploratory research questions 1 and 2: "why is China drawing lessons from abroad and what policies are transferred"; as well as the mixed question 5 "how are transferred policies implemented in China?" The quantitative data collected in this research largely comprises of descriptive statistic including energy and wind power statistics used to describe entities, settings or a phenomenon. Glass & Hopkins (1984) defines descriptive research as the collection of data to describe events. The data collected is then explained, categorised, tabulated, or illustrated in graphs and charts (qtd. in Knupfer & McLellan, 1996).

Quantitative data can provide evidence to help explain the concept of the policy learning transfer process using content analysis. Content analysis consists of quantitative descriptions found in written documents, visual media or audio media. The content collected are analysed but do not represent a defined population, the meaning is not altered and the "validity and reliability of data obtained" are not considered (Gall, Borg, & Gall, 1996, p. 356, 376). The quantitative data gathered in this thesis helps explain why certain policies were selected for lesson drawing to partially answer the descriptive question 3 "from which countries are the policies drawn?" as well as to help answer the mixed question 5: "how have transferred policies been implemented in China?" Generally, quantitative data in this thesis provides some indicators of how transferred policies have impacted the wind power sector.

4.4 Design of the Research

4.4.1 The research process

There are two components to the research setting: desk research based on secondary sources and primary research based in Beijing, China. The research was conducted in three phases, as illustrated in Figure 4.4.

Figure 4.4 Qualitative and quantitative data collection process
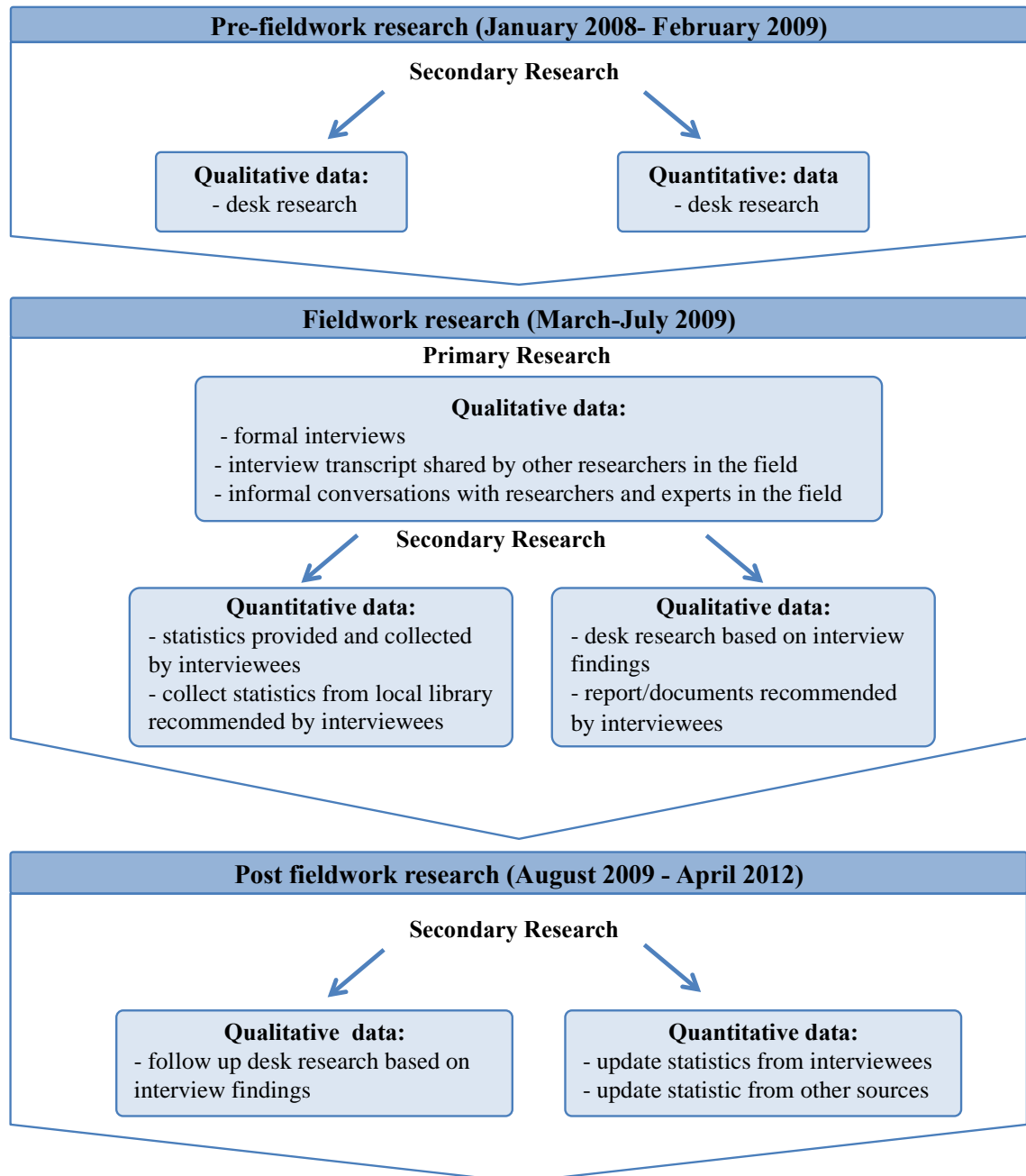
The pre-fieldwork research phase (January 2008 to February 2009) focused on secondary research. The secondary research provided the necessary background knowledge for the fieldwork research phase (March-July 2009), which largely focused on gathering primary research with some supplementary secondary research data provided by or recommended by interviewees. The data gathered during the interviews presented the initial empirical evidence of post transfer learning, that is, learning that occurred when transferred policies were implemented in China. Further research was needed after the fieldwork to gather more supporting evidence of policy learning from abroad and policy transfer. Thus the post fieldwork research phase (August 2009-April 2012) consisted of follow-up secondary research based on the interview materials. For instance, country examples and policy actors were identified during the interview process and in secondary literature recommended by interviews. In the post fieldwork phase, additional research was conducted on the identified countries and policy actors in order to search for more empirical evidence of policy learning from abroad.

The data collection phase for this thesis spanned from January 2008 until April 2012. Qualitative and quantitative information was collected over a period of time for a longitudinal analysis to describe how lesson drawing has impacted the development of the wind power policies since its early policy implementation in China. Qualitative information was gathered within the defined research time period between the 1950s until 2011; however some additional policy developments relevant to the research that occurred in 2012 were also included. The primary information was sourced from: personal interviews while secondary research was source from peer reviewed scientific journal and grey literature. Examples of grey literature includes materials outside of peer reviewed journals such as industry journals, conference papers, books, and reports from public and private organisations (Jones, 2004). For this research, grey literature consists of reports written by international institutions; media articles from Chinese and foreign press; national and international RE and institution websites, conferences and meeting presentations.

The quantitative data time period covers a period from 1990 to 2010 (some statistics from 2011-2012 were also included where relevant) and is collected through secondary sources, which include: RE electricity output, tariffs rates, installations measured in Megawatts (MW), grid investments, and some economic data. Information was gathered through secondary sources from: the National Bureau of Statistics of China, the Chinese Wind Energy Association, the China Electricity Yearbook, the United Nations Statistics Division, Eurostats, the International Energy Agency, the Organisation for Economic Co-operation and Development Statistics Portal, the World Fact Book, statistics personally collected by an interviewee, and from the sources mentioned in the qualitative sources (e.g. grey literature). The use of quantitative data is also important for understanding how transferred policies impact the local environment.

4.4.2 Pre-fieldwork research

The pre-fieldwork research comprised of secondary background research with an aim to develop a context and timeframe for the research data collection as well as to establish an initial policy survey for potential policy lessons. The "desk" research began with a search for primarily qualitative background information with some quantitative data on China's main energy and RE policies. This retrospective research extended as far as possible given the available information and data.

The information gathered in the pre-fieldwork phase formed the basis for the thesis storyline and provided the background information for the policy scoping exercise to identify the main energy and RE policies in China. A preliminary answer was established for the first two research questions: what is the rationale for China to draw policy lessons from abroad? And what policies are transferred?

4.4.3 Fieldwork research

The fieldwork research phase largely consisted of primary qualitative research in the form of open-ended interviews. The fieldwork research took place from March 2009 to June 2009 in Beijing, China, at the Institute of Energy, Environment and Economy in Tsinghua University. Tsinghua University sponsored the research as part of an independent academic exchange with SPRU (Science Technology Policy Research), University of Sussex. The research findings remained independent from the aims and objectives of the institution but there was a good level of cooperation including exchanges of ideas and knowledge (some of which are used in this thesis) with researchers at the institute to secure and conduct interviews.

The collaboration was essential in securing high profile experts and accessing researchers in government bodies, as the institute is highly reputable among the energy policy-making area. Tsinghua University produces a large number of graduates that enter into government positions, thus Tsinghua University alumni who held positions in the government were willing to participate in interviews and provide contacts.

Table 4.1 lists the individuals interviewed during the fieldwork.

Table 4.1 Interviewees and their respective organisations

Government Actors: China	
Interviewee	**Organisation**
1. Zhiwin Qi, Researcher	National Energy Bureau, April 25, 2009
2. Runqing Hu, Associate Research Fellow	Center for Renewable Energy Development, Energy Research Institute of the NDRC, May 15, 2009
3. Huiling Ma, Researcher	Renewable Energy Department of National Energy Admin Administration, June 11,2009
4. Hu Gao, Deputy Director,	Centre for Renewable Energy Development, National Development and Reform Commission June 3, 2009
5. Deputy Director	Ministry of Science and Technology, June 9, 2009
6. Liping Jiang, Deputy Chief Engineer	The State Grid, May 27, 2009
7. Dongming Ren, Deputy Director	Energy Research Institute, June 5, 2009
Foreign Government Actors	
Interviewee	**Organisation**
8. EU Renewable Energy Manager	EU-China Energy & Environment Programme, April 28, 2009.
9. Fredrick Weston, Director	The Regulatory Assistance Project; The Regulatory Assistance Project, May 28, 2009
10. Allen Chong, Trade Commissioner	Science Technology & Innovation, Embassy of Canada; April 2, 2009
11. James Godberg, First Secretary	Climate Change and Energy Section, UK Embassy May 19, 2009
Industry	
12. Research Consultant, and Researcher,	Azure International, April 28th, 2009
13. Sebastian Meyer, Director of Research	Azure International, May 19th, 2009
14. Gang Wu, CEO	Goldwind Science Technology, May 18, 2009
Industry Organisations	
15. Pengfei Shi, Vice-President	China Wind Energy Association, June 10, 2009
16. Bruce Li, Vice General Director,	China Clean Energy Network, May 13, 2009
17. Michael Li, Research Lead	China Greentech Initiative- June 12
NGOs	
18. Fuqiang Yang, Director	World Wildlife Foundation (WWF); March 13, 2009
19. Jing Yuan, Programme Associate	China Sustainable Energy Programme, The Energy Foundation; March 13, 2009
20. Yu Wang, Policy Researcher	Institute of Energy Environment and Economy, Tsinghua University; March 26, 2009
21. Deborah Seligsohn, Senior Fellow and Principal Advisor	The World Resource Institute, April 27, 2009,
Independent Experts	
22. Julian Wong; Independent Analyst	The Green Leap Forwards; March 31, 2009
Academia & Non-government research institutions	
23. Carlo Jaeger, Chairman	European Climate Forum, May 13, 2009
24. Zhen Liu, Professor	Institute of Energy Environment and Economy, June 4, 2009
25. Sheng Hong, Deputy Director	Unirule Institute of Economics, June 8, 2009

Although a standard interview guideline was prepared in advanced (see Appendix A for the full interview guideline) the guideline was infrequently used as the discussion often steered in the direction of the interviewee's experience. Some of the prepared questions where opened ended, giving the interviewee an opportunity to include his/her opinion while other questions provided prepared answers. Questions with prepared answers were discarded early on in the interview process, as seen in the second question of the initial interview guideline:

> Question 2: In your opinion, which local/foreign groups are instrumental in promoting policy transfer from abroad and how have the groups impacted renewable energy policy transfer? (bureaucrats and civil servants; policy entrepreneurs and experts; corporations and consultants; pressure groups; academia and think tanks; governmental and non-governmental international; organizations and institutions; foreign diplomats; and others)

One of the difficulties in answering such questions was that it assumed the interviewee was involved in or was familiar with the role of policy learning from abroad in the development of China's RE policies. However, many interviewees were not familiar with policy learning and transfer or could not provide specific evidence of policy learning from abroad but rather had knowledge on wind power industry and policy issues (in essence the post transfer learning process). The information gathered during these interviews was largely used for post-transfer policy learning. Additionally, there was some complementing secondary research that stemmed from the primary research. For instance, interviewees recommended certain government reports and statistics or provided independently collected statistics. Other forms of qualitative research included: attending forums and meetings to gain a better understanding of the RE and policy learning environment. The events attended are listed in Table 4.2.

Table 4.2 Meetings, conferences, and forums attended

Event	Participants
China International Energy Saving, Emissions Reduction and New Energy Science & Technology Expo (2009 CHIESER S&T Expo), March 23, 2009	▪ Organized by the Chinese Society for Sustainable Development (CSSD) and open to the public ▪ State-owned and private renewable energy and efficiency companies, CDM centres, embassies, local universities and research institutions etc.
Canadian Chinese Technology Commercialization Forum at the Canadian Embassy, March 25, 2009	▪ Chinese government officials and representatives from the Ministry of Science and Technology ▪ Canadian business, science and technology policy institutions and government representatives
Meeting on Pricing Mechanisms April 7, 2009	▪ Tsinghua University, the World Resource Institute and the UK Foreign Commonwealth Office
Meeting on the progress of the China Renewable Energy Scale-up Programme (CRESP) April 15, 2009	▪ CRESP representatives, Tsinghua University, the Lawrence Berkeley National Laboratory, National Renewable Energy Laboratory, ZSW (Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg)

Content from the events and meetings were not directly used in the research but contributed to validating some of the trends discovered in the pre-fieldwork research stage.

4.4.4 Post fieldwork research

Upon returning from the fieldwork, the information was reviewed in order to analyse the evidence of policy learning and transfer. The primary research revealed that there was more information collected on post-transfer learning compared to the policy learning transfer process in China. But additional evidence of policy transfer was still required in order to explain the post-policy transfer learning.

There were some key evidence revealed during the interviews that helped identify evidence for policy learning and transfer from selected countries but this required additional secondary research. The last part of the research phase comprised of. searching for additional policy learning and transfer evidence from the EU, U.S., UK, and Germany in documents recommended by interviewees, as well as in reports, and seminar and conference presentations available to the public on the World Wide Web.

There was also a need to update the quantitative information collected in China from interviewees. Researchers from the Institute of Energy, Environment and Economy were contacted again to verify new research findings as well as to help obtain updated statistics that were difficult or costly to access outside of China, such as statistics from the China Electricity Yearbooks.

4.5 Limitations in the research

Lack of access to policy decision makers

One of the limitations experienced almost immediately during the fieldwork was difficulties in gaining access to the policy and decisions makers in China, even with the help from the sponsoring institution. Although some high level interviews were carried out with individuals in government research institutions and organisations, there was no direct access to the policy makers who were involved in drafting and implementing policies. Thus it was not possible to directly draw a conclusion that a certain policy decision maker implemented a certain policy based on learning from abroad. Rather, policy transfer evidence was obtained through interviews with actors involved in the policy learning process as well as evidence found in secondary sources. On the other hand, even if interviews with policy makers were secured, the information may not widely differ from the information provided by other government employees. Most of the interviewees working in the government or government related organisations in China, for the large part, gave a formal story of policy implementation. The information provided during individual interviews was relatively straightforward to cross check

with other interviews or through secondary sources. But there was limited information revealed on the informal aspect of policy making and implementation during the interviews.

Generalisability of a Single Case Study

There are challenges to examining only one RE technology sector as extracting generalisable trends in China's RE sector can be difficult due to variations in the market development stages for different technologies. Some of the policy transfer issues are also industry and country-specific, thus lessons have to be carefully considered if they are to be applied to other industries and countries. A multiple case study carried out on two separate RE technologies would provide an interesting comparison and contrast but for practical reasons this was not carried out given the limited fieldwork time, resources and available data (Chapter 9 discusses how China's wind power case study can be applied internally in other RE sectors, and externally, in other countries and regions). The wind power sector was a practical choice for an in-depth case study as it is among the most documented RE sectors in China with sufficient statistics and secondary information available to compile evidence of policy transfer. Other RE sectors (not including large-scale hydro) make up a relatively small portion of the overall energy mix and publically available statistics for these RE technologies such as solar power are often amalgamated with non-wind RE statistics. Compiling the necessary information for these sectors would require a longer fieldwork period and require approaching individual government bodies or industry organisations.

Data inconsistency and availability

Qualitative and quantitative data collection

Qualitative data gathered in grey literature such as policy updates and current information was largely sourced from media articles, announcements on government websites, industry articles, and blogs from independent organisations. However, since the information was quickly released, accuracy was an issue at times. Additionally, media sources, particularly those owned and controlled by the government, were cited with caution. Thus when possible, grey literature sources were crossed check with other secondary sources and/or information gathered from the interviews, and similarly interview content (where possible) was also verified with secondary sources.

The quantitative data gathered for the research was not consistent due to the large number of government departments and organisations that collect energy and RE data independently. There is lack of coordination among these departments and organisations as well as a lack of transparency with the data collection methodology. Where possible, the government-collected statistics were compared with external statistics compiled by independent experts. Other formal

government statistics that could not be crossed examined with an alternative source were used cautiously as estimates.

Data availability

Tracking the full history of China's policy learning process requires a longitudinal study spanning over decades as well as significant access to both formal/informal and primary/secondary information and data. But the process of policy learning is not formally documented in China and is likely the case for other countries. This research does not intend to track and analyse the full history of China's RE energy policy process but to provide a broad snapshot of the policy learning from abroad and policy transfer process by gathering evidence from a variety of available sources given the existing limitations. This thesis not only aims to identify incidents of policy learning but also aims to make a case for post transfer learning by providing empirical evidence on how policy transfer influences the domestic policy making process. This requires an ex-post evaluation of how transferred policies are applied in China. The time frame selected for this post transfer learning evaluation was primarily limited to the 2000s.

Additionally, examining policy learning by only focusing on the technical component of the policy instrument and would entail a thorough technical/legal analysis and likely a comparative study of China's RE policy instruments with policies from abroad. Such a specific analysis is not realistic for all instruments as it would be difficult to ascertain which clause in a regulation or details in a tariff structure was influenced by policy learning. This type of information has not been systematically documented in China and the detailed drawing up of instruments occurs behind closed doors. A strong emphasis on the legal aspect of policy learning is not required to prove that policy learning has occurred as part of China's RE policy making process. For this thesis, the evidence of policy transfer included policy learning from abroad at the broader policy framework level or at the general policy instrument level, generally without specifying a significant amount of regulatory details.

4.6 Chapter 4 summary

In this chapter, the framework questions were examined using the case study methodology to answer the research question and the research design comprised of a single case study with two units of analysis. The research was set in the context of China's RE policy while the broader case study examined wind power policies in which the units of analysis where further studied using a qualitative method supported by quantitative data. The first unit of analysis examined first level policies while the second unit of analysis second level policies. Qualitative methods were primarily applied and comprised of open-ended interviews with independent experts as

well as actors in governmental bodies and research institutions, embassies and other regional organisations, industry and industry organisations, NGOs, academia, and research institutions.

Secondary qualitative research was also used for background information and to supplement the interviews. A large part of the more recent evidence was drawn from grey literature rather than from peer-reviewed literature due to the speed of policy revisions in China and the development pace of the RE and wind power policies. Quantitative data was used to support qualitative evidence. For instance, data was collected and presented in charts and graphs to show trends in wind power growth, and changes in wind tariff pricing which corresponded with policy developments. When there were gaps in the data, such as wind power electricity generation in certain years, estimations were used to calculate wind power electricity generation under certain conditions.

The next chapter discussed the key policies transferred in China's wind power sector as well as the countries from which key policy lessons were drawn in greater detail.

Chapter 5 - Influential Renewable Energy Policies from Abroad

In order to examine how China has adopted and applied a mixture of policies from other nations to its domestic context, an analysis should be carried out of how policies from abroad have been implemented in their respective countries. The first section of this chapter identifies and defines general energy and renewable energy (RE) policies based on the key RE policies implemented in China (discussed in Chapter 2- Background to China's Energy Structure and Renewable Energy Policy). The second part provides an analysis of pioneering, best practice, or relevant countries that have implemented the key energy policies identified in the first part of this chapter. The description and analysis in this chapter provides the necessary background for the policy learning and transfer discussion in Chapters 6 to 8, the empirical section examining the policy learning from abroad, policy transfer and the post transfer learning process.

5.1 Renewable energy policies

Hard transfer consists of learning about policy frameworks and/or policy instruments (see 3.5.1). There are several key RE policies in China with content from abroad which include first level policies, the Renewable Energy Law (REL, 2005) and the Medium and Long Term Development Plan for Renewable Energy Development (MLDP), as well as more specific second level policies comprising of feed-in tariffs, concession projects and mandatory market shares.

The RE policies implemented in China can be defined according to the categorisation of policies discussed in Chapter 3 (Table 3.3: Generic policies). Feed-in tariffs, concession projects and mandatory market shares are economic incentives that 'induce' market actors to undertake certain actions. These economic incentives occur in the form of facilitating markets (quota system accompanied by tradable permits), stimulating markets (tendering policies), subsidies (feed-in tariffs) and energy surcharges (end-user tariffs) placed on electricity consumption. Other types of policies include command and control policies such as frameworks and regulations that 'coerce' market actors to take on certain actions and/or behaviours. Finally non-market mechanisms include government agencies and government own-corporations (Weimer & Vining, 1992).

5.1.1 Facilitating markets

One means of facilitating the market is by creating new marketable goods through tradable permits. A tradable permit scheme is often part of a *quota system*, a quantity-based system that sets voluntary or obligatory targets. Quotas usually specify a certain percentage of electricity to be supplied by RE sources (RES). The government establishes the quantity of RE to be produced while the market sets the price of the RE electricity produced. Often, RE operators

will individually negotiate the sale electricity price with the grid operator. Typically, RE electricity generators receive a certificate of origin for every unit of electricity produced, which can be sold in the market to offset the premium required to generate electricity from RES. The demand for the certificate is created by the government through setting a fixed quota. Under the quota system, the retail electricity supplier must supply a certain amount of electricity from RES to end-users. Utilities can comply by either purchasing exchangeable certificates or owning a RE electricity generation facility and its generated output. As the demand for certificates increases, the price of the certificate increases. Failure to reach the quota often results in financial penalties (The European Association for Renewable Energy, 2006; Wiser et al, 2002; EPA, 2009). The quota itself can be categorised as a regulation if the quota obligation is legalised (discussed later in 5.1.5). However, in some cases the quota can be voluntary. In this research the quota system will simply be classified as a type of facilitating market instrument that is accompanied by a trading system.

The success of RPS varies depending on the policy details and the implementation method (REN21, 2011). Well-designed policies have contributed to the increased share of RE in the electricity mix at low costs to electricity end-users. Some key factors for successful policy design include establishing a long-term quota that provides a clear signal to the market regarding the commitment level towards RE. The quota system generally establishes mandatory obligations that should be met within a fixed timeline by the utilities. The quota is often based on either electricity production (MWh) or installed capacity (MW). Some quotas provide incentives such as credits for early compliance to help encourage earlier adaption of RE. Additionally, an enforcement mechanism is usually established to ensure compliance (EPA, 2009).

One of the largest criticisms of the quota system is that it favours large RE generators and the lowest cost technologies because certificate prices do not differentiate the cost of electricity generation (varying cost of electricity versus fixed return price for electricity generated). Thus the most economical RE technology would be developed first in the area with the highest resource base and good grid access. As a result, larger players tend to invest in large-scale projects such as wind and biomass generation plants. This pushes out smaller market participants with less capital and resources to invest in large-scale projects that benefit from economies of scale.

Additionally technologies in earlier phases of development, including solar PV and geothermal are often neglected due to the higher generation costs. Furthermore, the price of the certificates is dependent on the market, which fluctuates according to supply and demand. This lack of

long-term security may dampen the investment enthusiasm for the RE market for small scale and risk-adverse investors (European Association for Renewable Energy, 2006; Adam, 2008).

In spite of the drawbacks in the quota system, more countries are adapting this policy instrument and revising the structure to help address some of its weaknesses. For instance in 2005, 38 jurisdictions (states/provinces/countries) implemented RPS policies and this increased to at least 60 jurisdictions in 2011 (REN21, 2007; REN21, 2011). One means of dealing with the technology price variations is setting a quota system that has several resource tiers and requirements. One tier can be established for more mature and economical technologies while another tier can be established for less mature and more costly technologies (van der Linden, et al., 2005).

5.1.2 Stimulating Markets

Policies can help stimulate the market even in cases where "competition *within* a market cannot be guaranteed" but "competition *for* the market may be possible". One means of stimulating the market is through auctions where "the right to provide the good can be sold" (Weimer & Vining, 1992, p. 150-151). *Tendering policies* is an auctioning process facilitated by the government and involves competitive bidding to stimulate markets. This system is also known as concession bidding in some countries and is a hybrid of the quota system and feed-in tariffs (feed-in tariffs are discussed in the next section 5.1.3). The government sets a specified target quota for RE production and similar to the tradable quota system, the tariff price is established by the market. However, the difference is that the market determines the price through a competitive bidding process and the successful bidder is usually selected by a facilitating government body. Bidders who wish to develop RE projects can submit a tender detailing their offer, which often includes technical specifications and the proposed tariff price expected for electricity generation. The tenders are selected based on set criteria, where often price is the deciding factor. The successful bidder is granted a power purchase agreement securing revenues from electricity output for a fixed price over a specified time frame. In order to ensure the uptake of RE, the tendering policy is often coupled with a utility obligation to purchase electricity from RES (European Association for Renewable Energy, 2006; Wiser et al, 2002).

Tendering policies tend to place pressure on reducing costs due to the highly competitive bidding process and can be an attractive instrument for countries with limited experience in setting fixed tariffs for RE. Furthermore, the bidding process allows firms to establish an acceptable price for RE electricity according to their own cost structure and revenue generation expectations. There may also be different tenders for various technology bands in order to meet the wide range of RE targets. When tendering policy structures are well defined and implemented in a consistent and transparent manner, the long-term contracts can provide

security for investors and be an effective mechanism to help achieve long-term RE objectives (van der Linden, et al., 2005).

Compared to feed-in tariffs and tradable quota systems, tendering policies are not as successful in promoting RE. These problems stem from infrequent tenders, increased market ambiguity and complex bureaucratic processes. Furthermore, the intense competition often supports low cost electricity generation at the cost of local industry development. Some countries have dealt with this issue by requiring local content within the bidding criteria to ensure local components are used. However, the policy cannot avoid favouring large players and incumbent firms as they have the capacity to place lower bid prices. Tendering system has been criticised for lowering tariffs to an unprofitable level, as large firms can potentially forfeit revenues to gain a market share in a new growing industry (van der Linden, et al., 2005; Wiser et al, 2002).

5.1.3 Subsidies

Fixed feed-in tariffs (FITs) are a supply-side subsidy that guarantees prices for RE electricity to the grid, thereby incentivising the production of RE electricity. The government sets a specific price for RE production over a time period and the market determines the amount of electricity produced. The RE output varies according to the technology maturity, costs, and resource availability. Often, FIT are accompanied by complementing legislation that obliges grid operators to purchase the RE electricity at a set price. There may also be standard interconnection requirements and support provided for RE generators to connect to the grid. The FITs are paid per kilowatt-hour and rates may vary depending on the RE technology. The price is usually guaranteed over a fixed number of years and may be revised to account for changes in technology costs (The European Association for Renewable Energy, 2006; Wiser et al, 2002).

FITs are the most widely implemented policy instruments in the world. Since 2011, 61 countries and about 26 regional localities have applied FITs to help meet their policy objectives (REN21, 2011). Setting tariff prices over a fixed period of time provides a secure environment for investors by decreasing the risk associated with investment returns, particularly for capital-intensive projects. There are also low costs associated with administrative tasks and carrying out transactions, leading to an overall lower cost to end-users. Additionally, when a digression tariff is applied over a fixed period, the generator's profits falls over time and this prevents surplus electricity generation and promotes efficiencies through technological innovation. Generators are motivated to increase the amount of electricity produced per kWh in order to compensate for decreasing tariffs, thus more efficient RE technologies will result in reduced end-user costs and help develop a high tech sector.

FITs can also be customised to promote RE technology in a specific region, or encourage the development of varied generation facility sizes and promote specific technologies. Resource-poor regions can have an opportunity to invest in RE electricity generation and decentralised or centralised forms of RE can be developed according to the country/region's needs. Newer and more expensive forms of RE technologies will have increased chances of reaching commercial scale with differentiated tariffs to reflect the technology costs at certain development stages. FITs can also be introduced into various electricity market sizes without upsetting the market situation. For instance, FITs can be applied in smaller markets and allow small players to participate, which increases competition and prevents large incumbent firms from exercising their market power. Barrier to entry is therefore not determined by the size of electricity producer and its market share, but rather by technical performance. Both small and large players can participate in RE electricity generation (Cory, Couture, & Kreycik, 2009).

On the other hand, FITs can incur unnecessary costs if not properly implemented and result in inefficiencies–the two areas the instrument claims as its strength. In order for FITs policies to be effective, there must be an organised governing system along with supporting institutions set in place. For instance, Greece has a high solar power tariff and excellent solar resources but its' highly bureaucratic processes in approving RES projects has been one of the largest barriers in developing the sector (Wang, 2009).

Another weakness in setting fixed tariffs is the differing prices for resource-poor areas. This may lead to inefficient electricity power generation at a high cost. Limitations need to be set that allows RES to be developed in areas that are efficient and economical, and not merely for the sake of producing 'green' electricity. The government must be able to set appropriate tariff prices, as a very high price will lower barrier to entrance and result in an over production of RE and an unsustainable market. An example is seen in Spain's high solar PV tariff set, which prompted a large growth in the market. In 2008, the solar PV market grew by over 300 percent compared to 2007 levels, with over 2006 MW of newly installed power due to the very attractive FIT prices. The government responded to the solar power boom by placing a cap of 500 MW on the market, which decreased the market size by about 80 percent, or greater than 2100 MW in 2009 (Koot, 2009). Setting the cap for solar PV, overpricing RE electricity along with other factors including the world financial downturn, led to a decline in the solar PV market that impacted the global solar power industry. This indicates that adjustments to the FIT framework can lead to an unstable market environment, which contradicts the claims that FITs are stable and predicable. On the other hand, setting a very lower feed-in tariff will discourage investments in RES generation and targets may not be met. Price setting is key to creating a successful policy (Cory, Couture, & Kreycik, 2009).

The next three types of policies, end-user tariffs, regulations, and non-market mechanisms will be examined more briefly.

5.1.4 End-user tariffs

In the environmental context, *end-user tariffs* for electricity consumption internalise externalities by requiring consumers to pay additional surcharges to account for the negative environmental impacts of electricity generation. An end-user tariff can subsidise cleaner, alternative technologies by "transfer[ring] resources from the public to the "preferred" private alternatives" (UNEP, 2004, p. 26). End-user tariffs can appear as an extra surcharge on the end-user's electricity bills. The surcharge is usually collected by the electricity supplier and is later redistributed by an independent regulator or a governmental organisation/body (UK Office for National Statistics, 2006; Weimer & Vining, 1992). In this thesis, the end-user tariff is a supplementary policy instrument that is implemented to support grid policies and RE generation policies.

5.1.5 Rules and regulation

Policy targets, established in laws, are a type of regulation that set legally binding quotas (targets). As of 2011, there are 96 countries that have set RE targets according to the REN21's 2011 "Renewables Global Status Report". Over 50 percent of the countries with policy targets are developing nations, while other countries include the EU27 and emerging nations such as China but excludes the United States.

There are several types of policy targets and the most frequently implemented targets are based on electricity usage or generation. The targets set a percentage of the total electricity capacity (MW) or generation (MWh) that should be sourced from RE. The share is usually between 10 to 30 percent and should be met within the next 10 to 20 years. There are other targets that use different indicators or requires a percentage of RE based on the total primary energy or final energy consumption by end-users (million tonne of oil equivalent, Mtoe; or million joules, MJ) (REN21, 2011). Policy targets can be integrated into other policy instruments such as quota systems and tendering policies.

There are also other specific frameworks and regulations requiring compliance in areas such as grid connection applied in the energy and RE sector that will be examined more closely in 5.2. Designing and implementing the appropriate regulations, instruments or measures can be challenging and the outcomes uncertain. Drawing lessons from other countries can be a helpful exercise that could give some indication of how policies have worked or failed to work.

5.1.6 Non-market interventions

The government can intervene in the creation of independent agencies or government corporations. Independent agencies can exist at the local, regional and national level and are a form of "quasi-nongovernmental organisation" that are a "semiautonomous body" and are generally not part of a governmental department. These independent agencies can build and operate a broad range of facilities and services (i.e. water, gas, electricity, bridges, airports, industrial parks, etc).

Government corporations are most often created to deliver "tangible and divisible goods in sectors that at least appear to be natural monopolies" in utilities, telecommunications and transportation (Weimer & Vining, 1992, p. 181-182). Independent agencies and government corporation in China will be examined throughout Chapter 6 to 8 while more detailed cases of policy incentives and regulations applied in other countries are discussed in the remainder of this chapter.

5.2 Background of policies from key countries

The next section provides an analysis of energy and RE frameworks and policies, which act as references for drawing policy lessons from abroad in China. This part will not analyse policy learning, transfer and post transfer learning in China (discussed later in Chapters 6-8) but examine best practices or efficient policies from other countries. There are several regions and countries China frequently looked towards when studying technical policy learning for renewable energy policies including the European Union, United States, United Kingdom and Germany (see Table 5.1).

Table 5.1 Renewable energy policy case studies from abroad

Region/Country	Policy Level	Policy Type
European Union	1st policy level	Regulation: RE targets
United States	1st policy level	Regulation: Public Utility Regulatory Policies Act (PURPA), the Energy Policy Act
	2nd policy level	Facilitating market: Renewable Portfolio Standards (RPS)
United Kingdom	2nd policy level	Regulation: Non-Fossil Fuel Obligation (NFFO), demand-side tax (levy to support NFFO) and stimulating market (NFFO concession projects) Facilitating market: Renewables Obligation (RO)
Germany	1st policy level	Regulation: mandatory grid connection
	2nd policy level	Supply-side subsidies: feed-in Tariff

On a side note, the Clean Development Mechanism (CDM) is an important policy of the United Nations Kyoto Protocol, but the CDM will not be examined closely in this thesis. CDM is part of a wider global carbon emissions trading scheme and would require including a global

component to the research. The policies discussed in this thesis primarily focuses on regional (EU- level) and national energy, RE and wind power policies. Convenient

5.2.1 Policy targets at the European Union level

The EU is a region that has some of the most robust energy and climate change policies in the world. According to the World Energy Council's 2011 report "Policies for the future 2011: assessment of country energy and climate policies", European countries are in the first four rankings for energy sustainability, primarily due to the strong RE targets. This part explores target setting in the EU as a first level regulation.

The 1997, the European Commission's White Paper on RE "Laying down a community strategy and action plan" established an objective aligned with the Kyoto Protocol commitments to decrease greenhouse gases (GHGs). The aim was to increase the share of RE from 6 percent of the overall energy consumption in 1997 to 12 percent by 2010. Developing the RE sector was expected to create up to 900,000 jobs, save 3 billion EUR from 2010 onwards. By 2010, RE was also expected to decrease fuel imports by 17.4 percent and reduce 402 million tonnes in carbon emissions annually. The White Paper highlighted the importance of developing "high-profile projects" for certain RE sectors including installing one million solar PV systems, large wind farms totalling 10,000 MW and 10,000 MWth of biomass (European Union, 2001). Targets were also set out for individual RE technologies, as indicated in Table 5.2.

Table 5.2 EU renewable energy installed capacity and 2010 Target

Energy Source	2010 EU White Paper Targets	Actual 2010 Energy
Wind	40 GW	84.9 GW
Hydro	100 GW	122.4 GW
Solar PV	3 GWp	25.5 GWp
Biomass	135 Mtoe	172.5 Mtoe
Geothermal	5.2 Mtoe	0.8 Mtoe
Solar Thermal	100 Mio m^2	1.4 Mio m^2

Source; Eurostats qtd in EREC, 2004, REN21, 2011; Beurskens, Hekkenberg, & Vethman, 2011

Wind, hydro, solar PV and biomass targets were met and exceeded while geothermal and solar thermal targets were considerably under target. Wind power generation, in particular, more than doubled the target, and solar PV exceeded the target by 8.5 times. Solar thermal on the other hand, only reached 1.4 percent of it 2010 target, partially as a result of the recession (EurObserv'ER, 2011).

The targets in the 1997 White Paper became enforceable in 2001 through the EU Directive 2001/77/EC on the "Promotion of electricity from renewable energy sources". The Directive

required the EU to meet the 12 percent energy target, which translated to 22.1 percent of electricity generation by 2010 (see Table 5.3).

Table 5.3 EU renewable energy electricity generation and 2010 target

Electricity Generation	2001	2006	2009	2010	2010 Target
Total RE production (TWh)	441	478	587	695	675
Total electricity generation TWh)	3 106.7	3 354.8	3 210.0	3333	3,068
Share of electricity from RES (%)	14.1	14.2	18.2	20.8	22.1

Source: Eurostat, 2011; Eurostat, 2012; EDF & Observ'ER, 2011

The Directive placed "[t]he promotion of electricity from renewable energy sources (RES) [… on] high European Union (EU) priority for several reasons, including the security and diversification of energy supply, environmental protection and social and economic cohesion". The targets are also binding for 2004 accession member states, bringing the cumulative target to 21 percent for the EU 25. Member states are required to devise national actions plans and national targets in line with the overall EU targets. Additionally member must formally report their progress including the measures taken to meet the targets (EREC, 2004; European Union 2001).

Targets beyond 2010 were first discussed in 2004 at the European preparatory conference in Berlin, which suggested a general target for 2020. A technical study recommended that RE should make up 20 percent of the overall energy consumption by 2020. The goal was to be achieved by taking new concrete measures in addition to implementing existing policies. The European Commission (EC) called for a report on the "Evaluation of the effect of legislative instruments and other community policies on the development of the contribution of renewable energy sources in the EU and proposals for concrete actions" (COM (2004) 366). The suggested targets became legally binding during the 2007-2009 European Council Action Plan (7224/1/07) and the Energy Policy for Europe action plan was devised with new measures set to meet the 20 percent RE target by 2020 (EREC, 2007).

In 2009, the Directive 2009/28/EC "Promotion of the use of energy from renewable source" was implemented to create a "common framework for the production and promotion of energy from renewable sources" and to meet the 20-20-20 target (European Union, 2009). The aim was to reduce primary energy consumption and GHG emissions by 20 percent and for RE to make up at least 20 percent of the overall energy consumption by 2020. In order to meet the triple target, member states were required to set national targets, develop national action, cooperate with other member states, and guarantee the origin of electricity from RE sources and to ensure

that grid operations guarantee RE electricity distribution and priority access to the grid targets (see Appendix D, Table D.1 for details on EU member state targets). The EU target for electricity from RES was not met in 2010, as seen in Table 5.4, but some member states exceeded their targets such as, Germany. Hungary, Netherlands, Slovenia (REN21, 2011).

Table 5.4 Electricity produced from renewable energy to gross electricity

	2009	2010 Target
EU (27 countries)	18.3	21.0
Belgium	6.1	6.0
Bulgaria	9.8	11.0
Czech Republic	6.8	8.0
Denmark	27.4	29.0
Germany	16.2	12.5
Estonia	6.1	5.1
Ireland	13.9	13.2
Greece	12.3	20.1
Spain	25.7	29.4
France	13.5	21.0
Italy	20.5	25.0
Cyprus	0.1	6.0
Latvia	49.2	49.3
Lithuania	5.5	7.0
Luxembourg	3.7	5.7
Hungary	7.0	3.6
Malta	0.0	5.0
Netherlands	9.2	9.0
Austria	66.8	78.1
Poland	5.8	7.5
Portugal	33.3	39.0
Romania	27.9	33.0
Slovenia	33.6	36.8
Slovakia	17.9	31.0
Finland	25.8	31.5
Sweden	56.4	60.0
United Kingdom	6.7	10.0

Source: Eurostat 2011; European Union Directive 2001/77/EC

Although the EU fell short of meeting the 2010 targets, the EC believes that member states can meet or exceed the 2020 targets. But in order to meet the targets, member states need to fully implement their national action plans and double RE investments from 35 billion EUR annually to 70 billion EUR. Economic incentive instruments such as grants, loans, feed-in tariffs, and green certificates should be are expected to help develop the RE market (European Union, January 31, 2011).

Additionally, guaranteeing grid access is also essential to ensure that electricity produced by RE is fed into the grid. These prerequisites are highlighted in the EU directives for establishing RE

targets. Detailed measures are required to implement guarantee grid access policies, which should be drawn early on in the RE policy development stage.

The subsequent section examines the development of grid connection policies, regulations and market related energy and RE policies in the U.S., UK and Germany.

5.2.2 The American experience

As an early supporter of RE, the U.S. government introduced the Public Utility Regulatory Policy Act in the 1970s, a first level regulation for mandatory grid connection. Two decades later, RE development were reinforced in the Energy Policy Act, another first level policy that furthered the liberalisation of the energy market. The RE portfolio standards, a second level quota policy, was implemented the 1980s in selected states and eventually expanded to over half of the states in the U.S. by 2011. This section will examine how first and second level policies have contributed to promoting RE development at the federal and state level in the U.S.

The Public Utility Regulatory Policy Act (PURPA)

RE was formally supported at the national level in the U.S. during the late 1970's at a time of the global energy crises. An embargo was imposed on the U.S. by the Nations of the Organization of Petroleum Exporting Countries (OPEC) in 1973 and was later lifted in 1974 but the situation had already contributed to rising energy prices. As a nation dependent on oil imports, rising oil prices threatened the nation's energy security. Consequently, the Public Utility Regulatory Policy Act (PURPA, 1978) was enacted (McNerney, 2000), which supported the development of alternative energy sources, such as RE as well as the diversification the energy mix.

RE generators especially benefited from the new legislation, which classified non-utility[10], small power producers[11] and cogeneration facilities as qualifying facilities (QF) (McNerney, 2000). The inclusion of QFs in the power generation market enabled small-scale self-generating plants to connect onto the grid. PURPA explicitly stated that "each electric utility[12] shall make available, upon request, interconnection serve to any electric consumer that the electric utility

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[10] "A nonutility is a corporation, person, agency, authority, or other legal entity or instrumentality that owns electric generating capacity and is not an electric utility. Nonutility power producers include qualifying cogenerators, qualifying small power producers, and other nonutility generators (including independent power producers" (McNerney, 2000, p.8)"

[11] Small-scale power producers were defined as having less than 80 MW of generating capacity while eligible facilities producing power from wind, solar geothermal, hydroelectric or municipal wastes power did not have a capacity limitations

[12] Electricity utilities are electricity companies that either in the generation, transmission, and distribution of electricity, but not all utilities are involved in electricity generation. Electricity utilities are owned by investors, the public, cooperatives or the Federal government (EIA, 2007).

serves" (PURPA, Section 111, 12). Previously, utilities could refuse grid connection and self-generating plants were obliged to supply their own power at all times in addition to their redundant back-up power systems. PURPA increased energy efficiency since QFs were able to sell excess electricity to the utility when their supplies exceeded demand (Masters, 2004, p. 153).

