Principle-based burden sharing in an MRV world

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At the Copenhagen NGO summit, the A1 Mitigation group decided to use GDRs ("the effort sharing approach") as a reference framework, in the context of the emerging MRV architecture for international mitigation support. To this end, an analysis, as specified below, is to be done as soon as possible. Also, though perhaps not quite as quickly, the effort-sharing approach is to be compared to the cumulative per-capita emissions approach that some Parties are now supporting ("the budget sharing approach"), and perhaps also to other relevant burden-sharing proposals, with "relevance" defined by the support proposals actually have within and around the formal negotiations.

These analyses should be made in phases, with the immediate priority being the use of the GDRs framework to calculate a principle-based allocation among A1 countries of the necessary MRV support, this because that support is critical to a successful Copenhagen negotiations.

The effort sharing (burden sharing) component of the analysis

First, we need an effort-sharing analysis of A1 mitigation (and adaptation) obligations, the former taken as a "dual quantified target" as defined in the new CAN position on aggregate A1 mitigation obligations. The A1 "total target," in other words, will be partitioned between an aggregate domestic reduction obligation and an aggregate international mitigation obligation (IMO) for MRV support. This partitioning will be done, for 2020, as follows.

- *The domestic portion of the dual obligation*: We will quantify an aggregate A1 domestic reduction obligation, and then allocate it among A1 countries.
    - We take as a starting point CAN's call for aggregate A1 reductions of "more than 40%" by 2020. While this position provides guidance, it is not unambiguously clear, so we will start with a 40% reduction but explore its implications and consider other more levels of reduction as well. Specifically, we will examine A1 domestic reduction obligations of "more than 40%" with respect to their implications in terms of the magnitude and pace of implied non-A1 reductions. That is, we will assess them in terms of balancing the plausibility of A1 reductions and non-A1 reductions, considering both variations in projected mitigation costs and other factors such as potential implications for welfare.
    - CAN's "more than 40%" rule will be taken to specify a "bright line" between A1 domestic reduction obligations and A1 IMOs. It will, that is, be taken to specify an aggregate reduction that must be accomplished within A1. Note that this does **not** mean that all A1 countries will likewise have an exact 40% domestic reduction target. While giving identical domestic targets to all A1 countries would ensure that the aggregate A1 reduction adds up to the overall 40% target, it would make little sense from the perspective of cost-effectiveness, due to the variability of mitigation potential and mitigation costs within A1 countries. Indeed, assuming full flexibility to trade within A1, this approach would allow countries which have resisted mitigation thus far to capture "rents" associated with selling their relatively low-cost mitigation opportunities.

- To address this problem, we will define individual A1 domestic reduction targets so that each country is expected to mitigate up to the same marginal abatement cost, which will be defined as the cost that is necessary to support the specified aggregate A1 reduction of "more than 40%". The country-level domestic A1 reduction targets will be generated from a simple, heuristic analysis of mitigation cost curves (such as those composed by McKinsey for the Catalyst project, or those used by the widely published and well-vetted analyses based on the "FAIR" model of Höhne and collaborators).

- Emissions rights allocated under this system of domestic A1 targets will be assumed to be tradable **within** Annex 1. Flexibility in this regard can limit the inevitable inefficiencies or inequities arising from inaccurate projection of mitigation costs, but do so while maintaining the inviolability of the aggregate A1 target.

- At the same time, the aggregate A1 domestic reduction target will be firewalled off from the A1 IMO, in effect prohibiting non-A1 mitigation potential from being used to offset A1 domestic mitigation targets. And since trading **within** A1 is unrestricted, A1 marginal mitigation costs are equalized, which makes true A1 "comparability of effort" possible.

- *The international portion of the dual obligation*: The key objective of this analysis is to help clarify the terms of the emerging discussion of prospective MRV mechanisms. In particular, it is meant to help us (CAN and others) talk concretely about the nature, scope, and architecture of the necessary tech / finance package. There are lots of questions here, but a principal one is certainly the *size* of the necessary package and its allocation among A1 (or A2?) countries.

  - The aggregate international portion of the dual mitigation obligation (the aggregate IMO) will be defined to ensure overall consistency with an ambitious 2C global trajectory. To calculate it, we will first calculate the total global mitigation required to achieve the global 2C trajectory. From this, we will subtract the aggregate A1 domestic reduction obligation, leaving the required aggregate non-A1 reductions. We can then examine its implications and plausibility with respect to the magnitude and pace of implied mitigation activity in non-A1 countries.

