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Toward the Green Economy:
Assessing Countries' Green Power

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Abstract

The green power potential of a country is a central factor in the transformation to a green economy. This paper argues that green power will become a decisive factor for global change. Green power combines sustainability, innovation and power into one concept. By merging insights from political science, economics and innovation research, this paper develops a multidimensional, multilevel concept of green power that takes both resources and processes into account. A first empirical assessment of the current distribution of green power in global environmental governance shows that China and India, in particular, as well as Brazil and Costa Rica are catching up in clean technology and renewable energy. The European Union, Germany and the United States still dominate, but they are not fully maximizing their green power potential. In spite of their discursive power, the green power potential of the least developed countries is relatively small, making the jump toward a green economy unlikely.

Keywords: climate change, power, global environmental governance, innovation, green economy
JEL: A12, F02, F59, F64, O32, O44

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Article Outline

1 Introduction

"Green economy" is the new buzzword in global environmental governance. The Rio+ conference in June 2012 reflected the trend to focus on the economic system. While many actors, organizations and policymakers are hoping that the establishment of a green economy will be a relatively easy goal to attain, there is neither a clear vision of what it actually is yet nor how to get there. The most commonly used definition of a green economy comes from a United Nations Environmental Programme (UNEP) report, which states that a green economy leads to "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP 2011: 2). Put simply, this means that it is low carbon and resource efficient as well as socially inclusive (UNEP 2011), thus following a multidimensional view of sustainability.

This paper neither aims to solve the question of definition nor to resolve the controversy as to whether incremental or deeper transformative shifts are required for a more sustainable world. Instead, it asks two questions: First, what kind of power does a country need to undergo a green transformation process? Second, which countries have this power? I argue that it is a country's green power potential that is central to the transformation to a green economy. This paper shows which actors have the required green power to induce and shape this change.

Existing concepts of power in political science and economics do not suffice to explain the shifting power and the development of multiactor, multilevel, global environmental governance in this regard. The increase of environmental pressures and global attention to environmental problems moves environmental issues from the sidelines toward the center of global governance. I assume that those countries with green power will be those who manage and shape change. Moreover, if they enforce their green power in an effective manner, their position in the international system may strengthen. With green issues becoming more relevant to the competitiveness of countries (Fankhauser et al. 2012), environmental governance and green power are likely to become core interests in some countries.

Put simply, the concept of "green power" entails a combination of sustainability, innovation and power. Its starting point is a multidimensional understanding of power that is both resource based and process based. Thus, green power is more than economic dominance in the realm of green technology and more than the amount of natural resources in a given country. Drawing on a political science understanding of power as well as the economics and innovation literature, this paper develops the concept of green power. Moreover, it provides a first empirical application focusing on climate change and clean technology.

The paper is structured in four sections: The first section gives a brief overview of power concepts in political science and economics. Power is then related to the literature on innovation, primarily eco-innovation and climate innovation. The second section develops the theoretical concept of green power, drawing on the literature previously discussed. Additionally, it indicates possibilities for assessing green power and clarifies the methods and data this paper draws on. Although the primary goal of this article is the conceptual development of a country's green power and its potential, the third section also supplies a first empirical application, which shows that not only emerging economies such as China and India are developing significant green power – thus challenging the European Union (EU) and the United States (US) – but so are smaller countries such as Costa Rica and Colombia. The final section relates the empirical results to the theoretical starting points and identifies areas for further research.

2 Power and Innovation

2.1 Power in Political Science and Economics

Power remains a contested issue in political science. Therefore, this section can only provide a brief overview of the wider debate. In economics, however, power has been a somewhat

neglected issue (Whalley 2009). Neoclassic economists tend to exclude power as an explanatory factor of international trade and finance, deeming it irrelevant as long as it is not intentionally aimed at coercing other states. Both political science and economics draw on Max Weber (1980 [1921]) and Robert Dahl (1957), whose classic definitions have served as starting points for more encompassing, multidimensional conceptions of power. Weber defined power as "the probability that one actor in a social relationship will be in a position to carry out his will despite resistance, regardless of the basis on which this probability rests" (Weber 1980 [1921]: 152). Although Weber drew clear attention to the social relationship between actor A and actor B, both his and Dahl's definitions are one dimensional. According to Dahl, A has power over B to the extent that he can get B to do something that B would not otherwise do (Dahl 1957: 202).

In international relations, resource-based concepts, national power and "hard power" concepts continue to draw on Dahl. States applying hard power strategies use coercion, threat, rewards and/or monetary or military resources to get others to do what they otherwise would not do. This is similar to one-dimensional economic approaches that focus on the size of an economy. From this macroeconomic perspective, the capacity of a country to shape and possibly dominate the world economy (e.g., its share of global gross domestic product [GDP]) is the only relevant form of power. Some authors add GDP per capita, population and, sometimes, innovation in technology/research and development (R&D) expenditure to measure economic strength, thus moving toward hard power and national power concepts (Treverton and Jones 2005). In contrast to economic power, economic dominance "is about the real resources (or the real services provided by them) that a country can muster relative to other countries in the exercise or projection of power" (Subramanian 2011: 40). Thus, Subramanian stresses the active, real exercise of power and the relational character of power.

Relational approaches in both political science and economics shift the relation and interaction between actor A and actor B into the center. Accordingly, it is necessary to analyze power not only in relation to others, but also as a process in a specific context. In economics, relational concepts drawing on Dahl are prominent in game theory and in retaliatory studies (for an overview see Whalley 2009). Clearer conceptualization of the relationships between actors can be found in economic power studies that go beyond game theory (e.g. Kappel 2010, Herz and Starbatty 1991). Kappel (2010) shows that the power of a regional power in the international system cannot be understood independent of its region and its context. He provides a multidimensional measurement of the economics of regional powers that includes, among other things, technological leadership and vertical networks.

