Chapter 4

Roles of Scientific Community in a Cycle for Enhancing Mitigation Contributions

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Key Messages

- Though some leading research institutes have made assessment of intended nationally determined contributions (INDCs), most of them do not have direct access to information sources in many countries (especially developing countries) and sometimes the ambiguity of INDCs makes it difficult for them to make proper interpretation. This is why the involvement of local researchers or national teams is important for the assessment of INDCs and subsequent mitigation contributions of particular countries.
- A consortium of climate policy research institutes with good regional representation should be established. Involvement of local researchers (national teams) in such a research consortium is critically important to ensure its assessment corresponds better with national conditions and that it is politically acceptable for national and regional circumstances, thereby enhancing the credibility of its assessments.
- A cycle for reviewing and submitting subsequent nationally determined contributions (NDCs) can benefit from the following scientific knowledge which can be provided by the research consortium:
  - Basic comparison and assumption checks: A framework to provide a common basis for comparing NDCs and check their underlying assumptions and economic drivers;
  - Equity-based assessment: A top-down, equity-based assessment (i.e. allocating emission allowance across countries based on a specific formula of equity and other indicators) could provide benchmarks guiding the assessment of each Party's relative contribution to the global 2°C target in terms of equity and sufficiency;
  - Mitigation potential: Technology-based energy modelling can identify mitigation potential by providing different technology deployment portfolios to follow the long-term mitigation pathways and provide corresponding "narratives" (underlying macroeconomic drivers, mitigation potentials, other national circumstances), which are essential to a fair understanding, review and comparison of NDCs;
  - Opportunities and benefits: An assessment of opportunities and benefits that mitigation actions can bring is another vital piece of information for the proposed cycle. It is vital to specify concrete benefits that fit with each Party's

national interests and priorities, and that can move beyond the traditional burden/effort-sharing discussion, as well as motivate the increase in the mitigation efforts; and

- Aggregate ambition or adequacy of NDCs: An assessment of the collective effect of individual NDCs is essential for understanding the status of implementation.

1. Introduction

The message of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5) is clearer than ever. It is still technically possible to achieve the 2°C target, but the window of opportunity is closing rapidly. In the run up to the 21st Conference of the Parties (COP21), it is crucial to ensure that the aggregate greenhouse gases (GHG) emissions based on intended nationally determined contributions (INDCs) are consistent with the 2°C target. To achieve this, there is plenty of room for the research community to raise the ambition level of INDCs. However, despite the increasing amount of scientific knowledge to achieve the 2°C target being generated, the current the United Nations Framework Convention on Climate Change (UNFCCC) process does not necessarily make the best use of such knowledge and information.

This chapter aims to identify concrete ways by which the latest research on national and global GHG emission pathways consistent with the 2°C target could contribute to raising the ambition levels of INDCs toward the global 2°C target, and what kind of scientific inputs is required for the INDC cycle beyond 2015.

The chapter starts with the role of the research community in providing inputs to an INDC cycle process. The third section examines specific inputs which are relevant to the INDC cycle process. The fourth section discusses some implications of establishing a research consortium. The chapter will conclude by setting out the way forward.

2. Importance of scientific inputs to the INDCs process: Role of a consortium of climate research institutions

Tamura et al. (2013) proposed a specific process and steps to mainstream necessary scientific knowledge into the policy-making process in order to contribute to raising the ambition levels of INDCs. One of its distinctive features was to establish a consortium of research institutes with a view to providing benchmarks to which Parties can refer when proposing their initial contributions, and against which each Party's relative contribution to the 2°C target is assessed.

As discussed in Chapter 3, among INDCs submitted so far, there are different types of mitigation contributions—absolute targets (absolute reduction from base year emissions), business as usual (BAU) targets (emissions reduction from BAU scenarios), emission intensity targets (emission reduction against per unit of GDP) and a peak year target. Since common but relatively loose rules on upfront information regarding INDCs were agreed, it is not straightforward to have a clear understanding of each INDC, let alone compare them.

