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Building or stumbling blocks? Assessing the performance of polycentric energy and climate governance networks

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Abstract: Polycentric governance networks are on the rise in global energy and climate governance, but we know surprisingly little about their effectiveness. This paper analyzes the performance of four such transnational energy and climate governance networks. In the realm of sustainable energy, our cases are the Renewable Energy and Energy Efficiency Partnership (REEEP) and the Global Alliance for Clean Cookstoves (GACC). In the climate sphere, we examine the effectiveness of the Green Climate Fund (GCF) and the Clinton Climate Initiative (CCI). Using principles from governance and public administration about the effectiveness of institutions, we examine the extent to which four networks have contributed to improving governance outcomes in the spheres of climate and sustainable energy. Our evaluation focuses on the clarity of purpose, funding, institutional formality, efficacy, and level of resilience of these networks. Some differences between the networks notwithstanding, we find that the transnational governance networks generally fail to meet the criteria about what constitutes an effective institution. The paper concludes with a reflection on what could be done to enhance the performance of these governance networks.

Keywords: transnational governance networks; polycentrism; sustainable energy; climate governance

1. Introduction

The Paris Agreement, adopted in December 2015, epitomizes an important shift in global climate governance. Whereas early efforts to tackle climate change concentrated on negotiating a global agreement with binding targets—the Kyoto Protocol being a paradigmatic example—the focus has gradually shifted to less top-down, more diverse and more multi-levelled governance frameworks. The nationally determined contributions (NDCs)

which were prepared by all parties to the Paris Agreement are but one indicator of this trend. In addition to action at the state level, a 'groundswell' of climate actions has emerged as cities, regions, businesses and civil society groups have started to step up their acts on mitigation and adaptation (Chan et al., 2015; Hale, 2016). As a result, the climate governance landscape has started to exhibit some of the characteristics of what Ostrom called 'polycentric systems'—that is, systems characterized by multiple governing authorities at differing scales rather than a monocentric unit (Jordan et al., 2015; Sovacool 2011; Ostrom, 2010; Dorsch and Flachsland, 2017). It is also having to attune itself to more active attempts at rapid transition or 'deep decarbonisation' (Geels et al., 2017).

A variety of new terms have come to describe polycentrism as it has become more important in theoretical and empirical policy debates. Whether referring to 'polycentrism' (Ostrom, 2010), 'building blocks' (Stewart et al., 2013; Falkner et al., 2013), 'regime complexes' (Keohane and Victor, 2009; Abbott, 2012; Colgan et al., 2012), 'polyphonic federalism' (Sovacool, 2011) or 'bottom-up approaches' (Rayner, 2010), there is recognition that global climate governance has increasingly come to encompass action by sub- and non-state actors (Cole, 2015; Hale, 2016). What makes a polycentric approach so attractive is that it avoids using the 'government' or the 'state' as the single point of reference (Ostrom 2010; Cole 2015). As other authors who adhere to a polycentric approach have noted, "polycentric networks transcend the traditional ideas of jurisdictional integrity in state-centric systems" (Skelcher, 2005: p. 89).

Other voices are more critical of the shift from 'government' to 'governance'. According to these critics, governance networks and partnerships "can lead to a 'hollowing out' of the state, reinforce neoliberalism and accelerate privatization of environmental governance, […] increased business influence, power inequalities and skewed representation of stakeholders, fragmentation of global governance, reinforcement of elite multilateralism

and the retreat of state responsibility in the production of public goods" (Bäckstrand, 2008, p. 78). Besides accountability issues, questions are also raised over the effectiveness of polycentric approaches to climate governance. Jordan et al. (2015), for example, argue that "before we raise our hopes, we should better understand how the new forms of governing are actually (not) performing" (Jordan et al., 2015: p. 3).

Heeding that call, this paper qualitatively analyzes the performance of governance networks in the energy and climate sphere. Using principles from governance and public administration about the effectiveness of institutions, we examine the extent to which four such polycentric governance networks have contributed to improving governance outcomes in the spheres of climate and sustainable energy. Put another way, we examine network effectiveness, or the ability for that network to meet its own missions and goals. In the realm of sustainable energy, our cases are the Renewable Energy and Energy Efficiency Partnership (REEEP) and the Global Alliance for Clean Cookstoves (GACC). In the climate sphere, we examine the effectiveness of the Green Climate Fund (GCF) and the Clinton Climate Initiative (CCI).

The remainder of this paper starts with a discussion of our research methods and key concepts, and outlines our polycentric governance assessment framework. Next, the paper discusses and evaluates the four case studies in light of this framework. We conclude with a reflection on options to enhance the effectiveness of these governance networks.

2. Research methods: Qualitative case study analysis

The purpose of this study is to examine the performance of 'polycentric governance networks' in the domains of climate and energy. Transnational networks are defined by Andanova et al. (2009) as sharing three key features. First, they operate in the transnational sphere instead of being domestic governance networks. Second, they seek to address some form of public goal. Third and most importantly, they are composed of various actors and

organizations that recognize the authority of the network, but are also recognized by network authorities as legitimate parts of the network. The constituents of such networks may be public bodies and actors, private ones, or a mix thereof (Andanova et al., 2009). Transnational governance networks, by definition, are therefore polycentric.

Our core method is a qualitative, comparative, case study approach drawn from a synthesis of peer-reviewed literature as well as current reports and documents related to our four polycentric energy and climate networks. The cases have been selected on the basis of their budget (i.e., they all have funding in the order of multiple millions of dollars), duration of existence (i.e., they all exist since at least 2010), operational span (i.e., they all operate transnationally), scope (they all focus on aspects related to either sustainable energy or climate mitigation) and network governance character (they fit a three-tiered definition as described above). The resulting sample of cases was expected to share enough background conditions to be considered a homogenous population, while still exhibiting considerable variation in governance characteristics.

Since our study is explicitly structured by a well-developed conceptual framework that focuses attention on some theoretically specified aspects of reality and neglects others, our research method corresponds to what has been called interpretive (Lijphart, 1971: 691) or disciplined-configurative (Eckstein, 1973: 99–104) case studies. To be fair, our assessment of effectiveness is therefore shorter term, and it would not capture longer durations that may be more suitable to analyzing effectiveness (Sabatier, 1986). In addition, there hardly exist in-depth studies of these cases, some exceptions notwithstanding (e.g., Pattberg et al., 2009; Parthan et al., 2010; Szulecki et al., 2011; Vanderheiden, 2015; Widerberg and Stripple, 2016).

