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NET ZERO CARBON PRICES:
AN ALTERNATIVE TO THE SOCIAL COST OF CARBON

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Setting CO_2 prices

How much to charge for each ton of emissions is perhaps the most crucial element of a carbon pricing policy. However, there is little consensus among economists about the appropriate level for carbon prices.

One common approach is to use the social cost of carbon (SCC), which is described and used as an "optimal" CO_2 price. The SCC is a monetary estimate of the damages from emitting one additional ton of carbon dioxide into the atmosphere. Under a strong set of assumptions, the SCC reflects the price that balances the benefits and costs of emissions reductions.

But SCC estimates provide limited practical assistance to policymakers setting specific carbon prices, with estimates ranging from under $0 to over $2000 per metric ton.

New research, published in *Nature Climate Change*, presents an alternative to the SCC, called near-term to net zero (NT2NZ) CO_2 prices. The NT2NZ approach aligns with the emissions target-focused approach that frames climate policy discussions around the world, avoids uncertainties in estimates of climate damages and long-term decarbonization costs, and enables the consideration of CO_2 prices alongside a portfolio of policies.

The NT2NZ approach to setting CO_2 prices

NT2NZ CO_2 prices are estimated using four steps:

Step 1: Select a net zero CO_2 emissions target year, consistent with global action to stabilize temperatures.

- The target is informed by the best available science and economics.
- Temperatures roughly stabilize when global CO_2 emissions reach net zero.

Step 2: Select an emissions pathway to the net zero target.

- Informed by the trade-offs of deviating from a straight-line emissions pathway.
- Different jurisdictions will choose different targets and pathways.

Step 3: Estimate CO_2 prices that, when combined with other policies, are consistent with the emissions pathway in the "near-term."

- Energy/economic models estimate CO_2 prices required to reduce emissions on a desired pathway.
- The near-term focus avoids estimates that are contingent on highly uncertain long-term projections.

Step 4: Periodically update Steps 1-3.

Table 1: Approach to setting specific CO_2 prices

Desired attributes	**Social cost of carbon** (SCC)	**Near term to net zero** (NT2NZ)
Balances benefits and costs	Can be designed to identify CO_2 prices that, in theory, perfectly balance the benefits and costs of emissions reductions*.	Designed to imperfectly balance benefits and costs with policymakers selecting an emissions pathway based on the best available science and economics.
Helps policymakers set specific CO_2 price levels	SCC estimates span virtually any conceivable stringency level for a CO_2 pricing policy due to uncertain scientific, economic and value-laden assumptions.	NT2NZ estimates focus on how carbon prices will reduce emissions in the near-term, avoiding the largest uncertainties of the SCC approach.
Aligned with policy objectives	Disconnected from real-world policy discussions that focus on annual targets and a range of policy measures.	Treats CO_2 prices as one part of a broader policy strategy to limit global warming below dangerous thresholds.
Transparency	Estimates influenced by assumptions that are often not well understood by policymakers (e.g. the value placed on future generations by discount rates).	Estimates hinge on near-term variables (e.g. fuel prices) which enable a better understanding of the rationales for selecting specific CO_2 prices.

**The US government's SCC estimates are not designed as "optimal" CO_2 prices that balance benefits and costs but rather as a wide range of benefits estimates to incorporate into regulatory impact analyses.*

