Testimony: Dan Esty, Climate Optimist

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Revenue Use Matters

Pricing carbon and using some or all of the proceeds to provide strategic, cost-effective subsidies could achieve deeper, faster emissions cuts than a conventional price alone — without increasing costs to industry or consumers

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We are not reducing greenhouse gas emissions quickly enough. Sure, renewable energy is proliferating, electric vehicles are starting to gain market share, and countless numbers of innovations and policies are being pursued all over the world to reduce the amount of carbon released to the atmosphere. Yet we remain far from the needed decarbonization trajectory. After remaining flat for three straight years, worldwide emissions ticked up another 2 percent in 2017 and are predicted to continue rising in 2018, according to a report by the Global Carbon Project. The U.S. Energy Information Administration has projected that world energy-related CO_2 emissions will rise 16 percent between 2015 and 2040. The UN Environment Program, in its latest "emissions gap" report, found that the existing national pledges under the Paris Agreement are only a third of what is needed by 2030 to meet internationally agreed temperature targets.

At the same time, climate science seems to paint a bleaker picture with every new study. In November, the U.S. Global Change Research Program released its part of the National Climate Assessment, finding that climate change, driven by human activities, is causing global and U.S. temperatures to rise, heat waves to become more frequent, the incidence of wildfires to increase, the frequency and intensity of heavy rainfall to grow, ocean temperatures to warm, and sea levels to rise. All of that is occurring with only about 1°C of warming. To have a two-thirds chance of limiting warming to 2°C at the end of the century, the Intergovernmental Panel on Climate Change has concluded that global greenhouse gas emissions must be net zero by the latter half of the century — and significant amounts of *negative* emissions will probably be needed thereafter. Humanity is not even close to being on pace to achieve that.

In the United States, the Trump administration has abdicated leadership on climate change and is attempting to roll back climate-related regulations. Many subnational actors — states, cities, businesses, universities — have stepped up to assert climate leadership, pledging to meet the commitments the United States made under the Paris Agreement. This leadership is most welcome, but achieving our Paris commitments, much less achieving true deep decarbonization, will be a heavy lift. There is a suite of existing policies in U.S. states (and around the world) to address climate change, but given the scale of reductions needed, we need to boost these policies significantly to increase their emission-reducing power.

There is a growing consensus that carbon pricing is one of the key policies needed to achieve meaningful emission reductions. Putting a price on carbon, whether via a tax or a cap-and-trade mechanism, sends an economic signal that the atmosphere is no longer a free dumping ground for greenhouse gas pollution, spurring emission reductions and clean

energy deployment. Some of the states leading the way on climate change, such as California and the northeastern and mid-Atlantic states in the Regional Greenhouse Gas Initiative, already have carbon pricing policies in place.

Carbon pricing alone, however, is unlikely to get us to the levels of emission reductions needed. Analyses of carbon prices around the world have found that most are far below estimates of the *social cost of carbon* (a measure of the cost of the damages caused by emitting one ton of carbon dioxide). There is a way, though, to make carbon pricing policies much more powerful drivers of reductions. Here's the key: how the revenues are used can matter just as much as the price itself.

The uses of carbon revenues are starting to get more attention. Disagreement over revenue use may have been the primary factor that torpedoed the Washington state carbon tax referendum in 2016. Generally speaking, there are three broad categories of revenue use that are being implemented or at least discussed. The first is to support activities that bear some relation to climate change, such as achieving additional emission reductions and adapting to climate impacts, or that mitigate negative effects of the climate policy, such as offsetting the regressive effects of a carbon price on the poor. Another approach is to promote economic efficiency through a revenue-neutral tax swap that would replace economically undesirable taxes, such as business or payroll taxes. The third route is to provide a "dividend" to all citizens, whether based on the premise that the atmosphere belongs equally to every individual or based on the political calculus of building public support.

While all of these uses of revenue could be socially beneficial, and each has its supporters, there is a strong argument to be made for pursuing the first approach and devoting some meaningful portion of revenues to achieving additional emission reductions. First, as just noted, most carbon pricing policies are not that robust; political constraints create a significant hurdle to implementing carbon pricing policies at levels sufficient to achieve the reductions required. Second, there are some needed reductions that a carbon price will be unable to reach (e.g., some energy efficiency measures), requiring other types of solutions that carbon revenues could help fund. Third, to achieve the global targets of keeping warming well below 2°C (and below 1.5°C if possible), the reduction trajectory has to be so steep that it seems imprudent to give away resources that could be used to help. Finally, even if a cap or tax could get enacted that could achieve some jurisdictions' share of the 1.5°C or 2°C targets, the fact that we are already experiencing significant adverse impacts at about 1°C of warming suggests that those targets do not necessarily represent what is "safe" — just what would provide a reasonable chance of avoiding the worst impacts of climate change. In addition, emissions in other jurisdictions, especially in the developing world, will not be declining on a trajectory to meet global climate targets, so jurisdictions leading the way will have to go above and beyond.

