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The Multi-level System of Global Climate Governance – the Model and its Current State

Martin Jänicke*
Patschkauer Weg 51, 14195 Berlin, Germany

ABSTRACT
Multi-level global governance was introduced at the United Nations summit in Rio in 1992 as a new model to achieve a broad global mobilization of different actors in sustainable development. This model has been extended to climate governance. It has become a global system with its own inherent logic, dynamics and stabilization mechanisms. This article deals with the systemic dimension (the architecture) of global multi-level climate governance across levels and sectors. It refers to the model and its practical implementation at different levels. The text poses four hypotheses: (1) the global multi-level system of climate governance can be regarded as a structure which offers opportunities for ambitious innovation-based climate strategies; (2) each level of the global system has its own specific responsibilities, challenges, opportunities and mechanisms for lesson-drawing; (3) the main lesson to be learned is to make use of the co-benefits characteristic to climate mitigation; and (4) the system's multi-sectoral and multi-actor structure provides additional opportunities to address such co-benefits and to mobilize different interests in the pursuit of climate policy objectives. After outlining these hypotheses in more detail, the article will then conclude with a set of policy recommendations. © 2017 The Authors. *Environmental Policy and Governance* published by ERP Environment and John Wiley & Sons Ltd

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Introduction

IT IS COMMON TO CONCEIVE CLIMATE POLICY PRIMARILY AS A *PROCESS*: AS THE PROBLEM-ORIENTATED FORMULATION, IMPLEMENTATION AND achievement of goals; the formulation and application of road-maps; transition management; the implementation of instruments, etc. (Jordan *et al.*, 2012). This article deals not with such processes but with the *systemic dimension* of climate governance: the global climate governance 'architecture' (Biermann *et al.*, 2010; Biermann, 2014; Stern *et al.*, 2014). This refers to the global framework creating opportunities for action and interaction. This framework therefore also defines general actor configurations and the basic conditions associated with climate governance in all parts of the globe. The general idea is based on the model of global governance across multiple levels and sectors which was introduced at the United Nations (UN) summit in Rio de Janeiro in 1992. Since then climate governance has improved and has successfully applied this original model. The success of multi-level climate governance (MLCG) has been in stark contrast to the slow progress of the international climate negotiations.

*Correspondence to: Martin Jänicke. E-mail: hauptman@zedat.fu-berlin.de

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This article poses four hypotheses: (1) the global system of MLCG – with its global goal and knowledge base, a multiplicity of access points and incentives for innovation and diffusion – can be regarded as a framework which offers opportunity structures for ambitious innovation-based climate strategies; (2) each level of the global system of climate governance has its own specific responsibilities, challenges, opportunities and mechanisms of lesson-drawing; (3) the main lesson to be learned with regard to successful mitigation policy is to make use of the co-benefits characteristic to climate mitigation; and (4) the system's cross-sectoral and multi-actor structure provides additional opportunities to address such co-benefits and to mobilize different interests in the pursuit of climate policy objectives; in this context economic co-benefits have played the most important role thus far.

It is important to note that the multi-level governance (MLG) approach presents an opportunity structure. To make use of this structure, it needs supportive policies. It is the aim of this paper to explore a range of policy recommendations to develop those potentials.

This paper analyses cases of best practice (as a proven objective possibility). This methodological decision is of course biased because policy failure and political restrictions do not receive the same level of consideration. However, this choice can be viewed as legitimate as this is essentially a solution-orientated explorative study.

The Concept of Multi-level Governance

MLG is a concept which has stimulated wide research particularly over the last 20 years (Stephenson, 2013). Originally this concept was used to describe the governance structure of the European Union (Marks, 1993; Scharpf, 1997; Benz and Eberlein, 1999; Börzel and Risse, 2000; Hooghe and Marks, 2001; Conzelmann and Smith, 2008). After 20 years of research Paul Stephenson concluded that 'no other term in the study of European policy making ... has gained common currency like multi-level governance' (Stephenson, 2013: 817). After a few years, however, MLG developed into a more general concept. For instance, Bache and Flinders (2004) used it as an approach to understanding the dynamic inter-relationship within and between different levels of governance and government (see also: Kern and Bulkeley, 2009; OECD, 2009; Hooghe *et al.*, 2010).

There also exists a special model of MLG that dates back to the UN summit in Rio de Janeiro (1992). This model has developed its own tradition, first as a governance model for sustainability and Agenda 21 processes, and then later also in its application in other fields such as climate protection or the green economy (Schreurs and Tiberghien, 2007; Brondizio *et al.*, 2009; Kern and Bulkeley, 2009; Jordan *et al.*, 2012). This 'Rio model' of global sustainability governance was developed in the Agenda 21 action plan (UN, 1992). At this time it was a system of goal-orientated multi-level and multi-sectoral global governance which aimed to mobilize a broad swathe of actors to pursue sustainability (Jänicke, 2012a, 2015). It is a governance model which is not restricted to government actors, but aims to include a broad variety of business and civil society actors across all levels (Peters and Pierre, 1998). A formalized version of this model is presented in Figure 1. MLG at the time of the system's introduction was focused on the global, the national and, most importantly, the local level. Later this focus also widened to include the level of provinces with the launching of a special network of 'Regional Governments for Sustainable Development' at the UN summit in Johannesburg (2002).

