10

Energy and Climate Change

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Abstract

This chapter summarizes a series of discussions at the 23rd Ernst Strüngmann Forum, which aimed at understanding how differences in framing environmental problems in the area of energy and climate change are driven by differences in normative and theoretical positions. Utilizing the diverse expertise of individual group members, twelve framings were identified that shape the energy and climate debate. These framings are used to explore how more inclusive engagement of these framings might contribute to more societally relevant and impactful research.

Background

Over a century ago, scientists provided evidence that the burning of coal in industrial countries causes CO_2 concentrations to increase in the atmosphere (e.g., Arrhenius 1896; Callendar 1938). Since then, through increasingly sophisticated scientific models, early evidence of human impact has been upheld with greater accuracy. Findings reported by the Intergovernmental Panel on Climate Change (IPCC) are unequivocal: between 1850 and the present there has been a rapid increase in atmospheric CO_2 concentrations, from 280–400 ppm, and this increase is due to human activity (IPCC 2014:3, 5). The principal impacts of human-induced change in atmospheric chemistry are (a) rising average surface temperatures and (b) global mean sea-level rise (IPCC 2014:9, 11). Scientists at NASA's Jet Propulsion Laboratory have concluded that the *minimum* atmospheric CO_2 concentration will remain above 400 ppm for the next several decades "unless something dramatic happens with humans and the

Group photos (top left to bottom right) Sun-Jin Yun, John Byrne, Lucy Baker, Patrick Bond, Peter Lund, Hans-Jochen Luhmann, Joan Martinez-Alier, Fuqiang Yang, Götz Kaufmann, Lucy Baker, Hans-Jochen Luhmann, Peter Lund, Götz Kaufmann, Sun-Jin Yun, Fuqiang Yang, Patrick Bond, Joan Martinez-Alier, John Byrne, Sun-Jin Yun, John Byrne, Lucy Baker

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planet" (Schmidt 2017). Climate change, as a result of human activity, is now accepted as fact by the scientific community, and its principal consequences—a warming of the planet due to rising concentrations of CO_2 and increased risks of coastal inundation due to sea-level rise—are likewise regarded as beyond scientific doubt. Only a dramatic shift in human use of energy to low- and no-carbon sources (IPCC 2014:28) will avert the worst effect of climate change that humans now face: irreversibility of the effects of climate change (IPCC 2014:16).

In light of human-induced change in atmospheric chemistry, the consequent increase in average surface temperature and global mean sea-level rise, and the recent concern that without a fundamental change in our reliance on carbon-intensive economic development we as a species face the threat of irreversibility, one must ask: Why did it take so long for climate change to become an issue of global importance?

One explanation is that climate change itself is the product of the modern energy–society relationship. The drive to increase capitalist industrial economies required an extraordinarily rapid use of energy, initially supported by a coal-mining regime and "urban exudation" (Mumford 1936/2010: 169). This created a carbon-intensive ideology of progress that went unquestioned for nearly a century, in part, because it contributed to a spectacular increase in economic growth (Maddison 2001:29):

> From 1000 to 1820 the upward movement in per capita income was a slow crawl—for the world as a whole the rise was about 50 per cent. Growth was largely "extensive" in character. Most of it went to accommodate a fourfold increase in population. Since 1820, world development has been much more dynamic, and more "intensive." Per capita income rose faster than population; by 1998 it was 8.5 times as high as in 1820; population rose 5.6-fold.

The wealth boom of the last 150 years, however, has been deeply unfair in its distribution. So much so that social inequality is at risk of becoming embedded in nature itself, as the resources and services of ecosystems are managed by economic and technological forces that largely serve the ambitions of a small percentage of the human population (Byrne et al. 2002; Bond 2012).

The positive belief in the link between fossil energy use and economic growth became so entrenched socially and politically that an observer of the period noted that seen through the lens of this ideology, "a clear sky" would be taken as evidence of a labor strike or lockout rather than an environmental goal to ensure human well-being (Mumford 1936/2010). The consequences of this ideology and its global impact are well known. For society to question the validity of pursuing this ideology, let alone address what might be necessary, seems only possible under the threat of a catastrophe.

