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Toward ambitious INDCs: Linking research and policymaking

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Abstract:

This report, jointly prepared by the Institute for Global Environmental Strategies (IGES), Japan, and the Energy Research Institute (ERI), China, aims to identify concrete ways the latest research on national and global greenhouse gas (GHG) emission pathways could contribute to raising the ambition levels of INDCs toward the global 2°C target. The report reflects the discussions at the IGES-ERI Policy Research Workshop held in September 2014 in Beijing, China, and funded by the Ministry of the Environment, Japan (MOEJ). The workshop invited experts on energy and GHG modelling as well as energy and climate policies from mainly China, Japan, the EU and the USA. The key messages from the workshop are as follows:

- **The key initial step toward enhancing global mitigation ambitions is to enhance transparency and understanding of intended nationally determined contributions (INDCs)** of each Party, in particular major economies. Two different modelling approaches—a bottom-up approach, such as technology-based energy system modelling, and a top-down approach, such as allocation of mitigation efforts based on equity indicators—can serve as complementary sources of information in understanding INDCs.

- Bottom-up scenario assessments could help Parties better communicate their INDCs by providing **a "narrative" behind the numerical targets—information on underlying macroeconomic drivers, mitigation potentials and other national circumstances**. Such

information is essential for a fair review of INDCs.

- 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**. From this perspective, the regional effort-sharing ranges presented in the Working Group III Contribution to the 5th Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC; Figure 6.28 of Chapter 6) would be more useful if they are disaggregated to the country level for major emitting countries.

- **A consortium of climate policy research institutes with good regional representative can make modelling exercises more regionally nuanced and accountable for national and regional circumstances**. Such a research consortium can also be a vehicle for capacity building. The Research Consortium can be comprised of currently existing research initiatives such as the Low Carbon Society Research Network (LCS-RNet), the Low Carbon Asia Research Network (LoCARNet), the Deep Decarbonization Pathways Project (DDPP), the Open Climate Network (OCN), and the Climate Action Tracker (CAT).

- **Long-term national emissions pathways consistent with the 2°C target need to be developed by national experts**. Such country-specific emission pathways can be devised to reflect their national circumstances and fit with their developmental as well as socio-economic and environmental goals. The DDPP is a good example of such initiatives.

- **The concept of "carbon budget" at the national level can provide opportunity for a country to manage its long-term emission pathway in an effective and sustainable manner**. It is important to manage total cumulative GHG emissions to be consistent with the long-term global carbon budget for the 2°C goal, as well as to assess national GHG emission reduction targets from a perspective of their consistency with the global carbon budget.

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1 Introduction

The message of the 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5)[1] is clearer than ever. It is still technically possible to achieve the 2°C target, but the window of opportunity is closing rapidly. Toward the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC), it is crucial to ensure that the aggregate GHG emissions based on Intended Nationally Determined Contributions (INDCs) are consistent with the 2°C target. To achieve this, there is large room for research community to play in order 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 UNFCCC process does not necessarily make the best use of such knowledge and information.

This report jointly prepared by the Institute for Global Environmental Strategies (IGES), Japan, and the Energy Research Institute (ERI), China, aims to identify concrete ways 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. The report reflects the discussions that took place in the IGES-ERI climate policy workshop ("the Workshop") held in Beijing in September 2014, supported by the Ministry of the Environment, Japan[2]. The workshop invited experts on energy and GHG modelling as well as energy and climate policies from mainly China, Japan, the EU and the USA.

2 Importance of scientific inputs in an *ex-ante* review of INDCs: A role of a "consortium" of climate research institutions

Tamura et al. (2013) proposed 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 (Figure 1)[3]. The proposed process has three distinctive features: 1) A consortium of research institutes is established with a view to providing benchmarks to which Parties can refer to when proposing their initial contributions, and against which each Party's relative contribution to the 2°C target is assessed; 2) To enhance *ex-ante* clarity and comparability of Parties' contributions, the

[1] IPCC, 2014. "Climate Change 2014: Synthesis Report". 5th Assessment Report, Intergovernmental Panel on Climate Change.

[2] www.iges.or.jp/en/climate-energy/20140902.html. Its summary and proceedings are attached in Annex.

[3] Tamura, K., Kuramochi, T., and Asuka, J., 2013. "A Process for Making Nationally-determined Mitigation Contributions More Ambitious", *Carbon and Climate Law Review*, 4/2013: pp. 231-241.

