The Paris Climate Agreement and Beyond

Linking Short-term Climate Actions to Long-term Goals

IGES
Institute for Global Environmental Strategies

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Foreword

The year 2015 will be a critical year for the world in its endeavour to move towards a transition to sustainable development and to stabilise the climate system. In December, the 21st Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC COP21) will be held in Paris and is expected to strike a major deal on post-2020 climate regime.

Parties have managed to agree on the negotiation text as the basis on which they started substantive negotiations. They also began to submit their intended nationally determined contributions (INDCs). The submitted INDCs, including those from China, the US and the EU, cover around 87% of global carbon dioxide (CO_2) emissions. Another positive sign is that according to the International Energy Agency (IEA), global energy-related CO_2 emissions stalled in 2014, while the global economy grew by 3%. These developments are expected to send positive signals in the lead-up to COP21.

As the latest negotiation session held in October 2015 in Bonn indicated, however, much hard work remains to be done to find a middle ground from the negotiating text developed in Geneva, which reflects the widely-differing positions of the Parties. Furthermore, there is a critical concern that agreement in Paris will not be sufficiently ambitious to lead Parties to emissions reduction pathways consistent with the goal of limiting the temperature increase to 2 degrees Celsius above the pre-industrial levels, even if we take into account post-2020 targets already announced by China, the EU and the US. It will be vitally important for Parties to reach an agreement that allows the mitigation ambition of Parties' contributions to be reviewed and strengthened under specified time frames or "cycles" after COP21, although proposals made by several Parties for the assessment of Parties' commitments and contributions have faced strong disagreement from others.

This report aims to produce value-added IGES messages for core elements of the post-2020 climate regime. Key challenges in implementing the commitments under the future climate regime may also be addressed, including the creation of a cycle for reviewing and submitting subsequent nationally determined contributions after initial submissions in 2015, and contributions that can be made by a consortium of researchers/research institutes in developing such a system. It is my hope that this report will make a useful contribution to the establishment of an ambitious post-2020 climate regime.

Professor Hironori Hamanaka
Chair of the Board of Directors,
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Acknowledgements

This climate flagship report entitled "The Paris Climate Agreement and Beyond: Linking Short-term Climate Actions to Long-term Goals" synthesises IGES studies related to international climate policy, in particular on the post-2020 climate regime. As a research institute aiming to contribute to sustainable development of the global community, it is of vital importance to present our proposals to raise the level of ambition and to enhance effectiveness of post-2020 climate regime in a timely manner. I appreciate all the hard work of the Climate Flagship Team, consisting of IGES researchers in the Climate and Energy (CE) Area, the Natural Resource and Ecosystem Services (NRE) Area and the Programme Management Office (PMO) and coordinated by Kentaro Tamura and Satoshi Kojima, to prepare this publication on time. The Chair of the Board of Directors of IGES, Hironori Hamanaka, provided overall guidance throughout the production process.

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Hideyuki Mori
President,
Institute for Global Environmental Strategies (IGES)

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Abbreviations and Acronyms

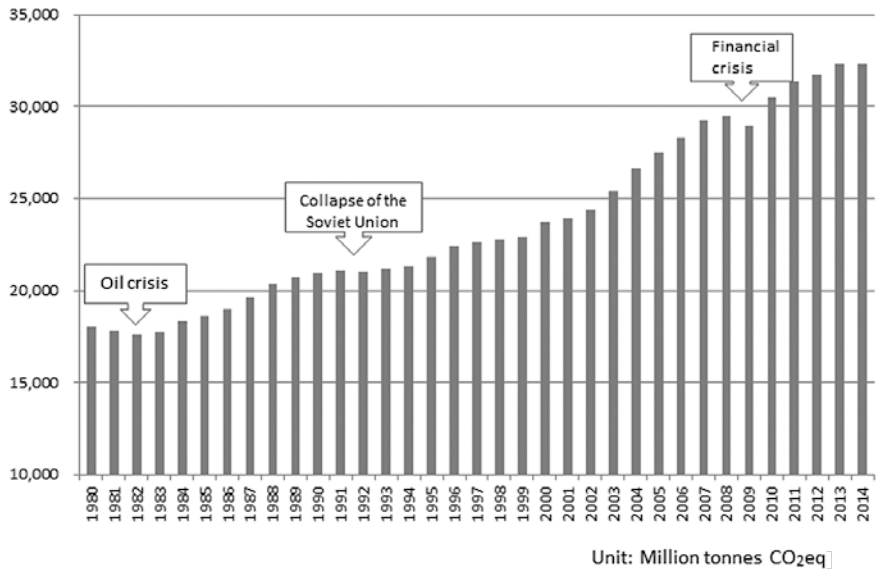
ADP	Ad Hoc Working Group on the Durban Platform for Enhanced Action
AHP	Analytic Hierarchy Process
AILAC	Association of Independent Latin American and Caribbean states
AOSIS	Alliance of Small Island States
APAN	Asia Pacific Adaptation Network
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Actions
BA	Biennial Assessment
BAU	business as usual
BRIICS	Brazil, Russia, India, Indonesia, China and South Africa
BRs	Biennial Reports
BURs	Biennial Update Reports
CAA	Clean Air Act
CAT	Climate Action Tracker
CBDR-RC	common but differentiated responsibilities and respective capabilities
CCA	climate change adaptation
CCS	carbon capture and storage
CDKN	Climate and Development Knowledge Network
CDM	Clean Development Mechanism
CO_2	carbon dioxide
CO_2eq	CO_2 equivalent
COP	Conference of the Parties
COP/MOP	Conference of the Parties serving as the meeting of the Parties
CTF	Common Tabular Format
DDPP	Deep Decarbonization Pathways Project
DOEs	designated operational entities
DRR	disaster risk reduction
EPA	Environment Protection Agency
ETS	emission trading system
EU	European Union
EU ETS	EU Emissions Trading System
FVA	framework for various approaches
GATS	General Agreement on Trade in Services
GCF	Green Climate Fund
GDP	gross domestic product
GEF	Global Environment Facility
GGBP	Green Growth Best Practice Initiative
GHG	greenhouse gases
GS	Gold Standard
Gt	gigatonnes
IAR	international assessment and review
ICA	international consultation and analysis
IEA	International Energy Agency
IET	International Emissions Trading
IGES	Institute for Global Environmental Strategies