Thus, the global energy and climate debate is about the looming catastrophe and the extraordinary social change needed to avert it. As seen in Figure 10.1, the projection of the world's energy future continues to rely on the presumption

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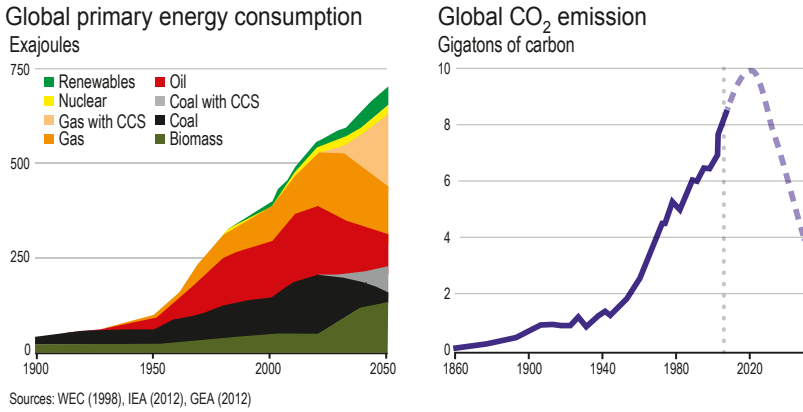

Figure 10.1 Global primary energy consumption and global CO_2 emission (GRID-Arendal 2015).

that our destiny is to be energy and carbon intensive. Only a spectacular shift in social commitment to the current development formula can bring about the needed reduction path in CO_2 emissions to challenge the prospect of irreversibility. Even so, the change discussed during 23 years of UNFCCC negotiations is modest compared to the change that science has forecast as necessary. In brief, humanity faces a crisis that derives from its economic success, the injustice that accompanies this success, and the need to change dramatically society's relation to living nature.

Framings

In our discussions, we identified twelve different framings. We searched at length for an appropriate language to characterize these framings and their political and/or analytical affinities. In some cases, the broad focus is on societal organization and operations (e.g., ecological modernization), whereas others champion specific strategies to address climate change and energy transformation. Several framings reflect long-standing conflicts over societal organization and operations (e.g., political economy vs. neoliberalism). In addition, some framings specifically inform the discourse on climate action and energy change (e.g., climate justice, energy sovereignty, and green economy).

We categorized the framings according to their political, economic, and/or analytical affinities and provide examples of key proponents. It is important to stress, however, that these framings are not inclusive: they are intended to provide an overview of normative and theoretical/conceptual positions that affect current discourse. Importantly, these framings do not agree on how society should characterize or address climate change problems or energy-related transformative responses. Continued conflicts in this area should be

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anticipated, and we view this conflict to be essential. We strongly recommend that the emerging conflict be treated as a means to expand understanding of the challenges society faces, as well as the alternative responses which might be possible: from social movements, to governmental or business sector actions/inactions, to international (dis)agreements. While we are not sanguine about the likelihood that such fundamental conflict will end soon, we believe the engagement in issues raised by the framings will lead to more socially relevant and impactful research.

Four of these framings focus on the market:

1. *Neoliberalism* espouses a policy philosophy that limits public actions to those that are consistent with market logic. Currently, fossil fuel markets still provide profitable opportunities, both in extraction and in the correction of negative environmental effects (e.g., carbon sequestration and geoengineering), and neoliberal policy prefers that markets decide the extent and terms of use for fossil fuels. Policies based on increasing carbon prices or emissions permits (European Union Emission Trading Scheme, EU ETS) or grassroots activities against "unburnable fuels" are treated as naive. Insofar as corporations and the interests of investment and finance drive politics, climate change policies will be implemented only to the extent that they guarantee capital accumulation.
2. *Ecological modernization* changes the energy mix with new technologies and economic instruments (e.g., carbon pricing, taxes, REDD, markets) in emissions permits. Actions are undertaken by governments or middle-level institutions, such as cities and regions. Here the emphasis is on technological change and economic instruments.
3. *Sustainable development* has its roots in the 1987 Brundtland Commission by the United Nations: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Report 1987). To meet these "needs" (in particular, the essential needs of the world's poor), economic alternatives to the current quantitative growth-driven economy should be prioritized. This perspective includes critiques of the neoliberal path of development, including the "steady-state economy" (Daly 1991), "limits to growth" (Meadows et al. 1972), and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.
4. *Green economy* aims to "put a price" on nature for the sake of maximum efficiency and rationality, for example, in carbon markets and other forms of emissions trading and virtual water sales that are increasingly packaged in exotic investment instruments. The economics of ecosystems and biodiversity (TEEB) within the UN Environment Program aims to "make nature's values visible" and thus "help decision

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makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms, and, where appropriate, capture those values in decision-making." The payment for ecosystem services (PES) approach is being pursued vigorously in many terrains, for example, natural capital accounting.

