FISCAL AND REGULATORY APPROACHES TO LIMITING GREENHOUSE-GAS EMISSIONS

Edward A. Parson, University of Michigan

Notes for Key Elements in Breaking the Global Climate Change Deadlock
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I will make a few observations about fiscal and regulatory approaches to reducing emissions of greenhouse gases. A few of these are obvious – which is not to say that they are necessarily easy, as there may be substantial political difficulties in putting into practice even obvious insights. I will then proceed to aspects of reducing emissions that are increasingly non-obvious, uncertain, problematic, or contested.

As background to the discussion of specific policies, it is crucial to note that the scale of the required changes is huge. Trajectories of global greenhouse gas emissions that avoid the worst risks of climate change – for example, by stabilizing the atmospheric concentration of total anthropogenic greenhouses around 450 parts per million, or by limiting global-average warming to approximately 2 degrees Celsius – require large reductions in emissions, perhaps by as much as 50 to 80 percent below current levels, by the middle of the century. This amounts to a fundamental transformation of the world's energy system, in a direction that it is most unlikely to go spontaneously through private market decisions. Providing the guidance and incentives to promote such a transition will require policies of a scale and duration that we rarely see, and have never yet seen in the management of any environmental issue.

An effective emissions mitigation strategy requires three components: (1) economy-wide measures that make emissions costly, through such approaches as emissions taxes, cap-and-trade systems, or hybrids of these two; (2) targeted measures that address high-priority sectors; and (3) public support for research, development, and demonstration projects in climate-safe energy technologies. Of these three elements, the first and third can be justified by classic market-failure arguments. The need for the second element is more contested – in that those with greatest confidence in the ability of incentives propagated through energy prices to motivate optimal responses in all consumer and producer decisions judge them unnecessary – but I find the case for them compelling. Note that the specific design details for each of these elements, as well as the relative reliance on each element in an integrated mitigation strategy, may vary. Because there is another session dedicated to measures to promote research and development, I will make a few observations just about the first two elements.

The first element: economy-wide measures to price emissions.

These measures are the essential core of a serious mitigation strategy. This is not to say that they can be sufficient as a complete mitigation strategy, but that they are necessary. The key design decisions in constructing such measures include their form (taxes, cap-and-trade, or hybrids such as a cap-and-trade system with upper and/or lower price

limits); their scope and point of application in the economy (e.g., upstream at the point where a unit of emitting energy enters the economy, or downstream at the point of actual emissions); and their stringency, both initially, and as subsequently adapted over time.

In choosing a specific design for these economy-wide, market-based measures, a few criteria appear evident. They should deploy uniform and sustained incentives, strong enough to achieve the required reductions, as broadly as possible across the economy. They should commence at a level strong enough to immediately seize attention and re-orient investment and R&D decision-making, without forcing wholesale premature scrapping of existing capital. They should be neutral over technologies that promise to contribute to emissions reductions. And they should be as simple and transparent as possible, in order to reduce administrative burden and opportunities for gaming; and enhance opportunities for assessing effectiveness, accountability, and learning.

Examining measures in terms of these criteria would tend to favor emissions taxes over cap-and-trade systems, applied upstream for maximal coverage and simplicity, starting at an initial level of perhaps $20 to $30 per tonne of CO_2-equivalent emissions, subsequently adjusted with adequate notice and lead-times. This is not, however, how existing programs and prominent proposals have approached the problem. With a few exceptions, current programs and proposals are opting for cap-and-trade systems, applied downstream. Because of the extreme heterogeneity of sources – perhaps a few thousand large ones and millions of small ones in any economy – this approach inevitably requires that the coverage of the system be limited, including the largest emissions sources. Initial emissions caps under such systems have been extremely gentle, in many cases not binding at all, resulting in marginal cost levels of as little as a few dollars per tonne.

Existing programs have taken this approach for obvious and understandable political-economy reasons. But such an approach carries risks for the long-term effectiveness of the system that are quite serious, including limited coverage (reducing cost-effectiveness), administrative complexity, volatility of permit prices (which can risk impairing the ability to provide the clear, sustained incentives needed to motivate investments), and providing many opportunities to game the system. A particular concern pertains to the ambiguous interests in cap-and-trade systems of the financial-market actors who might trade, make markets, and construct derivative instruments in emissions permits. These actors are among the most enthusiastic proponents of these programs, and their support may be an important factor in getting any GHG mitigation measure enacted. But in subsequent operation of the systems, their support may come at the cost of significant transaction costs or rent-seeking that obstructs appropriate adaptation of the system. These concerns are serious enough that they may suggest the need for serious re-consideration of cap-and-trade systems in favor of emission taxes, despite the strong political momentum now favoring the former.