INDC	intended nationally determined contribution
IPCC	Intergovernmental Panel on Climate Change
IPCC AR5	Fifth Assessment Report of the Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
JC	Joint Committee
JCM	Joint Crediting Mechanism
JI	Joint Implementation
KETs	key enabling technologies
KP	Kyoto Protocol
kWh	kilowatt-hour
LCS-RNet	International Research Network for Low Carbon Societies
LCTs	low carbon technologies
LDCs	least developed countries
LMDCs	like-minded developing countries
LoCARNet	Low Carbon Asia Research Network
LULUCF	land use, land use change and forestry
L&D	loss and damage
MDBs	multinational development banks
METI	Ministry of Economy, Trade, and Industry
MOE	Ministry of the Environment
Mt CO_2	million tonnes of CO_2
NAMAs	nationally appropriate mitigation actions
NAZCA	Non-State Actor Zone for Climate Action
NCA	nationally committed amount
NCE	New Climate Economy
NDC	nationally determined contribution
NELD	non-economic loss and damage
NGO	non-governmental organisation
NIES	National Institute for Environmental Studies
NMM	new market-based mechanism
OCN	Open Climate Network
OECD	Organisation for Economic Co-operation and Development
PM2.5	particulate matter 2.5 micrometers or less in diameter
QELROs	Quantified Emission Limitation and Reduction Objectives
RE/CCS	renewable electricity and carbon capture and storage-equipped electricity
REDD	reducing emissions from deforestation and forest degradation
REDD+	REDD Plus (reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries)
RMF	Results Management Framework
ROW	rest of the world
SBSTA	Subsidiary Body for Scientific and Technological Advice
SCF	Standing Committee on Finance
SDSN	Sustainable Development Solutions Network
TPE	Third Party Entity
UK	United Kingdom
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFCCC-COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
US	United States
VCS	Verified Carbon Standard
WHO	World Health Organization

Executive Summary

There is a hint of decoupling of world economic growth from carbon dioxide (CO_2) emissions, but greater efforts are needed to achieve the 2°C target.

The growth of global carbon dioxide (CO_2) emissions has recently slowed down. As seen in Figure S.1, global energy-related CO_2 emissions stalled in 2014 while global gross domestic product (GDP) grew by 3% in the same period, according to the International Energy Agency (IEA). A strong linkage between economic growth and CO_2 emissions growth has been persistent since industrialisation, because economic growth has been achieved by consuming increasing amounts of energy, mostly by burning fossil fuels. Over the last 50 years, a decrease in CO_2 emissions was observed several times in correlation with economic stagnation. However, the recent stall in emissions was achieved along with global economic growth. IEA attributes this possible breakdown of the correlation between economic growth and emissions growth to the expansion of low-carbon energies including renewable energies, improvement of energy efficiency, and structural changes in emerging economies such as China. Nevertheless, much greater mitigation efforts are vital to accelerate this decoupling trend to achieve the 2°C target.



Source: IEA statistics

Figure S.1 ***Global energy-related CO_2 emissions trends***

Behind the emissions structure change are similar motivations for reinforcing climate actions. Such common motivations should be leveraged by an international climate regime.

Major causes of structural change in emissions differ across countries, but there are similar motivations for climate policies observed among nations at different development levels with diverse political, economic, social and technological conditions. In particular, the European Union (EU), the United States (US) and China promote low-carbon energy and energy-efficient technologies with an aim to improving energy security and becoming global leaders in low-carbon technology markets. An international climate regime should be designed to leverage such common motivations to boost climate actions.

A cycle for reviewing and submitting subsequent nationally determined contributions (NDCs) after the initial submission should be established in the 2015 agreement.

Nationally determined contributions (NDCs) targeting 2025 or 2030 are part of longer-term efforts to transition to low-carbon societies. The latest research shows that the aggregation of nationally determined emission reductions is likely to be insufficient to achieve the 2°C target. There is also a concern that possible diversity of NDCs initially submitted would make it difficult to properly understand and compare NDCs. Thus, it is imperative to make continuous efforts to raise the level of ambition after the initial submission of NDCs. A cycle for reviewing and submitting subsequent NDCs can be a mechanism through which each Party's NDC will be ratcheted up.

For this cycle to work effectively and dynamically, the following three issues need to be solved: (1) How different implementation periods of NDCs can be addressed; (2) How the legal stringency and flexibility regarding NDCs can be balanced; and, (3) What kind of information and indicators should be used in the cycle.

Different implementation periods should be synchronised to encourage simultaneous action among Parties to adjust NDCs.

The institutional arrangements for Copenhagen/Cancun mitigation pledges are based on unilateral and uncoordinated adjustments of pledges mainly by improving mutual understanding among Parties and by allowing for easy updating of the pledges. However, the lessons learnt from that experience indicate that Parties are unlikely to increase the level of mitigation efforts unilaterally. Indeed, addressing this problem of collective action would require coordinated adjustments of NDCs.

Currently, some Parties have submitted a five-year implementation period for intended NDCs, while others have an implementation period of ten years. These should be synchronised to generate coordinated and collective adjustment of NDCs. By conducting interim reviews for those countries with a ten-year period cycle, it would be possible to have a review process every five years for both ten- and five-year period cycle countries. In other words, collective efforts to increase the level of mitigation contributions should take place in a five-year cycle.

By taking advantage of a package approach to the 2015 agreement, the NDC cycle can strike a balance between legal clarity and flexibility.