Three framings are analytically oriented:

1. *Sociotechnical systems analysis:* This perspective guides the discourse of climate change from unilateral "single-source, single-country" thinking into a much broader "global, no-boundaries" frame. This provides an important objective, evidence-based input to discussions with stronger elements in climate justice, and to some extent also on sustainability.
2. *Cost-benefit analysis*: Regardless of whether framings recommend action or inaction, they share a common methodology of valuation in money units to compare present and future costs and benefits or losses. The results depend on arbitrary discount rates chosen. Despite its simplicity, it has been a successful frame for the political discussions because of the social prominence of economics in politics. It is a state-driven approach.
3. *Common-pool resource management*: Climate change is an issue that can be approached in terms of the theory of common-pool resources. Access to the atmosphere and the oceans as sinks exhibits rivalry and non-excludability: there is rivalry, but so far no mechanism for excludability. Effective instruments for management of the commons (Ostrom 1991) must be established in the next conference of the parties, or elsewhere.

Five framings address aspects of the postmarket economy:

1. *Political economy*: This perspective sees energy as embedded within broader social, economic, and political forces and processes, and asserts that, if a just transition is to be achieved and inequality of access *between* and *within* countries and generations are to be addressed, a reconfiguration of infrastructures, institutions, technology and ownership; and modes of production and consumption are needed.
2. *Political ecology*: Regardless of whether they recommend action or inaction, political ecology framings share a common methodology of valuation that compares present and future costs and benefits (or losses) in ecological terms. The results depend on discount rates which political ecologists often see as arbitrarily chosen. This framing has been used by adherents to criticize the social prominence of economics in politics.
3. *Ecosocialism*: Proponents of this perspective respect the merits of valuing nature (though not counting it for the sake of marketization), at the

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same time confirming the role of anti-market social movements, including those of indigenous people and ecofeminists, in nature's stewardship. It is a state-driven approach.

4. *Climate justice*: Draws on "critical ecology movements" which invoke environmental justice, demand stronger laws and enforcement, and engage in campaigns against corporations and states which exploit the environment. This approach regards one of its purposes as supporting "strong sustainability." A common feature of this approach is to distinguish livelihood emissions and luxury emissions, to discuss who should reduce emissions, and how to represent liability for past excessive emissions, that is, the idea of ecological debt (see Agarwal and Narain 1991).
5. *Energy sovereignty*: This is a recent framing, inspired partly by new technological opportunities, such as distributed electricity generation, as well as by approaches which include environmental justice and concerns over the protection of diversity. Energy sovereignty is similar to concepts of "food sovereignty" in promoting the ability of small regions to determine their own plans for energy use and production, the elimination of "energy poverty," and the reduction of greenhouse gas emissions. Similar to the hope for a municipal "hydroelectric socialism" around 1900 (small dams of municipal property), publicly or privately owned energy sources would be made locally available according to needs and taken out of the sphere of capital accumulation.

Table 10.1 captures the key ideas, values, and concerns that emerged from our examination of these framings.

New Methods

What type of methods might best help researchers and communities assess the challenges of energy (and more broadly, social) transformation in the face of a rapidly warming world? Are new analytical methods required, or will current ones suffice? From our discussions, four methods emerged as potential candidates to improve understanding of the challenges we face, as well as to promote dialogue among proponents of the different framings.

Justice-Based Transformation Pathways

The IPCC has rightly earned praise for its efforts to synthesize available research and evidence in climate change. Through each of its five assessments and several special reports, the IPCC has provided the human community with an evidence-based understanding of the phenomenon and the risks that all forms of life face.

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Table 10.1 Response of framings to the core issues of sustainability, justice, and diversity.