PURPA stipulated that the utilities were obliged to purchase electricity from QFs at a just and reasonable price (Section 201 b) equivalent to the avoided cost defined as: "the cost to the electricity utility of the electric energy which but for the purchase from such co-generator or small power producer, such utility would generate or purchase itself from another source" (Section 210 (d), qtd. in Graves, 2006). In other words, the utilities compensated QFs according to the avoided cost for the electricity generation rather then the actual cost of generation and this lead to a favourable price for the new energy generators (McNerney, 2000).

The measures set in PURPA initially predicted that 12,000 MW of non-hydro RE would be developed. In fact, by 1991, 32,000 MW of non-hydro RE were produced by QFs. PURPA was one of the most effective legislation in supporting RE development, but it was not with its issues (Swezey, 1993). The price determined by the avoid cost was excessively high since prices were based on forecast of increasing fuel prices. While fuel prices did not reach the forecasts, utilities were still required to honour the 15-20 year fixed contract and passed the increased power costs to consumers. QFs artificially increased the electricity price but contracts persisted due to the utility's obligation to purchase. Additionally, inefficiencies arose since utilities were forced to purchase electricity from QF even when they had adequate power suppliers (McNerney, 2000).

The Energy Policy Act

In 1992 the Energy Policy Act (EPAct) was passed, opening the market to another category of power producers called exempt wholesale generators (EWG), which did not have capacity limits and could generate power from any fuel source or technology. QFs also benefited from EPAct, giving them access to wholesale markets where they could sell their electricity directly to the end-users (Masters, 2004, p. 153). Despite the enactment of the EPAct, QFs claimed that vertically integrated utilities (utility-owned generators) showed preferential treatment towards their own generating facilities. Thus in 1996, the Federal Energy Regulatory Commissions (FERC) simultaneously issued Orders No. 888 and No. 889 to address transparent, open access to transmission, leading to the first efforts of a deregulated power generation market.

As restructuring occurred in the energy industry, there was a strong focus on reforming the transmission sector. Since utilities functioned like a natural monopoly and required monitoring,

the grid was to provide open access in a regulated environment. FERC deregulated the power generation sector and shifted the industry towards a market-based structure. The main objective of deregulation was to lower electricity costs via new technologies, increase the rate of adoption for new generating technologies and to provide access to more economical electricity from other states (Hein, 2003).

With the enactment of the 2005 The Energy Policy Act (EPACT 2005), some measures in PURPA were revised including mandatory grid connection, open access to transmission lines and the creation of a competitive generation market. Utilities were exempted from purchasing electricity from QFs under the condition that they could prove that the QFs' electricity could be sold in the competitive wholesale market (Graves et al, 2006). The EPACT 2005 stimulated demand for RE by obliging the government to purchase a fixed amount of RE electricity (Senate Committee on Energy and Natural Resources, 2005). Other additions to the EPACT included a clause to promote alternative energy sources including RE (PURPA, Section 111, Paragraph, 12).

Another important supplement to the EPACT 2005 was placing a standard for interconnection services developed by "the Institute of Electrical and Electronics Engineers, IEEE Standard 1547 for Interconnecting Distributed Resources with Electric Power Systems" (PURPA 111(d) Paragraph 15). The additional PURPA standards would streamline integration standards and improve the uptake of RE into the grid. The revisions in the Public Utility Regulatory Policy Act since 1978 illustrates that the RE sector was stimulated by strong policies in the U.S., which also had shortcomings. Overtime, the policies were amended to address the issues of the artificially high avoided costs, and also to streamline policy implementation across the diverse states.

Renewable Portfolio Standard (RPS)

Since the 2005 Energy Policy Act, there have been no other major national policies dedicated to develop RE, even though the Act proposed to introduce the Federal Renewable Portfolio Standard (RPS). The RPS is a government-mandated policy that facilitates the RE market by establishing a minimum quota. Unlike EU-level RE targets that stipulate a general objective, the RPS specifically sets a target for electricity utilities to ensure that a fixed percentage of a utility's power plant capacity or electricity generation is derived from RES by a set date.

The EPACT 2005 proposed a federal RPS target amounting to 10 percent of the overall electricity output by 2020 but the proposal was rejected by the U.S. Conference Committee. In 2007, the House passed the Federal RPS for the first time and in 2009, the House and Senate re-introduced the RPS in the energy bill. The bill proposed that 25 percent of the total electricity

generated should be supplied by RE by 2025. As of January 2012, the federal RPS legislation has not been finalised and enacted, although the process has been underway (IEA, 2009; PEW, 2011; EIA, 2012).

A mandatory national RPS is not enacted at the national level in the U.S., but many states have implemented a mandatory or voluntary RPS targets. Most state RPS quotas are set by the respective governments and the price is left to the market. Electricity utilities can fulfil the requirement by: generating electricity from RE; purchasing RE certificates; or purchasing electricity from an independent RE generating facility (U.S. EPA, 2009; DMI, 2009).

The quota criteria for RPS differs in each state (see Table 5.5).

Table 5.5 States with renewable or alternative portfolio standards

	State	RPS Commitment (percentage of electricity sales)
	Renewable Portfolio Standard	
1	Alaska	50% by 2025
2	Arizona	15% by 2025
3	California	33% by 2020
4	Colorado	30% by 2020 (at least 3% from local solar)
5	Connecticut	27% by 2020
6	Delaware	25% by 2025 (at least 3.5% from solar)
7	Hawaii	40% by 2030
8	Illinois	25% by 2025
9	Iowa	105 MW
10	Kansas	20% by 2020
11	Maine	40% by 2017
12	Maryland	20% by 2022 (at least 2% from solar)
13	Massachusetts	15% new by 2020 (with 1% increase each year thereafter)
14	Minnesota	25% by 2025; Xcel Energy 30% by 2020
15	Missouri	15% by 2021
16	Montana	15% by 2015
17	Nevada	25% by 2025 (at least 6% from solar)
18	New Hampshire	23.8% by 2025
19	New Jersey	20.38% by 2021 (additional 5316 GWh from solar by 2026)
20	New Mexico	20% by 2020
21	New York	30% by 2015
22	North Carolina	12.5% by 2021 (0.2% solar; 0.2% swine waste by 2018)
23	Oregon	25% by 2025 (20 MW from solar PV)
24	Rhode Island	16% by 2019
25	Texas	5,880 MW by 2015
26	Vermont	Equal to incremental load growth
27	Washington	15% by 2020
28	Wisconsin	10% by 2015
	Alternative Portfolio Standard	
1	Michigan	10% by 2015
2	Ohio	25% by 2025 (12.5% from renewable sources)
3	Pennsylvania	18% by 2020 (at least 0.5% from solar)
4	West Virginia	25% by 2025

(Voluntary) Renewable/Alternative Energy Goal	
1 Alaska	50% by 2025
2 Florida	Unspecified targets and dates- at least 20%
3 Indiana	At least 10% by 2025
4 North Dakota	10% by 2015
5 Oklahoma	15% by 2015
6 South Dakota	10% by 2015
7 Utah	20% by 2025
8 Virginia	15% of 2007 sales by 2025

Source: PEW, 2011

Iowa was the first state to adopt the RPS in 1983 but the policy was only implemented on a wider scale around two decades after its adoption (SEIA, 2009; PEW, 2010). As of November 2011, there are twenty-eight states that have established a variation of the RPS. There are four states with Alternative Portfolio Standards and eight states with the Voluntary Renewable or Alternative Energy Goal. The Alternative Portfolio Standard is similar to the RPS but includes alternative energy forms such as nuclear energy. State RPS goals range between 10 to 50 percent and compliance dates are set from 2015 to 2030. Some states have also set 'carve-out' targets, which establish requirements within the RPS for certain RE sources, particularly for solar power (PEW, 2011).

Texas is an example of a successful case for the quota system. The state's RPS was implemented in 1999 and aimed to meet a target of 2000 MW of electricity from RES by 2009. A mandatory requirement was also set for utilities to purchase electricity from RES and was calculated as a percentage of the retailers' overall share of retail energy sales. In 2001 the Renewable Energy Credit-trading programme (REC) was established alongside with the RPS policies. The trading programme allocated one REC for every MWh. A capacity conversion factor then translated the quota targets measured in MW to MWh. The implementation of the RPS and REC has helped Texas to meets its ten-year target in just over six years. The state revised it generation targets to 5,880 MW by 2015, equivalent to 5 percent of the state's electricity demand (N.C. State University, 2009; SECO, 2007). The key factor to Texas' successful RPS system was the REC programme used to track RES electricity generation. The REC significantly reduced the cost associated with policy implementation and supported market development by bringing together electricity generators and retailers as well as distributing costs fairly among the market actors (Wiser et al, 2002).

Mandatory RPS policies implemented across states have played an important role in developing RE in the U.S. and have contributed to around 90 percent of non-hydro RE capacity installed from 2004-2011 (C2ES and RAP 2011). Some studies have shown that the total demand for RE

generation in states with RPS policies will increase from 137 TWh in 2010 to 479 TWh by 2025, which makes RPS policies "the most critical driver determining the pace of U.S. renewables growth going forward" (IHS Emerging Energy Research, 2010). The wind power sector, in particular, has largely benefited from RPS policies, which favours the development of the lowest cost RE technologies. RPS policies have also contributed to building a wind power supply chain and manufacturing capabilities in the U.S. as well as knowledge capabilities through training and crediting programmes (C2ES and RAP 2011).

Overall, the examples of the quota system accompanied by a certificate trading system and the grid policy development in the U.S. can be applicable in China's situation due to the similarities between both countries. For instance, China and the U.S. have a high dependency on imported energy and coal and need to diversity their energy mix. Additionally, both countries have vast geographical space, distinct provinces and states, varying levels of RES in each region, and challenges with grid connection for large-scale RES (Laird & Stefes, 2009).

5.2.3 The UK experience for renewable energy policies

The United Kingdom's RE sector has been developing relatively moderately considering that the country has the most abundant wind resource in Europe (Conner, 2003). In the recent decade, the government has implemented dedicated and properly funded policies but RE only totalled to 6.8 percent of the UK's overall electricity mix in 2011 compared to Germany's 17 percent share in 2010 (DECC, 2011; BMU, 2011). The UK's share of RE in 2010 fell short of the 10 percent goal, set in its 2003 Energy White Paper, by 3.4 percent and it is likely to miss the EU targets of 20 percent by 2020 (DTI, 2003; Ecologist, 2010).

The UK is not necessarily the best practice nation for studying RE if evaluated on its RE development rate but there are selected UK RE policies that could be appealing from an efficient and economical perspective, especially for emerging and developing nations that are concerned with the RE costs. This part will examine some of the main RE policies in the UK including the Non-Fossil Fuel Obligation (NFFO) and the concession bidding under the NFFO as well as the Renewables Obligation (RO).

Non-Fossil Fuel Obligation (NFFO)

There was limited direct support for the UK RE sector in the 1990s as most of the energy investments were funnelled towards coal, oil, gas and nuclear power. RE, however, received indirect policy support from the nuclear power sector through the Non-Fossil Fuel Obligation (NFFO) in 1990. The NFFO was a policy that required public electricity suppliers in England and Wales to purchase electricity from non-fossil fuel sources at above-market rates. Initially the UK government intended to create a subsidy programme funded by a levy to promote

nuclear energy since the industry could not be privatised. The UK was required to attain approval from the EC in order to issue a levy to promote nuclear power as a part of the EU Competition Directive. Thus, the government requested approval for a levy to support all non-fossil fuels without specifically stating that funds would be directed toward nuclear energy. The EC approved the policy to support non-fossil fuels and set an end date for the levy by 1998. By default, RE was accepted as a non-fossil fuels source and would receive support under the levy. All electricity suppliers[13] were then required to pay a levy on electricity generated from fossil fuels known as the Fossil Fuel Levy (FFL), which was implemented in the 1989 Electricity Act. The FFL was funded by end-user surcharges through charges to their electricity bills to promote non-fossil fuel technologies that were not commercially viable without policy support. A portion of the revenues from the levy was allocated to fund the NFFO (Conner, 2003; Mitchell, 1995).

The NFFO obligation to purchase electricity from non-fossil fuel sources were carried out through five concession rounds of bidding from 1990 to 1998. Interested RE generators could bid for contracts under the NFFO scheme and the successful bidder would receive the special rates from electricity suppliers (Conner, 2003; Mitchell, 1995). The difference between the special rates and the electricity wholesale price would be met by the FFL (Mitchell, 1995). The FFL increased consumer electricity bills by 10 percent in 1996 but the majority of the subsidies were directed to nuclear power. In 1990 and 1991 only 0.5 percent or 6 million GBP of the 1175 million GBP was allocated to RE. Over time, the distribution of funds slightly improved to 8 percent of the overall 1204 million GBP in 1994 to 1995 (Conner 2003).

A 600 MW declared net capacity (DNC) by 2000 was set for the first NFFO round (NFFO-1) but over 60 percent of the NFFO-1 contracts were from existing RES plants that had previously requested for greater support from the government. Compensation was awarded on a per KWh basis and prices were negotiated between the electricity suppliers and RE generators prior to bidding for the projects, therefore limiting competition. Changes were made in the second NFFO to promote some competition. Projects in the NFFO-2 mainly consisted of new builds and payments were issued when projects were commissioned for a fixed period until 1998. The limited compensation period required projects to be developed in a timely manner and also encouraged output efficiency to maximize profits. The first two NFFO rounds could be seen as a success when measured by capacity, particularly for the second NFFO round, as the capacity surpassed expectations (Mitchell, 1995).

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[13] Electricity supplied in the UK are vertically integrated, that is, they operate in the wholesale and retail market as well as generate and sell electricity to consumers (DECC and HM Treasury 2010).

Competitive bidding sped up the development of wind power generation in the UK. Planning permission and wind power construction were carried out almost simultaneously and sites were erected around the same areas. The surge of wind farms prompted a small pocket of organised resistance against wind power in 1990 and 1991, which contributed to bringing an end to the NFFO in 1998. The opposition against wind power in some regions held back the overall development of the industry. The time limitation and concession bidding also gave rise to other problems. The short duration for compensation prevented the domestic industry from developing since the only local wind manufacturer had limited capacity to supply turbines; thus other turbines from foreign sources had to be supplied within a short time period. Additionally the concession pricing favoured large wind farms and players. The cost of developing a small-scale wind farm was higher and small-scale projects and players encountered greater challenges in securing contracts and financing (Mitchell, 1995).

Policy limitations in the first two NFFO rounds lead the UK government to press for changes in the subsequent three concession rounds. Before the third concession round, the EC granted a request to extend the NFFO beyond 1998 for RE and provided better conditions for long-term development. The extension allowed RE developers a grace period. The grace period provided time for RES developers to deal with planning and construction aspects so projects could receive the special rate for a longer period without losing time on non-generation related activities (e.g. planning permissions and construction). A grace period of four years was granted in the third NFFO round and this increased to five years in subsequent rounds. Furthermore, another fifteen-year period for "indexed-linked premium payments" was announced to provide long-term stability and support (Mitchell, 2004, p. 1937).

Other changes in the NFFO conditions for the wind power sector included adjustments to differentiate between small and large projects, opening more opportunities for smaller players. With new conditions in place, the government increased the RE target of 1000 MW in the NFFO-2 to 1500 MW by the year 2000 (Connor, 2003). Another strong policy signal was announced for the third NFFO round in 1993 when the Minister of Energy provided a clear statement regarding the role of government policy to promote RE in the NFFO programme.

The policy announcement was based on the Energy Paper 55 "Renewable Energy In the UK: The Way Forward" (1988) and Energy Paper 60 "Renewable Energy Advisory Group: Report to the President of the Board of Trade" (1992) (Connor, 2003). These policies would propel the development of RE with economical potential and environment benefits by helping to: diversify and secure sustainable energy supplies; reduce emission of pollutants; and encourage internationally competitive RE industries. The announcement was the first clear policy to state that the NFFO programme goal was to establish a market so that RE could compete with

conventional energy in the near future (Mitchell, 1995).

By the end of the fifth NFFO round, only 1000 MW of the planned 3270 MW were developed and installed by 2003. Some of the factors hindering RE development included difficulties in obtaining planning permission, unrealistically low bid prices as well as an absence of regulations to penalise developers who abandoned their contract obligations. Due to the highly competitive nature of the concession contracts, some companies placed low bids with the anticipation of winning the contract on a low-cost basis. They were not legally bound to honour the contract terms; therefore if bid prices proved to be unprofitable, companies could abandon the contact.

Additionally, the NFFO promoted the lowest cost technology resulting in a disproportionately large development in biomass, landfill gas, waste-to energy and on-shore wind farms (Lip, 2007). On the other hand, the NFFO was effective in driving down the overall costs of RE. The average price of RE in the first NFFO round decreased by 2.6 times by the last concession round as indicated in Table 5.6.

Table 5.6 Average prices of NFFO rounds (1990-1998) in GBP/MWh

RES Technology	NFFO-1 1990	NFFO-2 1991	NFFO-3 1994	NFFO-4 1997	NFFO-5 1998
Wind	100	110	44.3	35.6	28.8
Wind sub-band	-	-	52.9	45.7	41.8
Hydro	75	60	44.6	42.5	40.8
Landfill gas	64	57	37.6	30.1	27.3
Biomass *	60	65.5	38.9	-	-
Total**	70	72	43.5	34.6	27.1

*Municipal/industrial waste ** The total average include other technologies such as gasification, forestry waste, anaerobic digestion, and waste/combined heat and power prices

Source: Mitchell, 2004

NFFO Pricing

There was a large disparity between the bid prices of the first two NFFO rounds (as seen in Figure 5.1) with the highest bids nearly twice the amount as the lowest bid. One of the factors contributing to the wide price range was the initial lack of experience and uncertainties in the actual cost of RE electricity.

In the first NFFO round, pricing was determined by a cost-based rationale where RE generators would only offer the necessary information to support their bid prices. There was no competition among bidders as projects were individually evaluated. Some adjustments were made in the second NFFO round (as previously discussed) to include competition within separate technology categories based on the marginal price of the technology. Each technology would compete in its own category rather than with all RE technologies. Wind power

compensation was at its highest in the NFFO-2 at 11p/kWh and the higher price was justified as a means of compensating generators for the shortened period of return due to the 1998 cut-off date. The attractive rates were an important driving force in increasing installed capacity during the initial concession rounds. Installed capacity increased 5.6 times in the first two concession rounds, the largest growth in the NFFO programme (Mitchell, 1995).

Figure 5.1 NFFO concession bid prices (GBP/MWh) and installed capacity (MW)
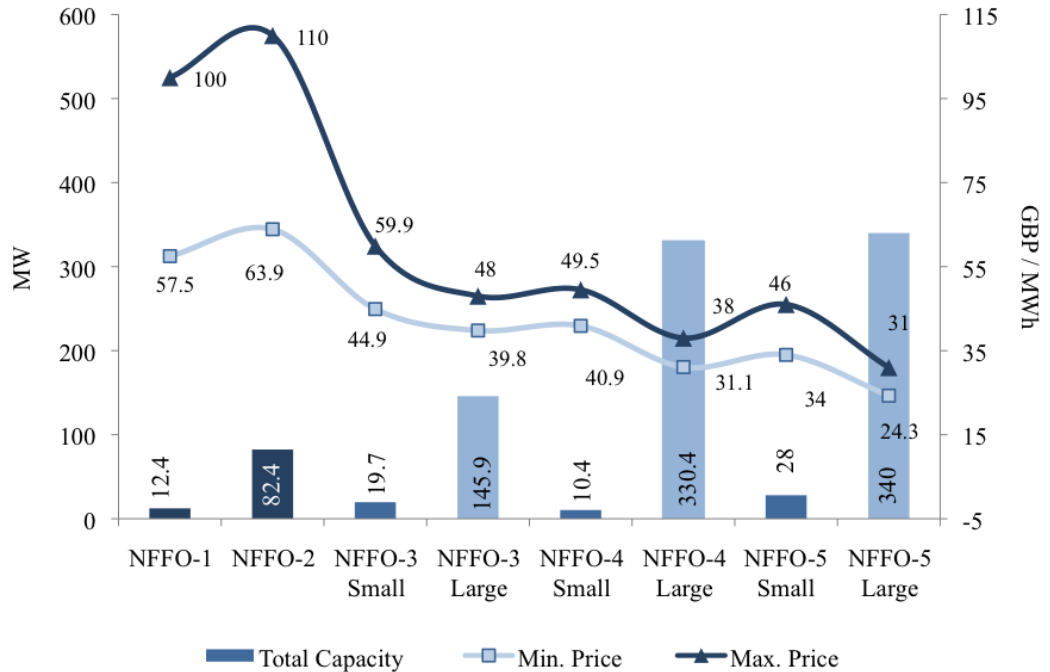
Source: Bolinger, 2001

After learning from the previous two NFFO experiences, the bidding prices in the successive concession rounds were more consistent. The important changes for the wind power sector included: the time extension for RE support and differentiating small and large sized wind farms. Creating two wind farm classifications was important to enable small-scale developers to participate in the market (Mitchell, 2004). As a result of the changes, the prices better reflected the cost of wind power production for small-scale wind farms and were nearly 1.0p/kWh higher then large-scale wind farms. The average prices dropped by around 2.5 times from 11p/kWh in the second NFFO round to 4.43p/kWh in the third round mainly due to the extended fifteen year period (Bolinger, 2001). In the fourth and fifth round, average prices decreased less intensively from 3.56 p/kWh to 2.88p/kWh. When examining the prices of wind power per kWh, the NFFO appeared to be an effective policy in terms of price minimisation.

Renewables Obligation (RO)

By 1997, there were already plans to introduce the Renewables Obligation (RO), a new RES support policy to facilitate the market. The RO would replace the NFFO and divert the RES obligation from procuring generation side contracts to placing obligations on electricity suppliers[14] to meet a minimum requirement to source a percentage of their overall electricity from RES. In 2002 the RO was enacted and electricity suppliers were obliged to purchase 3 percent (and increasing every year thereafter) of the overall annual electricity supply from approved RES. The quota set in the RO required RES to account for 10.4 percent of the cumulative supply by 2011. In the revised 2006 Renewables Obligation, the share would increase to 15.4 percent by 2015 (Statutory Instruments No. 1004, 2006). The scheme was scheduled to run until 2027 but the end date has been extended to 2037 in the 2010 Renewables Obligation Amendment Order (Crown, Statutory Instrument No. 914, 2002; DECC, 2012).

The RO is a market mechanism that is more dependent on market forces compared to the NFFO, as the obligation does not require suppliers to purchase all electricity generated from RES. Rather, RE generators must settle on all the terms including pricing and contract duration. In order to compensate RE generators for their higher costs, the generators receive a renewable obligation certificate (ROC) for each MWh of electricity purchased and the ROC can be sold to utilities or suppliers. Suppliers can fulfil their required targets by either investing in RE generating facilities or by purchasing electricity and the ROC from the RE generators.

Another option is to purchase the ROC individually from generators or the ROC trading market. If the suppliers do not meet the target, a buy out price or penalty must be paid at around 3 GBP/MWh (at 2003 prices), which is regularly revised according to the inflation. The proceeds from the buy out fee are fed back into the system and redistributed to suppliers who have met the quota in order to promote compliance. For instance, if an electricity supplier submits 5 percent of the ROC as part of the requirement to meet the Renewables Obligation, the supplier will receive 5 percent of the buy-out proceeds (Michelle 2004; Lipp 2007).

(See Appendix D for more details on ROC pricing and its impact on UK RE policies).

5.2.4 The German experience for guaranteed grid access and renewable energy pricing

Germany has been at the forefront of designing and implementing RE policies and is the architect of the Feed-in Law, a policy that has been instrumental in developing one of the leading RE sectors in the world. As with the U.S., Germany began to look towards alternative

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[14] There are six major electricity supplier companies that have 99 percent of the domestic supply (DECC, 2010).

energy sources in 1974 during the period of the global oil crisis. However, RE was not a priority for energy investments. Rather, the government set up attractive incentives to promote domestic hard coal. The incentives were funded by a 3.24-8.5 percent annual tax placed on electricity consumers since 1975. At that time, the Ministry of Research and Technology [15], who was responsible for RE but provided little policy and economic assistance, preferred to direct funds toward nuclear power pilot projects. There were limited initial investments in RE, amounting to 20 million DM (10 million EUR) in 1974 and by 1982, the spending was at its height of 300 million DM (150 million EUR) but decreased to 164 million DM (82 million EUR) in 1986. Most of the funds invested in R&D involved laboratory work, creating prototypes and training specialists. Nuclear R&D and demonstration on the other hand, received funding of approximately 13 billion DM (6.5 millions EUR) by 1980 (Jacobsson & Lauber, 2006; Lauber & Lutz, 2004).

The earliest policy intervention to promote RE was implemented in 1979. The Ministry of Economic Affairs, responsible for the utilities, introduced a policy for setting tariffs and mandatory grid connection under the existing National Competition Law. This required utilities to purchase electricity generated by RE according to the avoided cost. The cost of RE was priced as the marginal cost of a utility to generate one additional unit of power, either by constructing a new generation plant or by purchasing power from another supplier.

The objective of pricing electricity from RES at the avoided cost was to provide a fair energy price for alternative energy producers. The concept was carried forward from 1998 to 2003 by Association Agreements. The Agreements were collective private contacts that joined the utilities together with VIK, the large industry electricity consumer association, and the BDI (German Business Association). These organisations negotiated the Agreements and set guidelines for grid connection contracts and tariffs rates. The government left grid access implementation measures to the private sector and the grid was at liberty to interpret the measures for grid connection and tariff calculation, thus there was limited impact since the grid defined avoid cost as the "avoided fuel cost" (Jacobsson & Lauber, 2004; Glachant et al. 2008).

Initially there was limited financing and policy support for RE, but the modest investments and measures initiated the development of the RE industry. During the late 1970's the funding gave rise to a number of firms, academic institutions and notable organisations that were to become influential in shaping one of Germany's key RE policies. For instance, the Institute of Ecology (Öko-Institut), established in 1978, was key in providing guidance for RE policy formation. Another organisation, SFV (Förderverein Solarenergie) established almost a decade later in

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[15] Previously known as the Ministry for Atomic Issues founded in 1955.

1989 created the "cost covering payment" method for compensating RE electricity generation. The method was used in the national and local level feed-in laws.

Meanwhile investing in nuclear energy was becoming a contentious issue, especially after the Chernobyl nuclear incident in 1986. In 1981, a five year study commissioned by the Federal Ministry of Research and Technology, concluded that only RE and energy efficiency were compatible with the values of a "free society". The study also stated that RE and energy efficiency investments would be more economical than nuclear energy. As a result of the opposition against nuclear energy, RE gradually gained social and political support (Jacobsson & Lauber, 2006).

The Ministry of Research and Technology finally began to implement some significant measures in 1988 by supporting wind and solar power pilot programmes. The wind power programme began in 1989 with the objective of increasing wind power from its 20 MW-installed capacity to 100 MW, and later revised to 250 MW. Feed-in tariffs (FITs) were initially set at €0.04/KWh and later decreased to €0.03/KWh. The 1,000 solar roof programme was the other important initiative that helped to create a viable RE market. Revisions were also made for RE electricity to ensure that tariffs would compensate generators beyond the "avoid costs" (Jacobsson & Lauber, 2006).

The rise in RE associations and the gradual introduction of clearer policies eventually led to the formation of the Feed-in Law (Stromeinspeisungsgesetz, StrEG) in 1990. The Feed-in Law was essential for reinforcing mandatory grid connection, previously covered under the National Competition Law and stated that the grid was obliged to pay for feeding the electricity into the system (StrEG, Section 2, 1990). The law also indicated that the extra costs arising from RE grid connection and its related activities could be covered by the electricity end-user price. Pricing was also established for various technologies by taking a percentage of "the average revenue per kWh from the delivery of electricity by electricity utilities to all final consumers" (Section 3). The tariff for hydropower, landfill gas, sewage gas and biomass was set at 80 percent of the end-user electricity price while wind and solar power had a higher rate of 90 percent. (See Appendix E, Figure E.1 for details on tariffs for the technologies compared to the average electricity household rate from 1991-2000).

From the generator's perspective, the law had a sizable impact, as FITs for wind and solar (€0.082 - €0.088/kWh) were twice as high as the tariffs set in 1989 for the wind power programme. The higher rates were more beneficial to the wind power sector compared to the solar power sector, since solar power technology was more expensive and the tariffs were still too low to stimulate growth. The law also stipulated that RE generators were no longer required to negotiate contracts since the prices were set, easing the administrative process for grid

connection. Overall, clear legislation and guaranteed price for wind power and was instrumental in expanding the market from 56 MW in 1990 to 6,112 MW in 2000 (BMU, 2009).

The utilities were one of the most resistant stakeholders to RE and initially underestimated the new legislation that was aimed at the small hydropower industry. Later the utilities began to react when the Feed-in Law began to transform the electricity sector and allowed RE to develop into a competitive, thriving industry. The utilities were concerned about the vague terms of sharing costs equally over the regions and that they would be required to take on a large portion of the RE electricity tariffs costs, as experienced with coal subsidies[16] (Jacobsson & Lauber, 2006).

There was an urgent need to reform the Feed-in Law, not only to distribute costs nationally but to address other issues such as planning and investments for the future, meeting the EU standards, as well as revising the current conditions that were limiting the growth of the RE sector. Under the 1990 Feed-in Law, the 'Hardship Clause' stipulated that the upstream electricity supplier (high voltage transmission systems operators) were required to assume responsibility if there was undue hardships on the local utility to take up RE electricity. But this provision of the law was unclear and rarely put into practice. In 1998, the Feed-in Law was amended providing more specific clauses in the Hardship Clause (StrEG 2009, Section 4, paragraph 1). The revisions placed generation limits on electricity suppliers and minimal purchase obligations on utilities. In total there was a 10 percent ceiling set on the amount of electricity generated from RES. By 1997, some regions by the coast were approaching the 10 percent limit and new measures were needed (Lauber & Mez, 2004; BMU, 2000 March).

In 2000, the Renewable Energy Source Act: on Granting Priority to Renewable Energy Sources (Erneuerbare-Energien-Gesetz EEG) was passed, replacing the previous Feed-in Law. The legislation provided greater details and covered the issues of cost sharing and grid obligations mentioned in the 1990 law. The first scope of area discussed in the act reemphasised the grids' obligation to connect RE generators and, if necessary, to make upgrades in a timely manner to accept RE electricity (Section 3, paragraph 1). Grid operators must also provide access to the grid data so generators may proceed with the planning processes and assess the technical requirements for grid connection. The upstream transmission grid operators were responsible for purchasing the electricity by the grid operator according to set tariffs. The remuneration, specified in the EEG (BMU, 2000, Section 4-8), better reflected the costs associated with the various RE technologies (see Appendix E, Table E.1 for detailed tariffs.)

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[16] A few additional clauses were drawn up to restrict compensation to wind power generators that did not meet at least 60 percent of the reference yield as well as installations situated on exclusive economics zones, or declared protected natural sites, landscapes, and coastal areas.

Wind and solar power tariffs were separated in the 2000 Act (wind and solar were previously grouped together) and the set tariffs were also differentiated into the installation size to account for cost differences of plant sizes. For the case of wind power (BMU, 2000, Section 7), tariff rates increased from the pre-2000 set prices of €0.082 - €0.088/kWh to €0.0910/kWh in 2000. The wind power tariffs were increased for a number of reasons. Aside from the political interests in fostering growth for the RE sector, wind power was viewed as a good alternative energy source in diversifying Germany's energy mix and was seen as a valuable export industry and a domestic industry that would develop a skilled labour force.

In order not to disincentivise RE generators from achieving greater efficiency, a digressive tariff rate was introduced over a fixed time period. FITs were paid out for new installations since the enactment of the EEG over a period of 20 years (Section 9) with the exception for hydropower. Setting a time limitation was also necessary to fulfil the EU criteria regarding compensation and competitiveness. The digressive rate for wind power was 1.5 percent annually for new installations effective from January 2002. (BMU, 2000, Section 8).

Another important item on the EEG was grid connection obligations for the utilities and electricity generators. The grid operators are responsible for connecting RE generators to the "technically and economically most suitable grid connection point" (Section 10). RE electricity generators must fulfil their own obligations and meet the grid operator's technical requirements in accordance to the 1998 Energy Management Act (*Energiewirtschaftsgeset*). Technical specifications are particularly important for maintaining a certain level of standard and efficiency for intermittent sources such as wind and solar power that causes disruption to the grid. If the grid required upgrading for RE interconnection, the grid operator would be obliged to invest in transmission. The grid was also responsible for recording the exact costs and for passing on the costs through additional charges for grid access (BMU, 2000).

Since the burden for RE grid connection borne by the grid was relatively large, the EEG drew up terms to spread the costs over a Nation-wide Equalisation Scheme (Section 11). The scheme required transmission grid operators to document the differences in the amount of electricity purchased and the compensation paid out to the RE generators. The difference was then spread among the transmission grid operators (TSO) (Paragraph 1) and payments made on a monthly basis (Paragraph 3). If a TSO purchased more than its share of RE electricity it could either sell power or receive compensation from other TSOs (Paragraph 2). Furthermore, each grid operator was required to make the data available to increase transparency and ensure that the payments were accurate (BMU, 2000).

The cost-sharing scheme was designed to ease the grid's resistance to connect RE as it would not have to take on unreasonable costs. The new terms clarified the method of compensation.

Final electricity consumers would be required to pay €0.0005/kWh. The government projected that even if there was a strong growth in RE, the end-user costs would only increased to €0.001/kWh, which they justified as a "is a small price to pay for the development of this key sector" (BMU, 2000). The government designed the EEG "to promote the market introduction of emission-free and sustainable energy sources to substitute for conventional energy sources" and to provide "for strictly consistent, equal burden sharing among all power suppliers. This is in keeping with the " 'polluter pays' principle established in environmental protection" (BMU 2000, Annex A). The Renewable Energy Source Act has been crucial in building up a strong RE sector, at a costs of €18 per capita in 2002 (Jacobsson & Lauber, 2006).

Additionally, the redefinition in the Scope of Application was perhaps one of the most incentivising changes in the EEG for the utilities (BMU, 2000, Section 2). Previously in the Feed-in Law, the utilities were prohibited from engaging in RE generation activities. However, with the EEG, the utilities had the option of investing in new installations and were able to benefit from the new tariff rates. The combination of the Nation-wide Equalisation Scheme and the ability to participate in the RE market softened the utilities' resistance to RE.

The revised law created space in the electricity market for RE by not only providing attractive tariffs but also by taking the external costs of RE electricity generation into consideration. Essentially, the EEG narrowed the price gap between conventional and RE through reimbursing the additional cost of RE generation. The compensation was high and not all stakeholders in the energy sector welcomed high tariff rates. Politicians from the Ministry of Economics, especially those with a strong coal background objected to the FITs system and argued for a tender system. There was a growing fear that coal and conventional sources would be displaced by RE since the electricity demand was not projected to increase over the next decades. The conflicting views resulted in the revision of the Renewable Energy Source Act (EEG 2004), the "Act revising the legislation on renewable energy sources in the electricity sector" in 2004. The new legislation's aimed to raised the share of RE to at least 12.5 percent by 2010 and 20 percent by 2020 (Article 2, paragraph 2). The main amendments involved price adjustments for various technologies as well as the inclusion of other RES (see Appendix E, Table E.2 for a list of the tariffs and price adjustments in the revised EEG).

These new rates were generally higher then the first wind power tariffs prices set in 1990 Feed-in Law ranging from €0.082 - €0.088/kWh and the digressive tariff rate increased to 2 percent annually from the 1.5 percent set in the EEG 2000. The increase digressive rate took into consideration the technological advances and the decreasing costs of wind power. A new article was also added to the revised EEG, which required the progress of RE energy to be monitored every four years and the results submitted in a report. The continuous monitoring of the RE

sector enabled for timely policy revisions according to the needs of the sector (BMU, 2004). In 2007, the Federal Environment Ministry (BMU) submitted a progress report to the parliament outlining changes to the EEG. The parliament accepted the proposal in June 2008 and the EEG was amended and enacted in January 2009 (Busgen & Durrschmidt, 2009). The 2009 EEG established more ambitious goals to increase the percentage of RE in the overall electricity mix to a minimum of 30 percent by 2020. In order to achieve the high targets, adjustments were needed in the 2009 EEG. Some of the major changes included general increases in FITs for on-shore and off-shore wind power, hydropower, small-scale biogas and biomass plants, and geothermal. The prices for solar power, on the contrary, decreased (see Appendix E, Table E.3 for details on revised tariff prices). The revisions primarily benefited small-scaled RE installation for hydropower, biomass and biogas including landfill, sewage and mine gas. The separation of biogas provides for a more specific remuneration according to the differentiated costs of each technology.

In comparison to the 2004 EEG, the new tariffs in the amended 2009 EEG placed a differential cost of around €740 million by 2020 on the public. The higher offshore wind tariffs is expected to further increase costs by 2020 to approximately €800 million where as the increases for onshore wind, hydropower, biomass and geothermal is estimated to cost about €220 million. The decreased solar power subsidies on the contrary will save around €310 million. When translated to end-user electricity fees, the EEG, since 2000, has increased the final electricity end-user prices by €0.0005/kWh in 2000 to €0.00075/kWh in 2006, and is projected to increase to €0.015/kWh by around 2019. These price rises are relatively low compared to the residential electricity price increase of €0.05 from 2000 to 2006, which according to the BMU, was not linked to the EEG (Busgen & Durrschmidt, 2009).

Aside from tariff revision, "direct selling" was introducing to allow RE generators to sell a certain percentage of their electricity output to a third party on a month-by-month basis (Section 17). Direct selling further liberalised the market and provided RE generators the opportunity under favourable market conditions "to ask for prices above the fixed feed-in tariffs" (Freshfields Bruckhaus Deringer, 2008). Another amendment relating to grid obligations also placed RE generators in a favourable position. Under the recommendation provided by the Germany Wind Association (Bundesverband Windenergie eV, BWE) the EEG was revised to include grid capacity expansion and feed-in management. The addition required the grid to "optimise, boost and expand their grid systems in accordance with the best available technology in order to guarantee the purchase, transmission and distribution of the electricity generated from renewable energy sources" (Section 9). A 'compensation' clause was also created to reinforce the grid obligation, which stated that if the grid failed to meet its obligation, it would be liable to compensate the parties feeding in the electricity (BWE, 2008; BMU, 2009).

The changes in the 2009 EEG aims to meet the ambitious RE targets as well as ensure fair compensation without over burdening end-users and abandoning market principles. The gradual evolution of the EEG over the decade illustrates that the process of RE policy formulation requires continuous learning and frequent policy revisions in order to adjust to the market conditions.

(See Appendix D for more details on the outcomes of the German FIT Policy).

5.3 Chapter 5 summary

This chapter provided the context for the subsequent empirical chapters by identifying the main policy instruments that will be discussed in China's RE policy learning and transfer process including: quotas system accompanied with tradable permits that facilitate markets, tendering policies that stimulate markets, feed-in tariffs as supply-side subsides, regulations that set RE targets and quotas, and government agencies and corporations that assist with developing the RE sector.

This chapter also analysed RE policy instruments in their respective country of implementation in four major jurisdictions that have been recognised as policy leaders or have policy lessons that could be useful for China. These regions and countries include: the European Union's RE policy targets, the United States grid development policies and quota system, the United Kingdom's tendering polices and quota system and Germany's feed-in tariff and grid policies. The analysis of RE policies in each country provides a basis for exploring the policy learning and transfer framework questions in Chapter 6 to 8.

# Chapter 6 - First Level Renewable Energy Policy Implementation in China

The formation of renewable energy (RE) policy in China over the past decades has been a blend of domestic grown policies responding to local energy and policies adopted from abroad. The distinction between Chinese and foreign RE policies are often blurred, as policies from abroad are adapted to suit China's policy and economic environment. Drawing lessons from other nations can be a complex process since a large number of actors are involved and the policy learning and transfer process are not often systematically documented. But analysing the policy learning and transfer process does not need to be an ad hoc exercise. In this research, the background information provides a starting point for analysing policy learning in China's RE energy sector.

The major RE energy policies identified in Chapter 2 are analysed further in Chapter 5 in the studies of the EU, U.S., UK and Germany. Although this is not a comprehensive list of all policy learning experiences from abroad, these four jurisdictions represent the major influences of policy learning for key RE legislation in China. The detailed country and policy instrument analysis provided the basis for analysing policy learning from abroad and policy transfer in Chapter 6 to 8.

Chapters 6 to 8 will examine all the key questions within the framework, as seen in Figure 6.1. The figure provides a slightly modified version of the framework questions grouped according to the evidence drawn for policy learning, transfer and post transfer learning evidence. The questions: "why" "what" and "from where and who" and "how lessons are transferred" search for evidence of policy learning from abroad and policy transfer. The last "how" question examines the impact of transferred policies in the post policy transfer process by taking into consideration the motivation behind policy learning and transfer ("why"), policy actors involved ("what"), and countries the lessons are drawn from ("where") as well as the key actors involved in the transfer ("who").

This chapter explores the role of policy learning, transfer and post policy transfer in the formulation of first level policies and institutions that impact China's RE sector. The analysis begins with a discussion of policy learning for energy institutions and follows with an analysis of target setting in the Renewable Energy Law (REL) and the Medium and Long Term Development Plan for Renewable Energy (MLDP). The subsequent part of the chapter focuses on grid issues and explores policy learning in first level grid connection policies. Each policy is studied individually, first by drawing evidence of policy learning and transfer, then by discussing the impact of the policies in China.