Power in global value chains and networks is understood as relational as well (Pietrobelli and Saliola 2008; Raff and Schmitt 2009; Gereffi et al. 2005). Global value chain research provides a microperspective of the relations among different elements of the chain, normally consisting of a multinational corporation, different local producers and global buyers. Significant buyer power exists at the retail level in labor-intensive, buyer-driven chains (Raff and Schmitt

2009). In producer-driven chains in which the lead firms (usually multinational corporations) dominate, capital- and technology-intensive production is taken over by the lead firms. Smaller producers supply more labor-intensive production parts. Power relationships within these value chains are characterized by cooperation, dominance and/or exploitation, particularly regarding the distribution of different resources (Gereffi et al. 2005; Brach and Kappel 2009; Raff and Schmidt 2009). The type of cooperation and the level of hierarchy have an impact on growth, technology transfer and learning processes in developing countries that primarily host the subordinate firms in a value chain (Pietrobelli and Saliola 2008; Brach and Kappel 2009; Fu et al. 2011). Asymmetrical relationships lead to a different degree of integration into the global market at the disadvantage of developing countries, consequently limiting their green power potential. Moreover, innovation often happens in and through global value chains. The relative power of these chains, the capacity for innovation and overall economic power are intertwined, as we will see.

Relational power concepts have been criticized for neglecting the structural dimension of power (Guzzini 2000, Strange 1988). Structural power refers to the ability of an actor to influence and shape the rules and framework that make up the global political economy in which other actors have to operate. According to Strange, four different structures together form the global political economy: the security, financial, productive and knowledge structures (Strange 1975). Thus in Strange's concept, the ability to shape the knowledge structure directly relates to technological power and innovation. Structural power may be less clear in terms of time and space, but it also has a relational side to it. An important subtype of structural power relevant for a country's green power potential is business power or – more concretely – technological power (Falkner 2008, 2005; Fuchs 2005).

In international political economy (IPE), business power refers to the capacity of companies to influence domestic and international policy and regulations (Falkner 2008: 29). It "limits the ability of states to impose solutions that may be environmentally desirable but threaten to violate the fundamental interests of business" (Falkner 2008: 30). Economic networks present one form of this power. Today, transnational networks and network power impact upon economics as much as political factors do (Slaughter 2009; Kappel and Brach 2009). Technological power is another specific form of business power in environmental policy. Companies have technological power if they have privileged access to technical information and if they can steer technical innovation processes due to their expertise and their material resources (Falkner 2005). This technological power is particularly relevant for the advancement of environmental innovations and thus for a country's green power.

The different power concepts discussed show that simple one-dimensional concepts may not capture power adequately. In both economics and political science, different multidimensional concepts have therefore been developed (Lukes 1974, Baldwin 2002, Barnett and Duvall 2005; Whalley 2009). Lukes (1974, 2005) introduced the three faces of power, adding the discursive or ideological dimension to the debate. This sees actor A exercise power over B

by "influencing, shaping or determining B's wants, beliefs and understanding of the world" (Lukes 1974: 23). He additionally differentiates between active and passive power (Lukes 2005), which is useful for the conceptualization of green power. For example, a country may have the power to reduce greenhouse gas emissions but not actually use it (passive), whereas another country may generate its own room for action, thus developing a process-type green power (active).

Whalley (2009) differentiates between three dimensions of economic power: The first dimension concerns the current and prospective relative size of economies, including the power to control market access. The size of a country's trade and the size of foreign direct investment flows provide means to measure this. Drawing on Dahl, Whalley argues that the power to restrict or penalize other countries' market accession and the degree of economic independence or integration between countries are part of the relative size of economies. The second dimension of economic power targets the behavior of countries in international negotiations. Cooperation or noncooperation may be the result of bargaining power or retaliatory power. It reflects the current and prospective size of an economy and thus its power to shape future rules in cooperative non–zero-sum games (Shapley 1953). His third dimension connects the economic and political science concepts and sees soft power (Nye 2010) or the underlying reputational and intellectual considerations using perceptions, persuasion and legitimacy arguments. The belief in the market economy, free trade, openness and integration into the global economy as desirable strategies are a manifestation of this kind of power (Whalley 2009: 6). Whalley thus goes beyond Weber and Dahl, and comes closer to Lukes' third dimension of power.

Drawing on the insights of these studies, this paper uses a tripartite understanding of power as a starting point that is able to incorporate political and economic power. The differentiation into instrumental, structural and discursive power combines resources and processes and allows for direct and indirect forms of power. Instrumental power is close to both Weber and Dahl in that it targets the direct relations between A and B, which are shaped by the resources and capacities the actors have. According to Lederer (2012), not only coercion and force matter here, but also successful lobbying, agenda setting and rule setting in the economic realm. Structural power, as has been explained above, concerns the structures and constitutive relations that indirectly define actors' self-understanding, social capacities and interests (Barnett and Duvall 2005). Following Lukes (1974) and Barnett and Duvall (2005), discursive power targets the systems of knowledge and discursive practices that give an actor the power to shape others' identities. It is often exercised through framing and shaping debates.

This discussion has made clear that it is important to clarify which kind of power is exercised (or not exercised), in which context and by what means. Economic power – like political power – is multidimensional. Innovation is an important element of economic power, particularly for a green economy. Therefore, the next section turns to the relevance of eco-innovation and climate innovation for power.

2.2 Eco-innovation and Climate Innovation as Forms of Power

Innovation is central to economic power. It counts as the key to competitiveness, growth and often also as a central element to the transformation of economies toward more sustainability. This section will show that turning eco-innovation into green power depends on certain key features, which may differ between industrialized countries, emerging economies and developing countries. Primarily, these are the technological capabilities, the absorptive capacity, the degree of integration into global green value chains and the political framework. More advanced countries tend to have more economic power and capabilities for innovation. These capabilities, in turn, are partly dependent upon the relative power of value chains. Value chains may function as locations and channels for innovation, setting new standards in green technology and green practices.

Environmental or eco-innovation is defined as:

> all forms of innovation activities resulting in or aimed at significantly improving environmental protection. Eco-innovation includes new production processes, new products or services, and new management and business methods, whose use or implementation is likely to prevent or substantially reduce the risks for the environment, pollution and other negative impacts of resources use, throughout the life cycle of related activities.[1]

Climate innovation is a subset of environmental innovation. It aims at mitigating climate change and adapting to its impacts and includes bottom-up and social innovations (Bergman et al. 2010). In the literature, the mitigation side often prevails. Studies primarily analyze energy efficiency, renewable energy, carbon taxing and carbon capture and storage.