There is a general consensus among Parties that the 2015 agreement will be a package of a legally-binding core agreement and a set of related Conference of the Parties (COP) decisions and non-legal instruments. The core agreement would be concise and durable, providing key principles and direction, while COP decisions which are legal instruments but not legally-binding *per se*, would provide detailed operational rules. Non-legal instruments include a registry managed by the Secretariat and those that serve as communication and/or procedural tools. The question of how intended nationally determined contributions (INDCs) are anchored or inscribed in the 2015 agreement (for example, either in the core agreement or in a non-legal instrument) has significant implications for the legal nature and flexibility of NDCs.

Within the 2015 package, the core agreement should contain legal obligations for all Parties to submit, implement and regularly update NDCs, while they will be kept in a non-legal instrument (like the registry for Copenhagen/Cancun pledges). This approach could effectively strike the balance between legal robustness and flexibility, as well as lay a foundation for collective action for adjusting NDCs regularly.

A consortium of climate policy research institutes with good regional representation should be established to comprehensively assess the NDCs

Process for reviewing and submitting subsequent NDCs should be informed by scientific inputs, including basic comparison and assumption checks; equity-based assessment; mitigation potentials; opportunities and benefits; and aggregate ambition or adequacy of NDCs.

To provide these inputs, a consortium of climate policy research institutes with good regional representation should be established to gather a range of studies and scenarios from international, regional and local research institutes. This is particularly important for many developing countries, where greenhouse gases (GHG) mitigation pathway analyses are not readily available. In addition, this research consortium with good regional representation can ensure more nuanced assessment that is relevant to national and regional circumstances, thereby enhancing the credibility of assessments.

In individual NDC assessment, synthesis analysis of various GHG emissions scenarios can take into account various uncertainties, thereby enhancing the credibility and acceptability of the assessment results.

There are a wide range of approaches to evaluate INDCs proposed in the literature and they are complementary to each other. Three analyses conducted by IGES addressed the following perspectives: (1) comparison of economy-wide and sector-specific decarbonisation indicators with the US and the EU; (2) remaining emissions allowances under different effort-sharing principles; and (3) mitigation potential and policy effort. The results indicate that Japan's INDC may not be sufficiently ambitious in the global effort to achieve the 2°C target.

Along with traditional indicators such as "efforts required," it is important to include indicators of development benefits and other opportunities in the assessment of INDCs. Such forward-looking indicators can motivate Parties to take more ambitious mitigation policies.

Many studies published to date emphasise the level of "efforts required" or "burden borne" by each country to achieve the global 2°C target. By contrast, there are a limited number of studies that focus on long-term benefits delivered by the transition to low-carbon economy.

It would be useful and important to include indicators of such development benefits, which are "forward-looking", in the assessment of INDCs. However, country-level in-depth analyses of the benefits of the transition to a low-carbon economy are currently available only for a few countries (some large-emitting countries). Therefore, the research consortium could play an important role in developing these benefit-based indicators.

The 2015 agreement should also include a finance component and establish a cycle to review financial contributions to encourage greater efforts to provide financing of decarbonisation and building climate resilience.

The finance component will play two critical roles—to provide the means and incentives for developing countries to achieve their fair contributions to the global 2°C target and to send a political signal to rebuild confidence and trust among the Parties. The finance component should be composed of three key elements: (1) predictability of the scale of future funding; (2) developing countries' strategies to enhance enabling environments and scale-up domestic climate finance; and (3) the transparency of financial inputs and resulting impacts.

Accounting for the use of market-based mechanisms under the Framework for Various Approaches (FVA) should contain two key aspects: one is to ensure environmental integrity, and the other to incentivise mitigation actions by both developing and developed countries.

To contribute to the 2°C target, environmental integrity and incentives for mitigation actions by both developing and developed countries are two integral parts of an accounting framework for the FVA. An accounting framework for the FVA should be designed under a post-2020 climate regime to enable the realisation of these aspects, taking into account different national capacities and needs.

The accounting framework for the FVA should consider the needs and capacities of developing countries and promote support provided for them, so that all developing countries can have the opportunity to choose market-based mechanisms as an instrument to mitigate climate change, while ensuring environmental integrity.

Experiences obtained from the Joint Crediting Mechanism (JCM), currently being discussed under the FVA, show that developing countries are likely to encounter unique challenges at different stages of accounting, namely issuance of credits, transactions of credits, and accounting towards a country's NDCs. Major obstacles are related not only to their varying capacities, but also the design of the current reporting framework for developing countries under the United Nations Framework Convention on Climate Change (UNFCCC).

We propose: (1) capacity building to be included as an essential element for various mechanisms under the FVA; (2) review/coordination by a team of experts of the FVA to avoid a risk to environmental integrity and enhance a country's capacity; (3) simplified registry systems for countries without sufficient capacity; (4) synergies with other market mechanisms; and (5) enhanced reporting on the use of credits through Biennial Update Reports (BURs) in a gradual manner.

The FVA negotiation process focusing on accounting needs to consider these five points as a way to enable the wider participation of countries (especially developing countries) and to ensure environmental integrity of each mechanism. Such progress will help developing countries to develop implementation plans for their NDCs, including an option to use market-based mechanisms, because they can get a clearer idea about how best to use market-based mechanisms, given their national conditions, and how that will affect other parts of their mitigation actions, e.g. reducing emissions from deforestation and forest degradation (REDD), with respect to accounting under a post-2020 climate regime.

Loss and damage (L&D) associated with climate change has emerged as one of the important issues needing urgent attention at both national and international levels. The global community has recognised that there will be considerable L&D irrespective of our current level of efforts to mitigate and adapt to climate change.

Given the unpredictable and ever-changing nature of the global climate, adaptation will always be uncertain and potentially insufficient. In addition, the developmental deficit and mitigation deficit, lack of technical and scientific information and the capacity to use it at the local level contribute to L&D. In the UNFCCC process the discussion on L&D started relatively recently at COP16 in Cancun in 2010, and there remain many challenges in coping with L&D such as limited technical capacity to design and implement adaptation projects, limited financing and limited adaptation options.