The Agenda 21 was a direct result of the growing recognition that sustainable development at a global scale could only be achieved via MLG, which had the ability to mobilize the multitude of actors in different parts of the world at different levels of the global political system. The multi-sectoral and multi-stakeholder approach was regarded as necessary to address the polluting sectors and to harness the specific opportunities it offered for sustainable development (similarly, the governance approach of Agenda 21 also featured a systematic goal orientation) (UN, 1992; Jänicke, 2012a).

With the Agenda 21 process the Rio model of MLG was applied for the first time, and it was partly successful. Even within the first 10 years, 6.400 local Agenda 21 processes had been stimulated in different parts of the globe (UNDP/OECD, 2002). This transfer of knowledge and policy from the global to the local level was remarkable. Its success, however, was restricted to agenda-setting and policy formulation; its implementation was significantly less successful (Bertelsmann-Stiftung, 2013).

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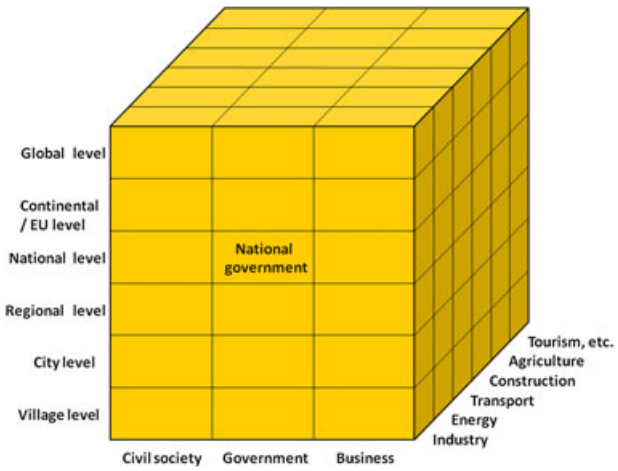

Figure 1. The Rio model of multi-level and multi-stakeholder governance (Jänicke, 2012a, 2015) [Colour figure can be viewed at wileyonlinelibrary.com]

Fritz Scharpf had already made the observation that different policies are characterized by different 'problem-solving capacity' from MLG (Scharpf, 1997: 531). The present article will show that climate policy – and the use of its economic co-benefits – was particularly successful in adopting the Rio model of global MLG and it seems to have been even more successful than the original Agenda 21 process (having now even succeeded in being implemented) (IPCC, 2014).

The two different results may be explained by the differing nature of the coalitions; the 'Rio process' to introduce an Agenda 21 at all levels of the global system was essentially 'norm-driven' and mainly based on a coalition of civil society and government actors. Climate governance with its socio-technical dimension, on the other hand, was essentially 'interest-driven' (van Schaik and Schunz, 2012) and conceived essentially as industrial policy. Therefore, climate governance also involved business actors as part of a broader (and stronger) coalition (Figure 1). In recent years, however, the civil society part of this coalition has become stronger, which has also broadened the interest base of both sustainable development and climate governance. The inclusion of, for example, health, environment or nutritional challenges is typical of this broader basis.

According to Geels (2011: 24), the MLG research perspective has emerged as 'a fruitful middle-range framework for analysing socio-technical transitions to sustainability'. Several authors focus on this particular kind of multi-level system in explaining the emergence and transition to new technologies in a society. A group of scholars refers to those MLG systems as 'Technological Innovation Systems' (Hekkert *et al.*, 2007), which is more specific than the concept of 'National Innovation Systems' (Lundvall, 2007). The multi-level system of climate governance, when conceived in 'socio-technical' terms, refers to a specific group of technologies – low-carbon technologies – and to the policies and institutions which support them. This is a necessary specification regarding the potential co-benefits of this particular group of technologies.

Multi-level Climate Governance as a System

In global climate governance the concept of MLG has become indispensable. This can be explained as follows:

(1) Sustainable development as well as climate protection are necessarily global approaches. Global governance, however, needs the intermediate levels of the global political system.
(2) The role of each level – from global to local – is specific. It has its own responsibilities, challenges and opportunities. And it has specific horizontal dynamics: peer-to-peer learning, competition and cooperation. Horizontal networks of cities and provinces/states have become global players in climate governance.

