

Emergence and Structuring of the Clean Energy Regime Complex

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Abstract

While many have observed a regime complex for global clean energy governance, research has not yet accorded sufficient attention to the interplay of multiple streams of politics that have led to the structuring of overlapping governance initiatives and ultimately the articulation of a set of norms that hold this regime complex together. To understand these dynamics, we argue that with the visibly increased agency of transnational actors and international organizations, four mechanisms together are likely to shape regime complexity, which are divergent state preferences, the agency of transnational actors, practices of intergovernmental organizations, and inter-organizational recognition and normative legitimation. Drawing on qualitative analysis of policy documents and interviews, and social network analysis, we study global clean energy governance from 1980 to 2014 to illuminate these dynamics. Our findings suggest the combination of these four mechanisms can explain the evolution from a non-regime to a loosely coupled governance system for clean energy.

Keywords: clean energy, regime complex, international organizations, network analysis

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1 Introduction

Between 1980 and 2014, numerous transnational initiatives and intergovernmental institutions emerged principally aimed at driving clean energy adoption to form a loosely coupled governance sphere, which is conceptualized as a regime complex. While scholars have observed regime complexes across issue domains, few have examined the multiple political mechanisms through which regime complexes arise and their implications for structuring. Early studies focused primarily on the interaction and overlap of institutions, identifying intergovernmental politics as the major contributor to complex governance.⁴ Yet such approaches explain only a narrow set of factors that drive regime complex formation, disregarding the agency of sub-state and transnational actors and the practices of international organizations (IOs). Often, regime complexity has developed organically from the ground up, despite the absence of a traditional focal regime or by forming a distinctive new sphere of governance in between two elemental regimes.

Clean energy is an issue domain characteristic of such complex, decentralized governance, akin to the complex governance of other issues ranging from small arms, forestry, fisheries, or the Internet among others.⁵ The clean energy regime complex is situated between the energy regime and climate change regime. While there is clear overlap between these three institutional constellations, the clean energy regime complex is also distinct, owing to the unique set of institutional mechanisms and norms that are specific to the globally recognized objectives of a clean energy transition. We expect that the processes that shaped the sphere of clean energy governance are representative of important dynamics of regime complex formation, which makes it an ideal case to study both conceptually and substantively as a pressing global issue. We focus

⁴ Alter and Meunier 2009; Alter and Raustiala 2018; Colgan et al. 2011; Keohane and Victor 2011; Raustiala and Victor 2004.

⁵ Bernstein and Cashore 2007; Hollway et al 2020; Orsini et al 2013; Radu 2019.

on two core questions: What are the political mechanisms that drive the emergence of a regime complex for clean energy? How do these mechanisms mold the structuring and norms of the regime complex? The article thus aims to illuminate two types of outcomes - on the one hand, the mechanisms driving the clean energy regime complex formation; and on the other hand, the emergent structure of the regime complex and the authority embedded within it.

The existing regime complex literature focuses on three major mechanisms that contribute to regime complexity— i) traditional intergovernmental politics associated with preference divergence and power; ii) the proliferation of transnational initiatives; iii) and the expanding practices of international organizations. Our theoretical framework and empirical research highlights also a fourth, understudied mechanism: iv) processes of interaction and mutual recognition among constitutive organizations for the purposes of legitimation and normative articulation. Our study contributes to the theorizing of regime complexes first by drawing attention to the dynamics of regime complex formation. Second, it underlines the relevance of four distinct but interrelated political mechanisms in the emergence of a decentralized and yet clearly identifiable sphere of governance. Third, it probes the processes that help create the regime complex's structure and nodes of power within it, which can ultimately affect its outcomes.

Empirically, we investigate first the interface of the three political processes resulting in platform proliferation and the emergence of the clean energy regime complex, from a 'non-regime' in the 1980s to a distinctive sphere of governance by 2014. Second, we use social network analysis (SNA), complemented with qualitative evidence, to illuminate the structuring of the regime complex through inter-organizational recognition and legitimation, as well as the articulation of overarching norms.

Our empirical findings emphasize the significance of the interplay of intergovernmental, transnational, and organizational politics resulting in rapid proliferation of governance initiatives for clean energy. It furthermore highlights the critical role of organizational interactions and epistemic recognition of initiatives as relevant and legitimate for the assemblage of a loosely coupled regime complex. We find that three multilateral organizations—the UN Framework Convention on Climate Change (UNFCCC), the International Energy Agency (IEA), and the UN Environment Programme (UNEP)—are central in the emergent complex structure, as referent points for recognition of epistemic quality and shared norms. Through a detailed case study, our analysis addresses the research gap, identified by Alter and Raustiala (2018, p. 344), on the processes and sequencing that shape specific regime complexes and their outcomes.

The following section theorizes the four mechanisms of regime complex formation and describes the methodological approach. The empirical analysis first traces the history of the emergent clean energy regime complex through state interests, transnational initiatives, and new IO-facilitated platforms, before introducing the SNA and qualitative discussion of organizational interaction and regime complex structure.

2 The Politics of Regime Complexity: Four Mechanisms

The concept of regime complex, defined as a set of “partially overlapping and nonhierarchical institutions governing a particular issue-area,”⁶ has contributed greatly to understanding institutional overlap and interplay. However, regime complexes are often depicted as resulting from preference divergence and manipulation of institutional landscapes to suit state interests.⁷

⁶ Raustiala and Victor 2004, 279.

⁷ Alter and Raustiala 2018; Drezner 2009.

Regime complexes are also identified *ex post* based on observed overlap and friction among preexisting regimes,⁸ or as a collection of loosely connected institutions.⁹ Less attention has been paid to the interorganizational processes contributing to the emergence of a regime complex and how the interaction among constitutive organizations shape its structure.

We stipulate that four distinct mechanisms can contribute to the formation of a regime complex in an issue area, as depicted in Table 1. Our theory presupposes that these four mechanisms are not independent of each other. Their *interplay* drives institutional proliferation and overlap, and combined with the normative recognition by relevant actors, ultimately forms a loosely coupled structure and a sphere of governance that is greater than ‘the sum of its parts.’¹⁰ Below we elaborate on how each mechanism may drive the rise and structure of regime complexity.

⁸ Alter and Meunier 2009; Raustiala and Victor 2004.

⁹ Keohane and Victor 2011, 2013; Orsini et al. 2013.

¹⁰ Gehring and Faude 2013; Keohane and Victor 2011; Orsini et al. 2013.