Figure 6.1 Policy learning from abroad, transfer and post-learning policy transfer evidence
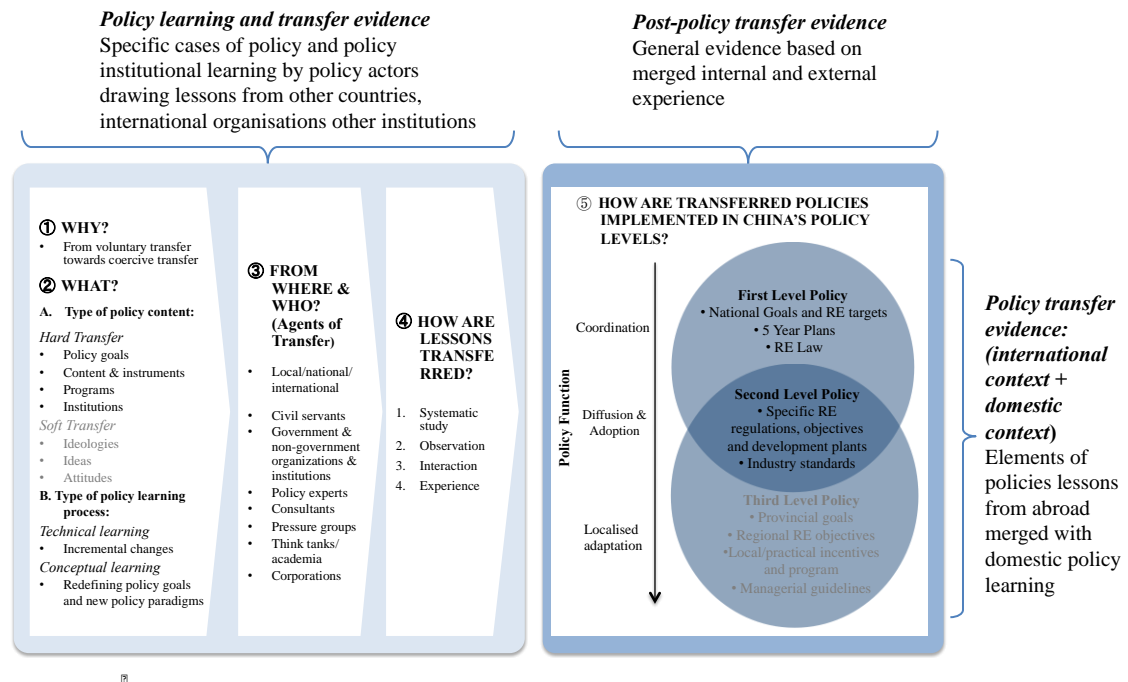
6.1 Policy learning from abroad and policy transfer for supporting institutions in the energy sector

First-level policies are essential in setting the needed framework for general energy development and pave the way for further high-level RE policies. These policies need the support of institutions in the implementation process. Energy institutions at the top level oversee grid activities and play a vital role in carrying out the coordination and adoption of grid regulations. In China, a number of supporting institutions exist in the energy sector and the Chinese government has drawn lessons from abroad to create corresponding energy institutions. Some of the *hard transfer* policy lessons on institutions were drawn *voluntarily* through organisations such as the Regulatory Assistance Project (RAP) while others lessons for institutional building were drawn under *coercive* conditions from large institutions including the World Bank.

Institutional building is an example of *conceptual policy learning,* where new ideas and perspectives are brought in from abroad and results in the creation of a new policy idea or policy institutional paradigm (see 3.5.2). In China, the conceptual learning eventually lead to the establishment of the State Electricity Regulatory Commission (SERC), an electricity market regulator. SERC is an example of a type of *hard transfer,* more specifically an *independent government agency* where government agencies provide a good or service in the market that is not directly part of a government department (see 5.2.5 for the full definition and see Figure 2.10: Major institutions in the energy and renewable energy framework). SERC was formed

with the support of the Regulatory Assistance Project (RAP), an organisation established by U.S. utility regulators that has been present in China since 1999. RAP worked alongside the China Sustainable Energy Program and liaised with other American organisations such as the Lawrence Berkeley National Laboratory's China Energy Group, and the Center for Resource Solutions (CRS)[17]. During the electricity reform period, RAP helped establish SERC and worked with government bodies involved in the reforms at the national, provincial, and local levels. RAP provided technical expertise, training, policy and R&D support, some of which were documented in *systematic learning* studies (see 3.8.1) in various reports (RAP, 2008).

An example of *systematic learning* was evident in the draft report published in 2000, titled: "Best Practices Guide: Implementing Power Sector Reform" (RAP, 2000) and focused on energy institutions and processes. The report stated that Chinese policy makers could apply policy lessons from the U.S. and other countries and stressed that:

> "learning and applying the lessons creatively to the situation in any given country will assure that reforms serve the widely held goals of an efficient, fair, and environmentally sustainable electricity sector. China's ongoing utility sector reform efforts can benefit greatly from the many lessons learned in the United States and other countries" (RAP, February 2000).

The section on policy institutions proposed the formation of an electricity regulator and provided an overview of a possible common framework for electricity utilities and the role of an electricity regulator, its major functions, responsibilities and key characteristics. The report stated that a utility "regulatory commission must impose a variety of economic regulations on the utility […]. The functions and responsibilities of a commission include: rate setting (often called tariff setting); general regulatory rulemaking; utility system resource planning; environmental impacts of resource utilization; conservation and efficient use of utility and societal resources; consumer protection; maintenance of the utility's financial integrity; assuring high system reliability; and utilization of appropriate tools to assure that utility management is given the proper set of incentives" (RAP, February 2000). These guidelines, were not all directly and fully implemented by SERC, but drew attention to the importance of creating an independent regulatory in the Chinese electricity sector that oversaw the key aspects of the energy sector including setting tariffs, managing resources and ensuring system stability.

In 2002, RAP published another report "Options for the Institutional Reform of China's Electric

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[17] "[S]ince 1999, CRS and its international team of consultants pursue a diverse array of renewable energy programs and activities, ranging from conducting technical analysis to offering policy support that have been crucial to renewable power penetration" Center for Resource Solutions" (CRS, 2011).

Power Industry" with the China Sustainable Energy Program (RAP & The China Sustainable Energy Program, 2002). The *systematic learning* example provided recommendations to: restructure the electricity sector; to develop the RE sector; and to form an independent regulatory agency as a crucial part of the reform along with the utility's rights and obligations. One of the recommendations indicated that it was "imperative that a strong regulatory body (or bodies) with broad jurisdiction be created and charged with, among other responsibilities, implementing the necessary reforms to meet China's objectives for the sector." (2002, p. 14-15). The suggestion to set up a strong regulatory body is of particular importance for enforcing regulations such as grid connection obligations.

A year later, RAP prepared another document "Report on the Establishment of SERC The State Electricity Regulatory Commission" (RAP, 2003) on behalf of the World Bank and China Sustainable Energy Program. The document was an extension of the World Bank's assistance to establish an electricity regulator in China. A year before RAP produced the report, the World Bank drafted a working paper "Establishment of a State Electricity Regulatory Commission in China A Suggested 'Roadmap' ". The paper provided working methods and plans to establish SERC and the power sector regulation process by drawing on international examples. The paper itself did not provide specific examples or recommendations but devised a strategic plan that included *systematic learning* through reports and *interactive learning* through face-to-face meetings. The paper stated that the strategic plan would be conducted by:

> "a team of Chinese experts (an interagency working group and an SERC Core Team) with input from international experts as appropriate. For most regulatory matters discussion papers will be required as a basis for wide-ranging stakeholder consultation. Training, study tours and twinning arrangements will be required to build and enhance the capability and experience of the SERC Core Team" (World Bank, 2002, p. 2).

As a part of the input from international experts, RAP produced the report to assist government bodies responsible for establishing SERC in the areas of regulatory functions, administrative and level processes, legal effects and enforcement, and organisation structure and funding. The report provided a review of regulatory trends in OECD countries, which showed a tendency for countries to establish independent regulatory agencies that would carry out regulatory responsibilities rather than through government departments. The U.S. was among some of the countries cited as an example. In the American model, regulatory functions were shared between the federal and state government but there were disputes over the division of authority at the federal and state level in the area of major restructuring (RAP, 2003, p. 23). The report authors recognised that China would remained cautious of the U.S. model since the Chinese national government retains strong control over areas of the political economy. The report

provided some options considering China's context stating: "there are many options for allocating regulatory authority vertically among China's levels of government. Even where authority has been placed at the local level, some options allow central regulators to exercise an overriding authority when needed" (RAP, 2003, p. 24). This policy learning example from the U.S. demonstrated that lessons could not simply be duplicated and that China's governing and political structure should be considered.

The World Bank has played both an indirect and direct role in contributing to building regulatory institutions and providing support for China to undergo reforms in its power sectors. Some of the influences present in World Bank initiated systematic studies, such as those conducted by RAP, as discussed above. These external forces contributed to *coercive policy transfer*. China felt obliged to follow the power reform trends observed internationally during the late 1990s and early 2000s as well as to comply with the bank's recommendations on the reform process since receiving the World Bank's support was important to attract foreign investments (Yeh & Lewis, 2004). Aside from supporting private investments and reducing barriers to market entry in the power sector, the World Bank was "a major advocate of establishing an independent regulatory authority " (2004, p. 449). The push for an independent regulator in the mid 2000s was a change in tone from the Bank's pressures to promote full privatisation of the power sector in the 1990s. Although the focus agenda has changed, the World Bank continued to exert its power to push forward its agenda. The consorted effort and influences, involving both coercive forces from the World Bank and voluntary learning from organisation such as RAP, has contributed to the formation of SERC in 2002. The next part examines SERC and other policies within China's first level energy policy environment.

6.1.1 Post transfer learning for policy institutions and consequences on policy compliance

The Chinese government took the policy learning recommendations into account and set up SERC, which officially began operations in 2003 (People's Daily Online, 2006). SERC's formation could have been premature in the electricity policy institution environment. According to Fredrick Weston, Director of RAP, the government failed to give SERC the necessary authority to carry out its regulatory duties. In fact, as of 2009, there has not been a documented case of SERC penalising grid companies for failing to meet their grid connection obligation (REN21, 2009). In order for SERC to be more effective, Weston noted that the regulatory body should have more policy tools such as authority over retail pricing and cost. But the Department of Price under the NDRC retains authority over price and therefore controls revenues. Weston argued that a regulatory body should have the comprehensive authority to make decisions regarding revenues and regulate independently from the legislation and

executive branch of politics. SERC, in relation to grid policies, should in principal assist with regulation compliance but its duties overlap with other institutions (R. Weston, personal communications, May 28, 2009). Table 6.1 summarises the roles for SERC's and other institutions overseeing RE and grid issues.

Table 6.1 SERC's duties and corresponding duties of other government bodies

SERC's Responsibilities	Overlapping Responsibilities in Other Government Bodies
"Overall regulation of the national power sector, establish a coherent system for regulatory organization and exercise direct leadership over its regional branches"	
"Develop laws and regulations, as well as relevant amendments, on sector regulation, formulate regulatory rules for the sector; establish rules for electricity market operations"	**National Energy Administration (NEA):** "participating in the formulation of policies related to energy"
"Participate in formulation of development plan for the sector; propose development plans for electricity markets and market designs for regional power markets"	**NEA:** "responsible for formulating and implementing energy development plans and industrial policies; promoting institutional reform in the energy sector"
"Monitor electricity market operations, ensure orderly and fair competition in the market, regulate transmission, distribution and non-competitive generation businesses"	**NEA:** "approving, reviewing, or examining fixed asset investment projects of the energy sector"
"Participate in stipulation and enforcement of safety and technical standards, quantitative and qualitative codes for electricity industry, issue and maintain business licenses, enforce environmental laws, regulations and standards for the sector in coordination with relevant environmental protection agencies"	**Ministry of Environmental Protection:** "take charge of environmental supervision and administrative inspection; and organize nationwide inspections on environmental law enforcement"
"Propose tariffs and adjustments to government pricing authority on the basis of market conditions, review tariff levels, and regulate fees and charges for ancillary services"	**NEA:** "making recommendations on energy price adjustment" **NDRC's The Department of Price:** "recommending objectives, policies and reform plans for price adjustment; formulating price and fee-charging policies and regulations; putting forward the scope, principles and measures of price management; […] setting and adjusting prices and fees administered by the central government;" **Ministry of Finance:** "research proposed tariff […] participate in the tariff negotiations, and put forward proposals to impose special tariffs"
"Investigate any possible violations of laws and regulations by market participants, and resolve disputes"	
"Supervise the implementation of universal service provisions policy; propose revisions to such policy, provide statistics and information of electricity market"	**National Bureau of Statistics:** Department of Industrial an Transport Statistics: "Responsible for organizational work in the implementation of surveys for industrial and energy statistics"
"Organize the implementation of sector reform programs"	**NEA:** responsible for "promoting institutional reform in the energy sector"

Source: Compiled from NBS, 2001; NEA, 2010; MOF, 2010; MEP, 2003

SERC's most clearly defined duties involve regulating and monitoring participants in the electricity sector but responsibilities in other areas, especially in energy policy formation, coincide with other ministries and departments. The unclear duties between government bodies prevent SERC from fully carrying out its regulatory responsibilities, as it does not have full jurisdiction over enforcing penalties for grid connection. Sebastian Meyer, Director of Azure International an energy consultancy firm in Beijing indicated in an interview that if there is a lucrative opportunity, there is likely to be greater regulation and enforcement. Government institutions will contend for influence and the entitlement to create revenues through setting fees and fines (S. Meyer, personal communication, May 19, 2009). Thus other government departments are unlikely to give up their jurisdiction over pricing.

SERC's ability to regulate and enforce RE grid connection requires coordination with the National Energy Administration (NEA; discussed in 2.8.1), which could be complex, as the NEA has been struggling to establish its own authority in the energy sector since it was established in 2008. The number of government institutions presiding over grid connection and RE has been problematic for the wind power sector. In order to gain influence over the rapidly developing sector, government institutions must have the authority and resources to carry out its edicts. Zhiwin Qi, a researcher at the NEA stated in an interview that the NEA was essentially created to oversee the State Grid's activities such as approving new generating plants above 50 MW (while plants less than 50MW fall under the provincial jurisdiction). However, due to the limited personnel in the NEA, a number of generating plants have been developed without approval. In 2009, there were only around one hundred employees in the NEA working directly on energy issues. It is not logistically possible to handle all the new grid connection cases in addition to addressing energy development issues; as a result, regulations have not been strongly implemented (Z. Qi, personal communications, April 2009). Also, according to media speculations, around half of the 100 positions in the NEA are filled by personnel at the deputy department level or higher. The NEA has requested for higher staff quotas but the State Commission Office for the Public Sector Reform (a government body that determines staffing quota, structure, and functions of government institutions) likely denied the request based on apprehensions that other government bodies would also call for additional staff and this would diminish the State Council's ability to "streamline the bureaucracy" (Downs, 2008, p. 44).

Weak energy institutions along with weak enforcement have allowed grid companies to exercise its monopolising power and to bypass the approval process to connect electricity generators or to prevent interconnection. Generally, grid companies must assess the risk of penalties and the advantages of connection or refusing to connect generating plants. For instance, the State Grid, which makes up the majority of the transmission and distribution activities, is solely owned by the government in order to ensure the security of power supply (P. Shi, personal

communication, June 10, 2009). Even if the gird does not adhere to the obligatory regulations, it would likely continue to operate as usual since the likelihood of enforcing financial penalties would be low. The NEA has been struggling to cope with the electricity plant approval process and would unlikely be able to cope with enforcing all penalties, even though collecting fines could generate revenues. As seen in the statistics of unconnected wind in Chapter 2 Table 2.4: Wind Power Grid Connected Capacity in MW (2008-2010)", the advantages of refusing grid connection appear to outweigh the risks of non-compliance since up to 31 percent of wind power remained unconnected in 2010.

The evidence of policy learning for conceptual policy learning is evident in the establishment of SERC, an independent government agency. These lessons were drawn primarily under *coercive transfer* conditions. In the late 1990s and early 2000s, international institutions such as the World Bank wished to push forward its energy deregulation agenda also exerted pressure on China to establish an independent regulatory agency. These pressures are not categorised as either positive or negative forces in this thesis but are merely described as external coercive forces that have shaped China's post-transfer learning process. Both learning experience from aboard and China's own domestic experience, driven by coercive forces, has helped to form its overarching RE policies and institutional establishments. Aside from the coercive forces in China's institutional policy learning, there were some elements of voluntary transfer as seen in RAP's systematic learning examples. Voluntary transfer will be further examined in the next sections with a focus on technical policy learning for first level RE policies.

6.2 Policy learning from abroad and policy transfer: renewable energy target setting at the first policy level

Policies can be drawn from countries or systems with dissimilar values and under *voluntary transfer* conditions where political actors willingly choose to apply policy lessons from abroad (see 3.4.1). In China, a number of transferred policies were applied from countries in different stages of development and with different political and economic systems. The case of RE policy transfer in China is unique in that after the country opened its doors to the world in the late 1970s, the Chinese government has drawn lessons from a wide range of countries and actors. This is because China is widely engaged in *hard transfer* focused mainly on *technical policy learning* in its wind power sector, which does not challenge China's basic political, economic or social objectives (see 3.1.3 for technical policy learning and 3.5 for hard transfer). Setting national energy strategies and targets does not usually conflict with China's existing political and economic structure since the government is not seeking to implement a new economic or social policy paradigm, as seen in the establishment of a new electricity market regulator.

Over the past half century, China has risen into an economically and politically influential

nation, establishing its own Chinese-style "socialist market economy" and a "multi-party cooperation" political system (see 2.7). Its leaders and policy makers are not necessarily searching for ideological lessons but look abroad for policy instruments through technical policy learning to tackle specific areas such as energy and environment issues. There has been a growing recognition that energy and environment issues should be integrated with development issues and concrete steps were first taken in the 8th FYP to set tangible energy and environment objectives (see 2.4).

Setting targets is an area Chinese policy makers have been familiar with, particularly with its experience implementing the FYPs. As with economic plans, China sets RE targets partly based on its FYP experience. Bennett (1991) states that one of the five motives for voluntary policy learning is to seek out best practices (see 3.4.1). Chinese policy actors have drawn on best practices from other countries that set RE targets through *systematic learning*, in studies or reports primarily based on explicit knowledge (see 3.6). One case of policy learning is evident in the report "Technology and Policy Studies Related to Renewable Energy Legislation in China" (CRESP, 2005). The study was conducted by the Renewable Energy Development Center of the Energy Research Institute in China and sponsored by the China Renewable Energy Scale-Up Program (CRESP). CRESP is a joint programme officially established in 2005 through collaborative efforts with the World Bank (WB), the Global Environment Fund and the Government of China. CRESP supports the implementation of RE development from a bottom up approach. In order to develop the RE industry, CRESP established six objectives: to investigate the present status of China's RE resources; learn lessons from RE development experiences in industrialised countries; study and draw up polices to develop and scale-up RE; provide cost-effective RE electricity at a commercial scale to the electricity market; and substitute coal and lower the negative environmental impacts at the national and global level (CRESP, n.d.).

The study was conducted by a specialist group established by CRESP and the Renewable Energy Development Center during the period when the REL was in the drafting process but the report was formally published after the formation of the REL. The study provided an overview of national and international RE technologies, policies and legislation and also analysed the issues in the development of RE in China. The findings were presented in five chapters including "Study on Wind Power Development" (Chapter 1) and "Study on the Incentive Policies and Experiences of Foreign Legislation on Renewable Energy" (Chapter 5). One of the major findings discussed in Chapter 5 of the report was the European experience of setting RE targets and enforcing compliance. The report gives an indication that policy learning occurred through *systematic learning* examples that examined policy lessons from abroad.

The report was a part of the "Research on Renewable Energy Legislation and Recommendation to Renewable Energy of the People's Republic of China"[18] and was prepared by a delegation of international and Chinese experts from a range of government and non-government institutions. The specific actors involved with providing foreign policy knowledge and for bringing forward the concepts to the decisions makers were not easily identifiable but knowledge appeared to be obtained through *observation* or lessons observed from a distance between local and foreign institutions and individuals. Observation involves drawing policy lessons in a piecemeal manner from various countries and places in time (see 3.8). In this study, policy actors from a number of western countries were engaged in the policy learning process. The report's preface lists the government departments, organisations and individuals that provided support in compiling the document. These actors can be divided into the local and international level:

Local Actors
- National Development and Reform Commissions (NDRC)
- Environment and Resource Commission of National People's Congress (NPC)
- Ministry of Science and Technology
- Ministry of Water Resources
- Ministry of Construction and National Environment Protection Bureau

Foreign Actors
- World Bank: Richard Spencer
- United Nations Development Program (UNDP)/Global Environment Facility (GEF) Capacity Building for the Rapid Commercialization of Renewable Energy in China: Bill Williams
- Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Germany
- National Renewable Energy Laboratory (NREL), United States
- Department of Technology and Industry (DTI), UK
- Institute for the Diversification and Saving of Energy (IDEA), Spain

The extent to which each individual or institution contributed to the study or the nature of support, such as providing knowledge, technical expertise or financial support, was not documented. However, the collaboration of expertise brought together a group of specialists who contributed to writing the report. The report's 10 main authors are reputable specialists in the RE field and include:

- Center for Renewable Energy Development of Energy Research Institute, NDRC: Zhongying Wang and Zhengmin Zhang
- Energy Research Institute of the NDRC: Jingli Shi; Junfeng Li; Sicheng Wang
- Renewable energy experts: Zhentao Luo, (solar energy), Jialin Luan (hydro power) and Pengfei Shi (wind power)
- Academia: Yanfang Li from the Law School of Renmin University, and Xiliang Zhang from Tsinghua University

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[18] Compiled by the Renewable Energy Development Center of Energy Research Institute of the NDRC and funded by the NDRC/WB/GEF China Renewable Energy Scaling-Up Project (CRESP)

The above listed authors were responsible for elements of policy learning, as they have compiled best practice studies within each respective RE technology sector and presented the findings in a report for decision makers.

The study formally identified elements of technical policy learning including policy goals, content and instruments. For instance Chapter 5 of the report, "Study on Incentive Policies and Experiences of Foreign Legislation on Renewable Energy" provides details on international experiences including the EU's RE policy development. The report citied the White Paper on Renewable Energy Development published in 1997, which announced a new target to double the share of RE to 12 percent by 2010. There was also reference to the EU Commission's approval on March 2004 to set a 20 percent target for electricity to be generated from RES by 2020. At the end of the chapter, conclusions and recommendations were drawn from the EU experience and suggestions were provided for China's legislation on RE:

> "There should be a clear objective of the legislation [for China]. The objective of the legislation in European countries is to [generate more] [..] energy […] and to reduce the GHG emission. Associated with the commitment on reducing the GHG emission, European countries have concrete target[s]. Therefore, the renewable energy legislation in China should ha[ve] its own target and objective[s]" (p. 127-128).

The recommendation for setting policy targets in the study is a part of a collection of reports decision makers consulted prior to the drafting of policies. Although the study was published after the REL was enacted in 2004, an interim copy of the report was provided to the Chinese government in 2002-2003 as a reference and recommendation for drafting the Renewable Energy Law, according to an interview with Hu Gao Deputy Director of the CRESP (H. Gao, personal communication, June, 3, 2009). Additionally, the study was a part of the "Research on Renewable Energy Legislation and Recommendation to Renewable Energy of People's Republic of China", a key study that contributed to drafting the REL in China.

In another example of policy learning from abroad, direct *interaction* occurred through the cooperation between the Chinese and German government while drafting China's 2006 Renewable Energy Law. According to the Federal Ministry for Economic Cooperation and Development, Germany's economic and environmental ministries provided recommendations to address economic and environmental concerns, as well as recommendations to "improve the content and implementation of Chinese environmental legislation" (BMZ, 2010). In a more specific example, GTZ, (Deutsche Gesellschaft fur Technische Zusammenarbeit) a state owned German corporation that promotes international collaboration for sustainable development, contributed to China's policy learning by working to "assist […] the Chinese government in the development of the Renewable Energy Law and the subordinated directives" (GTZ, 2005, p. ii).

In 2003, the National People's Congress requested a draft of the "Renewable Energy Development and Utilization Promotion Law" (a draft of the Renewable Energy Law, REL). The NDRC was appointed as the administrative body to oversee the draft and commissioned the Center for Renewable Energy Development (CRED) of the Energy Research Institute to coordinate the technical details of the draft. GTZ collaborated with CRED in part with its Technical Expertise for Renewable Energy Application (TERNA) programme (GTZ, 2004; 2005). According to GTZ, "the Government of China has received support in spelling out the legal framework under the TERNA wind energy programme and within other projects, including in particular the arrangements for feed-in tariffs and the compensatory mechanism specified under the Renewable Energy Law" (GTZ, 2007, p. 17). Although details were not explicitly stated about the interactions that occurred between the Germans and Chinese, knowledge was likely transferred through *interactive learning,* as Germany policy actors would be required to directly interact and with Chinese policy actors in order to provide legal framework support. The GTZ and Chinese policy actors contributed to policy learning process, which along with an accumulation of other policy learning processes, led to the transfer of policies.

6.2.1 Post-transfer learning: the influence of first level renewable energy policies on the wind power sector

Systematic policy learning at the first level occurred where policy lessons were drawn in reports as well as through direct *interactions* between China and foreign actors, which occurred through workshops and conferences. The result of policy learning discussed above along with China's own experiences has contributed to the formation of China's Renewable Energy Law (REL) and its corresponding legislation in the Medium and Long-Term Development Plan (MLDP). This section discusses the impact of the policy lessons applied in the home environment.

As a first level policy, the REL has been the main RE framework law to which other regulations, standards, and measures have been based. Similar to other laws in China, the REL primarily serves as a "statement of intent" (Meier, 2006) and is "purposely vague in its stipulations, serving as an umbrella document providing an outline of general principles to be clarified in subsequently released 'implementing regulations' " (CWPC, 2012). More specifically, the REL is an enabling legislation approved by the State Council but the implementation power is granted to energy authorities of the State Council (i.e., the NDRC) and the respective provincial and local government entities. These bodies are responsible for the management and development of RE in China. For instance, the REL stipulated that energy authorities under the State Council would set medium and long-term RE targets and prepare RE development plans, which upon approval of the Council, would be implemented through the

medium and lower policy levels (Chapter 2, Article 7 &8). Government officials at the provincial and municipal level (including autonomous regions) are to cooperate with the relevant bodies at the local and state level to devise specific development and utilisation plans for their respective administration.

RE is still in an early phase of market development and has higher generation costs compared to conventional forms of electricity generation. In order to stimulate additional investments in the new capital-intensive industry, the government created the necessary market conditions to foster growth by setting long-term targets. Setting ambitious targets communicates the government's priorities to the market and creates an environment of stability, low risk and guarantees market demand over a fixed period of time. The predictability reassures investors and contributes to building a viable RE market (Li, Shi, Wang, & Wang, 2007).

The overall the RE target is a central policy instrument used to develop the industry. According to the REL, the State Council must set overall RE targets as a "preferential area for energy development and promote [...] the construction and development of the renewable energy market by establishing total volume for the development of renewable energy and taking corresponding measures" (Chapter 1, Article). The REL did not specify targets but was the first legislation that set a framework for establishing future targets and provided the greatest level of regulatory support for RE (Ma & He, 2008).

As previously stated, the REL also specified that the energy authorities of the State Council were required to establish mid to long-term targets indicating the total quota for the country. A few years after the formation of the REL, the NDRC drafted a MLDP for RE in China (2007), a quasi-regulatory framework policy typical of the Chinese-policy making process (see 2.6.1). Specific objectives were formally announced for RE to account for 10 percent of the primary energy consumption in 2010 and would increase to 15 percent by 2020. The goal would be achieved by fully employing existing mature economical technologies, including hydropower, biogas, solar thermal, and geothermal (3.2, paragraph 1) in addition to supporting the development of the other RE such as wind, biomass and solar PV. New goals have been tentatively set to increase China's RE targets to 30 percent in 2050 (Schwartz, 2008). These targets have been one of the main driving forces in promoting the development of RE from the electricity generation.

Unlike the obligatory targets set by the European Union, China's RE targets established in the MLDP are non-binding objectives. But similar to the FYP, targets are set by the State Council under the National People's Congress are directly influenced by the Communist Party of China. The targets established at the top level are authoritative- whether they appear as guidelines in the FYP or in the REL. Government officials are also pressured to meet the targets and are

assessed on a performance evaluation system where job security and promotions are measured through a set of criteria. Until the latter half of the 2000s, officials were evaluated mainly on economic criteria and this motivated them to push for economic growth, attract investments, and encourage construction programs at the expense of the environment and sustainable development (Wang & Yan, 2011). However, the emphasis on meeting purely economic targets has been changing. Since 2007, the State Council approved the "Guo Fa [2007] 36: Energy Saving Monitoring and Assessing the Implementation of Statistical Programs and Methods of Notification". New methods of evaluation consists of accurate data collection to effectively measure and monitor development as well as applying detailed evaluation criteria to include energy and environmental issues with an emphasis on reducing energy intensity and increasing energy efficiency. Officials at all levels would be rewarded or penalised according to the energy, environment and economic evaluation criteria. In principal, officials would gain from drawing in RE investments, such as promoting wind farm development.

The direct and indirect pressure placed on government officials to meet the targets in the REL and Development Plan has contributed to the rapid growth in the wind power industry. The strong government support at the top policy level has not only succeeded in reaching targets but has exceeded the targets before the deadlines. Since 1990, wind power targets have been continuously revised, as seen in Table 6.2.

Table 6.2 Revisions of Chinese Wind Power Targets

Target compliance year	Year the target was set					
	1996	2004	2005 - 2007	2008	2009	2009 announced revisions
2010	3.17 GW	5 GW	5 GW	10 GW	10 GW	-
2020	8.5 GW	20 GW	30 GW	30 GW	100GW	150GW

Source: SDPC and SSTC, 1996; The Programme on New and Renewable Energy Development in China, 1996-2010; Unpublished report; NDRC, Medium and Long-term Development Plan for Renewable Energy, September 2007; Wind Power Monthly Special Report, November 2008; Xinhua News 2009; Mo, 2009

The revision of the wind power targets reflects the momentum of the market influenced by a number of factors. From the beginning of the mid 1990's, the wind power sector was propelled by investments funded by international assistance and cooperation with foreign wind turbines. Later on, wind concession bidding projects began in 2003 and new policies at the second policy level from abroad were implemented from the mid to late 2000. Additionally the REL and its supplementary legislation continued to accelerate growth in the wind power sector (Gan, 1998; Li, Shi, Xie, Song, & Shi, 2006) (second level policies will be examined in Chapter 8).

Returning to Figure 2.6 Wind power capacity and renewable energy policies in section 2.5, a steady rise in the wind power installed capacity is observed from 2006-2009. In 2006, the

cumulative installed capacity increased from 2.56 GW to 5.9 GW, surpassing the 5 GW 2007 target. By 2008, the 10 GW target for 2010 was exceeded by over 2 GW. The large growth observed in this period was a result of the first level policy direction as observed in the 11th FYP, the dedicated REL framework to expand RE and the MLDP that set more specific RE targets. The numbers alone appear to be impressive but further analysis is needed to understand if the installed capacity provides an accurate picture of China's wind power development.

Overall, the REL and the MLDP have contributed to developing the RE sector. These first level policies have been influenced by policy lessons from abroad but also contain elements specific to the Chinese context. One example is seen in setting wind power capacity targets and measuring the progress using installed capacity (MW), rather than the electricity produced (kWh). The next section will examine the elements in setting and measuring targets specifically in the wind power sector in China.

6.2.2 The impact of post transfer learning on wind power targets

Since the 1950s, the Five-Year Plans have set the precedence for establishing quotas based on targets. The FYP plans have developed a consistent and conventional approach focused on setting and meeting measureable and absolute figures. But unlike the European Union, where top level RE targets are measured using electricity generation and installed capacity statistics, the wind power sector in China primarily uses installed capacity as the main indicator for setting and measuring RE targets.

Beginning with measuring targets, there is a lack of consistent reporting data for wind electricity generation in China and this reveals the absence of a generation-based target. In the overall electricity generation sector, data for both capacity (MW) and electricity generated (kWh) has been collected by the government but electricity generation data for wind power has not been reported by the national statistic authorities prior to 2006. Electricity wind power generation data was first published in the 2008 China Electricity Yearbook. These statistics provided in the 2008 Electricity Yearbook may be questionable. Based on an interview with Pengfei Shi, a well known wind power specialist and Vice President for the China Wind Energy Association, wind power electricity generation statistics presented in the Electricity Yearbooks should be used cautiously and treated as estimates since the detailed data collection methods have not been reported publically (P. Shi, personal communication, June 10, 2009).

Independent experts such as Pengfei Shi, who has monitored the industry for decades, have also collected wind power statistics [19]. He stated that although wind power electricity generation

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[19] Pengfei Shi officially retired for a decade but continues to remain an actively involved in the wind power sector

(MWh) was collected at the firm level, the data was not published since it was viewed as confidential information belonging to the company. Shi built a personal rapport with wind farm generators and collected wind power statistics on a yearly basis; but the main indicator collected was wind power capacity. Companies were hesitant to disclose their electricity generation statistics, as providing the electricity generation statistics would reveal the wind farm's level of efficiency and firms perceived this as a threat to their competitiveness.

Yanjia Wang and William Chandler critiqued China's energy and emissions data collection in their policy outlook paper "Understanding Energy Intensity Data in China" (2011). The authors stated that the government collection authorities in China could improve their methodology and capabilities in their data collection and reporting systems. For instance when measuring electricity, natural gas and heat use, the authorities could collect the metered data and invoices from utilities rather than using data collected from company surveys. Additionally, the government does not conduct spot checks to verify that the overall data has been properly calculated. Greater efforts are also required to train government employees, and improvements are needed in the overall data collection, sampling and verification (Wang & Chandler, 2011).

Apart from individual experts and the national statistics office, large companies also collect wind power statistics. Runqing Hu, an Associate Research Fellow Center for Renewable Energy Development, in the Energy Research Institute of the NDRC, stated in an interview that the information collected for wind power statistics was managed by large companies that have dedicated wind teams for data collection. The information collected is released on an annual basis and is very detailed and includes specifications such as the number of wind farms and wind turbines (R. Hu, personal communications, May 15, 2009). However, it is possible that the information collected may not be fully available to the public. During the period in which secondary research was conducted for this thesis, comprehensive wind power electricity generation data was not attainable as it was not available using publically available sources. It was, however, not difficult to locate sources that provided wind power capacity data dating back to 1993. When the issue of wind power electricity generation data was discussed during interviews, most interviewees stated that the information was available and could be found in the Electricity Statistics Yearbooks (statistics was only available for 2006 an 2007). Only, Pengfei Shi questioned the reliability of the statistics collected and another foreign government interviewee that verified there was a gap in wind power electricity generation statistic (Interviewee with the EU-China Energy & Environment Programme, personal communication, April 28, 2009).

The company practice of keeping electricity generation statistics within the firm is changing partly with the development of CDM projects, which requires clearer and more transparent

reporting of electricity generation. Additionally, more precise wind data has been collected from 2008 onwards as the government requires all wind power generators to submit electricity generation data in order to accurately compensate the price difference between wind and conventional power (P. Shi, personal communication, June 10, 2009). This requirement was indicated in the second level policy the "Provisional Administrative Measures on Pricing and Cost Sharing for Renewable Energy Power Generation" (NDRC Price No. 7, 2006) (examined in greater detail in 7.2). The price difference has been passed onto the consumers at 0.001 RMB/kWh (end-user pricing policies are discussed in Chapter 7).

Table 6.3 provides details of statistics collected for China's wind electricity generation output from 2006-2010. The total electricity output and wind electricity generation data was collected by the statistics office and the installed capacity data was collected by the Chinese Wind Energy Association.

Table 6.3 China's Wind Electricity Generation and Total Electricity Output

Year	Wind Installed Capacity (MW)	Total Electricity Output (MWh)	Wind Electricity Generation (MWh)	Wind as % Total Electricity Output
2006	2,599	2,865,730,000	2,84,0000	0.10
2007	5,900	3,281,550,000	5,700,000	0.17
2008	12,200	3,451,013,000	13,079,000	0.38
2009	25805.3	3,681,186,000	27,615,000	0.75
2010	44733	4,207,160,000	44,620,000	1.06

Source: CWEA, Chinese Wind Energy Association, 2010; 2011; China Electricity Yearbook, 2008; 2010; 2011

The entrenched approach of setting FYP targets based on input could be a probable explanation for the focus on installed capacity (MW). According to an interviewee who worked with the EU-China Energy & Environment Programme, the targets set for RE are a reflection of the traditional approach observed in China's FYPs based on set quotas and absolute figures which were input oriented rather than output based. In the wind power sector, installed capacity is an input-based indicator that measures the theoretical size of the wind farm. The installed capacity of a wind farm is an absolute value that remains constant regardless if the wind farm is operating or is connected to the grid. Using an output-based indicator such as electricity generation would require measuring the electricity production after the wind farm is constructed and the value would vary depending on wind resource and wind turbine efficiency. Additionally, the wind farm must be grid connected in order to deliver the electricity generated to end-users. These added complexities compared to measuring installed capacity could impact how officials may be promoted. Since promotion is largely based on numeric figures, it is more

advantageous for officials to be evaluated by wind installed capacity targets, which shows impressive growth as opposed to electricity generation, which reveals inefficiencies and grid connection issues (grid connection issues are discussed in Chapter 7) (Interviewee with the EU-China Energy & Environment Programme, personal communication, April 28, 2009).

Verifying the electricity output for all wind farms is also much more labour intensive than tallying up the size of all registered wind farms to measure installed capacity. From an implementation perspective, monitoring and data collection is a significant challenge in China since there are a limited number of personnel working within the National Energy Administration (NEA) and the overall energy sector compared to the country's energy market size. This is due to the relatively new creation of the NEA in 2008 and the government's efforts in the past years to maintain a lean administration. For instance, there may be a dozen civil servants working on one specific energy issue for the entire country, which happens to be the largest energy consumer in the world (IEA, 2010) and the second largest electricity producer (World Bank, 2011). This small group of civil servants may be required to make a decision or draft a legislation based on the information that is available in a limited timeframe. They likely would not have sufficient time to examine issues in details and may omit areas that are not deemed urgent (interviewee in the EU-China Energy & Environment Programme, personal communication April 28, 2009).

There is an ingrained approach to setting targets based on installed capacity and this influences the reporting of statistics. There are efforts to measure progress in the wind power sector through electricity generated, but targets are still input oriented and do not consider efficiency. Setting targets either based on installed capacity or electricity generation alone is not sufficient to develop a RE energy sector and must be supplemented with other regulations or economic incentives. The remainder of this chapter examines the importance of establishing grid connection regulations to support RE and wind power development.

6.3 First policy level: policy learning from abroad and policy transfer for grid connection obligations in the REL

Since the Chinese government began establishing grid connection laws over the past two decades, there has been a disconnect in policy formation and policy implementation of grid connection regulations. National grid policies were set early on to support wind power development but as wind power generation began to rapidly outpace grid infrastructure development, interconnection became increasingly challenging due to a lack of strong policy support at the first and second level, inadequate grid incentives, and ineffective policy implementation.

In 2006, grid obligation was restated at the first policy level in the overarching REL and was

drafted with the consultation of local and foreign policy actors. There are a number of foreign policy actors that participated in policy learning but this section will focus on providing evidence of policy learning from two key countries: the United States and Germany. The policy lessons were drawn on a *voluntary* basis to gain a better understanding of grid connection regulatory measures, a type of *technical policy instrument* applied in other countries. Rose notes that if home policies are not sufficient, voluntary policy transfer may be a means of providing suitable solutions (see 3.1.4).

Policy Learning from the United States

The policy learning evidence for grid connection in the U.S. is based on direct *interaction* via face-to-face meetings as well as *systematic studies* of policies conducted by the Regulatory Assistant Project (RAP) and the Center for Resource Solutions (CRS), two influential foreign policy actors involved in drawing lesson from the American RE policy experience.

RAP, a non-profit organisation comprised of global policy specialists, provided advice on the design and implementation of the REL (RAP, 2010). An example of its early influence in China is documented in the *systematic learning* example: "The Role of Electric Power Sector Reform in China's Sustainable Development" published in October 2000 by David Moskovitz, RAP's co-founder. The report provided leading examples of RE regulatory policies including a "mandatory purchase requirement at avoided cost (e.g., PURPA in the U.S. and feed laws in Germany and elsewhere)"; and the "creation of a renewable energy fund to support new renewable energy production {…}" (Moskovitz, 2000). The example only briefly highlighted the grid connection policy without a detail explanation. But the technical policy learning on grid regulations also occurred through *interactions*, as the study was presented in the Beijing conference: "Energy Strategy and Technology for Sustainable Development; Session 4 of the International Conference on Engineering and Technological Science in 2000". This form of *technical policy lesson learning* appeared in the REL which reemphasised grid obligations to prioritise RE interconnection and established a fund for RE (the RE fund will be examined further in the post transfer learning in 6.3.1).

The CRS has also contributed to *technical policy learning* for grid connection regulations in its 2001 report "Renewable Energy Development in China: The Potential and the Challenges". The report provided a *systematic learning* example of China's RE policies and stated that "there [were] some legal provisions for the purchase of wind in China, but the policy [was] not enforced and utilities may still refuse to buy electricity from IPPs at a reasonable price" (Zhang, et al., 2001, p. 57). The lack of enforcement and monitoring created issues for World Bank funded wind power projects in Inner Mongolia, as discussed in Chapter 2, section 2.2.4. There were cases where the grid only purchased a small percentage of the electricity under the

Independent Power Industry (IPP) price stipulated for wind power while the remaining output were purchased under the average electricity price. The uptake of electricity by the grid was also uncertain since power purchase agreements were drawn individually which increased transaction costs (Zhang, et al., 2001).

CRSP's report "Renewable Energy Development in China" also cited the U.S. 1978 Public Utilities Regulatory Policy Act (PURPA) as a *systematic policy learning* example that required the grid to purchase electricity from IPPs. The report stated that PURPA:

> "was the single most important law in the renewable energy industry because it created a framework for enforceable power purchase agreements between utilities and IPPs. Creating the IPP industry was crucial for renewable energy because utilities do not have the expertise or interest in renewable projects. It is critical for China also to develop an IPP industry" (Zhang et al, 2001).

The legislation in the U.S. promoted RE as part of its IPP industry and PURPA established a mandatory responsibility on the grid for RE interconnection, which China drew on as an example of successful policy for developing the RE sector in the U.S. (Zhang et al, 2001) (see 5.2.2 for details on PURPA).

Learning from Germany

Components of Germany's EEG were adopted into the REL including guaranteed grid connection for RE electricity generators, supplemented by feed-in tariffs (BMU, 2005). The lesson drawing from the Germany's examples occurred through *interactive learning* between the Chinese and German government as well as through *systematic learning* initiated by the China Renewable Energy Scale-up Program (CRESP).

Interactions through collaborative projects facilitated policy learning between German and Chinese policy actors for drafting the REL. According to the Federal Ministry for Economic Cooperation and Development, German economic and environmental ministries provided recommendations to address economic and environmental concerns, and also helped to "improve the content and implementation of Chinese environmental legislation" (BMZ, 2010). In a more specific example of *interactive policy learning*, GTZ contributed to China's policy learning by working with the Chinese government in drawing up key RE policy drafts. In 2003, the National People's Congress requested a draft of the "Renewable Energy Development and Utilization Promotion Law" and appointed the NDRC as the administrative body overseeing the draft. The NDRC commissioned the Center for Renewable Energy Development (CRED), a part of the Energy Research Institute in China to coordinate the technical details of the draft. GTZ collaborated with CRED in part with its Technical Expertise for Renewable Energy Application (TERNA) programme and provided policy learning examples by analysing international

experience and promotion mechanisms (GTZ, 2004; 2005). This collaboration between GTZ and CRED also produced *systematic learning* examples of studies for technical grid polices at the second level, later discussed in Chapter 7, section 7.2.