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(3) Vertical interactions offer additional potential: the up-scaling of best practices via higher level policies and policy support for the lower levels. Vertical and horizontal MLG interactions have become central to the high speed of interactive learning and the diffusion of technical and political innovation. This is essentially a multi-impulse system for climate-related innovation.
(4) Multi-level climate governance is usually also conceived as *multi-sectoral* or multi-stakeholder governance, making it a model that can address not only all scales but also all relevant interest groups in global climate governance. This is particularly relevant as far as the 'multiple benefits' (IEA, 2014) or 'co-benefits' of climate protection are concerned (IPCC, 2014). (The sectoral dimension of MLCG is exemplified by the construction sector by Khosla *et al*. in this Special Issue.)

The above form the main advantages of the MLG model of climate mitigation. They are at the same time characteristics of a global system, which provides a distinct opportunity structure for interaction between different actors based on a common goal. A 'social system' in its classical definition 'is a mode of organization of action elements relative to the persistence ... of the interactive patterns of a plurality of individual actors' (Parsons, 1951: 15). Marks referred to MLG as 'a system of continuous negotiation among nested governments at several territorial tiers – supranational, national, regional, and local – as the result of a broad process of institutional creation and decisional re-allocation' (Marks, 1993: 392). Furthermore, Ostrom highlights the importance of so-called 'polycentric systems', characterized by 'multiple governing authorities at differing scales' (Ostrom, 2010: 552) to address global collective action problems (see Jänicke and Quitzow in this Special Issue).

The MLCG system of interaction between government actors as well as business and civil society actors at all levels of global governance is shown in Figure 1. The system features a global knowledge base [Intergovernmental Panel on Climate Change (IPCC) etc.] referring to shared global problems and objectives and a global policy agenda (UN, G20, etc.). The climate regime of the United Nations/Framework Convention on Climate Change (UNFCCC), although restricted by many factors, provides a global policy arena and has a general catalytic function. In addition there are horizontal global networks of activity formed by national governments, regions and cities. There also exists a global market for clean energy technologies together with a competitive green industrial policy at various levels of the system.

This global system provides a stable opportunity structure for clean-energy innovation, allowing for interactive learning and dynamic action within and between levels. It enables climate-related innovation at different points of the system and lesson-drawing at other points (Sovacool, 2011). It provides a plurality of access points, interlinkages and experiences together with incentives for bottom-up harmonization (up-scaling) of best practices and top-down initiatives, potentially inducing horizontal dynamics and reinforcing innovation and lesson-drawing (peer-to-peer learning). Cooperation (networking) and competition have a strong basis in this system.

This system has developed its own inherent logic and stabilization mechanisms (see Conclusion and Recommendation). It is a system of global interactive learning under a broad variety of possible interactions (Figure 2). Also, it is a multi-impulse system (Klemmer *et al*., 1999): individual climate-related impulses may be weak, but several impulses from different points of the system can have a strong combined effect.

The Role and Potential of Different Levels

Having conceived MLCG as a model (based on the original proposal of the Agenda 21 in 1992) we now will turn to its application. Instead of a detailed analysis we will solely illustrate that each level of the system has its own distinctive characteristics which can be relevant to climate governance. The levels have different responsibilities, challenges and opportunities. The African world region is 'the most vulnerable continent' to climate change (African Union, 2014: 1). The African Union therefore represents specific interests in the horizontal interaction with similar organizations [e.g. the European Union (EU)].

The horizontal dynamics on each level can differ too. Networking, cooperation, benchmarking and lesson-drawing can play different roles at different levels. The interaction between cities, for instance, is more intensive

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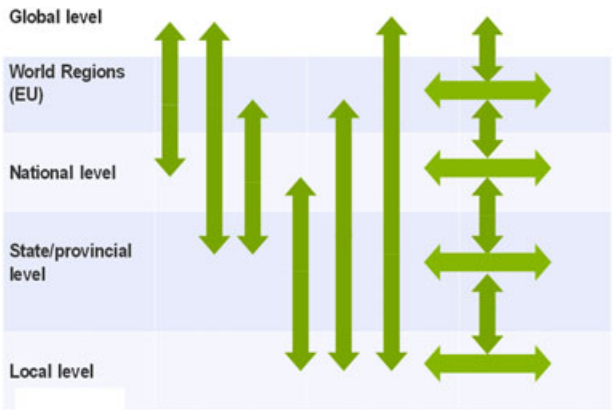

Figure 2. The multiplicity of possible interactions in the model of global multi-level governance (Jänicke, 2015) [Colour figure can be viewed at wileyonlinelibrary.com]

than between provinces or world regional organizations such as North America's Free Trade Agreement (NAFTA) or Asia-Pacific's Economic Cooperation (APEC). The lowest level of the system – the level of rural communities – also has become increasingly relevant in recent years. Again, this level plays a specific role, whether it be in the form of wind turbines, bio-mass or afforestation.

The Global Level

The global level of climate governance is first of all influenced by the UNFCCC-Regime, United Nations Environment Programme (UNEP), the Commission on Sustainable Development, or the knowledge-base of the IPCC. The G8 summit in Heiligendamm in 2007 and the G7 summit in Elmau in 2015 have also played a strong role in global climate policy. The G20 has referred to climate issues on several occasions (e.g. in the St. Petersberg Declaration, September 2013). The UN Security Council has also discussed issues such as the security impact of climate change (July 2011).