3. Polycentric governance assessment framework

Polycentrism, a form of governance that blends scales and/or types of actors (Visseren-Hamakers, 2015; Galaz et al. 2012) is related to the more recent literature on 'network governance' and 'governance networks'. McGinnis and Ostrom (2012) note that the concept of polycentricity, first laid out by Michael Polanyi (1951) and later adopted by Vincent Ostrom et al. (1961), can be seen as an early statement of the critical importance of network forms of governance in democratic societies. Yet, the more recent literature on network governance and governance networks rarely makes any mention to this pioneering work (Klijn and Koppenjan, 2012), despite the similarity of the concepts. Nonetheless, the 'governance networks' that are formed by actors from the state, the market and civil society to address climate change can be said to provide 'polycentric governance' in the sense that they include the self-organizing relationship between many centers of decision-making that are formally independent of each other (Ostrom et al., 1961: p. 831; Ostrom, 2010).

In this section we propose four criteria, drawn mostly from the literature on public administration, policy sciences, and governance, to assess the performance of polycentric energy and climate networks, building on an earlier study by Poocharoen and Sovacool (2012). We employ the term 'performance', which allows for a more contextualized evaluation compared with the concept of 'effectiveness'. Whereas effectiveness usually refers to 'outcome' (i.e., goal attainment), performance refers more to 'process' (i.e., the manner by which outputs and outcomes are achieved). Here, we argue it includes the ability of the network to (1) set clear goals; (2) mobilize resources; (3) adopt formal structures; (4) make internal operations more efficient; and (5) exhibit resilience. We maintain that these criteria are fundamental elements of organizational and institutional arrangements applicable to network settings. We now discuss each criterion in detail.

3.1 Clarity of purpose

It is intuitive that effective networks should have a clear sense of their goals and missions. Goal orientation of network members is a crucial part to make the network long-lasting. For any entity to measure the level of success first it must have a sense of purpose for its existence. Goals, missions, visions, objectives are expressions of an entity's purpose. Networks with clearly stated goals will often also have clear roles and responsibilities among members (Goodin, 1998). Also studies have shown that the success of a network is partly determined by whether there is alignment with different levels of goals of member agencies (Provan and Kenis, 2008). Clarity of purpose does not occur naturally but rather members must go through a process to have dialogues which creates a discourse to shape ideas and common understandings (Poocharoen and Sovacool, 2012).

3.2 Funding

Though funding can come with strings attached, implying a loss of autonomy and authority for the recipient governance network, a sufficient independent and continual source of funding is an important criterion to judge the effectiveness of networks. Often networks rely on their members to pool resources to implement network-led projects. The dilemma may arise where organizations, as members of networks, are also struggling to secure their funding and make use of their limited funds. Giving such resources away to the network might not be in their best interest. In addition, often network-led programs have multiple goals in nature, which may make them less attractive to donors or potential sponsors. Networks that can overcome such problems are prone to be more effective (Poocharoen and Sovacool, 2012).

3.3 Institutional Formality

Institutional formality refers to two aspects: whether the network has formal recognition; and whether partners have a formal structure to interact. Some indicators of having formal recognition includes having a permanent secretariat and full time staff. Also the

network might have legal status and it can be supported by established international entities. Legal formalization of networks helps to launch and sustain the network. However, it is also important to strike a balance and make sure the network can stay flexible and adapt to new structures and arrangements when needed (Poocharoen and Sovacool, 2012).

3.4 Efficacy

Efficacy refers generally to how effective the network operates. It has an internal and an external dimension. Internally, a key to managing networks is the capacity for partners to collaborate effectively. As for the external dimension of efficacy, it refers to how much influence the network has on altering actual policies or behavior. The external efficacy can only be assessed in view of a partnership‘s intended function (Bäckstrand, 2006), not in relation to whether it actually solves an environmental issue. This means that *information-sharing partnerships* are effective when there is a significant exchange of relevant knowledge between members; *capacity-building partnerships* would have to enhance members’ ability to develop new practices to respond to environmental issues; and *rule-setting partnerships* should produce broadly accepted and enforceable norms (Hahn and Pinkse, 2014).

3.5 Resilience

Of all the five criteria, this is the only one that distinguishes networks from single organizations. This criterion of resilience and strong ties illustrates the importance of inter-organizational relationships between network members, as well as elements of adaptability and the resolution of conflict. The relationships themselves are at the core of what makes the network ‘a network’. The network should have a life of its own. Members should be able to enter and leave the network without disrupting the direction and work of the network. Loose ties can be more adaptive (wider members, less formality, less clear objectives) but it can also make it difficult to mobilize as a single unit. Thus it is important to judge the strength of ties among network members to gauge its effectiveness. Moreover, resilient networks can adapt

and evolve to challenges and even continue to function after they have fulfilled their mandate, and tend to have formal modes of conflict resolution, arbitration, or consensus style methods of decision-making so that when members disagree, the entire network does not collapse (Poocharoen and Sovacool, 2012).

4. The performance of four polycentric networks

In this section, we apply the five principles to each of our four climate and energy networks. Each subsection progresses with the same structure: it begins with a brief introduction and description of the case before turning to a qualitative evaluation of how it performs among each criterion. To that end, we apply a relatively straightforward 4-point scale consisting of: weak, moderately weak, moderately strong, and strong.[1]

4.1 Clinton Climate Initiative (CCI)

The William J. Clinton Foundation is a nonprofit organization created in 1997 by the former U.S. President Bill Clinton, who launched the Clinton Climate Initiative (CCI) in 2006. The Clinton Foundation manages about $220 million in assets and operating expenses each year, of which about $8 million goes to CCI. CCI is a network because it is funded by private individuals and foundations but also works closely (and formally) with subpartners including other donors, governments, research institutes, and communities. The CCI currently focuses on three strategic program areas: *Energy Efficiency* (which focuses on reducing energy use among worldwide buildings), *Forestry* (which focuses on improving land use practices to reduce poverty and curb GHG emissions), and *Island Energy* (which seeks to address the climate change impacts facing small island nations). Previously, its core program elements were Cities, Clean Energy, and Forestry (CCI, 2009). In August 2006 it became the action arm of the C40 'Climate Leadership Group', a consortium of large cities committed to

[1] We could have gone with a numerical scale, but did not want to hide the qualitative or judgmental aspect of our evaluation.

reducing GHGs. The organization has program staff in many of these cities (called 'partner' cities).