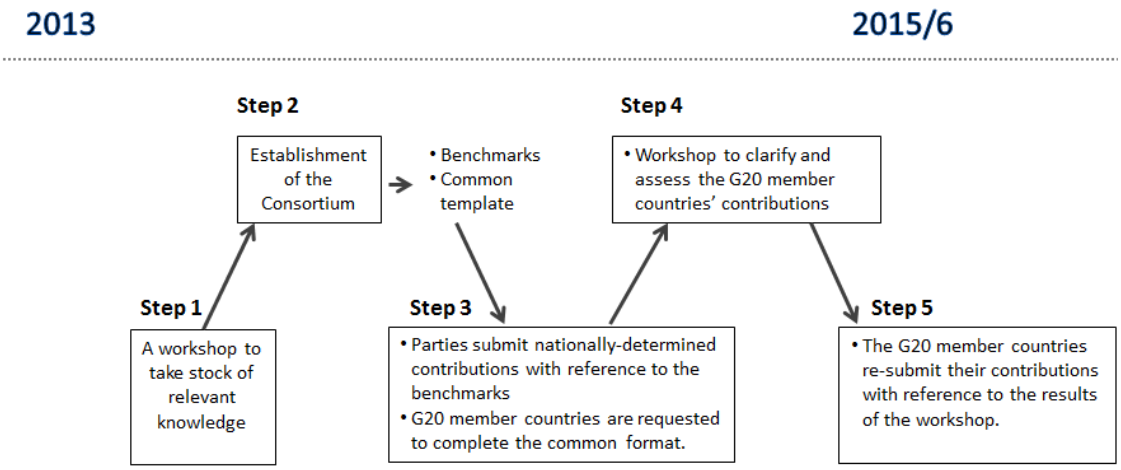

Figure 1: Timeline for the international consultation process to mainstream necessary scientific for raising the ambition levels of INDCs.
Source: Tamura et al. (2013).

consortium also provides a common and clear template for information on mitigation contributions that Parties will complete *ex-ante*; 3) A limited number of Parties—for example, the G20 member countries—are requested to complete the common template and go through an international consultation process with a view to amending contributions to meet the required aggregate contribution for the 2°C target.

In the Workshop, it was widely agreed among the participants that it is crucial to institutionalize an international process in which individual Party's mitigation contributions are assessed, and that research community can play substantial role in such a process. At the same time, *ex-ante* evaluation of INDCs and the aggregate emission levels for the post-2020 period would likely become politically very sensitive that it was largely agreed among the participants that the research community-driven process for reviewing INDCs should be formed outside the UNFCCC process. The Research Consortium outside the UNFCCC process will likely be comprised of currently existing research initiatives. Examples of these initiatives include the Low Carbon Society Research Network (LCS-RNet)[4], the Deep Decarbonisation Pathways Project (DDPP)[5], the Open Climate Network (OCN)[6], and the Climate Action Tracker (CAT)[7].

[4] www.lcs-rnet.org
[5] unsdsn.org/what-we-do/deep-decarbonisation-pathways/
[6] www.wri.org/our-work/project/open-climate-network
[7] www.climateactiontracker.org

3 Role of national emission pathway analyses in raising ambition levels of INDCs

While the high ambition level of INDCs is crucial, it is also very important to ensure that countries are on track to achieve deep decarbonisation for meeting the 2 °C target in the longer term. Therefore, consideration of long-term pathway for the formulation of short- and mid-term policies is crucial. Some major emitting countries such as the EU, Japan and the USA have set their own aspiring long-term mitigation targets (Table 1). However, only a few countries considered the consistency with long-term targets, when setting their 2020 mitigation targets. In other words, 2020 mitigation targets were not derived from an assessment of what will be needed to attain long-term emission reduction targets.

The first important step toward raising ambition levels of the post-2020 agreement is to obtain good understanding of the INDC of each Party, which are expected to be submitted in well advance to COP21, or by the first quarter of 2015 by those who are ready to do so. (Modelling) research community can help stakeholders understand Parties' INDCs better by providing information. There are two modelling approaches to calculate mid- and long-term national mitigation contributions (Figure 2): (i) a "top-down" approach, i.e., allocating emission allowance across countries based on a specific formula of equity and other indicators, and (ii) a "bottom-up" approach, i.e., based on technology-based energy system models which underpin the techno-economic feasibility. The two modelling approaches can help stakeholders understand the INDCs in different ways.

3.1 Role of potential-based ("bottom-up") national mitigation pathway analyses

In recent years, a number of studies have been conducted on long-term mitigation pathway analyses using a bottom-up energy balance model and based on a "backcasting" approach with a view to linking short- and mid-term mitigation targets with long-term ones. The "backcasting" approach sets a long-term GHG mitigation target first, and then the changes needed to achieve that target are determined. At the national level, in Japan, for example, backcasting analysis have been 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[8]

[8] "2050 Japan Low-Carbon Society" Scenario Team, 2009. Japan Roadmaps towards Low-Carbon Societies (LCSs), Scenario. "2050 Japan Low-Carbon Society" Scenario Team (The National Institute for Environmental Studies (NIES), Kyoto University, and Mizuho Information and Research Institute).

Table 1: Overview and assessment of current mitigation policies in key emitting countries

Indicator	Japan	USA	European Union	China
Long-term goal (target year/ target level)	2050: 80% vs. 1990 [a)]	2050: 83% vs. 2005 [b)]	2050: 80%-95% vs. 1990 [b)]	Not defined
2020 mitigation target	3.8% vs. 2005 [b)]	17% vs. 2005 [b)]	20% vs. 1990 (conditional 30%) [b)]	CO_2 intensity: 40%-45% vs. 2005 [c)]
Consistency of 2020 target with the long-term goal explained?	No	No	Yes [d)]	No
INDC: Level and timing of submission	Not announced yet	2025: 26%-28% vs. 2005 [e)]	2030: at least 40% vs. 1990 [f)]	Peak out CO_2 emissions by 2030 [e)]
Management of future cumulative emissions (carbon budget) considered?	No	No	No [g)]	No
Equity and other indicators applied	Not indicated	Not indicated	Not indicated	Not indicated

a) Ministry of the Environment, Japan, 2012. 4th Basic Environment Plan.