Framings	Sustainability	Justice	Diversity
Market-focused framings			
Neoliberalism	Sustainability of capitalism (accumulation of capital); sustainability of growth and new investment opportunity	Promotes cornucopian approaches—expands wealth and corrects environmental problems with the new wealth	Depletion or expansion of biodiversity depending on efficient management
Ecological modernization	Regulation of the economic system to maintain serviceable ecosystems	Pursues win-win situations of improved economy and environment	Adopts Environmental Kuznets curve thinking (internalizing externalities)
Sustainable development	Economic sustainability/weak sustainability	How to balance the present and the future by using cost-benefit analysis	Concerned with human diversity, both intra- and intergenerational needs
Green economy	More concern about economic sustainability than sustainable development	Weaker concern on justice than sustainable development	Concerned with economic profit and values bio- or other forms of diversity only when they are profitable
Analysis-focused framings			
Sociotechnical systems analysis	Analytical, nonterritorial approach to environmental sustainability	Context-based assessment of intra- and intergenerational equity	Methodologically possible to include diversity linked to production and value chains
Cost-benefit analysis	Interested in instrumental sustainability	Discounts future values to prioritize the "needs of the present"	Interested in pricing diversity
Common-pool resource management	Effective instruments for management of the commons	Adopts cooperation principle within communities to manage access on behalf of all members equitably	Biological diversity (diversified ways of protecting diversity through place-based management)

Table 10.1 (continued)

Framings	Sustainability	Justice	Diversity
Postmarket economy framings			
Political economy	Challenges the sustainability of the orthodox economic growth model	Concerned with the distribution of, access to, and ownership of resources and technology	Challenges nature's commodification; in this way, it assists efforts to protect biodiversity and livelihoods
Political ecology	Concerned with political, economic, environmental, and social relations	Objection to inequitable enclosure of atmospheric commons and unequal distribution of the costs of environmental change	Emphasizes the need to understand peoples' relationship to their environment
Ecosocialism	Collective ownership of the means of production, use of democratic planning that makes it possible to pursue ecological rationality	Democratic control, social equality, and the predominance of human need over profit making	Ecosystem planning at the large national scale
Climate justice	Emission constraint within carrying capacity, concerned about sustainable consumption	Distributed justice; luxurious emission vs. livelihood emission; ecological debt	Concerned with cultural and livelihoods diversity
Energy sovereignty	Community-based sustainability (local energy)	Self-governance principle; the right of individuals, communities, and peoples to make their own decisions on energy generation, distribution, and consumption	Can support relevant diversity efforts based on local energy sources appropriate to their ecological, social, economic and cultural circumstances

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To construct the much-needed assessments of justice-based pathways that will lead to a change in course, it is vital that IPCC's network of researchers be connected to the world's most vulnerable communities. Admittedly, this would take the IPCC beyond its mission of creating synthetic knowledge. However, these assessments are urgently needed now, and they must be based on the best available information. Although the IPCC, as an organization, has achieved a certain level of interdisciplinary knowledge, an even more robust commitment to interdisciplinarity is needed. Linking research institutions (such as the IPCC and others) with community networks that are at greatest risk is necessary if we are to address the challenge of climate change and energy transformation.

Climate Life-Cycle Analysis

In most legal frameworks for carbon emission reduction, penalization of carbon emissions is addressed solely from a production-based viewpoint. For example, the EU ETS is based on point-emissions of facilities whereas the United Nations Framework Convention on Climate Change (UNFCCC) Paris climate agreement relates to nations as carbon sources.

Systems that account for production-based emissions do not address the embedded emissions in products. They overlook the role of consumption in emissions (including the roles of value and production chains) and neglect key issues such as carbon leakage.

By focusing solely on singular, time- and space-constrained carbon source—without understanding that all products carry a CO_2 (or a greenhouse gas) history with them—key international agreements on climate and national mitigation measures may lose effectiveness and turn out to be costly exercises. In addition, sustainability and justice may also be jeopardized. For example, cheap goods produced in China, which Western consumers require and enjoy, cause high emissions locally and are accounted for solely in the national inventory. Alternatively, if a country adds unilaterally a carbon tax to its otherwise resource-effective production to reduce greenhouse gas emissions, this might transfer that industry to a third country which does not have any CO_2 restrictions and end up causing much higher overall emissions.

Thus, it is important to pay acute attention to the emissions of a product or service over the whole life cycle ("from cradle to grave"); this could be realized through a spatiotemporal type of life-cycle analysis (LCA), termed here as the climate LCA. From the climate policy side, this would mean putting more emphasis on consumption rather than production. We recognize that introducing this as a new basis for climate agreements may be complicated and involve methodological hurdles. However, in terms of justice, sustainability, and diversity, it could fill a major gap. For future science, this could be highly motivating.

We recognize that the idea of accounting for embedded emissions over value chains is not a new idea. Already in the late 1970s, in the aftermath

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of the oil crises, net energy analyses (e.g., based on Leontief's input–output model) were proposed to guide energy investments. In the late 1980s, research incorporated embedded CO_2 (Lund 1989) and later environmental analysis and LCA were introduced. Peters (2008) elaborated models for a consumption-based carbon inventory.