Whether a country can benefit from a first mover advantage by eco-innovation – and thus increase its economic green power – depends on five general factors (Walz 2011):

1) the characteristics of the technology
2) the competitiveness of the industry cluster
3) the demand for new technical solutions
4) innovation-friendly regulations
5) technological capabilities and trade performance.

Technological capabilities include the knowledge and skills necessary as well as institutional structures and inter-/intrafirm linkages.

Similar to innovation in general, eco-innovation and climate innovation occur primarily in industrialized countries (Jänicke 2011). The technology transfer mechanisms under the United Nations Framework Convention on Climate Change, such as the Clean Development Mechanism, reflect this. Increasingly, the traditional North–South transfer of technology and know-how no longer applies to all eco-innovation (Ockwell et al. 2010, Brewer 2008). Emerging

1 Environmental Technology Action Plan of the European Commissions. This definition is widely cited in the literature.

economies are catching up and are even among the world leaders in some fields now: solar energy (China), wind energy (India and China) and biofuel production (Brazil) (REN 21 2012).

For the relationship between environmental innovation and power, these developments imply, first, that the distribution of global economic power in terms of environmental innovation is shifting. This may help emerging economies catch up, which is environmentally and politically desirable. A country or firm has caught up if it has reached the current technological frontier in green technology and eco-innovation without surpassing it. While key factors differ from case to case, absorptive capacity (i.e., the ability to recognize and apply new information) is arguably the most important element in catch-up processes (Watson and Sauter 2011; Walz 2011; Intarakumnerd et al. 2002). The leading firms in industrialized countries with a highly skilled labor force and a large amount of specialized and tacit knowledge generally have high absorptive capacities. Absorptive capacities for sustainable technologies and technological capabilities differ substantially between emerging economies (Peuckert 2011; Walz 2011). The absorptive capacities of the least and less developed countries are generally smaller than those of emerging economies and late-coming industrialized countries.

Second, more environmental and climate innovation in developing countries and emerging economies means a greater contribution to controlling global environmental problems such as climate change. It also increase a country's green power. While emerging economies have more means to access eco-innovations, poorer developing countries face a number of challenges such as a lack of indigenous eco-innovation capabilities (Ockwell 2010).[2] Emerging economies more often succeed in diffusing existing eco-innovations, adapting them locally and later developing their own. This bolsters their green power potential.

Third, power shifts within value chains are slowly taking place. While lead firms distributing knowledge are still mostly headquartered in industrialized countries, technological upgrading is taking place in the emerging economies. There is evidence that countries such as China and India are now hosting some lead firms, thus building their own supply chains in the electronic appliances and automotive sectors (Baldwin 2011; Altenburg et al. 2007). More research is required to find out whether this applies to the green sector as well. If it does, it affects the current and prospective shape of the green economy due to the fact that new standards are being set in emerging economies as well.

While technological capabilities, absorptive capacity and the integration into green value chains are central for turning eco-innovation into green power, these factors' effectiveness greatly depends on the political frameworks guiding them. As Jänicke (2011) shows, policy cycle, market cycle and innovation cycle are ideally connected in a way that accelerates the diffusion of innovation. The coherence of environmental, energy and innovation policy is very important for the full exploitation of green power potential. It requires what I call smart

2 Three other main barriers exist for poor countries: the characteristics of eco-innovation, which have often not reached a commercial stage yet; incremental costs and market failures; and a complex picture regarding intellectual property rights (Ockwell et al. 2010).

governance. Smart governance is also necessary to limit the unintended effects of eco- and climate innovation, such as rebound effects and the green paradox (van den Bergh 2011). The debate on what to do about these effects is ongoing, albeit without a consensus. I therefore exclude the governance of rebounds and other unintended effects from an explicit measurement, simply designing a general category of smart governance. This is clarified in the next section.

3 Analytical Framework: Green Power and Green Power Potential

3.1 Dimensions of a Country's Green Power

Why do we need a new concept of green power? I argue that a country's ability to deal with climate change, to develop renewable energy sources and to secure a share of the global environmental commons is very likely to become a central issue of this century – together with financial crises, economic and security policy. Existing concepts cannot capture what kind of power enables both state and nonstate actors to manage green change.

This paper's review of the different conceptions of power makes it clear that any kind of conceptualization of green power needs to consist of a variety of features. The "green" in green power targets environmental governance, including energy efficiency and renewable energy. In my understanding, green power is:

— multidimensional;
— relational;
— active or passive;
— the share of the global commons a country possesses as well as its ability to make use of this possession in international negotiations and/or to attract external funding for its protection;
— economically innovative in terms of:
— the technological capabilities in green technology and eco-/climate innovation,
— the degree of integration in green value chains,
— the absorptive capacity for environmental innovations;
— the ability for smart governance of innovation, environment and energy.

This concept of green power takes both state and nonstate actors into account. It thus provides a complex picture of the different parts that make up the power of a country in global environmental governance. Green power is politically and economically multidimensional and includes resources and processes. First, the differentiation between instrumental power, structural power and discursive power is useful for an assessment of the power of global value chains in relation to other actors. For the purposes of this paper, soft power is understood as a type of discursive power.

Green instrumental power includes methods of direct influence – for instance, the EU's decision to introduce a carbon tax on aircrafts despite resistance from Chinese, Indian and

Northern American airlines. It also includes indirect forms, such as the EU's establishment of a new roadmap and a second commitment period of the Kyoto Protocol. Generally, green instrumental and discursive power can be applied in the same way as institutional and discursive power are to environmental governance.

Green structural power connects the concept of business power from international political economy with the concept of technological capability found in the innovation literature. It is always composed of the actions of state and nonstate actors, especially companies. The technological capabilities of a country such as the expenditure on R&D and the structure of the local innovation system provide the basis for this. The actions of governments and companies regarding rule setting and governance of innovation, trade and environmental and energy policy complement the picture. Since green power is relational, the context and behavior of others in each specific sector matters, both nationally and internationally. Markets and political conditions may shift as may technological leadership from company to company or from country to country.

Second, the economically innovative elements of green power – as outlined above – provide the connection between innovation, sustainability and conventional power concepts. Their assessment will be particularly interesting in the North–South context because catching up may change the distribution of power in environmental governance. It is likely that the country or company that manages to first develop and/or lead in highly relevant technologies for the green economy (e.g., storage technologies for electricity from renewable sources) will not only gain a significant global market share, but will also increase its global economic and political influence.