Clarity of purpose (moderately strong)

The clarity of purpose within the CCI is moderately strong, as its central focus has always been on the energy and climate spheres. The reason it has only moderate strength, however, is that the purpose of the organization continues to change, sometimes dramatically. For instance, in 2006, the *Cities Program* was the most developed program at the start of the CCI. CCI City Directors in partner cities delivered three types of capacity building during the earlier years of the Initiative: technical and analytical assistance, project assistance, and purchasing and financial assistance (CCI, 2009b).

However, after 2010, it was replaced and augmented with the Energy Efficiency Program. Similarly, CCI cancelled its former *Clean Energy Program* which had focused on two low-carbon technologies in the power sector: Carbon Capture and Storage (CCS), which isolates CO_2 emissions from power plants and other industrial facilities, and Concentrated Solar Power, which harnesses the sun's heat to run conventional turbines or engines. CCI failed at its ability to deliver large-scale demonstration projects around the world.

Funding (moderately weak)

A second moderate challenge is funding. Although CCI is perhaps comparatively well-funded to other climate and energy networks, it has weaker status within the Clinton Foundation. For the last fiscal year for which data was available (2013-2014), CCI received $8.2 million or only 4% of the Foundation's revenue, an amount both insufficient to achieve its goals and down from $8.4 million (and 8% of the portfolio across the entire Clinton Foundation) in 2013 (Clinton Foundation, 2013-2014).

Institutional formality (moderately strong)

The institutional formality of CCI is strong. It has existed for more than a decade and remains a core part of funding within the Clinton Foundation, which has its own secretariat, offices, staff, and multimillion dollar budget. CCI has also strengthened its legal formalization by partnering with other initiatives. For example, the integration of the CCI's Cities Program with the C40 alliance resulted in a joint initiative with a much stronger institutionalization, as it led to a doubling of the budget of the C40/CCI cities and allowed the CCI City Directors and programmatic teams to draw on the services of a secretariat in London.

Efficacy (moderately weak)

Despite its potential, at a global scale, the external efficacy of the CCI remains weak. The most recently available CCI Annual Report claims that their efficiency program displaced 35,000 tons of GHG emissions annually in the United States (Clinton Foundation, 2014), but the total amount emitted in 2014 for the country was 6.87 billion tons. The Annual Report also notes that the CCI program added 100 kW of solar energy capacity in the Seychelles, but their national grid has more than 100,000 kW, meaning their contribution added only 0.1 percent of capacity, inadequate expenditure related to need.

There are also programmatic difficulties mitigating effectiveness. In many cities, incentives are still misaligned against energy efficiency because lenders are unfamiliar with energy service providers and/or their technologies, because of the principal-agent problem involving landlords and tenants, or because people remain unsure about how to calculate the expected revenue from potential energy savings (Sovacool, 2011b). Others have limited budgets for energy efficiency projects, or may need to spend scarce time and resources on other more pressing matters. Studies have noted serious difficulties confronting the environment the Island Energy Program operates in as well. One critique of CCI's operations

as well as other donors noted that in Small Island Developing States, aid is almost never accompanied by the necessary policy reforms; in general there has been a bias towards centralized electricity generation rather than rural energy services; and development assistance from some partners continues to be tied to particular suppliers, undermining value for money (Dornan and Shah, 2016). A second study noted that renewable energy targets set by donors such as CCI are often not supported by well-structured action plans, and that most countries continue to lack effective regulatory body responsible for energy planning and financial investment (Keeley, 2016). Finally, the Forestry Program has faced impediments in implementation in places such as Tanzania. There, although CCI commissioned the NGO Mpingo Conservation & Development Initiative to provide expertise and resources for the completion of forest management plans and bylaws, documents became invalid before they were implemented, and almost half of implementing villages were unable to agree on joint boundaries necessary for effective management (Scheba and Mustalahti, 2015).

Resilience (strong)

Close connections to a former US president enabled the CCI to sit at the heart of a strong network of donors and partners. One of their earlier programs related to transport in cities saw a global partnership between CCI and the Institute for Transportation and Development Policy (ITDP) focusing on the implementation and improvement of Bus Rapid Transit (BRT) systems and bicycle networks. Projects in cities including Johannesburg, Bogota, Sao Paulo, and Mexico City are addressing route optimization, operational planning and, for BRT, fuel substitution. A CCI Hybrid Bus Test Program aimed to create a market for hybrid bus technology in Latin America and its Electric Vehicle Working Group brought together 12 cities in the C40 network to organize a coordinated procurement of electric vehicles by owners of public and private sector fleets. In May 2009 CCI's Cities program launched the Climate Positive Development Program working in concert with the U.S. Green

Building Council. In the domain of forestry, CCI has convened the "Carbon Measurement Collaborative," a network of scientists and forestry experts in carbon modeling, land use change, and satellite imaging to design and implement the NCAS in partner countries.

4.2 Renewable Energy and Energy Efficiency Program (REEEP)

Deeply affected by debates within the G8 about sustainable development, electricity, energy poverty, and renewable sources of energy, a collection of actors from the private sector, public sector, multilateral finance, and civil society decided to create REEEP in 2002. The network's mission is rooted in three central areas: climate change mitigation, energy access, and encouraging energy efficiency, conservation, and demand-side management. Voluntary contributions from its member states make up most of REEEP's budget and the network does not place restrictions on membership.

Clarity of purpose (strong)

The clarity of purpose for REEEP is relatively strong compared to our other case studies. The network supports only projects that can be scaled up in a "variety of different regulatory frameworks," in essence meaning their efforts and projects are designed to work in various countries and in different types of energy markets (Florini and Sovacool, 2010). One key part of this strategy is to overcome the remaining barriers to renewable energy by employing attorneys and technical experts to proposed changes to government regulation and policy. Another important part of their strategy is providing low-cost financing for projects so that entrepreneurs and investors can deploy cleaner technology in emerging markets. A third component is maintaining "technology neutrality," enabling its partners to decide which particular low-carbon technologies they want to adopt or deploy (Parthan et al., 2010).

Their most recent strategy espoused in their 2015 Annual Report emphasizes that REEEP (2015) seeks to target their efforts at entrepreneurs and the "missing middle" in renewable energy and energy efficiency finance. They note that small- and medium-sized

enterprises often make up 85% of employment in developing countries and two-thirds of GDP, yet remain under-utilized. REEEP hopes to catalyze and even galvanize the missing middle to harness the power of entrepreneurship to promote innovation in financing and technology.