Table 1: Mechanisms Driving Regime Complex Emergence and Structuring

Mechanism	Description	Examples
State Preferences and Dissatisfaction with the Institutional Status Quo	Discord of interests and dissatisfaction with the status quo among powerful state actors, which could inhibit the development of integrated regimes and promote proliferation of governance platforms	<ul style="list-style-type: none"> • Forum shopping or regime shifting • State investment in creation of new institutions outside of existing regime or cooperation frameworks • State exploitation of strategic inconsistencies across organizations to accommodate preference changes
Agency of Transnational Actors and Governance Initiatives	Rise of transnational actors and their capacity to establish alternative forms of governance	<ul style="list-style-type: none"> • Watchdog functions • Private governance • Standard setting
IOs and Their Practices	Expansion of multilateral institutions' organizational practices that can produce new governance platforms and increase connections among platforms	<ul style="list-style-type: none"> • Turf wars and competition • Horizontal rescaling • Institutional expansion of toolsets or missions to adjacent policy areas • Collaboration and partnerships
Interorganizational Recognition and Norm Articulation	Interorganizational recognition of institutions and initiatives as relevant and legitimate constituents of a sphere of governance (an especially overlooked dynamic so far).	<ul style="list-style-type: none"> • Mutual recognition across organizations • Information sharing across organizations • Participation in formal and informal channels • Legitimizing power whereby IOs establish their right to govern and the social recognition of their authority through other organizations in the field

2.1 State Preferences and Dissatisfaction with the Status Quo

Strong preference divergence and power differentials among states are widely considered an underlying driver of gridlocks in cooperation and regime complexity. As demonstrated by the early years of clean energy institutional proliferation, states used their financial and political influence to establish new multilateral institutions or create associated platforms reflecting their interests when they are dissatisfied with the status quo.¹¹ A range of tactics like forum shopping and exploitation of frictions and strategic inconsistencies across platforms, norms, and rules allow powerful actors to manipulate institutional landscapes to favor their agendas.¹² Power is critical because dissatisfied actors need to have political and financial resources to create and take advantage of multiple forums.¹³

¹¹ Colgan et al. 2011; Keohane and Victor 2011; Van de Graaf 2013a.

¹² Alter and Raustiala 2018; Raustiala and Victor 2004.

¹³ Alter and Meunier 2009; Drezner 2009.

Nevertheless, we find that state preference divergence and power are potent but insufficient factors for distinguishing between governance fragmentation and loose-coupling of diverse organizations to form a regime complex.¹⁴ Focusing on such factors exclusively misses the counterfactual that a group of actors with strong preferences and sufficient capability could also act to reform existing regimes.¹⁵ Moreover, a state-centric focus omits the agency of transnational and sub-state actors, which have increasingly gained capacity and tools to engage in experimentation and transnational governance. In sum, a theory of regime complex emergence requires more expansive notions of agency, power, and contextualization.

2.2 The Agency of Transnational Actors and Governance Initiatives

The rise in the power of transnational actors, from NGOs to corporations to standard-setting organizations, has resulted in a new societal capacity to construct alternative governance initiatives based on non-state or hybrid authority.¹⁶ Consequently, transnational governance, which connects different configurations of non-state and sub-state actors across borders in the pursuit of collective goods, is another important dimension of complexity. Scholars of climate change governance argue that transnational schemes are an essential part of a complex web of institutions and experiments seeking to tackle the issue.¹⁷ However, regime complex theory has only engaged with these developments to a limited extent.¹⁸ Therefore, we anticipate that transnational agency is an additional driver of complexity. This is particularly likely in instances of intergovernmental gridlocks or shift in resources that may provide motivation and space for entrepreneurial actors to

¹⁴ Keohane and Victor 2013; Orsini et al. 2013.

¹⁵ Keohane 1984; Krasner 1983.

¹⁶ Andonova 2017; Avant et al. 2010; Bernstein and Cashore 2007; Green 2014; Prakash and Potoski 2006.

¹⁷ Andonova et al. 2017; Bulkeley et al. 2014; Green 2014; Hoffmann 2011.

¹⁸ Abbott 2012; Abbott et al. 2016; Green and Auld 2017.

create transnational initiatives around specific issues.¹⁹ States and intergovernmental institutions may explicitly or tacitly provide space for non-state actors to assume certain functions, with expectation for greater efficiency, resources and expertise.²⁰ Transnational actors, in turn, can draw on existing international rules or direct collaboration with formal IOs to increase their legitimacy or rule-making authority.²¹ Transnational governance initiatives thus constitute an important mechanisms in the emergence of regime complexity that takes place both in parallel and in interaction with IOs and intergovernmental politics. Such processes can further impact the structure of a given governance field by shaping the nature of authority and organizational forms, increasing the density of the institutional landscape and interactions across institutions.

2.3 IOs and Their Practices

The third mechanism of regime complex formation relates to the evolving practices of IOs. When facing normative or resource pressures, IOs have acted as governance entrepreneurs to facilitate partnerships with non-state actors²² and used their platforms to orchestrate informal governance, thus expanding their resources and operations.²³ In additions, IOs have used issue-linkage and extension of standard practices such as rhetoric, policy initiatives, and operations to adapt to new challenges and incorporate issues such as climate change.²⁴ Sociological theories have argued more broadly how organizational dynamics like extending standard practices to adjacent policy areas have contributed to mission expansion and forum proliferation.²⁵ Regime complex analysis

¹⁹ Abbott et al. 2016; Bulkeley et al. 2014; Bernstein and Cashore 2007.

²⁰ Andonova 2017; Green 2014; Hale and Roger 2014.

²¹ Abbott et al. 2016; Kinniburgh et al. 2022.

²² Andonova 2017.

²³ Abbott et al. 2015; Hale and Roger 2014

²⁴ Hall 2015.

²⁵ Adler and Pouliot 2011; Barnett and Finnemore 1999; Hall 2015; Hannan and Freedman 1989.

must more fully account for IO practices and their interaction with other political mechanisms, such as state preference divergence and transnational governance, as drivers of platform proliferation and regime complexity.

Considering inter-governmental, transnational, and organizational politics more explicitly would shed light both on the evolution of pre-existing regimes with core hierarchical institutions and the bottom-up emergence of more distributed regime complexes between existing institutional structures. Hence, we expect significant change in global clean energy governance between earlier periods of time dominated by inter-governmental politics and after the late 1990s when transnational networks and IO programs proliferated rapidly in world politics. The three mechanisms together have implications for both the emergence of the regime complex and the constituent elements of its structure. However, we argue that more theoretical attention should be paid to inter-organizational strategies of mutual recognition and legitimation, which ultimately shape the structuring of the regime complex as a loosely coupled field and its normative content.

2.4 Interorganizational Recognition and Norm Articulation

The fourth mechanism in our framework examines how strategies of mutual recognition and legitimation shape the regime complex's structure, such as its density or the centrality and prestige of organizations, but also whether the regime complex can be characterized as loosely coupled and authoritative governance, in contrast to a highly fragmented structure or an earlier non-regime. Discussing the reconstitution of governance in an era of complexity, Ruggie clarifies that 'governance, at whatever level of social organization it may take place, refers [...] to the constellation of authoritative rules, institutions, and practices by means of which any collectivity

manages its affairs.’²⁶ Hollway (2021) argues that some degree of dependency between institutions makes a regime complex. Therefore, the structure of a regime complex is not simply defined by the assemblage of elemental regimes and platforms; it involves the emergence of an intersubjective field of organizations, which are recognized as relevant and legitimate in advancing a collective governance purpose.²⁷ To this effect, sociological perspectives lead us to consider processes of organizational interaction. These include strategies of associating with established organizations in the field as means of legitimation, which in turn attributes vetting power of such organizations in conveying legitimacy. Organizations further seek mutual recognition and competitive differentiation to establish their relevance,²⁸ all of which shapes the structuring of the organizational field of the clean energy regime complex.