The global level of climate governance in the narrow sense is characterized by comparably weak formal institutions (due to the UNEP and UNFCCC's small secretariats and budgets). Decision-making on legally binding rules is restricted by broad opposition and the preconditions of a global consensus, among other things. However, the process of climate negotiations has at least a catalytic function. Also, the knowledge-based influence of the global level is strong, providing core beliefs, legitimacy and relevant information for actors at lower levels of the system (see Khosla *et al.* in this Special Issue). There exists a global policy agenda with defined problems and broadly agreed-upon general objectives. Regular information on best practices is provided.

The Level of World Regions

Political organizations that represent regions of the world – whether it be the EU, Community of Latin American and Caribbean States (CELAC) or the African Union – play a role in the supra-national articulation of common interests and the discussion of solutions for common problems in the region. They can translate global objectives such as healthcare or poverty reduction into strategies that take regional conditions into account. Climate protection and adaptation have become more or less accepted as topics on the agenda at this level of the global system. The IPCC describes the role of regional cooperation for climate mitigation in a special chapter of its latest report (IPCC, 2014). The institutional capacity of organized world regions differs radically. In most parts of the global system this capacity is weak but has become stronger in the last few years. The European Union is an exceptionally strong case. Its system of MLCG is unique compared with multi-level systems in other world regions (Schreurs, 2013). The EU has placed importance on this level due to its strong demonstration effect and its active cooperation with other regional organizations (see Jänicke and Quitzow, and Jörgensen and Wagner in this Special Issue).

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Regional organizations such as the African Union as well as NAFTA or Association of Southeast Asian Nations (ASEAN) have their own sustainability and climate policy agenda. ASEAN is particularly active (IPCC, 2014). The African Union has adopted an 'African Climate Strategy' (African Union, 2014). APEC has, for example, a Climate Center and a Low Carbon Town Project. However, only the EU has the institutional power to formulate and implement ambitious policies (Richardson and Mazey, 2015). The EU subsystem of MLCG may be seen as the most dynamic subsystem of the global system (see Jänicke and Quitzow in this Special Issue). It has also undertaken horizontal peer-to-peer initiatives to strengthen international climate negotiations, which is of great relevance for the special level of world regions. Together with the 33 member states of the CELAC it published a statement supporting legally binding obligations and a global target of 2, 'or even 1.5 degrees' in the final climate agreement in Paris (UNFCCC, 2015).

The EU's climate partnerships with other large regional powers such as China and India are also of note (Torney, 2015). The climate partnership with China was initiated in 2005 and their latest joint statement on climate change, published in July 2015, includes an agreement 'to launch an EU/China Low Carbon Cities Partnership' (European Council, 2015). (The EU's climate partnership with India is outlined by Jörgensen and Wagner in this Special Issue.) In addition, since 2007 there has also been an EU Climate Partnership with the African Union.

The National Level

Climate policy – like environmental policy – has generally started at the national level. Most climate policy regulations to be implemented at sub-national levels are introduced by national governments (the EU being a special case of inclusion of the higher level). The nation-state has remained the most powerful actor, both as an individual and collectively in the global arena (e.g. G20) (Jänicke, 2012a; Wade, 2011). Climate policy leadership is strongest at this level. National governments, acting within networks, remain the key players in the MLG system. The nation-state has the highest level of legitimacy and is the main focus of public opinion. Compared to other political actors it has the greatest competencies and financial resources and has a monopoly on coercive power. The nation-state is the first point of redress for the public in case of crises (Jänicke, 2012a). The state also plays an important role as a competitor in international markets for clean energies. The accelerators discussed below underline the strong role played by the national level. National governments are not only at the core of all kinds of domestic policy networks, they are also members of global networks (Stone, 2008). Specialized policies are made within such specialized policy networks, and policy learning also essentially takes place within such networks.

The Provincial/State Level

The sub-national regions – provinces or states – have specific responsibilities in the implementation of national policies. They are often direct global players, competing for foreign direct investment and selling specialized products on the international market. Climate-related industrial policy is also regarded as a vehicle for the creation of jobs and business opportunities. Chinese provinces, US states and Japanese prefectures often play pioneering roles, experimenting and providing best practices (e.g. in the field of emissions trading). Several sub-national regions compete with the nation-state in terms of ambitious climate policies (e.g. *California*, Quebec or Scotland). Regional climatic opportunities can also drive states or provinces to support wind or solar power (Hooghe *et al.*, 2010; Rabe, 2011).