Funding (weak)

Although REEEP has many actors through which it raises revenue, in a global sense its market presence and influence remains weak. REEEP collects about $9 to $12 million in funding each year as part of its operational budget, the largest portion given from the governments of Norway and the United Kingdom. Yet the network spends more than ten times this amount on actual projects through money raised from its extensive network. For instance, in 2010, REEEP had managed almost 150 projects in 56 countries with a combined worth of $90 million, most of this supported through private equity financing with REEEP serving as a matchmaker, with 37 new projects in the design phase (Florini and Sovacool, 2010; Parthan et al., 2010).

However, in the most recent funding cycle of 2014/2015, REEEP held only a total of €5.99 million in project funds under management. Not only has this amount declined precipitously from the previous decade, it pales considerably both to global investment figures for clean energy or the amount needed to achieve universal energy access. For instance, in 2016, the global renewable energy sector received $285.9 billion in investment, and (since REEEP's focus is on small-scale systems), distributed/off-grid distributed systems received at least $300 million (REN21 2016). Analysts have also generated a number of estimates of the cost of providing universal energy access in developing countries, and these estimates range from as little as $30 billion per year to as much as USD $130 billion per year (Sovacool et al., 2016).

Institutional formality (strong)

Institutional formality has also strengthened over time and is now relatively robust. For its first two years the network only conducted workshops related to renewable energy, focused on identifying stakeholders interested in energy efficiency and renewable energy, and had no secretariat. An international secretariat was established in Vienna, Austria, in 2004. Its secretariat acts as a "central service hub" which collects and disseminates information and also provides support to the organization's 18 regional secretaries. A General Assembly for the network is in charge of overall strategy, a governing board manages the budget, and a program board and steering committee implements regional action plans. It also has regional offices in Beijing, Washington D.C., Johannesburg, New Delhi, and Southbank.

Efficacy (moderately weak)

This network, also, is ineffective at accomplishing its goals. As previously noted, it operates on a much smaller scale than inter-governmental organizations. It emphasizes facilitation and capacity and the majority of REEEP's partners are bankers, financiers, and NGO managers. One benefit to its structure is the flexibility it enables; because REEEP is relatively small, it can engage actors closer to the local scale, improving efficiency and accountability. Another advantage is the iterative relationship between partners in the network. Frequent interaction between members creates an intense amount of feedback about the effectiveness and challenges facing ongoing projects. The network sponsors and manages frequent meetings and consultations with its partners as well, which helps ensure that "fresh" data are always being circulated to members. REEEP managers have stated that this tends to enhance effective implementation, done through a decentralized network closer to "people on the ground," instead of relying on a "one-size-fits-all" strategy of implementing projects (Florini and Sovacool, 2009). One interdisciplinary study noted that REEEP's strengths included serving as a clearinghouse for knowledge about energy issues in developing

countries, possessing an active online platform and presence through their database and knowledge portal, and comprehensively identifying barriers to policy reform (Fadel et al., 2013). A more recent "Deep Impact Assessment" within the organization of 62 former and ongoing projects with impact across 32 countries noted that 79% of projects were deemed successes, while 8% were cancelled due to unforeseen circumstances and 13% were considered unsuccessful (REEEP, 2015).

Although this all sounds good, one serious disadvantage is that due to their smaller scale REEEP must simultaneously track scores of individual energy projects rather than, say, a large, massive power plant. Moreover, REEEP's large volume of members can create delays as those partners discuss, and at times disagree about, particular projects. Since the bulk of REEEP's budget is from voluntary contributions, its planning horizon for projects is pervasive orientated towards the short-term. Therefore, one study cautions that projects backed by REEEP (and other similar institutions in developing countries) often fail to provide comprehensive local financing for projects (Haselip et al., 2014). A second one warns that REEEP suffers from salient weaknesses including the fact that they provide mainly advisory services instead of actual capital and loans, that their outputs are manly publications rather than patents or programs, and that they have weak links with beneficiaries, especially governments (Fadel et al., 2013).

Resilience (moderately strong)

Finally, REEEP does exhibit resilience. It is supported primarily dozens of institutions including governments, private sector actors and associations, research institutes and intergovernmental organizations. Such a broad network ensures that if any of its 350 partners leaves the network the others still enable it to function. In 2015, for instance, it received significant sources of funding from Norway, Austria, Germany, and Switzerland in addition to the European Union, CDKN (in the United Kingdom), International Renewable

Energy Agency, Food and Agricultural Organization, and World Bank, in addition to others as well as private sector donations (REEEP, 2015).

4.3 The Global Alliance for Clean Cookstoves (GACC)

Launched in 2010, the Global Alliance for Clean Cookstoves (GACC) is a governance network hosted by the United Nations (UN) Foundation. The long-term goal of the alliance is universal adoption of clean cookstoves all over the world. By creating a global market for "clean and efficient household cooking solutions," the alliance aspires to "save lives, improve livelihoods, empower women and protect the environment."[2] At present, more than 600 million of the world's households still use solid fuels in inefficient cookstoves and open fires, causing serious environmental and health impacts that disproportionally affect women and children (GACC, 2011).

Clarity of purpose (strong)

The alliance has an ambitious goal to foster the adoption of clean cookstoves and fuels in 100 million households by 2020—the so-called "100 by 20" goal, and it strives for universal adoption by 2030. In November 2011, the Alliance released a report "*Igniting Change: A Strategy for Universal Adoption of Clean Cooking Solutions*." The report, to which more than 350 sector exports contributed, identified the creation of a thriving global market for clean cookstoves and fuels as the most viable way to achieve universal adoption of clean cooking solutions, and offered a three-pronged strategy for building such a market: enhancing demand, strengthening supply, and fostering an enabling environment (GACC, 2011). Conducting rigorous research is a major component of creating the environment necessary for increased awareness, funding, and action. The Alliance has already begun funding key research projects, as well as issued a request for applications related to decreasing stove-related injuries and deaths among young children. Rather than adopting an aid-driven

[2] http://cleancookstoves.org/about/, last accessed July 12, 2017.

approach, the Alliance promotes a decidedly market-based approach to promote switching to clean cookstoves. It reckons that past attempts to deliver clean cookstoves and encourage the use of clean fuels have failed because of a failure to understand and meet consumers' needs, especially in those cases where cookstoves were subsidized for the end user but not selected to best meet their interests (GACC, 2011: 17).

