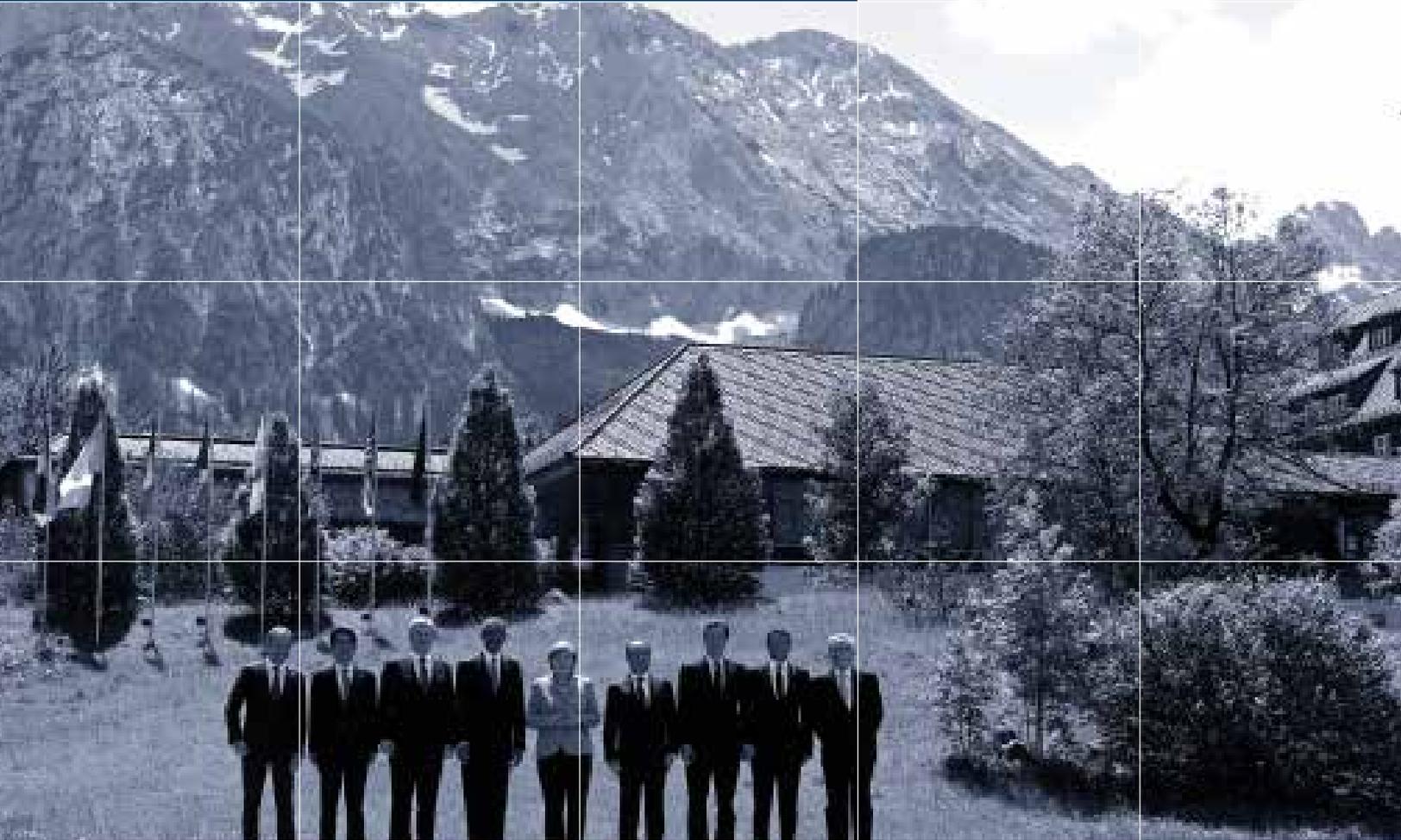




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THE G7 CLIMATE MANDATE AND THE TRAGEDY OF HORIZONS

David Livingston

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Carnegie Endowment for International Peace
Publications Department
1779 Massachusetts Avenue, NW
Washington, DC 20036
P: +1 202 483 7600
F: +1 202 483 1840
CarnegieEndowment.org

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About the Author

David Livingston is an associate in Carnegie’s Energy and Climate Program, where his research focuses on innovation, markets, and risk. Prior to joining Carnegie, David gained experience at the World Trade Organization in Geneva and at the United Nations Industrial Development Organization in Vienna. He has consulted for a number of organizations on projects relating to climate change, green growth, and stranded assets.

Livingston is also an adjunct lecturer at the University of Southern California, teaching a course on energy markets and policy at the university’s Washington, DC, center. He was selected as a Future Energy Leader for the 2014–2017 term of the World Energy Council and currently serves on the council’s Task Force on Rules of Trade & Investment.

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Summary

The 2015 G7 summit concluded by issuing the first public endorsement by a group of great powers of an accelerated effort to fully decarbonize the global economy. This is a significant achievement. However, the announcement's credibility and durability will depend upon its institutionalization via shorter-term initiatives and benchmarks that shape the future of energy and investment choices in the years ahead.

Leverage—With Limits—in Shaping the Global Agenda

- The G7 declaration's immediate impacts are limited. In terms of economic heft, population, and global greenhouse gas emissions, the relative weight of the group of states is declining. By contrast, the G20, which includes China and India, is growing in economic and political weight.
- The declaration provides a long-term target with which short- and medium-term policies must eventually reconcile, and it requires G7 members to consider timelines beyond the outcomes of the 2015 Paris climate conference.
- Leaders see the declaration's greatest contribution as catalyzing public and private capital for the green transition and pioneering innovative policies.
- To effectively shape the global agenda, the G7 should create meaningful linkages to processes under way in the G20 and via the 2015 Paris climate agreement.

How the G7 Can Enhance the Credibility of Its Announcement

Create a decarbonization task force. A network of experts drawn from each G7 member should coordinate on a regular basis and meet at least annually to support future G7 summits. Early work would focus on coordinating baselines, metrics, and interim targets, while later efforts could involve the harmonization of complex policies such as carbon markets.

