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COMMENTARY

Interim targets and the climate treaty regime

Brian C. O'Neill[1,2]*, Michael Oppenheimer[3], Annie Petsonk[4,5]

[1] *International Institute for Applied Systems Analysis, A-2361 Laxenburg, Austria*
[2] *Watson Institute for International Studies, Brown University, RI 02912, USA*
[3] *Woodrow Wilson School for Public and International Affairs and the Department of Geosciences, Princeton University, Princeton, NJ 08544, USA*
[4] *Environmental Defense, Washington, DC 20009, USA*
[5] *George Washington University Law School, Washington, DC, USA*

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Abstract

We propose that international climate change policy would be strengthened by the development and adoption of targets for atmospheric concentrations of greenhouse gases 25–50 years in the future in addition to near- and long-term targets. 'Interim concentration targets', which could be accommodated under the current Convention/Protocol framework, would provide several advantages over the current focus on either the short term (e.g. Kyoto Protocol) or the long term (e.g. ultimate stabilization targets). Interim targets would help constrain rates of climate change (which are not sufficiently addressed by short- or long-term targets, even when paired together). They would also provide a means for keeping open the option of achieving a range of long-term goals while uncertainty (and political disagreement) over the appropriate goal is resolved. We substantiate a number of rationales for such an approach, discuss the use of interim targets in other contexts, and illustrate how such targets for climate change policy might be set.

Keywords: Climate change; Stabilization; Targets

Introduction

Climate change policies are often discussed from the perspective of one of two very different time-scales: long-term objectives a century or more in the future, or near-term targets for the coming decade or two. For example, Article 2 of the UN Framework Convention on Climate Change, which describes its 'ultimate objective', has motivated many analyses of possible 100- to 200-year goals aimed at avoiding dangerous climate impacts, while near-term emissions targets such as those of the Kyoto Protocol currently provide the main focus for international policy formulation.

* Corresponding author. Tel.: +43-2236-807-0; fax: +43-2236-71-313
E-mail address: oneill@iiasa.ac.at

The emphasis to date on either the long term or the short term has been logical and necessary. Several of the greenhouse gases (GHGs), particularly carbon dioxide, have atmospheric life times on the order of a century or more, and other aspects of the climate system respond over the course of decades, centuries, and even millennia. Climate policy therefore demands a long-term perspective. At the same time, the international regime is premised on the idea that the design and implementation of policies consistent with potential long-term objectives ought to begin now.

But between the long term and the short term lies a yawning gap that cannot be effectively bridged by current policy perspectives. A key problem is that specifying only a long-term target – unless it is relatively stringent – provides little guidance on the short-term steps necessary to achieve it (Oppenheimer and Petsonk, 2003, 2005) because a wide range of emissions and concentration pathways may do so (O'Neill and Oppenheimer, 2004). This loose connection between the short and long term has serious shortcomings. First, because it provides no clear signal about where emissions should be headed over the next few decades, it precludes the kind of policy certainty over the timescale of multiple decades necessary to support investments in long-lived capital. It is precisely these types of investments that would be required now to make possible the additional emissions reductions needed in the medium term.

Second, a pair of short- and long-term targets by itself cannot constrain the rate of climate change in the intervening period. High rates of change over several decades could trigger dangerous consequences (O'Neill and Oppenheimer, 2004), especially for ecosystems, and would make adaptation more difficult. A short-term target by itself cannot guard against this possibility because it covers only a limited period of time. A long-term goal can limit maximum levels of climate change, but since it can be reached via many possible emission and concentration pathways, the risk of a high rate of change during the intervening years would remain.

Finally, a long-term target is particularly vulnerable to uncertainty: the longer the time horizon, the more scientific uncertainty accumulates. As a result, the prospects for soon reaching a binding political agreement on a single long-term target are dim. While some Parties to the Framework Convention support particular long-term goals, with the EU's 2°C target for global average temperature (above pre-industrial) perhaps most prominent, it will take widespread adoption of such a target for it to substantially affect global emissions and therefore climate change. Yet, deferring action until agreement is achieved risks committing the world to potentially dangerous climate change.