b) UNFCCC, 2014. "Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention". FCCC/SBSTA/2014/INF.6. United Nations Framework Convention on Climate Change. unfccc.int/resource/docs/2014/sbsta/eng/inf06.pdf

c) UNFCCC, 2010. Appendix II of the Copenhagen Accord (Nationally appropriate mitigation actions of developing countries): China. The United Nations Framework Convention on Climate Change. http://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/chinacphaccord_app2.pdf

d) European Commission, 2011. "Roadmap for Moving to a Competitive Low Carbon Economy in 2050". COM (2011) 0112. eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0112

e) The White House, 2014. "U.S.-China Joint Announcement on Climate Change. Beijing, China, 12 November 2014". www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change

f) European Council, 2014. "European Council (23 and 24 October 2014) Conclusions on 2030 Climate and Energy Policy Framework". SN 79/14.

g) The United Kingdom, an EU member state, has its own 5-year national carbon budget.

and later with the 80% target[9]. Globally, the DDPP recently conducted a similar analysis for 15 key countries[10]. The recently published report, comprised of analyses for 15 countries that cover about 70% of global energy-related CO_2 emissions in 2010, presented an exemplary deep dacarbonization pathway for each country. Besides the demonstration of emission pathways to achieve the long-term mitigation target, the report also demonstrated that deep decarbonisation can be compatible with continued wealth increase and access to development.

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 political and economic context underlying their INDCs. At the Workshop, participants emphasised that 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 long-term mitigation targets, as conducted by the DDPP, can serve as benchmarks to which Parties can refer when proposing their INDCs. The 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 are technically and economically feasible to compare their INDCs with. Moreover, the "backcasting" long-term mitigation pathway analyses assist country governments to develop its preferred technology deployment roadmap to achieve long-term deep decarbonisation, reflecting national priorities and circumstances. Bottom-up mitigation pathways, therefore, enable to assess the technical and economic feasibility of the INDCs as well as to discuss different technology deployment portfolios to follow the long-term mitigation pathways. In the Workshop, for example, there was a presentation of a comparative assessment of long-term mitigation scenarios for the U.S. (50% and 80% reduction from 2005 levels), which indicated that no single technology is absolutely essential to meet the above long-

[9] Ashina, S., Fujino, J., Masui, T., Ehara, T., Hibino, G., 2012. "A roadmap towards a low-carbon society in Japan using backcasting methodology: Feasible pathways for achieving an 80% reduction in CO_2 emissions by 2050". *Energy Policy* 41, 584–598.

[10] SDSN and IDDRI, 2014. *Pathways to deep decarbonization: 2014 report*. Sustainable Development Solutions Network (SDSN) and the Institute for Sustainable Development and International Relations (IDDRI).

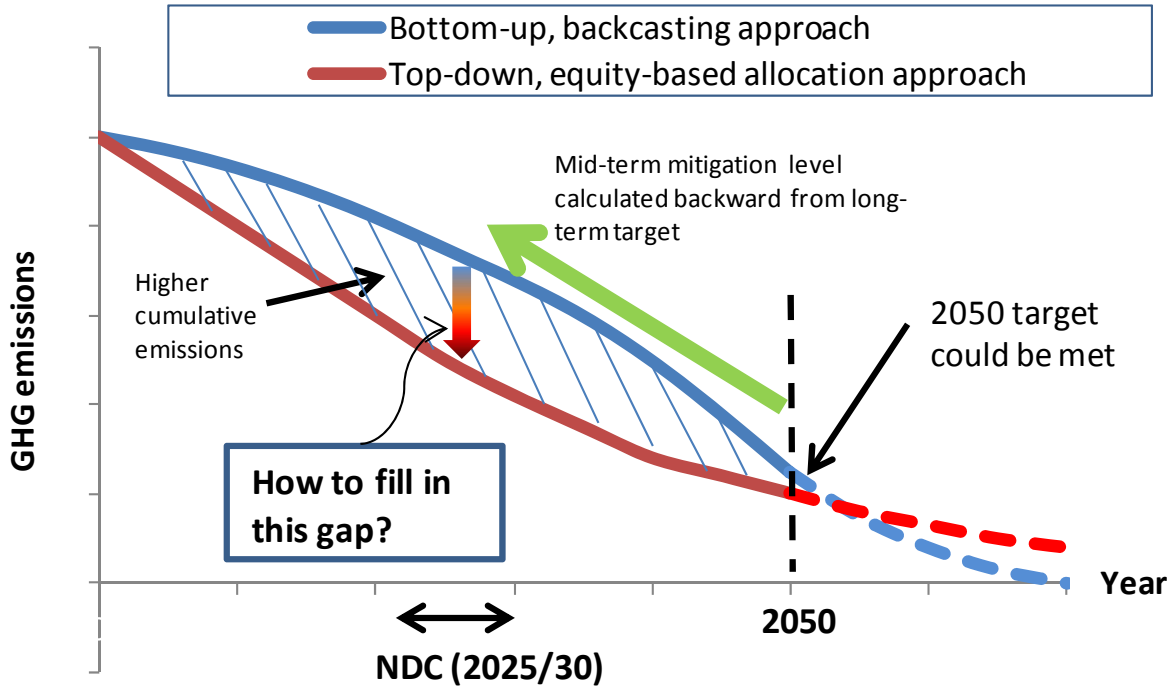

Figure 2: Two modelling approaches to quantify sufficient mitigation contributions for the 2025/30 period.

term mitigation targets[11].