The post-2020 international climate regime should support developing countries to measure and consider non-economic L&D data in identifying and implementing appropriately designed risk reduction options.

The survey of stakeholder positions and perceptions on various issues associated with L&D reveals that there is a disagreement on the definition of loss and damage calling for a more broad-based definition. Stakeholders showed significant support for promoting risk insurance as a means to address L&D. However, the research conducted by IGES indicates that risk insurance suffers from major limitations in addressing L&D, especially the non-economic L&D. Keeping in view the importance of non-economic L&D for the developing countries where communities still depend on natural resources, and their services, and informal social structures as support mechanisms, it is essential that the international climate regime help build the capacities of countries to give more emphasis on measuring and considering non-economic L&D data in identifying and implementing appropriately designed risk reduction options. It includes identifying simple methodologies for assessing the non-economic L&D, incorporating appropriate indicators in disaster databases and data collection formats and using this information for strengthening disaster risk reduction instruments including risk insurance and compensation.

It is our hope that this report will make a useful contribution to the establishment of an ambitious post-2020 climate regime. In particular, we hope that the report can help spur the discussion over ratcheting up mechanisms for mitigation and climate finance, as well as for the design of market-based mechanisms.

Chapter 1

Introduction

Kentaro Tamura and Satoshi Kojima

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1. Challenges for the international climate regime

More than two decades have passed since the Rio Earth Summit in 1992 when the international community officially acknowledged climate change as one of the most serious global problems. Since then, a certain level of effort has been made to tackle this problem and there has been increasing realisation that not much time is left for us to prevent serious negative climate impacts which could be potentially irreversible and catastrophic (Chen et al. 2011; Solomon et al. 2009). Still there is a sense of frustration that international climate efforts have failed to effectively address the problem (Andresen 2014).

Difficulties in addressing climate change stem from several unique features of the problem. Carbon dioxide (CO_2) emissions, the main driver of anthropogenic global warming, are an almost inevitable consequence of fossil fuel combustion and there is no established end-of-pipe solution to control this. It is a well-known fact that the mass consumption of fossil fuels enabled modern rapid economic growth, and consequently it is difficult to strongly decouple economic growth from CO_2 emissions (Burke et al. 2015; Wiedmann et al. 2015).[1] This is why many stakeholders including decision makers assume that climate mitigation will hamper economic growth. Another unique feature of climate change is its global externality aspect (Nordhaus 1991). No matter where greenhouse gases (GHG) are emitted, they contribute to global warming in the same way, and global warming affects everyone in the world. This global externality feature and the above mentioned difficulty in achieving strong decoupling of economic growth from GHG emissions raise the issue of burden-sharing across countries, particularly between developed and developing countries. In addition the climate change issue entails a high degree of uncertainty in terms of both scale of damage, which could be potentially catastrophic and irreversible, as well as probability of very severe climate events (Pindyck 2012). The international climate regime has been gradually developed to address these challenges.

1.1 Initial development of the climate regime: the Kyoto Protocol

With the ultimate goal of preventing "dangerous anthropogenic interference with the climate system," the United Nations Framework Convention on Climate Change (UNFCCC) was signed in 1992. The UNFCCC provides an overarching legal framework for international efforts to address climate change, and requires very modest obligations with

differentiation between Annex I Parties and non-Annex I Parties. For example, all Parties are requested to formulate and implement national policies to mitigate climate change, while Annex I countries were requested to return their emissions to earlier levels by 2000 without any specification of "earlier levels." By the first Conference of the Parties (COP1) in 1995, however, national communications and emission inventories submitted by Annex I Parties showed that there was little prospect to "return their emissions to earlier levels by 2000" in many of them. Against this background, a Berlin Mandate (Decision 1/CP.1) was adopted at COP1 to launch a new negotiation process towards a new protocol or another legal instrument by COP3 in Kyoto in 1997. The Berlin Mandate also clarified that Annex I Parties would take on numerical emissions reduction targets, while there would be no new commitments by non-Annex I Parties. This determined the basic structure of the Kyoto Protocol.

The Kyoto Protocol was adopted at COP3 in 1997 and set legally-binding emissions reduction targets for Annex I Parties. During the first commitment period (2005-2012), Annex I Parties including 37 developed countries and the European Community as a whole committed to reduce GHG emissions to an average of 5% against 1990 levels. Individual Parties' emissions reduction targets differed, and reflected the result of international negotiation. During the second commitment period (2013-2020), Annex I Parties including 28 European Union (EU) member countries committed to reduce GHG emissions by at least 18% below 1990 levels.[2] However, the composition of Parties in the second commitment period is different from the first (UNFCCC 2014)

1.2 Post Kyoto climate regime: the Copenhagen Accord and the Cancun Agreements

The Kyoto Protocol is a path-breaking regime where a group of countries agreed to set and implement legally-binding environmental targets in order not to exceed the carrying capacity of the Earth, based on the best available scientific evidence which still entails a high degree of uncertainty. Many developed countries with internationally legally-binding targets began to establish domestic legal frameworks to explicitly address climate change mitigation. During the first commitment period GHG emissions of the developed countries with legally-binding commitments as a whole (excluding economies in transition) saw a 7.6% reduction from the 1990 emission levels (without the Kyoto mechanism credits nor land use, land use change and forestry (LULUCF)), which well exceeded the Kyoto reduction target of 4.1%.[3] This was a major achievement of the Kyoto Protocol. At the same time, the limitations of the Kyoto Protocol become clear as explained below.

One such limitation is the participation of developing countries. On several occasions, developed counties sought further commitments from developing countries under the Kyoto Protocol. Such occasions included negotiations over the Marrakesh Accords (Decision 2/CP.7)[4] —the detailed rules of the Kyoto Protocol, Article 9 Review of the Protocol and the second commitment period based upon Article 3.9. However, their attempts failed because there was opposition from developing countries who made reference to the Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC) principle and the Berlin Mandate.