As nations, following the 2005 UN Climate Change Conference in Montreal, move forward under both the UNFCCC and the Kyoto Protocol to consider future emission reductions in the context of assessments of the science, we suggest that international climate policy would greatly benefit from the development and adoption of interim targets for atmospheric concentrations 25–50 years in the future, in addition to near- and short-term targets. Interim targets, which could be accommodated within the Convention/Protocol framework, would bridge the gap between the short term and the long term in three ways.

First, because it directs emissions and concentration pathways over the next few decades much more clearly than any particular pair of short- and long-term targets, an interim concentration target can more effectively address the risk of dangerously high rates of climate change.

Second, the process of developing, adopting and re-evaluating interim targets would better inform near-term policy decisions and provide important signals to decision makers who have multi-decade planning horizons, such as those addressing investments in emissions-producing infrastructure and capital stock. Of course, targets alone are not enough: only if economic agents believe in the ability of governments to maintain targets for limiting GHG emissions will emitters' expectations support the kind of multi-decade investment decisions required to stabilize concentrations. Carefully selected interim targets, with regular reviews of progress and of the targets themselves, could play a vital role in anchoring those expectations. Industry leaders have begun asking for precisely this kind of direction, with some calling on governments to announce, well before 2012, 'quantified objectives' to 2020, 2030, 2040 and 2050 (Executive Forum on Climate Change, 2005).

Third, an interim target could be designed to ensure that a range of century-scale objectives remains feasible while uncertainties are narrowed (O'Neill and Oppenheimer, 2002). A strategy of keeping long-term options open may broaden the grounds for agreement in climate policy discussions. Parties that may not be able to agree now to a common long-term target might be able to agree to the lesser objective that the option to achieve such a target should be preserved, in case it should turn out to be necessary. An interim target would be a useful means of implementing such a consensus.

Interim targets in other frameworks

Examples of interim environmental guideposts and the usefulness of institutions for developing them can be found in the 1987 Montreal Protocol on the Ozone Layer, which mandated a reduction in chlorofluorocarbon (CFC) emissions of 50% by 2000. While the numerical value was a political compromise, reducing emissions in order to stabilize CFC concentrations was recognized as an environmental necessity. It was understood that revision would be required as new information became available on the appropriate long-term objective with respect to decreasing emissions. In addition, under both the Montreal Protocol and the UN Economic Commission for Europe's agreement on Long-Range Transboundary Air Pollution (LRTAP), scientific and technical bodies for assessment of progress toward longer-term goals were established to inform decisions on near-term emissions reductions.

Examples of interim targets can also be observed in social policy, where, for example, policy-makers may, in nations expecting rapid population growth, set targets for teacher training and school construction (see Bruns et al., 2003), or, in nations with aging populations, set targets for delivering social services to the elderly (see Snow et al., 2005).

Interim targets are also visible in economic policy. For example, to maintain progress toward long-term economic growth goals, and because the long-term effect of short-term policies is not certain, central banks set medium-run targets for variables such as money aggregates, interest rates and inflation (Blanchard, 2000; European Central Bank, 2004; Federal Reserve Board, 2004). The credibility of the central banks is a necessary, although not exclusive, condition: inflation expectations are kept in check only when economic agents believe that the banks will maintain their monetary policy commitments going forward (European Central Bank, 2004).

The preceding examples provide admittedly imperfect parallels to addressing climate change. Some involve substantially shorter timescales. Some engage national rather than international decision processes. Nonetheless, the ozone and air pollution examples show how successful international environmental agreements recognize the importance of policy review processes to cross-check near-term actions with long-term goals (Victor et al., 1998), and monetary and social policy targets provide examples of widely used risk management approaches to high profile public policy issues (see Yohe, 2006).

Surprisingly, interim targets have received little attention in climate policy circles until recently, when several countries and US states adopted or proposed interim domestic emissions targets.[1] The EU has committed to examine interim targets that would be consistent with a long-term goal of limiting global average temperature rise to 2°C (EU Environment Council, 2004). Interim targets have also been discussed in terms of global emissions (Corfee-Morlot and Höhne, 2003; Pacala and Socolow, 2004) or radiative forcing (Hansen and Sato, 2004) goals for 20–50 years in the future. Other analyses have emphasized the need for new technologies (Hoffert et al., 2002) over the same period, or examined specific technology goals (Claussen, 2002; Pershing and Tudela, 2003).