In addition, Parties are invited to give a self-explanation about how their INDCs are considered fair and ambitious, and how they contribute towards achieving the objective of the Convention. These types of self-explanation or evaluation are highly relevant, since

it is critically important to make each party aware of their relative contribution to the 2°C target in terms of equity and adequacy. However, there are some concerns that not all Parties provide sufficient information in this respect.

The diversity and complexity of INDCs highlight the importance of establishing robust procedural arrangements ensuring greater transparency of action toward the implementation of nationally determined contributions (NDCs). The research community can play a substantial role in such a process. Scientific inputs to the process are:

(1) Basic comparison and assumption checks;

(2) Equity-based assessment;

(3) Assessment of mitigation potentials that are untapped by NDC;

(4) Assessment of opportunities and benefits that NDC can deliver; and

(5) Aggregate ambition or adequacy of NDCs.

As negotiations over an *ex-ante* consultation process at COP20 effectively ruled out a formal assessment of individual INDCs prior to COP21, it is likely that some Parties oppose a formal process through which individual contributions are assessed. Therefore, the research community-driven process for reviewing INDCs should be formed outside the UNFCCC process. A research consortium outside the UNFCCC process will likely be comprised of currently existing research initiatives. Examples of these initiatives include the International Research Network for Low Carbon Societies (LCS-RNet), the Deep Decarbonization Pathways Project (DDPP), the Open Climate Network (OCN), and the Climate Action Tracker (CAT). Some of them make an assessment of INDCs submitted, but they do not necessarily have participation of researchers or institutes from countries which are assessed. Geographic representation distinguishes the current initiatives from a research consortium proposed here.

Though some leading research institutes have made assessment of INDCs, most of them do not have direct access to information sources in many countries (especially developing countries) and sometimes the ambiguity of INDCs makes it difficult for them to make proper interpretation. This is why the involvement of local researchers or national teams is important for the assessment of INDCs and subsequent mitigation contributions of particular countries.

It is true that IPCC Assessment Reports and United Nations Environment Programme (UNEP) Emissions Gap Reports compile and provide some of the information listed above. However, IPCC is mandated to be policy relevant rather than policy prescriptive. The UNEP Emissions Gap Reports provide information on the gap at the aggregate level, but not at the individual country level. Inputs from the research consortium proposed here are more policy prescriptive, as well as country-specific. Therefore, IPCC and UNEP cannot play the role that the proposed research consortium is expected to play.

3. Information from the research consortium

3.1 Basic Comparison and Assumption Checks

One of the most important inputs from the research consortium is to provide a level playing field for comparison. For example, among Parties with absolute targets, some like Norway and New Zealand explicitly declare that they will use a carbon budget approach (a cumulative emissions control over multiple years), but others like the United States (US) say that they will use a single year target. In addition, the treatment of the land-use, land-use-change and forest (LULUCF) sector as well as international emission credits varies across countries (see Table 4.1). Furthermore, BAU targets and emission intensity targets require careful checking of counterfactual BAU scenarios and future gross domestic product (GDP) projections and methodologies to project BAU.

Table 4.1 ***Comparison of the scopes of INDCs for Japan, USA and the EU***

Country/ region	Base year	Target year	Mitigation level	LULUCF accounting	
				Base year	Target year
Japan	2013	2030	26%	Excluded	Included
USA	2005	2025	26 – 28%	Included	Included
EU	1990	2030	40%	Included (?)	Included

3.2 Potential-based assessment

In recent years a number of studies have been conducted on long-term mitigation pathway analyses using a bottom-up, technology-based energy model and based on a "backcasting" approach with a view to linking short- and mid-term mitigation targets with long-term ones (Figure 4.1). The bottom-up, technology-based energy system models underpin the technological feasibility of certain emissions pathways. The "backcasting" approach sets a future GHG emissions target first, and then the changes needed to achieve that target are determined. At the national level, in Japan, for example, backcasting analysis was conducted by a team led by the National Institute for Environmental Studies (NIES) in 2009 with the then long-term target of 70% reduction from 1990 levels by 2050 (2050 Japan Low-Carbon Society Scenario Team 2009) and later with the 80% target (Ashina et al. 2012). Globally, the DDPP recently conducted a similar analysis for 15 key countries (SDSN and IDDRI 2014). The recently published interim report, comprised of analyses for 15 countries that cover about 70% of global energy-related carbon dioxide (CO_2) emissions in 2010, presented an exemplary deep decarbonisation pathway for each country. Besides the demonstration of emissions pathways to achieve the long-term mitigation target, the report also demonstrated that deep decarbonisation can be compatible with continued prosperity.