Meanwhile, the coverage of the Kyoto Protocol's legally-binding commitments on the world's total emissions declined, currently covering 15% of total global emissions. First, the number of developed countries with legally-binding commitments has been declining. The US signed the Protocol, but did not ratify it. Canada withdrew from it in 2010. Japan, Russia and New Zealand decided not to participate in the second commitment period.

This means that these three countries are still Parties to the Kyoto Protocol, but are not taking on legally-binding commitments. Second, emissions from developing countries have been increasing rapidly. By 2007, the emissions from non-Annex I Parties became larger than those from Annex I Parties.

Given concerns over the effectiveness of the Kyoto Protocol on global emissions, the Bali Action Plan (Decision 1/CP.13)[5] was agreed at COP13 in 2007, launching a new negotiation process—the Ad Hoc Working Group on Long-term Cooperative Actions (AWG-LCA) —under the UNFCCC. The AWG-LCA aimed to reach an agreed outcome on a comprehensive new framework (including not only mitigation but also adaptation, finance and technology) by 2009. One of the significant features of this process was that developing countries first agreed to discuss mitigation actions. This was a departure from a "no new commitments" stand by developing countries and indeed was a turning point in climate change negotiations.

In 2009, heads of 119 countries gathered in Copenhagen. The Copenhagen Accord (Decision 2/CP.15)[6] was drafted but was not formally adopted at COP15 because several developing countries raised concerns about the transparency of the negotiation process and strongly opposed the adoption. However, 114 Parties expressed their agreement with the Copenhagen Accord. Furthermore, this Accord included many key ideas which laid the foundations for the Cancun Agreements (Decision 1/CP.16)[7] which were formally adopted at COP16 the following year in 2010.

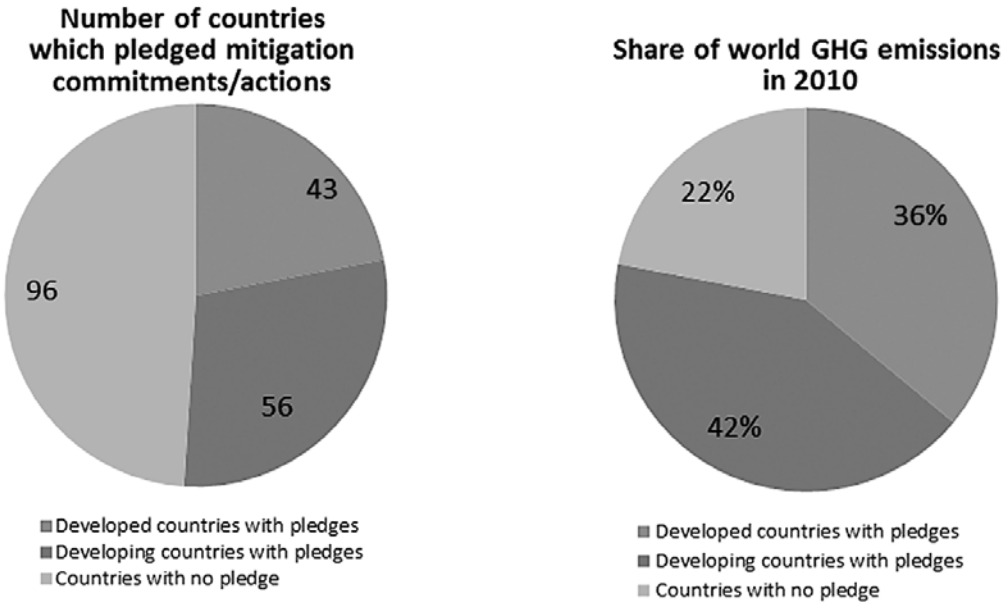
One of the key ideas incorporated into the Copenhagen Accord/Cancun Agreements is a so-called 2 degrees Celsius (2°C) target—holding global average temperature rise at less than 2°C from pre-industrial levels. As mentioned above, the ultimate objective of the UNFCCC is to prevent dangerous human interference with the climate system, but the UNFCCC itself does not provide a clear definition of what is dangerous. Parties agreed that the 2°C target is the temperature ceiling that would offer a reasonable chance of avoiding the worst impacts of climate change. In this sense, the 2°C target is a political interpretation of the ultimate objective of the UNFCCC.

Another key feature of the Copenhagen Accord and the Cancun Agreements is that distinction between developed and developing countries in terms of mitigation efforts began to be vague (Rajamani 2012). Under the Copenhagen Accord, developed countries made voluntary pledges for economy-wide mitigation commitments/targets; and developing countries made voluntary pledges for mitigations actions, so-called NAMAs—Nationally Appropriate Mitigation Actions. Many developing countries including China and India pledged economy-wide targets, although these are emission intensity targets rather than absolute reduction targets. Furthermore, developed country pledges are subject to international assessment and review (IAR), while developing country pledges are subject to international consultation and analysis (ICA). The difference between IAR and ICA is that the former aims to review progress towards the achievement of emissions reduction targets as well as the provision of support to developing countries, and the latter aims to increase the transparency of mitigation actions and their effects. Differentiation between developed and developing countries still exists, but has begun to blur.

1.3 The bottleneck of the current negotiation: a trade-off between effectiveness and comprehensiveness

The idea of voluntary pledges with international review was in sharp contrast to negotiation-based, legally-binding targets under the Kyoto Protocol. To ensure the

clarity and transparency of the pledges, international processes were agreed under the Cancun Agreements. However these pledges were essentially nationally-determined, and were not subject to international negotiation, let alone a compliance mechanism at the international level. This approach was considered necessary for ensuring wider participation of countries with different national circumstances. Indeed, 89 Parties including 43 developed countries and 56 developing countries have submitted their mitigation pledges, and their GHG emissions amounted to around 80% of the world GHG emissions in 2010 (see Figure 1.1).