Rethink electricity market design. Energy markets are designed around an old paradigm of large, centralized supplies dominated by fossil fuels. They must be redesigned to manage a more distributed and intermittent energy supply with high capital costs and low marginal costs.

Bring the global investment architecture into line with decarbonization imperatives. A complete decarbonization of the global economy will require

massive investments over the rest of this century. G7 members should engage with the private sector and financial governance institutions to send short-term market signals via a carbon price and long-term signals to redefine notions of fiduciary duty and climate-related risks.

Strengthen and streamline transportation and petroleum regulations.

New data and market developments are providing opportunities to reduce the carbon intensity of the value chains of traditional petroleum transport fuels and to better incentivize innovative alternative fuels. The G7 should seize these opportunities by modernizing and expanding its own approach to focus on more than just motor vehicles.

Introduction

In the lead-up to the November–December 2015 Paris climate conference (COP21), a number of countries, private sector actors, and international organizations made a litany of public declarations. These announcements were meant to raise ambitions toward a robust, comprehensive, and accountable agreement that will bend the world’s greenhouse gas (GHG) emissions trajectory in a way that minimizes the risk of more than 2 degrees Celsius of global mean temperature rise and severe concomitant damages.

No declaration has been so eye-catching as that of the G7, an informal bloc consisting of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.² The G7, at the June 2015 summit hosted by Germany at Schloss Elmau in Bavaria, called for “a decarbonisation of the global economy over the course of this century,” along with a commitment to “develop long term national low-carbon strategies” and to strive “for a transformation of the energy sectors by 2050.”³

The outcome was a testament to the political capital spent by German Chancellor Angela Merkel and her government in pushing for an explicit climate commitment, seeing in Germany’s own ambitious energy transition a reservoir of soft power and leadership by example that would be further magnified by an ambitious G7 stance on climate change. Though the end-of-century target is a compromise from Germany’s original ambition to see global zero net emissions (or decarbonization) by 2050, it was still the first time that such a group of great powers had agreed upon such a definitive goal. It was later implicitly corroborated in the COP21 agreement’s choice of 1.5 degrees Celsius as a new aspirational target for limiting the increase in global temperature that has taken place after the industrial revolution.

Nevertheless, the path between 2015 and 2100 is rife with uncertainty. Is this the beginning of the end of fossil fuels, or is it just noise on the periphery of business as usual? Will the declaration—Chancellor Merkel’s personal political project—see other G7 powers pursue incremental measures toward its consummation, or will it be orphaned at future summits, implicitly dismissed as appealing in principle but Sisyphean in practice? While the G7 has taken a historic step toward reconciling the gap between climate change risks and the political vision needed to address them, it is substantive policy follow-up in the years

Is the G7 declaration the beginning of the end of fossil fuels, or is it just noise on the periphery of business as usual?

ahead, both individually and collectively among G7 nations, that will determine the declaration's ultimate value to present and future generations.

The Tragedy of Horizons

In September 2015, Mark Carney, the governor of the Bank of England, delivered an address from the iconic, endoskeletal Lloyd's of London building that called for "breaking the tragedy of the horizon."⁴ The idea points to the asymmetry between society's knowledge of future catastrophic climate change on the one hand, and, on the other, society's inability to put in place incentives today that are needed to address it. Simply put, most important institutions—public and private—are poorly suited to tackle complex, global, and intertemporal challenges such as those posed by the accumulation of heat-trapping gases in the atmosphere.

Leaders across many sectors are often forced to focus on trends that are both conspicuous and imminent. For central bankers, this means a monetary policy horizon that extends for only two to three years, and a financial stability mandate in line with the credit cycle, which is ten years at most.⁵ For elected officials, decisionmaking is often dominated by short-term electoral cycles, from two to five years. For the private sector, this translates to business cycles of a little less than six years of average duration, and infrastructure capital cycles that range from twenty to fifty years.⁶

The challenge of climate change, meanwhile, is generational. Because carbon dioxide has an atmospheric lifetime of multiple centuries, plus 25 percent that lasts effectively indefinitely, it is a problem of stocks, not flows.⁷ What matters is a recognition that the cumulative amount of carbon dioxide emitted into the atmosphere, in addition to the amount being added by today's decisions, will determine the severity of climate change impacts that will be felt over the coming century.

Surely, no one would suggest that the technologies, policies, and political will exist today to completely remove the combustion of fossil fuels and other GHG-emitting activities from the global economy overnight. But what is needed is a mechanism, a plan, or, at the very least, a credible signal from the political leaders of today that such a path to full decarbonization is necessary and enforceable in the tomorrows to come. It would serve, in other words, to expand the various political, business, and policy horizons toward greater symmetry with the horizon of the world's shared climate challenge.

Can the G7 Make a Difference?

German Chancellor Merkel entered the G7 summit with climate change at the top of her priority list, hoping to secure from the other powers an agreement to decarbonize the economy by as soon as 2050. After experiencing pushback

from Japan and Canada, each due to its own idiosyncratic carbon abatement conundrums, the United States reportedly worked with Germany to help to deliver the 2100 horizon as part of a compromise agreement, along with an announcement of support for “sharing with all parties to the UNFCCC [United Nations Framework Convention on Climate Change] the upper end of the latest IPCC [Intergovernmental Panel on Climate Change] recommendation of 40 to 70 percent reductions by 2050 compared to 2010,” in the words of the G7 declaration.⁸ On the morning of June 8, a photo of the G7 leaders, standing in a meadow against the backdrop of the Bavarian Alps, appeared on the front page of many newspapers with the end-of-century goal filling the headline above. Since that summer day, however, there has been very little coverage or follow-up, calling into question whether such a distant goal will—or even can—affect the present.

The G7 in Context

The G7 is not what it once was. In 1980, G7 countries accounted for around 14 percent of global population and 61 percent of global gross domestic product (GDP).⁹ Today, G7 countries are home to just over 10 percent of global population and are responsible for less than half (46 percent) of global GDP. When GDP is adjusted for purchasing power parity, the number falls further to around 32 percent.¹⁰ This stands in stark contrast with the increasingly important G20, which includes countries such as India and China and today accounts for two-thirds of the world’s population, 85 percent of global GDP, and 75 percent of global trade.¹¹

The same pattern holds for the bloc’s waning role as a dominant emitter. The G7 in the early part of the twentieth century accounted for around 70 percent of the world’s annual greenhouse gas emissions, and even as late as 1995 still contributed more than half of GHG emissions globally. After this year, the scales began to tip, with non-G7 emitters accounting for the majority of annual contributions to climate change.