There are multiple challenges associated with a climate LCA system. For example, there are particular demands on quality of knowledge (e.g., data across nations and territories), politics (e.g., transparency), and monitoring, in which different areas of science need to be strongly engaged. This research could also bring about new knowledge with serious political implications. For this reason, such research needs to address both the theoretical framework as well as strong sociopolitical-economic linkages, for example, with issues related to climate justice and sustainability. Such research requires collaboration with other disciplines. We also see here an analogy to strategic environmental assessments, where science may provide important knowledge to local or regional communities and groupings on impacts such as diversity that may affect their habitat and living conditions (e.g., large-scale hydropower schemes).

In summary, climate LCA offers the potential to open up new avenues in global mechanisms on climate change mitigation and local energy solutions, or at least better and more objectively understand how the carbon emissions originate and how the value and production chains affect emissions. This could guide the discourse of climate change away from a unilateral "single-source, single-country" thought process to a much broader "global, no-boundaries" frame. It remains to be seen how this will affect the creation of new global mechanisms (e.g., a global CO_2 tax, equity-based burden distributions), but it would certainly provide objective evidence-based input to that discussion, with strong elements in climate justice and, to some extent, sustainability.

China Coal Cap Initiative

The coal cap initiative in China provides an example of an ongoing LCA. China plays a key role in climate change mitigation as it is the world's largest energy consumer and carbon emitter. China's energy production is heavily based on coal, which in 2015 accounted for 64% of its electricity. Nearly 30% of global energy-related CO_2 emissions emanate from China. The strong economic growth from which the global economy has benefited has driven up China's emissions. A considerable share of China's emissions originates from products intended for exports to Western economies, but the national carbon inventories do not recognize carbon export. Moving from a production- to consumption-based carbon accounting, putting more emphasis on carbon intensity in production and restricting carbon leakage could change this.

Meanwhile, China has intensified its efforts to reduce CO_2 emissions, in particular by decreasing the use of coal. A three-year effort, the "China Coal Cap Project," was launched in 2013 to provide government authorities with

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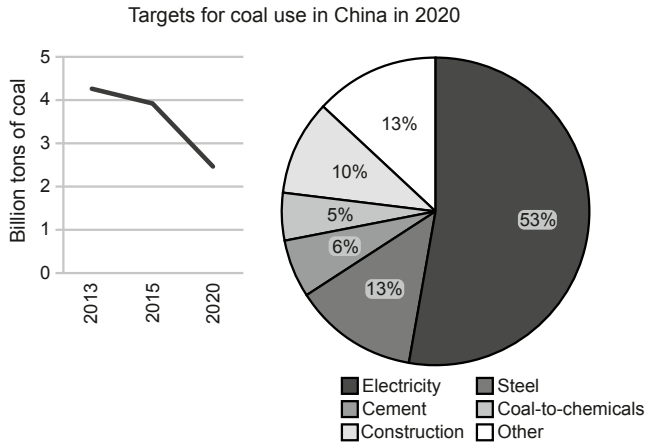

Figure 10.2 Progress and prospects for coal use by sector in China by 2020, provided by the National Defense Research Council of China.

recommendations on policies and their implementation. The first phase (2014) included detailed background analysis on health, climate, environmental, and other impacts vis-à-vis coal use, but it also proposed a coal cap to reduce the share of coal in energy from 64% to 17% by 2050. In the second phase (2015), a coal cap strategy was submitted to the 13th Five-Year Plan 2016–2020: the cap was broken down to regional, provincial, and municipal levels as well as to major coal-using industries. The third phase (2016) focuses on preparing a coal cap action and monitoring plan while laying the foundations for a long-term energy transition and development strategy. Pilot projects in three provinces will be launched to promote implementation of coal caps in practice, in particular in coal-intensive industries. In addition, extensive analysis of impacts and policy effectiveness is planned as well as spreading best practices to accelerate reduction of coal use.

Through these efforts, coal use has dropped by 7% in two years. The goal for 2020 is a 20% reduction from the peak in 2013 (Figure 10.2). The coal cap initiative advocates for China's leadership in global green governance, but it also presents a great opportunity for international cooperation. China is now in the position to be able to develop its green leadership to protect the environment and cope with climate change. China may also take the lead in achieving the 2030 UN Agenda for Sustainable Development.