Another case of drawing policy lessons through *systematic learning* is documented in the report "Technology and Policy Studies Related to the Renewable Energy Legislation in China" (see 6.3 above). The report was commissioned by CRESP and served as a government policy recommendation document for decision makers in China. The report attributed the success of the German RE industry to the German feed-in law (Stromeinspeisungsgesetz, StrEG) which focused on "forced grid connection, […] the obligation to connect […] renewable energy power to the gird and priority on purchase" (CRESP, 2005, p. 116).

Overall, voluntary lesson in the area of grid connection policies occurred through systematic learning and interactive policy learning from the U.S. and Germany. These policy lessons have played a role in forming China's REL. The next part will examine the impact of the REL on grid connection in the post transfer learning process.

6.3.1 The impact of post transferred learning at the first level for grid connection in the amended REL

Voluntary policy learning from foreign experiences resulted in the transfer of grid policies and continued post transfer learning from domestic experiences led to revisions within China's RE policies. Mandatory grid connection and purchase policies are among the key grid policy lessons that China has drawn from abroad. These lessons have been integrated into first level RE policies but implementation has been inadequate. Grid companies have refused to connect wind power generators often citing technical difficulties (D. Seligsohn, personal communication, April 27, 2009) or safety issues (G. Wu, personal communication, May 18, 2009). The technical issues of grid connection will be examined later at the second policy level in section 7.2. In addition to the non-compliance for grid connection, the NEA and SERC do not have sufficient resources or authority to enforce grid connection laws.

The grid connection requirements stated at the first policy level were not sufficiently addressed in the REL. The National People's Congress recognised that the REL was drafted within a short time span and implementation problems originating from the law have been exposed over time– not only for grid issues but also for general RE policy deployment. In 2008 and 2009, over 100 expert representatives to the National People's Congress (NPC) on RE and grid connection issues provided recommendations based on domestic learning and international experience to address the short falls in the original REL. The specific details about the policy lessons drawn, however, were not provided. But the type of learning at the very least involved *systematic learning*, a broad means of gaining explicit knowledge to investigate policy lessons from

abroad. Conclusions from the domestic and international learning lead to recommendations that included: resolving network planning and infrastructure issues to support RE electricity generation; and revising the inadequate RE electricity generation tariff and cost sharing mechanism to effectively implement RE policies (National People's Congress, 2009).

Dongming Ren, the Deputy Director of the Energy Research Institute in China stated during an interview that grid companies have been reluctant to invest in infrastructure for RE interconnection due to high upfront costs and financial restraints caused by delayed reimbursements for grid investments. Grid investments were usually recovered through customer surcharges, but there have been uncertainties in recovering the full grid investment costs, a serious deterrence to connecting wind and other RE generators to the grid (D. Ren, personal communication, June 5, 2009) (Chapter 7 provides a more detailed discussion on end-user surcharges). Additionally, grid companies were obliged to construct transmission lines and provide the necessary transformer for wind power grid connection (CREIA, WWF, 2008).

In order to address the recommendations put forward by the expert representatives, the government initiated an evaluation of the REL from 2006 to 2009 and requested an assessment report to review the impact of the policy implementation on RE industries and to summarise enforcements issues and the key issues of the REL. The report proposed amendments to address the issues uncovered during the evaluation. As a follow-up to the report, a number of forums, seminars, and meetings occurred with the relevant energy governing and monitoring institutions including the NDRC, NEA, Ministry of Finance, Ministry of Science and Technology, Housing and Urban-Rural Construction, SERC as well as the State Grid. The meetings in the follow up session were an example of post transfer learning that occurred through direct *interaction* between the expert representatives to the NPC on RE energy and the relevant government institutions. These participants provided their suggestions and came to a consensus for an amended draft of the REL, which was submitted to National People's Congress Standing Committee (NPC, 2009). In December 2009 the proposed draft to amend the REL was adopted and later enforced in April 2010 (Su & Tsen, 2010). Some of the areas covered included reemphasising grid obligation, responsibilities and enforcement measure, and revising provisions for grid infrastructure investment recovery (issues relating to investment recover, a second level policy issue will be examined in the next chapter, section 7.2.1).

The amendments also contained more specific clauses relating to grid responsibilities in the overall RE development, which would bear extra costs on the grid but could be subsidised under the Renewable Energy Development Fund (REDF) (examined in more detail in 7.2.1). These responsibilities specified that:

"Power grid enterprises should strengthen the planning and construction, expansion

of renewable energy power configuration scope, development and application of advanced technologies such as smart grid, improve power system operation management, improve the absorption capacity of renewable energy power for renewable energy to provide internet services." (Translation of Article 14 of the REL NPC, 2009).

The National People's Congress has also recognised that "the solution for the determination of the tariff of RE lies in the proper implementation of the relevant legislation, not in the amendments to the relevant provisions of the legislation" (NPC, 2009). As with previous grid connection policies, the new amendments did not set new measures but reiterated existing ones. For instance the revisions highlight the five focus areas for RE development first stated in the "Tentative Management Method of Special funds for Renewable Energy Development" (Chapter 1, Article 3). The new revisions restate these focus areas:

1. "Scientific and technological research, standard establishment and pilot project for the development and utilization of renewable energy;

2. Construction of renewable energy projects in rural and pasturing areas;

3. Construction of independent renewable power systems in remote areas and islands;

4. Surveys, assessments of renewable energy resources, and the construction of relevant information systems;

5. Localized production of the equipment for the development and utilization of renewable energy"

(Renewable Energy Law Amendment, Chapter 6, Article 24, qtd. in GTZ Sino-German Renewable Energy Programme, 2010).

Communication of grid connection policies to the industry and public has not always been clear and weak implementation has given an impression that interconnection laws were absent. During the announcement of the amended REL some media articles, including one released by Reuters, announced that 'new' grid connection laws were set, stating that "a new Chinese law requires power grid operators to buy all the electricity produced by renewable energy generator" (Hornby, 2009). Likewise, Xinhua, a local media source cited the information ambiguously, stating that "China's top legislature adopted Saturday an amendment to the renewable energy law to require electricity grid companies to buy all the power produced by renewable energy generators" (Xinhua, 2009). Mandatory grid connection regulations have existed since 1994 and SERC's supervision of the grid activities have existed since the 2006 REL, yet the local news article announced the information as a new component to the REL amendment. The unclear announcement and misinformation early on in the media may have been a result of pressure to provide timely information but it could also be a product of the vague grid regulations and poorly enforced interconnection laws. Industry participants and experts would have likely

known that grid connections laws were previously enacted, but if implementation rarely occurs, the regulation would appear to be non-existent.

Sebastian Meyer, Director of Research at the consulting firm, Azure International in an interview noted that when it comes to grid development goals and plans, there has been a lack of clear direction and this increases uncertainty for wind power investors. Since grid connection is a costly and timely investment, wind power generators would logically favour areas with access to grid connection (S. Meyer, personal communication, May 19, 2009).

Another factor contributing to the large percentage of unconnected wind power is the absence of incentives for the grid to accept RE. Incentive mechanisms are usually addressed in more specific second level policies, which have been overlooked in the formation and implementation of China's grid policies. Since 2002, power generation and grid transmission responsibilities were segregated (see 2.4.2) and the grid does not benefit from RE interconnection whereas the generation side receives a premium price for RE electricity generation. In the absence of incentives, the grid can avoid taking up RE despite the mandatory grid connection regulations. Pengfei Shi in an interview stated that polices regarding interconnection have created a "passive approach" on the transmission side; that is, the grid has not been actively seeking to connect wind power generators but has been passively reacting to the regulation (P. Shi, Interview, June 10, 2009). A key challenge is for the Chinese regulators to formulate a policy that would incentivise the grid to connect wind power and other forms of intermittent RE.

An example of how incentives could encourage grid connection in China is seen in situations where the grid has vested interest in RE grid connection. For instance, the local electricity distributor in the North Eastern region of China had a share in a wind power generation project, which is officially prohibited since transmission and generating activities were separated in the late 1990s (see 2.2.2). But in practice, the grid has invested in generating plantswhich could benefit for both parties as the vested interest guarantees grid connection since the grid directly benefits from generation activities (P. Shi, Interview, June 10, 2009).

6.4. Chapter 6 summary

In the area of institutional policy lessons, China has been drawing voluntary policy lessons from RAP, who has provided support to help China establish an electricity regulator. Eventually, the State Electric Regulatory Commission (SERC) was established in China with the assistance of RAP systematic reports and other institutions including the World Bank, who exerted coercive pressure on China to establish an electricity regulator. In China's post-policy learning process for institutional learning, SERC was not given a strong regulatory position in the electricity market as suggested by RAP and does not have full jurisdiction over the economic aspect of the

energy sector. As a result, SERC has not been able to effectively enforce grid regulations. This was not necessarily failed lesson learning but applying the policy learning lessons directly was not feasible in China's institutional context. Giving full regulatory power such as authority over pricing, currently overseen by the NDRC Pricing Department, would upset the existing balance of powers between the institutions involved in the energy sector. Similarly, the NEA created in 2008 to oversee the planning and coordinating aspect of the energy sector struggles with asserting its position as the governmental body. Policy lessons cannot always be applied in a straightforward manner in the domestic context due to the existing pre-existing institutional environment.

The REL and MLDP are both underlying frameworks for setting RE targets which is influenced by voluntary learning examples drawn from the European Union RE targets. China's RE targets are input-based, measured by installed capacity (MW) and only indicates the theoretical potential for electricity production rather than by electricity generated (kWh). Collecting wind power electricity generation data in China has not been straightforward due to the lack of transparency in reporting wind power electricity generation. Meeting wind power output based targets has generally been beneficial for Chinese officials whose performance is often based on achieving state targets. As with earlier FYPs where the emphasis was to rapidly industrialise and increase production, the wind power sector has focused on increasing capacity while overlooking other factors. That is, growth in the wind power sector would appear less impressive for government officials and statistics reporting purposes if output indicators were used to measure progress, as this would reveal that around one third of wind turbines have been idle due to unconnected wind farms.

China's grid connection policies at the first policy level have been based on voluntary policy learning from the U.S. and Germany. RAP in the U.S. provided grid connection policy lessons in systematic reports of the U.S. mandatory purchase requirement outlined in The Public Utility Regulatory Policy Act (PURPA). Likewise, Chinese experts have actively looked abroad for grid connection policies and have citied PURPA as an important policy that helped promote the RE sector. Examples of policy learning from Feed-in Law were also noted through interactive policy learning between Germany's GIZ and China's Center for Renewable Energy Development.

In the post-transfer learning analysis for grid connection policies at the first policy level, evidence of transferred policies were found within the REL, which has a clause for mandatory grid connection but has not been rigorously enforced. The Chinese policy makers recognised that REL was insufficient to address grid connection problems and conducted studies based on local and international experience and policy evaluations that led to amendments in the REL.

The amendments allowed grid companies to access the Renewable Energy Development Fund (REDF) for grid infrastructure development. The constant revisions indicate post transfer learning which includes fine-tuning legislations and guidelines to adapt to China's existing grid infrastructure, energy institutions and policy conditions, which are unique compared to its western counterparts.

After conducting a policy learning, transfer and post transfer learning analysis at the first policy level, the next step is to analyse detailed policy instruments at the second level. Chapter 7 will examine end-user tariff policies and technical grid issues at the second policy level while Chapter 8 will examine other second level policy instruments including Market Mandated Shares, competitive tendering and feed-in tariffs.

Chapter 7 - Second Level Policies (Part 1): End-user Tariffs and Grid Connection Codes

Policy learning has contributed to shaping some of China's key energy and renewable energy (RE) policies at the first policies level. These high level policies are responsible for coordinating economic development related to the energy sector and for establishing the basic policy and regulatory framework governing electricity market actors including grid transmission companies, wind power generators and electricity end-users. More detailed second level RE policies support the diffusion and adoption of high-level objectives though the development of specific instruments with elements of influences from abroad (see Chapter 3, section 3.9 for Hayek's knowledge base economy). This chapter will focus on technical grid connection codes and end-user pricing instruments that support the development of RE at the second policy level. Each policy is studied individually, first by drawing evidence of policy transfer from abroad then by discussing the impact of the policies on the wind power sector. The timeline shown in Figure 7.1 illustrates the main policies that will be examined in Chapter 7.

Figure 7.1 Second policy level instrument
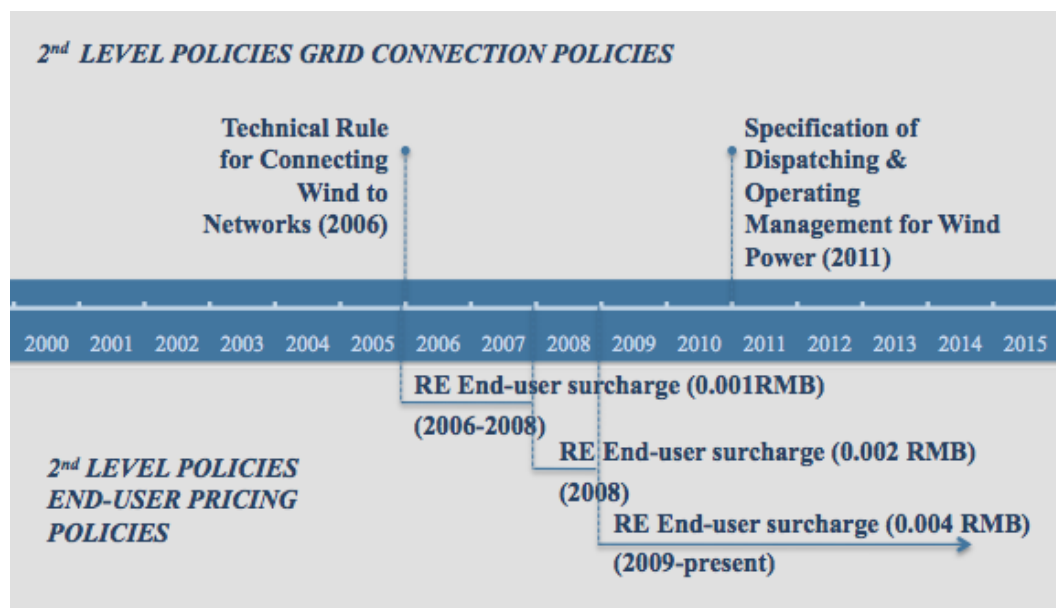
As discussed in Chapter 6, the main regulation placed on grid companies for RE development is the interconnection obligation, a basic criterion that theoretically guarantees the uptake of wind power. Mandatory connection is a policy directed at the grid companies but requires corresponding second level policy instruments including grid technical codes, a funding mechanism to support RE grid connection through end-user surcharges as well generation-side instruments including feed-in tariffs (FITs) and mandated market shares (MMS) to encourage the development of wind power generation.

This chapter examines how the role of policy learning has influenced the diffusion and adoption of policies at the second policy level for grid companies and electricity end-users. The first part of the chapter is an extension of the discussion in Chapter 6 on grid issues with a focus on technical grid codes to support interconnection obligations. The remainder of the chapter continues with a discussion of end-user tariffs as a supporting policy instrument that helps fund the additional cost of connecting RE to the grid.

7.1 Second policy level: policy learning from abroad and policy transfer for establishing technical standards and grid related specifications

When dealing with technical grid codes, learning can occur in the more commonly discussed form of technology transfer. While keeping in mind that technological transfer also occurs as a part of the overall learning process, this part of the research focuses on the *hard* transfer of specific grid code rules and specifications, a type of *technical policy learning* (see 3.1.3) that deals with grid connection issues without fundamentally changing the overall energy or RE objective. Technical grid codes will be discussed in the context of *voluntary policy learning* with lessons drawn from the United States and Germany in order "to emulate the actions of an exemplar; [and] to optimize the search for the best policy" (Bennett, 1991, p. 33) (see 3.4.1).

United States: CRS workshops and other policy learning examples

The Center for Resource Solutions (CRS) has been working with the China Sustainable Energy Program (CSEP) since the late 1990s on bringing international and Chinese experts together for *interactive learning* (see 3.8.1) through face to face meetings to work on RE policy and energy efficiency issues. One of the areas CRS covered was related to technical barriers that prevented the expansion of RE such as integrating large scale RE onto the grid. A team of consultants was formed to carry out workshops and training series in 2010 to address wind integration issues as a part of the *technical policy learning* based on experiences in China, the United States and in other parts of the world. The team comprised of experts from research and academic institutions- the Lawrence Berkeley National Laboratory, Georgetown University institution- as well as consulting firms Black and Veatch, Fichtner Consulting, and Exeter Associate. The team helped to identify, analyse and discuss future actions on grid connection issues in China and also trained Chinese energy officials and others on wind integration issues (Pennock, 2011).

One of the CRS workshops was conducted by Kevin Porter and Sari Fink from Exeter Associates, an American consulting firm in Maryland who presented their report in Beijing on "Wind Energy Curtailment: Case Studies" (Fink, Mudd, Porter, & Morgenstern, 2009) during the Energy Foundation Meeting on Wind Integration in June 2010. Porter and Fink provided

case studies from countries including Germany, which experienced wind energy curtailment[20] of around 74,000 MWh between 2004-2006. The report examined the issues that lead to wind curtailment such as lagging transmission development as well as the intermittent nature of wind power, which caused grid load problems and impacted grid stability. Using the experience from a number of countries, Porter and Fink presented some recommendations from the report. They suggested that grid companies in China should take all actions to prevent wind curtailment by making efforts to ensure that: all non-wind electricity generators operate at a minimum; imports should be reduced or avoided; and all exports opportunities should be utilised. If wind curtailment is necessary, wind should be dealt with along the same grounds as other generation types and should not be curtailed because of the relative ease to curtail wind to address grid stability issues. There should also be a discussion on whether or not wind generators should be compensated if curtailment is required or at the very least explore options to reduce economic loss. Other actions should be taken to minimise curtailment such as including "measures to reduce curtailment include large balancing areas, dynamic scheduling and dynamic ratings of transmission lines" (Fink, Mudd, Porter, & Morgenstern, 2009, p. 13). The issue of balancing areas and grid codes to improve grid reliability is examined in the next part.

In December 2010, the final CRS initiated workshop organised by the China Electric Power Research Institute (CEPRI) and the U.S. National Renewable Energy Laboratory and co-financed by the U.S. Department of Energy and the Energy Foundation was held in Beijing. The workshop is an example of an *interactive policy learning* case, with around 200 participants from the main government departments in China, academia, non-profit organisations, industry, and electric firms. During this final workshop, four key areas were discussed on grid codes, wind forecasting, balancing area and generator flexibility. One of the main problems identified were grid codes, a type of *technical policy instrument,* supporting grid reliability. In China, generators must adhere to set standards in order to connect onto the grid but wind generators can "drop off" entirely when there are grid disturbances. This abrupt decrease in supply poses greater threats to grid reliability as wind power installed capacity increases. If the grid codes were revised in China to allow wind power generators to continue operation during grid disturbances, grid reliability would improve and wind power could be safely integrated onto the grid (7.1.1 will discus the development of grid code standards in post transfer learning). The workshops also highlighted that China's wind forecasting compared to the U.S. was less precise but improvements to wind forecasting could help planning for wind power grid integration.

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[20] Wind curtailment occurs when "some or all of the turbines within a wind farm may need to be shut down to mitigate issues associated with turbine loading, export to the grid, or certain planning conditions" (The Intelligent Energy - Europe programme, 2009).

A valuable aspect of these *interactive policy learning* workshops was the comparison of policy differences and infrastructural differences between countries. A challenging area grid companies currently face in a number of countries is to balance a large influx of RE generation with the base load generation. In theory, large area such as the U.S. and China should be able to integrate RE more easily with the base load generation. However in the U.S., load balancing occurs across states while in China individual provinces oversee the balancing. But the load balancing is expected to improve as China continues to expand its transmission lines and increase its balancing size. There is also a difference in the grid and generator flexibility and this determines the speed in which grid-connected generators can begin or stop electricity generation according to wind power fluctuations. In the U.S., the grid is flexible due to its high share of natural gas fired generators that can start up and stop relatively quickly to account for variations in the power supply.

China, on the other hand, is highly dependent on coal power plants that have slower responses to changes in power supplies. There are also economic implications for reducing the electricity supply from coal as there is currently no compensation for coal generation plants that reduce their electricity output. For instance, coal generators in the northern regions usually supply electricity and heat to buildings. Reducing or stopping the electricity supply from coal plants when wind power plants produce electricity reduces the revenues of coal generators. This has larger financial implications for less well off regions that depend on coal fire generation plant as an important source of revenue generation for the area (Pennock, 2011).

The evaluations and recommendations provided during the CRS workshops would require time and resources to draft corresponding second-level policies. The rapid expansion of the wind power generation has left little time for in-depth wind integration studies. Previously, the grid infrastructure planning and development approach was reactive, responding to large-scale wind farm development. This, however, is changing as there is a stronger emphasis on studying and addressing wind integration issues not only from the U.S. by also from other countries such as Germany with advanced technical knowledge and experience in wind integration issues.

Germany

China has been drawing experience for establishing *rules and regulations, a technical policy instrument*, from Germany to address the technological challenges for wind integration. Policy lessons from Germany was drawn through *interactive policy learning* in collaborative programmes between China and Germany that involve drafting policy and providing technological solutions. The German government has played a role in supporting technical learning for wind power grid connection through a joint Sino-German Co-operation "China Wind Power Research and Training Project" (CWPP). The programme, runs from 2005-2015,

and is sponsored by the Federal Ministry for Economic Cooperation and Development (BMZ) and is carried out by GIZ who works alongside with implementing partners in China including the China Longyuan Power Group Corporation, a subsidiary of China Guodian Corporation and the China Electric Power Research Institute, a subsidiary of State Grid Corporation. The CWPP focused on four areas of training and applied research, operation and maintenance, service information and advice as well as professional training for technicians and engineers in the wind power sector. Over the course of the project, ten training courses were conducted on wind resources assessment and wind power integration. Workshop participants consisted of representatives from planning and design institutes, utilities as well as wind power developers and manufactures. Additionally, two workshops covering large-scale wind farm integration technology were carried out by CEPRI. These seminars and workshops along with study tours have contributed to training wind power engineers, business leaders and other leading figures in the field (CWPC, 2009; GIZ, 2010). The results of the technical and policy learning from the CWPP will be discussed in section 7.1.1 on post transfer policy learning for grid technical standards (CWPC, 2009).

Another instance of face-to face *interactive policy learning* occurred during the "Workshop on grid integration of renewable energies" organised by the State Grid's China Electric Power Research Institute (CEPRI) and GIZ in June 2010. The workshop covered a number of topics including: plans for wind power grid integrated in Germany, Europe and China; the development of grid codes in Germany and China; Germany's regulatory incentives for grid integration; and technical issues for wind power grid integration (CWPC, 2010). The topics discussed in the workshop covered the lack of regulatory incentives, one of the major problems for China's grid integration.

As a part of the "Workshop on grid integration of renewable energies", Claus Neumann, Director of the Operational Asset Management Department at the German Transmission System Operator in Amprion, Dortmund, gave a presentation on the "Regulation of Grid Integration in Germany" based on Germany's basic wind power grid integration regulations. Germany's regulation for grid connection was established through a legal basis founded on the German Renewable Energy Source Act 2004 and its amendment in 2009 (see 5.2.4); the regulatory framework including the newly enforced Equalisation Scheme ordinance enforced in July 2009 and the Equalisation Scheme Execution Ordinance enforced in February 2010; as well as the 2007 Grid Transmission codes: Network and System Rules of the German Transmission System Operators in the legal, regulatory and grid codes. The legal, regulatory and grid codes form a foundation that governs wind power integration by providing incentives established in the Equalisation Scheme and sets requirements for RE generating facilities to prevent disconnection

(Neumann, 2010). This presentation was given to Chinese experts in the area of grid integration along with other presentations which include:

- "European Wind Integration Study Towards a Successful integration of Wind power into European Electricity Grids" presented by Clause Newman
- "Grid Code Requirements and Test Equipment" presented by FGH, a German non-profit research association for electricity supply and the electrical industry; and
- "Large Scale Wind Power Integrated" presented by Professor Siegfried Heier from University of Kassel, Germany.

The results and impact of the "Workshop on grid integration of renewable energies" were not widely documented but the workshop was part of a wider Wind Environment Research & Training Centre (WERT) project running from 2008-2010 and commissioned by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and implemented by the State Grid Corporation of China. The project focused on building up China's technical and institutional framework via training and technical capacity building (GIZ, 2011). The impact of the WERT centre is discussed in the next part on post transfer learning.

7.1.1 Second policy level: post transfer policy learning for grid technical standards

This section will cover the post transfer learning for establishing technical grid codes, a type of *hard transfer* based on lessons drawn from abroad and China's own experiences. Grid codes will be discussed from the perspective of institutional building based policy learning from abroad related to training and education in the area of grid code policy formation. The education institutions are not covered under the main policy categorisation presented in section 3.5.1 (Table 3.1: Generic policies and interventions) and 5.2 (specific environmental policies); but the institutions can be categorised as training and education instrument (briefly described in 3.5.1 as 'other' policy instruments), which have been initiated and supported by the private sector in China.

Institutional Building

The joint Sino-German learning that occurred through the "China Wind Power Research and Training Project" (CWPP) from 2005-2010 (discussed earlier in section 7.1) contributed to building China's learning institutions for grid integration in the four areas of training and applied research, operation and maintenance, service information and advice as well as professional training for technicians and engineers.

Within these four areas, the project provided training through an exchange with the European Academy of Wind Energy and REnKnow.net. The exchange programme facilitated applied research in the areas of grid connection such as grid code compliance tests for wind farms, wind

power forecast systems, resource analysis, and micrositing (selecting the wind turbine type and precise location on a wind farm). Other areas of assistance involved testing wind turbines in accordance to international standards and certification. The CWPP also helped improve wind farm operations by assessing technical problems in wind farms. Service information and advice was provided through wind power helpdesks and online consulting advice offered in Chinese and English and policy advisory service for government departments involved in wind power development. In the area of professional training for technicians and engineers, the project established two reputable research and training institutions. In 2006, the Renewable Energy Department at the China Electric Power Research Institutes (CEPRI) was formed and has developed into a "leading authority in the field of wind power grid integration" (CWPC, 2009). In the same year, one of the CWPP project partners, China Longyuan Power Group and the Suzhou Nuclear Power Research Institute established the Suzhou Longyuan Bailu Wind Power Vocational Training Centre. Since 2009, the centre has trained over 1600 wind power technicians and other workers and is a pioneering institution that likely sets precedence for other wind power training institution in China (CWPC, 2009).

The "China Wind Environment Research & Training Center" (WERT- discussed in the latter part of section 7.1) was another Sino-German interactive learning project that focused on technical training for wind integration from 2008-2011. As a result of the training conducted through WERT, the State Grid Corporation of China who was the lead implementing agency of the project, established the National Center for Testing and Research for Wind, Solar and Storage Technology in Zhangbei. The centre carries out research and training in addition to licensing and testing – specifically testing to adhere to regional grid regulations. The policy implications resulting from the WERT project will be examined in the following discussion (GIZ, 2011).

Policy Formation

Since February 2006, the "B/Z 19963-2005, Technical Rule for Connecting Wind to Networks" was enacted as a preliminary guideline for the technical requirements for connecting wind farms to the grid in China. This code is seen as a quasi-regulation that is not formally implemented as a regulation (discussed in 2.4). The grid connection codes placed a disproportional burden on wind power generators who were expected to comply with standards to support grid connection. Some wind power firms argue that the burden of responsibility should not only lie on the wind power generators alone and that there are too many requirements for wind power generators. Grid companies can still avoid grid connection, most often citing safety concerns as an issue for refusing interconnection, even though wind power generators must adhere to connection codes (G. Wu, personal communication, May 18th 2009). While progress may not be as quick as wind

power generators may require, the State Grid was purportedly working to speed up developing its technology standards in order to increase the uptake of electricity from wind power (Polaris Power Wind Power News, 2011).

The aim of establishing technical codes was to improve gird stability and not necessarily to place wind farm generators at a disadvantage. In 2009, the codes underwent a revision by the National Standardization Committee with the State Electricity Regulatory Commission (SERC) supervising the amendments in collaboration with the China Electric Power Research Institute, who was responsible for the grid code revision. The institute collaborated with Long Yuan Electric Power Group Corporation, China Southern Power Grid Technology Center, and China Power Engineering Consulting. Based on policy learning from abroad and China's own post transfer learning, there where four areas revised in the grid code including:

- "Requirement of active power control;
- Requirement of reactive power capacity and voltage control;
- Requirement on Low Voltage Ride Through capability;
- Grid Integration Compliance Testing of wind farm" (Chi, 2010).

The grid revisions have taken international grid code standards into account, as seen in the a *systematic policy learning* case documented in the China Greentech Initiative 2009, "Renewable Energy Sector- Wind power Fact Book". The report, complied with the help of energy and environment organisations, academia and industry, cites a well-known international grid connectivity standard established by The International Electrotechnical Commission (IEC) "Power Quality Requirements for Grid Connected Wind Turbines" (IEC 61400-21). The standard established procedures for reviewing compliance with power quality specifications and developed a testing protocol to compare different turbine types with grid requirements (China Greentech Initiative, 2009). The IEC 61400-21 has been applied to the Low Voltage Ride Through (LVRT)[21] testing in China, with the first pilot test conducted in October 2010. Several full-scale tests were subsequently performed within the State Grid coverage area. The tests were conducted according to Grid Connection Guidelines for wind generators formulated by the CEPRI with the assistance from the WERT project (discussed above in Institutional Building). The Grid Connection Guidelines are the first binding guidelines for wind generators covering the State Grid area, which accounts for around 80 percent of the total grid area. The tests were conducted on wind turbines using a mobile lab to ensure the wind power equipment adhered to grid standards (GIZ, 2011).

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[21] DEIF Wind Power technology defines LVRT as "capturing the ability of a wind turbine (or in reality a wind park) to stay connected to the grid throughout a short mains voltage drop (a brownout) or a mains failure (a blackout)." (DEIF Wind Power Technology, n.d.)

Including a LVRT feature in the wind turbine control system allows wind farms to remain connected to the grids during brownouts (occurs when there is a drop in voltage) thereby maintaining grid stability. Wind farms in China are able to completely drop offline during grid disturbances resulting in major blackouts in China, which often stems from brownouts. Maintaining grid stability requires wind farms to remain online and operational during brownouts to offset the voltage drop (DEIF Wind Power Technology, n.d.).

The policy lessons for grid codes and grid connection guidelines have lead to the implementation of wind power grid integration standards. In February 2011, the China Electricity Council announced the first wind industry standard for power grid integration on the "Specification of Dispatching and Operating Management for Wind Power". The standard covered wind power integration and dispatching and was approved by the National Energy Bureau in August 2011. The new standards do not replace the "B/Z 19963-2005, Technical Rule for Connecting Wind to Networks" but function as a part of the overall grid integration standard system (Polaris Power Wind Power News, 2001; Energy China Forum, 2011).

The examples of lesson drawing from the U.S. and Germany in wind integration issues are only some of the few cases of how policy learning from abroad may lead to policy transfer and practical application within China. The next section examines policy learning and transfer in establishing end-user electricity tariffs to fund grid development.

7.2 Policy learning from abroad and policy transfer in electricity consumer pricing

RE generation policy mechanisms have been essential in developing the wind power sector in China. Implementing grid and generation policies requires funds to compensate the higher RE electricity prices in order to attract investors. In China, grid companies initially pay the higher cost of RE electricity generation and the additional costs are then pass on to electricity end-users. The following section will examine charges levied on electricity end-users. End-user charges are not discussed as a stand alone policy instrument in itself but as a supporting instrument to fund the cost for grid infrastructure development related to connecting RE and to fund the higher price of RE electricity for feed-in tariffs in China (discussed in Chapter 8).

In the early 2000s, grid companies in China were required to accept electricity from RES and also required government approval to increase prices. The grid companies would first absorb the costs and this impacted their short-term cash flow. If they received approval to increase prices, the premium price would not necessarily cover the costs for the period between the time of the price adjustment application and the approval date. The financial burden was placed directly on the municipal or county grid transmission companies where RE generators are located (Zhang et al, 2001). From a financial perspective, the local grids were penalised for RE development in

the area and the higher costs would be especially problematic for less well-off municipalities.

The added financial burden on local grids and end-users was unsustainable for the long-term development of wind power and RE. China has *voluntarily drawn lessons* from other countries to examine how end-user tariffs can address cost-sharing issues. In an *systematic policy learning* example, the Energy Research Institute (ERI) of the National Development and Reform Commission and the U.S. based Center for Resource Solutions (CRS), studied cost sharing issues in its 2001 report "Renewable Energy Development in China: The Potential and the Challenges". The authors of the report analysed China's RE situation and conducted a study of policy examples from other countries and made policy recommendations to spread RE costs over the entire country to reduce the financial impact on local utilities.

Within this *systematic learning* example, policy lessons where drawn *voluntarily* from the United Kingdom and the United States. The UK's Non-Fossil Fuel Obligation (NFFO) (see 5.3.3 for a full discussion of the NFFO), was cited as a programme that subsidised the higher cost of RE electricity through a fossil fuel charge. Such charges would "help to internalize externalities and when the fee is spread widely, [it] can disperse incremental program costs to an exceedingly low level" (Zhang et al, 2001, p. 64). California's System Benefits Charge programme was also cited as a good practice case, which required end-users to pay an additional 0.3-0.45 USD/kWh for RE programs, accounting for around 3 percent of the end-users' electricity bill. The fee funded $540 million towards RE programs in addition to $872 million for energy efficiency programs. Unlike other charges that primarily subsidised the extra costs of RE, the Benefits Charge programme pooled together the surcharge revenues so the funds could be utilised for a variety of needs such as loans, grants for local manufacturers, consumer rebates, and R&D investments. At the time of the report, a comparable programme was applied at the provincial level in Qinghai, a north western province in China. The programme was not implemented nation-wide at that time due to the complexities relating to tax collection. The burden for RE costs in China was primarily borne by the local electricity suppliers and the costs indirectly passed onto users, as previously mentioned (Zhang et al, 2001).

Several years later, the NDRC commissioned a report "Technology and Policy Studies Related to Renewable Energy Legislation in China" (CRESP, 2005). The report was an example of *systematic learning* for *technical policy lessons* drawn *voluntarily* from other countries (this report was first discussed in 6.2). The California benefits programme and UK's NFFO were also cited as some of the policy learning lessons. Policy examples from other countries were examined including the American Energy Efficiency Competition Law of 1986, a public fund that supported RE projects. The fund was financed by a surcharge of 0.05 USD/kWh issued on

electricity end-users and drew in around 147 million USD per year.

Germany was also cited as an example of a country that first implemented a fixed and incremental system (feed-in tariff) that included end-users participating in the additional cost of RE. As a pioneer of the feed-in tariff system, Germany's Renewable Energy Act was studied in greater detail throughout the report. The German study included a nation-wide equalisation scheme that spread the cost of RE energy throughout transmission system operators (TSO) and "concrete implementations methods [were] prescribed" (CRESP, 2005, p. 116). The system was the most beneficial for RE generators as TSOs purchased the electricity and paid the generators directly. The report noted that the regulation's success was a result of the "sufficient design and implementation of the renewable energy policy and law" and the "self-discipline" of German firms (CRESP, 2005, p. 116). Chinese policy makers have drawn policy examples from a number of successful cases in various countries but when similar policies were implemented in China, results varied due to differing policy environments and institutions.

7.2.1 Post transfer learning for electricity consumer pricing on renewable energy

The concept of applying a general electricity tariff throughout China to fund energy generation is not an entirely foreign import and has been implemented based on its own experience for a selected end-user group. Electricity tariffs were applied to fund projects as seen in the "two-cent" and "three Gorges Fund" surcharges collected by the local government in the late 1980s and early 1990s (discussed in 2.2.1). China drafted RE end-user policies based on its domestic experience of applying the surcharges along with lessons from international experiences, as shown in Figure 7.1: Second policy level instrument, section 7.1.

The end-user surcharge for RE has undergone several revisions since the REL. A detailed second level supplementary measure "Provisional Administrative Measures on Pricing and Cost Sharing for Renewable Energy Power Generation" (Measures on Pricing and Cost Sharing) was adopted in January 2006. The measures outlined RE electricity pricing and the cost sharing mechanism. All end-users were required to pay a RE tariff to the provincial grids including "wholesale customers, of the provincial grid enterprises, auxiliary power plants, large accounts directly purchasing electricity from the power plants" (NDRC Price [2006] No. 7, 2006, Article 13). The pricing sharing mechanism resembles the German nation-wide equalisations scheme where the TSO compensated RE generators directly and costs were spread across all four TSO companies (e.g. China's State Grid and South Power Investment Company). The increased RE costs were then passed onto end-users.

In China, the end-user surcharge was set by the State Council Pricing Department and charged according to the electricity consumed. The total RE tariff surcharge was determined by the RE

power generation price subtracted by the tariff for desulphurisation coal-fired generating units of the local provincial power grid and taking other factors into account such as operation and maintenance costs relative to the average electricity grid price, grid connection costs and other related reasonable costs[22].

The first RE tariff was issued by the NDRC in July 2006 under the "Renewable Energy Surcharge Level Regulation". The regulation required electricity end-users to pay 0.001RMB for each kilowatt-hour to fund RE and grid connection costs (CWPC, 2009). Since the first tariff in 2006 there have been several revisions, as stipulated in the "Provisional Administrative Measures on Pricing and Cost Sharing for Renewable Energy Power Generation" a quasi-law (discussed in 6.6) which states that RE tariff should be adjusted on a "timely basis" by the pricing authorities "according to the actual situation in the development of renewable energy" (Article 18). Determining an efficient end-user surcharge to cover the full cost of RE electricity can be challenging due to the wide ranges of RE generation prices along with varying "reasonable charges" related to each RE technology. See Table 7.1 for the RE end-user surcharge.

Table 7.1 Renewable Energy End-user Surcharge (2006-2010)

Year	RE Surcharge (RMB/kWh)
2006	0.001 electricity end-users
2007	0.001 electricity end-users
2008	0.002 (for industrial users)
2009	0.004 (as of November 2009 for industrial users)
2010	0.004

Source REN 21, 2009; Schuman, 2010

Revisions to the end-user surcharge were aimed at meeting the growing costs of RE generation and feed-in tariff costs since revenues from the surcharge did not cover the costs of the expanding the RE sector (Martinot & Li, 2010). RE electricity pricing, coal pricing, as well as average grid electricity pricing were used in the calculation of the end-user surcharge and changes in any of the parameters would impact the surcharge the grid will receive[23].

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[22] The total amount of RE tariff surcharge = $\sum$ [(RE power generation price - the yardstick tariff for desulphurizating coal-fired generating units of the local provincial power grid) * RE power purchased by the power grid + (O&M costs of public independent power systems from RE – the average electricity sales price of the local provincial grid) * sales volume of public independent power systems from RE] + the grid connection cost of RE power generation projects and other reasonable charges]

[23] Formula indicated in the "Measures on Pricing and Cost Sharing" legislation (NDRC, [2006] No. 7, Article 16):

$$\text{Total surcharge appropriated to provincal grid} = \frac{\text{national total of RE tariff surcharge} \times \text{sales volume of electricity}^*}{national \text{ sales volume of electricity}^{**}}$$

* sales volume of electricity at a price with the tariff surcharge within the service scope of provincial grid enterprise

After conducting research and seeking guidance from the State Electricity Regulatory Commission (SERC), the "Circular on the Printing and Distribution of Interim Measures for the Allocation of Revenues from Price Surcharge of Electric Power Generated From Renewable Energy" was on released in January 2007, containing specific details on pricing measures. The interim measure provided a more standardised approach for Independent Power Producer (IPP) agreements between the grid and RE generators. Provincial grids were required to settle the electricity fee with the generators according to the quantity of RE electricity supplied (Article 10). The measures also attempted to address the RE electricity pricing issues by designating the Pricing Department to oversee and approve prices (Article 9).

The NDRC's Pricing Department approved the extra surcharge and was responsible for the redistributions of funds according to the RE investments. Provincial grid companies were required to collect the extra surcharge and first pay for the RE tariffs within the province. Any surplus or deficit would be balanced nationally through trading fixed quotas (Article 6 & Article 8). The fund collection and redistribution responsibilities were placed under the provincial and national grid authorities and this appeared to be logical for managing RE grid costs for a very large country. But since the costs were incurred at the lower county level and reimbursement occurred at the provincial level, the collected surcharge was first funnelled through the higher level before the counties received payment and, at times, grid companies made a loss for purchasing RE (Cherni & Kentish, 2007).

The government attempted to address the issue by balancing the surplus and deficit through inter-provincial transfers to equalise the uneven investments and returns. After settling the tariffs with RE generators on a monthly basis, the provincial grids were reimbursed for the higher cost of RE electricity and the costs balanced through trading quotas between provinces. Although the provincial grids were required to pay out the RE tariffs on a monthly basis, tariff payments to RE generators were often delayed due (between six to nine months) to the long process of balancing costs and surcharges between provincial grids. RE generators would only receive the coal-fired electricity tariff when the grids were reimbursed, which would be insufficient to cover the short-term generation costs. Additionally redistributing revenues from the surcharge was challenging since provincial grids were reluctant to funnel funds to other provinces that were collected within their province (Schuman, 2010). As a result, the delayed reimbursement and complex balancing scheme impacted both generators and the grid by delaying the distribution of revenues.

Sebastian Meyer from the consulting firm, Azure International stated in an interview that

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** national sales volume of electricity at a price with tariff surcharge

economic performance is an indicator of economic growth and an important goal in China's development plans, thus a strong emphasis has been placed on maximising profits. Therefore important enterprises as well as government officials have been evaluated based on their economic performances. Investments for RE grid connection can be viewed as a burdensome cost since there may be a significant long-term financial commitment particularly when connecting large-scale wind farms to the grid over a long distance. As a result, grid connection delays between six to eight months, as stated above, were not out of the ordinary and had serious financial consequences on wind power generators. Idle wind farms equate to a loss making business, as loan obligations must be met. Delayed grid connection has been a serious bottleneck but the extent to which the issue has been hindering wind power development is not precisely known by industry experts and by the Chinese government despite the fact that the government has access to more electricity generation data than the private sector (S. Meyer, personal communication, May 19, 2009).

There is, however, an approximate estimation on unconnected wind power. According to the CRED, roughly 30 percent of wind power has not been connected to the grid (D. Ren, personal communication, June 5, 2009). This estimate is in line with the cited statistics in Table 2.4: Wind Power Grid Connected Capacity in MW. The delays have caused an indefinite uncertainty for investors. State run corporations may be able to absorb the cost but privately owned wind farms may be hard pressed without the anticipated cash flow. Additionally, the grid may refuse to accept all electricity generated from wind farms even though grid connection is mandated by law, as previously explained in Chapter 6 (6.3 First policy level: policy learning for grid connection obligations in the REL). Local grids have been known to produce documents with opt-out clauses that wind power generators must sign in order to receive grid connection. For instance, the wind power generator may be required to sign and acknowledge that the local grid has been fully developed and that the generator must absorb the risks associated with the grid's 'inability' to purchase all electricity generated from the wind farm (S. Meyer, personal communication, May 19, 2009). These clauses contradict the national grid connection policy but policies passed at the national level are not always implemented at the local level. This is a reoccurring theme of incomplete and inadequate policy implementation that will be explored further in Chapter 8 for Market Mandated Shares.