Source: Author's own estimation, based upon UNFCCC website

Figure 1.1 ***The status of mitigation pledges under the Copenhagen Accord and the Cancun Agreements***

However, the nationally-determined approach led to a concern that the sum total of these emissions reduction pledges would not be adequate enough. Thus there is a gap between a range of emission paths consistent with the 2°C target and emission projections under the current pledges (UNEP 2014). How to fill this gap became a major issue and, as seen below, Parties at COP17 agreed to start a work plan on deepening mitigation efforts, as part of the path they are charting towards a new future climate agreement in Paris.

Unlike the mitigation-centred Kyoto Protocol, the Copenhagen Accord and the Cancun Agreements provide a more comprehensive framework which addresses not only mitigation but also adaptation, finance, technology and capacity-building. In particular, with regard to finance, developed countries agreed to mobilise and provide scaled-up climate finance in the short and long term to enable developing countries to take greater and more effective action. As first-start finance, developed countries collectively pledged to provide USD 30 billion between 2010 and 2012. As long-term finance, they also pledged to mobilise USD 100 billion annually by 2020, through public and private sources. The Green Climate Fund (GCF) was set up as a new financial entity of the UNFCCC. This comprehensive approach is a precondition for deeper engagement by developing countries.

2. What can we expected from the Paris agreement?

Against the situation described in the previous section, the Paris agreement to be concluded at COP21 in December 2015, is set to be a new universal, legal agreement to deal with climate change beyond 2020. This agreement is expected to establish a solid foundation for bridging the gap between the 2°C target and the nationally determined contribution (NDC) process, which employs a bottom-up approach to allow for the sovereignty of individual nations so that they themselves determine the ambition level of their mitigation contributions.

In 2014, we observed a hint of strong decoupling of global CO_2 emissions from economic growth, that is, the global energy-related CO_2 emissions did not increase while the global economy grew from 2013 to 2014. However, further efforts are crucial to make the decoupling of economic growth from CO_2 emissions more robust, and shift the global emissions' pathway towards a range consistent with the 2°C. This is something to which the Paris agreement can actually contribute. It is certainly a challenging task to simultaneously pursue these two conflicting objectives; one, to attract all parties including not only developed nations but also developing nations; and two, to implement sufficiently ambitious collective commitment at the global level corresponding to the 2°C target. Ensuring the effective achievement of mitigation goals generally requires binding commitments from the Parties, but it is very likely that such a binding approach will be rejected by many countries, in particular developing countries.

In order to address this challenge and establish an ambitious and effective post-2020 international climate framework, the following aspects may be worthy of serious consideration. First is to develop a periodical cycle that also motivates and encourages Parties to increase their level of actions towards the 2°C target in the post-2020 period. Second is the departure from the conventional notion that strengthened climate action is synonymous with increased burden and cost. To date, various opportunities and benefits that the actions towards a low-carbon economy could deliver in both the short-term and long-term have been under-represented in the international climate negotiations.

3. The objectives of this report

This report, *The Paris Climate Agreement and Beyond: Linking Short-term Climate Actions to Long-term Goals,* discusses possible ways to enhance the Parties' contributions to climate mitigation and finance, and draws lessons for the international negotiations leading up to the Paris agreement. In particular, this report emphasises the importance of the dynamic nature of the climate regime, looking not only at the Paris climate agreement but also at the follow-up to the agreement (so-called "beyond"). This is of critical importance to make the NDC approach sufficiently effective to achieve the 2°C target.

In this regard, the report makes concrete proposals to establish a cycle for reviewing, revisiting and enhancing NDCs over time by addressing three key questions: (i) how different implementation periods can be addressed; (ii) how legal stringency and flexibility regarding NDCs can be balanced; and (iii) what kind of information and indicators should be used in the cycle. It also examines the role of market-based mechanisms to incentivise mitigation actions in both developed and developing countries.

The report also takes up the issue of the time-scale gap between the long-term nature and the associated high degree of uncertainties of climate change, and examines the

necessity of short-term tangible benefits for policymakers to make decisions. With this situation in mind, the report puts great emphasis on the necessity to provide clear signals to various stakeholders that ambitious climate actions are not only an obligation of the current generation to future generations but will also be rewarding even in the short term.

The remainder of the report is organised as follows:

Chapter 2 reviews the global CO_2 emissions trend and highlights the major factors of structural change in emissions based on the cases of the European Union (EU), the United States (US) and China. Based on the obtained insights, this chapter discusses the importance of the feasibility of the climate regime in both static and dynamic senses, that is, not only that it is feasible under the current political reality but also that it will enable more ambitious and feasible measures in the future.

Chapter 3 proposes a dynamic cycle for reviewing and submitting NDCs in order to enhance climate mitigation and climate finance. This chapter argues the importance of striking a balance between legal stringency and flexibility in order to involve all members of the global community without losing effectiveness to achieve the 2°C target. Further, it is pointed out that the international finance component for post-2020 must be certain in terms of future funding scale and transparent in terms of financial inputs and resulting impacts.

Chapter 4 provides a concrete proposal to fully utilise the scientific community in order to effectively implement the dynamic cycle proposed in the previous chapter. In addition to assessing NDCs from the viewpoint of equity, sufficiency, mitigation potentials and ambition levels, this chapter highlights how important it is for the scientific community to identify and demonstrate opportunities and benefits of mitigation actions in order to address the static and the dynamic political feasibility issues discussed in Chapter 2. In order to ensure effective contributions from the scientific community, it is proposed to establish a consortium of climate policy research institutes with good regional representatives.

Chapter 5 presents an initial assessment of Japan's intended nationally determined contributions (INDCs) as an illustration of the assessment of NDCs *ex-ante* as a part of the proposed dynamic cycle. Among a wide range of approaches proposed to evaluate INDCs, this chapter reports on the results of three analyses: (i) international comparison of economy-wide and sector-specific decarbonisation indicators; (ii) remaining emissions allowances under different effort-sharing principles; and (iii) mitigation potential and policy effort. These analyses are based on large scenarios reported in the literature, taking account of uncertainties entailed in GHG emissions modelling. It is claimed that such a synthesis approach is well accommodated by the research consortium proposed in the previous chapter.