Illustrative U.S. NT2NZ CO_2 prices

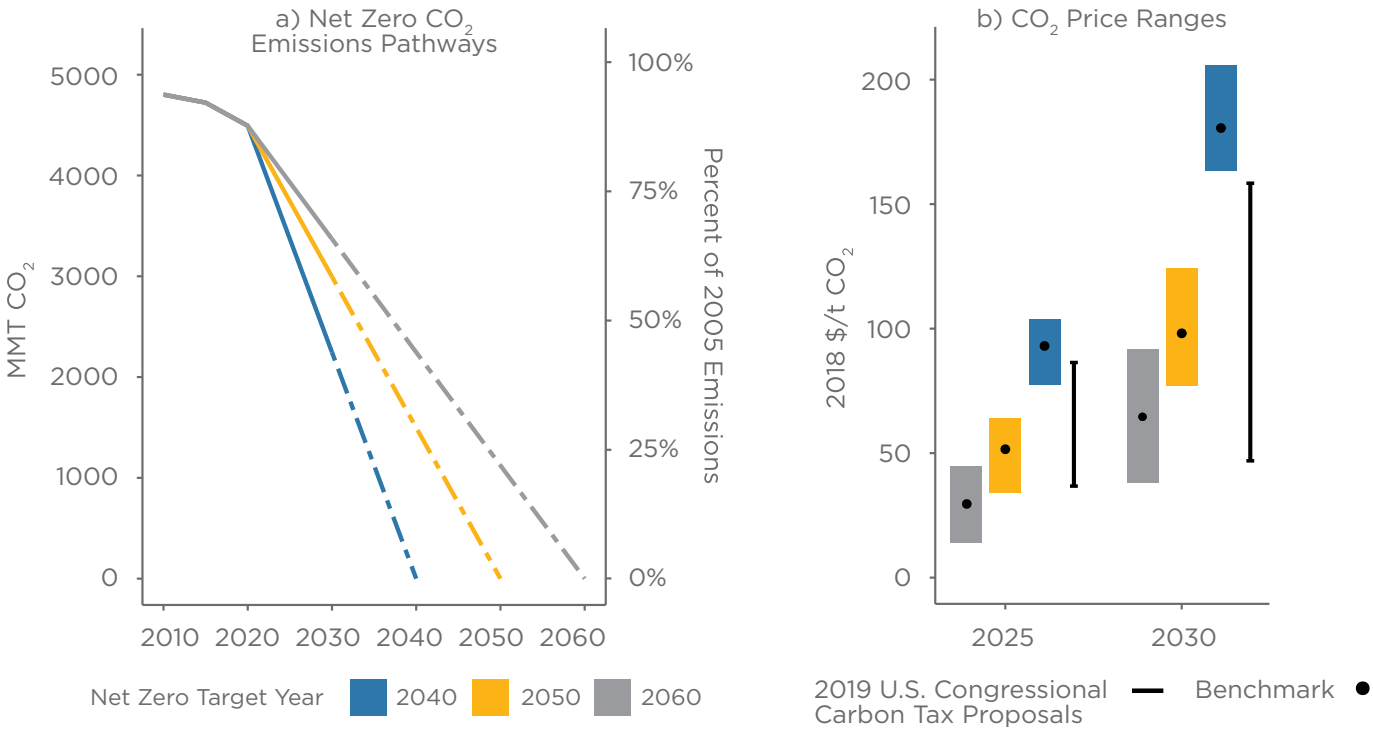
To illustrate our approach, we estimate NT2NZ CO_2 prices for the United States using the following methods:

- Assume three possible net zero targets for US CO_2 emissions of 2040, 2050, and 2060 with an illustrative straight-line pathway.
- The integrated assessment model GCAM-USA is used to estimate CO_2 prices over the next 10 years needed to follow that pathway. (The modeling is based on available information in 2019, and thus does not account for any lasting impacts of the COVID-19 crisis.)
- We assume that the CO_2 price is combined with complementary policies that address separate market failures: energy efficiency policies, air pollution regulations, and early-stage support for the deployment of low-carbon technologies.

Results

- The benchmark scenario finds NT2NZ CO_2 prices in 2025 of $32, $52 and $93 per metric ton (in 2018 dollars) for net zero targets in 2060, 2050 and 2040, respectively (black dots in Figure 1).
- NT2NZ CO_2 prices in 2030 are roughly twice as large.
- Sensitivity scenarios capture uncertainty in influential model inputs (colored ranges in Figure 1).
- The range of NT2NZ CO_2 prices, with a net zero by 2050 target, is largely consistent with the range of CO_2 prices in legislation proposed to the US Congress in 2019.

Figure 1: U.S. CO_2 Emissions Pathways to Net Zero and Associated NT2NZ CO_2 Prices



How do the illustrative CO_2 price estimates compare?

A 2019 report from the Intergovernmental Panel on Climate Change identified global CO_2 prices in 2030 that range from $135-$6,050 (in 2010 dollars per ton of CO_2) for consistency with 1.5º warming scenarios and $15-$220 for consistency with 2º warming scenarios. NT2NZ CO_2 prices will differ for numerous reasons:

- While studies often assume the CO_2 price is implemented by itself, we assume multiple policies are implemented to address multiple market barriers to emissions reductions.
- While in many studies, near-term CO_2 prices are contingent on assumptions about long-term technological progress, the actors within GCAM are influenced only by current market conditions.
- NT2NZ CO_2 prices differ by jurisdiction, and the US has a large amount of coal-fired electricity generation that can be replaced at a relatively low cost.