We expect that organizations with greater recognition due to their established expertise and normative vetting power are likely to be more central and have greater influence within the regime complex. Moreover, the bi-directional interaction among transnational actors and IOs are likely to be particularly important, given that transnational actors often operate without explicit delegation of authority and actively pursue strategies of recognition and normative legitimation.²⁹ Indeed, Allan (2020) has documented the significance of recognitions for non-state actors, such as NGOs in their forum multiplication strategies across IOs. IOs may respond by delegating responsibilities or creating partnerships with transnational actors, which has compounding impacts on the governance structure of the regime complex.³⁰ These activities will have an impact on the structure of a governance field, whereby interactions across institutions proliferate and the density of the

²⁶ Ruggie 2004, 504.

²⁷ Andonova et al. 2017; Bäckstrand 2006, Bulkeley et al. 2014.

²⁸ DiMaggio and Powell 1983; Scott 2001.

²⁹ Abbott et al. 2016; Allan 2020; Bulkeley et al. 2014.

³⁰ Andonova 2017; Hale and Roger 2014.

governance sphere increases along with the centrality of institutions with prominent expertise or broad normative mandates. Such interdependencies thus shape the structure of the emergent regime complex as a sphere of governance beyond the sum of its parts. In the event of institutional proliferation without interplay, we would expect a highly fragmented and dispersed governance space with little engagement among constituent organizations that lacks a coordinated framework or clusters centered around certain members.

In summary, we argue that the four mechanisms discussed above work in conjunction with each other to shape regime complexity in the contemporary global governance context. Each mechanism individually is insufficient to account for the emergence and structuring of regime complexes that encompass a great diversity of organizational forms. While different strands of literature have illuminated the relevance of inter-governmental politics, transnational initiatives and IO platforms, few studies have presented an integrated perspective on such dynamics and the relevance of inter-organization recognition in the structuring of regime complexes.

The empirical analysis examines the mechanisms and their interplay to understand the politics of the emergence and structuring of a clean energy regime complex. The analysis draws on primary and secondary sources, interviews, and a dataset of organizations and transnational initiatives engaged in clean energy governance in the period 1980-2014 (list of initiatives in Annex 1). We conducted 25 interviews with 13 multilateral organizations and transnational initiatives active in clean energy governance. The dataset draws on the two most comprehensive sources for the specified time-period, mapping respectively intergovernmental organizations and related platforms working on clean energy³¹ and transnational clean energy initiatives as a sub-set of transnational climate change governance.³² The timeframe is appropriate as it captures the period

³¹ Data from Barnsley and Ahn 2014.

³² Data from Bulkeley et al. 2014.

when clean energy first gained salience in the 1980s through the rapid proliferation of clean energy initiatives in the late 1990s and early 2000s, when a sphere of governance with a distinctive set of norms and objectives was institutionalized in the UN Sustainable Development Goals (SDGs). The next section examines the relevance of inter-governmental politics, transnational agency, and IO practices as drivers of forum proliferation and *emergence* of an identifiable clean energy sphere of governance, from the baseline of a non-regime in the 1980s. The SNA in the following section investigates inter-organizational recognition within the emergent regime complex, whether the organizational field has become more structured, and what types of organizations represent central nodes. The SNA analysis is complemented with qualitative evidence on organizational interaction and normative articulation, allows us to capture the regime complex structuring and claims of legitimation of authority around a set of norms and nodes of power. We thus focus on two discernable outcomes: the emergence of the regime complex and its structure.

3 From Clean Energy ‘Non-Regime’ to Governance Complexity: Political Mechanisms

3.1 State Preferences: Gridlock to IRENA

Divergent state interests and power engendered the lack of multilateral cooperation over clean energy for many decades. The main political dynamic after the 1970s oil crisis and until the late 1990s was not sharp preference divergence among states, but rather a limited interest in international coordination on renewable energy, as all major powers sought to retain sovereignty over energy policy. The first UN Conference on New and Renewable Sources of Energy (1981) proposed the creation of a special energy body within the World Bank with policy and financing powers; although without support from the US. Nevertheless, a Working Party on Renewable Energy Technologies was created as an advisory body to the IEA in 1982. By the early 1990s,

concern about climate change increased again the salience of energy externalities. However, under the 1992 UNFCCC and its Kyoto Protocol (1997), countries did not adopt a dedicated instrument on clean energy technology transfer, revealing limited interest in international coordination.³³ The Kyoto Protocol Joint Implementation (JI) mechanism and Clean Development Mechanism (CDM), which generate emission offsets, became the UNFCCC's main vehicles for renewable energy diffusion, along with the Global Environmental Facility (GEF), which serves multiple conventions.³⁴

Considerable divergence of state preferences became visible with the US's exit from the Kyoto Protocol. At the 2002 World Summit on Sustainable Development, the European Union's proposal on a renewable energy agreement outside the UNFCCC framework was flatly rejected both by the US and developing countries, consolidating the status quo of a clean energy 'non-regime.'³⁵

However, the increasing divergence of interests among major states and coalitions pushed clean energy governance from a non-regime toward a fragmented architecture of multiple institutions.³⁶ Efforts to promote cooperation took place through informal platforms, such as the G-20 Gleneagles Summit (2008) where the UK and Germany facilitated informal consensus around clean energy goals and energy efficiency, stimulating the creation of the International Partnership for Energy Efficiency Cooperation (IPEEC) as a separate platform associated with the IEA to foster dialogue with emerging economies. The US-sponsored Major Economies Forum (MEF) was an alternative platform intended to engage energy and climate issues outside of the Kyoto Protocol. In other words, preference divergence and strategies of major economic powers

³³ Benedick 2001.

³⁴ Andonova et al. 2018; Stadelmann and Castro 2014.

³⁵ For the concept of non-regime, see Dimitrov 2006.

³⁶ Biermann et al 2009.

were a key political dynamic in the early 2000s, propelling forum proliferation toward regime complexity. Ultimately, political interests shifted sufficiently to facilitate the creation of a new intergovernmental institution, the International Renewable Energy Agency (IRENA), in 2010. Within a decade, IRENA grew its membership to 168 states and now commands a budget that rivals the IEA's to support policies and projects on renewable technology deployment. However, these developments left the impression of institutional fragmentation, with overlapping mandates and organizational redundancies, rather than loosely coupled governance. While intergovernmental politics was a key driver of platform proliferation, this alone is insufficient to understand the variable geometry of the emergent clean energy regime complex.

3.2 The Emergence of Transnational Clean Energy Governance

Transnational initiatives for clean energy, driven by cross-border collaborations of non-state, subnational, and public actors, expanded rapidly since the late 1990s.³⁷ Several political mechanisms interplayed to shape this transnational sphere of governance. Private and sub-state actors created new outlets for clean energy collaboration to engage in market-based and informal mechanisms for project-based activities.³⁸ At the same time, such initiatives drew growing support from philanthropic organizations and donor countries seeking to promote the diffusion of clean energy policies and technology. Subnational actors, such as cities, regions, and national agencies, similarly led the way since the early 1990s with strong interest in energy efficiency and clean transportation. Manifestations of such strategies include the Local Governments for Sustainability (ICLEI), created in 1990 and involving over 1,750 municipalities across 100 countries, and multiple networks of global cities and regions, for example C40, the Covenant of Mayors, Energy Cities, and Regions 20. Our data reveals (Annex 1) that private transnational initiatives are

³⁷ Bulkeley et al. 2014; Florini and Sovacool 2009; Zelli et al. 2020.