Chapter 6 discusses accounting issues under a framework for various approaches (FVA) including market-based mechanisms for a post-2020 climate regime and argues the necessity to incorporating capacity building as an essential element. With the example of the Joint Crediting Mechanism (JCM), currently being discussed under the FVA, the chapter shows that developing countries are likely to encounter unique challenges in different stages of accounting, namely issuance of credits, transactions of credits and accounting towards a country's INDCs. To overcome these challenges, the chapter proposes options to enhance the role of accounting under the FVA to ensure environmental integrity and incentivise mitigation actions by both developing and developed countries.

Chapter 7 takes up the issue of loss and damage (L&D) associated with climate change. Scientists have long warned about the possibility of residual damages from climate change irrespective of our current level of efforts to mitigate and adapt, but it was at COP16 in Cancun in 2010 that this issue received proper attention in the international climate change regime. Currently there is limited agreement on a common definition of L&D, making it more difficult for stakeholders to effectively tackle this issue. This chapter aims to review the ongoing discussion on L&D, to identify adaptation barriers and limitations of the current L&D approaches, and to suggest a way forward to overcome such limitations, drawing on the findings of ongoing IGES work on stakeholder positions and perceptions on various issues associated with L&D.

Finally, Chapter 8 summarises the major key messages of the main chapters and brings the book to conclusion by highlighting the way forward.

Notes

1. In this report, strong decoupling of economic growth from CO_2 emissions is defined as reduction of the level of CO_2 emissions under economic growth, and weak decoupling is defined as reduction of carbon emission intensity, in terms of CO_2 emissions associated with one unit of GDP, under economic growth (cf. Handrich et al. 2015).
2. Doha Amendment to the Kyoto Protocol. 2012
3. The authors estimated based on the emission database developed by the Greenhouse Gas Inventory Office of Japan (http://www-gio.nies.go.jp/aboutghg/nir/nir-j.html).
4. FCCC/CP/2001/13/Add.1
5. FCCC/CP/2007/6/Add.1
6. FCCC/CP/2009/11/Add.1
7. FCCC/CP/2010/7/Add.1

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Chapter 2

Historical and Recent Trends of CO_2 Emissions: Current Status and Ways to Close the Gap towards the 2°C Target

Masahiro Suzuki, Madoka Yoshino,
Kentaro Tamura and Satoshi Kojima

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Key Messages

- Global energy-related CO_2 emissions stalled while the world GDP grew 3% in 2014, which is an encouraging sign for the start of strongly decoupling emissions growth from economic growth on a global scale. However, it is apparent that much more effort is needed to achieve the 2°C target.
- The degrees of decoupling differ among the three largest emitters. Since 1990, the European Union has shown an evident trend of strong decoupling, achieving economic growth with decreasing CO_2 emissions. During the same period, the United States increased emissions but started to show a decreasing trend in recent years, and China increased emissions whilst also showing a weak decoupling of emissions from economic growth.
- Major driving factors of structural change in emissions differ across countries. However, national climate policies are associated with, and often triggered by, other national priorities such as security, economic growth, domestic and international leadership, and welfare of citizens. Development of an international climate framework for leveraging these national priorities to boost climate actions is essential for bridging the gap towards the 2°C target.
- Mitigation efforts generate long-term benefits while decision-makers tend to worry more about the short-term negative impacts to the economy. Transition to a low-carbon development path essentially requires overcoming this short-term thinking by putting more priority on long-term sustainability. Under the current political reality, however, demonstration of short-term tangible benefits of climate actions could play an important role to encourage more robust climate actions.

1. Introduction

The global distribution of carbon dioxide (CO_2) emissions has changed significantly in recent decades. Many developed nations reached a mature economy in which their economy grew at a relatively small rate or stagnated, and their population stabilised or started to decline. Many developing nations, on the other hand, experienced strong economic and population growth, and increased their share of the world's total emissions – a trend which is likely to continue into the foreseeable future.

Under such circumstances, a number of regulations and other political and economic measures have been put in place worldwide, particularly among developed nations and developing nations with high growth rates, aiming to reduce emissions growth through decarbonising energy systems. Perhaps as a result, according to the International Energy Agency (IEA), world energy-related CO_2 emissions growth stalled while the world gross domestic product (GDP) grew 3% in 2014, which indicates the start of decoupling CO_2 emissions growth from economic growth at the global level (IEA 2015). IEA attributes this trend mainly to the improvement of energy efficiency and the strong investment in low-carbon energies, in particular, renewable energies. However, IEA also warns that neither the current level of effort nor the intended nationally determined contribution (INDC) level will limit the global mean temperature increase to 2°C above pre-industrial levels (IEA 2015), which is required to prevent the most severe consequences of climate change (the 2°C target).

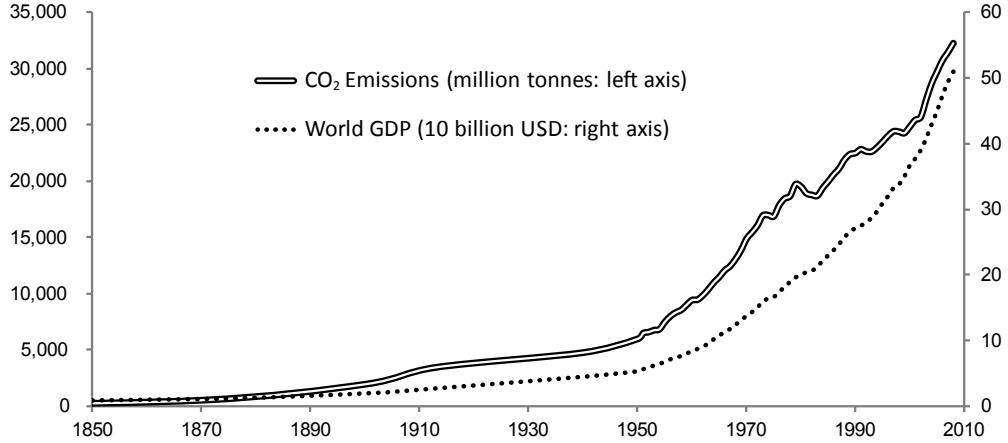
This chapter aims to examine these recent changes in CO_2 emissions, and to identify measures to accelerate this decoupling trend. The rest of this chapter is organised as follows. Section 2 reviews the historical trend in global CO_2 emissions and economic growth both at the global level and by three groups at different development stages: (1) the Organisation for Economic Co-operation and Development (OECD) nations – a group of developed countries; (2) BRIICS (Brazil, Russia, India, Indonesia, China and South Africa) – a group of emerging countries; and (3) rest of the world (ROW) – a group mainly consisting of developing countries. Section 3 then takes a closer look at the world's three biggest emitters: the European Union (EU), the United States (US) and China, with an aim to identify the major drivers of decoupling trends in each country/region.[1] With the identified drivers in mind, Section 4 discusses important elements to further accelerate reducing the emissions to meet the 2°C target with an emphasis on the importance of short-term benefits in the current political reality. Finally, Section 5 presents a summary.

