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Net-Zero Emissions Pledges: Background and Recent Developments

On January 27, 2021, President Biden signed Executive Order 14008, which expressed the intent to "put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050." A number of other countries, as well as cities, regions, and companies, have also made "net-zero" emissions pledges. This In Focus explains the concept of net-zero emissions, identifies recent net-zero pledges, and presents a series of questions to consider when examining net-zero pledges. This In Focus does not address or evaluate the challenges involved in achieving net-zero targets or the technological advances and/or policy options that would likely be needed to reach them.

Background

Net-zero emissions refers to a situation where any continued human-caused greenhouse gas (GHG) from an entity (e.g., country, subnational government, company) is balanced by human, or anthropogenic, carbon removal from the atmosphere that stores the carbon dioxide (CO_2) in geological, terrestrial, or ocean reservoirs, or in products. Carbon removal can include enhanced carbon storage in forests, wetlands, grasslands, and agricultural lands, or the use of removal technologies such as direct air capture, bioenergy with carbon capture and storage, and enhanced weathering of minerals. It excludes natural CO_2 not directly removed from the atmosphere by human activities.

A net-zero emissions target may include all GHGs, or sometimes only CO_2. The use of terms can vary. *Climate neutrality* can be a synonym for net-zero emissions, while net-zero emissions that includes only CO_2 may be known as *net-zero decarbonization* or *carbon neutrality*.

While related, carbon capture and storage is not equivalent to carbon removal. *Carbon capture and storage* (CCS) is a process in which a relatively pure stream of CO_2 from industrial and/or energy-related sources is separated, conditioned, compressed, and transported to an underground storage location for long-term isolation from the atmosphere. In the case of a power plant burning fossil fuels or a CO_2-emitting industrial facility (e.g., steel or cement plant), CCS would reduce the amount of emissions that would have been released into the atmosphere, but it does not directly remove carbon from the atmosphere. However, when CCS is used in combination with biofuels as an energy source, some carbon is removed from the atmosphere because the carbon in the source plants for the biofuel was recently assimilated from atmospheric CO_2.

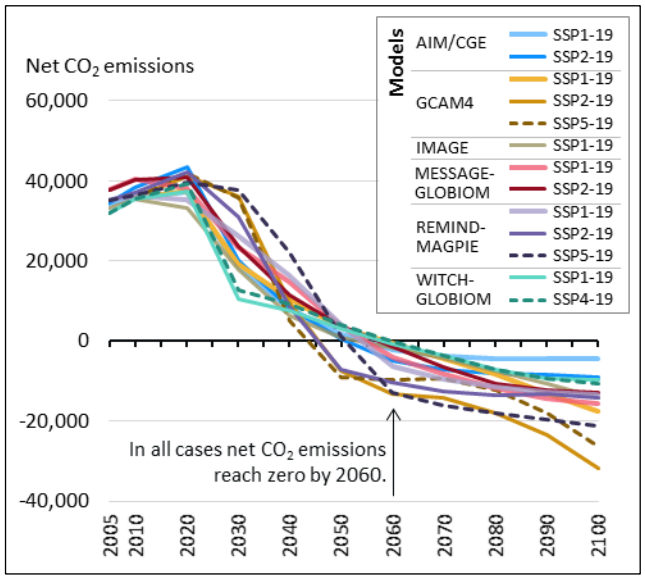
Net-Zero Emissions and U.N. Framework Convention on Climate Change

The United States is a party to the Senate-ratified U.N. Framework Convention on Climate Change (UNFCCC), the stated objective of which is "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

Subsidiary to the UNFCCC, the Paris Agreement, which the Biden Administration has rejoined, includes a goal to keep the global average temperature to well below 2°C above preindustrial levels, while pursuing efforts to limit the temperature increase to 1.5°C. One question addressed by both scientists and policymakers is when global emissions would need to reach net-zero in order to limit the likely global mean temperature increase by 2100 to, for example, 1.5°C or 2°C. **Figure 1** shows a subset of modeling scenarios that limit likely warming in 2100 to 1.5°C. Overall, the Intergovernmental Panel on Climate Change (IPCC) estimates that if net emissions were zero by approximately 2050, then the likely global mean temperature increase might be limited to 1.5°C by 2100. Similarly, the IPCC estimates that the likely global mean temperature increase might be limited to 2°C by 2100 if net-zero emissions were achieved by approximately 2070.