A case study: interim concentration targets

Like long-term targets, interim targets for climate change can be defined in terms of metrics ranging from particular aspects of emission-generating activities (e.g. technology characteristics of the energy system), to emissions themselves, to concentrations, to temperature change, to specific impacts (Hammitt, 1999). There is uncertainty in each link in this chain that no metric can avoid. Concentrations, the object of Article 2 of the UNFCCC, provide a compromise metric at the mid-point of the causality chain: part of the uncertainty resides in the climate change and impacts that would result from a given concentration target, while part resides in the activities and emissions that would meet the target. We prefer concentrations to global average temperature change, which is frequently used for analysis of long-term targets, because changes in atmospheric concentrations lead temperature changes, can be measured more accurately, and are less subject to natural variability, thus providing more precise feedback on progress toward goals. However, we envision that an interim concentration target would be chosen based in part on consideration of long-term temperature change consequences. It would also be related to emissions and activities, since those would likely be the direct focus of national climate policies that seek to meet a concentration target.

We illustrate interim targets using equivalent CO_2 concentration, i.e. the concentration of CO_2 that by itself would produce the same radiative forcing as the combined effect of all radiatively active gases and aerosols.[2] Equivalent CO_2 provides a means of integrating the effects of multiple gases into one target, and therefore is more closely related to temperature change outcomes experienced by the time the target is reached. However the longer-term climate change consequences of an interim target may be more closely related to concentrations of just the long-lived gases, in particular CO_2 alone (Keppo et al., unpublished), and further analysis of this issue is required.

An interim concentration target or range could be chosen based on (1) limiting the risk of exceeding a given rate of climate change; (2) whether the target keeps open the option of reaching a long-term objective that may become desirable as we learn more; and (3) the feasibility, costs and other implications of the portfolio of mitigation strategies that might achieve the target.

As an illustration of the rate-of-change criterion, we quantify the interim target consistent with limiting rates of global average temperature change to 0.1°C per decade (O'Neill and Oppenheimer, 2004). The implications of a rate of 0.2°C per decade are also examined. Figure 1 draws on modelling results for dozens of future multi-gas atmospheric stabilization pathways (O'Neill and Oppenheimer, 2004) to relate equivalent CO_2 levels in 2050 with associated average rates of global mean temperature change. It indicates that, based on a best-estimate climate sensitivity of 2.5°C (Ramaswamy et al., 2001), a target of about 430 ppm equivalent CO_2 in 2050 would limit the rate of change to 0.1°C per decade, while 0.2°C per decade could be achieved with a target of

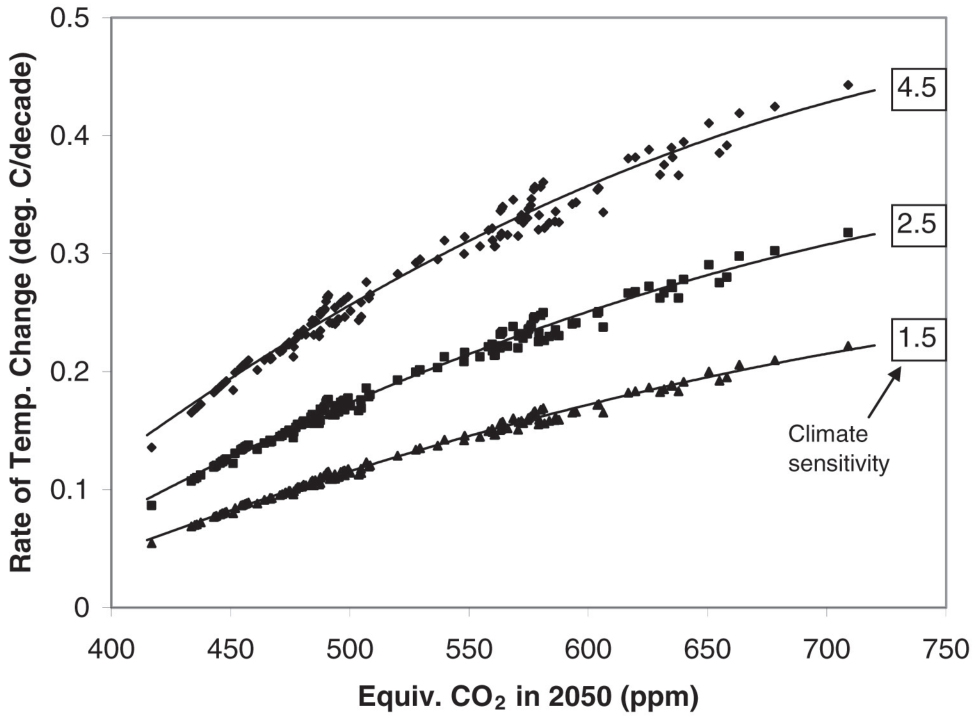

Figure 1. Average rate of global mean temperature change, 2000–2050, as a function of equivalent CO_2 level in 2050. Calculated from scenarios in O'Neill and Oppenheimer (2004).

