Int Environ Agreements (2021) 21:1–7
https://doi.org/10.1007/s10784-021-09527-6

EDITORIAL

Achieving the ambitious targets of the Paris Agreement: the role of key actors

S. Andresen[1] · G. Bang[2] · J. B. Skjærseth[3] · A. Underdal[4]

Accepted: 25 January 2021 / Published online: 26 February 2021

1 Purpose and scope

The Paris Agreement (PA) of 2015 was widely celebrated as the first encompassing global mechanism for international climate cooperation (Bang et al. 2016). The agreement's key value lies in its universality, with broad participation[1] and the same obligation to pledge, report and review for all parties (Victor 2015). The ambition mechanism enshrined in the agreement relies on a requirement for all parties to voluntarily propose increasingly ambitious nationally determined contributions (NDCs) every five years, as part of a 'pledge and review' governance system (Pickering et al. 2019). 2020–21 will likely provide evidence of enhanced ambition as parties are set to report new NDCs in the run-up to the 26th Conference of the Parties in Glasgow.

Looking back and looking forward, this special feature addresses the prospects of increased ambitions in the domestic climate policies of three important actors: China, the EU and USA. Combined, the three actors are responsible for almost 50% of global emissions (Ge and Friederich 2020), and with strong economic and technological muscles they inhabit influential roles in international climate cooperation. The targets, policy mixes and trajectories of China, the EU and USA will therefore be crucial for the Paris Agreement's (PA) goal attainment.

[1] With US re-entry in 2021, the only non-participants are Syria and Nicaragua.

✉ S. Andresen
sandresen@fni.no

G. Bang
guri.bang@nupi.no

J. B. Skjærseth
jbskjaerseth@fni.no

A. Underdal
arild.underdal@stv.uio.no

[1] The Fridtjof Nansen Institute (FNI), Fridtjof Nansens vei 17, P.O.Box 326, 1326 Lysaker, Norway

[2] Norwegian Institute of International Affairs (NUPI) and CICERO, Oslo, Norway

[3] The Fridtjof Nansen Institute (FNI), Lysaker, Norway

[4] University of Oslo, Oslo, Norway

Looking back, we offer in-depth case studies and comparison of past and current climate policies of the three major emitters (see Bang, Heggelund and Skjærseth; Skjærseth et al. this issue). To enable the comparison, we develop a conceptual framework for examining two important conditions for achieving the PA's ambitious goals to hold the global average temperature increase to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C. First, drawing on the policy mix literature (Jordan and Huitema 2014; Hawlett and del Rio 2015; Kivimaa and Kern 2016; Rogge and Reichardt 2016; Kern et al. 2019) we trace the emergence of broad mixes of reinforcing policies in the three actors, acknowledging that such policy mixes are needed to accelerate a societal transition towards net zero emissions. In the case studies, we focus on 'push' and 'pull' policies for redirecting and accelerating technological change, green industrial policies, policies for just transition, policy feedback from implementation experiences and economic recovery packages. Second, we acknowledge that increased ambition will also depend on the PA's effects on actors' targets, policy mixes and emissions trajectories. Our case studies provide a basis for comparing the actual impact of the PA so far on the three largest emitters.

Looking forward, this special feature includes analysis of how the economic crisis following the COVID-19 pandemic may affect future climate policy development in the three actors in terms of disrupting stability, providing windows of opportunity for rapid policy innovation—or causing lower ambitions. While the COVID-19 crisis has—at least temporarily—reduced world GHG emissions by 8% in 2020, low-carbon economic recovery packages are needed to sustain this declining trend. Projections show that even if the transport sector will gradually be wholly electrified and the use of coal will be fully phased out of electricity production and be replaced by renewable energy sources this is not enough to attain the 2 °C target (Bloomberg 2020; DNVGL 2020). Our analysis of the biggest emitters aims to build more knowledge about policy ambitions and mixes that may enable an accelerated low-carbon societal transition. In the following sections, we elaborate on the conceptual framework employed in the special feature articles, starting with an introduction to 'green growth' that is the preferred strategy by governments aiming towards net zero emissions.