Provincial and state activities seem to have increased in recent years. Some examples include nine US states having reduced their CO_2 cap by 45% in 2014 (IEA, 2014); 12 Chinese provinces planning to reduce their CO_2 emissions by 1.3 billion tons by 2020 (Bloomberg New Energy Finance, 2014); and Scotland aiming to generate 100% green power by 2020. There are regional networks such as R20 Regions of Climate Action, the Compact of States and Regions, and the Regional Governments for Sustainable Development.

The City Level

Cities and local communities are particularly important because this is the level where most national regulations have to be implemented (see following section). This level of government has responsibility for policy areas that

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are relevant to climate policy (housing, transport, infrastructure, land-use, waste and often also energy). Seventy per cent of energy-related emissions are caused by urban activities (UNFCCC, 2015). Most jobs in the 'climate industry' are at the urban or local level. There are several national and international city networks for low-carbon development, such as the International Council for Local Environmental Initiatives or the EU-based Covenant of Mayors with about 6800 municipal members (2016). The Chinese Government has also launched a pilot programme for low-carbon provinces and cities (2010) (Can Wang *et al.*, 2014) (see Schreurs in this Special Issue).

The global renewable energy policy network REN21 has summarized the rising importance of the city level as follows: 'Thousands of cities and towns worldwide have policies, plans, and targets to advance renewable energy, often outpacing ambitions of national legislation ... (C)ities seek to share and scale up best practices ... in turn, national governments often observe sub-national actions and consider using successful programmes as blueprints for national policies.' (REN21, 2014: 86).

Rural Local Communities

One 'level' that has been ignored for a long time but that is becoming increasingly important is that of rural local communities. The countryside provides necessary sinks if the sequestration of CO_2 is at stake. Pioneer villages can 'export' green electricity. They can be areas of experiments such as car-sharing based on electro-mobility powered from renewable resources (see Jänicke and Quitzow in this Special Issue). The German '100%-renewable-energy-regions', which have a strong basis at the village level, may be cited as an example; the number of such regions has doubled within only 4 years from 72 to 146 and these participating local communities now have a population of about 25 million (Institut dezentrale Energietechnologien 2015, Umwelt 12/2013). A remarkable initiative in China has demonstrated best practice in 'an internet-based green economy' in poor agricultural regions based not only on renewable energy but also on a broad variety of resources (LuAn Declaration, Foziling, LuAn, 10 October 2014). 'Smart village' activities can be observed in several developing countries.

The Micro Level of Individuals

The micro level of the multi-level system of global climate governance is formed by the action of individuals, voters, consumers or non-governmental organization (NGO) members. It is sometimes restricted because the intervention of individuals comes later in the chain of causation of climate problems; as consumers they act at the final stage of the value chain. Individuals did not 'invent' most climate problems and therefore cannot be the main source of solutions. Nevertheless, individuals switching electricity suppliers or taking part in consumer boycotts or internet campaigns can have a strong impact. Private ownership of solar or wind power installations is another strong example of the role individuals can play. It should be added that technical innovation and climate policy advocacy coalitions are essentially based on individual core beliefs (Sabatier, 1988). Individuals at the lowest level of the system of climate governance can generally be considered as members of a global system if they refer to global climate problems, objectives and a global knowledge base (e.g. information from IPCC reports).

The Multi-sectoral Structure of the Global System – an Opportunity Structure to Address Co-benefits

The dynamic potential of MLCG cannot be fully explained without referring to the interest structure of actors. As mentioned above, the successful use of the Rio model of global governance by climate policy can be explained by the fact that in the EU, and also in the US or China, economic links were established between interests and climate policy objectives. Therefore, the MLG system of climate protection not only is an opportunity structure for clean-energy innovation and its diffusion, it has also proven to be an opportunity structure for addressing the economic co-benefits of climate protection.

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In addition there is an even broader variety of positive side effects that can result from climate policy. The International Energy Agency (IEA) found at least 15 possible 'multiple benefits' of energy efficiency (IEA, 2014). The IPCC has published a list of 18 potential 'co-benefits' of climate mitigation (IPCC, 2014), far more than the former 'double-dividend' theory! The list is not even complete, as the potential economic co-benefits do not include the costs of pollution control, which can be avoided by climate mitigation measures. A study by the International Institute for Applied Systems Analysis revealed that the EU's planned climate and energy targets for 2030 will significantly improve air quality. That means that achieving new air pollution limits for 2030 is likely to be 5.5 billion euros cheaper per year than the EU Commission has predicted before the climate and air package for 2030 was published (ENDSEurope 30 October 2014).

The dynamic potential of the MLG system of climate governance is strongly connected to the specific stimulus of co-benefits potentially related to climate mitigation (Table 1). This makes voluntary and interest-driven solutions (van Schaik and Schunz, 2012) and opportunity-sharing possible (Table 2). This is in clear contrast to the strict and demanding regime of legally binding obligations and burden-sharing (Figure 3).