Critical Policy Analysis

Critical policy analysis has emerged to oppose what Sachs (2002:33) characterized as "conventional development thinking"; namely, the assumption that the market economy should decide the direction and value of development.

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Table 10.2 Tasks needed to conduct critical environmental justice research (Dryzek 2008; see also Kaufmann 2013).

Tasks	Methodology
Criticism of technocratic and accommodative analysis	Reveal assumptions behind technocratic description Clarify the particular frame Don't be a consultant! Reveal the tunnel vision of research
Explication of dominant and suppressed meanings	Differentiate your research from dominant discourse Contribute to redefinition of environmental justice Collect and provide the relevant data Reflect the spatial scale you are choosing
Identification of agents of impairment	Name relevant stakeholders See stakeholders' polyrationality Identify people's tacit beliefs
Identification of communicative capacities and standards	Identify factors of communicative capacity Identify communicative standards

This is tantamount to accepting a universal ideal of development "irrespective of the fact that [the] world is already dehumanized and dehumanizing" (Irigaray 2003:167) and embracing the view that "equity is a problem of the poor." Instead, critical policy analysis adopts the view that "justice is about changing the rich and not about changing the poor" (Sachs 2002:33).

Methodologically, critical policy analysis contests the assumptions and moral standards of existing power elites, which the social system (Luhmann 1995) of (social and natural) sciences does not examine. This also entails consideration of "climate change" as a discourse–regime (Foucault 1981; Costa 2011) dichotomy, as it has already been characterized (Vlassopoulos 2012). Dryzek (2008:200) offers guidance to researchers on how this method can be applied to pursue environmental justice research that avoids the pitfalls of conventional policy analysis. Table 10.2 addresses the tasks identified by Dryzek (2008).

Action Research

Action research is a method that combines "knowledge" from both academics and activists. To see the potential for issues related to climate change, consider the following examples.

Local communities are directly impacted by decisions to extract fossil fuels in terms of when and/or where to leave them in the ground as well as associated political opportunities. Utilizing their own criteria, local communities could benefit from the use of formalized multiple criteria methods. Similarly, as communities and lay persons become generally aware of climate change, they might react to locally perceived impacts (e.g., sea-level rise, retreating

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glaciers, and changes in vegetation). A concerted effort to build an action–research network would allow researchers to learn about the local impacts that are of greatest concern to these communities. This would support a synthetic learning process between science and society.

From a technical perspective, it can be argued that coal (particularly brown coal) should be the main focus of reduction because it produces more CO_2 per unit of energy than oil or natural gas. An action–research perspective could, however, show that while there are indeed grassroots actions to "leave the coal in the hole" (e.g., Fuleni in South Africa, Sompeta in Andhra Pradesh in India, Laubnitz in Germany), actions elsewhere oppose natural gas fracking or favor "leaving oil in the soil." Rigorous accounting of avoided carbon emissions, discussions of "leakage," and so forth by academics would be inspired through, and accompany, such actions.

Policy and Strategy Discussions in the Discourse: Highlighted Tensions

In our deliberations, we discussed the typical management interventions suggested by several framings to address the challenge of climate change and the need for energy transformation, and considered policies that go beyond management intervention. Here we offer a synopsis of that debate to highlight tensions in the policy component of the energy and climate change discourse. Again, the framings identified above inform our effort to understand key tensions surrounding policy. We did not attempt to discuss the full range of policy proposals and practices, as this is beyond the scope of this report.

Carbon Pricing

Significant political and analytical effort has been expended, in different ways, to price carbon. International initiatives (e.g., the Kyoto Protocol) and national policies (e.g., China's recent creation of markets to facilitate in-country carbon trading) typify attempts to use this policy tool.

In either of its two main forms—carbon trading and carbon taxation—carbon pricing establishes a right to pollute through the purchase of emission commodities in a market. Well-documented problems of fraud have been associated with European and U.S. carbon markets. The approach is criticized for being distributionally regressive, allowing the rich, for example, to maintain energy-intensive lifestyles while shifting the burden of social change to poorer countries.

This policy tool can lock in existing power relationships by encouraging change at the margins. Taxation simply raises the cost of the next unit of output rather than entailing the full-fledged restructuring that many industries require.

Generally, carbon pricing has not raised the cost of pollution sufficiently to provide an incentive for wealthy societies to decarbonize. The size of the

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world's carbon market peaked in 2008 at $140 billion, and by 2014 had dipped to $50 billion. Several analyses suggest that prices above $150–500 per ton are needed to instigate the dramatic change inherent in the science forecasts that we must achieve (Ackerman and Stanton 2012). In 2006, the European Union price peaked at $35/ton and the current price has fallen to about $6/ton; in California it hovered around $12/ton, Korea around $9/ton, and China at $3–7/ton, depending on the city.