One caveat for the bottom-up, backcasting approach is that although it prescribes mitigation actions required to achieve the future emission target of certain point of time, say the year of 2050, the sum of individual, national emission pathways described by the backcasting approach is not necessarily consistent with specific temperature target. The DDPP 2014 report shows that the aggregation of national pathways does not yet achieve the full decarbonisation needed to "likely" stay below the 2°C limit. This does not undermine the significance of the interim DDPP, the primary purpose of which is to analyse technical feasibility of deep decarbonisation pathways within each country, not the lowest possible level of cumulative emission to 2050. However, its results underscore 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.

Another caveat of the potential-based, bottom-up approach as a benchmark-setting method is that it cannot reflect historical

[11] Clarke, L., Fawcett, A., Weyant, J., McFarland, J., Chaturvedi, V., Zhou, Y., 2014. "Technology and U.S. Emissions Reductions Goals: Results of the EMF 24 Modeling Exercise". *The Energy Journal* 35 (Special Issue 1) 9-32.

emissions explicitly. Equity as well as the Common But Differentiated Responsibilities and Respective Capabilities (CBDR&RC) are still the prevailing principles of the UNFCCC. The potential-based, bottom-up approach can take capabilities into account, but not responsibilities, in particular historical emissions. Indeed, some concerns about how equity and CBDR&RC can be reflected in the DDPP were raised by several Chinese participants at the IGES-ERI Workshop.

3.2 Role of global effort-sharing ("top-down") analyses

The other approach is equity-based, top-down 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 GHG concentration goal and 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: (i) responsibility (historical emissions), (ii) capability (capacity to pay for mitigation), (iii) equality (emission rights per person), and (iv) cost-effectiveness, of which the first three are explicitly equity principles [12]. Figure 3 shows the emission allowances under different effort-sharing approaches for various country groups presented in the IPCC AR5.

One limitation of the equity-based, top-down approach is political feasibility. The two biggest emitters, China and the US, are very unlikely to accept externally determined constraints on emissions. Though national emission 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 CBDR&RC can be operationalised, as the last two-decade international negotiation showed. 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 emission

[12] Höhne, N., den Elzen, M., and Escalante, D., 2014. "Regional GHG reduction targets based on effort-sharing: a comparison of studies", *Climate Policy* 14 (1), 122 –147.

allowances for 2030 to stay on the 2 °C pathways 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 *ex-ante*. At the IGES-ERI workshop, participants emphasized the need for comparing 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, it was emphasized during the IGES-ERI workshop that the aforementioned mitigation ranges presented in IPCC AR5 would be even more useful for *ex-ante* assessment of INDCs if the figures are 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 studies published[12], the literature coverage can be regionally balanced and strengthened through the Research Consortium by involving regional research networks such as the Low Carbon Asia Research Network (LoCARNet)[4]. As a result of the enhanced literature coverage, the top-down benchmarks for mitigation efforts provided the Research Consortium will become more nuanced and accountable for national and regional circumstances and thus enhances the political acceptance of *ex-ante* assessments by the Consortium.

The prerequisite to enable this assessment is that each Party provides information on which equity principle(s) were used to determine its mitigation target and how the target is considered as a fair contribution to the global effort. The major emitting countries such as China, EU, Japan and the U.S., however, have not clarified the equity principles with which their targets are consistent (Table 1). While it should be acknowledged that in many cases the national mitigation targets are formulated upon bottom-up assessment of mitigation potentials or at the levels that are politically agreeable, the provision of information on equity principles gives governments an opportunity to justify the fairness and sufficiency of their INDCs in the light of global 2 °C target.

Discussing the two modelling approaches described above, participants at the Workshop emphasised the importance of the management of the total cumulative emissions. The concept of "carbon budget" at the national level can provide opportunity for a country to manage its long-term emission