In 2012, the most recent year for which comprehensive data are available, the G7 powers accounted for approximately 24 percent of global emissions (not including the conversion of forests into agricultural land). In 2005, when the Kyoto Protocol entered into force, this figure was around 31 percent; when the protocol was first adopted in 1997, that figure was yet higher at 35 percent.¹² Although the G7’s absolute emissions have declined only very slightly over the past two decades since Kyoto was drafted, its relative share has diminished substantially with the vast emissions increases of China, which by the early 2010s was already emitting more than all the G7 countries combined.¹³

By mid-October 2015, the poorly publicized, though consequential, tropical peatland and forest fires ablaze throughout Indonesia had resulted in the emission of nearly a gigaton of GHGs in only the first several weeks—more

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than the entire annual emissions of Germany.¹⁴ Since then, emissions from the fire have risen to more than an estimated 1.75 gigatons of GHGs, surpassing G7 member Japan as well.¹⁵

The Indonesian fires were a distinctive and discrete event, but when added to the G7's receding weight in the global economy, they nonetheless raised the perennial question of the value of the G7 more generally: Is its agenda-setting power still meaningful? In short, yes, though historical inertia can only carry the G7 so far on the issue of climate change.

From Talking Points to Turning Points

The G7 announcement is significant in furthering the global conversation about climate change and should not be prematurely discounted. It is not a one-off event but the latest triumph in a succession of German engagements on climate change in multilateral fora that have seen Berlin come to be perceived as a source of global leadership on the issue.¹⁶ It was, after all, Angela Merkel, as environment minister in the cabinet of former chancellor Helmut Kohl, who helped to quietly broker the 1995 Berlin Mandate—a key precursor to the Kyoto Protocol. Her signature appeared the following year on a declaration by the European Environment Council that “global average temperatures should not exceed 2 degrees above pre-industrial level.”¹⁷ With this declaration, the council became the first global political body to endorse the highly consequential 2 degree target. Clearly, there is a precedent for lofty pronouncements to, when properly shepherded through labyrinthine national and international politics, end up as the basis for far more material policy in the years and decades that follow.

The specific G7 decarbonization wording did not end up in the Paris climate conference's final text, although a number of German leaders had hoped it would, the elaboration of a new aspirational 1.5 degree goal—accepted by all parties—may have implicitly carried forward the G7's momentum.¹⁸

The 1.5 degree goal reflects a surprising level of symbolic ambition on the part of the global community, particularly considering that entering the Paris climate conference the survival of even the less-stringent 2 degree target language was under scrutiny (regardless of the rationale, perhaps well-justified, for its de-emphasis).¹⁹ Notably, Article 4 of the Paris agreement calls for “global peaking of greenhouse gas emissions as soon as possible . . . so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century.”²⁰ The timeline is conceivably more accelerated than that of the G7, although both would allow for decarbonization to finally be reached only in 2100 in their most liberal interpretations.

More importantly, the Paris agreement is broader in scope, including all greenhouse gases rather than only carbon dioxide. Some have surmised that this necessarily implies *negative* carbon dioxide emissions (atmospheric carbon

dioxide removal) by the end of the century, given the implausibility of negative greenhouse gases that are not carbon dioxide. But, in any event, the conceptual framework put forward by the Paris agreement is equally—if not more—dramatic in the changes it implies than that of the G7 declaration.²¹ Miguel Arias Cañete, the European Union (EU) climate and energy commissioner, acknowledged as much to reporters in the aftermath of the summit, noting, “We have been working under the assumption of 2 degrees. . . . For sure 1.5 means a trajectory of full decarbonization.”²²

The climate challenge, of course, is one to be solved not through declarations but through deeds, and the G7 must continue to play a central role in maintaining accountability and progress toward achieving long-term goals. Even if the developed world has increasingly less leverage to resolve the growth in GHG emissions today, there has been reticence by key emerging economies such as Brazil, China, and India to commit to unilateral mitigation actions in the absence of the developed world taking a leadership role in light of its historical contribution to the stock of greenhouse gases in the atmosphere. The G7 is responsible for 59 percent of historical GHG emissions from 1850 to 2010.²³ As some of the wealthiest major economies in the world, these countries would—under almost any conceivable framework of international cooperation—be expected to assume a meaningful role. Even today, there remains ample room for progress within the borders of G7 countries; the greenhouse gas emissions of all G7 coal plants alone account for approximately twice those of the entire African continent.²⁴

The G7 decarbonization announcement answers the call from a number of important constituencies in a way that other global bodies have thus far failed to do. Fund managers overseeing \$12 trillion in assets globally—including the CEO of CalPERS, the largest public pension fund in the United States—wrote a letter prior to the G7 summit acknowledging climate change as one of “the biggest systemic risks” facing the investment community and calling for G7 governments to agree to a long-term goal for cutting GHG emissions.²⁵ Similar calls have been made by other groups of investors, business leaders, and even a coalition of ten oil companies.²⁶ The G7 also serves as a reference point, having encouraged similar language, or at the very least elevated ambition, at the Paris climate conference.

A Global Energy Transition

For many observers, even those willing to take an optimistic view of the G7 announcement’s symbolic and catalytic significance, it remains unclear whether the G7 members are well-positioned to meaningfully contribute to the ultimate goal. After all, it must be remembered that the target—rightfully—remains

The greenhouse gas emissions of all G7 coal plants alone account for approximately twice those of the entire African continent.

one for the entire global economy. Given the shrinking significance of the G7 across numerous global metrics, what is its most appropriate role?