  - To convert this total non-A1 reduction requirement into an aggregate IMO for A1, there are two further matters to consider.

    - *Autonomous non-A1 mitigation actions*: It is important to assess the mitigation arising from autonomous action voluntarily undertaken by non-A1 countries. There is good reason to believe that this amounts to a quantitatively significant sum, and equally so that it constitutes a politically important step that well deserves to be highlighted.

      - The question of how best to estimate non-A1 mitigation actions remains open. Suggestions are welcome.

    - *International sources of mitigation support*: When re-expressing the IMO in monetary terms, it is necessary to consider the potential for non-nationally specific international finance. That is, sources of mitigation finance that are not "owned" specifically by any particular A1 nation, such as aviation and maritime taxes, a Tobin tax, global auction revenues, etc. We will cite estimates of these potential revenue streams, and consider them as important potential contributions to the global MRV

package. We will also, as requested, support an alternative run in which these international sources of mitigation support are assumed to be zero, so as to quantify their impact on national IMOs.

- The aggregate IMO is then straightforwardly defined as the total non-A1 mitigation requirement, minus the reductions available through autonomous non-A1 actions and international sources of support.

- The IMO for individual A1 countries is then also straightforwardly defined, and in a manner that ensures comparability of total effort among A1 countries, in terms of the GDRs-derived RCI. That is, the domestic plus international mitigation required of each A1 country (its total target) is proportional to that country's share of the total A1 RCI.

  - *A glimpse at the future:* Note that this way of defining the IMO yields different results than if autonomous non-A1 actions and international sources of mitigation support were neglected, and the global mitigation requirement were divided among all countries – both A1 *and* non-A1 – in a manner proportional to RCI under a system of *global differentiation*. This approach could be taken in the future, with the goal of achieving "comparability of effort" among *all* countries, within a regime in which the A1 / non-A1 distinction was eliminated. However, as we now wish to make this analysis as useful as possible for the Copenhagen negotiations and the immediate post-Copenhagen period, we are instead taking the above approach, which is consistent with the UNFCCC and KP commitments of A1 countries, which include full financial and technological support for the necessary actions in non-A1 countries. However, we will also make it easy to examine the implications of a future regime of global differentiation, by quantifying the difference between the hypothetical A1 IMO under a hypothetical effort-sharing system based on global differentiation and the UNFCCC-compliant effort-sharing system presented above.

  - *Framing and Terminology:* Note also that the analysis of the total A1 obligation as presented here is quantitatively equivalent to dividing the global mitigation among all countries proportional to their RCIs, but assigning the non-A1 portion (that is not covered by autonomous actions or international support) as an additional so-called "sequencing obligation" for A1. We've proposed to not use this framing, however, as it risks the appearance of prematurely advocating global differentiation.

- Having calculated the IMO in tons – in aggregate and for each A1 country – it will then be immediately re-expressed in monetary terms (dollars or euros), to indicate the size of the required finance and technology "package". To make this translation, we will cite various estimates of the likely cost of mitigation, but we will not attempt any new mitigation cost analysis.

The budget sharing (resource sharing) component of the analysis

Second, we need an analogous analysis of the budget sharing approach. This is an important approach, if for no other reason that it is the basis of the Bolivian proposal, the Algerian proposal, the Chinese discussion of cumulative per-capita obligations, and so on. While we still have to understand better the differences – subtle and not-so-subtle – between these approaches, the intention here is to analyze a "basic" carbon budget sharing approach in detail. This must of course be done with respect to the same database and the same reference and emergency pathways used in the effort-sharing analysis, so as to

produce a set of A1 national dual-obligation results that can be compared to it in an "apples to apples" manner.

We do not yet commit to doing this analysis in the immediate short term (we can't since we don't have a model that implements it) but we do think that it is important to pursue the problem and compare the results of the two approaches in the concrete terms of A1 dual quantified obligations and, more generally, the emerging MRV world.

Some specific points about the budget-sharing analysis

- The point of the budget-sharing approach is to define a non-A1 "supported development" trajectory that, through the magic of finance and tech, allows non-A1 to develop as if A1 had not consumed most all of the atmospheric space. The quantity of finance and tech is, therefore, related to the historic overuse by A1 countries of the global carbon budget. As the A1 total target in the budget-sharing model is defined in a somewhat different manner than in the effort sharing model, it's not automatically the case that A1's IMO will be the same. However, considering the large past and ongoing excess emissions of A1, the implied support package might well be sufficient in scale to shift non-A1 emissions all the way down to the level required by the global 2C pathway. That is, it might well be large enough to equal full incremental cost funding for mitigation in non-A1 countries, minus whatever effort is voluntarily accepted by non-A1 as "autonomous action."