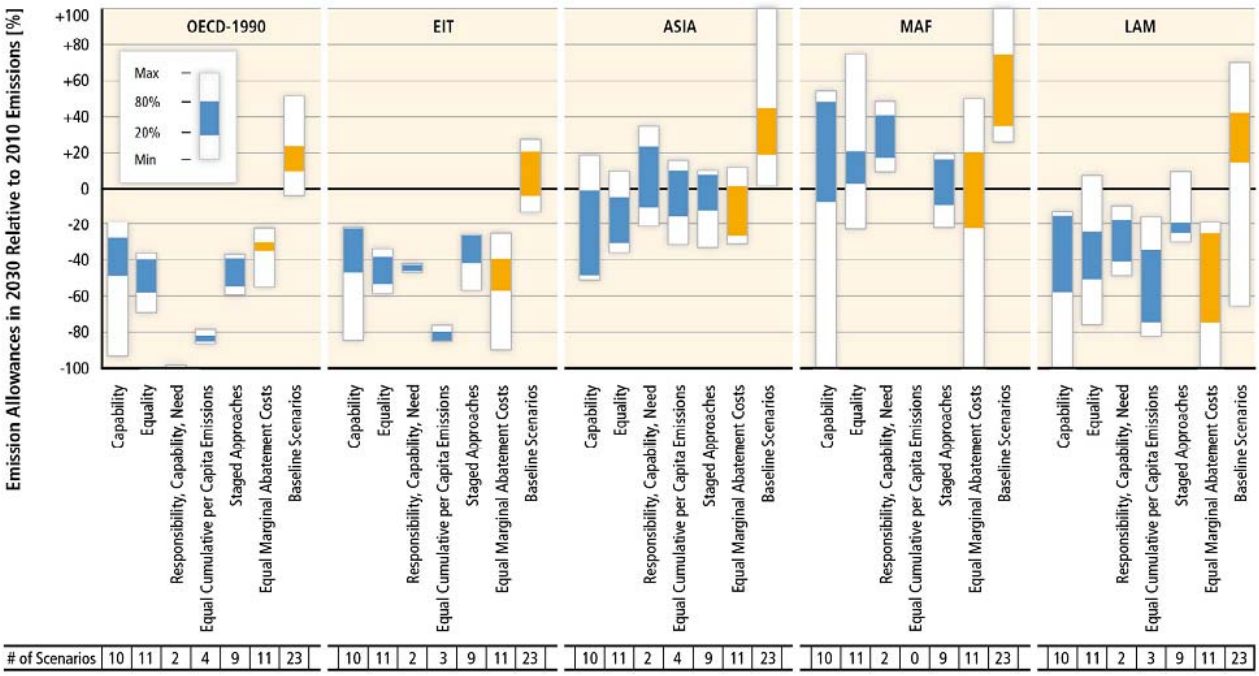

Figure 3: Emission allowances in 2030 relative to 2010 emissions by effort-sharing category for mitigation scenarios reaching 430-480 ppm CO_2eq in 2100. Source: Figure 6.28 of Chapter 6 in the WGIII contribution to the IPCC AR5 (IPCC 2014).

pathway in an effective and sustainable manner. For instance, the UK has adopted a method of managing total emissions. It has calculated its total permissible emissions to achieve its long-term target to reduce greenhouse gas emissions by at least 80% by the year 2050, compared to 1990 levels. The total amount that can be emitted every five years is called the "carbon budget" and is stipulated in the 2008 Climate Change Act[13].At present, the UK's carbon budgets have been formulated for four periods between 2008 and 2027. It is crucial to manage the total cumulative emissions to be consistent with long-term global carbon budget for the 2°C target, as well as to assess national GHG emission reduction targets from a perspective of their consistency with the global carbon budget.

4 Importance of *ex-post* assessment of pre-2020 mitigation

While previous sections focused on the *ex-ante* assessment of INDCs, it is equally important to conduct a thorough *ex-post* assessment of the pre- and post-2020 mitigation contributions by the Parties. Well-designed ex-post assessments can draw

13 http://www.legislation.gov.uk/ukpga/2008/27/contents

important lessons for effective mitigation in the post-2020 period and also serve as a solid basis for the better understanding of INDCs. *Ex-post* assessment of the impacts of energy and GHG emissions reduction policies require high level of expertise and thus, this is also an area where research community can make substantial contributions.

5 Urgent need for scaling up the finance for low-carbon development

Various modelling analyses presented in the IPCC AR5 as well as in the IGES-ERI workshop have shown that a major transition of the current energy infrastructure is needed in order to achieve the 2 °C target. Although significant amount of investments is needed to realize the major transition of energy infrastructure, the current level of finance for low-carbon development is not enough. In particular, a large increase of investments for energy efficiency in the building, transport and industrial sectors are required (Figure 3). Climate policy is not about just incrementally changing the existing energy infrastructure; meeting the 2 °C target requires major transition of energy infrastructure and all countries are facing needs for significant investments. Macro-financing framework for both domestically and international would be necessary for the long-term climate finance.

In the Workshop, there was a presentation and discussion on the current status of Carbon Capture and Storage (CCS) technology. Current policies to support CCS deployment have not been successful, despite the high interest and need for the technology. It can be identified as one of the low-carbon technologies that need serious political commitment.