2 Green growth

The green growth approach has been embraced by policymakers around the world as a preferred policy response to the climate change challenge. Leading international institutions like the OECD, UNEP and the World Bank see green growth as a route to reduce the environmental impacts and ecological deprivation associated with economic growth, while protecting natural resources and biodiversity (OECD 2011; UNEP 2011; World Bank 2012). According to 'green growth' theory, continued economic growth is compatible with sound environmental stewardship, because technological change and substitution can lead to decoupling of GDP from resource use and carbon emissions (Hickel and Kallis 2019). This is also underlined by the Impact Population Affluence Technology (IPAT) and Kaya formulas as applied in IPCC assessments (IPCC 2014). The goal of green growth has now become included in national and international climate policy, also in the Sustainable Development Goals (UN 2020). The European Green Deal explicitly aims to decouple all resource use from economic growth by 2050 (Skjærseth, this issue).

The literature mentions specific mechanisms for achieving green growth, indicating that technological change will improve the ecological efficiency of the economy, and that governments can accelerate this process with the right policy regulations and incentives (Hickel and Kallis 2019). While recognizing the enormity of the challenge posed by climate change, proponents of green growth emphasize the potential that lies in untapped opportunities for resource efficiency and renewable energy through technological improvements and behavioural change (Antal and Van den Bergh 2016; Victor et al. 2019). Basically, mixes or packages of reinforcing policies will be needed to break the emissions trend (OECD 2011; World Bank 2012; Global Commission on the Economy and Climate 2014; Geels et al. 2017).

3 Policy mixes for low-carbon technological change

From a green growth perspective, then, low- or no carbon technologies are the key to decoupling economic growth from emissions, with three ways of breaking the emissions trend and meeting the Paris targets[2]: shifting the energy mix towards sources emitting less or no CO_2; promoting energy saving so that less energy is consumed while more goods and services are produced and driving carbon capture and storage (CCS) or equivalent 'removal and storage' options. All these necessitate technological change—from new ideas, to cost reduction of existing low-carbon technologies to make them competitive with higher-emitting alternatives and affordable and applicable to context. The state, industry and the research community drive such changes—from innovation via market uptake to change in energy- and socioeconomic systems (Åhman et al. 2018; Eikeland and Skjærseth 2019).

In the following, we outline policy mixes for various transition functions. Policy mixes will emerge from both internal and external drives such as political systems, state–society relations and possibly the PA itself (see e.g. Skjærseth, Bang and Schreurs 2013). They form part of the conceptual framework for examining past, present and future climate policies in China, the EU and the USA (Bang, Heggelund and Skjærseth, this issue).

Research indicates that a combination of 'supply-push' and 'demand-pull' policies is needed to speed up innovation and technology change. *Supply-push* policies refer to instruments that provide financial and other support to research and innovation, pilot and demonstration projects, thereby providing a technology 'push' that may accelerate low carbon technologies. One example of international cooperation in this field is the 25-member *Mission Innovation* related to the PA.[3] This 'mission', which includes China, the EU and the USA, aims to accelerate clean energy innovation by increasing public and private investments in certain focused low-carbon areas, including mobility, renewables, nuclear, carbon capture and storage (CCS), hydrogen/fuel cells, energy storage and grids.

Studies of 'success factors' in the design of technology demonstration policy conclude that the long-term contribution to technological change is inherently uncertain, depending on factors like learning and technological maturity (Nemet et al. 2016; Hart 2017; Åhman et al. 2018). This high uncertainty makes public support to research and innovation crucial for reducing the risk for private investment across the entire value chain. Public support to research and innovation can also create opportunities for technology manufacturers in

[2] Energy-related emissions, excluding removals from land-use and forestry.

[3] http://mission-innovation.net/.

the international market, promoting or consolidating first-mover advantages. China, the EU and the USA have been among the major players in low-carbon technology innovation, due to their market size, investments, and research capacities.

Innovation studies show that *demand-pull* instruments play a crucial role, together with technology push instruments (Rogge and Hoffmann 2010; IPCC 2014). Demand-pull policies include the carrot, the stick, and the sermon: binding targets, carbon pricing, subsidies, state-aid rules, technology standards and so on. In the EU for example, various demand-side targets and policies are aimed at increasing energy efficiency, promoting renewables, and reducing GHG emissions towards 2030 and beyond. Adequate 'pull' policies may also significantly reduce the risk for private investments in, e.g. large-scale demonstration projects. One example is CCS: it needs 'push' support from basic research, small pilot- and larger demonstration projects to prove its technological potential and bring costs down. However, parallel 'pull' from a sufficiently high carbon price based on taxes or emissions trading will lower the risk of investments for making CCS commercially viable. In general, energy technologies need strong support—from ideas to the mass market—via large-scale demonstration projects, due to the scale of investment, technological and regulatory inertia and fossil fuel lock-in—often leading to the 'valley of death' for low-carbon energy technologies (Åhman et al. 2018). Thus, both push and pull policy instruments are necessary; they need to be aligned to drive technology change through various *stages* of the innovation process. A strong supply-side technology push is deemed particularly important in the earlier, R&D, and demonstration phases of innovations, whereas a strong market pull is considered more important in the later, deployment phase to ensure (full) market introduction.

