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Sharing Our Hopes, Fears, and Solutions to Solve Climate Change While Creating a Better Society: The Deep Decarbonization Pathways Design Framework

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It is now broadly understood that the global average temperature must not rise more than 1.5°C (2.7°F) above pre-industrial levels if we are to limit climate change. We have already raised the planet's temperature by an average 1°C (1.8°F), causing significant damage in the form of wetter hurricanes, more frequent flooding, and disappearing coral reefs. Above the current level of warming, damages will start compounding rapidly and become highly unpredictable (e.g., due to melting Arctic permafrost). Every tenth of a degree matters, with +2°C (3.6°F) considered a very dangerous threshold (e.g. an estimated ~99% of coral reefs will die at +2°C) (IPCC 2018).

The 2015 Paris Agreement attempts to crystalize this collective awareness into policies and action. The agreement is a new form of international treaty, based on the idea that climate change is a development challenge: We have a climate change problem because fossil fuel-based technologies were available when developed countries industrialized and became wealthy. Finding a practical way for developing countries to gain wealth without emitting greenhouse gases (GHGs) or air pollutants, while developed countries reduce their own emissions, will be key to solving the climate problem.

The Paris Agreement is also completely voluntary: Countries offer what emissions reductions they are willing and able to make now, with the ambition of continually improving these contributions over time with increasing mutual trust and cooperation on technology and financing.

Keeping the global temperature rise below +1.5-2°C requires that GHG emissions from all sources fall to zero by 2050-2075. Vehicles, buildings, and industry each contribute roughly 25 percent of global GHG emissions in the form of carbon dioxide (CO_2), and the last 25 percent of emissions are non-CO_2 gases from agriculture, land use, and fossil fuel extraction. To keep temperature rise below 1.5°C (or even 2°C) "negative emissions" will be required, such as bioenergy with carbon capture and storage (BE-CCS) or direct air capture (DAC-CCS).

The large-scale actions needed to achieve the +1.5-2°C goal are increasingly known. These actions include behavioral changes in transportation and material use, energy and material efficiency, material recycling, decarbonization of our energy sources and the direct fuels we use (e.g., switching to electricity derived from nuclear, wind, and solar instead of coal, oil, and gas), and better land management and agricultural practices. These findings have been confirmed through many analytical approaches, including global integrated assessment models, national and regional modeling, and detailed sector analyses (Bataille et al. 2016a, Clarke et al. 2014).

The big question, however, is how sub-regions, cities, firms, and organizations use this knowledge? How does this information turn into coordinated action to reduce emissions and meet the goals of the Paris Agreement? These actors might now have a vague idea how they might eliminate their emissions (elimination, not partial reduction, being required), but will really only have a functional understanding (if that) of their own direct actions, and success will depend on other actors cooperating. For example, electric vehicle (EV) buyers need companies to make and sell EVs, bicyclists need bike lanes, companies trying to use more recycled plastic need a secure and high-quality supply, and steel makers making zero-carbon steel at a 40 percent premium need buyers (Bataille et al. 2018, Vogl et al. 2018).

Given the interconnectedness of these entities and their actions, how can understanding of solutions needed to meet the climate challenge be shared and implemented, building the foundation for collective trust for planning and binding contractual commitment for action? A method has been developed to do this, based on co-development of deep decarbonization pathways (Waisman et al. 2019), and was used in the lead-up to the Paris Agreement to demonstrate 2°C compatible futures for 16 countries representing 74 percent of global CO_2 emissions (Bataille et al. 2016b).

The Deep Decarbonization Pathways (DDP) design framework works with the human need to understand our world and our practice of describing about the world using qualitative stories. It also, however, makes these stories tangible by requiring all participants who want to tell their decarbonization story to translate them into basic numbers such as number of households, kilometers traveled, modes of travel, how much steel is made and with how much carbon emitted, and quantities and types of fuel used. On top of this, the DDP qualitative storylines must include broader development components relating to a society's core goals and values, such as wealth generation, poverty alleviation, air quality, secure access to energy, and how the Sustainable Development Goals are met or not met (von Stechow et al. 2016).

Climate policy, which fundamentally meets long-term existential needs for all, must work within pressing development policies, or it will be trampled by these short-term needs. Short-term policies and action are the core target, but the key objective of the approach is to ensure that short-term actions are decided upon with a clear understanding of their consequences for long-term climate stabilization.