- In the budget-sharing approach, an individual A1 country IMO would, instead of being determined by its RCI, be determined by its historic overuse of the global carbon budget.

- Note that the budget sharing approach may not be fully specified in any of the formal proposals that are based on it. We may need to make additional assumptions, which we will present transparently, to allow obligations for individual A1 countries to be computed.

- In order to facilitate clear comparison between the two approaches, it will be necessary to do at least two runs of each.

    - The effort-sharing analysis will be done with both a 1990 and a 1950 "responsibility start date." The 1990 date will (for all the reasons explained in the GDRs books) be taken as the default.

    - The budget-sharing analysis will be done with both a 1950 and a 1900 start date.

        - The 1900 run, which captures about 95% of historical A1 fossil carbon emissions, and about 100% of historic non-A1 fossil carbon emissions, (from 1850 to 2005, using CAIT data for fossil-carbon emissions), will be taken as the default.

        - The 1950 run will 1) facilitate comparison with the effort-sharing analysis, and 2) allow us to gauge the sensitivity of the overall results to changes in the start date.

    - In addition, we might want to consider a run that drops the capacity side of the RCI to zero, because this would isolate the quantitative differences between the effort-sharing

and budget sharing-approaches, as alternative implementations of a responsibility-only allocation.

Required modifications to the GDRs online calculator

- It is important that these analyses be done in CO2e terms.
- We will replace our emergency 2C trajectory with the trajectories behind Malte and Bill's Nature paper. Both the 75%/2C trajectory and the 350 trajectory must be supported.
- The ease with which we are able to do this will depend in large part on the ease of getting the trajectory out of Malte/Bill's supplementary materials. We already have the 75%/2C trajectory from Malte.
- We need a rough, but serviceable, system of nationalized baselines that take account of a small number of "qualified national circumstances" (e.g. the rate of population growth). It is not expected that this system will change the final numbers very much, but it is expected that it will constrain the ability of parties to indulge special pleading based on non-qualified circumstances. Also, all baselines (global and national) need to be much more transparently explained. Also, the no-regrets wedges should be eliminated from the GDRs analysis, as they are confusing.

  The best way to deal with baselines is probably by adopting a simple IPAT approach. This leaves us with small set of three parameters to credibly define: income growth, population growth, and autonomous carbon-intensity improvement.

  - There are various ways to select these nation-specific numbers.

    1. *population*: we can always use UN mid-range projections. We don't know if there are any skeletons buried therein, but these are a well-known, widely-adopted standard. They provide a high, medium, and low, in case we want to do sensitivity analyses.
    2. *carbon intensity*: This is trickier. One can always just extrapolate historical carbon intensity improvement, but this is a pretty crude approach since trends shift over time. It's also potentially perverse, in that it penalizes early action. (If you've been investing ambitiously in efficiency recently, that rate becomes locked into your baseline.) Maybe there are some corrections that can be made.
    3. *income*: This might be trickiest. We could implement some brutally simply method, like an utterly transparent extrapolation of historic growth. We could be more sophisticated, and adopt a more complex and elegant model like conditional income convergence. But there is a fairly strong argument for going with the brutally transparent approach, along with a true-up period.

  - As we work though all this, we will do so in a manner that allows us some flexibility to alternative assumptions. Minimally, we will allow for sensitivities to alternative income growth for various nations.
  - In this new baselines system, we will see if there are credible ways to account for the global financial crisis.

- The current implementation of the GDRs effort-sharing approach does not account for either previous mitigation action or free-riding. Considering the significant differences in emissions growth since 1990 for countries such as the US, Canada, and Australia, compared to countries like Germany, Sweden, and the UK (at least some of which is attributable to mitigation action) it is obviously worth accounting for post-Rio history in the calculation of national obligations. One way to do this is to calculate obligations in a manner that calls for "comparability of effort" based on mitigation effort *over and above* that which would be required to meet Kyoto targets. By this approach, the GDRs-derived obligation would, in essence, be calculated from national baselines that have compliance with Kyoto built into them. We will explore this approach, considering how to take into account such issues as the EU bubble, CDM, and hot air.

- There are issues with the RCI itself, but they will not be explored as part of this analysis. But, for the record:

    - There seems to be a desire in some parts to redefine the RCI such that the development threshold is operational only on the capacity side. To model this, we could make it possible to set the responsibility side threshold to 0 while still having a positive development threshold on the capacity side.