Third, it would be short sighted to limit green power to the natural resource base of a country and its capacity to make smart use of such power economically and politically. The mere possession of natural resources tends to lead to political difficulties, as a large body of research on the resource-curse debate shows (e.g Haber and Menaldo 2011). Moreover, the development of payment systems for ecosystem services and trust funds for protecting the global commons in various countries – such as Brazil, Indonesia and Ecuador – suggests an interaction level and power relations beyond simple national power. Still, this dimension is a necessary part of green power. I focus on those natural resources that are usually cited as true global commons: biodiversity, rainforests, oceans and the global climate. I thus exclude extractive natural resources such as minerals or metals from my understanding of green power.

Fourth, a country's ability to execute smart governance of its environment, energy and innovation so that steering mechanisms and incentive schemes do not contradict each other and measures are actually implemented is important. While the management of rebound effects may fall into this category as well, I neglect it for the time being due to the controversial state of the art in this field. I also exclude the regime type of a country as a relevant dimension because results on the influence of democratic/authoritarian regimes on environmental policy behavior are mixed at best.

In general, green power can be active or passive. It is active when a country or its companies actively use their abilities to influence a situation or promote and protect their innovations. This includes the creation of possibilities for action in line with its own interest. Green power is passive when these capabilities are not used or when a country abstains from acting or deciding on certain processes (e.g., during international climate negotiations). This difference is captured in the notions of green power and green power potential. Green power potential captures what a country could actually do if it chose to mobilize all resources, foster innovation and take environmental decisions. Green power captures what is actually being done.

The green power concept captures the ability to induce and shape change in environmental governance through a comprehensive, interdisciplinary approach that also transcends governance levels. This is a clear advantage. Moreover, the concept will show who currently has the power for a green transformation, who has the potential and what capacities, abilities and/or processes this draws on. Finally, it allows for case sensitive but comparative research using both quantitative and qualitative data, as shows the next section.

3.2 Measurement

The measurement of innovation capabilities, micro-/macroeconomic power and political power is already comprehensive for each dimension, making a combined assessment even more difficult. It is therefore important to be clear about the underlying concepts and assumptions, including potential political effects of a particular power concept. In this paper, I take a case- and context-sensitive approach that combines quantitative and qualitative data.

It is not the aim of the following indicator compilation to aggregate into a single index using the same sort of numbers for all cases. Instead, a parallel measurement of the dimensions is required, which includes a careful weighting of the evidence gathered through an analytical compare-and-contrast type discussion; the fourth section of this paper clarifies this. The dimensions measured may have to be adjusted according to the available data and number of cases. It is essential that any study aiming to assess green power states which indicators it is using and for what reasons (e.g., data availability) and, also, reflects upon their implications for comparability, validity and reliability. Table 1 provides the indicators and potential data sources for each of the green power dimensions used in this study. The shaded areas show which dimensions and indicators were used for the illustrative application of the green power concept in this paper. Even though I only provide a partial empirical assessment of the current distribution of green power, it should suffice to demonstrate the benefits of the concept.

Table 1: Green Power Indicators

Green Power Dimension	*Indicator*	*Data/Source*
Instrumental	Size of the economy (GDP)	World Bank
	Attraction of external funding to protect the own natural resources/environment	Existence/pledges in national green funds and GEF fund access
	Ability to shape international negotiations in the country's interest (bargaining success, agenda-setting, successful abstention/blocking)	Qualitative assessment of policy documents, negotiation protocols
Structural	Organizational strength and financial resources of relevant nonstate actors (companies, NGOs)	Qualitative assessment
	Lobbying success of these groups in key environmental negotiations at the international level in relation to others	Qualitative assessment
	Market share in renewable energy/clean technology	Secondary data (e.g., Ren 21, Bloomberg New Energy Finance [BNEF])
Discursive	Successful establishment of frames and beliefs according to the actor's own perceptions	Qualitative assessment using policy documents, interviews, gray literature
	Shaping of the international debate	Id.
	Credibility as a green country/role model in the eyes of others	Id.
Share of global commons	Share of renewable energy in energy/electricity production	IEA
	Share of rainforests and deforestation rate	FAO
	Density of marine life	UN
	Greenhouse gas emissions (absolute)	IEA/UNFCCC
	Density of biodiversity	UN
Technological capabilities in eco/climate innovation	R&D expenditure (general)	OECD/UNESCO Stats
	R&D expenditure for clean technology	BNEF
	Companies' access to technical/scientific information	Primary data
	Steering capacity to use this information (manpower/ financial resources of companies/level of education)	Primary data
	Patents registered for green technologies	WIPO data
	Current market share in renewable energy and clean technology	Secondary data (e.g., Ren21, BNEF)
Degree of integration in green value chains	Number of national companies taking part in value chains in clean technology, energy efficiency, etc.	Manual counting per green sector/primary data collection
	Value added along the chains	Import/export data for approximations, primary data at firm level
	Distribution of profit	Return on capital employed
Absorptive capacity for environmental innovations	Access to relevant knowledge and ability to process it	Interviews/surveys
	Indigenous innovation: local skilled labor available	Education levels: secondary school enrolment, tertiary enrolment (World Bank, UNDP)
	Indigenous innovation capability: relevant local science/research institutions	Qualitative assessment
Ability for smart governance	Environmental Performance Index (EPI) as general indicator for the implementation of environmental policy	Online
	Coherence of policy goals and governance mechanisms concerning innovation, environment and energy	Qualitative assessment

Source: Author's own compilation.

The next sections provide empirical assessments of the shaded indicators in selected issue areas. While green power encompasses a range of fields that impact sustainable development, the focus of this paper lies on climate governance, renewable energy and clean technology. Therefore, the starting point is the distribution of green power in the international climate negotiations, complemented by an assessment of green power in global environmental governance at the nexus of climate governance, renewable energy and clean technology.