about 550 ppm. These results are consistent with limiting incremental radiative forcing over the period 2000–2050 to the equivalent of an additional 60–180 ppm of CO_2 in the atmosphere. Because this increase includes the effects of all radiatively active gases and aerosols, it implies that a greater reduction in non-CO_2 greenhouse gases could afford more flexibility for limits on true CO_2 levels (Hansen and Sato, 2004). Alternatively, the more that CO_2 emissions from land-use change are reduced, the more flexibility could be afforded to limits on GHGs from other sources, and vice versa.

Uncertainty in climate sensitivity and forcing factors for radiatively active gases and particles is also a key consideration. If 2.5°C is considered the median of an uncertainty distribution for the climate sensitivity, then there would be a 50% chance that even if the interim target is met, the rate of climate change could exceed the intended constraint. If climate sensitivity is actually 4.5°C, these targets would result in changes of 0.15–0.3°C per decade (Fig. 1), while if sensitivity turns out to be low (1.5°C), the targets would result in 0.06–0.13°C per decade.

Regarding the keeping-options-open criterion, an interim target for 2050 in the 430–550 ppm equivalent CO_2 range could maintain options for stabilizing concentrations at various levels in the longer term. For example, an interim target in this range is consistent with one proposal to limit additional warming to 1°C in the long term (Hansen and Sato, 2004), but would also allow for the possibility of easing emissions mitigation later if new information indicates that a higher stabilization level can still prevent dangerous impacts. In contrast, if a higher interim target is adopted, it could risk foreclosing the option of limiting warming to 1–2°C by requiring post-2050 emissions to be reduced so quickly as to be unacceptably expensive. One possibility would be to pair interim concentration targets with an 'atmospheric interest rate' on delayed reductions which could be raised or lowered in response to new information.

There have been no mitigation analyses based explicitly on interim concentration targets. Detailed multi-gas mitigation analysis is required to explore particular mitigation portfolios over the next several decades, and how they would affect the technological, political and economic feasibility of various long-term targets (Wigley et al., 1996; Hammitt, 1999; Keppo et al., unpublished). The approach of sequential decision-making under uncertainty, which shares a similar spirit with interim targets, indicates that the anticipation that we will learn more in the future about appropriate long-term goals can affect policy decisions in the short- to medium-term (Ha Duong et al., 1997; Yohe et al., 2004; Tirpak et al., 2005).

Connecting long-term climate change outcomes to short-term actions is difficult, given scientific uncertainties, but at the same time it is crucial, given the potential for dangerous, irreversible impacts over the coming decades and the risk that delay could permanently foreclose long-term options for stabilizing the climate. Interim targets provide a natural bridge between the two timescales.

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Notes

1 Examples include the UK (UKDTI, 2003, proposing to reduce GHG emissions 60% by 2050), Germany (Trittin, 2003, proposing to reduce GHG emissions 40% by 2020), California (Schwarzenegger, 2005, setting out targets of reducing GHG emissions to 2000 levels by 2010; to 1990 levels by 2020; and to 80% below 1990 levels by 2050) and New Mexico (Richardson, 2005, appointing commission to provide recommendations for reducing the state's GHG emissions to 2000 levels by 2012, 10% below 2000 by 2020, and 75% below 2000 by 2050).

2 Equivalent CO_2 concentration is a distinctly different measure from carbon equivalent emissions. The latter involves converting emissions into concentrations and then into radiative forcing, and accounting for differences in behaviour over time, typically by using an index such as the Global Warming Potential (GWP: Fuglestvedt et al., 2003). The former requires only converting concentration to radiative forcing at a given point in time, and therefore is much more straightforward, particularly for the well-mixed greenhouse gases.

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