The second element: targeted sectoral measures

In addition to market-based, economy-wide measures to put a price on emissions, more narrowly targeted measures will in all likelihood be necessary in specific high-priority

sectors. These can be necessary in several types of areas, including areas with strong government influence over emissions-relevant outcomes such as planning and zoning, infrastructure development, and major publicly supported energy investments. But the most important of these measures will be regulatory initiatives in sectors that have high payoffs but in which we do not expect big enough or fast enough adjustments in response to the economy-wide incentives propagated through energy markets. These are most typically products or equipment whose initial construction locks in a long-lived tail of environmental burden, particularly those purchased by consumers rather than businesses. Prominent examples are buildings and vehicles, both strong cases for performance-standard regulations, ideally of a form that allows significant flexibility in determining the specific distribution of efforts, perhaps in a market-based form.

A particularly sharp and difficult example is provided by a well-known small household appliance, the "Dustbuster" made by Black and Decker. A colleague has informed me that the wall-plug unit on the Dustbuster uses an analog transformer, whose decades-old technology draws 24 Watts at all times – even when the actual vacuum unit is fully charged, or not plugged into the base. The cost of replacing the transformer with modern digital technology, which would reduce the load even during peak charging and eliminate it at all other times, is about 80 cents. The question that arises is: what form of policy or regulation would we want to induce or require the Black and Decker Company to fix this? You would have to be an extreme believer in the smooth propagation of optimal incentives through markets to believe that policy-generated incentives operating through energy prices would motivate consumers to demand the change and for Black and Decker to provide it. On the other hand, who would propose drafting a performance regulation for Dustbusters? It is selected as an extreme example of a seemingly desirable and small technical change that is not being made, but there are tens or hundreds or thousands of other products that one would have to regulate, and the set of products requiring this scrutiny changes every year. The solution to this problem is not obvious, and although I am, in general, highly skeptical of offsets, cases like this might call for them.

Moving up to the level of designing a complete mitigation strategy, the two biggest challenges appear to be integration and adaptation. For overall effectiveness, national mitigation strategies must be integrated into a system of global cooperation, probably by working simultaneously from the top down and the bottom up. The integration of national approaches should aim to achieve an efficient (i.e., cost-minimizing) allocation of international burdens, an equitable distribution of total burdens, and should avoid distorting competitiveness and trade. Nations who get ahead of their trading partners can of course avoid competitiveness effects by imposing trade measures at their borders to neutralize their economy-wide policies. But such trade measures are dynamite, and would have to be strongly disciplined to avoid completely undermining the world trading system.

In addition, processes are required to adapt measures adopted over time, linking near-term actions to long-term goals. Such an adaptive approach is crucial, because on the one hand, the initial round of actions will not solve the problem, but on the other, we do not know exactly where we need to go to solve the problem – either in terms of the precise

path or the ultimate goal for emissions, technologies adopted to limit them, or policies adopted to motivate the technologies. Rather, we must monitor, assess, learn, and adapt as we go, constructing early steps to promote learning and establishing processes and structures to apply what is learned to guide future decisions. Despite the extreme attention now being paid to climate change and energy, and the many proposals for significant early actions, this problem has not been solved, or even subject to significant progress.

To close, what would I do if I were a philosopher-king? First, I would take advantage of the three-part charge (what leaders should do now, what they should ask their Ministers to negotiate, and what new institutions they should create), to do immediately what is obvious and leave all the hardest questions to Ministerial negotiation or new institutions.

I would instruct my head of government to do three things immediately. First, enact an emissions tax of $30 per tonne of CO_2-equivalent emissions, upstream (at point of production or import) on energy-related CO_2 emissions and – as feasible—downstream on point-source emissions of other greenhouse gases. This tax would be rebated on energy exports and injected into appropriately monitored and permitted, long-term sequestration sites. The tax should be brought into effect within two years, and the revenues initially used entirely to reduce other taxes. The tax should have a planned schedule of future increase at 5% (real) per year, subject to future adjustments which could be either up or down. The incremental revenues from the annual increase in the tax would not be committed at the outset, in order to make them available for technology investments, at home and abroad.

Second, adopt national regulations for efficiency of buildings, vehicles, and major appliances. The level of these should be calculated to be cost-effective on a life-cycle basis, consistent with a specified scenario of future energy prices plus the planned trajectory of carbon-tax increases. Since the carbon tax would be increasing each year, new models introduced each successive year would have a slightly higher performance standard. These standards should be defined at the level of each manufacturer's product line, with exchange between firms allowed, to allow manufacturers flexibility in how they choose to allocate efficiency improvements across their product line.