Grid connection issues are one of the unintended impacts resulting from the inefficient grid investment recovery system. In 2009, the government addressed this problem in the amended Renewable Energy Law by allowing grid companies to access subsidies from the Renewable Energy Development Fund (REDF), financed by the end-user surcharge and a RE special fund. The RE special fund was previously set up in the 2006 "Tentative Management Method of

Special funds for Renewable Energy Development", a second level policy that established a specific fund for RE in the area of: R&D, RE projects in rural areas, surveying and assessing RE resources, and supporting local manufacturing of RE technologies. The REL revisions, a part of the REL post policy transfer process (first explained in Chapter 6, section 6.5.1), allowed grid companies to access the REDF. The post transfer learning consisted of a deliberation process engaging RE experts and industry participants to examine grid recovery costs for RE investments based on local and international experience. The REDF under the amended REL allows the grid to cover the difference between interconnection costs for conventional and RE and other costs associated with RE grid connection (NPC, 2009). Any costs incurred prior to the amended REL resulting from the shortfall between the surcharge revenues and RE development and grid connection cost would also be covered by the fund. Provincial grids would continue to collect the surcharge directly from consumers but rather than balance the differences between provinces, the surcharge would be directly funnelled into the REDF and managed by the central government. Grid companies would settle the costs with the government and would be eligible to apply for additional compensation if RE grid connection and development costs were not covered by end-user surcharges (Schuman, 2010). Aside from reimbursing the grid for the additional RE costs, the REDF also provides funding for R&D to further develop technologies and lower the cost of RE in the longer term.

The continuous adjustments in the REL indicates that post transfer learning is a dynamic process that involves policy revisions— at times heavily based on domestic learning experiences with only trace elements of policy learning from abroad.

7.3 Chapter 7 summary

Technical grid codes and end-user tariff policy lessons at the second policy level were primarily drawn on a voluntary basis from the U.S. and Germany. In the first part of this Chapter, technical policy lessons were drawn through systematic and interactive policy learning for grid technical standards. Key policy actors, including the Centre for Resources Solutions from the U.S. and GIZ from Germany, developed joint projects with the Chinese government. The impacts of policy learning resulted in institutional building by establishing education and training centres and forming grid connection codes to improve overall grid stability.

The second part of the chapter examined systematic policy learning examples from the UK's NFFO example, funded by end-users to pay for the costs of RE electricity generation and Germany's nation-wide equalisation scheme where RE electricity costs were spread among transmission system operators and reimbursed by electricity end-user tariffs. The end-user tariffs was adopted in China to support RE costs and related grid development that exhibited characteristics of the German equalisation scheme but yield different results. The outcome of

electricity consumer pricing policies was not very efficient in terms of covering all the RE costs incurred by the grid and often grid reimbursement for RE interconnection was delayed. There have been efforts to address this issue in the amended 2009 REL, which allow grid companies access to the Renewable Energy Development Fund to reimburse the cost of RE grid connection. Such revisions are expected to ease the financial burden for grid companies and help to promote RE grid connection.

Generally policies for grid companies and electricity end-users tend to be complementary policies that support the key development policies in the wind power generation market. The next chapter will examine second level policies, primarily focusing on how the wind generation-side has been influenced by policy learning from abroad and policy transfer and how these regulations and instruments have contributed to China's wind power development.

Chapter 8 - Second Level Policies (Part 2): Mandated Market Share, Tendering Policies and Feed-in Tariffs for Wind Power

Renewable energy (RE) and wind power policies at the first and second level in China are primarily focused on the generation side. At the first policy level, generation-side policies comprise of macro level targets measured with installed capacity for RE generators. Policy support mechanisms for RE generators at the second level consist of wind power tariffs determined by concession projects, government approval on a project-by project basis, and fixed resource based tariffs — all key generation-side policies that have been essential in driving the growth observed in the wind power sector. The quota system, another policy at the second level, include RE targets for both generator and grid companies.

Second level policies specify the details needed to achieve macro level objectives and form the core generation policies responsible for the significant growth observed in China's wind power sector. This chapter will explore the range of second level policies based on the *hard transfer* of *technical policy lessons* implemented in the wind power sector including the on going formation of the mandated market share (MMS) policies for both generators and grid companies, tendering policies accompanied by local content criteria and the development of feed-in tariffs (FITs). Each policy is studied individually, first by drawing evidence of policy transfer then by discussing the impact of the policies in the wind power generation sector. The timeline in Figure 8.1 illustrates the policies examined in this chapter.

Figure 8.1 Time line of second level wind generation policies
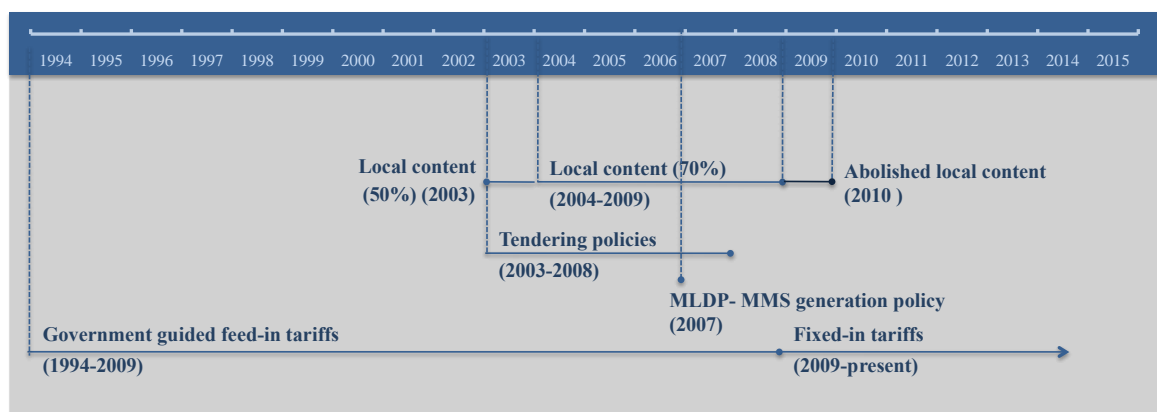
China has primarily drawn voluntary policy lessons of economic instruments (see 3.2) from the United States for its Renewable Portfolio Standard (RPS), the United Kingdom for tendering (concession) policies and Germany for its feed-in tariff policies (Programme Associate at the China Sustainable Energy Programme, personal communication, March 2008). Currently, feed-in laws and tendering policies have been implemented within the wind power sector while the

Market Mandated Shares (MMS is China's version of the RPS) has not been fully implemented in China. Section 8.1 explores some policy learning examples and post transfer learning related to MMS quotas for RE electricity and grid company quotas.

8.1 Policy learning and transfer: the renewable portfolio standard

China has based its Market Mandated Share policies on a RE quota system (see 5.2.2 for detail discussion on the U.S. RPS system and 5.2.3 for the UK's RO quota based system). The quota system is generally categorised as a facilitating market instrument that helps develop a market by setting conditions (i.e., quota) to create a demand and/or a new market good such as tradable permits (see 3.5.1 for discussion of technical policy instruments).

The Chinese government was examining the possibilities of applying RPS policies in the early 2000s when the RPS was still a relatively new policy tool implemented in developed nations (Jaccard, Chen, & Li, 2001). An example of the *voluntary policy learning* is seen in the article "Renewable portfolio standard: a tool for environmental policy in the Chinese electricity sector" (Jaccard, Chen, & Li, 2001), which was produced through a collaborative effort between the School of Resource and Environmental Management, Simon Fraser University and China's Energy Efficiency and Renewable Energy Division, and the China State Development Planning Commission. The article is a *systematic learning* example of RPS policies applied in the U.S. and highlighted China's early interest in the RPS as a viable policy:

> "the Chinese government already has several policies to support renewables. It is now interested in better understanding how it might use the RPS to further this policy aim, and as a consequence has listed the RPS as one of the key renewable support policies to be explored during the 10th Five Year Plan" (2011, p. 112).

The RPS was becoming a more widely applied policy in the U.S. due to its 'economic efficiency', as RE generators are incentivised to reduce costs by competing for a share in the quota. The RPS is also argued to be 'equitable' since costs are spread across end-users (Jaccard, Chen, & Li, 2001, p. 113). RPS policies could also be aligned with existing targets and guarantee a percentage of the electricity market for RE generators.

The article argued that China could implement the policy into its existing electricity market with its monopoly utilities in a similar manner as the U.S. The enactment of PURPA in America obliged monopoly utilities to purchase electricity from independent power producers. Ensuring that RE electricity is accepted by the grid creates the necessary foundation for the RPS (see 5.3.2 on PURPA). The authors of the report developed ideas for a RPS policy and proposed potential components for a RPS system in China, as seen in Table 8.1.

Table 8.1 Summary of key considerations in RPS design

Selection of target
▪ Size of the target
▪ Timing of the target
▪ One target for all renewables vs. separate target for individual renewables
▪ Cost cap vs. no cost cap
Eligible resources
▪ Strictly renewables vs. inclusion of other technologies/energy forms
▪ All resources vs. only new renewables investment
▪ Only grid-connected facilities vs. all renewables facilities
▪ Any size renewable vs. facility size limitation
▪ Allow renewable imports vs. only domestic facilities
Applicability
▪ Geographic area covered
▪ Market participants to whom the RPS applies
▪ Energy vs. installed capacity
▪ Company-wide vs. product-specific
Flexibility mechanisms
▪ Account balancing mechanism
▪ Trade among electricity providers
Administrative responsibilities
▪ Setting the RPS target
▪ Certification of renewables
▪ Compliance monitoring
▪ Penalties

Source: Quoted directly from Jaccard, Chen, & Li, 2001

The article demonstrated that policy learning not only occurred through systematic learning but also through *interactive policy learning*, as the content was based on a workshop arranged by the authors on "Developing and Implementing a Renewable Portfolio Standard for the Chinese Electricity Sector". The Beijing workshop held in January 2000 was an example of *interactive policy learning*, where knowledge was explicitly exchanged. The workshop brought together the China State Development Planning Commission and the China Council Working Group on Energy Strategies and Technologies to discuss and bring forward ideas about the RPS (Jaccard, Chen, & Li, 2001). The China Council working group's main mandate is to advise the China Council for International Cooperation on Environment and Development (CCICED) on energy strategies and energy technologies that support sustainable development objectives. CCICED was established in 1992 by the government as an international advisory body with a mission to exchange and disseminate international experiences, study environment and development issues, and provide policy recommendations in line with sustainable development principals to decision makers at all levels of the Chinese government (CCICED, 2008). The China Council's involvement in the workshop as a nationally endorsed and internationally recognised policy advisory body is highly influential; thus findings would be more likely received by policy

makers.

During the same year of the Beijing workshop, the Regulatory Assistance Project (RAP) presented a report "The Role of Electric Power Sector Reform in China's Sustainable Development" (Moskovitz, 2000) to the Energy Strategy and Technology for Sustainable Development in the International Conference on Engineering and Technological Science in Beijing, China. The report was a type of *systematic learning* example that provided recommendations for general power sector reforms and also discussed RE generation. The report suggested to apply "mandatory purchase requirement at avoided cost[24] (e.g., PURPA in the U.S. and feed laws in Germany and elsewhere)" (see 5.3.2 for the U.S. and 5.3.4 for German policies) and also stated that the "Renewable Energy Portfolio Standard [should be] applicable to all generators or retail electric sellers in a competitive electric market". These "leading examples" implemented to promote RE electricity generation were described as cost-effective measures developed alongside the competitive electricity retail markets (Moskovitz, 2000).

Another *voluntary policy learning* example is found in a study commissioned in 2002 by the Chinese government and conducted by the Center for Resource Solutions (CRS) (discussed in Chapter 6 &7). The study, "Renewable Energy Policy Options for China: A Comparison of Renewable Portfolio Standards, Feed-in Tariffs, and Tendering Policies" [25] examined various policy options for developing the RE sector. Within the report, the RPS was cited as one of "the three most prominent policies in the U.S. and Europe to stimulate the commercialisation of renewable electricity projects" along with feed-in tariffs and tendering policies (Wiser, Hamrin, & Wingate, 2002). At the time the report was written in 2002, 12 states had implemented the RES[26] in the U.S. (see 5.2.2 for RPS details). Although the specifications for RE differed in each state, electricity generators could generally fulfil the requirement by: generating its own electricity from RES; purchasing RE Certificates; or purchase electricity from an independent RE generating facility (Wiser, Hamrin, & Wingate, 2002; Pew, 2009; U.S. EPA, 2000).

Aside from the CRS policy learning studies, Chinese experts have *voluntarily drawn policy lessons* of the UK Renewables Obligation (see 5.3.3), as seen in the *systematic learning* example: 'Technology and Policy Studies Related to Renewable Energy Legislation in China" (2005), commissioned by CRESP [27] and compiled by the China's Renewable Energy Development Center of the Energy Research Institute. The report provided a mini-case study of the UK RO system, which set targets as a percentage of the total power supply. The RO was

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[24] The avoided cost is "the marginal cost for a public utility to produce one more unit of power" (IEP, 2012)

[25] The report was commissioned by China's Center for Renewable Energy Development, Energy Research Institute and the State Development Planning Commission (currently the NDRC).

[26] Thirty-three states have implemented the RES as of March 2009 according to the US Environmental Protection Agency.

[27] The China Renewable Energy Scale-up Programme was first discussed in Chapter 6, section 6.4

implemented as a means to ensure that all power suppliers in the privatised electricity market would meet the RO obligation through the RO Certificate (ROC) trading system supervised by OFGEM, the UK's gas and electricity regulator. The RO targets are set higher "as to maintain a comparatively higher market price and therefore encourage […] investment in the renewable energy power" (CRESP, 2005, p. 114). The CRESP report also referred to Texas as a case study for implementing the RPS. Unlike the UK RO targets based on a percentage of the overall electricity supply, the Texas RO targets were set by installed capacity (MW) (see Chapter 5, Table 5.5). Drawing on a variety of RPS policy examples provides a wider scope of potential policy lessons for China's RE sector (CRESP, 2005, p. 112).

There have also been a number of other contributions and forms of policy learning in "workshops, studies, study tours and other TA [technical assistance] too numerous to mention individually [that] have been financed by multilateral and bilateral donors and foundations in the field of the Mandated Market Policy (MMP [28]), sector reform and legal frameworks supportive of renewable energy" (GEF, 2005). According to the Global Environment Facility (GEF), countries including Australia, Germany, Netherlands, and the UK and organisations such as The Energy Foundation, and multilateral institutions including the Asian Development Bank, the EU, UNDP, and the World Bank financially supported programs in China. Consequently "the combined effect of these efforts has been to build consensus for […] the MMP concept and to inform the debate on the relative merits of the price based and quantity based systems and their applicability to China" and to ensure that the MMP would "be enshrined in law and regulations.

The outcome has been the draft REL and the corresponding implementation regulations. The lessons from this consensus are incorporated into the project design" (GEF, 2005). The GEF also financed 20.82 million USD and another 33 million USD from counterpart funds to build national level institutions. Of this funding, MMP received the following amount in designated areas described in Table 8.2.

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[28] MMP was the terminology used by the GEF to describe the market mandated share

Table 8.2 Funding for MMP related research

MMP research (U.S.$1 million GEF)
Studies on further development of the MMP and its implementation will include:
(a) distributing national targets between provinces;
(b) setting the tariff level for renewables;
(c) transforming the policy from price-based to quantity-based (based on early versions of the law the price-based mechanism has been chosen at least as an interim measure);
(d) sharing incremental costs between provinces;
(e) developing trading schemes to minimize MMP cost;
(f) linking the MMP to carbon trading mechanisms; and
(g) preparing a medium- to long-term plan for renewable energy development. Financing will support consultants to undertake the studies;
MMP implementation (U.S.$1.25 million GEF)
Studies, capacity building and training to support implementation of the REL will include:
(a) preparation of regulations that outline detailed implementation mechanisms; and
(b) capacity building and training for implementing agencies, regulators, and others affected by the law. Financing will support consultants and training activities to implement this subcomponent

Source: Quoted directly from GEF, 2005

The research and implementation plans stemming from the GEF funds required *interaction* as a part of knowledge transfer where advice and funds were directly funnelled towards the specific quota policy. This is a form of *coercive policy transfer* as the funds' purpose was to specifically promote the quota system through direct interactions. The coercive transfer does not indicate that the GEF required China to implement the quota policy; rather the coercive forces act as an additional external pressure to implement the MMS policy since a sizable amount of resource and time was invested to studying and formulating the specific MMS policy. This external pressure from the GEF along with the concerted efforts based on voluntary policy learning from foreign and domestic actors has contributed to the policy learning process in developing the basis for the MMS in China but the full implementation of MMS is still underway.

8.1.1 Post transfer learning on the Mandated Market Share: a focus on electricity generators

The RPS framework has been altered to form a Chinese-style Mandated Market Share, as indicated in the Medium and Long Term Development Plan (MLDP). The MLDP establishes macro level RE targets and set a foundation for the MMS as a quota system to be implemented at the second policy level. The quota system has not been fully implemented in China and there are essential components such the flexibility/trading mechanism (see Table 8.1: Summary of key considerations in RPS design) that have not been finalised. Nevertheless, the on going speculation of its imminent implementation has already impacted RE generators. The MMS is primarily based on the U.S. Renewable Portfolio Standard (RPS) (see 5.2.2) with some references made to the UK Renewables Obligation (RO) (see 5.2.3), as discussed above.

In China, the concepts from the RPS have been applied in the MMS, which has been widely discussed and noted in the 2007 MLDP:

> "In areas covered by large scale power grids non-hydro renewable power generation's share of total power generation will reach 1 percent by 2010 and over 3 percent by 2020. Power generators with self-owned installed capacity of over 5 GW will be required to have a non-hydro renewable energy installed power capacity self-owned that accounts for 3 percent of their total self-owned capacity by 2010 and for over 8 percent of their total self-owned capacity by 2020" (NDRC, 5.1, 2007)

Essentially, large scale grid companies are required to have 3 percent of their total power generation from RES. Additionally, power generations with capacity over 5 MW must ensure that 3 percent of their total installed capacity is sourced from RE by 2010 and 8 percent by 2020.

The Energy Research Institute (ERI) of the NDRC has been developing a support plan based on the MLDP (Xinhua, 2009). There has been some speculation that the support plans may include specific steps on implementing the MMS policy. According to the Deputy Director at the ERI, amendments to increase RE targets are expected, although the specific details are still unknown and there is no specific schedule for the implementation of the quota system (D. Ren, personal communication, June 5, 2009). The National Energy Administration (NEA) was in the process of drafting the New Energy Industry Development Plan for submission to the State Council for approval and the new plan was expected to be drawn up in 2009 and would include short term plans along with details about the MMS policy (Su & Ge, 2009) (see section 8.1.3 for the latest update on the MMS implementation).

Although the MMS system has not been fully implemented, the expectation of its implementation in the near future has triggered a strong response from the state-owned, big five electricity generation companies to invest in RE, primarily wind power. According to Sebastian Meyer of Azure International, a consulting firm, approximately 88 percent of the installed wind power in 2008 comprised of the state-owned companies (qtd. in Fairley, 2008). The domination of the wind power sector by large conventional state-owned firm is primarily a result from the anticipated MMS, which will require all conventional generators to meet the 3 percent target for RE generation (as noted in the MLDP previously), cites Zhiwin Qi, a researcher at the National Energy Administration (NEA) (Z. Qi, personal communication, April 25, 2009). Qi further stated that the incumbent firms were willing to invest in low-return projects in order to secure the best wind resource locations with good access to grid connection. Consequently, large-scale investments by conventional electricity generators have contributed to driving prices artificially low in the concession bidding process (discussed later in 8.2).

The anticipation of the MMS in the near future has helped to drive the RE market in the past few years but concrete legislation is needed for long-term growth. The Chinese government has been recognising the need to devise a MMS framework and on December 2009 passed the amended Renewable Energy Law. For the first time, the quota obligation for both grid companies and electricity generators was legalised. The State Council's energy authorities and the State Electricity Regulatory Commission (SERC) have been appointed to oversee the implementation process but specific targets and other details have not been established. The MMS quota must be met by RE electricity generation and the grid companies through providing grid connection and purchasing the RE electricity according to the revised REL.

The quota policy may have been an appealing policy in the early 2000s; however, the RE policy environment has evolved quickly in the past decade and integrating the MMS policy into the complex web of policies implemented throughout the past decade is much more challenging. Ryan Wiser, a policy expert, raised questions regarding the practical implementation of the MMS policy in China's present RE policy environment. As a consultant for the Centre for Resources Solution (CRS), Wiser was invited to speak at a workshop organised by the NEA. The workshop took place in December 2010 with the aim of receiving comments and recommendations from government agencies and businesses to draft a RE quota system management method.

Previously Wiser contributed to a report in 2002 "Renewable energy policy options for China: a comparison of renewable portfolio standards, feed-in tariffs and tendering policies" (Wiser, et, al 2002). The 2002 report provided successful policy lessons from abroad including the RPS; however, his more recent presentation in 2010 gave another perspective to the quota system. Based on the U.S., experience, Wiser stated that the quota system was "not an easy policy to design well" and it is one of the many policy options, but not necessarily the best option. In the U.S., RE development had already outpaced some RPS requirements and the short term trading contracts did not provide the long-term stability required for sustainable RE development. Additionally RPS policies needed to be rigorously tracked and enforced due to non-compliance (Wiser, 2010). As previously discussed in Chapter 6 for grid issues, China has been struggling with enforcing mandatory grid obligations and this raises questions whether the energy institutions would enforce the quotas once the MMS policy has been implemented.

Wiser also warned against "disrupt[ing] China's already successful RE policies" which comprise of national RE targets, feed-in tariffs, concession projects, grants, RE Fund for cost sharing, quotas on large generating companies and the quota placed on the grid. He noted that "almost every policy in the book is being used […] within a unique energy market structure" (Wiser 2010). Wiser's presentation was not a simple case of promoting policy learning from the

U.S. but also considered China's post policy transfer learning and its current RE policy mix. The collection of policies implemented and revised over the past years have created a new policy environment, particularly with the introduction of feed-in tariffs in 2009 (discussed later in 8.3) and the Renewable Energy Development Fund (REDF) (discussed previously in 7.2.1). Some of the questions raised during the presentation were: "why should the generator receive a REC [renewable energy certificate] in order to receive higher revenue?" since they already receive a feed-in tariff and "given the existence of the REDF, how would the price of a quota transaction be established? The Fund already allocates cost, so what is the value of trade?" (Wiser, 2010).

This more current discussion of the U.S. quota policy widely differs from the lesson drawing example discussed earlier in the 2001 Jaccard, et. al. article "Renewable portfolio standard: a tool for environmental policy in the Chinese electricity sector" (Jaccard, Chen, & Li, 2001; see 8.2.1) which recommended that China implement a U.S.-style RPS policy by setting quota obligations on utilities to purchase RE electricity. The drawn out MMS policy implementation process provides an interesting view on how post policy transfer learning from abroad has influenced the conclusions drawn from policy lessons over a course of a decade.

Policy learning has been an influential factor in shaping the development of a market-based policy mechanism in China. Using examples from quota policies such as the RPS, the Chinese government has engaged in policy transfer by attempting to formulate its own MMS policy. Although the MMS policy is referred to in the amended 2009 REL and requires electricity generators and suppliers to meet RE targets, the specific details are still in question (see 8.1.3 for further update). One interesting issue to investigate is how the governing bodies are expected to administer and simultaneously carry forward a generation and supply quota, if the policy was fully implemented.

8.1.2 Post transfer learning for Mandated Market Share: a focus on grid policies

The separation of the transmission and generation activities in China adds to the complexity of establishing the MMS. The MMS is based on policy lessons from the RPS implemented in the U.S., which set quotas according to utilities' power plant capacity or electricity generation. China's RE quotas, on the other hand, are allocated separately to grid companies and electricity generation companies, as discussed above. Setting MMS targets can provide an incentive for grid companies if the policy is fully implemented along with a RE trading quota system for the grid.

Interestingly, the RE quota specified for grid companies are based on a percentage of the total electricity generation while MMS targets for power generators are based on installed capacity.

Setting two targets based on two different indicators adds to the difficulties of implementing an allegedly single MMS policy instrument. There has not been a detailed implementation plan for the MMS, likely due to the complexity of integrating a quota system with existing RE policies (as discussed previously in 8.1.1). As with the MMS electricity generation quota, the amended REL in 2009 legalised the grids' obligation to meet the quotas but the exact share was not stipulated (Finamore, 2009).

There are arguments opposing a grid quota which claims setting a quota for the uptake of RE electricity caps the growth of the market. The grid would have little motivation to accept RES electricity beyond the minimum quota. Shucheng Wang, Vice Chairman of the Finance and Economic Committee of the National People's Congress, insisted that setting a minimum target would hamper the growing wind power sector but maintains that the grid must accept all electricity produced from RES. Grid companies on the other hand have protested against setting a quota for RES electricity intake as it would be difficult to accept all RES due to it intermittent nature (Xinhua, December 2009).

The MMS grid quota implementation process is complex and the details are still in question – although there has been recent clarification on provincial level targets (see 8.1.3). As an economic incentive, the MMS is intended to increase RE shares by encouraging the grid to take up RE. However, in practice there is no real incentive to take-up RE unless the MMS is fully implemented and is accompanied by a certificate tracking system that would potentially give grid companies another revenue stream.

8.1.3 Recent developments in MMS grid policies (as of September 2012)

In 2012, The NEA announced a newly purposed MMS quota comprising of three separate quotas for power generation companies with a generation capacity of more than 5 GW for grid companies and for electricity end-users. According to the vice-president of the China Renewable Energy Society, Xiangan Meng, "The quota mechanism is exactly designed to solve the problem of who will generate wind power, who will buy wind power, and who will use wind power" (Wu, 2012). The specific implementation date, however, was not announced and the details on the intended incentives and punitive measures were also not provided. Likewise, there was no indication of how the quota for generation companies would function with the existing economic incentives such as the feed-in tariffs.

There are two targets set for electricity generation companies. The first target is based on installed capacity and requires generation companies to secure 11 percent of the overall generation capacity from RE by 2015. The second target for generation companies requires that 6.5 percent of the cumulative electricity produced must be derived from RE by 2015 (Wu,

2012). This two-tiered RE quota addresses some of the issues concerning installed capacity targets, which does not measure the actual amount of electricity produced (mentioned in Chapter 6, section 6.3). The separate quota proposed for electricity generation signifies a change towards target setting that better reflects the actual development of wind power electricity rather than reporting a theoretical potential (e.g. installed capacity targets). Wind power data collection and reporting statistics is likely to be more rigorous and transparent when the proposed quotas are implemented as RE and wind companies will no longer be able claim that their electricity generation statistics are confidential, as argued earlier in Chapter 6. The two-tiered quota for generation companies set both a theoretic and output based goal, adding another layer to the MMS quota, which includes newly proposed targets for grid companies and end-users targets.

The new quota set for grid companies require that the State Grid, China's largest power company, which supplies more than 80 percent of the country's electricity to ensure that at least 5 percent of its generation supply is derived from RES. Southern China's proposed quota is set at 3.2 percent, Inner Mongolia Grid at 15 percent and Shaanxi provincial grid at 10 percent (Wu, 2012).

The quotas for electricity end-users energy consumption were established according to four basic regions and must be met by the provincial authorities as seen in Figure 8.2. The end-user quotas are based on RE resources, the economic environment, total electricity power consumption and the electricity power transmission capacity in each province.

Figure 8.2 End-user quota for renewable energy in China
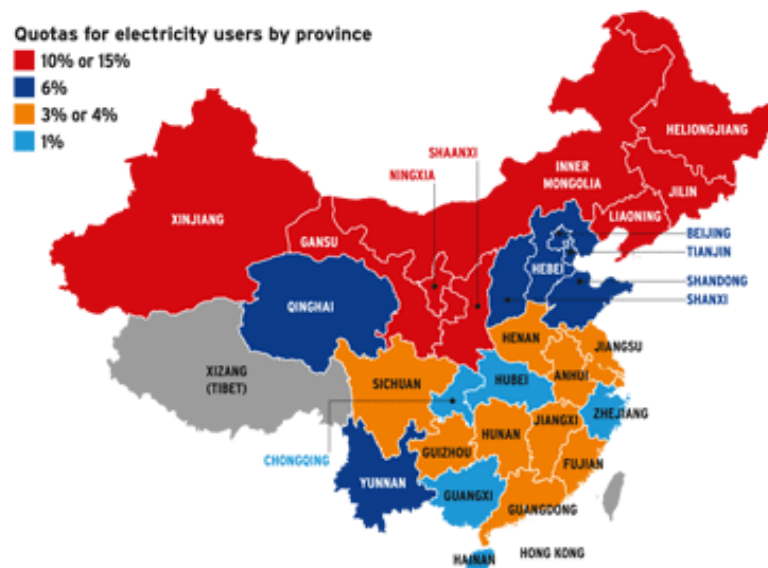
Source: Wu, 2012

During the time when the REL was implemented, the Chinese government argued that "utility-level targets are considered too complicated and costly to be implemented in China" (CREIA et

al., 2007). Since then, the NEA established provincial level targets and targets for the various grid companies but have not disclosed how they intend to track and monitor the generation, grid and end-user obligations, other than stating that they intend to publish public notices at the beginning of each year stating the performance of the previous year for obliged parties (grid companies and power generating companies) (Wu, 2012).

In other countries, policies that place targets on the grid often require a tracking and accounting systems such as the Renewable Portfolio Standard (RPS) policy in the U.S. where compliance is tracked through issuing RE certificates. This also questions whether or not the RE certificate can be developed in China's energy sector as the energy institutions may not be prepared to fully implement a certificate trading which involves issuing, tracking and trading certificates.

Additionally there are existing fixed feed-in tariffs that provides incentives for RE generators (discussed later in 8.3). Establishing a MMS generation quota on top of the tariffs, particularly a system with tradable RE certificates for generators could lead to double compensation for RE generators and would upset the existing RE structure. For instance, the feed-in tariff pricing has been developed and refined since 1994 and the tariffs currently consider the cost of developing wind energy in different resource areas across China. Introducing another economic incentive could result in over-incentivising wind power production and result in the development of excess wind farms in poor wind regions with low efficiency and output. The cost of electricity could correspondingly increase, as end-users would have to pay for the additional RE generation. There would also be larger burdens placed on the lagging grid infrastructure development. Therefore the argument on additional effort and cost for a transmission-side RE electricity target and the addition burden on end-user and the grid raises questions whether implementing a MMS generation quota is still necessary.

The next two parts of this chapter will discuss two other types of economic incentives: tendering policies (stimulating market policy) and feed-in tariffs (supply-side subsidy) (see 3.5.1 for generic types of policy instruments).

8.2 Policy learning and transfer: competitive tendering and local content policy

Tendering polices (concessions projects) were implemented in China from 2003 to 2008 and have been an important factor in driving the growth of the wind power sector in China. Concessions projects are a stimulating market policy instrument in which the government oversees a competitive bidding process to prompt market demand. In the RE sector, projects are auctioned off and bidders propose an electricity tariff price for each kW of RE electricity generated. The winning bidder is offered the contract usually based on the proposed electricity tariff. The tariff is another economic incentive instrument known as a *supply-side subsidy* which

guarantees the price of RE generated. Thus, concessions policies are a hybrid between a *stimulating market* (see 5.2.2) and *supply-subsidy* policy (see 5.2.3).

The *technical policy learning* for concession projects in China occurred through *voluntary policy learning,* as policy actors drew best practices lessons from abroad with the aim of applying the lessons in China. Chinese policy actors studied concession policies from other countries prior to the implementation of the wind power concession rounds. One of the most cited examples of concession projects is based on the UK's Non-Fossil Fuel Obligation (NFFO) concession programme (see 5.3.3). A set of lesson drawing examples can be found in the Centre for Resource Solution (CRS) 2001 report "Renewable Energy Development in China: The Potential and the Challenges" (Zhang, Wang, Zhuang, Hamrin, & Baruch, 2001). The reports argued a case for developing the RE sector and provided *systematic policy learning* examples of policy tools to promote RE technologies including wind power. The policy experience was drawn from both local knowledge and policy experience from abroad:

> "Many Chinese experts believe that increased local production of wind power generators and expanded production scale could cause the costs of wind generation decline remarkably. Based on the experience in other countries, costs could decrease to 0.32 Yuan/ kWh by 2010 and to 0.22Yuan/kWh by 2030. The experience in other countries has shown that competitive pressures and properly structured policies can bring down the prices of wind power significantly" (2001, p. 18).

The NFFO programme in the UK, implemented from 1990-1998, was referred to as a 'successful case' early on in its implementation due to the decreasing cost of wind power as well as other types of RE generation. But later on, the NFFO failed to meet its RE targets in 2003 (DTI, 2003). In the British wind industry, the bidding process was successful in the economic sense of lowering the average price of wind power over a period of approximately seven years from the first bidding round to the fifth bidding round. Prices fell from 10 pence/KWh to 2.88 pence/KWh (1.08 RMB/KWh to 0.376 RMN/KWh) (Zhang, et al, 2001).

In another CRS report "Renewable Energy Policy Options for China: A Comparison of Renewable Portfolio Standards, Feed-in Tariffs, and Tendering Policies" written in 2002 and prepared for China's Energy Research Institute, Center for Renewable Energy Development and the State Development Planning Commission, the authors discussed various policy alternatives including the NFFO. In this *systematic learning* study, the NFFO was stated as "the most widely cited example of a tendering policy" that used a fossil fuel levy to pay for the "incremental cost of renewable energy generation" (Wiser, Hamrin, & Wingate, 2002, p. 6). The NFFO was seen as a "flexible legislation" that could be revised every year to address problematic areas. Additionally the tendering procedure was an effective method of issuing a

large volume of contacts in a cost effective manner. Over the period of five years the RE tenders resulted in approximately 823 MW of new installed capacity (Wiser, Hamrin, & Wingate, 2002, p. 6). At the time the report was written, the NFFO was generally viewed as a successful policy but experience later indicated that the policy failed to help UK reach its 10 percent RE goal set in the 2003 Energy White Paper (see 5.3.3 for a full discussion for the NFFO).

The NFFO was also cited in separate studies in the early 2000s as an economically efficient means of increasing wind power generation. Two institutions, Tsinghua University's Institute for Techno-Economics and Energy System Analysis (ITEESA) and the Center for International Climate and Environmental Research in Oslo (CICERO), collaborated to examine cost effective RE policies in their article "Cost-competitive incentives for wind energy development in China: institutional dynamics and policy changes" (Liu, Gan, & Zhang, 2002). The article is an example of *interactive policy learning* that occurred between Chinese and Norwegian policy actors. The output was a study that analysed the wind power pricing in China during the late 1990s. The report noted that wind farm developers did not have strong incentives to reduce costs since they aimed to have the highest feed-in tariffs approved by the local pricing authority and utility. Consequently, changes were needed and the UK NFFO policy was used as a policy example which helped drive down wind power prices as seen in the excerpt below:

> "Comparatively, the price of wind power in UK has fallen down to an average of 3.0 p/kW of the NFFO-5 contracts in 1998 from 8.0 p/kWh of the NFFO-1 contacts when the NFFO system was first introduced into wind power industry in 1990 (Kettle, 2000). UK's experience provides a good example " (Liu, Gan, & Zhang, 2002).

The direct reference to the NFFO is an example of policy actors drawing policy lessons from abroad to help drive down the cost of wind power development. Lin Gan, one of the report's authors was a Chinese research fellow at CICERO at that time. Gan possessed international experience and education in the area of energy and environmental policy making. Another author, Xiliang Zhang, was a key expert in RE policy and the executive leader in the expert group that drew up the experts' version of China Renewable Energy Draft Law. Xiliang Zhang also contributed to the 2005 report "Technology and Policy Studies Related to Renewable Energy Legislation in China", which also referred to the UK NFFO examples as 'effective' bidding purchase system for ten years but also commented on the negative lessons, as some contracts were not honoured and some projects were not completed because it did not receive planning permission or the bid price was too low to be profitable (see 5.3.3 for full discussion). By the time the report was published, China had already implemented its bidding system for two years, since 2003. The short timeframe did not allow for a thorough analysis of the bidding system but the immediate impact was a significant fall in wind power grid prices. Drawing from

the NFFO learning experiences in the UK, the report questioned if all the concessions contracts would be developed in China.

As a part of the concession rounds, China adapted a local content component into its bidding criteria, a policy directed at developing a domestic manufacturing market. Local content requires a stipulated percentage of domestically produced technology in wind projects. Local content criteria in China originated from technology transfer programs. In 1991 the "Ride the Wind Programme" helped to form joint venture programs with Made (a Spanish wind turbine manufacturer,) and Yituo (a Chinese tractor machinery manufacturer), as well as Nordex- (German wind turbine manufacturer and Aero Engine Cooperation in Xi'an). The cooperation between the joint venture required the companies to meet a 20 percent local content criteria (Lewis, 2007). Policy learning from abroad in the example of local content stemmed from practical collaboration through technology learning and transfer, which lead to the formation of policies to promote the Chinese wind power sector. Local content requirements are not discussed as a separate policy mechanism in this thesis but as one of the required criteria bidders must fulfil to be considered for the competitive bidding process.

The local content criteria in China were later refined through the concession round as more international experience was gathered. For instance, the report "A Review of International Experience with Policies to Promote Wind Power Industry Development" written by the CRS provided examples of local content obligations from various countries (Lewis & Wiser, 2005). The report cited Spain's local content requirement for wind turbines installed in the country. Joint ventures between foreign and domestic companies, such as Denmark's Vestas and Spain's Gamesa established in 1995, were required to comply with the requirements to receive subsidies. As a result of the local content obligation, 4000 jobs were created with 700 MW of installed capacity (Lewis & Wiser, 2005). The *systematic policy learning* from other countries provided China with examples of how local content requirement worked elsewhere but China's implementation of the same policy has evolved uniquely with other second-level policies, discussed in 8.3.1.

The evidence of policy learning leading to the implementation of concessions projects represents the formal story of how China has applied lessons from abroad to formulate its own version of policies. But on an informal and undocumented level, there may be another story behind policy making in China. The information is based on an informal interview conducted outside of China while attending a Wind Power Trade Show in Warsaw, Poland in April 2009. A well known expert with significant experience in the global wind power sector and in China claimed that the policy making process in China was driven by a few powerful individuals with vested interests. For instance, the informant claimed that the wind power bidding policy as opposed to a strict feed-in tariff was implemented because a decision maker wanted to award

contracts to allies and friends. Policy learning and implementation was not entirely based on rational decision making as believed. Such claims are difficult to verify without conducting additional research and following through the interview and would steer the research into a path away from policy learning from abroad and the post transfer learning analysis process. Additionally, due to resource and time limitations another round of fieldwork could not be conducted in China; thus the official information gathered in the fieldwork was used for this study. However, this information provides another interesting perspective on the complexity of policy learning in the overall policymaking process.

8.2.1 Post transfer learning on competitive tendering and local content

Policy learning from abroad is a continuous process and does not stop after policies have been implemented in the domestic environment. The process continues as post transfer learning based on learning experiences from aboard and domestic experiences. After the concession bidding system was implemented in China, policy actors continued to resort to the NFFO's positive and negative experience. Local content requirements were established earlier than tendering policies but were later integrated into the bidding criteria and evolved as China gained more experience from its concessions rounds and from studying cases in other countries. As an important part of policy transfer, continuous learning provides policy makers with experience to amend policies in order to address undesired or unforeseen outcomes.

China's wind power sector entered into a scale-up and local manufacturing phase with the initiation of the national wind power concession programme in 2003 and the corresponding local content requirements. The programme was carried out until 2008 in five consecutive rounds and has been responsible for an installed capacity of 8.8 GW by the end of August 2008 (CREIA & WWF, 2008). The bidding rounds were overseen by the NDRC and selected according to the stipulated criteria, including a 50 percent local content requirement increased in 2003 to help develop the Chinese wind turbine industry. The 50 percent local content requirement was a modification of the previous 40 percent requirement established during the Ride the Wind Programme launched in 1996 (Xia & Song, 2009). Overall, local content criteria increased from 20 percent in 1991 up to 90 percent over the concession round period and would eventually be cancelled in 2009 after the domestic wind manufacturing sector became highly competitive in the local and international market. The details of the local content requirement will be discussed along with the concession rounds in this section.

The concession process drove the commercialisation of wind power in China and attracted investors to the large-scale wind power generation market by creating a guaranteed market for wind power electricity. The local content requirement also helped developed the local manufacturing sector. Successful bidders were awarded a 25 year contract and a guaranteed

fixed price determined through a bidding process for the first 30,000 full load hours, after which the tariff was adjusted to the average electricity price (Xia & Song, 2009; Li J., Shi, Xie, Song, & Shi, 2006). The uptake of wind power was also theoretically guaranteed, as provincial grids were obliged to purchase electricity from RE generators and the incremental costs were spread throughout the grid (Li, Gao, Shi, Shi, & Ma, 2007). The bidding rounds have largely contributed to the accelerated growth of wind power installations as seen in Figure 8.3.

Total cumulative installed capacity (from concession and non-concession projects) increased by 2019 percent (or around 21 times) from 567 MW in 2003 to 12,020 MW in 2008. Prior to the concession rounds, wind power growth rates were relatively low and ranged from 17-32 percent from 1998-2001. After the bidding process began in 2003, wind power capacity growth rate began to rise and nearly doubled between 2004-2005. From 2006 onwards the installed capacity increased by over 100 percent.