Chancellor Merkel, in hosting the G7 summit and prioritizing extensive discussions on the climate issue, is not naive as to the role that the G7 can hope to play. “Even if G7 countries had zero emissions tomorrow we still couldn’t solve the climate problem,” she said in the aftermath of the summit.²⁷ At the same time, she highlighted the role that Germany and other advanced economies must play in developing, proving, and scaling technological solutions to square the energy and climate circle. Merkel’s implied message, then, is that the G7’s greatest impact lies in moving first, piloting new policy approaches, and rebuking—through empirical experience—those critics that fear the incompatibility of rapid decarbonization with economic growth and social stability. For Berlin, the G7 announcement offers an opportunity to spur its six fellow advanced economies to follow its lead.

Germany made great efforts in 2015 to gestate its domestic *Energiewende* project—an ambitious planned transition away from nuclear and fossil energy on the backs of accelerated renewables and energy efficiency gains—as a key tenet of its foreign policy as well. This can be seen in the launch of a new Global Energy Transition Dialogue that attracted key policymakers from countries including China, Norway, the United Arab Emirates, and the United States, as well as in the words of its architects and advocates.²⁸ State Secretary Stephan Steinlein has called the *Energiewende* a global project at its core, noting that it can serve as “the world’s laboratory. . . . Whatever succeeds here will inspire hope and courage; whatever fails might not even be attempted elsewhere.”²⁹ Germany hopes that the *Energiewende* will become a role model for the rest of the world, while over time absorbing lessons and policy tools from other countries, such as the United States with its nascent but innovative decarbonization plans.

The success of Germany’s energy transition plans and other national efforts will depend, in part, on the ability of the G7 to use its unique position in global politics to exercise its climate mandate. The G7 is a forum for stimulating dialogue and building trust among some of the most important advanced economies in the world. These countries share, in large part, a similar commitment to the system of international economic governance established in the aftermath of World War II, broadly overlapping security interests, and a desire to exercise leadership befitting of wealthy nations on global commons issues such as climate change. This does not always translate into accord on the means and timelines involved, but nonetheless creates an opportunity for a multilateral forum such as the G7 to pursue more ambitious, explicit public goals than those possible in much larger consensus-based bodies such as the United Nations (UN) and its forum for international climate negotiations, the UNFCCC.

Recommendations for Translating Principles Into Progress

Now that the public goal of complete global decarbonization by 2100 has been made explicit, the hard work must begin. Policymakers in the G7 countries must address a number of challenges for the decarbonization declaration to have a substantive impact on the emissions trajectory of the global economy over the course of this century.

The G7 must be mindful, for example, of the role it plays in the larger arena of climate governance. It has the legitimacy of a great powers club that has tackled—occasionally successfully—issues of systemic importance in the past. It includes countries such as the United States, which never ratified the Kyoto Protocol, and Canada, which ratified but later withdrew from the protocol. Both will be critical players in the post-Kyoto climate governance regime. At the same time, however, the G7 will need to avoid the centrifugal dynamics that have often plagued the proliferation of multiple minilateral fora against the backdrop of a larger but slow-moving institution. Specifically, this will involve deftly and diplomatically reconciling the G7 goal with the outcomes of the United Nations negotiations in Paris and beyond, and communicating these in a coherent framework that strengthens, rather than undermines, the legitimacy of the multilateral process.

Credible follow-through is crucial, particularly in light of the inability of countries in both the G7 and G20 to make good on far less expansive and ambitious climate goals, such as the pledge to eliminate “over the medium term inefficient fossil fuel subsidies.”³⁰ Part of the challenge with the latter, as is often the case, is that clear and shared definitions were never established, even as governments reiterated their commitment to the goal year after year.³¹ No common understanding has yet been reached as to what constitutes a subsidy, what makes it inefficient, and what exactly “medium term” means. Learning from this experience, G7 countries must work, in the context of future summit preparations, toward a coherent and shared understanding of what decarbonization entails, including comparability of baselines, accounting methods, and strategies used in each national context. Mechanisms for data sharing, transparency, coordination, and monitoring of progress toward the G7 goal among constituent countries are clearly needed. At present, there are very few institutionalized membranes across which the diffusion of information and experiences can take place, casting doubt on the vision of those who wish for the globalization of G7 climate action.

Finally, and most crucially, the G7 must match its words with political capital, putting into place at the national level credible, stable, and long-term policies to change individual actors’ behaviors, ranging from industry to investors to final energy consumers. This must go beyond crediting existing policy frameworks with progress toward the G7 goal; it must include additional and

robust national policy development with institutionalized mechanisms for coordinating approaches and learning from successes and failures. In this way, each G7 country—and not just Germany with its *Energiewende*—can play the role of a policy laboratory in which successes will be both internalized as progress toward some national commitment and externalized as a public good that other countries may choose to mimic in years to come. This points to a clear difference between the Intended Nationally Determined Contributions (INDCs) made by most countries in advance of the Paris climate conference and the G7's goal of decarbonization by the end of the century. The former mostly involved packaging in succinct terms the likely outcomes of extant, often loosely or uncoordinated policy measures and trends; the latter must necessarily involve new and well-coordinated policy in the G7, with the hope of it spilling over to the rest of the world.

As such, it will involve taking on sacred cows, challenging conventional wisdom, tackling new sectors with new tools, and rethinking the very architecture of energy markets in the twenty-first century.