The global MLG system of climate protection was able to address and to integrate a broad spectrum of economic co-benefits because it has, since Rio, also been a system of multi-sectoral governance, with, for example, the construction sector becoming highly relevant at the city level (see Khosla *et al.* in this Special Issue). The producers of electric vehicles or modern public transport have become similarly important. Agriculture and forestry have a new role at the local level of the MLG system of climate protection. The sectoral integration into climate governance is, however, so far quite different, with sectors such as transport or agricultural lagging behind the energy sector.

The question remaining is how non-economic co-benefits can be better addressed by climate governance. Most co-benefits of climate mitigation are related to potential economic advantages (Table 1). Climate protection, however, necessitates more than economic and technical change. The increase and vitalization of natural capital is necessary as well as structural change, and changes to lifestyles, societal norms and institutions. In other words, there are limits to viewing a climate policy in terms of industrial policy, which is primarily based on the interaction between government and the business sector.

In this regard civil society is very important at all levels of the global multi-level system of climate governance. It is the main societal basis for strategies that go beyond technological approaches and it can also refer to sectoral problems and opportunities (e.g. NGO activities on bioenergy or low food miles), so a broad coalition between

Economic	Social	Environmental
Energy security	Health impact (e.g. via air quality and noise)	Ecosystem impact (e.g. via air pollution)
Employment impact	Energy/mobility access	Land use competition
New business opportunity	(Fuel)Poverty alleviation	Water use/quality
Productivity/competitiveness	Food security	Biodiversity conservation
Technological spillover/innovation	Impact on local conflicts	Urban heat island effect
	Safety/disaster resilience	Resource/material use impact
	Gender impact	

Table 1. Possible co-benefits of climate protection (IPCC, 2014)

Climate benefit only	Multiple (co)benefits
Burden-sharing	More opportunity-sharing
Norm-driven	More interest-driven
Obligatory	More voluntary
Fixed targets	More dynamic targets

Table 2. Specifics of the co-benefit approach to climate governance

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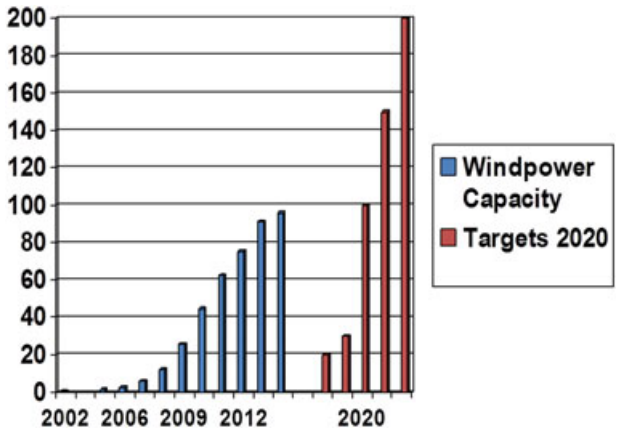

Figure 3. The development of wind power capacity in China, 2002–2015, and targets for 2020 (REN21, 2016) [Colour figure can be viewed at wileyonlinelibrary.com]

government, civil society and the business sector is important. This enlarged coalition can address a broad variety of economic and non-economic co-benefits. The non-economic co-benefits (health, environment, food and water security, gender impacts, etc.) could, if fully addressed, strengthen the societal basis of climate governance.

Accelerators of Climate Governance

The global system of multi-level and multi-sectoral climate governance is an *opportunity structure* for climate governance actors, not a driver as such. There is no automatism, but a broad systemic potential which can be activated by purposeful action. The global multi-level system of climate governance is the necessary condition where actors and their strategies are the sufficient condition. This necessitates a knowledge-based, skilled and motivated form of leadership (Wurzel and Connelly, 2011), acting within networks. It is important that this is a reflexive strategy that is open to new learnings (Voss and Bornemann, 2011). It should be ambitious but nevertheless realistic in terms of feasibility within a given capacity.

The dynamic potential of the global system of climate-related MLG can be exemplified by accelerators that can be activated by skilled strategic action. This refers to the phenomenon of 'multi-level reinforcement' which was first discussed with regard to the EU (Schreurs and Tiberghien, 2007, 2010; Jordan *et al.*, 2012). I have outlined the accelerators to support the argument that MLG provides an opportunity structure for climate-related innovation and its rapid diffusion (Jänicke, 2012b, 2015). The five accelerators can overlap and reinforce each other. The first two refer to policy-induced market dynamics, particularly the up-scaling of national markets. The other three mechanisms of reinforcement are related to vertical and horizontal dynamics at different levels of the multi-level system of climate governance:

- **Mutually reinforcing cycles** of (a) policy-driven markets for low-carbon technology, (b) induced innovation and (c) positive policy feedback, increasing the ambition to further develop policy in case of unexpected success (Jänicke, 2012b).
- The creation of **lead markets** for low-carbon technologies – the national market as a 'runway' for entering the global market; lead markets for clean energy technologies are markets where the learning costs of low-carbon technology are returned (Beise and Rennings, 2005; Quitzow *et al.*, 2014).
- **'Lesson-drawing'** (Rose, 1993): the diffusion of climate policy innovations by peer-to-peer learning from pioneers, creating a demonstration effect for others by providing best practices and reducing the risk of failure.
- **Up-scaling and higher-level support for climate policy innovations** at lower levels (IPCC, 2014). This is a particularly interesting mechanism in the EU (see Jänicke and Quitzow in this Special Issue).