Using carbon revenues to achieve additional reductions likely would have strong public support. Several polls over the past few years have shown that the preferred use of carbon revenues is to support the development of clean energy. For instance, a 2016 Yale poll found that 81 percent of registered voters support using carbon tax revenues to support the development of clean energy, more than for any other use; the least popular uses of tax revenues were reducing corporate taxes (26 percent), reducing payroll taxes (46 percent), and returning the money as dividends to households (48 percent). Similarly, a 2014 National Surveys on Energy and Environment poll found that a carbon tax with revenues used to fund research and development for renewable energy programs received 60 percent support, including support from majorities of Democrats, Republicans, and independents — and greater support than rebate checks or deficit reduction.

The RGGI states and California already direct most of the revenues from emission allowance auctions toward climate-related purposes, investing both in reducing emissions (through renewable energy and energy efficiency) and in moderating the economic effects of carbon prices on their citizens. At present, the RGGI states and California simply allocate the proceeds from emission allowance auctions into particular programs, many of which seem to be chosen in a rather piecemeal fashion. There does not seem to be a disciplined effort to tailor the spending of auction revenues in order to achieve both the biggest emission-reducing bang for the buck and reductions beyond what their caps alone would achieve. We need our leading states to do even better.

A price-and-subsidy system is one way to do better. This approach not only puts a price on CO_2 and possibly other greenhouse gas emissions to create a financial disincentive to emit those gases, but also uses the revenues generated to provide targeted subsidies that cost-effectively encourage investment in additional reductions of emissions — reductions well beyond those that would have been achieved by the carbon tax or cap itself.

The basics of the price-and-subsidy approach are pretty straightforward. The first step, clearly, is having emitters pay for their emissions, whether via a carbon tax or allowance auctions in a cap-and-trade system. Some portion of the proceeds are then pooled in a fund and used to subsidize additional reductions. If revenues are to be directed toward achieving additional cuts, it makes sense to do so cost-effectively, which can be achieved by utilizing mechanisms, such as reverse auctions, that "buy" additional reductions, starting with the cheapest beyond what the price signal or cap alone would achieve. It also makes sense to limit subsidies to the difference between the carbon price and the abatement cost of the reduction, to avoid offering excessive subsidies that duplicate the incentive of the price. In addition, reductions should be paid for only as they occur, rather than offering up-front, multi-year payments to projects. Combined, these cost-effective features maximize the amount of additional reductions that can be achieved with the pooled revenues.

Let's make this even clearer with a simple example. Imagine a jurisdiction enacts a tax of $20 per ton of CO_2. Any entity that can reduce emissions for less than that cost will do so, to avoid having to pay the tax. That is the effect of the price signal. If a reduction costs $21 a ton, however, the emitter's incentive is to pay the tax and save a dollar. If, instead, that emitter is given a subsidy of $1 per ton, and emitters with $22-per-ton reductions are given subsidies of $2 per ton, then those reductions also would get made. The cost to emitters would be the same — $20 per ton — but instead of paying it as a tax, they would spend it, in concert with the subsidy, to achieve reductions. (Giving these emitters subsidies of, say, $5 a ton would be wasteful.) Any emitter or project developer who wants to could submit a bid for a way of achieving reductions. The subsidies would go first to the cheapest reductions beyond the price signal, working up the reduction cost curve until all of the designated carbon revenues have been spent.

Over time, as the carbon tax rises, some activities that had received subsidies would no longer qualify. For instance, the emitters with the $22-per-ton reductions would no longer receive subsidies once the tax rises higher than that level, as the price signal alone should then drive those reductions. The risk of receiving smaller or no subsidies in later years as the tax level rises — and therefore having to bear more of the reduction costs themselves — should give emitters incentive to use the subsidies to make their reductions early. Activities performed earlier to achieve reductions mean less greenhouse gases added to the atmosphere.

None of these policy mechanisms are novel in and of themselves. Carbon prices are being implemented in many jurisdictions. Reverse auctions are already used to purchase renewable energy, energy efficiency, and emissions reductions. Subsidies to support clean energy, energy efficiency, and other ways of reducing greenhouse gas emissions are also common. What the price-and-subsidy approach does is to link up these elements into a single, systematic, turbocharged whole. Carbon prices send out the signal to reduce emissions, and reverse auctions for subsidies amplify that signal, increasing the incentive to abate and, therefore, the scale and rate of emission reductions.