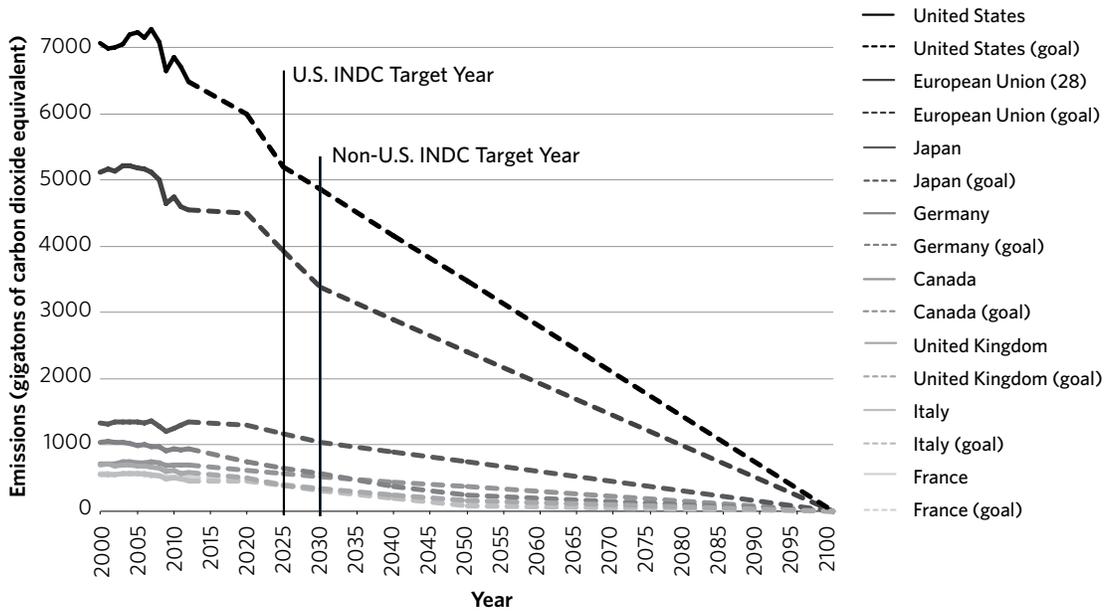
If they pursue objectives in a thoughtful and coordinated fashion, G7 members can have a positive material impact in the suggested focus areas that follow. Not only will they drive decarbonization at home, but they will, in a number of areas, set the tone and shape the discussion of other important multilateral fora, such as the post-Paris UN climate negotiations and the G20, which itself is set to pay increasing attention to energy and climate issues in the years ahead.

Achieve Consistency in Climate Commitments

The Paris climate conference helped define the new contours of the post-Kyoto international climate regime. This regime has rapidly evolved from a top-down to a bottom-up approach, seen by many as necessary to encourage the broadest possible participation, as well as legitimization, by great powers such as the United States that never ratified the Kyoto Protocol. In such a bottom-up—and possibly more minilateral—world, comparisons between the G7 countries' commitment in Germany earlier this year and their commitments at Paris (the INDCs) are inevitable. Crucially, there must be some semblance of consistency, or at the very least a coherent narrative, between these twin sets of commitments in order for the intentions of the G7 countries to be deemed credible.

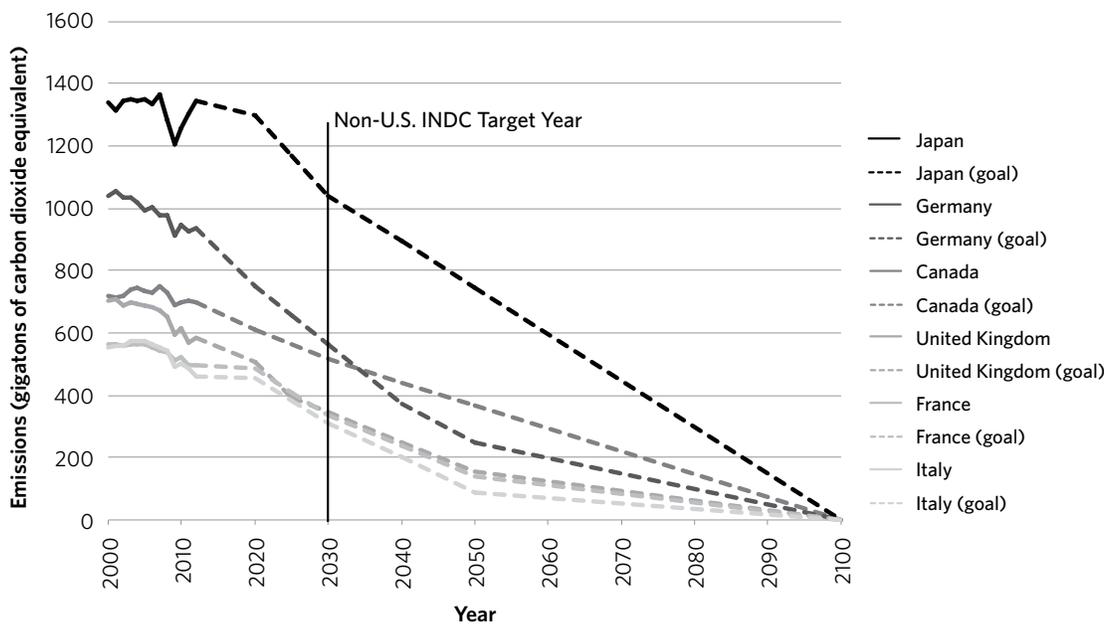
At first glance, it may appear that interim emissions-reduction commitments (either via the UNFCCC process or independent of it) by G7 members are largely consistent with long-term trajectories needed to achieve full decarbonization by 2100 (see figures 1 and 2).³² In reality, however, a number of the members' 2020 targets—let alone those for 2025 or 2030—are in danger of being missed, given current rates of emissions reductions. Moreover, the cost of the last half of emissions reductions is expected to be significantly higher than the cost of the first half of emissions reductions, as the easiest and most cost-effective measures will already have been adopted.

Figure 1. The G7's Historical Greenhouse Gas Emissions and Implied Future Decarbonization Path



Sources: Grantham Research Institute Global Climate Legislation Database, United Nations Framework Convention on Climate Change, UK Committee on Climate Change, World Resources Institute

Figure 2. The G7's Historical Greenhouse Gas Emissions and Implied Future Decarbonization Path Excluding the EU and the United States



Sources: Grantham Research Institute Global Climate Legislation Database, United Nations Framework Convention on Climate Change, UK Committee on Climate Change, World Resources Institute

Note: INDC stands for Intended Nationally Determined Contributions

The G7 leaders' declaration includes an endorsement of the Paris climate agreement's steps to "enhance transparency and accountability including through binding rules at its core to track progress towards achieving targets."³³ This language, though seemingly banal, is significant in that it underscores the shift to a new climate governance paradigm in which unilateral, country-designed mitigation commitments are married to a multilateral infrastructure for monitoring, reporting, and verifying progress. The latter is envisioned by the G7 as universally binding, while the former is implicitly universal but non-binding. As some experts have noted, this is largely in line with long-standing U.S. efforts to break down the firewall between developed and developing countries, while creating a platform to substantively compare the commitments that most countries brought to the climate potluck in Paris.³⁴ The fact that G7 countries have agreed to a common position here is promising, and it can be grounds for further progress in defining just how these "binding rules" might look and what best practices, if any, the G7 can establish for complying with them.