Policy mixes or policy packages are needed to 'push' and 'pull' technological change. It is increasingly recognized that significant change towards a low-carbon economy cannot be achieved with single instruments, but requires a broader mix of reinforcing policies. Recent studies have examined how new combinations of policy instruments shape transition by redirecting and accelerating technological change (Jordan and Huitema 2014; Hawlett and del Rio 2015; Kivimaa and Kern 2016; Rogge and Reichardt 2016). Combinations of policies are needed not only to support innovation in low-carbon energy sources and systems, but also for more comprehensive sustainability transitions (Kern et al. 2019). Achieving this will require broader policies for *green industrial* growth, including instruments aimed at promoting new 'green' business opportunities and constraining the support for existing polluting industries. This has been conceptualized as policy mixes targeting both ´niche support´ and ´creative destruction´ (Kivimaa and Kern 2016).

When energy and climate policies become more ambitious, societal opposition is likely to emerge, as with the 'yellow vest' protests in France. An emerging scholarship has started to examine the importance of energy justice and equity concerns in the context of *distributional challenges* in sustainability transitions (Szulecki 2018). Political decisions may affect fairness across the entire energy cycle—from extraction to final use (Healy and Barry 2017). Combinations of (other) policies are also needed for ensuring a socially fair transition. Economic and other support to, e.g. coal regions or poor energy consumers will be necessary to ensure that no one is 'left behind'. At least in democratic systems, the energy- and sustainability transition needed to break the emissions trend and meet the PA targets will fail unless there is sustained public support.

In a long-term perspective, successive policy mixes will be necessary, each bringing the major emitters closer to the 2050 target in line with the regular 'stock-taking' and increase in ambitions every five years under the Paris Agreement. The *policy feedback* literature provides a starting point for conceptualizing how policies are linked through various policy

Table 1 Policy mixes and transition functions

Polices and transition functions	Effect
Supply-push policies: Provide funding of low-carbon research and innovation, pilot, and demonstration projects	Develop new solutions and reduce costs of low-carbon technologies
Demand-pull policies: Provide incentives and lower the risk for investments	Promote deployment and market uptake of low-carbon technologies
Green industrial policies: Promote new business opportunities and constrain support for polluting activities	Create 'green' jobs, new niches and reduce emissions
Policies for distributional effects: Ensure energy justice—that no one is 'left behind'	Reduce opposition to climate policies and promote sustained public support
Policy implementation and reform: Promote positive policy feedback from domestic implementation experiences	Enable successively more ambitious climate policies towards 2050 and beyond
Recessions and economic recovery policies: Exploit external shocks to accelerate climate policies	Promote green growth in the economy as a whole

phases: adoption, implementation, and reform of policies. Since the 1980s, the study of policy feedback has focused on how existing policies affect politics and policy development (Béland 2010). Jordan and Matt (2014) define 'policy feedback' as effects flowing from adopted policies on actors' original preferences and the reformed policy in question. This insight has since been expanded to include feedback from policy mixes which may have wider effects—policy mixes affect not only their own development but also other instruments in the same issue-area (Edmondson et al. 2019).

Policy feedback may stem from both positive and negative domestic *implementation experiences* and learning (Skjærseth 2018). Implementation of policies for achieving the goals of the Paris Agreement can entail various benefits—like energy security, 'green' jobs, energy technological innovation and alleviation of related problems such as air pollution. For example, reduction of air pollution has been the single most important factor for reducing coal in electricity production in China's (Heggelund, this issue). However, the political, administrative, and economic costs and resources invested in implementation also shape implementation experiences. These may trigger negative policy feedback that undermines reformed policies and reduces the likelihood of meeting the PA target. One example here is energy-intensive industries like steel and aluminium that are based on production processes requiring non-substitutable fossil fuels that are exposed to international competition.