Some simplified modeling — such as using a linear marginal abatement cost curve — can make clear the potential power of using carbon revenues to accelerate reductions under a price-and-subsidy approach. First, let's assume that all such revenues are directed toward achieving additional reductions. Modeling suggests that a price-and-subsidy approach could boost a conventional carbon pricing policy that would achieve a 20 percent reduction to one that theoretically could achieve a 60 percent reduction — without increasing costs for emitters or consumers. Relatively stringent reduction targets could become even more ambitious: a 40 percent reduction could theoretically become an 80 percent reduction, a 60 percent reduction could become a 92 percent reduction, and so on. These numbers, of course, are purely theoretical. Reality is not a simplified model. Technology, reliability, or other constraints may limit the number of additional reductions that are achievable during a given period. Some projects take time to get up and running. Still, the potential of the approach is clear.

Few jurisdictions are likely to devote all the revenues generated by a carbon tax or cap-and-trade program to achieving additional reductions, as there are other political, social, and climate realities that could benefit from carbon revenues. Some percentage probably should go to offset the regressive effects of the carbon price on the poor. Some could go to help coal communities transition. Some may have to go to tax relief, dividends, or other areas needed to garner political support. Some revenues probably should be used to promote adaptation and resilience to climate impacts. The need for urgent climate action, however, suggests that a meaningful portion of the revenues should go toward cost-effectively achieving additional near-term reductions.

Using even a relatively small percentage of the revenues could give a significant boost to reductions. Again, simplified modeling shows the potential power of this approach. For example, given a price that would achieve a 20 percent reduction alone, it is theoretically possible to boost reductions to 27 percent using only a tenth of the revenues, to 35 percent using a quarter of the revenues, or to 45 percent using half of the revenues.

Jurisdictions implementing a price-and-subsidy approach will have to determine which types of additional reductions qualify for the reverse auction subsidies. The price-and-subsidy approach presented here works best when the additional reductions are ones already subject to the price, which enables the subsidy to provide emitters with enough of an incentive to take further action. (Carbon revenues could, of course, also be used to support reductions of emissions not covered by the price, but that is outside the scope of this proposal.)

Price-and-subsidy could be technology-neutral, designed to simply accelerate the next-cheapest reductions available beyond what the cap or tax would achieve. Constraints could also be implemented to support additional objectives. For instance, to address environmental justice concerns, priority could be given to bids to achieve additional reductions in low-income communities or to achieve reductions in local air pollution as well as in greenhouse gases. In addition, there should probably be a constraint to prevent using revenues in ways that achieve cheap, near-term reductions but that lock in technologies or infrastructure incompatible with deep decarbonization pathways.

While price-and-subsidy can work with either a carbon tax or a cap-and-trade system, there is an extra step required for the latter. To ensure the reductions subsidized by the reverse auction are additional to what the cap alone would achieve, an allowance must be retired or otherwise removed from the system for each subsidized ton of reduction. Otherwise, excess allowances could be banked, or other emitters could use them instead of making reductions (which means the subsidized reductions would end up displacing reductions required by the cap instead of being additional). Assuming the universe of bidders for allowances is the same as the universe of bidders for subsidies, a jurisdiction could even have the allowance auction and the reverse auction rely on the same bids and only sell the allowances that are actually needed. Alternatively, and more simply, it probably would be sufficient to reduce the number of allowances sold in subsequent auctions to reflect the number of reductions that, to date, have been achieved by means of subsidies. Reducing allowance sales to account for prior subsidized reductions would allow a jurisdiction to ratchet its cap down further — and then continue to use allowance revenues to drive even more reductions.

The core idea is to accelerate reductions and to do so cost-effectively. A price-and-subsidy approach would enable governments to use carbon revenues to achieve deeper, faster emission cuts without increasing costs to emitters or consumers. Looked at another way, governments could achieve higher levels of reductions far more cheaply with a price-and-subsidy approach than with a conventional price alone. Even if it utilizes only a portion of revenues, a price-and-subsidy system can help jurisdictions dramatically accelerate their drive toward a zero-carbon future.

Given that the U.S. government is likely to remain actively hostile to efforts to fight climate change for the foreseeable future, leading states trying to ensure the country meets its Paris commitments — and goes even further to achieve deep decarbonization — could use a price-and-subsidy approach to take climate leadership. They should combine carbon prices with cost-effective subsidies to spur much larger, much faster emission reductions. True climate leadership should include using the money collected from a tax or an allowance system to get onto an emissions-reduction trajectory that is more commensurate with the urgency of the climate challenge. Revenue use matters. **TEF**