Figure 8.3 Wind power installed capacity from 2003-2009

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
AIC (MW)		1	10	3	9	23	41	91	54	44	76	56	68	98	197	503	1333	3267	6154	13786	18928
TIC (MW)	4	5	15	17	26	38	79	170	224	268	344	400	468	567	764	1266	2599	5866	12020	25805	44733
AGR (%)	20%	196%	18%	54%	44%	108%	115%	32%	20%	28%	16%	17%	21%	35%	66%	105%	126%	105%	115%	73%	
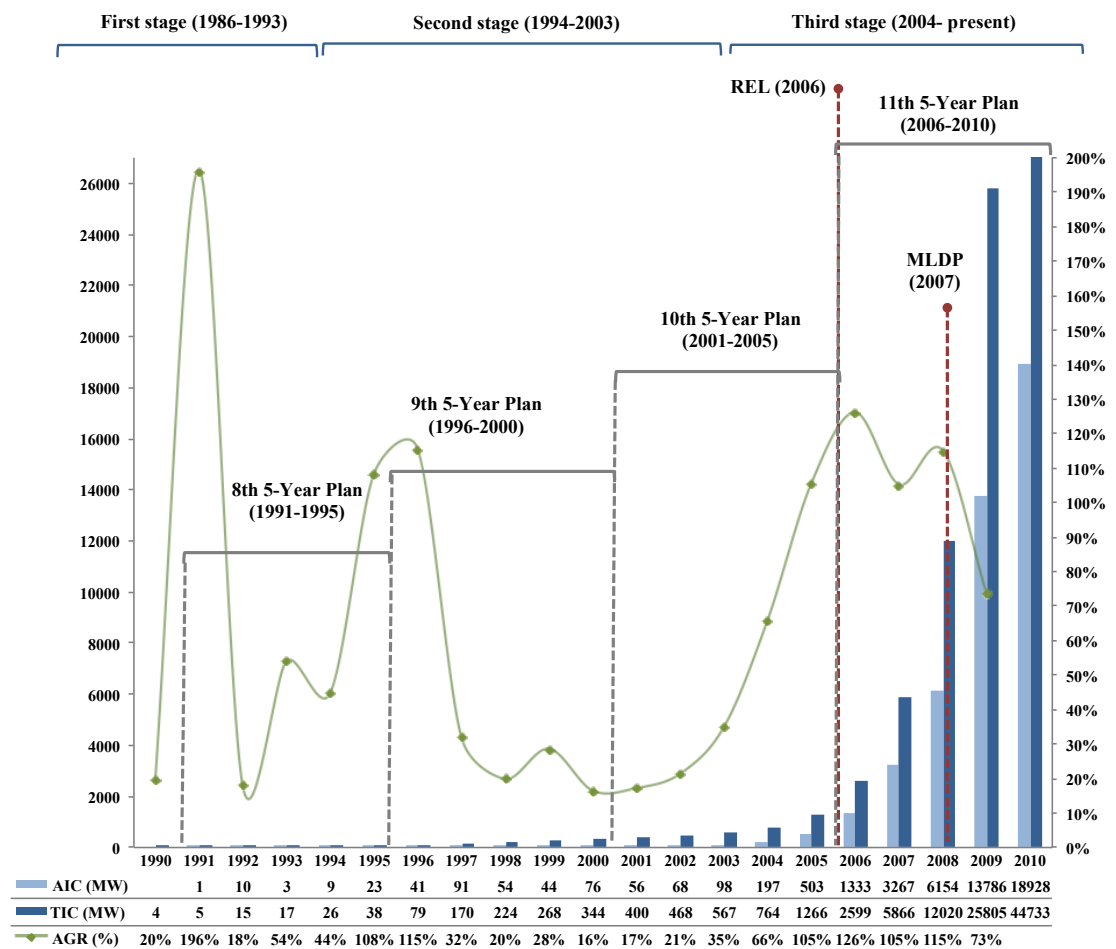
AIC: annual installed capacity; TIC: total install capacity; AGR: annual growth rate

Source: Pengfei, 2008; CWEA, 2009

Competitive tendering was successful in developing large-scale on-grid wind power projects at the national level particularly since local government and utilities were at first reluctant to

invest in wind power development as discussed in Chapter 7 (CREIA, WWF, 2008). Similar to the UK's NFFO experience, the first three concession rounds between 2003-2006 led to very low tariff prices, raising questions on how the prices would impact the sustainability of the wind power sector.

Table 8.3 provides more details on the average price differences observed in projects from year to year, which appears less extreme compared to the price difference between individual projects ranging from 0.382 to 0.5547 RMB/kWh.

Table 8.3 Comparison of tariffs on concession projects (RMB/kWh without tax)

Phase	Year of selected project	Feasibility study price	Contract price	Feasibility & Contract Price Difference* (%)	Difference between contact price** (%)	Average Contract Prices in Each Year	Difference in Average Contract Price
1	2003 Rudong Phase I	0.6374	0.4365	31.52%			
1	2003 Huilai	0.574	0.5013	12.67%	14.85%	0.467	
2	2004 Tongyu	0.5093	0.509	0.06%	1.54%		
2	2004 Huiteng Xile- Inner Mongolia	0.4091	0.382	6.62%	-24.95%		
2	2004 Rudong Phase II	0.5425	0.519	4.33%	35.86%	0.47	0.23%
3	2005 Anxi- Fujian	0.514	0.4616	10.19%	-11.06%		
3	2005 Dongtai Jiangsu	0.5042	0.4877	3.27%	5.65%	0.477	0.99%
4	2006 Huiteng Liang Inner Mongolia	0.4803	0.42	12.55%	-13.88%		
4	2006 Bayin	0.5143	0.4656	9.47%	10.86%		
4	2006 Danjinghe	0.5361	0.5006	6.62%	7.52%	0.462	-2.65%
5	2007 Beiqinghe	0.5587	0.5547	0.72%	10.81%	0.555	20.05%

* Price difference between feasibility and contract price within one project
** Difference in contract prices between different projects

Source: Li, Gao, Shi, Shi, & Ma, 2007; Pengfei, 2008

During the first two bidding rounds, the lowest bid price was the decisive factor for selecting a bidder. As seen in Table 8.3 the price difference between the feasibility study and the contract price in the first concession round for the Rudong Phase I (Jiangsu Province) project differed by 32 percent with the final tariff price set at 0.4365 RMB/KWh. The price gap between the feasibility study and actual tariff in the Rudong Phase II project carried out in the second concession narrowed to 4.33 percent with a final tariff increasing to 0.519 RMB/KWh. The price adjustment better reflected the Rudong feasibility study price of 0.5425 RMB/KWh.

Some of the largest price fluctuations were seen in the second concessions round. For instance in 2004, the tariff awarded for the Huitengxile (Inner Mongolia) project during the second bidding round was relatively low at only 0.382 RMB/KWh. Although the contract price was

only 6.62 percent lower than the price determined in the feasibility study, the difference between the final prices of the Huitengxile and the Rudong project amounted to 0.137 RMB/Kwh, or around a 36 percent difference. Also when compared to the Tongyu project in 2004, the Huiteng Xile contract price was approximately 25 percent lower. These were sizable differences for projects won within a same time period. The contract price of 0.382 RMB/KWh was much lower than the national benchmarked on-grid tariff of 0.51 RMB/KWh for Inner Mongolia (CREIA, 2008; WWF, 2008). Bidder selection based on the lowest bid price continued up until the forth concession round. During the forth round, the criteria was changed as a result of the experience gained from the previous bidding rounds.

From the second bidding round to the last procurement round, local content increased from 50 percent in 2004 to 70 percent in 2008. In 2005, local content accounted for 20 out of 100 percent for the criteria in evaluating wind project bids and this share eventually increased to 35 percent. In order to ensure that locally sourced components were met, wind developers in the fourth concession round were required to bid and sign contracts with turbine manufacturers (Lewis, 2007). Determining the local content was far from straight forward. Researchers from Tsinghua University, Institute of Energy & Environmental Economics have explained that the calculation of the localised content may be complex since the material purchase price and the production costs were regarded as trade secrets and companies were unwilling to fully disclose the information. Thus there were uncertainties in accurately calculating the 70 percent local content (researchers at Tsinghua University, personal communication, May 2009). Nonetheless, the local content criterion was beneficial in protecting the early development of the domestic wind sector.

During the forth concession programme, all bidders were state owned companies although some collaborated with foreign firms. The low number foreign investors were not only the direct result of the local content requirement but also uncertainty in pricing due to the concession project-based programme. Since prices were determined on a project-by-project base, this created uncertainty in the market; there were no clear methods to determine whether a project would receive a fair tariff. Generally uncertainty and low tariffs deterred foreign companies from the market since they were unable to compete with the low-cost local manufacturers. However, according to the CEO of Goldwind Science Technology, a Chinese wind turbine manufacture, stated that if the pricing would be set too high, this would allow too many participants to enter into the industry (G. Wu, personal communication, May 18, 2009). Since the new criteria have been set in place, there have not been any foreign firms selected for government led concession projects. The bias against foreign companies has caused resentment among those who have supported the early development of the wind power sector (Rajgor, 2008). The low presence of foreign firms does not necessarily indicate a lack of interest in

China's wind power market; rather there are challenges for foreign firms to compete in a market with extensive protectionist policies favouring local firms.

The local content and low prices favoured local wind developers and have helped to establish a strong domestic wind power sector that can currently compete in the international market. In 2005, one Chinese wind manufacture was listed in the global top global players and the share of domestic wind manufacturing capacity was only at 21.1 percent. By 2009, the share of domestic wind manufacturing grew to 87.7 percent and three Chinese manufacturing companies were listed among the top 15 global companies including Sinovel, Goldwind and Dongfang (Trabish, 2011). As a response to the domestic wind market conditions, the government cancelled the 70 percent local content requirement in the "Notice on Abolishing the Localisation Rate Requirement for Equipment Procurement in Wind Power Projects by National Development and Reform Commission" released November 2009 and effective in January 2010 (Li, Shi, & Gao, 2010). Opening the market to foreign companies creates opportunities for joint ventures and technological exchanges which are crucial to the advancing the Chinese wind power sector.

Although local content comprised of one third of the overall evaluation, price continued to play the largest factor in the selection process. The approved prices ranged from 0.42- 0.50 RMB/KWh and generally met the standard investment of return in the wind power sector (Li, Shi, Xie, Song, & Shi, 2006). Furthermore, in 2006, The REL came into force and stated that wind power pricing should be determined by two methods: competitive tenders and by government approval. The additional approval steps contributed to narrowing the wide range of wind power tariffs found in the earlier concession phrases.

In the fifth concession round, revisions were made to the selection criteria based on domestic learning from the previous rounds. The lowest price was no longer the determinant in project selection. Rather, the highest and lowest bids were taken off the tender and the bid closest to the average bidding price had a greater likelihood of winning the tender (Shi, 2008). The weight factor for price accounted for 25 percent of the total criteria and other requirements such as technical specifications were considered (CREIA & WWF, 2008). The changes have resulted in more stable tariffs but the final price (between 0.468 to 0.5510 RMB) still remained lower then expected. Additionally, the companies that won the concession projects were primarily state owned companies, although a private company, Huadian Power International Co, won a 300 MW project (CWPC, 2012).

Given the experience gained over the competitive tendering process, the NDRC had a clearer understanding of setting appropriate wind power prices. One of the (official) reasons concession bidding was selected over fixed feed-in tariffs was due to the lack of experience in setting wind power prices throughout China. The wide range of wind resource potential, varying price of

coal and differing economic situation in each province made it difficult for the NDRC's Department of Price to set fixed tariffs (Li, Gao, Shi, Shi, & Ma, 2007). An associate research fellow from the Centre for Renewable Energy Development in China stated in an interview that the government was uncertain about the price of wind power since the industry was new and required more experience through concession tendering to determine the actual price of wind power. Competitive tendering was a means of experimenting to determine a reasonable wind power tariff (R. Hu, personal communication, May 15, 2009). The next discussion will focus on the government fixed wind power tariffs.

8.3 Policy learning and transfer: non-concession feed-in policies

Over the past years China has been *voluntarily* drawing policy lessons from best practices worldwide and has created its own duel wind tariff system based on the tendering process and on fixed government-guided prices. *Systematic policy learning* reports have cited fixed tariff policies from Germany and the U.S. as one of the most widely applied instruments to promote RE electricity generation. Wind power tariffs are a type of *subsidy* (see 3.5.1) aimed to incentivise wind power electricity generators and have been argued to be an effective economic incentive to promote a stable RE sector.

German and American examples were studied as benchmark cases for mandatory purchase policies in the 2001 CRS systematic policy report "Renewable Energy Development in China: The Potential and the Challenges" (also referred in 7.3.1; 8.2 and 8.4). The Feed-in Law (StrEG) and PURPA were commended for having "successfully launched the most diverse renewable energy markets in California and a sizable wind power market worldwide" (Zhang, et al, 2001, p. 64). In particular, PURPA established a more level playing field for RE and conventional electricity generators and for this reason has gained global recognition for its advancements in the wind and solar power sector. Having studied the international cases, the authors provided recommendations for China stating: "If China were able to develop such a law – and make it enforceable through real legislative "teeth", it could be the single most important contribution to renewable energy development in the country." (2001, p. 78). They provided recommendations for a proposed policy that included "establish[ing] a fair purchase price for electricity generated from RES (e.g. based on long-term marginal cost of power for the region)" (2001, p. 78).

An example of systematic policy learning on feed-in tariffs (FITs) was provided in another CRS report, "Renewable Energy Policy Options for China: A Comparison of Renewable Portfolio Standards, Feed-in Tariffs, and Tendering Policies" (discussed previously in 8.2. Germany's Electricity Feed-in Law was cited as a successful RE policy implemented in 1990. At first, the feed-in law was resisted by the German utilities but was nevertheless implemented and has been

responsible for the strong development of Germany's RE sector, which is among the largest wind power markets in the world (see 5.2.4 for details on Germany's RE policies) (Wiser, Hamrin, & Wingate, 2002).

Systematic Chinese studies on the U.S. and American fixed tariff prices were also conducted by wind power experts Junfeng Li, Pengfei Shi and Xiliang Zhang in the "Technology and Policy Studies Related to Renewable Energy Legislation in China" (CRESP, 2005). The report was commissioned by China Renewable Energy Scale-up Program (CRESP) (discussed in 6.3 and 8.3) and referred to FITs examples from a number of countries including Germany and the U.S. Some areas in the German example discussed annual price revisions for the feed-in law and the revised FITs implemented in the Renewable Energy Law of 2000. The price amendments in 2000 classified wind resources according to high and low wind conditions. These modifications were continually revised in the German feed-in policy to take into account learning experiences from the market. PURPA was also examined as an American policy that "made great contribution to the development of renewable energy at [an] early stage" with its fixed prices for renewable energy electricity (CRESP, 2005, p. 111). Both policy examples from Germany and the U.S. emphasised the importance of a fixed, but flexible feed-in tariff policy.

Another *systematic learning* example of Germany's feed-in tariffs was cited in a 2006 report "A Study on the Pricing Policy of Wind Power in China". The report was written by leading Chinese wind experts Junfeng Li and Pengfei Shi and was published by the Chinese Renewable Energy Industries Association, Greenpeace and Global Wind Energy Council. The policy learning example discussed Germany's feed-in policies and provided possible pricing policy scenarios to improve China's existing feed-in tariff structure. The German case study provided in the report noted several revisions in the tariff system, first in 2000 to account for each technology's development pathway and resource potential. Later revisions in 2004 placed a price floor and guaranteed a 20-year digressive tariff rate for wind power producers. Germany's applied tariffs and amendments resulted in an installed capacity of 18,430 MW or 30 percent of the global total in 2005 (Li, Shi, Xie, Song, & Shi, 2006). Keeping the tariff revisions in mind, the authors proposed several options to amend China's tariff system. The first option was to partition the area in China according to wind resource. Inner Mongolia, Xinjian, Gansu and Ningxia were classified as strong resource areas while other regions were categorised as weaker wind resource areas. A geographic component was used along with the wind resources to divide the resource areas into the northern, coastal and inland regions. Subsequently regional fixed tariffs were suggested, as seen in Table 8.4.

Table 8.4 Wind tariff and project investment return rate

Region	Northern	Coastal	Inland
Typical operating hours at full load	2700	2200	1900
Tariff reference (RMB/kWh)	0.48	0.58	0.68
Project IRR (%)	10.91	10.24	10.77

Source: Li, Shi, Xie, Song, & Shi, 2006

The fixed regional tariffs could be set according to the tendering tariffs as a reference point, but under the condition that the price was 'reasonable'. Regions could then be further subdivided. The authors recognised that potential problems may arise since there were differences in wind resources within one region. Nevertheless, the pricing scenario provided a policy option to revise the existing tariffs according to lessons learned from international policy cases and from domestic experience.

There were also cases of *interactive policy* learning on FITs that occurred as a part of the cooperation between the German and Chinese government and enabled for explicit knowledge exchanges through face-to-face interactions. The German government recognised that "China [was] also discussing the introduction of an electricity feed act similar to the German Renewable Energy Sources Act" (BMU, 2004) and its rapidly expanding wind power sector as part of the global solution to addressing climate change. The German government pledged "to do all in its power to support this development". One example of this support involved the annual Sino-Germany Environment Forum where the German and Chinese government met to discuss and promote environmental policies. The event was also a platform for the German government to promote its feed-in legislation as a "mechanism that has proved most efficient worldwide in speeding up the expansion of renewable energies" (BMU, 2006). The cumulative systematic and interactive policy learning experiences from Germany and the U.S. have contributed to forming a fixed FIT specific to China's wind power resources and will be examined in the next section.

8.3.1 Post transfer learning on feed-in policies

Government guided tariffs have been implemented since 1994 before the concession programs began in 2003 (Liu, 2007). The guided tariffs were set according to the total power generation costs and borrowing cost plus a 'reasonable' profit. Eventually the State Planning Commission set the average tariff for wind power based on the turbine operation period and the loan payment over fifteen years. The tariffs were adjusted over time from a variable price based on individual projects to a fixed government-guided price announced in July 2009 (see Figure 8.4 for tariff timeline). The gradual move towards a fixed FIT has been a result of China drawing from its

own post transfer learning experience and from countries like Germany and the U.S for best practices.

In China, fixed feed-in tariff based on the coal price was set for the biomass sector but was not initially established for the wind power sector because the government was concerned that the wind power tariff in the south would be nearly double the price of the western regions due to the higher coal price in the south (CREIA et al., 2007).
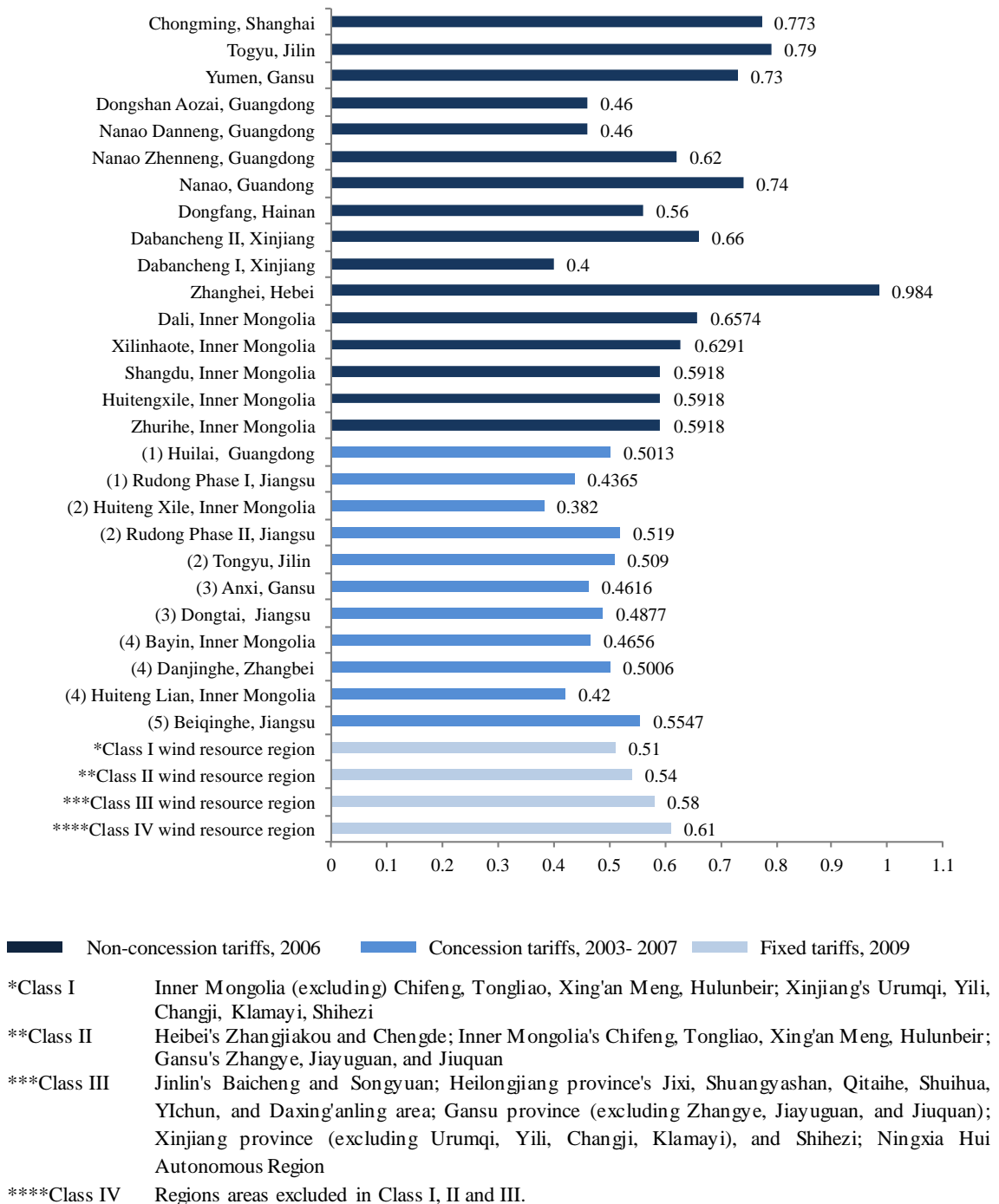
Figure 8.4 Second level wind tariff policies
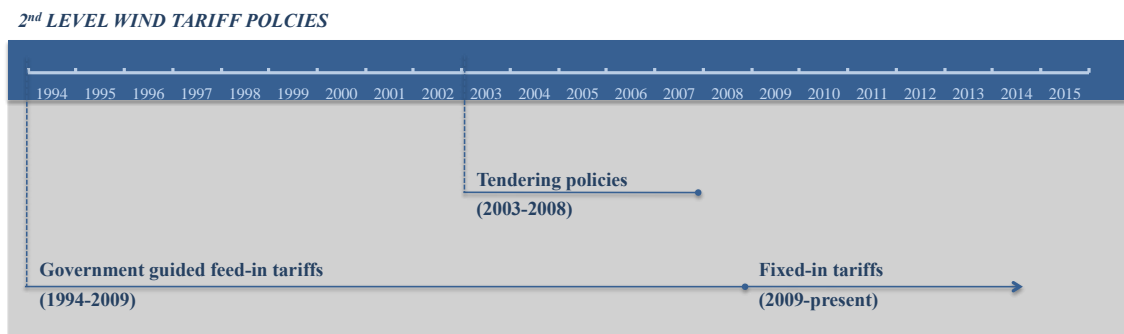
In China, fixed feed-in tariff based on the coal price was set for the biomass sector but was not initially established for the wind power sector because the government was concerned that the wind power tariff in the south would be nearly double the price of the western regions due to the higher coal price in the south (CREIA et al., 2007). Western regions may have abundant wind resources, but it would still be less favourable to invest in the region as the price difference would be large enough to deter investors from the western area. As seen in the progression of prices in Figure 8.5, non-concession tariffs in 2006 had the widest range of prices starting at 0.4 RMB/kWh and increased to 0.984 RMB/kWh. Some of the price differences were a result of the variation between regions but did not always hold true as prices in Guangdong also varied, ranging from 0.46 to 0.74 RMB/kWh. In general, non-concession tariffs averaged at 0.640 RMB/kWh, which was around 1.34 times higher then concession projects averaging at 0.476, RMB/kWh.

From 2007 to 2008 the tariff prices became more stable ranging from 0.51 to 0.64 RMB/kWh in 2007 to 0.51 to 0.06 RMB/kWh in 2008 (NDRC 2007-2008, qtd. in GWEC, 2009). These tariff prices were not fixed over the operation period of the wind farm and could be changed by the Pricing Bureau or the provincial grid company. The tariffs depended on the wind resources and investment costs and varied in each province. For instance, Inner Mongolia had the lowest tariffs while the north and northeast regions in Shanxi and Liaoning were awarded higher tariffs (Department of Climate Change, NDRC, 2008). Although the tariff range was not a clearly fixed feed-in tariff, the set price floor and price ceiling increased the predictability of wind power tariff pricing compared to the previous practice of tariff setting.

Figure 8.5 Comparison of concessions tariff, non-concession tariff and fixed tariffs (RMB/KWh excluding tax)

■ Non-concession tariffs, 2006	■ Concession tariffs, 2003- 2007 ■ Fixed tariffs, 2009

*Class I — Inner Mongolia (excluding) Chifeng, Tongliao, Xing'an Meng, Hulunbeir; Xinjiang's Urumqi, Yili, Changji, Klamayi, Shihezi

**Class II — Heibei's Zhangjiakou and Chengde; Inner Mongolia's Chifeng, Tongliao, Xing'an Meng, Hulunbeir; Gansu's Zhangye, Jiayuguan, and Jiuquan

***Class III — Jinlin's Baicheng and Songyuan; Heilongjiang province's Jixi, Shuangyashan, Qitaihe, Shuihua, YIchun, and Daxing'anling area; Gansu province (excluding Zhangye, Jiayuguan, and Jiuquan); Xinjiang province (excluding Urumqi, Yili, Changji, Klamayi), and Shihezi; Ningxia Hui Autonomous Region

****Class IV — Regions areas excluded in Class I, II and III.

Source: Li, Gao, Shi, Shi, & Ma, 2007; Pengfei, 2008; CRESP, 2009

The experiences from government set prices and the concession ranging from 0.382 to 0.5547 RMB/kWh (discussed in 8.2.1) were taken into consideration for setting the fixed-tariff announced on July 20, 2009, which replaced the competitive bidding programme for on-shore

wind power farms. Four benchmark prices based on wind resources were formally set, ranging from 0.51 to 0.61 RMB/kWh, the same range previously set a year ago (CRESP, 2009). In 2009, the cost of wind power generation ranged from 0.43 to 0.53 RMB/KWh[29] and was likely to decrease to 0.32 RMB/KWh in high resource locations such as Hebei and Inner Mongolia[30].

The implementation of the four fixed feed-in tariffs based on wind resources has been a result of post transfer learning of setting tariffs based on concessions projects and through government approved prices. Setting tariffs through competitive tendering is another example of how policy makers have applied their experimental policy approach (see 2.4.1) until sufficient experience based on market experience has been gained to set fixed prices. In the case of the wind power sector, the tariffs based on concession projects were experimental policies while fixed-feed-in tariffs have been based on the domestic learning experience and reflect a price that is seen by policy makers as more conducive to developing the wind power market. Additionally, policy learning from local actors also contributed to the overall post transfer learning process through systematic studies such as the 2006 report "A Study on the Pricing Policy of Wind Power in China" (Li, Shi, Xie, Song, & Shi, 2006) (discussed previously in 8.3), compiled by Chinese experts that provided recommendations to set different wind power tariffs based on resource areas. The fixed prices were expected to provide a more stable market for the long-term development of the wind power sector. The announcement of the set tariffs has been a result of continual work in progress driven by many years of policy learning from international lessons and local experience through concession projects and from Chinese policy experts.

8.4 Chapter 8 summary

China has applied a mix of second level policies, drawing *voluntary policy lessons* from Germany and its feed-in tariffs, the U.S. and its Public Utility Regulatory Policies Act and Renewable Portfolio Standards, as well as the UK and its Non-Fossil Fuel Obligation and Renewables Obligation. The policy makers in China did not directly adopt these policies but have implemented a form of government-set tariffs, a tendering policy with local content criteria and is currently in the process of implementing the Mandated Market Share, its own version of the Renewable Portfolio Standard. The feed-in tariff pricing policy has evolved from a government-guided price, which later ran concurrently with concession based prices, and finally led to establishing fixed feed-in tariffs based on wind resource potential. The development of these second level policies indicate how post-transfer learning has been a part of a dynamic policy making process, and how both international and domestic learning

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[29] Based on a 30 percent self-owned capacity investment and 1800 utilization hours for a 50,000 KW wind farm (China Research and Intelligence, 2009).

[30] Based on utilization hours of around 2500 hours (China Research and Intelligence, 2009).

experience play a vital role in forming and modifying policies according to the changing environment.

The MMS policy is another second level policy that has not been fully implemented in China. China has been learning from the U.S. RPS through systematic learning examples and interactive workshops with experts and policy actors as well as through the UK RO to a more limited degree. Additionally, there has been some coercive transfer with the Global Environmental Facility who has provided funding to push for a quota system. Post transfer policy learning in China has resulted in the MMS, a Chinese-style RPS policy in which quotas are placed on the grid as well as on electricity generators and more recently end-users. There have been difficulties in following through with the full implementation as other generation-side policies were implemented in the past decade, such as tariffs based on government guided prices, concession projects, and fixed feed-in tariffs. Integrating another grid and generation side incentive policy into the current policy mix could be an administrative challenge.

Competitive tendering policy lessons have been drawn voluntarily from the UK NFFO concession rounds. The policy was seen as an economically attractive option that would help drive down the cost of wind power electricity generation. In order to develop a strong local market, a local content requirement ranging between 20 to 90 percent was required for bidders to qualify for the project; however the details for determining the criteria where often ambiguous. The high local content obligation increased barriers to entry for foreign firms and it was cancelled in 2009, which allowed foreign firms to compete against Chinese firms without preferential government support.

The post policy transfer learning with respect to concession projects occurred over five concession rounds between 2003 to 2008, a period which saw high growth rates, especially from 2006-2008 (Figure 8.2: Wind power installed capacity from 2003-2009). The tariff rates that generators received during the first round were very low and unprofitable largely due to the selection criteria based on the lowest bid price. As China continued to learn from its concession rounds, the lowest pricing criteria was no longer the determining factor for winning bids, but decisions were based on the average price bid. The experience from the concession rounds contributed to establishing fixed feed-in tariff (FIT) prices in 2009. Before fixed FITs were established in 2009, government guided FITs were set early on in 1994 based on systematic and interactive learning experiences from Germany's FIT Law. Policy examples from PURPA in the U.S., which established fixed tariffs, were also drawn from studies. But unlike Germany, China did not immediately set fixed tariffs for the entire country. Policy makers experimented with the tariff prices and as a result there were significant variations in price between provinces

and different projects. The post-transfer learning experience from the concession and government guided prices provided a basis for a fixed wind tariff prices that allowed for reasonable profits across different resources regions.

Overall, the MMS and generation side tariffs have provided the economic incentives to encourage electricity generation from wind power while other policies at the second level set the necessary technical codes for RE grid connection and helped fund RE development through levying taxes on electricity end-users. This rich mix of second-level policy instruments are influenced by policy learning from abroad and post transfer learning and forms a crucial part of the driving forces behind the development of China's wind power sector.

Chapter 9 - Conclusions: Reflections and Lessons

9.1 Summary of the thesis

This thesis examined the policy learning, transfer and post-transfer process by exploring the research question: "what renewable energy (RE) policy lessons has China drawn from abroad and how have these transferred policies been implemented in China's wind power sector?" This thesis identified elements of policy learning from abroad in the area of renewable energy and wind power policies and examined how transferred policies were applied in China's first and second level policies and how these policies were adapted to fit China's unique political and economic environment. Within the context of this thesis, the main function of first level policies is to coordinate medium to long-term general strategies, objectives and frameworks. Second level policies have more specific objectives that focus on the diffusion and adoption of detailed RE policy instruments.

The thesis first introduced the background to China's energy and RE sector in Chapter 2. The main grid issues were also discussed along with the institutional, political and economic context for examining policy learning from abroad and policy transfer in the development of China's RE policies. Chapter 3 examined the policy learning and transfer literature and developed a framework to analyse the policy learning and transfer process based on the literature review and China's specific RE context. Chapter 4 described how the framework would be applied in a case study design to examine China's RE sector with a specific focus on the wind power policies. Two units of analysis were examined in the case study: the broader first level policies and the more detailed second level policies.

The first part of Chapter 5 identified the specific RE policy instruments including target setting, tendering policies accompanied with local content criteria (concessions projects), quota policies (Market Mandated Shares, MMS), feed-in tariffs (FITs), regulations (including grid connection obligations), and end-user tariffs. Government institutions and companies were also studied as non-market mechanisms, such as state owned energy companies providing services and electricity market monitoring agencies overseeing the energy sector. The second part of the chapter provided a description and analysis of four jurisdictions where the most widely applied RE policies were originated or implemented including: the European Union, United States, United Kingdom and Germany.

Chapters 6 to 8 provided empirical analysis of policy learning from abroad, policy transfer and post transfer learning for first and second level policies and answered the framework questions. Chapter 6 examined first level policies the Renewable Energy Law (REL), the Medium and Long Term Development Plan (MLDP) and supporting energy institutions. Chapter 7 explored

second level technical grid codes and electricity end-users tariffs. Chapter 8 continued with the analysis of second level policies, examining wind power generation policies including Market Mandated Share (MMS) generation side and grid quotas and the recent end-user quota, tendering policies, and feed-in tariffs (FITs).

9.2 Application of the framework

A case study method was applied to examine policy learning, transfer and post-policy transfer in China's wind power sector. The units of analysis were explored using the policy transfer and post-transfer learning framework.

The first part of the framework identifies evidence of policy lessons through answering the "what" question as well as the "where" and "who" questions by drawing evidence from certain countries and identifying the policy agents. The second part of the framework analyses the impact of policy transfer by examining how policy experience drawn from abroad has been implemented in China, along with its own policy learning experiences. The lines are often blurred between learning from abroad and domestic learning experiences, thus the term post-transfer learning is applied to explain the on going processes of learning based on experiences from home and abroad. The framework's purpose is not to specifically indicate which elements of post-transfer learning are derived from abroad or to discuss post transfer learning as a single event, but to examine policy transfer as a process in the domestic context.

The framework questions provide a broad guideline for systematically analysing policy learning from abroad, transfer and post transfer learning; however the questions were not necessarily answered in order from the first question to the last question:

Question 1: Why is China drawing lessons from abroad?

Question 2: What types of policy contents are transferred and what types of policy learning processes are involved?

Question 3: From which countries are the policies drawn from and who are the key actors in the policy transfer process?

Question 4: How are the lessons (knowledge) transferred?

Question 5: How are transferred policies implemented in China?

Table 9.1 below summarises the research aims and outcomes from Chapter 2 to 8.

Table 9.1 Research question answered in the corresponding chapters

Chapter	Research Aim	Outcome
2	*Establish RE context in China* ▪ Background and policy scan of key energy and RE policies ▪ Explanation of why China could engage in policy learning	▪ Analysis of potential RE policies that could be influenced by lesson drawing from abroad
3	*Literature review* ▪ Review of policy learning and transfer concepts and implementation in China's RE sector	▪ Analysis of general energy and environmental polices that could be drawn from abroad ▪ Formulate framework
4	*Methodology* ▪ Introduce research questions and describe method	▪ Show how the framework will be applied
5	*Background study of key policies from abroad* ▪ Identify specific RE policy mechanisms ▪ Provide analysis of policy instruments from key countries China drew policy lessons from	▪ Provide context in order to draw links in subsequent chapters of policies in China that exhibit elements of specific RE policies from certain countries
6-8	*Explore the framework questions "why" "what" "from where and who" and "how"* ▪ Seek evidence of policy learning from abroad and policy transfer and analyse the impact of post-policy transfer learning	▪ Provide evidence of policy learning and transfer based on a survey of RE policies in Chapter 2 and policies from abroad in Chapter 5

Prior to the fieldwork study, a survey of policies that exhibited elements of learning from abroad was conducted based on the discussion of China's energy and RE background in Chapter 2. Chapter 3 distinguished between hard transfer and soft transfer. Hard transfer focuses on policies objectives, goals, content and institutions while soft transfer is often associated with ideologies, ideas and attitudes. Additionally technical learning was defined as learning that does not challenge the fundamental policy objective while conceptual learning leads to policy paradigm or institutional paradigm changes. The chapter also provided general policy taxonomy and narrowed down the potential policies to examine the exhibited elements of learning from abroad. A detailed RE policy inventory analysis from pioneering countries/regions or countries with policies relevant to China's RE sector was carried out in Chapter 5 prior to the empirical study. The analysis contributes to answering the "what", "from where" and "who" questions in Chapter 6 to 8. Chapters 6 to 8 mainly focused on two aspects: searching for policy learning evidence and analysing the process and the impact of post transfer learning in China's RE sector.

Figure 9.1 illustrates the evidence of policy learning from abroad, policy transfer and post policy transfer based on how knowledge is transferred.

Figure 9.1 Evidence of policy learning from abroad, the policy transfer and post transfer processes
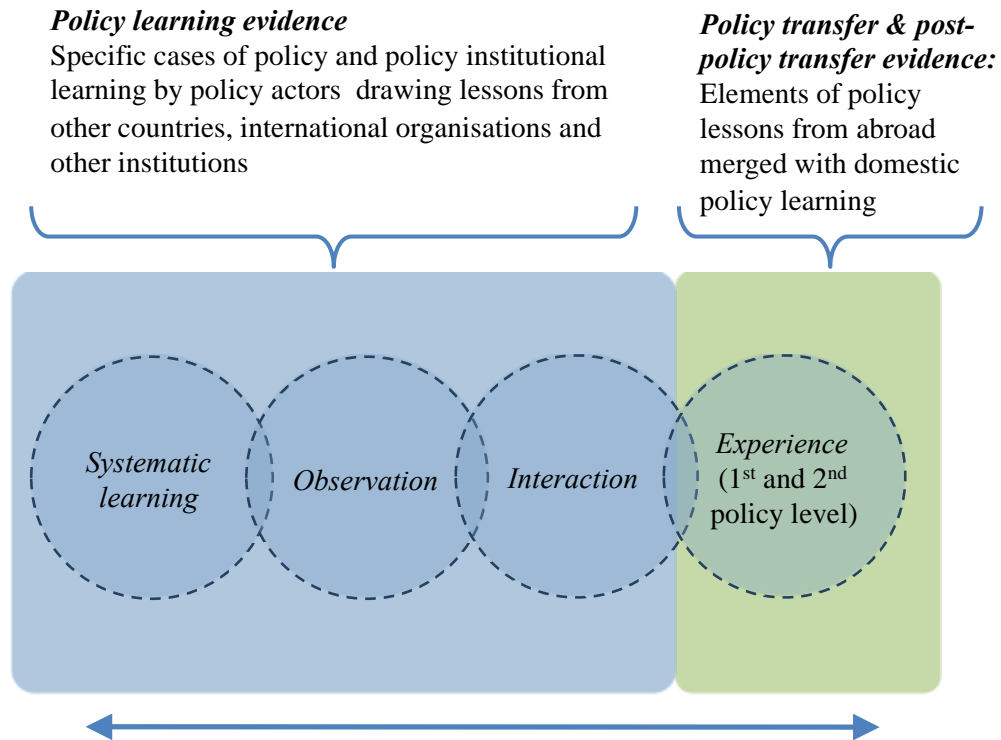
Source: concepts built from this thesis and based on Kemp & Weehuizen's 2005 learning types

Evidence of policy learning can be located in documented transfers of knowledge through *systematic learning, observation and interactions*, which comprise of varying degrees of explicit and implicit knowledge (as discussed in 3.8.1 Obtaining knowledge as a part of policy learning). Transferred knowledge that requires more 'hands on experience' (observation and interaction) could involve more implicit knowledge as oppose to desk-based research (systematic learning), where knowledge is presented in a more explicit manner. Post transfer learning evidence is based on *experience*, in which learning is largely based on implicit knowledge stemming from China's unique learning experiences and context. At times, the domestic learning experience may also be complemented by additional learning from abroad that may have elements of explicit knowledge transfer.

Verifying policy transfer requires evidence of knowledge transfer *and* evidence that the transfer of knowledge has led to policy adoption. Validating that a specific policy has been transferred as a result of a specific learning process can be challenging and sometimes impractical as not all aspects of the policy making process are transparent and formally documented (particularly in

China) or available to the public. Additionally, there are a number of actors involved with the policy learning process and pinpointing all actors responsible for policy learning and the exact policy lesson leading to the implementation of a policy may not be feasible.

The aim of this thesis is not to find the exact details of how specific policy lessons lead to a specific policy transfer incident but to recognise that the *cumulative* process of policy learning from abroad is part of the policy transfer process; and finally, post policy transfer occurs after the policy is implemented into the domestic environment. The post-transfer learning analysis is a means of validating evidence of policy transfer, as elements of policies from abroad were found in a modified form in domestic regulations and policy instruments.

9.3 Findings

As observed throughout the thesis, the main objective for drawing policy lessons from abroad is to search for policy examples and to learn from the experiences and errors of other countries. The motivation, however, may differ as policy makers could have voluntarily searched for policy lessons to apply solutions to existing problem at home or could have faced stronger external pressures to adapt certain policies. For instance, there was external pressure from large global organisation such as the World Bank that advocated the establishment of independent energy regulators in newly reformed energy markets, as well as pressures from organisations such as the Global Environment Facility that provided funding for China to study and implement the quota based policy.

Coercive transfer played some role in developing China's RE sector, but the voluntary motivations to search for policy lessons from a variety of countries have produced a much larger and complex policy mix within the wind power sector and the broader RE area. It should be noted that voluntary and coercive transfer occurs at varying degrees. Generally voluntary transfer exhibits stronger internal motivations to engage in policy learning from abroad and consequently policy transfer. Coercive transfer is based on stronger external forces that compel a domestic country to adapt a particular policy from abroad. China is eager to draw RE policy lessons from abroad as it recognises that RE, and more specifically wind power, requires policy support and one means of obtaining this support is through drawing lessons from abroad. There is a diversity of local and foreign policy actors from different regions and organisations involved in the policy learning, transfer and the post transfer process.

Table 9.2 provides a summary of the diverse policies transferred from abroad, the key actors involved in policy transfer, and the post-transfer learning or the 'result' of the policy learning in China.