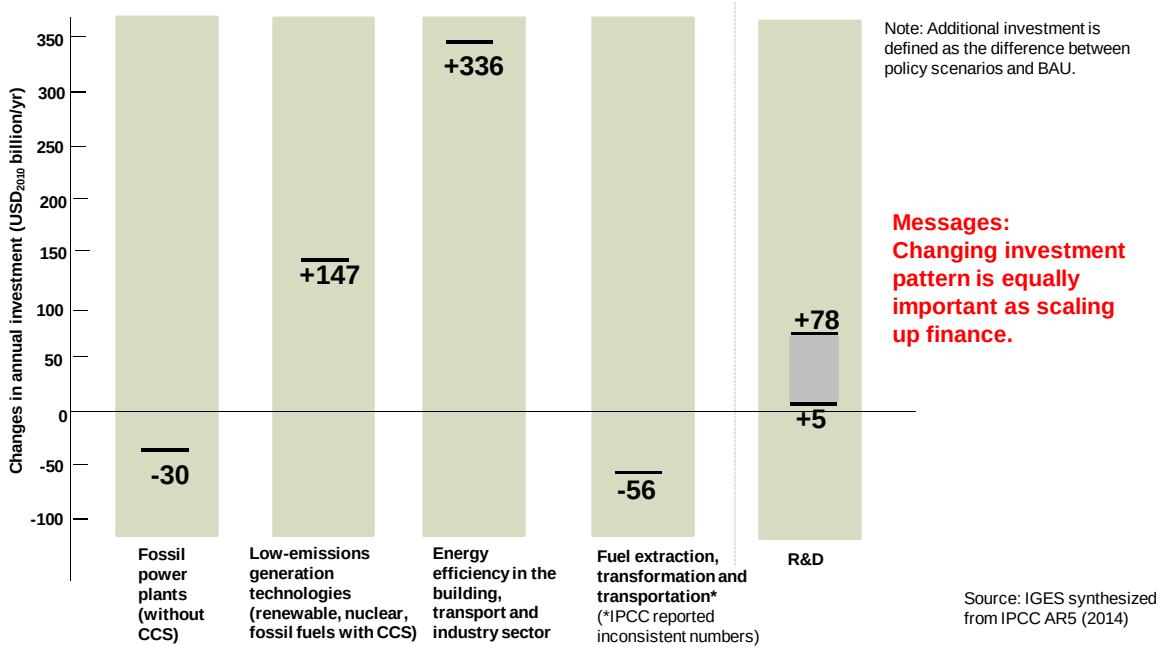

Figure 4: Breakdown of additionally required investment required by 2030 to stay below 2 °C. Source: IGES analysis (Yu, 2014)[14] based on the WGIII contribution to the IPCC AR5 (IPCC 2014).

[14] Yu, 2014. "Enhanced delivery of finance, technology and capacity building to support actions of developing countries". IGES-ERI Workshop.

6 Strengthened network of climate mitigation research initiatives

As described in Section 2, an international cooperation of various mitigation policy research initiatives through the Consortium of climate research institutions, proposed by Tamura et al. (2013), 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. Moreover, strengthened cooperation across various initiatives would enhance the effectiveness of research activities because similar type of activities conducted under different initiatives could be harmonized.

The strengthened network of climate mitigation research initiatives also enhance the 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 invigorates the national mitigation policymaking process. Although international community has supported capacity building activities on energy and climate modelling, further support for such activities would become increasingly important toward the post-2020 period.

7 Way forward

While increasing amount of scientific knowledge is available as to what extent each Party needs to reduce its GHG emissions to achieve the 2 °C target, the knowledge is not necessarily well communicated with national and international policymakers. In particular, a key question is if and how such knowledge can be utilized at ex-ante and/or ex-post processes for reviewing INDCs. This brief report primarily focus 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 report also proposes the establishment of a Consortium of respected research institutes with good regional representative to conduct and compile modelling exercises. Without this proposed process, various research institutes and initiatives would independently review and assess INDCs in any case. A concerted action in 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 INDCs during the first half of 2015.

Appendix A: IGES-ERI Policy Research Workshop—Summary

The Institute for Global Environmental Strategies (IGES) and China's Energy Research Institute (ERI) of the National Development and Reform Commission (NDRC) co-hosted a policy research workshop on low-carbon development in major economies entitled "*On the road to Paris: The readiness of key countries for COP 21 and beyond*", with the support of the Ministry of the Environment, Japan (MOEJ). The workshop was held in Beijing, China, and was the tenth workshop since 2005.

The main purpose of the workshop was twofold: firstly to exchange the latest scientific knowledge on national and global greenhouse gas (GHG) emission pathways to achieve the 2 °C target and the latest developments of national and international climate policies; and secondly to discuss the common messages and policy recommendations to deliver to the 20th Conference of the Parties (COP 20) of the United Nations Framework Convention on Climate Change (UNFCCC) in Lima, Peru.

Session 1: Scientific Basis for the 2°C Goal Pathways

This session discussed main points from the IPCC AR5 WG3 (Chapter 6) as well as the Deep Decarbonisation Pathways Project (DDPP) with regard to the global and national pathways toward the 2°C goal.

Findings

It is still technically possible to achieve the 2 °C goal, but the window of opportunity is closing rapidly. However, the world still tends to invest in high-carbon infrastructure and facilities thereby leading to carbon lock-in. Any delay in taking mitigation actions will considerably increase the difficulty of attaining the long-term transition toward a zero-emission world.

Avoiding carbon lock-in at present can provide ample mitigation opportunities and pave the way for cost-effective 2°C mitigation strategies. 2°C goal-consistent national emission pathways differ from country to country, and nationally optimized pathways can lead each country to a sustainable society with deep emission reductions.

Long-term national emissions pathways in consistency with the 2°C goal need to be developed by national experts. Such country-specific emission pathways can be devised to reflect their national circumstances and fit with their developmental as well as socio-economic and environmental goals. The DDPP is a good example of such initiatives.

While countries are expected to nationally determine their post-2020 mitigation targets or actions under the UNFCCC negotiations, there is a risk that the sum of Parties' contributions may not be sufficient to achieve the 2°C goal. 2°C goal-consistent national

emission pathways can be benchmarks to which Parties can refer when proposing their initial commitments and against which each Party's relative contribution to the 2°C goal will be assessed. It is important to institutionalize an international process in which individual Party's mitigation contributions are assessed outside the UNFCCC process. It would be effective and manageable that such a process be conducted at regional level and/or within specific group and then be summed up globally.