The third immediate initiative would be to announce a set of expedited approval procedures for assessment, issuing permits, and plant sites of new climate-safe energy technologies, to help smooth deployment of the required buildup.

There would also be three tasks delegated to Ministers to negotiate with their counterparts from other nations.

1. Convene a process, with both political and analytic input, to develop metrics to quantify and compare the stringency of mitigation efforts across nations, to provide objectively based information likely to be needed in future negotiations.

2. Drawing on the results of this metrics effort, prepare a proposal to monetize the equivalent mitigation stringency and other effects of national or regional cap-and-trade systems, in preparation for a negotiation to gradually replace cap-and-trade systems by emission taxes. This effort should draw on the analogy and inspiration of the early GATT process, in which nations committed to replacing quantitative trade restrictions (quotas and prohibitions) by more transparent tariffs.
3. Third, Ministers should work together to develop a system to manage and offset the competitive effects of emission taxes or cap-and-trade systems through a system of transparent and legitimate trade-related measures. Two principles should guide this negotiation that will be crucial to making any resultant proposals legitimate and allowing the possibility of finding mutually advantageous resolutions. First, the system of trade measures should be negotiated with explicit consideration of the development status of particular trading partners: there should be no expectation of or commitment to a one-size-fits-all approach. Second, the negotiation of trade measures should be conducted in conjunction with the negotiation of a set of technology partnerships in low and non-emitting energy technologies between industrialized and developing countries.

These initial Ministerial negotiations will naturally lead to the subsequent tasks for which new institutions are likely to be needed. International institutions and processes will be required to extend and sustain the analysis and comparison of national mitigation strategies. They will be required to convene negotiations over the conversion of cap-and-trade systems into harmonized emissions taxes. They will also be required to analyze, manage, and adapt over time to the emerging regime that links national and regional mitigation efforts (increasingly implemented as emissions taxes rather than cap-and-trade systems), trade measures to manage resultant competitive burdens in a transparent and legitimate manner, and R&D and technology partnerships.

Closing Comments (at end of discussion)

I will address three points: the role of broad measures that put a price on emissions; the risks and potential benefits of trade-related measures such as border tax adjustments; and the costs of delaying.

First, the role of broad measures that put a price on emissions. In my view these are necessary for an effective emissions-limitation strategy, but they are not sufficient. In this sense, I agree with Olivier that the goal is a coordinated multilateral tax, and that such a system may begin with a relatively small group of participating nations (provided the set of participants expands quickly enough thereafter), although in my view it is not energy that should be the basis for the tax, but emissions. (After all, in my view the purpose of this tax is only secondarily to raise revenues to fund required global initiatives – its first purpose is to create incentives to reduce emissions). The reason of such measures is to squeeze uniformly across the entire economy. Even at the relatively modest level of $30 per tonne CO_2 that I propose as the start, there are many new

investments and technologies that are likely to become attractive business propositions immediately: a great number and diversity of efficiency-enhancing investments across the energy conversion and usage sectors of the economy, plus substantial expansion in current niches for renewables (i.e., those niches that are viable without the much larger, highly targeted subsidies being directed at them in many jurisdictions) and, crucially, some carbon-capture applications. As the level rises over time (as it must) and as R&D proceeds, the profitable scope for deployment of all varieties of climate-safe technologies will continue to expand. Of course, you could imagine other alternative policies that would promote the same investments in all the technologies you can think of to promote: but the crucial contribution of these price-creating measures (other than their simplicity, uniformity, and transparency) is that they create incentives for the vast host of other innovations that no one is likely to think of in advance. Rather than picking a specific set of technologies and gambling that they are the right ones and we can design policies to promote them, these measures apply to the residual – the whole economy, including all the things you did not think of in advance.

The disposition of the revenues that come from these policies – from a tax, or from the sale of emissions permits – must be thought of as part of the political bargaining involved in attempting to get the policies enacted. If you are primarily concerned with domestic politics in the nations considering moving first, then the most important place to deploy these revenues is domestically, through reduction of other taxes or expenditure on other programs to reduce the burdens on the sectors and regions bearing the largest direct cost from the tax or permit policies. If you are primarily concerned with either motivating a global bargain, or finding a cost-minimizing global distribution of mitigation efforts (note that these are distinct reasons), then the most important place to deploy these revenues is internationally, to fund technology, demonstration projects, and new investments in rapidly growing developing countries. Clearly some balance of these – and in all likelihood, expenditures beyond what can be raised from the mitigation policies themselves – will be necessary. I differ with those, however, who argue (usually in pursuit of a global cost-minimizing solution) that technology expenditures in developing countries can substitute for mitigation efforts in industrialized countries. The need to motivate broad participation in a global bargain requires a credible indication of serious efforts on the part of the presently rich industrialized countries, and the currency of such credible efforts cannot just be monetary expenditure: it must also be action to reduce emissions, even if these do not appear to be the cheapest opportunities in the world to reduce emissions at present.