Funding (moderately strong)

In its five-year progress report, the Alliance reported that it had attracted more than $413 million in pledges from governments, foundations and corporations to the sector. This includes $265 million in carbon finance. The partner base of the Alliance has expanded from just 19 at the launch to 1,300 partners. The Alliance has helped to drive more than 28 million cookstoves into the field by 2014, well on its way to reach its target of 100 million by 2020 (GACC, 2015). The only reason we give it a "moderately strong" score is that its budget remains insufficient to reach universal access of cleaner cooking devices, i.e., it does not have the resources to achieve its mission. Bazilian et al. (2014) estimate that at least $1.8 billion is needed in annual investment to achieve universal access to cleaner cooking or a cumulative investment of about $89 billion (Bazilian et al., 2014; Fusonerini et al., 2014).

Institutional formality (moderately strong)

The GACC did not emerge *ex nihilio*. The Alliance builds on a previous multi-stakeholder initiative, launched by the US Environmental Protection Agency (EPA) and a handful of partners at the World Summit on Sustainable Development in 2002. The Partnership for Clean Indoor Air (PCIA) grew to more than 590 partners, working in 116 countries to reduce exposure to indoor air pollution from household energy use.[3] In 2012, the PCIA has been formally integrated into the GACC. At the heart of this administrative choice to set up a new office in Washington D.C. with a new mission and vision, albeit with a

[3] PCIA has a legacy website: http://www.pciaonline.org/.

decidedly modest budget and staff,[4] was the beginning of a new 'partnership approach' in US diplomacy—a strategy to leverage public-private partnerships at the service of US foreign policy objectives (Zolli et al., 2015; Bazilian et al., 2017).

Efficacy (moderately strong)

The Alliance is the strongest of the four networks. It has commissioned assessments of the cookstove and fuel markets in 16 countries. Draft Market Assessments have been completed in 16 countries. Collaboration is currently strongest with six focus countries in Africa and Asia: Bangladesh, China, Ghana, Kenya, Nigeria, and Uganda (GACC, 2014). One of the Alliance's most significant achievements has been to draw international attention to the issues around inefficient cooking and household air pollution in the developing world – and to place the problem firmly on the public agenda. To aid this work they have secured support from a range of celebrity ambassadors including actress Julia Roberts and Ghanaian football star Stephen Appiah (Shell Foundation, 2014).

In addition, the Alliance has helped to promote international cookstove standards. One of the greatest barriers to the widespread adoption of clean cookstoves has long been the lack of internationally-recognized clean cookstove standards and benchmarks to assess the quality of improved stoves and provide a valuable assurance for consumers and investors (GACC, 2011, p. 17). In 2011, the Alliance and the International Standards Organisation (ISO) gained a broad consensus for a methodology to benchmark stove quality across several parameters including emissions reductions, fuel efficiency, durability and affordability – a big step towards this goal (Shell Foundation, 2014).

[4] According to its own website, the GACC currently has a staff of 27 employees. It does not disclose its operating budget, but a Washington Post article mentioned it was in the order of $10 million a year. https://www.washingtonpost.com/opinions/these-cheap-clean-stoves-were-supposed-to-save-millions-of-lives-what-happened/2015/10/29/c0b98f38-77fa-11e5-a958-d889faf561dc_story.html

We label the network only "moderately strong", however, because of the barriers it faces in adoption. *Up in Smoke*, a 2012 study by researchers at the Massachusetts Institute of Technology in Cambridge, highlighted some of the ongoing challenges (Duflo et al., 2012). A randomized controlled study in Odisha, India, identified no long-term improvements in health, fuel consumption or — the authors inferred — GHG emissions in households that had been given a clean cooking-stove, primarily because the stoves were not being used. Although the devices had been distributed by the award-winning NGO Gram Vikas, they quickly fell into disuse, or were not maintained at a level that kept emissions low (Subramanian, 2014). Consequently, the study found no significant improvement in lung functioning, and several other health outcomes. This underscores that market-based approaches may not always work at the bottom of the pyramid in communities in "extreme" or "hardcore poverty" (Sovacool and Drupady, 2012).

Resilience (strong)

The Alliance works with a strong network of public, private, and non-profit partners to accelerate the production, deployment, and use of clean and efficient cookstoves and fuels in developing countries. The Alliance's partners include governments such as the United States, Germany, Norway, and Peru; international development organizations such as the World Bank, local NGOs, universities, as well as foundations and private companies such as Morgan Stanley and Shell.[5]

4.4 The Green Climate Fund (GCF)

The Green Climate Fund (GCF), a network consisting of financiers, governments, development partners, and climate action groups, was conceived at the 2009 Copenhagen

[5] For a full list, see: http://cleancookstoves.org/partners/.

climate talks and formally adopted at the Cancun climate conference in late 2010 (UNFCCC, 2011a). The GCF is the financial mechanism of the UN Framework Convention on Climate Change (UNFCCC) and is accountable to the Conference of the Parties (COP). It aims to make an "ambitious contribution" not only to "attaining the mitigation and adaptation goals set by the international community to combat climate change," but also to promote "the paradigm shift towards low-emission and climate-resilient development pathways" (UNFCCC, 2011b). Over time, it is supposed to become the main multilateral financing mechanism to support climate action in developing countries (UNFCCC, 2012). The GCF works with a growing network of accredited entities to implement its projects. These partners on the ground may operate at international, regional, national and sub-national scales, and they may be public, private or hybrid entities.

Clarity of purpose (weak)

The GCF has been plagued by persistent differences between developed and developing countries, but also increasingly between board members and the secretariat on visions for the fund. These tensions already surfaced in the design phase of the GCF, where it became apparent that developed and developing countries had widely differing visions on the functions, mandate, scope and operational capabilities of the GCF (Schalatek et al., 2011). One contentious issue was the relationship of the GCF to the UNFCCC. Developing country negotiators from the G77+China sought to place the fund under the "authority" of the COP, as is the Adaptation Fund Board, rather than merely being accountable to and guided by it, like the Global Environmental Facility, which they perceived as dominated by donor state interests (Vanderheiden, 2016).

In addition, the GCF has been off to a rocky start. Key donors have expressed concern that the GCF lacks focus and direction. In a series of submissions to the GCF board in

December 2015, officials from those and other countries warned of opaque decision-making, weak investment guidelines and poor engagement with the private sector (GCF, 2015).

Funding (weak)

The GCF became operational in the summer of 2014, commencing its initial resources mobilization process, even though important aspects of its institutional design and management still needed to be clarified (Lattanzio, 2014). The GCF was officially opened for capitalization at the UN climate summit in September 2014. By late May 2017, the GCF had raised $10.3 billion in pledges from 43 state governments.[6] The largest contributors (in absolute terms) are the US ($3 billion), Japan ($1.5 billion), the UK ($1.2 billion), France ($1 billion), and Germany ($1 billion). While this might seem like a huge figure, especially compared to the other networks that we analyze here, it falls way short of the target of $100 billion that advanced economies have formally agreed to jointly mobilize annually by 2020. Moreover, in June 2017, the Trump administration announced its withdrawal from the Paris Agreement and made it clear that the U.S. would stop financing the GCF. With a pledge of $3 billion, the US is the single largest contributor to the GCF's initial capitalization goal, but the new administration has made it amply clear that the remaining $2 billion will not be deposited.