³⁸ Green 2014; Newell 2011; Zelli et al. 2020.

underrepresented in the first decade of proliferation of clean energy platforms. However, prominent private-sector-driven transnational networks include Global Sustainable Electricity Partnership of major electricity companies and the Gold Standard for carbon-offset certification, which explicitly prioritizes renewable energy. Private-sector investment in and diffusion of renewable energy technology was largely driven by market-based and policy incentives.³⁹

The interface of different political mechanisms is represented by the rising transnational interest in clean energy, as well as specific agendas and incentives promoted by donor agencies.⁴⁰ States with active policies have backed large transnational initiatives in collaboration with industry associations, advocacy groups, and international organizations (e.g., Renewable Energy and Energy Efficiency Partnership [REEEP] in the UK and REN21 in Germany), illustrating the interaction between mechanisms identified in our theoretical framework.⁴¹ Transnational politics and network-based initiatives ultimately became a central mechanism in expanding the complexity of clean energy governance, owing to their proliferation and increased interactions with IOs. This activity is exemplified through the increasing involvement by non-state and subnational actors in the climate regime, fostered through formal and informal interactions with the UNFCCC-centered climate regime, IOs, and climate-related partnerships.⁴²

3.3 IOs and the Expansion of Clean Energy Platforms and Practices

The evolving practices of IOs broadening their mandates by developing clean energy programs constitutes another mechanism in the emergence of a regime complex; this mechanism is

³⁹ Aklin and Urpelainen 2018; Stadelmann and Castro 2014.

⁴⁰ Andonova 2017; Newell 2011; Szulecki et al. 2011.

⁴¹ Andonova 2017; Colgan et al. 2011; Szulecki et al. 2011; Van de Graaf 2013b.

⁴² Andonova et al 2009; Bulkeley et al 2014; Hale and Roger 2014

particularly notable for organizations like the IEA, UNEP, and the World Bank.⁴³ The IEA needed to remain relevant following the proliferation of alternative state-orchestrated platforms for clean energy, such as IPEEC and IRENA. Instead of reforming and modernizing the IEA, for reasons of its limited membership and mandate focused on fossil fuels, new organizations and initiatives for clean energy were created in parallel to the pre-existing energy regime.⁴⁴ The IEA capitalized on its expert capacity to attract donor contributions for new policy and training activities. For example, in 2010, the Low-Carbon Energy Technology Platform was created with member states' support *within* the agency as a primary mechanism to advance its advisory functions with emerging and developing economies.⁴⁵

At the World Bank, two streams of organizational politics prompted the expansion of clean energy platforms. First, the Bank's Environment Department catalyzed the creation of a multiplicity of funds for carbon offsets and climate financing.⁴⁶ Secondly, pressure from advocacy actors and donor countries incentivized various World Bank departments to orchestrate programs with transnational actors.⁴⁷ The success with carbon funds ultimately made the World Bank a focal point for the establishment of the Clean Technology Fund (part of the Climate Investment Funds) in 2008 as the single largest international instrument for clean technology investment at the time.⁴⁸ As shown in the case of the IEA, the World Bank and alternative platforms, the interactions and mutual recognition among transnational actors and IOs forged new collaborations and institutions, expanding governance capacity.

⁴³ Nakhooda 2011; Newell 2011; Van de Graaf 2013a.

⁴⁴ Interview at IPEEC Secretariat, Paris, 9 June 2014.

⁴⁵ Interview at IEA, Paris, May 2015.

⁴⁶ Andonova 2017.

⁴⁷ Hale and Roger 2014.

⁴⁸ Nakhooda 2011; Newell 2011.

UNEP followed a different organizational path to clean energy. Unlike the IEA and the World Bank, UNEP had a strong environmental mandate but relatively little engagement with energy issues until 1997 when its Division of Technology, Industry and Economics (DTIE) created a new Energy Branch to work on renewable energy and energy efficiency. Mark Radka, the founding director of this unit, characterizes these developments as a ‘strategic decision by UNEP to occupy an organizational niche that was opening up as several policy streams converged.’ Climate change is a natural extension of the environmental work of UNEP, underlining a normative rationale for issue linkage and mandate extension. UNEP’s staff viewed the adoption of the Kyoto Protocol, as an opportunity to undertake clean energy as a new sphere of work, building upon the organization’s expertise on technology transfer and clean production, global membership (in contrast to the IEA), and capacity to facilitate partnerships linking government and nonstate actors.⁴⁹

While donor states’ interests and continued funding of multilateral organizations are inevitably tied to the priorities set within these organizations, this mechanism alone cannot fully explain regime complexity, but rather works in conjunction with transnational and organizational politics. The three organizations’ expanding practices and agency – while navigating and engaging donor states’ interests and funding– reveal how the mechanism of organizational politics contributed to creating a specific sphere of clean energy governance. Institutional interactions and interplay, through IO expansion and partnerships with transnational actors, increases the density of the institutional landscape and legitimacy of organizations as central repositories of clean energy expertise. There is significant diversity of platforms and interplay of political, organizational, and transnational interests and power, supporting our theoretical expectations and prompting us to

⁴⁹ Interview at UNEP DTIE Energy, Paris July 2015; Interview at REN21, Paris, May 2015.

further examine how these initiatives interact to structure the emergent field of governance. Yet, existing studies have not examined the degree and form of structuring of this sphere of governance during the period examined here. The following section undertakes this task using SNA and qualitative evidence of interorganizational recognition of relevance and epistemic authority.

4 Recognition, Legitimation, and Structuring of the Clean Energy Regime Complex

The SNA allows us to examine how structural complexities emerge from the processes of interaction and recognition among different organizations.⁵⁰ As DiMaggio and Powell (1983, p. 149) observe, “The structure of an organizational field cannot be determined *a priori* but must be defined on the basis of empirical investigation’; it involves multiple types of interactions and ultimately “the development of a mutual awareness among participants that they are involved in a common enterprise.” We thus conduct a SNA of the organizational interactions within the emergent clean energy regime complex to discern its structure and the relative centrality in terms of perceived epistemic authority, legitimating power, and prestige of different institutions. As suggested by the fourth mechanism in our theoretical framework, we anticipate that organizations that embody broadly recognized expertise, norms, and participatory platforms are likely to gain centrality as referent points of recognition and inter-organizational epistemic legitimation.⁵¹ Therefore, an institution’s relative network centrality would be based on the high recognition potential of their normative or expertise claims.⁵²

We study a network of 11 multilateral institutions and 33 transnational initiatives that are listed in Annex 1. We examined two sources of referencing and recognition among the

⁵⁰ Green 2013; Hollway et al. 2017; Kim 2019.