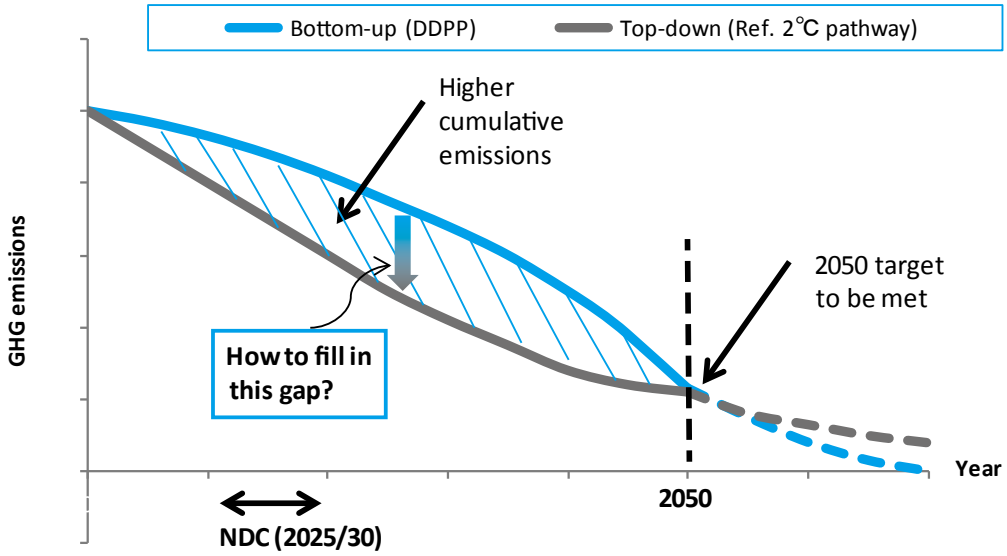


Figure 4.1 ***Two modelling approaches to quantify sufficient mitigation contributions for the 2025/30 period***

The key initial step toward enhancing global mitigation ambitions is to enhance transparency and understanding of INDCs of each Party. In order to achieve this, it is crucial that the Parties provide various modelling assumptions as well as the political and economic context underlying their INDCs. A fair review of INDCs will be feasible only after the "stories" or "narratives" behind the INDCs are well communicated. Bottom-up scenario assessments could help Parties better communicate the INDCs to stakeholders by providing a "narrative"—information on underlying macroeconomic drivers, mitigation potentials and other national circumstances. It is imperative to submit these types of information when Parties propose their INDCs.