Institutional formality (Strong)

After its establishment in 2010, the GCF's institutional design and governance structure was further elaborated in the subsequent COPs. The 2011 Durban meeting adopted the basic design of the GCF as "the operating entity of the Financial Mechanism of the Convention" (UNFCCC, 2012). It also set forth the composition of a board, to have 24 members, composed of an equal number from developing and developed countries, with representation from relevant UN groupings including Small Island States (SIDS) and Least

[6] For an overview of the pledges, see: http://www.greenclimate.fund/contributions/pledge-tracker.

Developed Countries (LDC). The 2012 Doha agreement endorsed the consensus decision of the GCF board to select Songdo, Incheon, Republic of Korea as the host of the GCF (UNFCCC, 2012). At the November 2013 conference in Warsaw, Ms. Héla Cheikhrouhou was appointed as the executive director for the GCF secretariat (UNFCCC, 2015).

Efficacy (weak)

In terms of effectiveness so far the impact of the fund has been limited. Firstly, $10 billion is a far cry from what is actually needed to invest in climate change interventions—Flam and Skjaerseth projected in 2009 that as much as $100 billion per year would be needed to prepare all developing countries for climate change (Flam and Skjaerseth, 2009). Similarly, an assessment from the Potsdam Institute for Climate Impact Research, European Environment Agency, and other institutions calculated that at least $70 to $100 billion of investment will be needed per year for every year from 2010 to 2050 if climate change adaptation needs are to be met (Füssel et al., 2012). Secondly, after having secured pledges of just over $10 billion, the GCF now faces the challenging task of moving from resource mobilization to implementation (King, 2016).

Resilience (moderately weak)

Given that contributions to the GCF by states or private parties are voluntary, along with its governing structure that avoids putting the Fund directly under COP authority, critics view the GCF as moving away from the UNFCCC principles and processes, especially the "common but differentiated responsibilities" principle (Vanderheiden, 2016). This has hurt actors willing to participate in the network. A small handful of key European and North American donors have been responsible for the bulk of funding so far.

5. Conclusions and Discussion

Although care must be taken when generalizing our findings from a small sample of course cases, a first conclusion that follows from our assessment of the four transnational governance networks is that they must govern a complex set of arrangements. The CCI operates at a nexus of business, politics, lenders, and experts, with most of its partners being cities. REEEP works primarily with financial institutions and investors as well as engineering and technology firms. GACC works mostly with NGOs and state based donors. GCF works mostly with nation states and nationally designated actors under the UNFCCC but, to implement its actions on the ground, it works with a network of accredited partners.

Second, however, is that each network has strengths and weaknesses (which we summarize in Table 1). Some of the criteria may create tradeoffs with each other; each network is truly "strong" at the moment in only one category or two categories only, i.e. CCI in resilience and institutional formality, REEEP and the GFC in formality, GACC in clarity of purpose and resilience. No network scores well on all of our criteria, which suggests that polycentric governance networks fail to meet the criteria set out by public administration about what constitutes an effective institution.

Table 1: Qualitative Evaluation of Four Climate and Energy Governance Networks

	Clarity of Purpose	**Resources/ Funding**	**Institutional Formality**	**Efficacy**	**Level of Resilience**
Clinton Climate Initiative	Moderately strong	Moderately weak	Moderately strong	Moderately weak	Strong
Renewable Energy and Energy Efficiency Partnership	Strong	Weak	Strong	Moderately weak	Moderately strong
Global Alliance for Clean Cookstoves	Strong	Moderately strong	Moderately strong	Moderately strong	Strong
Green Climate Fund	Weak	Weak	Strong	Weak	Moderately weak

Put another way, despite its promise, polycentric governance networks in action seem to succumb to their challenges. CCI's programs struggle to overcome lack of knowledge about energy efficiency practices and technologies, split incentives, the first cost hurdle, and a misalignment of government incentives. REEEP must work in environments with weak capacity and also is subject to on and off again funding streams that are somewhat idiosyncratic. GACC faces social acceptance issues as well as contestation over what constitutes a "clean" technology. GCF faces disagreement within the COP process and paltry donations so far. All four networks seem underfunded—and therefore ineffective—concomitant to the challenges they face. This way, our study adds to the voices who regard the "polycentric turn" in international energy and climate governance with a healthy dose of caution (Jordan et al., 2015).

Furthermore, the results of our analysis corroborate the observations of previous studies regarding the importance of the internal organizational structure of transnational governance networks for their effectiveness (e.g., Szulecki et al., 2011). Yet, our study brings additional nuance to this thesis, as it tentatively suggests that not all four criteria seem equally important. The level of resilience, or the relationships between parts of the network, does not seem to be a robust predictor of the overall effectiveness of the network. As Table 1 (above) shows, even networks that are strongly resilient can suffer from low levels of effectiveness, with the CCI being a prime example. Indeed, a hypothesis that warrants further examination is whether some of these criteria (e.g., the level of funding) constitute necessary conditions that need to be met before other conditions (e.g., network characteristics such as resilience or formality) come into play.

In a world where polycentric governance networks are thriving and not likely to wither away, the challenge of how they are governed remains a pertinent one. There have been some sporadic calls and proposals to change the meta-governance of multi-stakeholder partnerships

to increase their effectiveness (e.g., Chan and Pauw, 2014), but as Pattberg and Widerberg (2016) observe: “these calls for more overall synergies can only be realized if the building blocks, i.e., the individual governance arrangements, are designed and implemented in ways that enable their success.”

By assembling multiple actors from different branches of society, polycentric governance networks present a promising channel to coordinate efforts at improving sustainable development—albeit one that does not fully live up to its potential. These networks can be strengthened internally if they more strictly abide by key meta-governance principles such as network framing (clarity of purpose); network design (funding and formality); and relationships between parts (resilience). Powerful public or private actors could intervene directly to strengthen the networks on these critical issues. Leadership, like nature, abhors a vacuum.

6. Bibliography

Abbott, K. W. (2012). The transnational regime complex for climate change. *Environment and Planning C: Government and Policy*, 30(4), 571-590.