    - Or we could allow even finer control on the responsibility side. For example, we could allow some sort of a time-varying threshold. Note that, in the existing GDRs calculations, the quantification of responsibility already expresses the fact that the carbon load associated with "subsistence" or "sustainable development" emissions will drop over time as national economies decarbonize.

- The IMO must be expressed in monetary form. It would seems that, in the general case, what is needed is an ability to 1) allow for alternative price/ton ratios, and get comparable results for all of them, 2) add an "A1 adaptation obligation," which is sized in cash terms.

- Ideally, the calculator would implement both the effort-sharing and budget-sharing models. There should be a tab for each which collects all the params that are specific to it.

The overall logic, on the effort-sharing side, will be as follows

- Compute the A1 total target, in tons of CO2e, and the shares of it that go to various countries, according to their shares of the A1 RCI. Do this for both 2015 and 2020, to represent the 2nd and 3rd commitment periods.

- For each country and region, compute the portion of its total target that represents domestic reductions. The domestic / international dividing line should default to 40% obligated A1 domestic reductions, below 1990 levels. Express all of these numbers as tons of CO2e.

    - It would also be useful to present these reductions in terms of percentage reductions below baseline (in key years, e.g. 2020) and percentage reductions below 1990. This should be done, but on the side, so as to keep the primary results very simple to understand).

- For each A1 country and region, compute the IMO as the remainder of the total target. This is straightforward subtraction, and yields the IMO in tons of CO2e.

- For a number of possible carbon (actually CO2e) prices, convert the tons result into monetary terms. Then it can usefully be compared to the numbers which the finance group comes up with.
    - The finance group number (one analysis being used by CAN members would set at $150 billion / year from 2013 to 2020) needs to be separated into mitigation and adaptation components for the purposes of this analysis. That is, this analysis proceeds by converting tons to units of currency, and thus its bottom line is an IMO in currency terms that does not include adaptation.
- We will also present results in terms of a hypothetical global differentiation analysis, in which there are no annexes and a mitigation obligation is calculated for every country, as it might appear after the A1 countries meet their Rio obligations and pave the way for a (post-Copenhagen) transition to a system of global, principle-based mitigation obligations. Assuming that some of this non-A1 "obligation" is met through autonomous mitigation action, what would be the size of its remaining mitigation "obligation." How does this compare to anticipated sources of international finance?
- Finally, once the second, budget-sharing analysis is complete, how do the results of the two approaches compare?

Questions that this analysis is intended to inform

The CAN 40% aggregate target is an enormous ask for A1, and the recognition that it's only one side of an even larger total target will not be universally welcomed. Which is all the more reason why international mitigation obligations must be calculated in a transparent and principle-based manner.

This is clear, but it hardly exhausts the uses of this analysis. In particular, now that we have reframed national obligations in terms of dual quantified obligations, and quantified the IMOs that go along with domestic mitigation obligations, we can ask new questions.

- What does all this imply for the road past Copenhagen? What guidance does it provide for a future global system of principle-based obligations? Because the lures of free-riding are an abiding threat in any arrangement intended to protect a common resource, any adequately robust climate regime must be based on a principle-based system that fairly and transparently divides the efforts of climate protection among those people who have the affluence and capacity to bear it. Such a system must not minimize the scale of the obligations of those in the North so as to be more politically "realistic", nor must it elide the obligations of wealthy people in the South, those who have levels of responsibility and capacity comparable to the people of the North.
- What do the MRV side of A1's obligations imply for the North, where they are obviously problematic? For one thing, recalcitrant elites will loudly advertize them as unjust and unsupportable foreign demands. And, even in the best of cases, IMOs will make A1's total obligation visibly larger. On the positive side of the ledger, IMO tons will be cheaper than domestic tons, and this clearly opens paths forward. What, on balance, are the northern politics of A1 total targets?
- What does the MRV side of A1's obligations imply for the South? After all, even if finance and technology that is "new and additional" and "adequate, predictable, and sustainable" and that

covers “full incremental cost” is actually provided, non-A1 countries mitigation actions will be necessary that are extremely daunting, in terms of trust, political feasibility, and indeed technical feasibility. Are there implications in terms of the overall social welfare and development agenda of the South?

- What does this analysis imply for our overall cost estimates? How much comfort, in particular, do we have with the $150 billion cost figure that the finance group has derived from the current literature? And how great is the potential for the international sources of funding?

- Critically, how can these international sources of funding be best designed? In particular, how can they best leverage the effort-sharing (or budget sharing) principles that were applied to divide the global mitigation obligation among A1 countries?