Second, trade-related measures such as border tax adjustments. These are often attacked as illegal, illegitimate, and excessively belligerent, and consequently antithetical to the pursuit of a cooperative global bargain. While these charges are not wholly without merit, I disagree with the aggregate assessment and believe that these measures have a substantial and constructive role to play in pursuit of a global mitigation strategy. First, in their primary role of offsetting some of the competitive disadvantage imposed by economy-wide mitigation measures, they are one component to be considered of the political bargaining necessary to enact mitigation policies in countries considering moving early. Second, their secondary role is to bring other countries – not just

developing countries, but also (perhaps most importantly) industrialized countries that are not moving first, to the bargaining table. In this respect, they must be partly understood as a threat—a stick that is deployed in careful balance with various positive incentives; and as a carrot, to get nations seriously engaged in working out a cooperative mitigation regime. And like all threats, as we know from the path-breaking work of Thomas Schelling forty years ago, they are most useful if they never have to be acted upon. In this respect, the best analogy is to the trade restrictions that are included in Article 4 of the Montreal Protocol on the Ozone Layer. When nations first negotiated restrictions on the core ozone-depleting chemicals in 1987, they included prohibitions on the import of controlled chemicals or products containing them, from non-parties to the treaty. But while these measures represented non-trivial incentives, a far more onerous set of trade measures were also considered – restrictions in trade of products "made with, but not containing" the controlled chemicals. While the first category of prohibitions potentially included packaged aerosol products, air conditioning and refrigeration equipment (if it was shipped with its charge of working fluid), and insulating foams, this second category was vastly broader, including essentially every product that included electronic chips or boards. While no one was of the opinion that such a sweeping trade restriction could be implemented, parties to the Protocol kept a working group studying its feasibility for several years, periodically reporting back to the Parties – with the effect of providing a powerful incentive for any wavering countries to join the Protocol in order to avoid even the risk of coming under such a Draconian measure. In other words, even studying such measures represented a threat, which was effective in motivating virtually all nations to join the Protocol, and which consequently did not have to be deployed. The analogy to trade measures in a greenhouse-gas regime should be clear. Even if such measures should turn out to be unworkable, it is important not to prematurely renounce even considering them – because if, God help us, we must sustain a regime in which some major economies are limiting emissions and others are not, they may be needed; and because, even in a more cooperative world, the possibility of retaining the prospect of using them *in extremis* can be very helpful, along with the carrots, in bringing nations on board.

Finally, some thoughts on the cost of delaying action to reduce emissions. Current estimates of the costs of stabilizing at various levels assume serious efforts to slow growth starting essentially immediately, although the large reductions start to be realized later. Given the current political climate on the issue, it is entirely likely that there will be delays in starting serious efforts – possibly even delays of several decades. If we delay, future changes must be more rapid and more extreme to attain the same limits on emissions or concentrations. Under most assumptions, this means costs are higher, perhaps much higher. (Of course, there could be some huge breakthrough in say, cheap high-efficiency photovoltaic cells, that makes it suddenly cheap and easy to cut emissions in the future, neglecting problems of capital turnover, scale-up, and the like.) Delaying has no particular implications for the distribution of the costs of mitigation, however – that depends on the nature of efforts taken up after the delay. (Delay does greatly increase the costs from climate impacts and associated adaptation efforts, of course.) Cost estimates are highly uncertain, however. Current estimates of the cost of stabilizing at 450 ppm, for example, differ among models by a factor of 5 to 10: a total cost of 1 or

2% GDP loss, or 10 to 20% GDP loss. These differences represent real limitations to current knowledge. They turn on different assumptions about the ease of substituting away from emissions-intensive energy in the economy, and the responsiveness of technological innovation in climate-safe energy technologies to price and policy incentives. But because we cannot do much to reduce these uncertainties based on the historical data we have available, there is an additional factor that favors early action: we need to take real, early steps to reduce emissions in order to learn more about how we want to achieve the required larger cuts in the future and about how much they will cost. It is entirely plausible that if we wait 10 or 20 years more to start serious investment in mitigation efforts, that we will face the same choices as we do today, with fewer new options on the table (developing these will take money and effort, which requires incentives), and with not much more information available about what it will cost. If signs of serious climate change and impacts continue to mount over the period of this delay, we can expect increasingly strident calls for the various "hail-Mary" technological options that are already being proposed as reasons to wait – large-scale recapture of CO_2 from the ambient air, or geo-engineering.