Abbott, K. W., & Snidal, D. (2009). Strengthening International Regulation through Transmittal New Governance: Overcoming the Orchestration Deficit. *Vand. J. Transnat'l L.*, 42, 501.

Andonova, L. B., Betsill, M. M., & Bulkeley, H. (2009). Transnational climate governance. *Global Environmental Politics*, 9(2), 52-73.

Bäckstrand, K. (2006). Multi-stakeholder partnerships for sustainable development: rethinking legitimacy, accountability and effectiveness. *Environmental Policy and Governance*, *16*(5), 290-306.

Bäckstrand, K. (2008). Accountability of networked climate governance: The rise of transnational climate partnerships. *Global Environmental Politics*, 8(3), 74-102.

Bazilian, M. Economy, R., Nussbaumer, P., Yumkella, K. (2014). The Scale of Investment for Universal Access. *Energy Poverty*. Oxford Press.

Bazilian, M, BK Sovacool, and T Moss. "Rethinking Energy Statecraft: United States Foreign Policy and the Changing Geopolitics of Energy," Global Policy (in press, 2017)

Chan, S., & Pauw, P. (2014). *Proposal for a global framework for climate action to engage non-state and subnational stakeholders in the future climate regime*. Briefing paper 15/2014. German Development Institute.

Chan, S., Asselt, H., Hale, T., Abbott, K. W., Beisheim, M., Hoffmann, M., ... & Pauw, P. (2015). Reinvigorating international climate policy: A comprehensive framework for effective nonstate action. *Global Policy*, 6(4), 466-473.

Clinton Climate Initiative (2009). "Our Challenge, Our Work," CCI Fact Sheet, Updated May 2, 2009.

Clinton Climate Initiative, "Cities," CCI Fact Sheet, Updated April 28, 2009.

Clinton Climate Initiative (2016). "Forestry Program," available at https://www.clintonfoundation.org/our-work/clinton-climate-initiative

Clinton Foundation. Bill, Hillary & Chelsea Clinton Foundation Consolidated Financial Statements December 31, 2014 and 2013

Clinton Foundation. (2014). Unlocking Human Potential: Clinton Foundation 2013-2014 Annual Report.Clinton, H.R. (2010). Remarks on Global Alliance for Clean Cookstoves at the Clinton Global Initiative. Sheraton Towers, New York City, September 21, 2010. Available at: http://www.state.gov/secretary/20092013clinton/rm/2010/09/147500.htm.

Cole, D. H. (2015). Advantages of a polycentric approach to climate change policy. *Nature Climate Change*, 5(2), 114-118.

Colgan, J. D., Keohane, R. O., & Van de Graaf, T. (2012). Punctuated equilibrium in the energy regime complex. *The Review of International Organizations*, 7(2), 117-143.

Dornan, M. & Kalim U. S. (2016). Energy policy, aid, and the development of energy resources in Small Island Developing States, *Energy Policy* 98: 759-767.

Dorsch, M. J., & Flachsland, C. (2017). A polycentric approach to global climate governance. *Global Environmental Politics*, *17*(2), 45-64.

Duflo, E., Greenstone, M., & Hanna, R. (2012). *Up in smoke: the influence of household behavior on the long-run impact of improved cooking stoves*. NBER Working Paper, 18033.

Eckstein, H. (1975). Case studies and theory in political science. In Greenstein, F., and N. Polsby, eds. *Handbook of political science*, vol. 7, Reading, MA: Addison-Wesley, 79–138

Fadel, M. El et al. (2013). Knowledge management mapping and gap analysis in renewable energy: Towards a sustainable framework in developing countries, Renewable and Sustainable Energy Reviews 20, 576–584

Falkner, R., Stephan, H., & Vogler, J. (2010). International climate policy after Copenhagen: Towards a 'building blocks' approach. *Global Policy*, 1(3), 252-262.

Flåm, K. H., & Skjærseth, J. B. (2009). Does adequate financing exist for adaptation in developing countries?. Climate Policy, 9(1), 109-114.

Florini, AE and BK Sovacool (2009). "Who Governs Energy? The Challenges Facing Global Energy Governance," Energy Policy 37(12) (December), pp. 5239–5248.

Fusonerini, F., Howells, M., Rogner, H., Bazilian, M. (2014). Estimating the cost of energy access: the case of the village of Suro Craic in Timor Leste. Energy

Füssel, H. M., Hallegatte, S., & Reder, M. (2012). International adaptation funding. In: O. Edenhofer et al. (eds.), *Climate Change, Justice and Sustainability* (pp. 311-330). Springer Netherlands.

GACC (2011). *Igniting change: a strategy for universal adoption of clean cookstoves and fuels*. Washington D.C.: GACC.

GACC (2014). *New Sources of Climate Finance for Clean Cooking Initiatives.* Washington D.C.: GACC.

GACC (2015). *Five years of impact: 2010-2015.* Washington D.C.: GACC.

Galaz V, Crona B, Osterblom H, Olsson P, Folke C. (2012) Polycentric systems and interacting planetary boundaries - Emerging governance of climate change-ocean acidification-marine biodiversity. *Ecological Economics* 2012, 81:21-32

GCF (2015). Compilation of submissions for the strategic plan for the Green Climate Fund. GCF/16-12-2015. Available at: https://www.greenclimate.fund/documents/20182/132734/GCF_16-12-2015_-

_Compilation_of_submissions_for_the_strategic_plan_for_the_Green_Climate_Fund.pdf.

Goodin, R. E. (1998). *The Theory of Institutional Design*. Cambridge University Press.

Geels, FW, BK Sovacool, T Schwanen, and S Sorrell. "Sociotechnical transitions for deep decarbonisation," Science 357 (6357) (September 22, 2017), pp. 1242-1244.

Hahn, T., & Pinkse, J. (2014). Private environmental governance through cross-sector partnerships: Tensions between competition and effectiveness. *Organization & Environment*, *27*(2), 140-160.

Hale, T. (2016). "All Hands on Deck": The Paris Agreement and Nonstate Climate Action. *Global Environmental Politics*, doi: 10.1162/GLEP_a_00362.

Haselip, James et al., Financing energy SMEs in Ghana and Senegal: Outcomes, barriers and prospects, *Energy Policy* 65 (2014) 369–376

Jordan, Andrew J., et al. (2015). "Emergence of polycentric climate governance and its future prospects." *Nature Climate Change* 5, 977-982

Keeley, Alexander Ryota. Renewable Energy in Pacific Small Island Developing States: the role of international aid and the enabling environment from donor's perspectives, *Journal of Cleaner Production* (2016, in press).