Session 2: Evolutional Policies towards Bridging the Emission Gap

By looking at the current policies and action plans to reduce GHG emissions, this session discussed what actions would be necessary for bridging the emissions gap.

Findings

Recent policy developments in the four key emitting economies (China, Japan, the US and EU) show that they started taking into consideration the long-term mitigation goals upon implementing policies. Emissions trading schemes are developing and implemented at regional and city levels. While some of them face challenges, others, such as the Tokyo Cap-and-Trade scheme, were proved effective in reducing emissions particularly from commercial sectors.

Most Parties are taking multi-policy approaches combining market-based mechanisms and regulatory measures. They are also trying to build synergies between climate change policy and other policy agenda such as development and energy security, behind which there are various motivations.

However, most of these targets and policies are not explicitly designed in consistency with the 2 °C goal.

- Almost all key emitting economies have not yet explained the consistency of its 2020 target with their long-term target.
- The concept of carbon budget, as emphasized in the IPCC AR5, indicated the importance of the management of total cumulative emissions. But, the management of cumulative emissions has not yet been sufficiently discussed in most key emitting countries. In addition, almost all key emitting countries have not explained what equity principles they subscribe to.
- While a broad range of low carbon technologies should be deployed widely to achieve the 2 °C goal, institutional arrangements including policies and measures, markets, and behaviours have not been geared up for such deployment yet.
- While the existing coal-fired power plant standards and regulations require

to apply the CCS or at least to consider it for the future, the development of legal and regulatory infrastructure for CCS seems to be as slow as the development of the technology itself. An enhanced shift from coal to gas is not a sufficient to achieve the 2 °C goal. Deployment of the CCS to the existing coal power generation is indispensable.

Messages

The concept of "carbon budget" at the national level can provide opportunity for a country to manage its long-term emission pathway in an effective and sustainable manner. IPCC AR5 highlighted a concept of "carbon budget," which is a finite amount of GHG that can be emitted if the increase in global temperature is to be curbed to a certain level. This suggest the importance to manage the total cumulative emissions to be consistent with long-term global carbon budget for the 2°C goal, as well as to assess national GHG emission reduction targets from a perspective of their consistency with the global carbon budget.

Each country's long-term (aspiring) domestic goal and a carbon budget management can be a critical part of information associated with the submission of intended nationally determined contribution (INDC). Such information can enhance comparability of efforts among countries and the effectiveness of all the efforts.

A clearer roadmap toward full CCS deployment should be developed through implementation of appropriate standards and regulation which is consistent with the 2 °C goal. The development of legal and regulatory infrastructure for CCS is the key.

Session 3 International Cooperation towards Achieving the 2°C goal

By looking at the current international cooperation within and outside the UNFCCC, this session discussed what international actions would be necessary for bridging the emissions gap.

Findings

Within the UNFCCC, negotiations over a post-2020 climate regime have been intensified, and a process to raise the ambition level of pre-2020 mitigation is also gaining momentum. However, further efforts are required to mainstream the latest scientific knowledge in the decision making process in order to keep the direction of climate regime toward transformative changes.

Outside the UNFCCC, many of international collaborative initiatives (ICIs) can play complementary roles to the UNFCCC process by scaling up their activities to offer new possible channels for public climate finance with the potential to deliver new emission reductions, and potentially catalyse to raise

ambition in national pledges. However, methodologies or systematic ways of approach for them to access each national client have not been well developed.

The existing financial and technological means of implementation focus mostly on feasibility study and capacity building. Limited resources have been provided for realizing actual technology transfer or NAMA implementation on the ground. Financial schemes for supporting state-of-art technology uptake and diffusion are very limited. The link between the financial mechanism, the technology mechanism, and the NAMA registry has not been well established. Neither is clear how the three institutional arrangements can generate synergies and ensure the delivery of finance, technology and capacity building support in an effective and efficient way.

Messages

International collaboration for assessing the relation between post-2020 targets and national long-term emissions pathways can be conducted on a regional basis.

The UNFCCC can play important roles in facilitating the environmental effectiveness of ICIs by crafting rules for defining their additionality and avoiding their overlaps and double counting.

Building synergies among the GCF, the CTCN and NAMA registry can enhance delivery of finance, technology and capacity building to support implementation. Such synergies will contribute to more efficient use of financial resources, and can provide more funding and technological opportunities for developing countries as well as the donor countries the transparent information on the demand.

While recognizing the necessity of international support, it is widely recognized that each country has the primary responsibility for financing its development and accordingly domestic finance mobilization should be given a central role. National climate fund is an important tool that developing countries can use to strengthen ownership of climate finance and to blend domestic and international funds together to make effective implementation of projects.