Some now propose to redesign the tool of carbon pricing as a "cap and dividend" scheme (i.e., carbon tax plus redistribution). To date, however, this approach has attracted only modest interest.

Notwithstanding lackluster performance (this is putting it mildly), proponents of the following framings continue to champion the use of carbon pricing: neoliberalism, sustainable development, green economics, and ecological modernization. This underscores a real tension in the case of climate policy: despite a record that fails tests of sustainability, justice, and diversity, carbon pricing is still accorded a powerful role in discussions about societal action. This tension can be traced to deeper concerns of the viability of the market economy in a warming world.

Nonmarket Policy Strategy

In the Paris Agreement of December 2015 (UNFCCC 2016), Article 6 calls for the adoption of "cooperative mechanisms." It reflects the widespread critique of market mechanisms pursued under the Kyoto Protocol. The Article specifically adopts a mandate of "nonmarket cooperative mechanisms" (Paris Agreement Art. 6.8–6.9), but lacking full definition, it remains up to the Parties to elaborate proposals for defining the mechanism, allowing cooperation without revealing market features. Scientists should have a major role in elaborating such proposals.

We do not assume that Article 6 will lead to transformative change underscoring as it does the support for market-based mechanisms and, in this regard, may reflect increasing pressure on framings which are market-focused. The conflicts in framings focused on the market and/or the postmarket economy in the energy and climate change sphere, illustrate the creative value of framing conflict to rethink environmentalism.

Municipal and Citizen-Led Policy

Recently, citizen movements and local governments have played significant roles in recasting the energy and climate change debate. The emergence of activities at this scale can serve as a catalyst for change and a source of some of the most aggressive inventive strategies emanating from it. One representative example is Seoul.

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Seoul's civil movements and metropolitan government have worked together to reduce grid electricity use rapidly via a campaign called "One Less Nuclear Power Plant (OLNPP)." Initiated in April 2012, OLNPP's initial goal was to "retire" one Korean nuclear reactor by December 2014 through city-wide conservation and local renewable energy supply strategy that would cut grid consumption. By June 2014, Seoul had met its goal, lowering the country's need for nuclear generation by 6%. In August 2014, OLNPP launched its next initiative to "retire" a second reactor—a step that directly challenged the national government's nuclear expansion policy. Despite several efforts by the national government to interfere in the campaign and a negative media coverage (which falsely accused OLNPP of threatening an economic slowdown and eventually higher electricity prices), civil support remains high.

The actions in Seoul led to four provincial governors signing a "Joint Declaration for Local Energy Transition" in November 2015. Together, these governors and the municipal government of Seoul represent 49.2% of the country's population.

Some argue that nuclear power is a so-called "clean energy" option. The movement launched in Seoul, however, regards nuclear power as a key driver for Korea increasing the energy intensity of its economy and pursuing unchecked economic growth. These features undermine decarbonization by promoting production and consumption of goods from materials that are carbon-based (e.g., steel, cements, plastics) and interrupting carbon stores that are provided by forests, prairies, and undeveloped land and replacing them with buildings, streets, and so forth. For this reason, the campaign measures its progress in tons of oil equivalent.[1] Moreover, the politics of nuclear power are seen as antidemocratic, fostering the consolidation of energy policy making at the national level by technocratic, corporate, and military elites, ignoring the desires of communities and local governments. Finally, the primary motive of the OLNPP campaign is to reduce energy use in any form, singling out nuclear power for its current dominance in the national energy mix and politics, but aiming to shift society and the economy away from "more is better" to "enough is enough."

The recently launched Solar City Seoul initiative[2] clarifies the political and social underpinnings of OLNPP. The city has adopted a 1 GWp solar power target for installation by 2022 on building rooftops. A part of the project (currently the largest urban solar initiative in the world) is dedicated to reducing electricity bills for low- and moderate-income families. Moreover, the mayor has cited the initiative as a means to end the use of coal-powered electrical generation that is associated with city pollution problems. This distributed solar

1 To obtain the One Less Nuclear Power Plant report, see http://energy.seoul.go.kr/en/olnpp.jsp#none as well as the Seoul Metropolitan Government website: http://english.seoul.go.kr/policy-information/policy-focus-2017/one-less-nuclear-power-plant/

2 See http://english.hani.co.kr/arti/english_edition/e_national/820207.html (accessed Feb. 7, 2018).

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power plant reflects the principles of sustainability, democracy, and justice guiding Seoul's civil society-led OLNPP program.