Create a G7 Decarbonization Task Force

The G7 must create an institutionalized framework for advancing toward its end-of-century decarbonization goal if this goal is to have credibility with investors, industry, and civil society, and contribute to actual, additional mitigation beyond business as usual. This could start with a task force of experts

The G7 could create a task force of experts in order to establish frameworks for comparing the existing decarbonization policies of each country.

chosen from each G7 member that would agree to meet in person annually, and via electronic means far more regularly, in order to establish frameworks for comparing the existing decarbonization policies of each country and what emissions trajectory they imply. The task force could also help in establishing consistent metrics and benchmarks for the G7. There are notable differences in these areas among the G7 members. For example, the EU uses 1990 as its baseline year for most of its climate goals, but previous goals announced by Japan have used 2013 as a baseline. Countries may choose to select a baseline year with relatively high emissions due to a historical trend or anomaly, skewing the comparability of ambition between various countries. This may seem a trivial matter, but it is poised to become more relevant as global five-year reviews of countries' decarbonization efforts take place and as potential climate-policy-related trade disputes grow that require objective comparison of different national policy frameworks. Similarly, interim target years (such as those embedded in the INDCs) vary or are often communicated in ways that make comparisons more challenging, including among the voluntary ambitions announced by various EU members.

At later stages, the task force can conduct independent audits of each country's evolving policy approach and flag deviations from the credible

decarbonization pathways needed to achieve the G7 goal. In addition, the task force can produce positive long-term mandates, such as laying the groundwork for harmonization of carbon pricing schemes in the G7—from the EU Emission Trading Scheme to carbon pricing mechanisms in various Canadian provinces and cities (including Alberta, British Columbia, Quebec, and Toronto) and U.S. states (including a pioneering market in California, as well as possible new markets that may be catalyzed by the forthcoming Clean Power Plan—President Barack Obama’s legacy policy to control carbon pollution from existing power plants). Every year, the task force would also be responsible for working with that year’s G7 host country to craft more substantive statements on climate and energy than have previously been the case.

Canada and Japan—two of the G7 members that displayed reservations toward a more ambitious 2050 decarbonization goal—have recently seen windows of opportunity open for the formation of more forward-leaning stances on climate mitigation in the framework of such a working group.

Japan will host the next G7 summit, set to take place in Mie Prefecture in May 2016. Tokyo has come under criticism over what some in the environmental community see as inadequate substantive emissions-reduction commitments via the Paris climate agreement process. Japan will be in the spotlight to articulate how a tepid decarbonization trajectory to 2030 can be reconciled with its acceptance of the G7’s goal of complete decarbonization by the end of the century. The country has been put in a difficult position in the aftermath of the 2011 disaster at the Fukushima Daiichi Nuclear Power Station, an event that has sidelined the vast majority of its zero-carbon nuclear fleet. Japan will continue to struggle to meet its short-term energy requirements with any mix that does not include a sizable share of fossil fuels, but this also opens up opportunities for aggressive medium- and long-term targets in national policy processes that would help bridge the horizons of its UN and G7 climate commitments.

Canada, meanwhile, saw the election of Liberal Justin Trudeau as prime minister in October 2015, ending nearly a decade of Stephen Harper’s Conservative government. Trudeau has already indicated his intention to bring greater ambition to climate issues, creating a newly blended environment and climate minister position and a cross-ministry committee on climate issues. He is already hinting at a more active and visible role in international fora such as the UN climate process, opening the door for heightened ambition in the G7 process as well. For example, in the wake of the 2015 U.S. rejection of the Keystone XL pipeline, which would have carried oil from Alberta, Canada, to the Gulf of Mexico, Canada could work to communicate clearer criteria for how the expansion of its emissions-intensive oil sands industry will be made consistent with long-term decarbonization goals. A lack of trust, transparency, and clear communication surrounding Canada’s governance of the oil sands’ full life-cycle greenhouse gas emissions in many ways contributed to Keystone XL’s eventual defeat.

The Trudeau government can also work to lay the foundation for the eventual harmonization of carbon pricing mechanisms in Canada, Mexico, and the United States, in order to achieve North American Free Trade Agreement consistency and avoid trade frictions, in a step that would logically precede eventual linkage with mechanisms in the EU and Japan, thus covering all G7 members.

Rethink Electricity Market Design

The G7's efforts must also focus on redesigning the electricity market to take full advantage of renewable energy sources. These sources present a number of challenges to electricity distribution as it is carried out today. The fixed

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costs associated with renewables are quite high (though decreasing) and variable costs are very low: by dramatically impacting the dispatch curve of power resources, renewables can exert enough pressure on wholesale prices to make fossil fuel generation uncompetitive.³⁵ Further, the possibility of consumer-side generation complicates the centralized power-production model that has impelled states and localities to sponsor electric-utility monopolies.³⁶ Yet the unpredictability of electricity supply creates a new public goods problem when sun, wind, and water are not readily available. Put simply, incumbent electricity market designs are not ready for an ever-increasing share of renewable energy sources.

This is not, however, an indication that renewable electricity generation is not viable. Indeed, the skepticism of many in the United States that the transition to a fully decarbonized energy system by the middle of this century is impossible is challenged by a number of rigorous techno-economic assessments—such as a 2015 paper in the journal *Energy and Environmental Science* by a number of leading researchers—that provide a road map for such a transition.³⁷ While the up-front costs of achieving this transformation would be substantial, they are likely to be covered nearly completely by the back-end savings associated with lower fossil fuel infrastructure, maintenance, and production costs. Obstacles to such a future are not technical but social: those of market design, financing, and intertemporal discount rates.