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- **Horizontal dynamics at lower levels** induced by vertical climate policy initiatives: reinforced lesson-drawing from pioneers, networking, but also competition if a policy measure is established at higher levels (Jänicke, 2015).

Three of these accelerators will be briefly outlined below:

Mutually reinforcing cycles are characterized by the interaction of policy-induced clean-energy markets, induced technological learning (which can be supported by targeted R&D policy) and a policy feedback caused by unexpected success and the creation of new interests and capacities.

The installation of wind and solar power in China is an example of this. The country's (originally) ambitious wind power target of 20 GW by 2020 has been increased several times to 250 GW (Figure 3), and the photovoltaic target from 1.8 to 150 GW. This was due to the unexpected speed of the diffusion of the policy (see also Schreurs in this Special Issue). Unexpected success in greenhouse gas emissions reductions also led to more ambitious targets to be achieved by 2020 in the three frontrunner countries of EU climate policy, namely the UK, Germany and Denmark (see Jänicke and Quitzow in this Special Issue). Mutually reinforcing cycles can also be observed at the state/provincial level in Scotland and Texas (Jänicke, 2012b).

The accelerator of *lesson-drawing* (Rose, 1993), the diffusion by peer-to-peer learning from best practices in pioneer countries, has become extremely important in global climate governance (Kern, 2000; Busch and Jörgens, 2004; Tews and Jänicke, 2005). 'Trendy solutions' (Chandler, 2009) pioneered by these countries are then adopted by other countries, also as a strategy to avoid domestic trial-and-error and learning costs. This can lead to 'adaptive expectations' (Arthur, 1988): increased diffusion can enhance the belief in further diffusion. This then often reaches a critical mass of countries, the stage in the process at which diffusion becomes self-perpetuating. Lesson-drawing is a particularly remarkable mechanism because it is completely voluntary, contrary to the legally binding nature of international climate law.

Lesson-drawing is possible on different levels (Kern, 2000). So far, however, it has been most important for the country-to-country diffusion of policy innovations. Global figures for the adoption of climate-related legislation at the national level have doubled within 5 years (IPCC, 2014). The same is true for countries with targets for renewable energy and energy efficiency targets (Figure 4). It is remarkable that developing countries have recently witnessed the highest speed of diffusion of policies supporting renewable energies (REN21, 2016).

The accelerator of *horizontal dynamics induced by vertical climate policies* can be characterized as innovation and best practices at lower levels being scaled up and supported by higher levels. The newly established policy and its support from the higher level can induce horizontal dynamics at the lower level: pioneers of the same level become relevant as benchmarks, partners or competitors. Networks and pro-active coalitions can support this kind of horizontal learning, which is induced by the higher level.

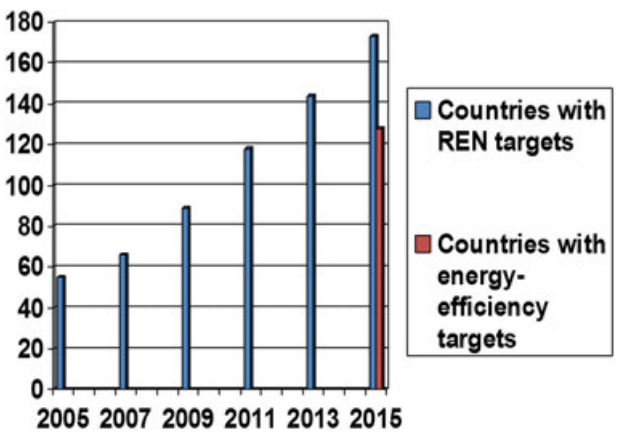

Figure 4. Countries with renewable energy and energy efficiency targets, 2005–2015 (REN21, 2016 [Colour figure can be viewed at wileyonlinelibrary.com]

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This mechanism has become particularly important at the city level (see above). Just a few of the many examples include more than 50 local governments in the US (including Washington, DC) releasing a plan to enhance communities' resilience to climate change through steps including the increased use of renewable energy and energy efficiency in buildings and other infrastructure (REN21, 2014). Thirty-six Indian cities have finalized solar city master plans in response to the National Solar Cities Programme, which will support a total of 60 cities becoming green cities (REN21, 2014). Eighty per cent of the 287 Chinese cities at the level of prefectures and above have proposed to establish themselves as eco-cities. Of those 230 cities, 46.3% have established targets to develop specifically as 'low-carbon cities'. Local climate mitigation and horizontal lesson-drawing between cities is being explicitly supported by the central government (Zhou *et al.*, 2012; see Schreurs in this Special Issue).