⁵¹ Abbott et al. 2016; Bäckstrand 2006; Hollway 2020; Widerberg 2016.

⁵² Green 2013.

organizations: the websites of all international and transnational organizations in our database (e.g. ‘About Us,’ ‘History,’ ‘Partners,’ etc.) and, if available, each organization’s flagship publications on clean energy. These are the main broadly accessible sources through which each organization communicates its expertise as a basis for epistemic and normative authority. We code as 1 any reference to the expertise or publications of other organizations represented in our data; 0 if such reference is absent. We treat the referencing of other initiatives in the network as a proxy for recognition of their epistemic authority and legitimating power, validation of a set of norms, or differentiation of an organizations’ expertise.⁵³ It follows from the preceding discussion that an organization’s mention on the official website or in flagship publications are treated as indicators of its perceived epistemic and normative authority, and thus its relative centrality and power in the emerging organizational field.

The network analysis uses degree centrality in a directed network, because indegree centrality allows us to measure how many other nodes send links (references) into a given node, as a measure of prestige, and outdegree centrality measures the number of links (references) out of a given node, as a measure of diffusion.⁵⁴ We also use eigenvector centrality as a measure of influence to capture whether the most referenced organizations hold authority and legitimizing power within the network.⁵⁵ The ties capture the structure of the network and the relative importance of different organizations in terms their position in the network as referent points of epistemic or normative authority. Through these methods, we capture the directionality of the interorganizational recognition while centrality measures and an exponential random graph model

⁵³ DiMaggio and Powell 1983; Green 2013; Haas 1989; Hollway 2020.

⁵⁴ See Green 2013 and Hafner-Burton et al 2009 for the application of similar methodological approaches.

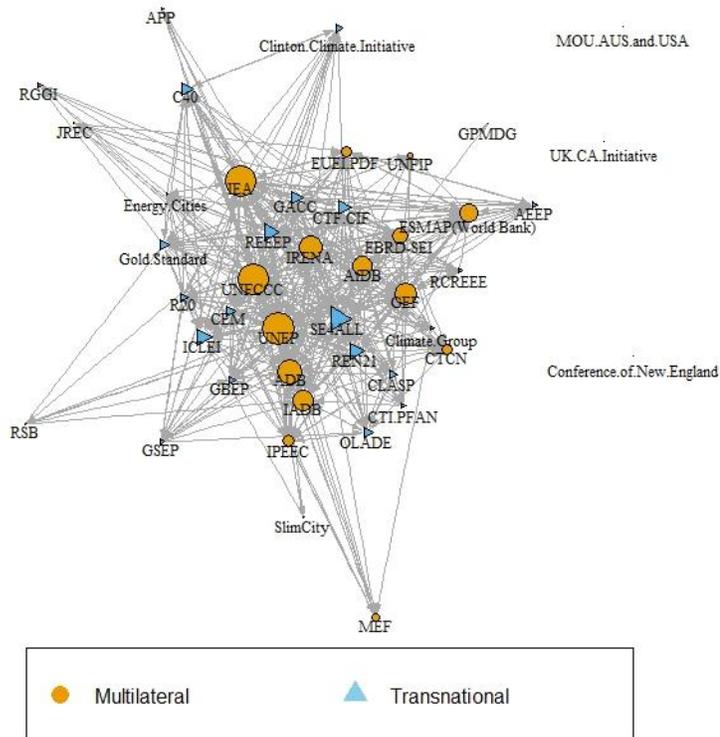
⁵⁵ Hafner-Burton et al 2009.

(ERGM) provide further insights into the roles of IOs and transnational initiatives in the regime complex structure.

Figure 1 maps a network of international initiatives on clean energy according to their in-degree centrality. The nodes represent clean energy institutions, differentiating between multilateral organizations (circles) and transnational platforms (triangles). The ties between nodes reflect instances of interorganizational and epistemic recognition in other organizations' publications. A node's size is proportionate to an initiative's in-degree centrality scores (see Annex 2). This analysis thus provides a first-order descriptive inference about organizational centrality and influence in the structuring of the regime complex at its emergence.

Figure 1: Perceived relevance and epistemic authority of organizations

Clean Energy Regime Complex (node size = indegree centrality/3)

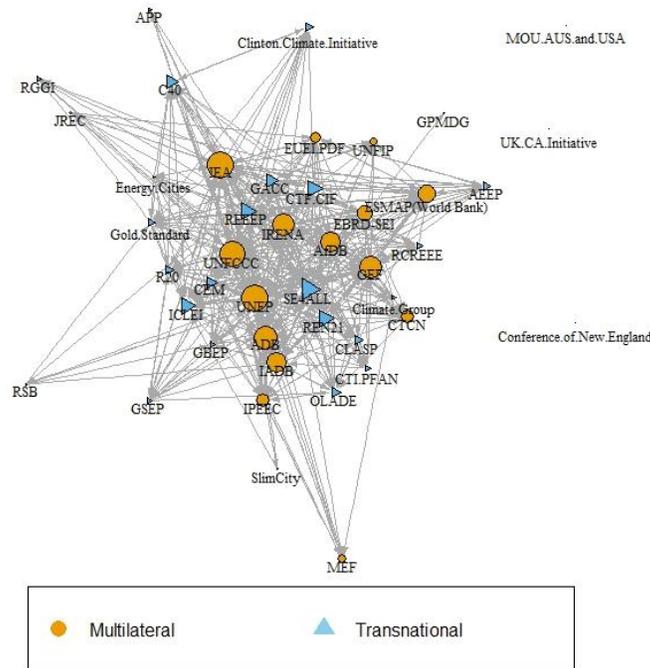


Figures 1 and 2 reveal a highly differentiated network structure, where some organizations are more central and authoritative within the complex while others are relatively marginal. Multilateral organizations tend to be the most frequently mentioned and thus perceived as relevant and prestigious actors by others in the network. However, several transnational initiatives (REEEP, Sustainable Energy for All [SE4ALL], and REN21) also have relatively high in-degree centrality scores, reflecting as implied by our fourth mechanism their ability to establish prominent epistemic and normative authority.⁵⁶ Of particular significance, three multilateral organizations—UNEP, the IEA, and UNFCCC—hold the most central positions across most indicators (see Annex 2). UNEP holds the highest in-degree centrality score (recognized by 75% of organizations in the field), closely followed by the IEA (73%) and the UNFCCC (71%). The three most prestigious organizations have a high eigenvector centrality score (Figure 2), revealing that those who are themselves well-referenced reference others with high frequency. Thus, they have considerable legitimating power within the network to deem other initiatives as relevant and as central nodes for brokering information among organizations. Others seek association with them as a means of establishing their epistemic and normative standing in the governance field, shaping the structure of the regime complex in important ways. Since our analysis ends in 2014, the score of IRENA is relatively low as a recently established organization, but already points to its overall centrality in the regime complex. Further research can examine how the structure of the regime has evolved over time, particularly after the adoption of SDGs and the Paris Agreement.

⁵⁶ Zelli et al. 2020.