To meet this temperature goal, the Paris Agreement includes a net-zero emissions aim, specifically calling for a "balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century."

Figure 1. Global CO_2 Emissions over Time Across Selected 1.5°C Modeling Scenarios



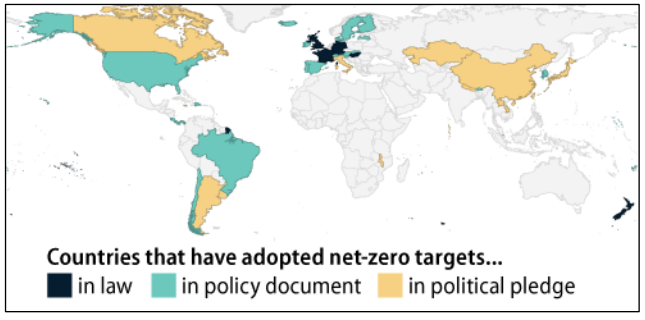
Source: CRS analysis of data from International Institute for Applied Systems Analysis, "SSP Database (Shared Socioeconomic Pathways) - Version 2.0," at https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10.

Notes: The legend indicates the model name. For each model, there are multiple runs based on different socioeconomic scenarios. In all cases net CO_2 emissions reach zero by 2060. These are a subset of emissions scenarios consistent with limiting likely warming to 1.5°C in 2100 that use the same socioeconomic assumptions and have publicly available data.

Recent Net-Zero Pledges

As of March 2021, 59 countries have communicated a net-zero target, representing 54% of global GHG emissions, although they vary as to whether the target is a political pledge (e.g., by a head of state such as President Biden), incorporated into a policy document, or enshrined into law (**Figure 2**). For example, France, Germany, and the United Kingdom have legally binding 2050 net-zero GHG emissions goals, while the Republic of Korea and China have carbon neutral pledges for 2050 and 2060, respectively. By one estimate, as of September 2020 more than 800 cities, 100 regions, and 1,500 companies have made net-zero pledges. Subnational governments vary in how much authority they have in meeting these targets.

Figure 2. Countries That Have Adopted Net-Zero Targets



Source: CRS, based on data from Net-Zero Tracker, World Resources Institute, at https://www.climatewatchdata.org/net-zero-tracker.

Issues to Consider on Net-Zero Pledges

Net-zero pledges can vary widely in their details. A recent article in *Nature* (Joeri Rogelj et al., "Net-zero targets are too opaque," March 18, 2021) discussed a number a questions that could be considered when evaluating net-zero emissions pledges:

- *What is the time frame for the net-zero target?* Are there intermediate milestones?
- *Is the target based on a global temperature goal (e.g., 1.5°C or 2°C)?* Would the global climate goal be achieved if every country enacted the same target?
- *What is the scope of GHG emissions?* Are all GHGs included, or just CO_2? How are the GHGs aggregated to determine net-zero?
- *What are the relative contributions from reductions in GHGs, direct carbon removals, and offsets?* Reductions and removals are under control of the entity (government, business), while offsets are purchased reductions undertaken by someone else.
- *What policies, laws, regulations, and funding programs will be established to meet the net-zero target?*
- *Has the target been set with regard to the financial and technical capacity of the country or considerations of equity and fairness?*
- *Could the net-zero target lead to carbon leakage, the situation where emissions reductions in the country with the net-zero target result in an increase in emissions in another country?*
- *For companies, does the target include only emissions resulting from their direct activities, or emissions across their value chains as well?*
- *How will progress on meeting the target be monitored, reported, and verified?*
- *How will social and environmental risks be managed?*

Additional Resources

CRS Report R46204, *The United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement: A Summary*, by Jane A. Leggett

CRS In Focus IF11791, *Mitigating Greenhouse Gas Emissions: Selected Policy Options*, by Jonathan L. Ramseur et al.

CRS In Focus IF11501, *Carbon Capture Versus Direct Air Capture*, by Ashley J. Lawson

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