The markets that distribute electricity today were constructed with the old model of centralized fossil fuel generation in mind. Long-term decarbonization will require the construction of new kinds of markets, and in particular those that are focused around the integration of renewables at the lowest cost to consumers and producers. Such integration of electricity-generating capacity will diminish not only the possibility of serious supply shocks but also electricity production costs, according to a report from the German Advisory Council on the Environment.³⁸

Renewable generation and its attendant intermittency of supply, however, also demands increased participation and engagement by consumers. Widespread adoption of smart meters and smart thermostats can empower

consumers with data to reduce unnecessary energy consumption and, with it, the cost of their electricity bills. More robust information, implemented along with dynamic pricing that reflects real-time electricity availability, will begin to unsettle consumption habits formed around a twentieth-century grid.

Unlocking demand-side innovations and empowering new business models may be challenging in Germany and the United States for sociocultural reasons particular to each country. Germans have been reluctant to adopt smart meters, which they perceive could threaten their privacy. Both Germany and the United States should be motivated to pursue further cost-effective energy efficiency. That is because the average German household benefits from much lower per capita energy consumption but is faced with high electricity prices, while the average U.S. household enjoys lower electricity prices and is beginning to embrace smart meters en masse but consumes far more than the Germans. For Americans, the challenge is one of embracing both technological innovation and a gradual evolution of norms related to building size, transport patterns, and urban planning.

The importance of paradigm awareness cannot be stressed enough when considering large-scale transformations in energy use. Modeling can provide insights as to the effectiveness of changes along some parameters, but where commitments—such as the imperative to decarbonize the economy—seem unattainable, policymakers must examine whether ideas of feasibility and prudence are constrained by a traditional, centralized, fossil-fuel-based status quo that can itself be transformed through rewriting market rules and reshaping social norms.

Provide Signals to Long-Term Investment

The nature of energy investments is quickly changing. Uncertainty about future oil prices and the dynamic regulatory realm has led to at least a temporary rethinking and withdrawal from large projects, such as Shell's Arctic exploration and oil sands projects, as well as to the growth of a movement by institutional investors to divest or become more active shareholders. As the shale revolution makes natural gas cheaper and coal faces more stringent regulation, new power generation capacity is likely to favor natural gas use. These changes in the contemporary investment environment offer levers for pursuing decarbonization by 2100, but how can policymakers best make use of the two capital cycles remaining in this century to achieve the G7's goal?

The above-described difficulties of integrating renewables into extant electricity markets have engendered ambivalence about fossil fuels' role in the future of power sector infrastructure. Should fossil fuel capacity be maintained to ensure security of supply? Should power sector regulations harness technology-neutral market forces to guide investment decisions, or should regulations directly

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mandate the phaseout of incumbent technologies? While the natural gas boom has helped force coal out of the market, a decisive phasedown of coal plants is an integral aspect of decarbonization—managing the decline of incumbents is as important as fostering the rise of new energy technologies in such a heavily politicized sector.

The Obama administration’s approach, articulated in the 2013 Carbon Pollution Standards and 2015 Clean Power Plan, has been to specifically regulate coal-fired power plants, while also offering states flexibility in reaching Environmental Protection Agency–specified emissions targets. Picking winners is often an inefficient mode of policymaking, but shedding coal plants is necessary if the G7’s climate targets are to be reached. In the long term, discussion will also be necessary about how to avoid lock-in to natural gas infrastructure that will be useful for near-term emissions reductions but problematic for full decarbonization.

The G7’s decarbonization goal presents problems for investment decisions: How should agents account for the net present value of a potentially revolutionary technology when it may only appear in eighty years’ time? This question of accurate discounting will be important to keep in mind as policymakers allocate funding for basic research and development in the coming years, and as investors with heterogeneous risk tolerances and investment horizons appraise the commercial viability of whatever such research and development yields.

The need to bring the global investment architecture in line with a twenty-first-century understanding of sustainability and climate risk is not circumscribed to a single class of investors or a single sector. Industry, the second-largest source of global greenhouse gas emissions, continues to use twentieth-century chemical processes and technology. Innovation in fundamental but overlooked sectors—chemicals and steel production, for example—may take the form not of incremental improvements but rather of watershed transformations if investment is properly guided by principled management and stable, long-term policy.

The outsized role of the financial sector in the transition to a sustainable, decarbonized world economy is also often overlooked. The G7 includes many of the nerve centers of global finance, from London to New York to Tokyo. It would be tempting to assume that, in today’s globalized world, attitudes toward environmental risk and the silent revolution of green finance would be largely the same across geographies, but in fact there exist highly divergent levels of cultural acceptance, often in line with the scale of institutional innovations under way and the level at which they are taking place.³⁹ For example, Mark Carney’s aforementioned speech on climate change and associated systemic economic financial risk was not the result of idle musing but instead a strategic waypoint in a broader investigation of climate risk and the prospect of “stranded assets” in the fossil-fuel-based economy that he initiated in 2014.⁴⁰ Similarly, the buy-in of financial governance institutions in other G7 countries has been slow to develop, even as the issue is rising on the agenda of the Financial Stability Board, an international body monitoring the global

financial system, and a variety of powerful institutional investors with trillions of dollars in assets under management. True leadership by the G7 on the design of a sustainable financial system cannot take place without the earnest participation of more conventional fiscal policy thought leaders in countries such as Germany, Japan, and the United States. Until central banks and financial regulatory authorities are ready to take the quantification and management of climate risk seriously, there will be little reason for private financial sector actors to follow suit, save for those motivated by a certain far-sightedness or an explicit environmental and social governance mandate.

The G7's decarbonization goal makes a symbolic gesture that climate-related issues are not tangential to the work of ensuring growth and prosperity; they are at its very core. This political symbolism must be followed up with policy and regulatory innovation, from standardized climate risk disclosure methodologies to stress-testing norms and other mechanisms for mainstreaming climate change into the function of the global financial system. Given the G7's sizable, though waning, grip on global finance, it enjoys the first opportunity to own this challenge and shape it in line with shared principles. Should it fail to do so, there are plenty of emerging powers—from Brazil to China to the G20 writ large—that are ready to try their hand at rules for a sustainable twenty-first century financial system themselves.

Tackle Transport and Petroleum Comprehensively

The Volkswagen emissions scandal that came to light in September 2015 highlights not only the scope of cheating among regulated entities but also the shortcomings of current environmental regulatory frameworks, including those for lowering the GHG emissions of the transport sector.⁴¹ There are a few straightforward steps in all G7 countries that can be taken to improve and expand policy.