Horizontal dynamics on the city level induced by climate policy regulations at higher levels have become a remarkable phenomenon in global climate governance. National support schemes for renewable power or the EU Directive on the Energy Performance of Buildings are examples of such vertical intervention inducing horizontal dynamics. These horizontal processes, particularly lesson-drawing between cities, influence the speed of implementation. They are the difference between whether the implementation is weak and restricted or whether additional motives arise to surpass the 'vertical' objectives.

The rapid increase in private investment in renewable energies at the local level is the most visible result of this accelerator (based on support schemes at the national level). Ten years ago the EU was the strongest example of this process. This pioneering role has, however, more recently been adopted by Japan and also the US and China (Bloomberg New Energy Finance, 2014, 2015).

Conclusion and Recommendation

For many years, the literature on global environmental and climate governance was characterized by a search for an optimal level of climate policy. Economists in particular highlighted the dominant role of the global level (Deutscher Bundestag, 2013: 353ff, 546ff). The 'polycentric approach' (Ostrom, 2010), on the other hand, regards the plurality of actors and levels and the complexity of their interactions not as obstacles but as an opportunity for innovation and interactive learning (Sovacool, 2011). This can be regarded as a *multi-impulse system*, where the plurality of impulses from different points of the system and at different points in time can play the same role as one strong (often contested) impulse or instrument.

Global climate policy occurs in a system of multi-level and multi-sectoral governance. The present article has shown that each level of this system has its own potential. All levels meanwhile have a climate policy agenda and contribute to the climate policy outcome, although the existing potential has not yet been fully used. For instance, rural villages have only become relevant in recent years. This global system has developed its own inherent logic. It provides an opportunity structure for climate-friendly technology, policy, knowledge innovation and lesson-drawing. The main lesson to be learned on each level concerns the co-benefits which are the specific advantages of climate mitigation. Economic co-benefits have played an important role in mobilizing economic interests in support of climate action at all levels of the multi-level system of global climate governance, although the participation of sectors is different.

This opportunity structure can be used to promote ambitious and effective climate actions. Smart policies can accelerate change. There are several empirical cases in which effective use of this dynamic potential has promoted effective climate governance and rapid diffusion of low-carbon technologies. 'Reflexive governance' as 'adaptive management' with interactive 'learning by doing' may be an adequate general concept for this mode of steering (Voss and Bornemann, 2011; Brousseau *et al.*, 2012).

The multi-level system of global climate governance seems to have become increasingly irreversible. This is due to the increasing institutionalization of climate policies, the dynamics of change enabled by the system itself, and the rise and strengthened position of new interests supporting climate action (Patashnik, 2008). The new interest base can, however, only gain strength when status quo interests are definitively weakened.

The following policy recommendations can be drawn from the analysis above (see also Jänicke *et al.*, 2015):

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(1) Use the dynamic potential of the multi-level system of global climate protection via smart governance. Provide and secure a shared global problem definition and goal structure. Base policy on existing best practice at different levels. Translate, where possible, climate policy objectives into the language of co-benefits.
(2) 'Progression over time': apply dynamic targets based on achievements and learning-by-doing. Raise ambitions in cases of success (this is what Articles 3 and 4 of the Paris Agreement are about).
(3) Increase the capacity of the multi-level system of climate governance at each level, because each level offers specific potential for innovation and lesson-drawing. Support horizontal networks and coalitions. Provide or improve channels for interactive learning. Increase the visibility and the demonstration effect of best practice.
(4) Support lower levels of government and stimulate horizontal dynamics through bench-marking, competition, lesson-drawing and networking. Give the horizontal networks of the lower levels a voice at the global level. Strengthen the institutional and financial basis of local communities.
(5) Create or improve mechanisms to monitor the impacts of policy within and across policy levels of the multi-level system of global governance. Develop feedback mechanisms for systematic policy improvement linked to monitoring outcomes.
(6) National governments – both as single and as collective actors – generally have the strongest capacity within the system and therefore should lead with ambitious climate policies and take the final responsibility (in a complex system with often unclear responsibilities). National leadership requires involvement in a broad variety of networks. Competition within and between states can promote progress in climate governance.
(7) The different economic co-benefits are best addressed by a multi-sectoral approach, which, together with the MLG approach, goes back to the UN summit in Rio de Janeiro in 1992.
(8) A technology-based economic approach to climate policy is necessary because technical change will be critical in addressing climate challenges. This approach has been the most dominant so far (IPCC, 2014). Climate policy must, however, also go further to address non-technical aspects.
(9) This broader approach should be based on a coalition of government, business and civil society actors operating at all levels of the global multi-level system of climate governance (Figure 1). It should focus its actions on the economic and non-economic co-benefits identified by the IEA and the IPCC to connect climate policy objectives with this broad interest base.

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