Most countries have adopted and implemented at least some climate policies incrementally. However, such incremental policy development will be insufficient for the radical changes needed to attain the Paris Agreement's ambitious targets. *External shocks*, like the corona/recession crisis, may affect policy development. Theories on the role of exogenous shocks build largely on the insight that established institutions and policies are inherently hard to change (Powell and DiMaggio 1991; Skocpol and Pierson 2002). Structural forces such as path dependency and its self-reinforcing mechanisms are expected to lead to stability (Pierson 2004). However, exogenous shocks, such as large economic recessions, may be powerful disrupters of such relative stability, providing moments of openness for rapid policy innovation—which may lead to major changes in status quo policies (Kingdon 2003; Capoccia 2015). In the end, the direction of change—whether COVID-19 pandemic and economic responses reinforce status quo, accelerate policies, or cause lower ambitions—is ultimately an empirical question (Table 1).

In summary, we have identified policy mixes and transition functions for directing low-carbon technological innovation towards breaking the current emissions trend. From a green growth perspective, 'effective' policies must be aligned to both 'push' and 'pull' low-carbon technologies in various stages. Policy mixes will also have to be combined in broader mixes or packages to stimulate new economic niches and restrict pollutive activities. Moreover, policy mixes must ensure a 'just transition', to prevent opposition and promote sustained public support—at least in democratically governed countries. Furthermore, domestic implementation of policy mixes must result in positive policy feedback as a foundation for stepping up and reforming climate policies, in line with the Paris Agreement. Finally, responses to crises and economic recessions, as with the COVID-19 pandemic, should accelerate climate policies for green growth in the economy, to break the current emissions trend.

We first offer detailed empirical studies of past, present, and future policy mixes in China, the EU and the US (Bang, Heggelund and Skjærseth). In the concluding article (Skjærseth et. al.), we compare the policy mixes in the three major emitters and examine the effect of the bottom–up design of the Paris Agreement—two important conditions for achieving the Paris Agreement's ambitious goals.

References

Åhman, M., Skjærseth, J. B., & Eikeland, P. O. (2018). Demonstrating climate mitigation technologies: An early assessment of the NER 300 programme. *Energy Policy, 117,* 100–107. https://doi.org/10.1016/j.enpol.2018.02.032.

Antal, M., & Van Den Bergh, J. (2016). Green growth and climate change: Conceptual and empirical considerations. *Climate Policy, 16*(2), 165–177.

Bang, G., Hovi, J., & Skodvin, T. (2016). The Paris agreement: short-term and long-term effectiveness. *Politics and Governance, 4*(3), 209–218.

Béland, D. (2010). Reconsidering policy feedback: How policies affect politics. *Administration and Society, 42*(5), 568–590.

Bloomberg. (2020). New Energy Outlook 2020. Report. https://about.bnef.com/new-energy-outlook/

Capoccia, G. (2015). Critical junctures and institutional change. In J. Mahoney & K. Thelen (Eds.), *Advances in comparative-historical analysis: Strategies for social inquiry* (pp. 147–179). Cambridge: Cambridge University Press.

DNV-GL. (2020). Energy transition outlook 2020. Report. https://eto.dnvgl.com/2020/index.html

Edmondson, D. L., Kern, F., & Rogge, K. S. (2019). The co-evolution of policy mixes and socio-technical systems: Towards a conceptual framework of policy mix feedback in sustainability transitions. *Research Policy*. https://doi.org/10.1016/j.respol.2018.03.010.

Eikeland, P. O., & Skjærseth, J. B. (2019). *The politics of low carbon innovation: The EU Strategic Energy Technology Plan*. Cham: PalgraveMacmillan.

Ge, M. and D. Friederich (2020) Four Charts Explain Greenhouse Gas Emissions by Countries and Sectors. World Resources Institute Blog. https://www.wri.org/blog/2020/02/greenhouse-gas-emissions-by-country-sector

Geels, F., Sovacol, B., Schwanen, T., & Sorrell, S. (2017). The socio-technical dynamics of low-carbon transitions. *Joule, 1*(3), 463–479.