4 Green Power Distribution in Current Global Environmental Governance

4.1 Green Power in the International Climate Negotiations

Given the high amount of international attention to the topic, the international climate negotiations are a suitable example for assessing the distribution of instrumental, structural and discursive green power. In a first step, this focus helps to identify relevant actors, while not categorically excluding countries inactive in the negotiations from further analysis. In a second step, these countries' green power is compared to their green power outside the negotiations, focusing on the fields of clean technology and renewable energy. The resulting picture gives a differentiated, balanced take on green power. This section shows to what extent big countries such as the US, China and Germany as well as small countries such as Costa Rica and Ecuador have the green power potential to influence change and whether/how they do so. The analysis of the international climate negotiations draws on policy documents of the respective countries, negotiation documents and the Earth Negotiations Bulletin (IISD/ENB, various years).

Ample literature exists on the role of specific countries, negotiation strategies and the various factors determining (un)successful bargaining in the international climate negotiations (e.g. Weiler 2012; Michaelowa and Michaelowa 2012; Schreurs 2012; Rong 2010). It indicates that the distribution of instrumental, structural and discursive power has changed in the last few years. For instance, in line with their share of global emissions (see section 4.2), China, India and Indonesia now have structural veto power. This means that without their participation, a global climate deal is virtually ineffective. Consequently, the industrialized countries, particularly the US and those in the EU, are no longer the only countries with structural power. The exit of Canada, Russia, New Zealand and Japan – and possibly Belarus, Ukraine and Kazakhstan – from the Kyoto Protocol has two sides to it. On the one hand, the Kyoto Protocol has been saved from complete failure by this exit, which could be counted as the successful application of direct instrumental power by the supporters of the protocol. On the other hand, their exit has a negative impact on the attempt to manage climate change due to these countries' high emissions and structural power. At the Doha negotiations in December 2012, there were fierce power and interest struggles concerning the transfer of any surplus emission rights from the first Kyoto period to the second and the possibility of

selling them without participating in the second period. A compromise was finally reached and determined that only those countries participating in the second period can transfer and sell their surplus rights (e.g., Poland). While this reflects a slight instrumental power gain for beneficiaries such as Poland, it is a power loss for Russia. In any case, the climate regime is further weakened by the withdrawals.

Brazil's and Indonesia's structural power differs somewhat from the others because it focuses on reducing emissions from deforestation and forest degradation (REDD) and preserving the rainforests. The rainforest nations – particularly Papua New Guinea and Costa Rica – have been able to exert some instrumental power during climate negotiations in the past with the establishment of REDD on the agenda. In Doha, Papua New Guinea pushed for the establishment of a REDD committee, but the issue was postponed until the June 2013 negotiation round – the same as the controversial verification mechanisms. The opposing viewpoints of Brazil and Norway in particular hindered an agreement on a verification mechanism.

At the Durban negotiations in 2011, the EU was the only negotiating party that managed to gain some direct instrumental power by achieving its negotiation goals and pushing India into accepting the Durban Platform for Enhanced Action; India, in turn, suffered a loss of power in Durban. At the "transitional" Doha conference, bureaucratic processing was at the forefront instead of political maneuvering, which left underlying power distributions largely intact. Neither the EU as a whole nor Germany separately uses their green power potential to the full extent. While they claim leadership in climate policy and clean technology, they do not coerce or push the US and Canada toward more engagement – at least, not within the climate regime. The increasing internal disaccord between member countries, particularly the defensive stance of Poland, weakened the general power position of the EU in 2012. Outside the climate regime, the EU had begun to exert instrumental power toward their North Atlantic allies by setting a carbon aviation tax. Facing strong resistance from the US, China and India, the EU actually reversed its decision during the run up to Doha in order to reopen the door for international solutions.

China and the US are in a negative balance of power in the international climate negotiations. They both have a lot of green power potential in all three dimensions, but do not use it for fear of taking a substantial first step before the other does. For the US, domestic veto players further restrain any proactive behavior at the international level. This passive green power of both countries restricts the scope of climate negotiations. However, both actively use their green power outside the negotiations through, for example, tariff setting on solar energy components and expanding their technological capabilities.

Regarding discursive power, some additional players are active in the international climate negotiations. The least developed countries (LDCs) and small island states (AOSIS) have a certain moral-discursive power as they will be hit hardest by climate change. While this led to a sense of responsibility and financial support by some industrialized countries, the framing of international equity has not turned into substantial financial commitment by

all industrialized countries yet. In Doha, only the EU, Germany, France, UK, Denmark and Sweden announced concrete financial pledges up to 2015.

There is a new framing or even an informal norm underway as the LDCs and AOSIS increase the pressure on the emerging economies to do their share as well. The breakup of the formerly united G-77 became very obvious in Doha. While the groups of the LDCs and AOSIS remain, the Association of Independent Latin American and Caribbean states (AILAC) was formed by Colombia, Peru, Chile, Costa Rica, Guatemala and Panama at the 2012 mid-year negotiations in Bonn. The AILAC calls for the mitigation of emissions by industrialized and developing countries as well as an incentive system to do so for all countries. Opposing the AILAC is the new group of Like-Minded Countries, comprised of members of the Arab Group, Argentina, Venezuela, Bolivia, Ecuador, India and China. They continue to advocate for international equity and the historical responsibility of the industrialized countries (IISD/ENB 2012, various issues). These alliances have started to shift the relational power between negotiating parties.

In relation to India, China has more discursive power, even though it did not use it in Doha. At the beginning of the Durban conference in 2011, China already cautiously signaled its participation in a post-2020 climate treaty, while India refused. India's power in the international climate negotiations is rather passive and comes about through blocking (except in the realm of technology transfer), thus setting it apart from the other three BASIC countries (an alliance consisting of Brazil, South Africa, India and China). In the climate negotiations, South Africa's power is generally smaller than the power of the other BASIC countries, but greater in relation to its region. This greater power related to its region primarily comes from the discursive dimension, as the country managed to foster transparency and participation of the LDCs and civil society organizations in Durban 2011.

The majority of the instrumental, structural and discursive green power in the international negotiations lies with a small number of industrialized countries and emerging economies. Some developing countries are in quite a strong position regarding specific aspects – for instance, the rainforests (e.g., Papua New Guinea, Colombia and Ecuador) or the pursuit of a carbon neutral economy (Costa Rica). Others, however, such as the Democratic Republic of Congo are not able to use the power potential based on their share of the global commons because of a lack of negotiating capacity (e.g., lack of staff). Outside the climate regime, the national green or climate funds of Brazil, Guyana, Indonesia and Ecuador signal some instrumental power. Even though the donor countries are in an initially stronger power position because they have the financial resources, the pledges made[3] are a sign of the instrumental power of the receiving countries. Here, the relational power is nearly balanced.