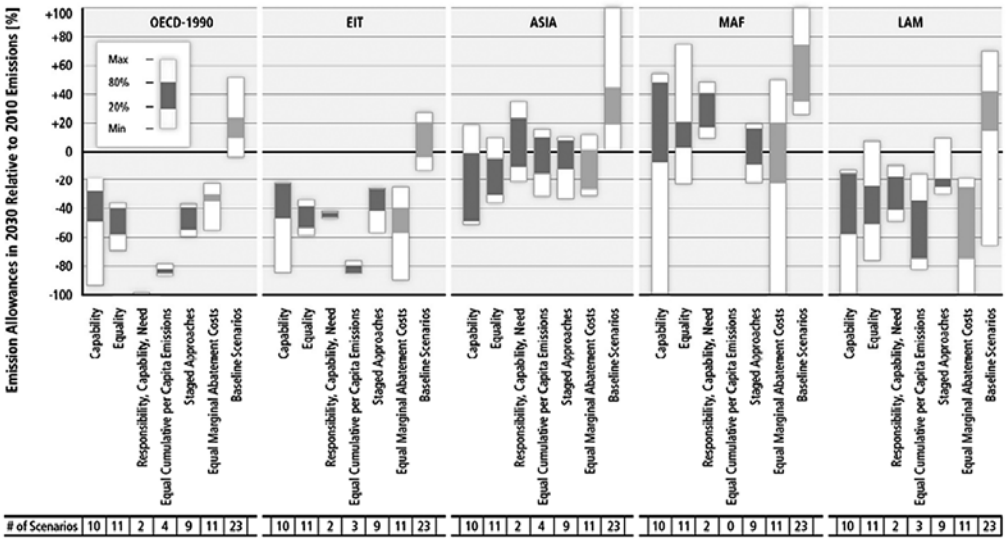
The bottom-up mitigation pathways underpinned by a long-term mitigation target, as conducted by the DDPP, can serve as benchmarks to which Parties can refer when proposing their INDCs. A consortium can bring together all existing bottom-up long-term mitigation pathway analyses, thus offering the Parties a menu of long-term mitigation pathways that technically serve to compare their INDCs with. Moreover, the "backcasting" long-term mitigation pathway analyses assist country governments in developing their preferred technology deployment roadmap to achieve long-term deep decarbonisation, reflecting national priorities and circumstances. Bottom-up mitigation pathways enable the assessment of the technical and economic feasibility of the INDCs as well as discussion on different technology deployment portfolios to follow the long-term mitigation pathways. A comparative assessment of long-term mitigation scenarios (50% and 80% reduction from 2005 levels) indicated that there is no silver bullet technology to meet the aforementioned long-term mitigation targets (Clarke et al. 2014).

One caveat is that although the bottom-up, backcasting approach prescribes the mitigation actions required to achieve a future emissions target at a certain point in time, say the year 2050, the sum of individual, national emissions pathways described by the backcasting approach is not necessarily consistent with a specific temperature target. The interim report of the DDPP shows that the aggregation of national pathways has not yet

achieve the full decarbonisation needed to make staying below the 2°C limit "likely". This does not undermine the significance of the interim DDPP, the primary purpose of which is to analyse the technical feasibility of deep decarbonisation pathways within each country, not the lowest possible level of cumulative emissions to 2050. However, this provisional result underscores the importance of how to manage the total amount of cumulative emissions to 2050, if we want to keep global warming within a certain level.

3.3 Equity-based assessment

Another approach is a top-down, equity-based approach or global effort-sharing approach. The salient feature of this approach is to allocate specific numerical emissions targets among countries to achieve a certain long-term goal such as a GHG concentration goal or a temperature goal, using a specific formula of equity principles and other indicators. While there are various formulas for effort-sharing, they are usually based on one or more of the following four basic indicators: (1) responsibility (historical emissions); (2) capability (capacity to pay for mitigation); (3) equality (emission rights per person); and (4) cost-effectiveness, of which the first three are explicitly equity principles (see Chapter 5 for a detailed description). Figure 4.2 shows the emission allowances under different effort-sharing approaches for various country groups presented in the IPCC AR5.



Source: Figure 6.28 of Chapter 6 in the WG3 contribution to the IPCC AR5 (IPCC 2014).

Figure 4.2 Emission allowances in 2030 relative to 2010 emissions by effort-sharing category for mitigation scenarios reaching 430-480 ppm CO_2eq in 2100

One limitation of the equity-based, top-down approach is political feasibility. The two biggest emitters, China and the US, are highly unlikely to accept externally determined constraints on emissions. Though national emissions targets prescribed by equity-based, top-down approaches are usually more ambitious than those derived from potential-based, bottom-up approaches, they are often more ambitious than governments can politically accept. In addition, there is little prospect for achieving consensus on criteria for defining how the principles of equity and common but differentiated responsibilities

and respective capabilities (CBDR-RC) can be operationalised, as the last two decades of international negotiations have shown. Even if Parties subscribe to an equity principle, it is probable that Parties choose the equity principle that leads to higher emission allowances, which would lead to aggregate emission levels that are not sufficient for the 2°C target.