Figure 2: Prestige and influence in the clean energy regime complex

Clean Energy Regime Complex (node size = eigenvector centrality*10)



The ERGM allows us to distinguish the effects of the organizational dynamics suggested in our theory from the structural effects of network characteristics that may interfere with the variables of interest. Table 2 reports the main results with constraints on the number of in- or out-degrees in network simulation. The first five variables (mutual, triangle, transitive, m2star, and cycle4) capture structural effects of the network that influence the formation of ties between organizations unrelated to our recognition and epistemic legitimation argument. Controlling for these effects, we used the geometrically weighted degree (GWD) statistic (“gwdegree” for outdegree distribution and “gwidegree” for indegree distribution) to test the network centrality, which could provide evidence of our mechanism of inter-organizational legitimation. Across different models, the coefficients of the variables measuring GWD distribution (using both fixed

and non-fixed parameters) remain statistically significant.⁵⁷ This further supports our argument and the findings of the SNA analysis that organizations with established expertise and/or broadly adopted norms are more popular within the network due to their greater vetting authority. The MCMC diagnostics show the model convergence and goodness-of-fit test, which confirm that the statistics from our model generally match the observed network statistics (see Annex 3). Hence, our ERGM results suggest that the clean energy regime complex constitutes a network with a set of initiatives maintaining popularity when controlling for endogenous network efforts.

⁵⁷ According to Levy et al. (2016), negative GWD coefficients reflect significant centrality scores of networks as GWD always responds more to changes of low-degree nodes.

Table 2: ERGM analysis of the clean energy network

	Clean Energy Network			
	(1)	(2)	(3)	(4)
mutual	0.892*** (0.219)	0.975*** (0.232)	0.878*** (0.241)	0.956*** (0.229)
triangle	0.299** (0.124)	0.282** (0.127)	0.279** (0.122)	0.292** (0.123)
transitive	-0.159 (0.125)	-0.144 (0.129)	-0.134 (0.125)	-0.148 (0.126)
m2star	0.074*** (0.018)	0.087*** (0.016)	0.029 (0.018)	0.052*** (0.016)
cycle4	-0.034*** (0.008)	-0.034*** (0.008)	-0.028*** (0.008)	-0.031*** (0.008)
nodematch.type.1	-0.044 (0.166)	-0.033 (0.169)	0.358** (0.165)	0.385** (0.174)
nodematch.type.2	0.196 (0.148)	0.189 (0.148)	-0.202 (0.166)	-0.276* (0.160)
gwodegree	-2.225** (1.025)			
gwodegree.decay	0.362 (0.524)			
gwodeg.fixed.0.3		-2.471*** (0.663)		
gwidegree			-2.236*** (0.685)	
gwidegree.decay			0.852** (0.371)	
gwideg.fixed.0.8				-1.997*** (0.695)
AIC	-573.155	-563.238	-574.167	-563.805
BIC	-517.246	-518.511	-523.849	-519.078

*p < .1; **p < .05; ***p < .01

In addition, we test for positive homophily effects to establish if similar organizations reference each other more often than dissimilar organizations do.⁵⁸ This provides an additional layer of understanding of the structuring of the emergent clean energy regime complex and the patterns of interactions and legitimating power among transnational and intergovernmental initiatives. In models 3 and 4, we find some positive homophily effect among multilateral organizations (nodematch.type1) but not among transnational organizations (nodematch.type2),

⁵⁸ McPherson et al. 2001.

which corresponds to the observable implications of our argument that transnational initiatives are more likely to refer to multilateral institutions with a broadly endorsed normative mandate or epistemic credibility to establish their relevance and legitimacy.⁵⁹ Next, we examine qualitative evidence on the extent to which interorganizational recognition and centrality is explicitly associated with certain epistemic and normative qualities, and explore the articulation of a set of norms that are constitutive of the clean energy regime complex.

5 Inter-organization Structuring and Norm Articulation: Qualitative Evidence

Our qualitative evidence, based on interview and primary documents, provides support for the significance of strategies for recognition and legitimation, through which organizations establish their claims or by which their authority is recognized by other organizations in the field.⁶⁰ This is demonstrated first by the IEA's interest to stay relevant in response to the normative salience of clean energy and rise of emerging state powers, as well as competition with newly created organizations like IRENA. We furthermore found that organizations made references to other organizations that embody normative bases of authority, as exemplified by the UNFCCC.⁶¹ The centrality of the UNFCCC in the regime complex structure is associated with the strategy of both IOs and transnational actors to justify their work on clean energy by referencing its broadly adopted norms on climate change mitigation. Apart from its implicit legitimating power, it is difficult to explain the centrality of UNFCCC, given its limited explicit provisions on clean energy

⁵⁹ Note that the homophily effects are not entirely robust across all four models.

⁶⁰ Andonova 2017; Bäckstrand 2006; Bernstein and Cashore 2007; Bulkeley et al. 2014; DiMaggio and Powell 1983; Faude and Grosse-Kreul 2020; Green 2013; Hannan and Freeman 1989.

⁶¹ DiMaggio and Powell 1983; Keohane and Victor 2011.

or resources to support technology innovation.⁶² Specifically, the adoption of the UNFCCC Kyoto Protocol increased the ‘political resonance’ of clean energy and provided strong rationale for UNEP to create its Energy Branch.⁶³ The World Bank’s Environment Department referred to the market-based mechanisms of the UNFCCC Kyoto Protocol to launch its climate finance and project-based transfers of technology.⁶⁴ Similarly, many transnational partnerships with a high level of social recognition within the network (e.g. REEEP, REN21, C40) frame their work on energy transitions in reference to the UNFCCC. This normative justification, referencing the broadly endorsed and participatory UNFCCC process, appears to be an important element in the recognition of clean energy programs and transnational initiatives.

References to specialized expertise and quality have been another dominant strategy of interorganizational differentiation and legitimation in reference to prestigious organizations in the clean energy regime complex. Such strategies can help to account for the high centrality and prestige IEA in the SNA. While the fossil fuel–focused mandate of the agency has undermined its leadership in clean energy governance, our interviews suggest that peer institutions recognized its long-standing epistemic authority, invoking ‘its unparalleled analysis, publications, data projections; it is a key node in the production of credible knowledge on clean energy.’⁶⁵ Indeed, as the clean energy field became more crowded, the IEA itself undertook a survey of clean energy governance initiatives and other deliberate moves of expertise-based claims of authority and functional differentiation vis-à-vis IRENA, IPEEC, and other platforms.⁶⁶

⁶² Benedick 2001.

⁶³ Interview at UNEP 2015.

⁶⁴ Andonova 2017.

⁶⁵ Interview at UNEP, 2015.

⁶⁶ Interview at IPEEC, 2014.

Despite UNEP's limited financial power, the IO differentiated itself with its focus on developing countries and its reputation as a broadly participatory organization with credible expertise and legitimating power, while actively pursuing clean energy projects through its energy department and transnational initiatives.⁶⁷ This helps to account for its centrality and prestige in the regime complex.