The power distribution in the climate negotiations is also relational as a whole if compared to climate governance initiatives, clean technology markets and other international

3 For an overview of the climate finance landscape, see Buchner et al. 2012.

bodies. Since the UNFCC needs to be seen as a body with only limited power in relation to other international institutions, the power exerted is hampered by the restricted ability of enforcement. It is now necessary to analyze the active and passive green power of these different countries in the other dimensions.

4.2 Green Power at the Nexus of Climate Governance, Clean Technology and Renewable Energy

This section analyzes the distribution of green power in global environmental governance according to a country's share of the global commons, GDP, technological capabilities and ability for smart governance according to the Environmental Performance Index (EPI). This analysis will be connected to and extend the above assessment of the distribution of instrumental, structural and discursive power. Relevant development concerning other indicators of green power will be highlighted in order to put the present results into a broader perspective, if possible.

Table 2 depicts the share of the global commons of those actors identified as central to the international climate negotiations and/or relevant in at least one of the other green power dimensions. Since this paper focuses on clean technology, renewable energy and climate governance, the share in global biodiversity and marine life are excluded. The table confirms the green power of the US, EU and Germany in terms of both their relevance for the global climate (amount of CO2 emissions both in total and per capita) and forest protection. This strengthens their position in global climate governance, both within and outside of the climate negotiations.

The four BASIC countries also have green power in both areas, but slight differences exist. While China emits the most carbon emissions globally, it is also the only country among the emerging economies to have achieved some significant progress in afforestation. Brazil's total carbon emissions are lower, which has slightly reduced the pressure to act compared to China and India. However, Brazil's vast amount of rainforest and its high deforestation rate has seen the country become the focus of REDD activities and other sustainable forest management actions. The same situation also applies to Indonesia. Both countries thus have significant green power potential in this field. Ecuador's and Papua New Guinea's green power potentials are also backed by their share of global rainforests, even though their levels of carbon emissions are very small compared to the others. This coincides with their power in the climate negotiations. Japan and South Korea are two interesting cases. Both are significant players for the protection of the global climate and the forests, but neither belongs to the central driving or blocking forces in the international climate negotiations. Either they are not using their green power potential, or it is restricted to only some of the green power dimensions.

Table 2: Share of Global Commons in 2010

	CO_2 emissions[a] (total in million tons)	*CO2 emissions[a] (kg Co_2/capita)*	*Forest area (1000 ha)*	*Deforestation rate (% annual change 2005-2010)*
United States	5 368.6	17 312	304022	+ 0.13
China	7 258.5	5 395	206861	+ 1.39
EU	659.5	7 294	156865	Not available
Germany	761.6	9 315	11076	0
Norway	39.2	8 011	10065	+0.78
India	1 625.8	1 388	68434	+0.21
Brazil	387.7	1 989	519522	-0.42
South Africa	346.8	6 938	9241	0
Indonesia	410.9	1 713	94432	-0.71
Japan	1 143.1	8 974	24979	+0.04
South Korea	563.1	11 521	6222	-0.11
Costa Rica	6.5	1 403	2605	+0.90
Colombia	60.7	1 310	60499	-0.17
Ecuador	30.1	2 081	9865	-1.89
Papua New Guinea[b] (for the AOSIS)	3.4	500	28726	-0.49

[a] CO_2 emissions from fuel combustion.

b 2009 data is the latest year available.

Sources: International Energy Agency (IEA) 2012; World Bank 2012, online: <http://data.worldbank.org/indicator> (3 June 2013).

The instrumental power of the EU and Germany in the climate negotiations is further strengthened by their general economic power, indicated by the global GDP rank (see Table 3). The US, China, Japan and the other emerging economies also benefit from their economic strength in global climate governance, particularly in the clean technology and renewable energy markets. Costa Rica, Ecuador and the AOSIS are generally at a disadvantage here.

While GDP serves as one of the indicators for instrumental power, the EPI presents one possibility to assess a country's ability for smart governance. It measures how close countries are to attaining their own established environmental policy goals in 10 policy categories relevant to environmental stresses to human health and ecosystem vitality. The EPI uses 22 indicators that are weighted, aggregated and then compared to the respective policy goal taken from national regulations and international treaties.[4] In 2012, the top five performers were Switzerland, Latvia, Norway, Luxembourg and Costa Rica. Since attaining environmental policy goals is a prerequisite for smart governance of the environment, energy and innovation, it is one of the two indicators for smart governance in this paper.

4 The ten policy categories are environmental health, air pollution (effects on human health), air pollution (effects on ecosystems), water (effects on human health), water resources (ecosystem effects), biodiversity/habitat, forests, fisheries, agriculture, climate change/energy. For each country and indicator, a proximity-to-target value is calculated based on the gap between a country's current results and the policy target. Apart from national regulations and international targets, standards set by international organizations, expert judgments and ranges of values observed in the data over time were used to establish the 2012 targets. (Emerson et al. 2012).

Table 3 clearly shows that those countries with the most green power in the dimensions analyzed this far do not automatically have the best preconditions for smart governance. Of the industrialized countries of interest to this paper, only Norway and Germany benefit from a very strong performance. Of the BASIC countries, only Brazil counts as a strong performer; China, India and South Africa all perform weakly. This weakens their green power in this dimension and simultaneously undermines it in the other dimensions. Costa Rica is the only developing country among the top five EPI performers. This shows that Costa Rica is clearly very active and manages to turn its green power potential into green power, albeit within the limits of economic possibilities that are rather small in comparison to big emerging economies such as China or India.