Despite being a politically infeasible option for determining precise numerical emissions reduction targets, the equity-based, top-down approach could provide benchmarks guiding the assessment of each Party's relative contribution to the global 2°C target in terms of equity and sufficiency. In the IPCC AR5, the required regional emissions allowances for 2030 to stay on the 2°C pathway were presented for various effort-sharing approaches. These ranges serve as useful benchmarks against which the INDCs can be compared to assess the sufficiency of each Party's INDCs. It would be useful to compare INDCs or currently discussed mitigation target levels with the required mitigation levels identified in the IPCC AR5 to ensure the consistency of INDCs with the 2°C target. Moreover, the aforementioned mitigation ranges presented in IPCC AR5 would be even more useful for an assessment of INDCs if the figures were disaggregated to the country level for major emitting countries. This exercise can be carried out by the consortium.

While the ranges of required regional mitigation efforts for 2030 are based on an extensive review of about 40 published studies (Höhne et al. 2014), the literature coverage can be regionally balanced and strengthened by the research consortium with the involvement of regional research networks such as the Low Carbon Asia Research Network (LoCARNet). As a result of the enhanced literature coverage, the top-down benchmarks for mitigation efforts provided by the research consortium will better correspond to national and regional conditions and thus will enhance the political acceptance of assessments by the consortium.

3.4 Opportunity assessment

Equity discussion may turn out to be a zero-sum game over the allocation of the right to emit among countries, and the discussion may well be brought to a standstill. To avoid such a deadlock, it will be important to look at opportunities. Identifying opportunities and benefits that INDCs can bring is a starting point for the ratcheting-up of individual NDCs, thereby filling the gap between an emissions path required by equity-based burden-sharing assessments and a path prescribed by potential-based technological and costs assessments.

However, framing climate change action in terms of "burden" and "costs" is at odds with the growing evidence about the benefits of investment in resource efficiency and emissions reductions (Averchenkova 2014). A cost-oriented discourse should be transformed into a benefits-oriented one. The New Climate Economy Report actually identified many sectors in which ambitious mitigation actions can deliver benefits, including urban development, local pollution and congestion, agriculture, energy efficiency, fiscal reform, energy security, financial innovation and technological innovation (New Climate Economy 2014). Specifying concrete benefits that fit with each Party's national interests and priorities can move beyond the traditional burden/effort-sharing discussion, and motivate an increase in the mitigation efforts.

3.5 Aggregate effect of INDCs

An assessment of the collective effect of individual INDCs is essential for understanding the status of implementation. Indeed, the UNFCCC Secretariat was mandated to compile

a synthesis repot on the aggregate effect of INDCs by 1 November 2015. This assessment should be done on a regular basis in accordance with the INDC cycle proposed in Chapter 3.

4. Strengthened network of climate mitigation research initiatives

An international cooperation of various mitigation policy research initiatives through the consortium would not only strengthen the scientific robustness of the outcomes from the consortium but also enhance the political acceptability of the messages delivered by the consortium. Involvement of local researchers (national teams) in such a research consortium is also critically important to ensure its assessment corresponds better with national conditions and that it is politically acceptable and accountable to national and regional circumstances, thereby enhancing the credibility of assessments. Moreover, strengthened cooperation across various initiatives would enhance the effectiveness of research activities because similar types of activities conducted under different initiatives could be harmonised.

A strengthened network of climate mitigation research initiatives also enhances outreach and capacity building capability in countries where mitigation policy research is not sufficiently developed. The development of a country's own long-term low-carbon pathways using its own home-developed modelling tool could invigorate the national mitigation policymaking process. Although the international community has supported capacity building activities on energy and climate modelling, further support for such activities will become increasingly important toward the post-2020 period.

5. The way forward

While increasing amount of scientific knowledge is available on the extent to which each Party needs to reduce its GHG emissions to achieve the 2°C target, this knowledge is not necessarily effectively communicated to national and international policymakers. Key questions include if and how such knowledge can be utilised in processes for reviewing NDCs. This chapter primarily focuses on what kind of information the two different modelling approaches can provide and how they can be used in the process for reviewing INDCs. The chapter also proposes the establishment of a consortium of respected research institutes with good regional representation to conduct and compile modelling exercises. Without this proposed process, various research institutes and initiatives would independently review and assess NDCs in any case. Concerted action by the research community could provide further policy impacts. It is our hope that this report will catalyse a coordinated action by research institutes to generate useful information sources for reviewing NDCs.

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