Even the world's automotive fleet, one of the single-largest sources of GHG emissions, long ago slipped away from the grip of the seven industrialized economies. While the G7 accounted for more than 90 percent of global auto production in the early 1960s and as much as 70 percent in the year 2000, this had decreased to around 40 percent by 2009 and has not increased since then.⁴² Nevertheless, even as manufacturing has moved away from the G7, the world's axis of automotive power—in terms of where leading manufacturers are headquartered—still rests with Germany, Japan, and the United States.

This creates leverage to change outcomes globally, not just in the developed-country bloc. To begin with, G7 policymakers should focus on better enforcement of pollution regulations (in particular, carbon dioxide and fuel efficiency standards) worldwide. This would include extending “real driving emissions” testing to end-use vehicles, rather than just pre-sales

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models, the full provision of recall and fine authority to regulators, and full testing of the durability of pollution control devices in addition to their efficacy. The convergence on a common, science-based regulatory design framework (such that regulations reflect the best understanding of air pollutants and automotive engineering) and common testing standards among G7 countries before agreeing to a system of mutual recognition of certifications is essential. This would greatly diminish the scope for manufacturers to shop for certifications in less stringent or well-enforced jurisdictions and then use that certification for entry into other markets.

Finally, and of perhaps greatest systemic importance, is working toward a comprehensive understanding of how the G7 plans to manage the overall and evolving emissions of the petroleum sector over the coming century. Oil is the largest fuel in the global energy mix, and the International Energy Agency forecasts that it will remain so even amid significant climate action in the years ahead.⁴³ While conventional wisdom holds that the only meaningful climate policy for oil is to phase it out entirely, this will be a difficult and long-term endeavor, and, in the meantime, unconventional oil resources have contributed to a widening spread in the carbon intensity of different global oils. These oils range from conventional light oils produced using traditional methods to tight oils that are hydraulically fractured, as well as heavier oils such as the oil sands of Canada and Venezuela. Each oil (and oil-to-fuel pathway) has a unique carbon footprint, with heavier oils and more energy-intensive processing likely to lead to higher emissions. The Carnegie Endowment for International Peace's Oil-Climite Index has indicated that a difference of 80 percent exists between the most carbon-intensive and least carbon-intensive crude oil pathways among the 30 oils that were included in the first phase of the index.⁴⁴

At a time when the regulatory burden on biofuels and the vehicles using liquid fuels is increasing, surprisingly little scrutiny is paid to the dominant oil-derived fuels themselves. While far greater open-source and consistent oil data is needed, there are indications that oil sector inventories are not accounting for total emissions throughout the oil supply chain, from extraction to refining to combustion of all oil co-products. Furthermore, emissions controls are available to reduce greenhouse gases in the petroleum sector, and in some cases these can be made cost effective or provide a net economic benefit with only a modicum of regulatory intervention needed to provide marginal incentives.⁴⁵

The G7 could help spur the modernization of the oil sector through new standards for transparency, data reporting, and carbon intensity reductions. This could take the shape of improvement and expansion of flawed but well-intentioned emissions-intensity standards in the EU and California, or could involve an intelligently designed carbon tax or other such mechanism.⁴⁶ At a bare minimum, the G7 is in a good position to drive a conversation on greater transparency in the too-opaque oil market given that the bloc includes consumers as well as major producers in Canada and the United States.

A platform already exists for this through the Joint Organizations Data Initiative (JODI) collaboration between eight different international organizations. JODI has been driven by the G20 thus far, but this has understandably resulted in a least common denominator of ambition as to the data coverage, particularly given that the membership of the G20 includes states such as Saudi Arabia, for whom the linkage of petroleum production with climate change is a sensitive one. No GHG emissions data is currently collected by JODI. The G7 could begin to voice political support and outline a pathway for JODI's mandate to eventually expand to climate-relevant data. This would start a new conversation at the international level, and possibly pressure the G20 to assume a similar position at future summits, particularly as the salience of climate change in G20 discussions grows more generally or as membership in the G20 evolves to favor greater climate ambition in the group.

Conclusion

It would be premature to endorse the G7 decarbonization announcement as a turning point or *deus ex machina* to guide increased ambitions in the aftermath of the Paris climate conference. Yet it would similarly be a mistake to dismiss it as an unsubstantial gesture that will lead to little. It is fully possible that new initiatives and additional commitments will sprout under its shade and, with follow-through, lead to a meaningful change in trajectory. Its ultimate test, after all, will be how the announcement stimulates longer-term policy action in seven wealthy but heterogeneous economies, all driving toward a common point of convergence at the end of this century. In any case, the G7 has helped to place in sharp contrast the gap between the action required to avoid catastrophic levels of climate change on the one hand, and the fitness for purpose of most political, economic, and technocratic institutions that need to address the climate challenge on the other.

In a world replete with responses to short-term crises and exigencies, the G7 goal provides a long-term vision that is increasingly rare in the multilateral sphere. The alternative to G7 leadership, even if only a starting point, is not another structured system but a so-called G-Zero world of complexity, uncertainty, and ambiguity. Few other institutions are ready or willing to take on the G7's leading role. The G20—though one day a possible forum for durable action on climate change—remains very much in a period of gestation and is still searching for equilibrium among its highly dissimilar member countries. The UN climate process, having endured the weaknesses of the Kyoto Protocol as a system of governance, is now likely to maintain a bottom-up approach for the foreseeable future.

In the interim, it is the G7 that must carry forward the mandate of, bit by bit, wrestling the climate change tragedy of horizons toward a more constructive and less catastrophic denouement. Japan's hosting of the 2016 summit

presents a prime opportunity to not only endorse the outcome of the year before but to commit real resources and political capital toward improving it with substantive, institutionalized mechanisms for progress in the years ahead. This may demand new functions and experiments from bodies such as the G7 that are unfamiliar with challenges as interspatial and intertemporal as climate change, but, to paraphrase Albert Einstein, the world's global governance institutions cannot use the same thinking that got us into the problem in order to get us out of it.

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