New Policies for "Unburnable Fossil-Fuel Reserves"

To explore new policies with respect to "unburnable fuels," reserves were calculated using the IPCC's Fifth Assessment Report database (Jakob and Hilaire 2015). The amount of carbon embodied in fossil fuels yet to be released (and consequently still to be burnt) was found to be 1000 Gt of CO_2 under the conditions that (a) the 2°C target will be met by humankind and (b) other emitting sectors (e.g., forests, agriculture) will keep to the predefined limits delineated in the IPCC Fifth Assessment Report (IPCC 2014). "Unburnable fossil-fuel reserves" is the complement to this; their exact volume is not known but is projected to be about ten times what is still allowed to be burned. Where it occurs, which national states are stakeholders of these resources, and to what extent is not exactly known (McGlade and Ekins 2015). The breakdown by fuel type (i.e., coal, oil, and natural gas, which have quite different carbon content) has only been roughly established.

Who are the actors of social and technical changes in the field of energy and climate change? The typical policy discussions and analysis leave aside movements for climate and environmental justice. These movements have provided the impetus for a "Blockadia" strategy of leaving fossil fuels in the ground. This strategy, however, could prove to be the most important effort to date to act on climate change by transformative energy action.

The UNFCCC and the Paris Agreement

There are contrasting evaluations of the achievements made by the UNFCCC. The Paris Agreement is no exception. Some celebrate the Paris Agreement because it is viewed as having established a landscape in which nation-states, subnational actors, and transnational networks will be able to reconfigure existing linkages between sustainability, diversity, and justice, and, perhaps, improve upon them. In turn, this could open up opportunities for "bottom-up" movements to claim a larger segment of the decision-making and design processes involved in climate change policy. Many, however, criticize its nonbinding approach to nationally determined contributions in the volunteer emission reduction target without clear consideration of ecological debts of the North. Still others regard the Paris Agreement as "a fraud or a fake, unless greenhouse gas emissions are taxed across the board" (Hansen 2015).

Binding targets, absent from the Paris Agreement, are preferred by the postmarket economy framings and in many instances by the analysis-focused framings. Market-focused framings in the energy and climate space support what others see as a notable failure. This testifies to the continued power of

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market thinking, but it also underscores the increasing isolation of these framings politically and analytically. Again, we wish to stress that framing conflict should be seen as instigating inventive rethinking of environmentalism.

One concrete example is the rising importance of civil movements. In spite of many problems acknowledged by even its supporters, the Paris Agreement is being used by civil movements to demand that national governments respond to climate change by transforming economic structures. When governments are reluctant to act, civil society demands action based on international agreements. When industries are reluctant to act, governments as well as civil society can demand action: they can work together to assert energy sovereignty and self-designed climate policies. A recent assessment of the Paris Agreement by several civil society organizations suggests that it can be used to mobilize political challenge to governments and industries that fail to meet the objectives of a just and sustainable response to climate change (Climate Equity Reference Project 2015).

Civil society has been the main source of criticism of the Paris Agreement for its lack of commitment to environmental justice. As we have noted, this critique is fast becoming the dominant source of challenge to inaction on energy and climate problems. A key example in this regard is the focus on the international system's exclusion of indigenous groups from the negotiations generally, and specifically the lack of reimbursement negotiations about the already existing damage caused by the former colonial powers. The international apparatus built to address the problem of climate change is far from answering this criticism.

The U.S. secession from the Paris Agreement in June 2017 must be viewed as a major setback for the UNFCCC. The departure of the largest per capita emitter of greenhouse gases from the Agreement underscores again the environmental justice failings of the process and structure. In addition, it contests the efficacy of the international approach. However, internationally and in the United States, actions by the private, public, and nongovernmental sectors to curb emissions are growing and can be attributed to the commitment by civil society to demand action. The strong rebuke of the U.S. decision by European, Asian, African, and Latin American government leaders as well as by corporate leaders may indicate that the obligation to act now is being felt in these quarters.

The search continues to realize a thorough rethinking of environmentalism to address the problem of energy and climate. Hopefully the framings presented and applied here will assist efforts to find a suitable environmentalism that can meet our urgent challenge.

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