Appendix B: Agenda of the IGES-ERI workshop

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IGES-ERI Policy Research Workshop

On the road to Paris: The readiness of key countries for COP 21 and beyond

Tuesday, 2 September 2014

Building C, Conference Room 20, China People Palace, Beijing, China

(复兴门外大街真武庙路 1 号/No.1 Zhenwumiao Road, Fuxingmen Ave, Xicheng District, Beijing)

Organised by:

Energy Research Institute (ERI), China

Institute for Global Environmental Strategies (IGES), Japan

Funded by:

Ministry of the Environment, Japan

Objectives:

- To obtain better understandings of scientific findings regarding the 2°C goal;
- To share best practices and lessons learned from the mitigation policies on the ground in each region (Japan, China, US, and EU);
- To provide researchers' inputs to policy makers with regard to additional actions and policies that key countries can take in order to bridge the emissions gap at the country, region and global levels;
- To seek international collaboration for realizing the 2°C goal

Expected outcomes:

- Draw up findings and recommendations for countries to take from the researchers' perspectives.
- Prepare and distribute short report at the COP20 in Lima and at UNFCCC meetings in 2015.

AGENDA

8:30-9:00	**Registration**
1. Opening remarks	
09:00-09:05	Opening remarks [Prof. Jiang Kejun, ERI]
09:05-09:10	Opening remarks [Mr. Naoya Tsukamoto, Principal Researcher/Secretary General, IGES]
2. Scientific findings with regard to the 2°C goal	Moderator: Naoya Tsukamoto, IGES
This session will review key findings from IPCC and DDPP reports with regard to the global and national pathways toward the 2°C goal. The scientific discussions will form our understanding of what is needed for the 2°C goal and what is lacking in action.	

Discussion points 1. The latest scientific knowledge of emissions pathways •How can national emissions pathways collectively be consistent with the 2°C goal? 2. Interaction between science and policy-making •Whether and how can 2°C goal-consistent national emissions pathways be benchmarked against individual countries' mitigation targets and actions?	
09:10-09:15	Session introduction [Naoya Tsukamoto, Principal Researcher/Secretary General, IGES]
09:15-09:30	Global pathway toward the 2°C goal [Prof. Jiang Kejun, ERI]
09:30-09:45	Deep decarbonisation pathways project [Dr. Henri Waisman, Coordinator of the Deep Decarbonisation Pathways Project, the Climate Program, IDDRI]
09:45-10:20	Q&A and Discussion
10:20 – 10:30 Break	
3. Current policies and additional policies towards bridging the gap	Moderator: Prof. Jiang Kejun , ERI
Current global efforts are not enough to achieve the 2°C goal. Each major emitter needs to implement additional policies to close the emissions gap. Representatives of key countries will introduce their current policies and action plans to reduce GHG emissions. Discussion points 1. 2020 mitigation targets and actions: Latest progress and good lessons 2. Post-2020 mitigation actions •How can countries fill in the gap between expected emissions under current policies and the necessary levels suggested by science? •How are equity or "fairness" principles addressed in recent national policy debates?	
10:30-10:45	Session introduction and China's policies in the context of meeting the 2°C goal [Prof. Jiang Kejun, ERI]
10:45-11:00	China's renewable energy policies [Dr. Gao Hu, Deputy Director, Renewable Energy Development Center, ERI]
11:00-11:15	US policies in the context of meeting the 2°C goal [Dr. Jae Edmonds, Chief Scientist/ Battelle Fellow, Pacific Northwest National Laboratory Joint Global Change Research Institute]
11:15-12:00	Q&A and Discussion
12:00 – 13:00 Lunch Break	
13:00-13:15	Japan's policies in the context of meeting the 2°C goal [Dr. Takeshi Kuramochi, Task Manager, IGES]
13:15-13:30	Emission Trading Scheme of the Tokyo Metropolitan Government [Mr. Hisataka Goto, Deputy Director, Trade Section, Bureau of Environment, Tokyo Metropolitan

	Government]
13:30-13:45	EU policies in the context of meeting the 2°C goal [Dr. Noriko Fujiwara, Associate Research Fellow and Head of Climate Change, The Centre for European Policy Studies]
13:45-14:00	EU's position on coal power plants and CCS development [Mr. Thomas Spencer, Head of the Climate Program, IDDRI]
14:00-14:45	Q&A and Discussion
14:45 - 15:15 Coffee Break	
4. International collaboration for bridging the gap	Moderator: Kentaro Tamura, IGES
This session will overview the existing discussions for international collaboration under and outside the UNFCCC. Lessons learned from existing international initiatives will be shared to enhance international cooperation for realizing the 2°C goal. Discussion points 1. What are the current status and potential contributions of international initiatives to address climate mitigation? 2. What are the roles of the UNFCCC in facilitating the so-called International Cooperative Initiatives (ICIs) outside the UNFCCC? 3. What are the approaches to mobilise domestic financial resources in developing countries to enhance mitigation actions?	
15:15-15:20	Session introduction [Dr. Kentaro Tamura, Deputy Director of the Kansai Research Centre/Leader of Climate and Energy Area, IGES]
15:20-15:35	International framework to promote international collaboration under the UNFCCC framework [Prof. Yukari Takamura, Nagoya University]
15:35-15:50	Strategies for enhanced delivery of finance, technology and capacity building to support developing countries' action [Dr. Yuqing Yu, Task Manager/Senior Researcher, IGES]
15:50-16:05	Prospects for international cooperative initiatives [Dr. Maarten Neelis, Regional Manager China, Ecofys]
16:05-16:30	Q&A and discussion
5. Wrap up	Moderator: Kentaro Tamura, IGES
16:30-17:30	Expectations towards COP21