Finally, the SE4ALL initiative of the former UN Secretary General Ban Ki Moon quickly gained centrality after its creation in 2011. It was deliberately structured as a multi-stakeholder network to engage the broader spectrum of organizations in clean energy governance.⁶⁸ The initiative demonstrated evidence of organizational entrepreneurship as it was not initially funded by member state discretionary contributions, but rather carved out of pre-existing resources and later produced funding opportunities for clean energy.⁶⁹ SE4ALL's relative centrality reflects its normative vetting power, emphasizing reduction of energy poverty and transition to increased share of clean energy, ultimately paving the way to the SDG on Affordable Clean Energy (2015).

Our research thus shows how processes of mutual recognition, legitimation and vetting among organizations fundamentally shape the structure of an emergent regime complex. These processes enable the articulation of norms that hold the regime complex (loosely) together.⁷⁰ This dynamic is thus also a key aspect of the politics of regime complex formation and structuring. Our analysis suggests that IOs are likely to be important referent objects of recognition or legitimation strategies, particularly when they have a strong epistemic reputation or broadly endorsed normative foundations. The mutual recognition, strategic differentiation, and deepening

⁶⁷ Interviews at REN21 2012, UNEP 2015, REN21 2015.

⁶⁸ Barnsley and Ahn 2014; Interview at REN21 2015.

⁶⁹ Interview at IEA, Paris, 3 April 2013.

⁷⁰ Ruggie 2004.

collaboration among these actors increased the interdependencies, impacting the density and centrality of organizations in the clean energy regime complex structure.

6 Conclusion

The formation of the clean energy regime complex evolved from a non-regime to a regime complex of multiple institutions straddling several levels of governance. This article highlights how several mechanisms interplayed to shape the global governance of clean energy. Our research reveals that four distinct political mechanisms have shaped the emergence and structuring of the clean energy regime complex. Each mechanism alone is insufficient to bring forth the emergence of the clean energy regime complex, but rather the mechanisms are interrelated and have a compounding effect to increase complexity. State preference divergence contributes to institutional fragmentation and complexity, as states dissatisfied with the energy or climate change regimes sought out alternative forums or created new institutions. This provided space for the parallel proliferation of transnational initiatives and the expansion of IO practices and platforms into the domain of clean energy. The clean energy regime complex further involves dynamics of organizational interaction and epistemic and normative vetting and legitimation, as elements of structuring.

This article contributes to broader debates on complexity in global governance by providing conceptual tools for understanding the dynamics through which a regime complex is created and how the drivers of formation and inter-organizational interface affect the resulting structure. Our findings corroborate conceptions of governance that can no longer be strictly dependent on the authoritative role of states and formal delegation of authority to international

institutions. Increasingly, transnational initiatives assume governance roles alongside formal institutions. Our research suggests, however, that the explicit recognition and structuring of authority matters, if the constellation of organizations is to become a regime complex with an identifiable public purpose and normative authority. The centrality of multilateral organizations like the UNFCCC and UNEP, reveals that legitimation of constituent organizations takes place through interaction and recognition aligned with certain norms. Moreover, the continued existence of transnational initiatives has depended on their global uptake and recognition by peer multilateral and transnational organizations. Our approach can serve as a model for examining regime complex emergence and structuring, resulting from the interactions among the four political mechanisms across different issue domains, and particularly those with a relatively decentralized structure in the absence of strong pre-existing regimes.

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Annex 1: Organizations in the Clean Energy Regime Complex (1980-2014)

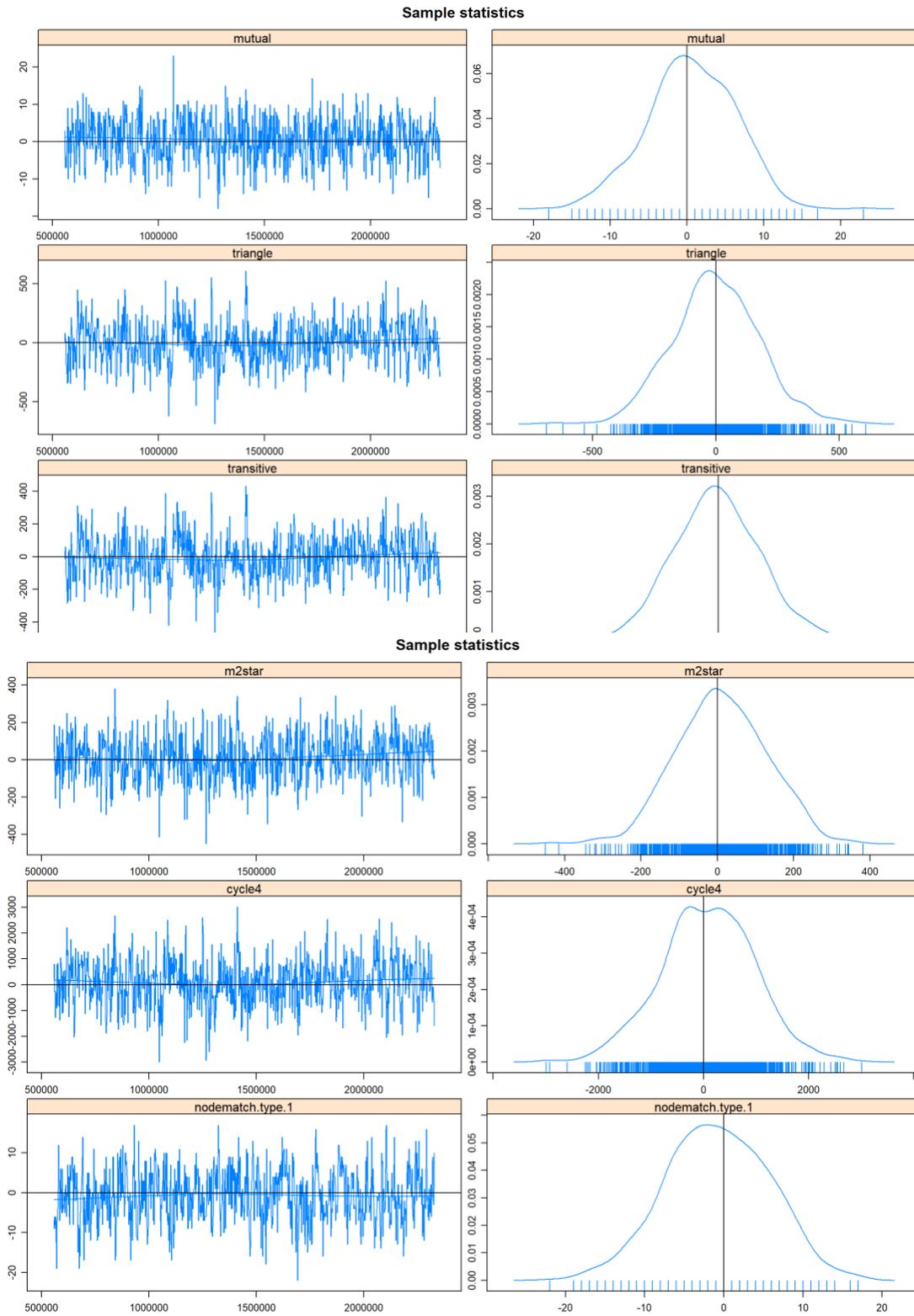
Organization/Initiative	Acronym	Type	Year
Asian Development Bank (ADB) - Clean Energy Program	ADB	ML	2008
Climate Technology Centre & Network (UNEP/UNFCCC)	CTCN	ML	2013
Energy Sector Management Assistance Program (ESMAP) / World Bank	ESMAP/WB	ML	1983
European Bank for Reconstruction and Development's Sustainable Energy	EBRD	ML	2006
Global Environment Facility - Renewable Energy Projects	GEF	ML	1992
Inter-American Development Bank - SE4ALL Hub	IADB	ML	2014
International Energy Agency (Renewable Energy; Platform on Low-Carbon Energy Technology)	IEA	ML	1999
International Partnership for Energy Efficiency Cooperation (IPEEC)	IPEEC	ML	2009
International Renewable Energy Agency (IRENA)	IRENA	ML	2009
United Nations Environment Programme (Energy Branch)	UNEP	ML	2006
United Nations Framework Convention on Climate Change (CDM, JI)	UNFCCC	ML	1997
Africa-EU Energy Partnership (AEEP)	AEEP	TN	2007
Asia-Pacific Economic Cooperation (APEC)	APEC	TN	1989
Asia-Pacific Partnership on Clean Development and Climate (APP)	APP	TN	2006
C40 Cities	C40	TN	2006
Clean Energy Ministerial (CEM)	CEM	TN	2009
Clean Technology Fund/Climate Investment Fund	CTF/CIF	TN	2008
Clinton Foundation (Climate Initiative)	Clinton Climate	TN	2006
Collaborative Labelling and Compliance Standards Programme (CLASP)	CLASP	TN	1999
Conference of New England Governors and Eastern Canadian Premiers CC Action Plan	Conference New England	TN	2000
CTI Private Financing Advisory Network (PFAN)	CTI-PFAN	TN	2006
Energy Cities	Energy Cities	TN	1990
EU Energy Initiative Partnership Dialogue Facility	EUEI-PDF	TN	2004
Global Alliance for Clean Cookstoves	GACC	TN	2010
Global Bioenergy Partnership	GBEP	TN	2005
Global Sustainable Electricity Partnership	GSEP	TN	1992
Gold Standard	Gold Standard	TN	2003
Green Power Market Development Group	GPMDG	TN	2005
ICLEI - Local Governments for Sustainability	ICLEI	TN	1993
Johannesburg Renewable Energy Coalition (JREC)	JREC	TN	2002
Latin American Energy Organization	OLADE	TN	2010