Global Commission on the Economy and Climate (2014). *Better growth, better climate: the New Climate Economy Report.* http://newclimateeconomy.report/2014/misc/downloads/

Hart, D.M., (2017). *Across the 'second valley of death' Designing successful energy demonstration projects.* Report by the Information Technology and Innovation Foundation (ITIF)

Hawlett, M., & del Rio, P. (2015). The parameters of policy portfolios: Verticality and horizontality in design spaces and their consequences for policy mix formulation. *Environment and Planning C: Government and Policy, 33,* 1233–1245.

Healy, N., & Barry, J. (2017). Politicizing energy justice and energy system transitions: Fossil fuel divestment and a 'Just Transition.' *Energy Policy, 108,* 451–459.
Hickel, J., & Kallis, G. (2019). Is green growth possible? *New Political Economy, 25*(4), 469–486.
IPCC. (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Geneva: IPCC
Jordan, A., & Huitema, D. (2014). Innovations in climate policy: The politics of invention, diffusion and evaluation. *Environmental Politics, 23,* 715–374.
Jordan, A., & Matt, E. (2014). Designing policies that intentionally stick: Policy feedback in a changing climate. *Policy Sciences, 47,* 227–247.
Kern, F., Rogge, K. S., & Howlett, M. (2019). Policy mixes for sustainability transitions: New approaches and insights through bridging innovation and policy studies. *Research Policy, 48*(10), 103832.
Kingdon, J. W. (2003). *Agendas, alternatives, and public policies* (2nd ed.). New York: Longman.
Kivimaa, P., & Kern, F. (2016). Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions. *Research Policy, 45*(1), 205–217.
Nemet, G.F., Kraus, M. & Zipperer, V. (2016). *The valley of death, the technology pork barrel, and public support for large demonstration projects*. Discussion Paper no 1601, DIW Berlin, https://www.diw.de/documents/publikationen/73/diw_01.c.540709.de/dp1601.pdf
Organisation for Economic Cooperation and Development (OECD). 2011. Towards green growth. Paris: OECD. https://www.oecd.org/greengrowth/48012345.pdf
Pickering, J., McGee, J. S., Karlsson-Vinkhuyzen, S. I., & Wenta, J. (2019). Global climate governance between hard and soft law: Can the Paris agreement's 'Crème Brûlée' approach enhance ecological reflexivity? *Journal of Environmental Law, 31*(1), 1–28. https://doi.org/10.1093/jel/eqy018.
Pierson, P. (2004). *Politics in time: History, institutions and social analysis*. Princeton: Princeton University Press.
Powell, W. W., & DiMaggio, P. J. (Eds.). (1991). *The new institutionalism in organizational analysis*. Chicago: University of Chicago Press.
Rogge, K. S., & Hoffmann, V. H. (2010). The impact of the EU ETS on the sectoral innovation system for power generation technologies: Findings for Germany. *Energy Policy, 38*(12), 7639–7652.
Rogge, K. S., & Reichardt, K. (2016). Policy mixes for sustainability transitions: An extended concept and framework for analysis. *Research Policy, 45*(8), 1620–1635.
Skjærseth, J. B. (2018). Implementing EU climate and energy policies in Poland: Policy feedback and reform. *Environmental Politics, 27*(3), 487–518.
Skjærseth, J. B., Bang, G., & Schreuers, M. (2013). Explaining growing climate policy differences in the European Union and the United States. *Global Environmental Politics, 13*(4), 61–80.
Skocpol, T., & Pierson, P. (2002). Historical institutionalism in contemporary political science. In I. Katznelson & H. V. Milner (Eds.), *Political science: State of the discipline* (pp. 693–721). New York: W.W. Norton.
Szulecki, K. (2018). Conceptualizing energy democracy. *Environmental Politics, 27*(1), 21–41.
United Nations (2020). Sustainable Development Goals Knowledge Platform. https://sustainabledevelopment.un.org/?menu=1300
Victor, D.G. (2015): Why Paris Worked: A Different Approach to Climate Diplomacy. In Yale Environment 360 (15 December).
Victor, D.G., Geels, F.W. & Sharpe, S. (2019). *Accelerating the low carbon transition: The case for stronger, more targeted and coordinated international action.* London: Report for the Department of Business, Energy and Industrial Strategy.
World Bank. (2012). Inclusive green growth: The pathway to sustainable development. https://www.imf.org/external/np/seminars/eng/2012/rio/pdf/mf.pdf