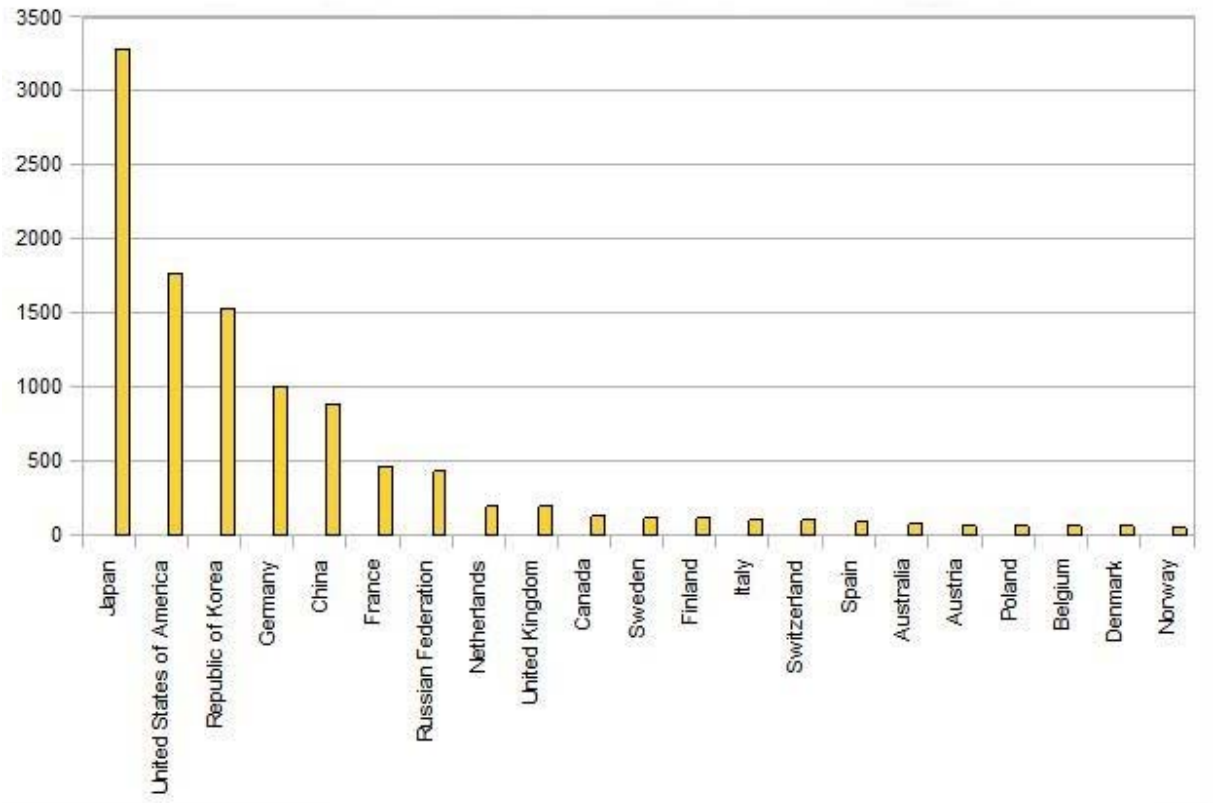
Table 3: Gross Domestic Product and Environmental Performance

	GDP-PPP Rank 2010*	*EPI Rank 2012*
United States	1	49
China	2	116
Japan	3	23
India	4	125
Germany	5	11
EU	Not available	Not available
Brazil	9	30
South Korea	13	43
Indonesia	16	74
South Africa	24	128
Norway	42	3
Costa Rica	84	5
Colombia	27	27
Ecuador	61	31
Papua New Guinea (for the AOSIS)	124	Not available

*PPP= purchasing power parity.
Sources: World Bank 2011, Environmental Performance Index 2012 (Emerson et al. 2012).

Concerning technological capabilities, the patents granted for environmental technology by the World Intellectual Property Organization show a clear lead by Japan, the US and South Korea, followed by Germany and China (Figure 1). China is the only emerging economy among the top 20 (apart from Russia), which underlines the general increase of its power in global environmental governance in this green power dimension as well. However, the dominance of European and developed Asian countries along with the US also applies to the trend of patent granting in environmental technologies over time. It supports the active green power of these countries' governments and their companies in the global market.

Figure 1: Patent Grants for Environmental Technology 2010



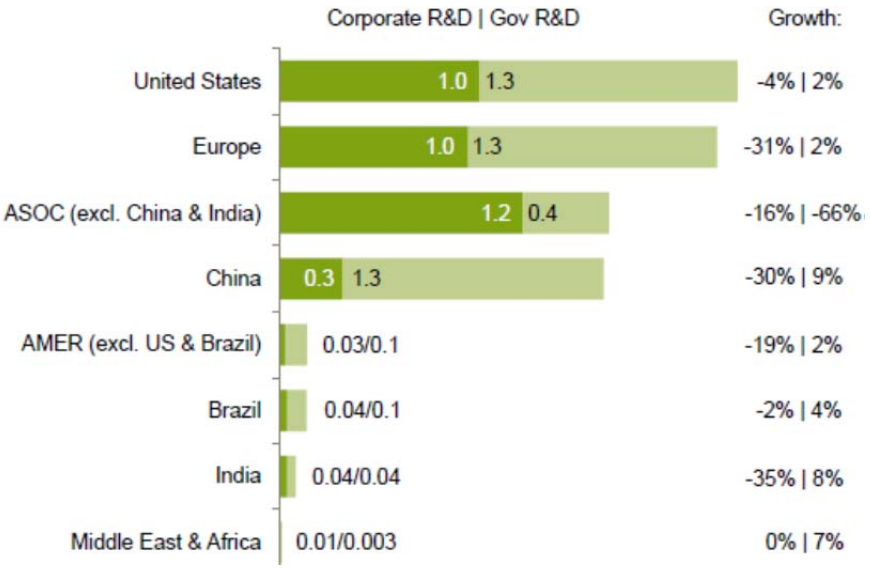
Source: World Intellectual Property Organization.

In spite of this seemingly dominant role of the industrialized countries, some developing countries are clearly expanding their green power potential in specific sectors. Chinese and Indian companies, for example, have some technological business power in wind energy: four Chinese companies controlled 26.7 percent of the world's wind turbine production market in 2011, while India's Suzlon held a 7.7 percent share (Ren21 2012: 58). As Lema et al. (2012) show, China has not only increased market and production power in this sector, but has also started to increase its domestic innovation capabilities and to set up its own types of flexible value chains. In solar energy, seven Chinese companies are already among the top 15 producers of photovoltaic (PV) cells worldwide (Ren 21 2012). This indicates an increase of the structural power of Indian and Chinese companies in these areas and a simultaneous decrease of European companies' and US companies' power. In 2012, the US began to set import tariffs on Chinese PV cells. After a complaint by European PV manufacturers, the European Commission initiated an antidumping procedure against Chinese producers in September 2012. These actions reflect both the decline in structural power of Europe's and the US's companies and their fear of a further shift of the market toward China.