***Note: TN= transnational; ML=multilateral**

Annex 2: Centrality scores in the clean energy regime complex

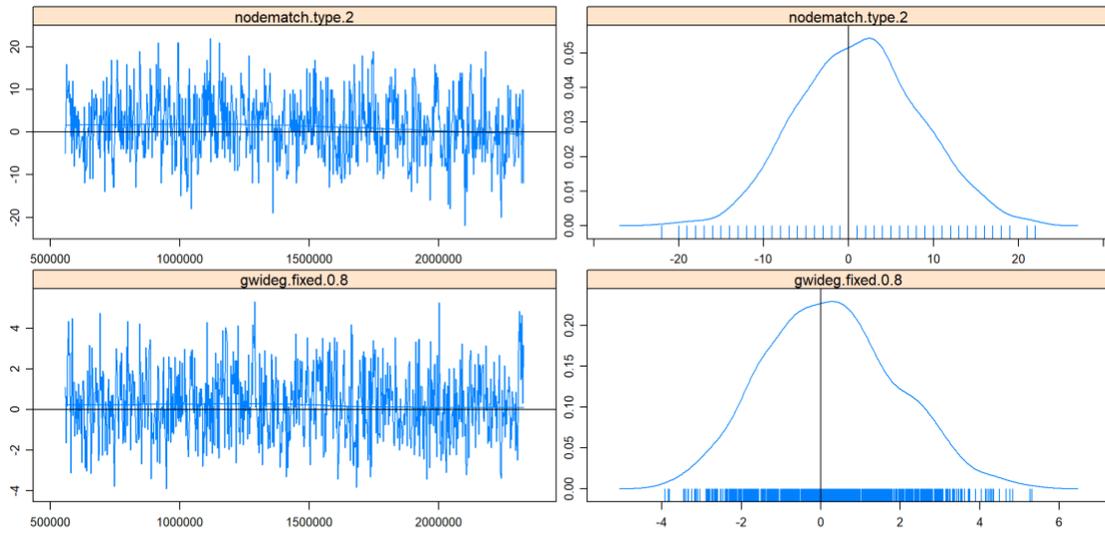
	Outdegree	Indegree	Betweenness	Eigenvector
UNEP	16	33	46.811954	1
IEA	38	32	265.035495	0.994199276
UNFCCC	31	31	176.693729	0.966701503
ADB	15	25	26.023213	0.886389805
SE4ALL	29	27	150.180309	0.882177981
IRENA	34	24	94.8900845	0.833730028
GEF	18	23	19.77515	0.816549324
IADB	20	21	29.518483	0.770955581
AfDB	21	20	23.3624516	0.739021842
ICLEI	10	20	16.4826157	0.719033517
REN21	20	19	26.5506758	0.715281577
REEEP	24	19	39.804041	0.711644412
CTF/CIF	26	16	25.6233383	0.687226525
ESMAP (W	16	19	13.2690994	0.659183204
GACC	18	14	37.4202748	0.589718862
C40	7	15	10.0835995	0.580114526
EBRD - SEI	12	16	5.80570541	0.575346018
CTCN	8	11	1.24478022	0.519342944
CEM	16	12	12.0054335	0.485972691
IPEEC	12	12	5.21981629	0.484217608
OLADE	9	11	3.10946276	0.442398346
EUEI-PDF	14	11	3.69319292	0.434316032
CLASP	7	10	6.0717549	0.400908585
R20	12	10	5.23042046	0.391775646
Clinton Cl	4	9	2.8543401	0.361040792
AEEP	8	8	0.18333333	0.354446496
Gold Stand	12	11	19.4411097	0.328772903
MEF	1	9	0.07142857	0.320322074
CTI-PFAN	9	6	0.09090909	0.285341837
UNFIP	4	6	0.36785714	0.28395384
RCEEE	10	6	0.08333333	0.280662638
GSEP	11	6	1.14805195	0.263476834
GBEP	10	8	16.0148735	0.249425285
RGGI	0	6	0	0.226162166
Climate G	7	4	0.84007937	0.19089183
APP	2	3	0	0.146911944
JREC	7	2	0	0.113436261
Energy Cit	15	2	0.66230159	0.098891855
RSB	5	2	0.33730159	0.085147844
Slimcity	3	1	0	0.05751349
GPMDG	0	1	0	0.051033164
Conferenc	0	0	0	1.87E-17
MOU AUS	0	0	0	1.87E-17
UK-CA Init	0	0	0	1.87E-17

Annex 3: MCMC diagnostics and goodness of fit⁷¹



⁷¹Model 4 in Table 2

Sample statistics



Goodness-of-fit diagnostics