The pathways design framework works as follows: The process can be run by nations, regions, cities, sectoral associations, and others. The key is that all stakeholders with an interest in the outcome and with power in the process are included, especially those who can block progress. First, all stakeholders are asked to present their qualitative storylines, in their own "language," of how they believe our collective goals, including climate policy, should be achieved. Second, they are asked to translate these storylines into common quantitative "dashboards" based on common key indicators (imagine simple spreadsheets), which allows for direct quantitative comparisons. These dashboards are collected by the team running the project and are analyzed with the stakeholders, with the goal of finding convergences or divergences, which stakeholders iteratively learn from. Third, through "backcasting" from a long-term goal (e.g., zero

energy emissions at a given date) it can be assessed whether these stories actually meet the collective needs of the stakeholders.

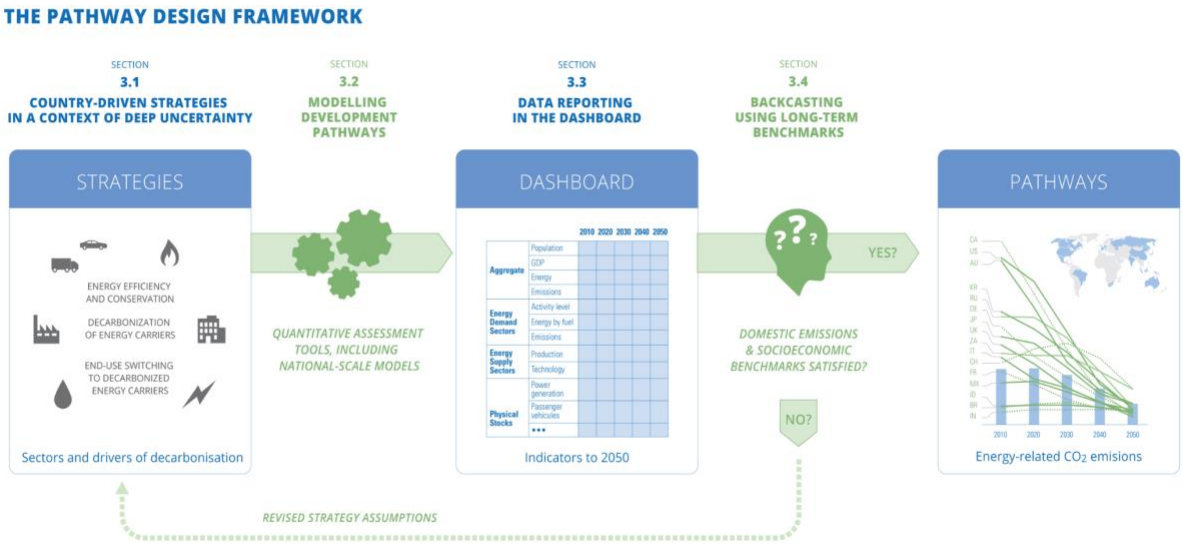

Figure 1. Deep Decarbonization Pathway Design Framework

In this process, used first in the French "Energy Law" debate, one or several pairings of qualitative storylines and quantitative dashboards typically emerge as meeting the greater set of social goals as well as the needs of most if not all stakeholders. These results are then checked against broader social and global goals. These "settled" scenarios, open for revision with new information and learning, allow for longer-term infrastructure planning and the development of policy packages to meet the given jurisdiction's needs within the national and global context.

The pathways design framework's use of storylines, strategies, modeling, dashboards, and scenarios has a broader benefit in difficult political environments, where these tools can help to align conceptual languages (i.e., ways of describing the world), bridge understanding of key ideas (i.e., ideas of how the world works), and support the iteration of alternative visions, until a working understanding is achieved among willing stakeholders and decision-makers. This may even allow for long-term, consistent climate policy across political parties, as has been achieved in British Columbia, California, most of the European Union, Québec, the United Kingdom, and other jurisdictions, which is essential for the success of long-term climate policy.

Meeting our social development and climate change goals is possible, but we cannot avoid complex planning and negotiations with stakeholders who have strong opinions and possibly fears. The DDP pathways design framework provides a tool for stakeholders to learn each other's languages, share options, and communicate their hopes and fears, all in a way that is both naturally human and quantitatively rigorous. The outcome, we hope, is to arrive at collective visions that will allow for robust and stable long-term climate policy.

Additional Resources

Past examples of national DDPs can be found at www.deepdecarbonization.org, including a national tool kit at http://deepdecarbonization.org/research-methods/ddpp-collective-toolkit/. Visit

https://ddpinitiative.org/ for information and our evolving sectoral tool set. A Personal Transport tool is available for trial (contact yann.briand@iddri.org), and tools are under development for Freight Transport; Agriculture, Forestry and Land Use (AFOLU); Heavy Industry; and Cities. Please contact the author for further information at chris.bataille@iddri.org.

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