Table 9.2 Policy Lessons and corresponding key actors and countries

Policy Levels	'From where': country; 'what': hard transfer (polices/ institutions)	'Why': forces behind policy learning/ transfer	'How': Type of Learning	'Who': key actors involved in policy transfer	'What': learning process (conceptual vs. technical learning); 'How': learning result
First policy level: Macro economic plans & RE target setting	▪ European Union targets for RE ▪ Germany's ▪ (Chapter 6, section 6.3)	▪ Voluntary	▪ Systematic learning: report indirect observation with local and foreign institutions and individuals	▪ China Renewable Energy Scale-Up program (CRESP- collaboration of World Bank, Global Environment Fund and the Government of China), Renewable Energy Development Center of Energy Research Institute (ERI) of the NDRC	▪ Technical learning ▪ Regulatory/quasi-regulatory framework: Renewable Energy Law (REL), Medium and Long Term Development Plan (MLDP)
		▪ Voluntary	▪ Interactive learning: legal framework support and recommendations	▪ German's Federal Ministry for Economic Cooperation and Development (BMZ) Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) and China's Center for Renewable Energy Development (CRED)	
	▪ U.S. regulatory institutions ▪ (Chapter 6, section 6.2)	▪ Voluntary	▪ Systematic learning: reports	▪ Regulatory Assistance Project (RAP), Lawrence Berkeley National Laboratory's China Energy Group, The Center for Resource Solutions (CRS)	▪ Conceptual learning ▪ Non-market mechanism (government agency): State Electricity Regulatory Commission (SERC)
		▪ Coercive	▪ Systematic learning: reports; interactive learning: study tours	▪ World Bank	

Policy Levels	'From where': country; 'what': hard transfer (polices/ institutions)	'Why': forces behind policy learning/ transfer	'How': Type of Learning	'Who': key actors involved in policy transfer	'What': learning process (conceptual vs. technical learning); 'How': learning result
First policy level: Grid policy	▪ US's PURPA (Chapter 6; 6.5)	▪ Voluntary	▪ Interactive learning: conference; systematic learning: reports	▪ RAP and Center for Resource Solutions (CRS)	▪ Technical learning ▪ Regulatory framework: Amended REL
	▪ Germany's Feed-in Law (StrEG) (Chapter 6; 6.5)	▪ Voluntary	▪ Interactive learning: collaboration; systematic learning: report	▪ CRESP, China's Renewable Energy Development Center of the ERI	
		▪ Voluntary	▪ Interactive learning: drawing up policy drafts	▪ China Sustainability Program, GTZ, CRED	
	▪ China's Renewable Energy Law (Chapter 6; 5.1)	▪ Voluntary	▪ Systematic learning: evaluation report; interactive learning: report meetings, seminars, forums	▪ RE experts, experts to the National People's Congress, National Development Reform Commissions, National Energy Administration, Ministry of Finance, Ministry of Science and Technology, Ministry of Housing and Urban-Rural Construction, SERC, and the State Grid,	
Second policy level: Technical standards	▪ U.S. Technical standards (Chapter 7; section 7.1)	▪ Voluntary	▪ Interactive learning: workshops, meetings	▪ CRS, CSEP, Lawrence Berkeley National Laboratory, Georgetown University, Black and Veatch, Fichtner Consulting, and Exeter Associate, China Electric Power Research Institute (CEPRI), The U.S. National Renewable Energy Laboratory	▪ Technical learning ▪ A) Quasi-regulatory framework: B/Z 19963-2005- Technical Rule for Connecting Wind to Networks; B) Specification of Dispatching and Operating Management for Wind Power (integration standard)

Policy Levels	'From where': country; 'what': hard transfer (polices/institutions)	'Why': forces behind policy learning/ transfer	'How': Type of Learning	'Who': key actors involved in policy transfer	'What': learning process (conceptual vs. technical learning); 'How': learning result
Second policy level: Technical standards	▪ German regulatory incentives for grid integration (Chapter 7; 7.1)	▪ Voluntary	▪ Interactive learning: collaborative programmes, workshops, and study tours	▪ GIZ, Federal Ministry for Economic Cooperation and Development (BMZ), China Wind Power Research and Training Project (CWPP), China Longyuan Power Group Corporation, the China Electric Power Research Institute, CEPRI	▪ Technical learning: see A&B above ▪ Institutional building (non-government): China Electric Power Research Institute; Suzhou Longyuan Bailu Wind Power Vocational Training Centre ▪ National Center for Testing and Research for Wind, Solar and Storage Technology
Second policy level: Technical standards	▪ The International Electrotechnical Commission Requirements for Grid Connected Wind Turbines (IEC 61400-21) (Chapter 7; 7.1)	▪ Voluntary	▪ Systematic learning: report	▪ State Electricity Regulatory Commission (SERC), SEPRI, Long Yuan Electric Power Group Corporation, China Southern Power Grid Technology Center, and China Power Engineering Consulting, China Greentech Initiative	▪ Technical learning ▪ Grid Connection Guidelines
Second policy level: electricity end user tariff	▪ UK's NFFO (Chapter 7; 7.2)	▪ Voluntary	▪ Systematic learning: report	▪ CRS, China Energy Research Institute (ERI)	▪ Technical learning ▪ End-user surcharge: electricity end-user tariffs to fund grid development
	▪ California's System Benefits Charge; American Energy Efficiency Competition Law; Germany's equal-isation scheme (Chapter 7; 7.2)	▪ Voluntary	▪ Systematic learning: reports	▪ CRS; ERI; CRESP, China's Renewable Energy Development Center of the ERI	

Policy Levels	'From where': country; 'what': hard transfer (polices/ institutions)	'Why': forces behind policy learning/ transfer	'How': Type of Learning	'Who': key actors involved in policy transfer	'What': learning process (conceptual vs. technical learning); 'How': learning result
Second policy level: Generation-side policies & grid policies	▪ The U.S. RPS & PURPA (Chapter 8; 8.1)	▪ Voluntary	▪ Systematic learning: studies; interactive policy learning: workshops	▪ Resource and Environmental Management, Simon Fraser University, China's Energy Efficiency and RE Division, State Development Planning Commission, and China Council Working Group on Energy Strategies & Technologies	▪ Technical learning ▪ Economic incentive to facilitate the market (quota systems): MMS for electricity generators and the grid
		▪ Voluntary	▪ Systematic learning: reports	▪ RAP, CRS	
	▪ The UK RO (Chapter 8; 8.1)	▪ Voluntary	▪ Systematic learning: report	▪ CRESP, China's Renewable Energy Development Center of the ERI	
	▪ Mandated Market Policy (Chapter 8; 8.1)	▪ Coercive	▪ Interactive learning: funding projects	▪ GEF	
Second policy level: generation-side policies (tendering policies)	▪ UK's NFFO	▪ Voluntary	▪ Systematic learning; reports	▪ CRS, for China's Energy Research Institute, Center for Renewable Energy Development and the State Development Planning Commission	▪ Technical learning ▪ Economic incentive to stimulate the market: competitive tendering rounds with local content criteria
	▪ UK's NFFO; Spain's local content requirement	▪ Voluntary	▪ Interactive learning & systematic learning: report	▪ Tsinghua University's Institute for Techno-Economics and Energy System Analysis (ITEESA) and the Center for International Climate and Environmental Research in Oslo (CICERO)	

Policy Levels	'From where': country; 'what': hard transfer (polices/ institutions)	'Why': forces behind policy learning/ transfer	'How': Type of Learning	'Who': key actors involved in policy transfer	'What': learning process (conceptual vs. technical learning); 'How': learning result
Second policy level: generation-side policies (feed-in policies)	▪ Germany's Feed-in Law (StrEG)	▪ Voluntary	▪ Systematic learning: reports; interactive learning: forums	▪ CRS, CRESP, Chinese Renewable Energy Industries Association, Greenpeace and Global Wind Energy Council, Germany government (BMU)	▪ Technical learning ▪ Economic incentive (subsidies)- Feed-in tariffs
	▪ US's PURPA	▪ Voluntary	▪ Systematic learning: reports	▪ CRS, CRESP, China's Renewable Energy Development Center of the ERI, Chinese Renewable Energy Industries Association, Greenpeace and Global Wind Energy Council	
	▪ Germany	▪ Voluntary	▪ Interactive learning: forums	▪ BMU	

Summary of table 9.2

As indicated in Table 9.2, the knowledge transferred in the policy learning process at the first and second policy level primarily occurred through systematic learning (explicit lessons usually found in reports) and interactions (face-to-face exchange based on explicit and implicit knowledge). Post transfer learning occurred as a result of the experiences gained at home and from abroad. Additionally, all of the examples of policy learning examined in this thesis were drawn from Western Europe and the United States. The direction of knowledge exchange primarily flowed from these countries into China. This does not indicate that other nations have not learnt from China's experience; but due to the focus of this thesis, the main evidence sought was policy learning from abroad in China.

In China's case, conceptual learning, a type of learning that led to the adoption of a new policy paradigm, occurred at the first policy. New energy institutions were a by-product of conceptual learning that occurred through both voluntary and coercive transfer. Other regulatory polices at the first level include voluntary learning for technical policy lessons, based on incremental changes, which helped establish RE targets and grid connection obligations in the REL and MLDP.

At the second level, technical policy lessons were drawn through voluntary policy learning for grid code standards, a type of quasi-regulation or interim legislation, as well as end-user tariffs, a supporting policy that pays for RE costs for grid and electricity generators. Other second level policies include economic incentive policies. Policy learning for the MMS quota, an economic incentive to facilitate the market for RE, occurred both on a voluntary basis and also as a result of coercive transfer by the Global Environment Facility. As of September 2012, China's MMS quotas have been in the process of implementation and quotas have been set for RE electricity generators, the grid and end-users. Voluntary lessons were drawn for tendering policies, an economic incentive policy to stimulate the market, as well as feed-in tariffs, a supply-side subsidy for RE electricity generators.

Collecting evidence

When a case for policy learning was made, the intent was not to track policy learning from abroad in the policy making process or to strictly focus on the specific details of the policy instrument. Rather, the objective of the research questions were to locate evidence of policy learning in order to verify or make known the role of policy learning in the formation of China's RE policies and to examine the nature of the learning process.

After searching for evidence of policy learning in particular policies in China, the next part of the research question could be answered on 'how' the transferred policies have evolved in

China at the first and second policy level. There was a deliberate attempt to avoid evaluating the transferred policies since policy evaluations were not a part of the thesis scope. Answering the 'how' question provides some understanding on the impact of transferred policies within one particular sector. Some of the policy measures or instruments may have had a positive impact on installed capacity but a negative impact on electricity generation, since a percentage of wind farms have not been connected to the grid. The negative impact does not immediately indicate that the policy failed, but rather greater enforcement for gird connection obligations may be required.

9.4 Contribution to the policy learning and transfer literature

Policy transfer from abroad to China

This study of policy learning from abroad, policy transfer and post-transfer learning in China's wind power sector widens the scope of countries that are typically studied in the policy learning and transfer literature. Most of the policy learning and transfer literature covers western countries and lesson drawing between countries with similar economies and political structures; but with the growing trend toward globalisation, more countries are collaborating despite differences in economic development and political ideologies. China has been drawing RE policy lessons and cooperating with the West despite dissimilar political ideologies and economic development stages.

Linking existing literature of lesson drawing to policy learning from abroad, policy transfer and post transfer learning processes

As seen in the evidence of systematic policy learning throughout Chapter 6 to 8, there are a number of systematic learning reports and studies that provided policy lessons that could be applied in China; but based on the empirical examples in this thesis, there were virtually no links that connected the policy lessons from abroad with policy learning and transfer concepts or studies that examined lesson drawing as part of the policy learning and transfer process. This thesis bridges the gap between the discussion of policy learning and transfer concepts with empirical studies of policy learning in China and also introduces the post transfer learning process as a part of the overall policy learning and transfer process.

The concept of post-transfer learning is not frequently mentioned in policy learning and transfer literature but shows an important aspect of the policy transfer process where the domestic learning coupled with learning from abroad leads to the implementation of hybrid policies, that are neither purely domestic nor foreign. Post transfer learning is not only a part of the domestic policy making process but also a part of the policy learning and transfer process. Policy lessons drawn from abroad are adapted through unique domestic learning experiences, and it is this mix

of domestic and foreign learning that can result in customised policies. Additionally, further policy lessons can be drawn from abroad after lessons are implemented in the domestic environment to address issues that arise during the implementation process. The process of continued lesson drawing from abroad indicates that policy learning does not abruptly end after transfer but continues as a part of the domestic policy-making process.

This thesis also provides additional components to existing policy learning and transfer frameworks. The policy transfer and post transfer learning framework developed in this thesis (see Figure 3.2: Policy transfer and post transfer learning framework) is based on Dolowitz and Marsh's policy transfer framework (see Figure 3.1: Dolowitz and Marsh's policy transfer framework). However, there are two other aspects not included in Dolowitz and Marsh's framework that have been added to the framework applied in this thesis. These aspects include examining how knowledge is transferred via systematic learning, observation, interaction, and experience and applying the multi policy-level approach to analyse post-transfer based on the policy function. At the first level polices coordinate and at the second level policies focus on diffusion and adoption.

9.5 Reflections and policy implications

*Policy experimentation in China's renewable energy policy mix*

First and second policies that were influenced from abroad were studied beginning from the 1990s up to 2012 (see Figure 9.2 below for the policies discussed in this thesis). During the course of this period and RE policies were formulated and evolved in China's dynamic energy policy environment. The thesis shows that a wide assortment of policy instruments were applied to a single renewable energy sector in China. Based on the policy learning examples referred to in this thesis (see Chapter 5), it is more common for countries to apply one main RE policy instrument (usually accompanied by supporting regulations) to promote the development of a particular RE sector.

China, instead, has taken the "muddling through approach" (May, 1992) in policy making by applying a number of policies and experimenting with the policy implementation through trial and error. The incremental approach includes establishing "quasi-laws" that could be amended after gaining sufficient experience (Heilmann, 2007) (discussed in 2.4.1). The gradual approach has allowed for adjustments in policies and regulations based on learning, which has contributed to building up a robust wind power sector. The array of policies began partly from policy experimentation based on policy learning and transfer experience and has developed into a set of policies that have been both directly and/or indirectly responsible for the wind power sector's unprecedented development.

In the case of China's RE policy learning and transfer process, policy experimentation played a role in amending policies to reflect the actual market conditions. The experimental approach applied in China's RE policies is not an undisciplined and strictly ad hoc process; rather it reflects a conscious process of policy learning based on foreign and local experience that has led to forming and revising policies that are more effective in promoting RE.

As seen in the Figure 9.2, there are fewer policies at the first policy level compared to the second policy level. There are three main overarching policies consisting of the Five Year Plan the Renewable Energy Law and the Medium and Long term Renewable Energy Development Plan (MLDP). The MLDP, in particular, is a quasi-regulatory framework policy that outlined RE targets and set the premises for the MMS generation and grid quotas at the second policy level.

Figure 9.2 Policies examined at the first and second level in this thesis
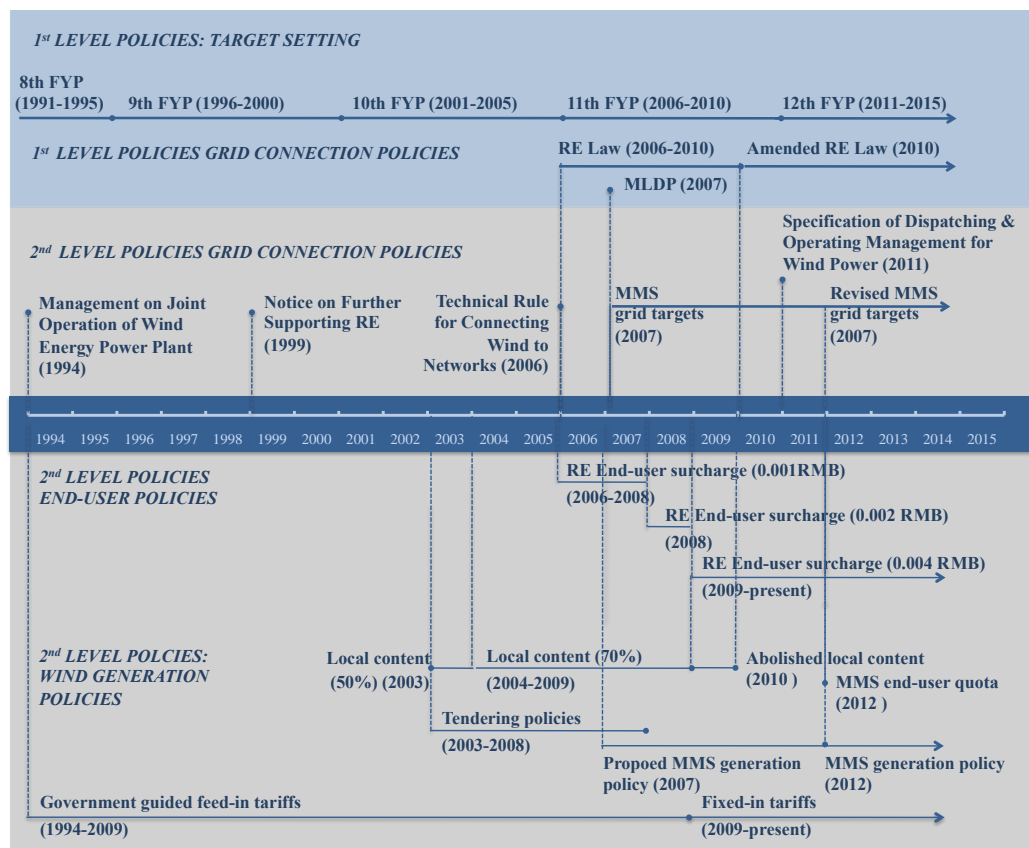
*blue shaded area represent first level policies and grey shaded area represent second level policies

Others second level grid policies comprise of two policies supporting and reinforcing grid connection for wind power and two main technical grid codes. One of the grid codes, the "B/Z 19963-2005, Technical Rule for Connecting Wind to Networks" was enacted as a quasi-regulation that provided technical guidelines for connecting wind power onto the grid. This code underwent revisions based on domestic policy learning experiences as it placed excess

burden on wind power generators (discussed in 7.1.1). End-user policies at the second level primarily consisted of end-user surcharges revised over a period and recently also included the MMS quotas announced for end-users in 2012. The end-user tariff were stated in the "Provisional Administrative Measures on Pricing and Cost Sharing for Renewable Energy Power Generation" a quasi-law indicating that RE end-user tariff should be revised on a timely basis based on RE development. Based on the experimental approach, policy adjustments were made to grid codes for RE grid integration and modifications were also made to end-user tariffs to more effectively fund the cost of RE electricity generation.

The complications lie in the second policy level for electricity generator where there are at least three distinct policy instruments, each with its unique development trajectory. Although the policy instruments were market incentives and are not quasi-laws, these policies were implemented using an experimental approach. Fixed feed-in tariffs were not immediately set when tariffs were implemented, as the government did not have a clear indication on wind power pricing. RE electricity generation tariffs were first implemented in 1994 and the government approved the wind power tariff prices for each project. After nine years of implementing government-approved tariffs, the Chinese government introduced concession projects to run alongside the government-approved tariffs from 2003 to 2008. The concession projects also included local content criteria to further develop the local wind power sector.

RE electricity generation tariff prices were established on a project-by-project basis set by the government through concession bidding. This was a means of experimenting with wind power pricing until sufficient experience was gained to established fixed tariffs that reflected the cost of wind power and considered variations such as wind resource potential across different regions. China applied the general concepts from a mix of the German FITs and the UK NFFO concession projects and also included fifteen years of its own experimental policy learning to establish fixed feed-in tariffs. Although there were some issues with inconsistent tariff pricing and ambiguities in the local content criteria for tendering policies, tariffs and concession policies are generally viewed as effective policies that helped developed the wind power sector.

Expanding the policy mix: when to stop?

Due to the lack of experience in implementing market-based instruments within the RE sector, China has taken on an experimental approach to its RE policy development and has relied on policy lessons from abroad to provide insight on how policy instruments could potentially impact its domestic RE sector. As a result, an extensive policy mix from abroad has been implemented in attempt to deal with the multi-dimensional issues of RE development (i.e., target setting, grid development, generation-side policies). This has created a complex policy mix within the wind power sector and the wider RE and energy sector.

As expected, some of the policies complement each other, such as tendering policies and local content requirements or feed-in tariffs and grid connection obligations. However, difficulties arise when the FITs and a complicated MMS policy are introduced in the policy mix within the same time frame as FIT and covering the same group of RE electricity generators. Other countries such as the UK have implemented both a quota and FITs for various sized RE projects (see policy interactions in 9.6: Further areas of research); but China's policy combinations are far more complex and usually comprise of multiple targets that overlap with other policy objectives.

Since 2007, policy makers in China first set their intentions to implement the MMS in the Medium and Long Term Development Plan that required 3 percent of the grid's electricity supply to be generated from RE (excluding hydro power) by 2020; but the policy has not been fully implemented. There are several complexities that need to be resolved. Insiders in the industry argued that if clear, mandatory quotas were not allocated to the grid, there would be continued discrepancies in the generation and uptake of wind power. Pengfei Shi noted that a 'decomposition' or the break down of broader national targets into detailed targets at provincial or project level was required (China Energy Net, 2009).

In 2012, a revised MMS quota was announced for generators, grid companies and end-users. The quota for each target group was further divided into the following:

- two RE generation targets based on installed capacity and electricity generation;
- the largest grid companies with different quotas depending on their size and coverage area.; and
- end-users quotas according to four defined regions (see 8.1.3).

In total, there are at least ten separate quotas within the revised MMS policy and there are currently no details on the implementation timeframe and process, as well as no clear indication of how these quotas will be monitored and enforced. The government may have already established an implementation plan and will unveil this in the near future or it may apply its trial and error approach for the MMS policy. But at China's current RE development stage, is it necessary to apply additional instruments to the proven, existing polices and risk upsetting the policy mix? Additionally, introducing the MMS quotas would require monitoring and enforcement – an area that energy institutions in China have been struggling to cope with, particularly in enforcing grid connections.

The next part will discuss some of the institutional issues the energy and RE sectors face, how they have been impacting the RE policy development, and how they could hinder the future implementation of the MMS quotas.

Institutional building

The rapid formation of RE policy and energy institutions has created a gap between policy formation and policy implementation. China continues to learn from its own experiences but also continues to look abroad for other policy solutions in addressing its grid connection issue. One of the challenges the Chinese government faces with implementing RE policies and overseeing grid development is finding a means to effectively mobilise its human resources in its existing government bodies to fully implement policies such as grid obligations and pending RE policies such as the MMS quotas. The unclear responsibilities between energy institutions adds to the difficulties of implementing policies and enforcing penalties, particularly due the large policy mix in China's RE sector and insufficient human resources in the energy institutions to implement and monitor the growing number of policies.

For instance, the State Energy Regulatory Commission (SERC) and the National Energy Administration's (NEA) functions and responsibilities in the energy sector overlap as both organisations are officially responsible for participating in energy policy making, formulating development plans, monitoring and reviewing energy investment projects, and recommending and reviewing pricing adjustments (discussed in 6.3.1).

SERC is confronted with a serious challenge of enforcing regulations as it lacks "teeth" and does not have sufficient support from the understaffed NEA. The NEA has a monumental task of harmonising and managing energy related activities including planning, development and evaluation in energy policy (discussed in 2.5). These tasks spread across around 100 personnel working in the NEA leaves limited resource for supporting SERC in its monitoring and enforcement role. There is also another layer of bureaucracy in the energy sector. The National Energy Commission NEC was created in 2010 and placed directly under the State Council and was led by Premier Wen Jiabao. The NEC was intended to be a super ministry that would oversee energy strategies and coordinate all the government bodies involved in energy related issues and the NEA was to continue providing administration and implementation support in the energy sector as the NEC's administering arm (discussed in 2.5). However, in practice, the NEC has limited authority as the NDRC's Pricing Bureau still holds power over pricing, which is the NDRC's "main instrument of macro-economical control". Retaining power over energy pricing enables the NDRC to ensure that another government body cannot adjust prices that contradict the NDRC's overarching goals, including inflation control (Downs, 2008, p. 44). It remains to be seen over the next years whether or not the NEC the NEA, its administering body, will differ from its predecessors and succeed in coordinating the fragmented government bodies of energy sector in order to effectively implement its existing and pending RE policies.

9.6 Further areas of research

Policy Interactions

This thesis covers a variety of policies examined individually but a separate direction of research related to policy learning and transfer can examine the interactions of various policies in the post transfer learning process. As discussed above in 9.5 "Expanding the policy mix: when to stop" the experimental approach has contributed to an extensive policy blend of instruments and the MMS quota with three targets for the grid, electricity generators and end-users, has yet to be fully implemented along with feed-in tariffs and other RE and grid connection policies. Understanding how these policies interact with each other can help to identify policy synergies, overlaps or negative unintended impacts of the interacting polices.

Policy interaction literature can be referred to as examples of studying how policy interacts in China's RE sector. For example Smith and Sorrell's (2001) study on "Interaction between environmental policy instruments: carbon emissions trading and Integrated Pollution. Prevention and Control" draws attention to the importance of studying policy interaction while drafting new policy instruments. The policies examine the potential interaction of the Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC) and the carbon emissions trading scheme outlined in the Kyoto Protocol, which were not yet implemented at that time. Policy interactions were examined through identifying the policy objectives, the "features and dynamics" of the policy instrument and the "conditions for positive and negative interactions" (Smith and Sorrell, 2001).

Considering the existing policy mix prior to introducing a new policy instrument could be useful for policy makers in China since the MMS quota, which could potentially be accompanied with a trading certificate scheme, has not yet been fully implemented and must exist alongside the FITs.

Examining policy learning at the third policy level

The policy learning process at the third policy level can be examined through the lens of policy experimentation or pilot projects that were carried out on setting provincial RE targets from a bottom up approach (the third policy level). Sebastian Heilmann describes policy experimentation as "a purposeful and coordinated activity geared to producing novel policy options that are injected into official policy making and then replicated on a larger scale" (Heilmann, 2007, p. 3). More specifically, experimental policies are implemented first at a smaller scale and later formed into broader laws if proven successful. Tracking the progress of RE policy experimentation at the third level, such as examining if pilot projects contributed to establishing provincial targets across China, could be an interesting policy learning case.

Provincial and municipal level policies and initiatives as well as other specific policies and incentives at the third policy level were not covered in the thesis but could be further studied. The concept of post-transfer learning in the area of RE target setting in China could be examined at the municipal and provincial level from a bottom up perspective based on the cumulative policy learning experiences for developing provincial grid targets. For instance, there have been recent studies contributing to the overall knowledge and development of provincial level targets, as seen in the project "Total target allocation mechanism of renewable energy and its validation", headed by Zhen Liu[31] and funded by the National Natural Science Foundation (2011-2013). The project[32] draws experience on RE planning policies from California and the European Union as well as RE models, including the RETScreen software developed by the Government of Canada. RE development scenario were created at the provincial level based on RE project level data and considered factors such as RE resource, technology, economy, population and other factors (Z. Liu, personal communication, August 2010). Such studies that consider the unique conditions of each province contribute to the cumulative knowledge that leads to the development of the newly proposed provincial level quotas, a third level RE policy.

Applying Lessons to other sectors in China and other Nations

The case of policy learning and post transfer learning process in China's wind power sector can be generalisable to a certain extent for other RE sectors in China. A thorough documented study of the wind power sector can be compared and contrasted to other large-scale RE technologies such as off-shore wind and solar power. In the solar sector, the government has currently been pushing for the development of industrial-scale solar power plants and can look toward wind power polices to examine if the lessons could be applicable in the solar sector. For instance, the wind power case study could provide insights on connecting large-scale solar farms to the grid and lessons could be drawn in the area of price setting to prevent over or undervaluing solar electricity.

Additionally, policy learning and transfer frameworks and lessons could be applied to other BRIC countries in similar stages of development. For instance, India has a rapidly growing wind power sector and is a key player in Asia's wind turbine manufacturer sector (GWEC,

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[31] Zhen Liu is a Professor at the Low-Carbon Energy Research Center, Chongqing University of Technology and was interviewed for this thesis.

[32] This project provides the methodology for RE targets based on results from another project, "The pathway and support system to achieve China's 2020 greenhouse gas control goal", headed by Prime Minister Wen Jiabao and supported by the NDRC and the Ministry of Science and Technology. Xiliang Zhang from Tsinghua University carried out the project between 2010-2011 collecting data from 973 RE projects and proposed RE targets that were revised by both the central and local governments. The research results of the NDRC and MOST project contributed to the newly proposed MMS end-user quotas in 2012(Z. Liu, personal communication, September 2012)

2012). India's progress in the wind power sector could be compared to China's progress and analysed through policy learning and transfer concepts. Such comparative studies could shed light on the impact and significance of lesson drawing from abroad for emerging markets. Likewise, emerging economies from Eastern Europe could benefit from China's example. Poland, for instance, had a similar background with the Soviet influenced/controlled planning system and has been experiencing an expanding economy in the recent decade. Poland also has a high reliance on its domestic coal supply, but unlike China, it has not developed a robust RE energy sector despite mandatory obligations to meet EU targets, which it will not likely reach by 2020 given its current development path.

China's unprecedented growth in the RE energy sector provides a persuasive argument for other nations to study its case and consider drawing lessons from its experiences as an emerging nation highly dependent on traditional forms of fossil fuels. But learning does not have to be limited to emerging countries and could be applicable to other countries such as Canada. Although there are ambitious RE policies at the provincial level (i.e., Ontario's feed-in tariffs), national policies tend to favour fossil fuels and greater efforts are needed to promote RE. Furthermore, Canada has abundant wind resources but only ranks 16th worldwide for wind power electricity generation. Like China, Canada is a geographically vast country and has an energy sector dominated by monopoly-like energy players and also faces some issues with grid connection, codes and standards (Canadian Centre for Energy Information, 2012). Drawing lessons from China can be helpful in providing insights on similar issues and also serve as a case study of how a geographically vast country that is highly dependent on natural resources can make dedicated efforts to promote the development of its domestic RE sector.

There may be a number of similarities between China's energy policy learning examples but the lessons may not always be directly applicable to other countries due to the individual context within each country. For instance, Canada has an abundant supply of fossil fuel compared to its domestic consumptions patterns and is less motivated to invest in RE sources. China, on the contrary, is struggling to provide sufficient energy to meet the demand of its large population and industries. Regardless of the varying contexts, there are some broader policy lessons that can be considered.

Overall, the policy learning, transfer and post transfer framework proposed in this thesis could be applied to examine transferred policies in longitudinal studies over an extended period of time. As Dolowitz (2009) states, a majority of studies "examine policy transfer as if it ends with the passage of a policy" (Dolowitz, 2009, p. 329) (discussed in Chapter 3, section 3.2). However, in practice, transferred policies continually change as a result of internal and external policy lessons and the transferred policies become more integrated in the home environment

over time. Rather than examining policy transfer as a stand alone incident that ends after polices are implemented, the proposed framework in this thesis considers the continuous learning from internal and external policy lessons that occur over a period of time after policies have been transferred.

Additionally the learning that occurs after policy transfer consists of the unique lessons that are continuously refined to the specific conditions within the country. These specific policy adjustments cannot be directly and fully duplicated in other countries, as the post transfer process reflects the implicit knowledge developed from the learning process. The policy learning and post transfer analysis process, however, can be generally applied as a systematic method of addressing policy problems, seeking experiences and solutions from abroad as well as applying and adjusting the policy according to the domestic conditions.

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Appendix A: Sample Interview Guideline

Interview Question Guideline:
The Role of Policy Transfer in China's Renewable Energy Policy Formulation

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Date: Organization:
Contact Name: Contact E-mail:
Contact Position: Contact Telephone:
Notes:

Renewable Energy Policy

The development of renewable energy (RE) policy has been a gradual process beginning in 1983 with policies on rural electrification, wind farm guidelines in 1994, and studies into renewable energy portfolio and feed-in tariffs models in the early 2000's.

1. What do you think has been the largest driving force in the development of renewable energy sector over the past several decades?

International Cooperation in formulating China's Renewable Energy Policy

2. In your opinion, which local/foreign groups are instrumental in promoting policy transfer from abroad and how have the groups impacted renewable energy policy transfer?
- Bureaucrats and civil servants
- Policy entrepreneurs and experts
- Corporations and consultants
- Pressure groups
- Academia and think tanks
- Governmental and non-governmental international organizations and institutions
- Foreign Diplomats
- Others?

3. How have general foreign ideas and opinions on renewable energy shaped China's attitude towards renewable energy over the past decades?

China's renewable energy policies promote the local industries by requiring projects to hold a certain percentage of Chinese content in order to be eligible for subsidies/other benefits.

4. Do you think that such regulations protecting the Chinese market will hinder the development of the overall renewable energy sector since such policies may limit the participation/investments of foreign companies? OR

5. Do you feel that the policies are necessary to help develop the local renewable energy manufacturing sector and promote the overall renewable energy sector? Other thoughts?

6. How has international cooperation at the industry and firm level influenced the development of the renewable energy sector?

Renewable Energy Technologies- Focus on Wind Power

7. Which policy mechanisms do you feel have been the most beneficial in developing the renewable energy sector?

8. How has the global financial crisis affected the growth of the wind power sector?

9. Do you think that grid connection poses as a barrier to wind power installations? Why or why not?

10. A number of Chinese wind power companies have successfully gained a substantial share of the market over the past few years out growing establish global players. What do you think has been the largest driving force in the growth of Chinese wind power companies?

China' installed wind capacity appears to be impressive but numbers may not accurately reflect the overall energy generating efficiency. Tendering policies had pushed down tariffs leading to little or non-existing profits. As a result, some developers have attempted to cut costs by using lower quality materials, which increases the long-term operational and maintenance costs.

11. How has the government addressed the low wind tariff issue and continue to maintain internationally recognized technological standards for the wind power sector?

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Appendix B: Measuring Wind Power Development Using Installed Capacity, Capacity Factor and Electricity Generation

Installed capacity provides a top-level view of wind power growth but does not give an indication of the actual wind power output. Other indicators such as electricity generation or the capacity factor should be used to analyse how transferred polices have impacted the progress of wind power development in China. Since this data is not available or unreliable, it can be determined using assumptions. Pengfei Shi indicates that electricity generated can be estimated by multiplying capacity (MW) by the number of operational hours per annum, which he estimated as 2000 hours in China. For instance in the year 2008, wind power electricity generation is calculated as follows:

$$Electricity Generated\ (MWh) = Installed\ Capacity\ (MW) \times Actual\ Operating\ Hours$$

$$Electricity\ Generated\ (MWh) = 12,200\ MW\ x\ 2000\ hours = 1,134,000\ MWh$$

Another metric that can be used to calculate electricity generated is the capacity factor (CF). The capacity factor is defined as the "the actual output over a period of time as a proportion of a wind turbine or facility's maximum capacity" (National Wind Watch). The capacity factor provides a percentage of wind power output measured in hours over a given time span, usually over one year. If the estimated operating hours in a year amounts to 2000 hours, then the capacity is calculated as follows:

$$Capacity\ factor\ (\%) = \frac{Actual\ operating\ hours\ per\ annum}{Total\ available\ operating\ hours\ per\ annum}$$

$$Capacity\ factor\ (\%) = \frac{2000\ hours}{365\ days \times 24\ hours} = 23\%$$

Aside from the average operating hours, the average capacity factor can be another useful metric for estimating electricity generation if electricity generation data is unavailable. For instance if the capacity factor for wind power output is 23% then the electricity generation in 2008 is as follows:

$$Electricity\ Generated\ (MWh) = [Installed\ Capacity\ (MW)] \times [Theoretical\ Operating\ Hours \times Capacity\ Factor\ (\%)]$$

Electricity Generated = 12,200 MW x (365 days x 24 hours x 23%)= 1,134,000 MWh

The average capacity factor observed in the wind power industry falls between 15-30 percent and can be used to approximate the lower and higher ranges of wind power electricity generation in China (National Wind Watch, n.d.). Table B.1 presents three scenarios of the wind power electricity generation in China using a capacity factor of 15, 23 and 30 percent between 1994-2010.

Table B.1: China's Wind Installed Capacity and Total Electricity Output

Year	Wind Installed Capacity (MW)	Total Electricity Output (MWh)	Total Electricity Output (CF=15%) (MWh)	Wind Electricity Output (CF=23%) (MWh)	Total Electricity Output (CF=30%) (MWh)	Wind as % Total Electricity Output (CF=15%)	Wind as % Total Electricity Output (CF=23%)	Wind as % Total Electricity Output (CF=30%)
1994	26	928,080,000	34,164	52,000	68,328	0.004%	0.006%	0.007%
1995	38	1,007,730,000	49,932	76,000	99,864	0.005%	0.008%	0.010%
1996	79	1,080,020,000	103,806	158,000	207,612	0.010%	0.015%	0.019%
1997	170	1,134,470,000	223,380	340,000	446,760	0.020%	0.030%	0.039%
1998	224	1,166,200,000	294,336	448,000	588,672	0.025%	0.038%	0.050%
1999	268	1,239,300,000	352,152	536,000	704,304	0.028%	0.043%	0.057%
2000	344	1,355,600,000	452,016	688,000	904,032	0.033%	0.051%	0.067%
2001	400	1,471,660,000	525,600	800,000	1,051,200	0.036%	0.054%	0.071%
2002	468	1,640,470,000	614,952	936,000	1,229,904	0.037%	0.057%	0.075%
2003	567	1,910,580,000	745,038	1,134,000	1,490,076	0.039%	0.059%	0.078%
2004	764	2,203,310,000	1,003,896	1,528,000	2,007,792	0.046%	0.069%	0.091%
2005	1,266	2,500,260,000	1,663,524	2,532,000	3,327,048	0.067%	0.101%	0.133%
2006	2,599	2,865,730,000	3,415,086	5,198,000	6,830,172	0.119%	0.181%	0.238%
2007	5,900	3,281,550,000	7,752,600	11,800,000	15,505,200	0.236%	0.360%	0.472%
2008	12,200	3,466,882,000	16,030,800	24,400,000	32,061,600	0.462%	0.704%	0.925%
2009	25,800	3,681,186,000	33,901,200	51,600,000	67,802,400	0.921%	1.402%	1.842%
2010	44,733	4,207,160,000	58,779,543	89,466,580	117,559,086	1.397%	2.126%	2.794%

Source: National Bureau of Statistics of China, 2010, 2011; China Electricity Yearbook, 2008; 2010;2011; Li JunFeng, 2006; Wind Power Monthly, 2008; Global Wind Report, 2008 & 2009

The scenarios give a broader picture of the probable wind power electricity generation ranges. The results vary widely depending on the capacity factor and may underestimate or exaggerate output.

Figure B.1 provides an illustration of the wind power output shown in Table B.1, showing a more exaggerated gap between the lower and higher ranges as capacity increases.

In the lower scenario (capacity factor of 15 percent), wind power comprises of less than 1.4 percent of the overall electricity generated in 2010 compared to the higher scenario (capacity factor of 30 percent) that makes up nearly 2.8 percent of the overall electricity generation. A difference of 15 percent between the lowest and highest capacity factor amounts to wind power contributing to merely one and three quarters more towards the overall electricity output.

Figure B.1: China's Wind Installed Capacity and Total Electricity Output
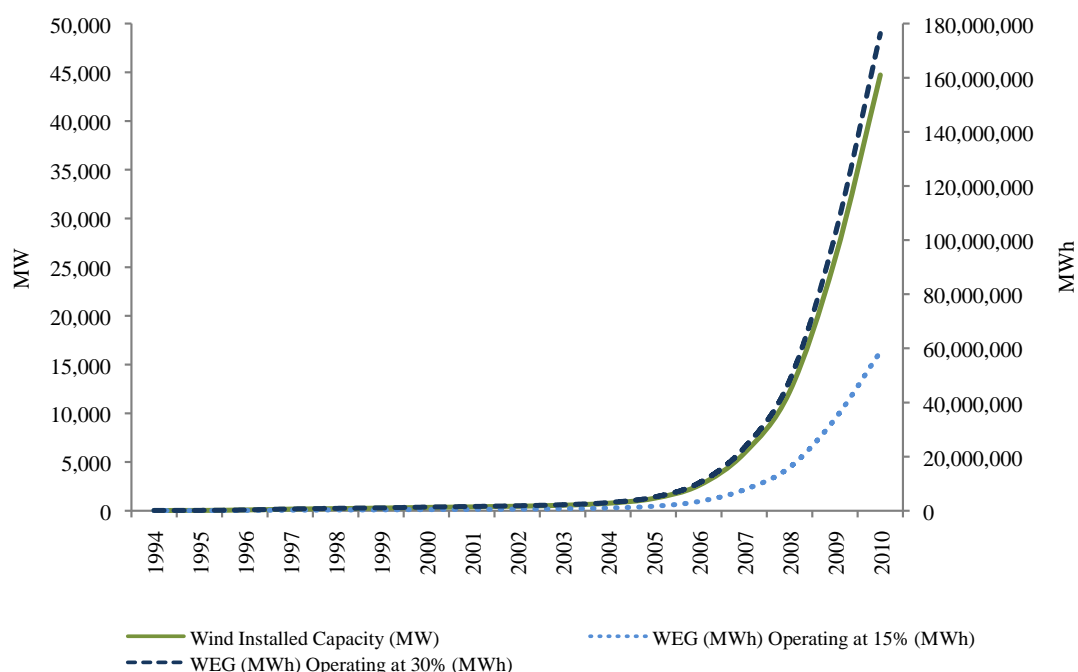
*WEG= wind electricity generation

Source: National Bureau of Statistics of China, 2010; Li JunFeng, 2006; Wind Power Monthly, 2008; Global Wind Report, 2008 & 2009

The capacity factor can provide an approximate indication of wind power electricity generation but the results may vary too much to provide any accurate view of wind power electricity generation. These scenarios can be compared to the electricity statistics provided in the Electricity Yearbooks shown by the shaded area in Table B.2.

Table B.2: China's Wind Electricity Generation and Total Electricity Output

Year	Total Electricity Output (MWh)*	Wind Electricity Generation (MWh)*	Wind Electricity Output (CF=15-30%) (MWh)	Wind as % Total Electricity Output*	Wind as % Total Electricity Output (CF=15-30%)	Capacity Factor*
2006	2,865,730,000	2,840,000	3,415,086 - 6,830,172	0.10	0.119% - 0.181%	12.5%
2007	3,281,550,000	5,700,000	7,752,600 - 15,505,200	0.17	0.236% - 0.360%	11.0%
2008	3,451,013,000	13,079,000	16,030,800 - 32,061,600	0.38	0.462% - 0.704%	12.2%
2009	3,681,186,000	27,615,000	33,901,200 - 67,802,400	0.75	0.921% - 1.402%	12.2%
2010	4,207,160,000	44,620,000	58,779,543 - 117,559,086	1.06	1.397% - 2.794%	11.4%

* From China Electricity Yearbook

Source: National Bureau of Statistics of China, 2010, 2011; Li JunFeng, 2006; Wind Power Monthly, 2008; Global Wind; Report, 2008 & 2009: CWEA, Chinese Wind Energy Association, 2010; 2011; China Electricity Yearbook, 2008; 2010

When the capacity factor is calculated using the wind electricity generation data provided in the Electricity Yearbook, the values are lower than the estimated industry average used in the

scenarios. This could be a result of varying wind resource, wind farm down times or grid connection issues. In fact, the NDRC has recognised that the grid access constraints has lowered operational capacity factors (Ip & Chu, 2010). Also, the values derived from the Electricity Yearbook, including wind electricity generation statistics and wind as a percentage of total electricity output, are lower than the scenarios. Collecting electricity output data provides more information on generation, transmission and grid connection and can help policy makers to evaluate the first level policy goals, identify problem areas as well as adjust infrastructure investments, targets and second level policies accordingly.

The problem of setting output based targets is brought up in the amended 2009 REL. According to the revised REL, a quota system will be set based on a percentage of electricity generated from RES (discussed further in Chapter 8). Carrying forward the quota system "hints at a change of policy, changing the metric of renewable energy targets, [as well as] shifting the focus from renewable energy capacity installed towards the amount of electricity actually generated from renewables" (CWPC, 2012). As a basic criterion to developing a RE framework, target setting is a necessary policy tool at the macro level, which has been largely responsible for developing the wind power electricity generation sector.

Appendix C: Details on wind generation capacity and electricity consumption at the provincial level

Table C.1 and C.2 lists the provinces with the highest wind power generation capacity and the highest electricity consumption. The top electricity consuming provinces, accounting for 64 percent of China's demand while the top wind power generators make up over 86 percent of the total national wind power generation capacity.