Keohane, R. O., & Victor, D. G. (2011). The regime complex for climate change. *Perspectives on Politics*, 9(01), 7-23.

King, E. (2016). Green Climate Fund has more money than projects. *Climate Change News*, May 27, 2015. Available at: http://www.climatechangenews.com/2016/05/27/green-climate-fund-has-more-money-than-projects/.

Klijn, E. H., & Koppenjan, J. (2012). Governance network theory: past, present and future. *Policy & Politics*, 40(4), 587-606.

Lattanzio, R.K. (2014). International Climate Change Financing: The Green Climate Fund (GCF). November 17, 2014. Congressional Research Service, Washington D.C.

Lijphart, A. (1971). Comparative politics and the comparative method. *American Political Science Review* 65(3): 682–693.

McGinnis, M. D., & Ostrom, E. (2012). Reflections on Vincent Ostrom, public administration, and polycentricity. *Public Administration Review*, 72(1), 15-25.

Oberthür, S., & Stokke, O. S. (2011). *Managing institutional complexity: regime interplay and global environmental change*. MIT Press.

Ostrom, V., Tiebout, C. M., & Warren, R. (1961). The organization of government in metropolitan areas: a theoretical inquiry. *American Political Science Review*, 55(04), 831-842.

Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change*, 20(4), 550-557.

Parthan, Binu et al. (2010). Lessons for low-carbon energy transition: Experience from the Renewable Energy and Energy Efficiency Partnership (REEEP), *Energy for Sustainable Development* 14, 83–93.

Pattberg, P., Szulecki, K., Chan, M., & Mert, A. (2009). Assessing the role and relevance of the Renewable Energy and Energy Efficiency Partnership (REEEP) in global sustainability governance. *Enhancing the effectiveness of sustainability partnerships* (Washington D.C.: National Academies Press), 81-108.

Pattberg, P., & Widerberg, O. (2016). Transnational multistakeholder partnerships for sustainable development: Conditions for success. *Ambio*, 45(1), 42-51.

Polanyi, M. (1951). *The logic of liberty*. Routledge & Kegan Paul.

Poocharoen, Ora-Orn and BK Sovacool (2012). "Exploring the Challenges of Energy and Resources Network Governance," *Energy Policy* 42 (March), pp. 409-418.

Provan, K. G., & Kenis, P. (2008). Modes of network governance: Structure, management, and effectiveness. *Journal of public administration research and theory*, *18*(2), 229-252.

Rayner, S. (2010). How to eat an elephant: a bottom-up approach to climate policy. *Climate Policy*, 10(6), 615-621.

REEEP (2015). A New Normal for Growth: Annual Report 2014/2015 (Vienna; REEEP).

REN21. Renewables 2016 Global Status Report. Paris: REN21 Secretariat.

Sabatier PA. (1986) Top-down and bottom-up approaches to implementation research: a critical analysis and suggested synthesis. *Journal of Public Policy*, 6:21-48.

Schalatek, L., Nakhooda, S., Bird, N. (2011). *The Design of the Green Climate Fund*. Working Brief, Heinrich Böll Stiftung and Overseas Development Institute, November 2011. Available at: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/7478.pdf.

Scheba, Andreas and Irmeli Mustalahti, Rethinking 'expert' knowledge in community forest management in Tanzania, *Forest Policy and Economics* 60 (2015) 7–18

Shell Foundation (2014). Briefing document: Global Alliance for Clean Cookstoves. Available at: http://www.shellfoundation.org/Our-Focus/Partner-Profiles/Global-Alliance-for-Clean-Cookstoves/Business-Model.

Skelcher, C. (2005). Jurisdictional integrity, polycentrism, and the design of democratic governance. *Governance*, 18(1), 89-110.

Sovacool, BK. 2011a. "An International Comparison of Four Polycentric Approaches to Climate and Energy Governance," *Energy Policy* 39(6) (June, 2011), pp. 3832-3844

Sovacool, BK.2011b. "Rising to the Challenge of Sustainability: Three Cases of Climate and Energy Governance," In Fereidoon P. Sioshansi (Ed.) Energy Sustainability and the

Environment: Technology, Incentives, Behavior (New York: Elsevier, 2011), pp. 551-570.

Sovacool, BK and IM Drupady. 2012. Energy Access, Poverty, and Development: The Governance of Small-Scale Renewable Energy in Developing Asia. New York: Ashgate Studies in Environmental Policy and Practice.

Sovacool, BK, M Bazilian, and M. Toman. (2016). "Paradigms and Poverty in Global Energy Policy: Research Needs for Achieving Universal Energy Access," *Environmental Research Letters* 11(6) (June), pp. 1-6.

Stewart. Richard B., Oppenheimer, Michael, Rudyk, Bryce. (2013). Building blocks for global climate protection. *Stan. Envtl. LJ*, 32, 341.

Subramanian, M. (2014). Deadly dinners. *Nature*, 509(7502), 548-551.

Szulecki, K., Pattberg, P., & Biermann, F. (2011). Explaining variation in the effectiveness of transnational energy partnerships. *Governance*, 24(4), 713-736.

UNFCCC (2011a). Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010. March 15, 2011.

UNFCCC (2011b). Green Climate Fund–Report of the Transitional Committee. Draft decision-/CP.17, available at: http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cop17_gcf.pdf.

UNFCCC (2012). Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011. March 12, 2012. Available at: http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf.

UNFCCC (2015). Report of the Green Climate Fund to the Conference of the Parties. September 21, 2015. Available at: http://unfccc.int/resource/docs/2015/cop21/eng/03.pdf.

Van de Graaf, T. (2013). *The politics and institutions of global energy governance*. Palgrave.

Vanderheiden, S. (2015). Justice and Climate Finance: Differentiating Responsibility in the Green Climate Fund. *The International Spectator*, 50(1), 31-45.

Visseren-Hamakers, I. J. (2015). Integrative environmental governance: enhancing governance in the era of synergies. *Current Opinion in Environmental Sustainability*, 14, 136-143.

Widerberg, O., & Stripple, J. (2016). The expanding field of cooperative initiatives for decarbonization: a review of five databases. *Wiley Interdisciplinary Reviews: Climate Change*, *7*(4), 486-500.

Zolli, C. et al. (2015). Understanding Global Opportunities. Exploring the role of the US Department of State's Office of Global Partnership in Public-Private Partnership (P3) Development of the Global Alliance for Clean Cookstoves. Technical Report, November 2015, available at: http://www.state.gov/documents/organization/251105.pdf.