China is the current leader in clean technology expenditure, followed by Germany and the US. In 2010, China invested nearly fifty billion USD in clean technology. Mexico, Pakistan, Egypt and Kenya also invested over one billion USD in clean technology in 2010. The

strongest growth in investments compared to 2010 happened in India due to the implementation of the national solar mission, which is part of India's domestic climate policy (BNEF 2012). The US and Europe continued to lead government and corporate R&D expenditure in renewable energy in 2011 (Figure 2). While Brazil and India stand out among the emerging economies, China is the only country that is on its way to reaching the same levels of R&D expenditure as the industrialized countries.

Figure 2: Corporate and Government R&D Expenditure in Renewable Energy by Region in 2011 and Growth in 2010



Source: Bloomberg New Energy Finance 2012 (BNEF 2012: 65).

What can be drawn from these different indicators? First, even though not all dimensions could be measured in depth here, the assessment shows that no country has yet managed to exert green power in all dimensions and/or use its full potential. Table 4 summarizes the current distribution of green power in the broad relational categories of "high," "medium" and "low." Second, the EU, the US and some industrialized Asian countries – such as Japan and South Korea – currently still have more green power than other countries. Germany, for example, has high technological capabilities in environmental technology and is highly integrated into global green value chains (e.g., Enercon, Siemens and Solarworld). However, these industrialized countries do not fully use their green power potential and their advantage is not as great as could be expected.

Third, the emerging economies have almost reached a comparable level of green power in some fields. China in particular and, to a lesser extent, India and Brazil are catching up in some areas of climate governance, clean technology and renewable energy. Since the categories in Table 4 have been kept quite rough for illustrative purposes, additional differences need to be pointed out. Both the active power and the green potential between China and the other emerging economies differ quite strongly, as it does between the emerging economies

and other developing countries. Costa Rica, however, is an exception. A country – even if it has a small economy – is likely to increase its green power if it manages to implement its ambitious low-carbon development goals and to increase its technological capabilities. Ecuador and Colombia, for example, have at least some green power potential. However, more research is necessary to assess all green power dimensions in order to increase the validity of these findings. Follow-up studies are needed for a range of other developing countries and emerging economies that are showing first signs of domestic eco-innovation or are beginning to enhance their green power through more investments in clean technology, such as Kenya, Egypt and Mexico. Since the absorptive capacity for environmental technologies is generally lower in developing countries, it seems likely that the resulting green power will be limited. For the LDCs and AOSIS, the potential to expand their green discursive power to other dimensions is, therefore, currently rather low.

Table 4: Comparative Overview of Current Green Power Distribution

Country	Instrumental power	Structural power	Discursive power	Share of global commons	Technological capabilities for eco-innovation	Ability for smart governance
United States	Medium	High	Low	High	High	Medium
China	Medium	High	Low/Medium	High	High	Low
Germany	Medium	High	Medium/Low	High	High	High
EU	Medium	High	Medium/Low	High	High	-
Japan	Low	Medium	Low	High	High	High/Medium
South Korea	Medium	Medium	Low	High	High	Medium
Norway	Low	Low	Medium	Medium	High	High
India	Medium	High	Low	High	Medium	Low
Brazil	Medium	High	Low	High	Medium	High/Medium
South Africa	Low	High	Low/Medium	Medium/High	Medium	Low
Costa Rica	Medium/Low	Low	High	Medium	Low	High
Indonesia	Medium	Medium	Low	High	Low	Low
Colombia	Medium	Low	Medium	Medium	Low	High/Medium
Ecuador	Medium/low	Low	Medium	Medium	Low	Medium
AOSIS	Low	Low	High	Medium (Papua New Guinea) Low (AOSIS)	Low	-

Source: Author's own compilation.

In terms of the theoretical implications of these results, two points need to be made: First, even though discursive power is regarded as the highest form of power by Lukes (1974, 2005) and others, it looks as if it needs to be backed by significant green power in more than one of the other dimensions to be effective. It is also possible that discursive power for green change is even subordinate to instrumental and structural power. This would suggest that green power works differently to conventional political or economic power. Second, green

power and the differentiation between its active and passive forms has proven to be a valuable multidimensional and multilevel concept that looks beyond pure political science. It enables the identification of those actors that are likely to successfully manage a green transformation regardless of their global relevance in other policy fields. Moreover, the green power concept assesses their respective strengths and weaknesses in a way that facilitates theory building. Methodologically, it offers enough flexibility so that it can be adapted to specific research questions and cases, but enough comparability to allow for mid-level generalizations. Additional research targeting the interplay of different dimensions and factors is required.

5 Conclusion

This paper introduced a concept of green power and argued that it is central for the transformation toward any kind of green economy. As environmental issues slowly move from low politics to high politics, green power is likely to become a relevant factor for the general distribution of power in the international system. The concept of green power combines a political science perspective on power along the dimensions of instrumental, structural and discursive power with a multidimensional view of economics and environmental innovation capacities. The differentiation between active and passive green power allows for an assessment of a country's potential on the basis of its resources, capacities and actual use of power.

A first assessment of the current distribution of green power has shown that countries of the global South – particularly China and India, and to a lesser extent Brazil and Costa Rica – are catching up in certain fields such as clean technology and renewable energy. In this conceptualization of green power, small countries like Costa Rica and Ecuador emerge as relevant future actors that are otherwise easily overlooked. The US, the EU and Germany still dominate, but they are not fully using their green power potential either. The green power potential of the LDCs is relatively small as their green power is concentrated in the discursive dimension. Although the literature expects this to be one of the highest forms of power available, it seems to be subordinate to instrumental and structural power. Alternatively, a critical level of green power in more than one other green power dimension (e.g., technological capabilities or smart governance of innovation, energy and environment) may be required to render discursive power effective for change. More in-depth research that targets all green power dimensions and expands the number of analyzed cases is required. Currently, a power shift that will allow the LDCs to leapfrog toward a green economy is largely unlikely.

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