Table C.1 Top Wind Power Generation Provinces (2006)

Province	Wind Power Generated (kw)	% of Total Wind Power Generated in China
Inner Mongolia	**508890**	**26.47%**
Liaoning	*232260*	*8.72%*
Hebei	*325750*	*8.32%*
Jilin	**252710**	**10.37%**
Jiangsu	*108000*	*4.97%*
Gansu	**12775**	**5.73%**
Xinjiang	**206610**	**5.07%**
Shandong	*144600*	*5.93%*
Ningxia	**159450**	**6.01%**
Guangdong	*211140*	*4.87%*
Total wind generation of top provinces		**86.46%**

Source: Pengfei, 2007

Table C.2 Top Electricity Consumers by Province (2006)

Province	Electricity Consumption (10 million kwh)	% of Total Electricity Consumption in China
Guangdong	3004.03	11%
Jiangsu	2569.75	9%
Shandong	2272.07	8%
Zhejiang	1909.23	7%
Hebei	1734.83	6%
Henan	1523.5	5%
Liaoning	1228.27	4%
Shanxi	1097.68	4%
Sichuan	1059.44	4%
Shanghai	990.15	3%
Inner Mongolia	884.91	3%
Total electricity consumption of top consumers		**64%**

Source: National Bureau Of Statistics of The Peoples Republic Of China, 2006

The provinces of Guangdong, Jiangsu, Shandong, Hebei and Liaoning have a high electricity demand and greater motivation to invest in grid connection for wind power and, in general, increased capacity from other energy sources in order to meet their electricity needs.

Guangdong and Jiangsu, the largest electricity consumers, import between 78-82 percent of their energy supply respectively primarily to support their industrial sector, which makes up 67 percent and 80 percent of the electricity consumption respectively. Investing in grid infrastructure for wind power development would be highly beneficial for improving energy security within the provinces particularly for Guangdong. In 2011 and a part of 2012, the power restrictions were placed on energy intensive and polluting industries in Guangdong and four other provinces due to power shortages (Reuters, 2011). The other provinces, Shandong and Hebei, have around 50 percent of the coal imported from other provinces while Liaoning imports a large majority of its energy needs from Heilongjiang and Inner Mongolia.

On the other end of the electricity consumption scale Jilin, and the autonomous regions Xinjiang and Ningxia each make up around 1 percent of China's electricity consumption. As major wind power generator Jilin is located closer to electricity demand and its network is connected to Hebei a major electricity consumer (SERN, 2010). Xinjiang is located in the far west and transporting electricity, for instance 4000 km from the Shanghai coast, would be prohibitively expensive and would entail constructing ultra-high voltage transmission lines (Song, 2011).

As an energy resource-rich province and a larger electricity consumer, Inner Mongolia has a high level of self-sufficiency and supplies electricity to other provinces as China's major wind power producer. Gansu also has a high level of self-sufficiency but has a lower level of electricity consumption and is an exporter of energy. The provinces in this area is endowed with a high wind resources and wind power investments but are not major electricity consumers, as Inner Mongolia accounts for 3 percent of the overall country's electricity usage while Gansu accounts for 2 percent of the country's electricity usage. Like Xinjiang, these provinces are also located further away from the areas of high electricity consumption, which can be a serious problem since major investments are needed to transport electricity to other provinces (SERN, 2010).

Appendix D: Detailed data on the EU and UK case study

Figure D.1 Share of renewable energy in gross final energy consumption and targets in the EU
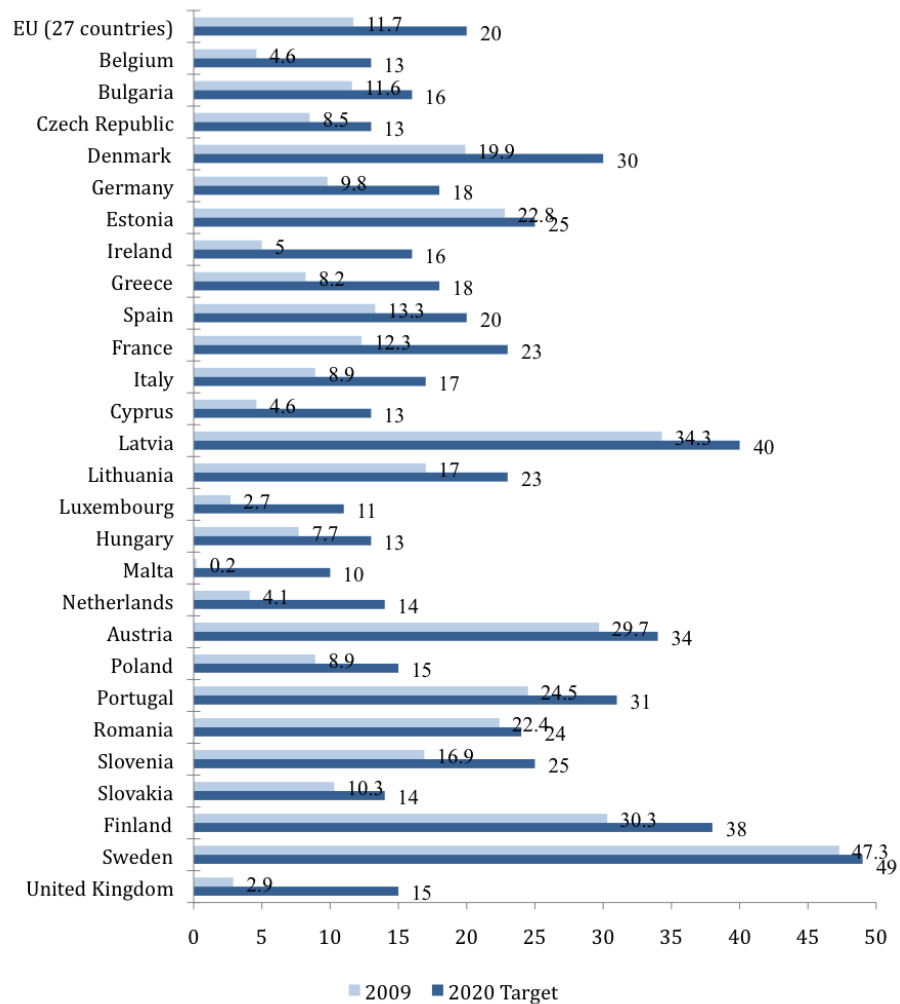
Source: Eurostat, 2011

1. RO Pricing and costs

The ROC system provided an attractive incentive for existing RE technologies rather then newer more costly technologies that require long-term subsidies. The RES developers supported the RO as the market-based system was thought to be more economical for customers (Toke & Lauber, 2007).

Table D.1 provides an overview of the RO pricing for certificates from the beginning of its enactment to the end of 2009.

Table D.1 ROC obligation and pricing in GBP/MWh in England and Wales

	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
Total target ROCs	867,596	12,387,720	14,315,784	16,175,906	19,390,016	22,857,584	25,944,763	26,971,916
Total ROCs submitted	4,973,091	6,914,524	9,971,851	12,232,153	12,868,408	14,562,876	16,813,731	18,747,129
Obligation met by ROC (%)	55	56	70	76	66	64	65	70
Average Market ROC price	47.12-48.21	45.93-52.07	46.12-45.72	39.16-40.62	44.81-48.12	49.27-53.27	51.34-52.90	45.52-49.16**
Buy-out price (£/ROC)	30.0	30.51	31.39	32.33	33.24	34.30	35.76	37.19
Redistributed premium price (£/ROC)	15.94	22.92	13.66	10.21	16.04	18.65	18.61	15.17
ROC value (£) to supplier	45.94	54.43	45.05	42.54	49.28	52.95	54.37	52.36

* Average Auction price within a given date in October of the year and in July of the following year

** Average Auction price within a given date from October 2009 and in June 2010

Source: OFGEM, 2005; 2009; 2010;e-roc, 2011

The value of the ROC for suppliers ranged from 42.54-54.43 between 2002-2010 GBP/MWh, higher then average prices of the forth and fifth NFFO rounds, which had an average price of 34.6 and 27.1 GBP/MWh respectively. The total ROC value to the supplier is determined by adding the buy-out price and the redistributed premium resulting in an attractive compensation for large-scale RES wind generators. If there are insufficient supplies of electricity produced from RES, the price of the ROC should increase according to supply and demand.

Due to the shortage of RE generation, the short-term certificate prices have increased. In theory, there are restrictions to price increases since the buy-out penalty sets a ceiling on the price of ROC. In practice, the ROC market price often exceeds the buyout prices because suppliers do not receive the redistributed premium if they only buyout the ROC obligation. If suppliers purchase the ROC in the market, they would benefit from the redistributed premium. The ROC market price, however, does not exceed the ROC value to the supplier (e-rok, 2011). For instance, the buy-out price in 2009-10 was £37.19, while the market price was between £45.52-£49.16 but did not exceed £52.36, the total value of the ROC to the supplier. Suppliers that did not meet the RO in 2010 could purchased ROCs at the market price, between £8.33-£11.97, higher than the buyout price. However, because the redistributed premium was £15.17, suppliers still gained between £3.2-£6.84.

The ROC value is determined by the redistributed premium, which is in turn influenced by the RE supply and demand. As the amount of electricity generated from RES reaches the RO target, the recycled premium decreases and will eventually reaches zero when the yearly RO targets are fulfilled (Mitchelle, 2004). The chart indicates that the ROC only met 55-76 percent of the RO, thus the ROC market price will continue to be higher than the buy-out prices due to the redistributed premium.

The variability of prices leads to an uncertain long-term market development and increases investors' risk. Investors then demand higher compensation due to the risk, thereby increasing the overall costs of RE. Additionally RE generators also face uncertainties since there are risks that utilities may not purchase electricity from RES beyond their obligation levels if the RO targets are met. The uncertainties can lead to increased cost for the consumer, the very aspect the RO policy should prevent (Toke & Lauber, 2007; Mitchelle, 2004).

Aside from the overall costs, RO tend to promote the development of industrial scale and lowest cost RE technologies such as onshore wind and biomass with its single ROC price. Implementing RO can also be more costly compared to feed-in tariffs. According to a study "Policy frameworks for renewables" conducted by Carbon Trust, an independent governmental organisation, the cumulative subsidies for RO up until 2020 would cost 49 GBP/MWh, while a RE development premium (i.e. feed-in tariffs) would cost around 40 GBP/MWh (The Carbon Trust and L.E.K. Consulting, 2006). From 2008, the government began to address the disproportional investments in the more economical technologies by introducing feed-in tariffs in the 2008 Energy Act, which was implement later in 2010. FITs would be allocated for small, decentralised energy facilities while RO would promote larger scale RE projects.

In 2009, the government introduced "banding provisions" which were differential rates for technologies in the 2009 Renewables Obligation Order. The banding provisions "govern the amount of electricity in respect of which each ROC is to be issued" (Crown, Statutory Instruments No. 785 2009).

Table D.2 lists the band provisions and the electricity amount allocated to one ROC for some of the main RE technologies.

Table D.2: Amount of electricity (MWh) stated in ROC for each technology band

Technology Band	Amount of electricity in one ROCs (MWh)
Electricity generated from landfill gas	4
Electricity generated from sewage gas Co-firing of biomass	2
Onshore wind Hydro-electric Co-firing of energy crops Energy from waste with CHP	1
Offshore wind	2/3
Wave Tidal-stream Solar photovoltaic Geothermal	1/2

* The chart does not include all technologies listed in the 2009 Draft RO Order

Source: Crown, Draft Statutory Instruments 2008

The bands are periodically reviewed to allow for adjustments. For instance under the 2009 RO bands, the costs of implementing the RO are expected to exceed the RO levy budget by around £130 million and £290 million in 2013-14 and 2014-15 respectively. The costs incurred are a result of excess compensation for lower cost technologies (DECC, October 2011). DECC has proposed new bands and has carried out a consultation over the period of October 2011 to January 2012 to examine the potential impacts of the proposed bands.

Pöyry, a management consulting firm, conducted a review consultation to examine the potential impact of the bands under four scenarios: maintaining status quo, providing minimum support, providing extra support for marine energy and a portfolio approach that supports individual technologies at its expected cost level. After considering the consultations, the final banding provisions are expected to come into effect from 2013-17 (Pöyry, 2011)

1. Impact of UK Renewable Energy Policies

The continuous evolution of RE policy in the UK reflects a learning process in its policy formation. The NFFO and the RO have been criticised for their limited effectiveness in developing the RE sectors as whole. However, despite the problems, UK RE policies have played an important role in contributing to the growth of certain RE technologies, primarily the wind power sector. For instance, wind power generation increased by twenty-one folds in more than a decade beginning with only with 488 GWh in 1996 and increasing to 10,182 GWh in 2010, as shown in Figure D.2.

Figure D.2 Wind power generation in the UK, GWh (1196-2008)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Onshore	487.7	667.0	876.9	850.2	944.9	960.1	1251.2	1275.5	1736.4	2501.2	3573.7	4491.3	5792.1	7563.7	7136.9
Offshore				0.9	5.0	4.8	9.9	198.7	402.7	651.4	782.6	1305.1	1740.2	3045.5	
Growth rate %		36.8%	31.5%	-3.0%	11.3%	2.0%	30.1%	2.3%	50.5%	50.1%	45.5%	24.8%	34.6%	31.1%	9.4%
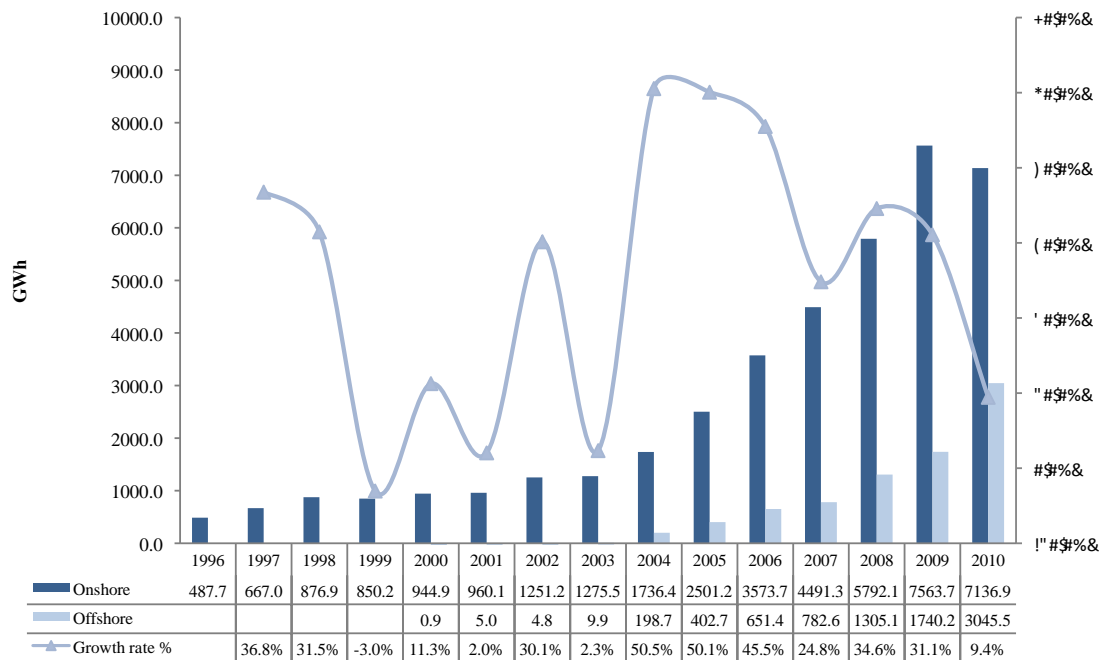
Source: DECC, 2011

Off-shore wind power began to take off from 2002 when the RO was enacted. This does not necessary indicate that the new policy was the sole driving force for offshore wind development since there were other factors such as government capital grants which helped to propel the market (Mitchelle, 2004). Since the banding provisions were introduced in the 2009 RO order and additional support for offshore wind power was introduced in the 2010 Renewables Obligation Amendment Order, offshore wind power began to rapidly develop. Offshore wind power growth rate increased by 75 percent from 1,740 GWh in 2009 to 3,046 GWh in 2010 while onshore wind power growth rate decreased by 5.6 percent in the same period. If the bands will be revised in favour of off-shore wind power and other wave technologies, offshore wind capacity is likely to increase between 359 MW to 844 MW during the RO banding period (2013-2017). Investments in onshore wind power would then decrease, but the capacity increases in offshore wind, wave and tidal may not be large enough to offset decreases in onshore wind power and enhanced co-firing (Pöyry, 2011).

At the general level, ROs have helped increase the level of RE in the overall electricity mix. The share for RE has increased nearly four times from 1.8 percent in 2002 when RO were implemented to 7 percent in 2010 (DECC, October 2011; 2011). Despite the policy efforts, the UK has repeatedly fell short of it annual target by 2.2-3.8 percent, as indicated in Table D.3.

Table D.3: RO Targets and realised renewable energy generation as a percentage of overall electricity supplies.

	2006	2007	2008	2009	2010	2015
RO Obligation %	6.7	7.9	9.1	9.7	10.4	15.4
Actual % of RE electricity	4.5	4.8	5.3	6.7	7.0	-
Difference (%)	2.2	3.1	3.8	3.0	3.4	-

Source: DECC, 2011; Crown, Statutory Instruments No. 1004 2006

The share of electricity from RES could potentially increase with the introduction of FITs and new RO banding; but under currently conditions, the UK will not likely meet its nearing 2015 RO target.

The failures and successes in the development of UK RE policy can be valuable lessons for other countries to follow or avoid. Its innovative NFFO policy helped create a market for RE through its concession projects and the RO intended to use market mechanisms to reach its RE goals. On the other hand there are negative lessons that can be avoided by taking into consideration the various development phases of each RE technology.

Appendix E: Detailed Data on the German case study

Figure E.1: German feed-in tariff rate €cents/kWh, from 1991 to 2000 compared with electricity household rate €cents/kWh

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Wind, solar (90% of sales price)	0.0847	0.0843	0.0845	0.0863	0.0881	0.0878	0.0875	0.0856	0.0843	0.0823
Biomass up to 5 MW (75 %; post 1994 80%)	0.0706	0.0703	0.0704	0.0720	0.0783	0.0780	0.0778	0.0761	0.0749	0.0731
Hydro, landfill and sewage station methane up to 0.5 MW (75%; post 1994 80%)	0.0705	0.0703	0.0704	0.0720	0.0783	0.0780	0.0778	0.0761	0.0749	0.0731
Hydro, landfill and sewage station methane from 0.5 MW - 5 MW	0.0611	0.0609	0.0610	0.0624	0.0636	0.0634	0.0632	0.0618	0.0608	0.0594
Total Average Electricity house hold tariff	0.1032	0.1029	0.1036	0.1045	0.1053	0.1029	0.1024	0.1024	0.1012	0.0959

Source: Staiss 2000 qtd. in Lauber & Mez 2004; Eurostat

Table E.1: Feed-in tariffs for the Renewable Energy Source Act 2000 in €/kWh

RE Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Hydro, methane from landfill, coal mines & sewage stations											
Up to 500kW	0.0767	--→									
500kW- 5MW	0.0665	--→									
Biomass											
Up to 500kW	0.1023	0.1023	0.1010	0.1000	0.0990	0.0980	0.0970	0.0960	0.0950	0.0940	0.0930
500MW-5MW	0.0920	0.0920	0.0910	0.0900	0.0890	0.0880	0.0870	0.0870	0.0860	0.0850	0.0840
5MW - 20MW	0.0869	0.0869	0.0860	0.0850	0.0840	0.0830	0.0830	0.0820	0.0810	0.0800	0.0790
Geothermal											
Up to 20MWe	0.0895	--→									
Above 20MWe	0.0716	--→									
Wind power											
At least 5 years	0.0910	0.0910	0.0900	0.0880	0.0870	0.0860	0.0840	0.0830	0.0820	0.0810	0.0790
After special rate ceases	0.0620	0.0620	0.0610	0.0600	0.0590	0.0580	0.0570	0.0570	0.0560	0.0550	0.0540
Solar radiation											
Installations*	0.5060	0.5060	0.4810	0.4570	0.4340	0.4120	0.3920	0.3720	0.3530	0.3360	0.3190

* on non-build up areas up to 100kW and mounted on buildings up to 5MW (declining

Source: Staiss 2003 qtd. in Lauber & Mez, 2004

Wind and solar power tariffs were separated in the 2000 Act (wind and solar were previously grouped together as seen in Figure E.1 above).

Table E.2: Revised tariffs in the 2004 Renewable Energy Sources Act (EEG)

Renewable Energy	€/kWh	Number of Year Tariff Granted (from the date of commissioning)
Methane from landfill, coal mines & sewage stations		
Up to 500kW	0.0767	20 with digressive rate of 1.5%
Up to 5MW	0.0665	
Over 5MW	*0.0665**	
Hydro		
Up to 500kW	*0.0967*	
Up to 10MW	*0.0665*	
Up to 20MW	*0.0610*	15-30 with a digressive rate of 1% from 2005
Up to 50MW	*0.0456*	
Up to 150MW	*0.037*	
Biomass		
Up to 150kW	*0.115*	
Up to 500kW	*0.099*	
Up to 5MW	*0.089*	20 with a digressive rate of 1.5% from 2005
Above 5MW	*0.084*	
Additional bonus**	*0.0200-0.0600*	
Geothermal		
Up to 5MW	*0.150*	
Up to 10MW	*0.140*	20 with a digressive rate of 1% from 2010
Up to 20MW	0.0895	
Above 20MW	0.0716	
Wind power		
Onshore: for at least 5 years	*0.087*	
Onshore: after special rate ceases	*0.055*	20 year with digressive rate of 2; onshore from 2005; off-shore from 2008
Offshore: for at least 12 years	*0.0939*	
Offshore: after special rate ceases	*0.0619*	
Solar radiation		
Non-building integrated	*0.457*	
Building integrate***: up to 30kW	*0.574*	20 with a digressive rate of 5% from 2005 and for non-built up areas: 6.5% from 2006
Building integrate; 30kW-100kW	*0.546*	
Building integrate: over 100kW	*0.540*	
Non-built up area bonus	*0.05*	

*Tariff listed are not minimum rates

** Bonus for using wood, manure, agricultural product and combined heat and power

***The installation must be attached to or integrated on top of a building or a noise protection wall

Source: Lauber & Mez, 2006; BMU, 2004

In Table E.2, the revised tariff rates lists the tariffs and price adjustments in the revised EEG are shaded and italicized, wind power tariffs were differentiated into on-shore and off-shore rates (Article 10). For onshore wind power tariffs, the over tariff prices decreased from €0.0910/kWh set in the 2000 Renewable Energy Source Act (EEG 2000) to the new rate of €0.087/kWh. Offshore wind power installations were given a rate of €0.0939 if the installations were located

at least three nautical miles seawards from the shoreline. There were also increased tariff revisions for biomass and solar PV. Solar power tariffs rose from the previous EEG 2000 rate of €0.5060/kWh to approximately €0.540/kWh - €0.574, which finally made investments in solar power generator facilities profitable without further financial subsidies. The increased rates were in fact set earlier in 2003 and inevitably resulted in the expansion of the Germany solar power sector in 2004.

Table E.3 lists the revised prices. The shaded and italicized rates indicate a favourable tariff change in the 2009 EEG for the particular technology or installation size.

Table E.3 Revised tariffs in the 2009 Renewable Energy Sources Act

Renewable Energy	€/kWh	Number of Years Granted (commissioned before Jan1, 2010)
Landfill Gas		
First 500kW	*0.0900*	20 with digressive rate of 1.5%
500kW-5MW	*0.0616*	
Sewage Gas		
First 500kW	*0.0711*	20 with digressive rate of 1.5%
500kW-5MW	*0.0616*	
Mine Gas		
First MW	*0.0716*	
1MW-5MW	*0.0516*	20 with digressive rate of 1.5%
Over 5 MW	*0.0416*	
Hydro		
Up to 5MW: first 500 kW	*0.1267*	
Up to 5MW: 500 kW- 2MW	*0.0865*	
Up to 5MW: 2MW- 5MW	*0.0765*	
Up to 5MW (commissioned before Jan.1, 2009 & modernized since Dec.31, 2008) for the first 500kW	*0.1167*	
Up to 5MW commissioned before Jan.1, 2009 & modernized since Dec.31, 2008 500kW-5MW	*0.0865*	20 (or year modernization was completed) with a digressive rate of 1% from
Over 5 MW: first 500 kW	0.0729	
Over 5 MW: 500 kW-10MW	0.0632	
Over 5 MW: 10 MW-20MW	0.0580	
Over 5 MW: 20 MW-50MW	0.0434	
Over 5 MW: over 50MW	0.0350	
Biomass		
First 150kW	*0.1167*	
150 kW – 5 MW	*0.0918*	
500kW- 5MW	0.0825	20 with a digressive rate of 1.0% from 200
5MW-20MW	0.0779	
Additional bonus*	0.0100-0.0600	
Geothermal		
First 10MW	*0.1600*	
Over 10 MW	0.1050	*20 with a digressive rate of 1% from 2010*
Bonus use with heat	0.0300-0.0400	

Wind power		
Onshore: for at least 5 years	*0.0920*	
Onshore: after special rate ceases	*0.0502*	
Repowering Installations	*0.05***	20 year with digressive rate of 1% for onshore wind; 5% for off-shore from 2015
Offshore: first 12 years	*0.1300-0.1500****	
Offshore: after special rates ceases	*0.035*	
Solar radiation		
Non-building integrated	0.457	20 with a digressive rate of 10% from 2010 and for non-built up areas;
Rooftop or attached to building: 1st 30kW output	0.4301	
Rooftop or attached to building: 30kW-100kW	0.4091	9% from 2011 for standalone buildings and rooftop systems over 100kW;
Rooftop or attached to building: over 100kW	0.3958	
Rooftop or attached to building: over 1 MW	0.3300	8% from 2010 and 9% from 20111 for rooftop systems up to 100kW
Up to 30kW: use within building****	0.2501	

*Bonus granted for using innovative technology, energy groups/manure or combined heat & power ** Increase the initial compensation by €0.05/kWh *** Bonus of €0.02/kWh is paid to installations commissioned before January 1st, 2016 **** The installation operator or a third party uses the electricity within the immediate vicinity of the installation

Source: BMU, 2009

Wind power tariffs also increased 5.8 percent from the previous onshore installation rate of €0.087/kWh to €0.0920/kWh for a duration of twenty years, the highest feed-in price since the introduction of tariffs. Offshore wind power prices increased dramatically by 60 percent from €0.0939/kWh to €0.15/kWh for a period of twelve year for installations commissioned before January 2016 and decreases to €0.13/kWh thereafter. However, the special rate for offshore wind decreased by 77 percent in the 2009 EEG from €0.0619 to €0.035. Nevertheless, the rise in offshore tariffs for the initial twelve years finally enabled for an economically feasible investment (BWE, 2009). These changes in tariffs were applied to account for the growing costs of raw materials for manufacturing wind turbines, including copper and steel (IEA, 2009).

Solar power tariffs on the other hand decreased due to the falling costs of solar PV. This is largely a result of the successful growth of the solar power sector stimulated by the high tariffs set in the 2004 EEG. In 2003, there was a total installed capacity of 3800 MW but after the new tariffs were implemented, the totally installed capacity grew over nine folds from 2003. There was a general decrease of €0.01/kwH for solar installations on rooftops and attached on buildings (Busgen & Durrschmidt, 2009).

Impact of the German Feed-in Tariff Policy

There are several methods to determine the success of the Germany feed-in tariff. One of the more concrete evaluation methods is through a quantitative analysis including the measurement of indirect benefits such as environmental improvement (CO_2 reduction) and societal benefits (number of jobs created) as well as direct measurement of RE output. Several numerical indicators are used to measure RE output which include: RE electricity generation, installed

capacity for RE electricity generation, and the final share of electricity consumption.

Electricity generated, measured in GWh, provides an accurate measurement of increases in renewable energy production compared to capacity output, measured by MW. GWh indicates the actual amount of electricity produced from renewable energy sources over a fixed time whereas capacity only indicates the installation sizes and does not consider unconnected RES facilities. Since capacity does not measure electricity generation, down time from intermittent renewable energy resources, operational malfunctions and other inefficiencies are not accounted for. Nevertheless, electricity output and capacity will be useful to evaluate the impact of the implemented policies on RES generation.

The first policies for RE grid connection were implemented in 1991 to 2008, and during this period, RE electricity generation has increased five times, comprising of 15.1 percent of the gross electricity consumption. Figure E.2 illustrates the growth of RE and the corresponding policies implemented.

Figure E.2 Renewable Energy Electricity Generation in GWh (1990-2008)
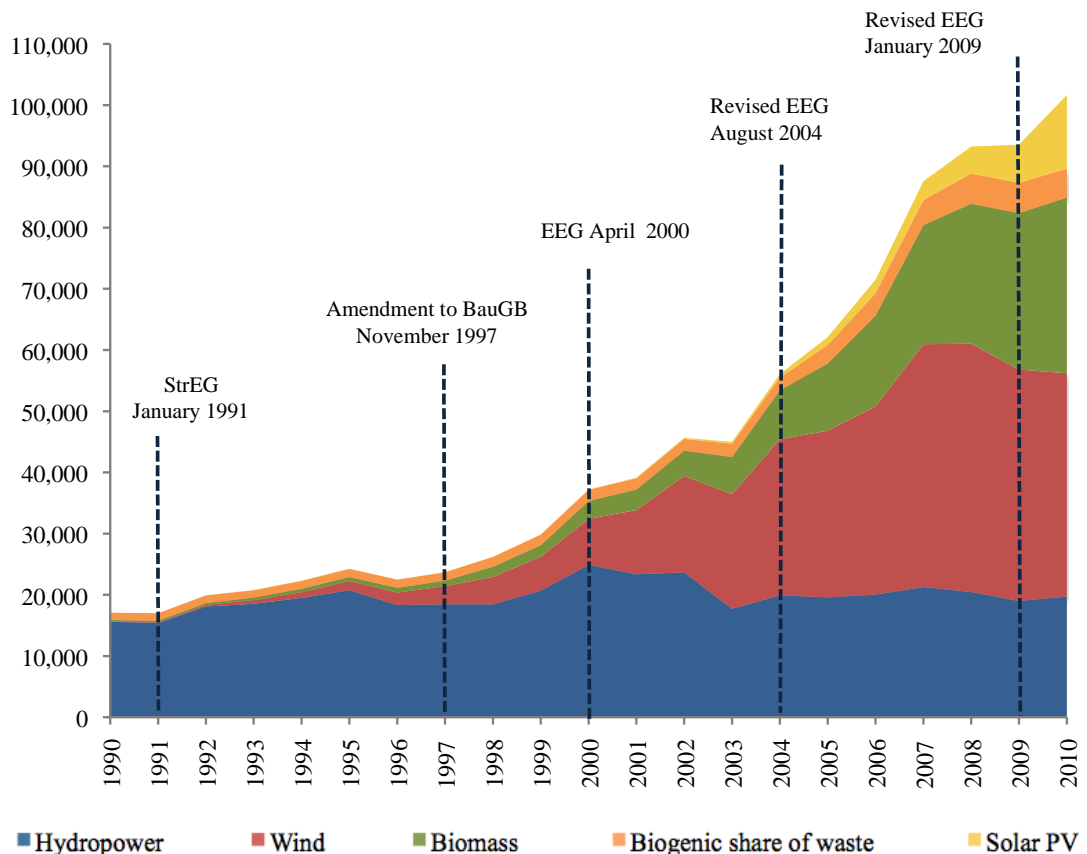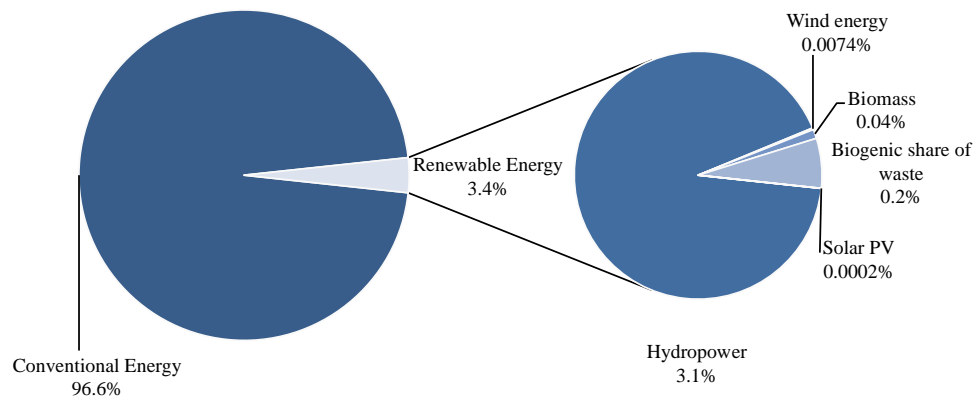

Source: BMU, 2009

As illustrated in Figure E.2, the enacted policies contribute to the growth of RES electricity to a greater or lesser extent. The first two major policies, the Feed-in Law (StrEG) and the Federal

Building Code (BauGB) only appeared to have a moderate impact on the expansion of RE. Hydropower is the dominating RES during this period. When wind and biomass technologies are examined individually, growth within these sectors appears to be more significant.

From 1990 to 1999, prior to the EEG implementation, biomass electricity generation increase by over 8 times from 222 GWh to 1847 GWh during the period while wind power electricity generation increased by approximately 77 times from 71 GWh to 5528 GWh. With the enactment of the EEG in 2000 and the subsequent revisions in 2004 and 2009, RE generation has expanded more rapidly, particularly for wind and solar power. Wind power benefited from high FITs in the EEG 2000 while in EEG 2004, solar power tariffs were raised making investments in solar PV even more attractive. Prior to the EEG 2000, solar power increased only reached 42 GWh, increasing 42 times from 1990 to 1999. After EEG 2000 was enacted, solar PV increased around 188 times, generating 12,000 GWh by 2010. Wind power also experienced a high growth and outpaced hydropower electricity generation by the time EEG 2004 was enacted.

Examining RE electricity generation by technology can help indicate the effectiveness of policies in developing a particular technology. Chart E.3 and E.4 gives a breakdown of RE technologies in 1990 and 2008.

Figure E.3 Share of Renewable Energy to the total Electricity Generation in 1990

Source: BMU, 2009

In 1990, RES sources only made up 3.4 percent of the overall electricity generation. Hydropower was the dominating technology with 92 percent of the RES while biogenic share of waste, biomass, wind, and solar PV comprised only of 6.5 percent, 1.2 percent, 0.22 and 0.01 percent respectively.

In 2008 the proportion of RE electricity relative to conventional energy increased from 3.4 percent in 1990 to 15.1 percent and RE technologies ratios also change. Wind power became the dominating technology, with 43 percent of the overall RES share, nearly twice the share of

hydropower. Biomass and solar PV share also increased to 24 percent and 4.3 percent respectively. The percentage of biogenic waste, however, decreased since 1990 while geothermal energy emerged as a new technology.

Figure E.4 Share of Renewable Energy to the total Electricity Generation in 2008
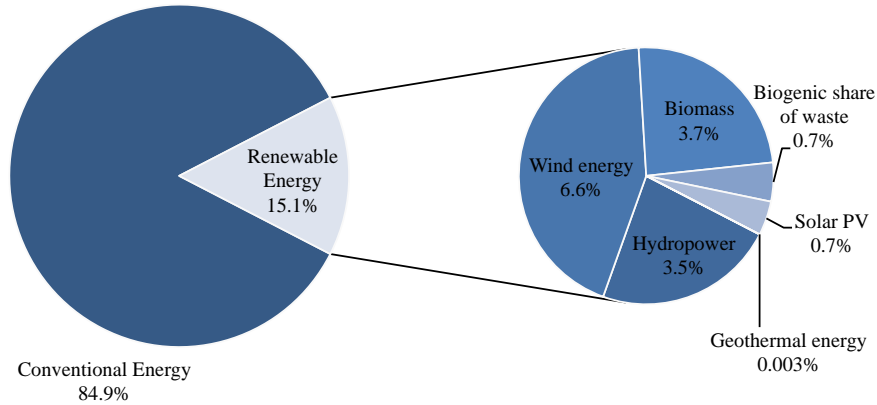
Source: BMU, 2009

Since 1990, the development of RES technologies has been more even, with less focus on hydropower and greater emphasis on wind, biomass and solar PV. Furthermore, new technologies such as small scale geothermal (up to 10MW) have been promoted under the EEG 2004 through favourable tariffs. Installation capacity is another a useful measurement to indicate the policy interest as well as investments directed towards certain RES technologies. As illustrated in Chart E.5, the RE capacity shown to have relatively high growth from 1991 to 2008 compared to the other periods.

Figure E.5 Renewable Energy Electricity Capacity (MW) (1990-2008)
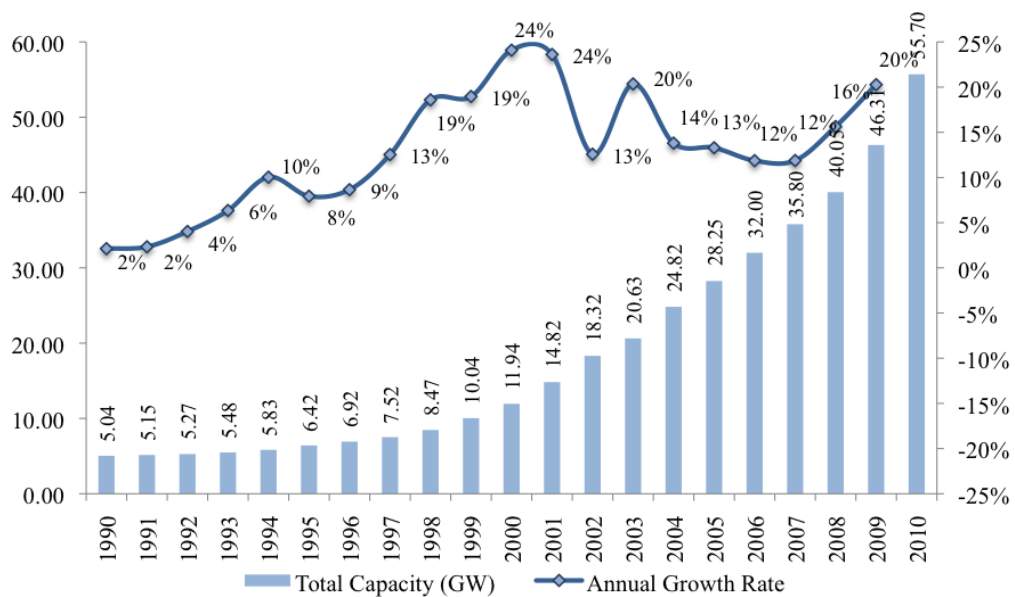
Source: BMU, 2009

Table E.4 indicates that the percentage of share for wind power compared to the total renewable energy capacity is growing the most rapidly. Hydropower capacity remains steady but its share of the overall growing renewable energy capacity decreases while the proportion of the installed capacity increases for all other forms of renewable energy

Table E.4 Renewable Energy Electricity Generation in GWh (1990-2010)

	Hydro-power	Wind	Biomass	Biogenic share of waste	Solar PV	Geothermal energy	Total electricity generation	% of Gross Electricity Consumption
1990	15,580	71	222	1,213	1	0	**17,087**	**3.1**
1991	15,402	100	259	1,211	2	0	**16,974**	**3.1**
1992	18,091	275	297	1,262	3	0	**19,928**	**3.7**
1993	18,526	600	433	1,203	6	0	**20,768**	**3.9**
1994	19,501	909	570	1,306	8	0	**22,294**	**4.2**
1995	20,747	1,500	665	1,348	11	0	**24,271**	**4.5**
1996	18,340	2,032	759	1,343	16	0	**22,490**	**4.1**
1997	18,453	2,966	879	1,397	26	0	**23,721**	**4.3**
1998	18,452	4,489	1,642	1,618	32	0	**26,233**	**4.7**
1999	20,686	5,528	1,847	1,740	42	0	**29,843**	**5.4**
2000	24,867	7,550	2,893	1,844	64	0	**37,218**	**6.4**
2001	23,341	10,509	3,348	1,859	76	0	**39,133**	**6.7**
2002	23,662	15,786	4,089	1,949	162	0	**45,648**	**7.8**
2003	17,722	18,713	6,085	2,161	313	0	**44,994**	**7.5**
2004	19,910	25,509	7,960	2,117	556	0.2	**56,052**	**9.2**
2005	19,576	27,229	10,979	3,047	1,282	0.2	**62,113**	**10.1**
2006	20,042	30,710	14,840	3,675	2,220	0.4	**71,487**	**11.6**
2007	21,249	39,713	19,430	4,130	3,075	0.4	**87,597**	**14.2**
2008	20,446	40,574	22,872	4,940	4,420	17.6	**93,270**	**15.2**
2009	19,000	37,809	25,515	5,000	6,200	18.6	**93,543**	**16.1**
2010	19,694	36,500	28,710	4,750	12,000	27	**101,681**	**16.8**

*Highlighted rows represent the years renewable energy policies were enacted

Source: BMU, 2010

According to Table E.5, the share of wind power increased from 6.2 percent to 41.6 percent of the overall RES capacity from 1995 to 2003 (see highlighted wind power column in Table E.5). After 2003, the share of wind power decreases, which is partly due to the decrease of offshore tariffs. This growth was fuelled by policies supporting the development of wind farms through high tariff prices. The guaranteed tariffs stimulated investments, which resulted in the rapid increased capacity of wind power.

Table E.5 Percentage Share of Renewable Energy Technology Capacity (MW) (1990-2010)

Year	Hydropower	Wind	Biomass	Solar PV	Geothermal
1991	91.2%	0.4%	1.3%	7.1%	0.0%
1990	90.7%	0.6%	1.5%	7.1%	0.0%
1992	90.8%	1.4%	1.5%	6.3%	0.0%
1993	89.2%	2.9%	2.1%	5.8%	0.0%
1994	87.5%	4.1%	2.6%	5.9%	0.0%
1995	85.5%	6.2%	2.7%	5.6%	0.0%
1996	81.5%	9.0%	3.4%	6.0%	0.1%
1997	77.8%	12.5%	3.7%	5.9%	0.1%
1998	70.3%	17.1%	6.3%	6.2%	0.1%
1999	69.3%	18.5%	6.2%	5.8%	0.1%
2000	66.8%	20.3%	7.8%	5.0%	0.2%
2001	59.6%	26.9%	8.6%	4.8%	0.2%
2002	51.8%	34.6%	9.0%	4.3%	0.4%
2003	39.4%	41.6%	13.5%	4.8%	0.7%
2004	35.5%	45.5%	14.2%	3.8%	1.0%
2005	31.5%	43.8%	17.7%	4.9%	2.1%
2006	28.0%	43.0%	20.8%	5.1%	3.1%
2007	24.3%	45.3%	22.2%	4.7%	3.5%
2008	21.9%	43.5%	24.5%	5.3%	4.7%
2009	20.3%	40.4%	27.3%	5.3%	6.6%
2010	19.4%	35.9%	28.2%	4.7%	11.8%

Source: BMU, 20098

After examining the output of RE in electricity generation and installed capacity, a conclusion can be drawn that German's policies has played an crucial role in developing the renewable energy sector. Feed-in tariffs have been very influential in rapidly developing the wind power sector and more recently, the solar power sector. In addition, new RE technologies such as geothermal may continue to growth with the support of tariffs. The continued policy support will to be a key factor in expanding the renewable energy sector. On the whole, the Germany policy experience is frequently cited for its success in developing one of the leading global markets for renewable energy, thus its success and failures are closely monitored for lessons to be applied in other countries.