2. The historical CO_2 emissions trend and today's global emissions outlook

This section first analyses the relationship between CO_2 emissions growth and economic growth since the early 19th century with a focus on the changing use of different types of energy resources. It then reviews the global distribution of CO_2 emissions in recent decades and argues the necessity of further emissions reduction to achieve the 2°C target.

2.1 Historical trends of CO_2 emissions and economic growth

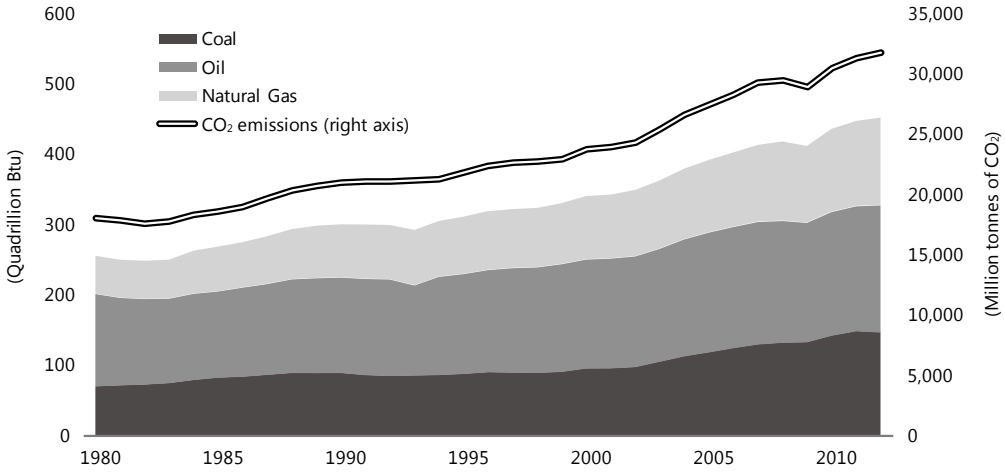
Since the early 19th century when the world started to boost its economy through rapid industrialisation, there has been a strong correlation observed between economic growth and CO_2 emissions growth (See Figure 2.1).



Source: GGDC (2010) for World GDP, Boden et al. (2015) for CO_2 Emissions, re-compiled and calculated by the authors.

Figure 2.1 ***CO_2 emissions and world GDP***

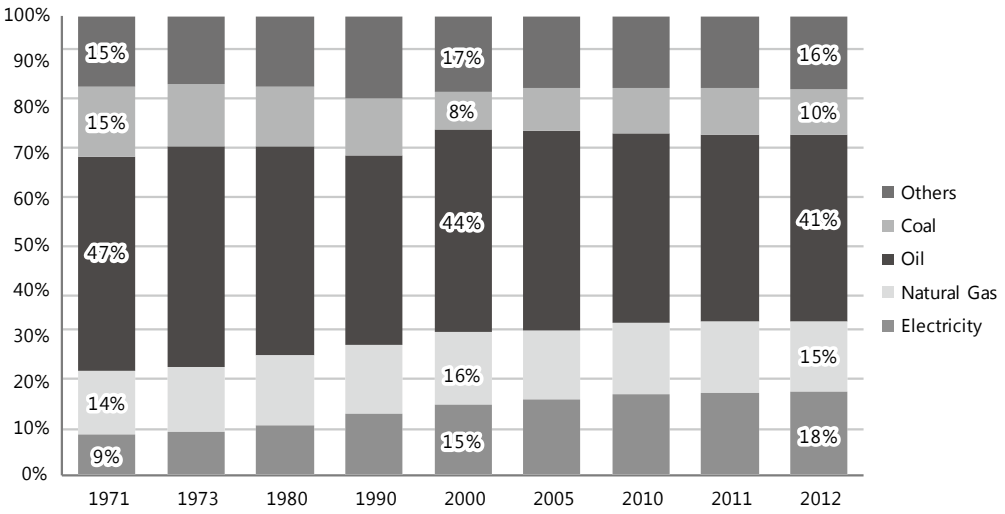
This strong linkage between economic growth and emissions growth has been persistent due to the fact that economic growth has been achieved by consuming an increasing amount of energy, most of which was generated by burning fossil fuels. At first, coal was the dominant resource to empower industrialisation while oil gradually gained greater importance, particularly from the late 19th century when many nations went through militarisation and fuelled their battleships, tanks and aircrafts with oil (Yergin 2011). This shift from coal to oil was further accelerated as a result of the energy consumption revolution in the mid-20th century, and the world energy systems developed into a complex platform that consumes different kinds of fossil fuels including coal, oil and natural gas to meet the continuously rising and diverse demand for energy (Cherp and Jewell 2011). For example, these resources often fulfil a specific demand for energy such as oil for transportation, coal for industrial use as a raw material including for iron and steel production, and natural gas for the demands from industry and households for heating and cooking. Consequently, the demand for all these fossil fuels increased rapidly as the world economy went through continuous growth. As shown in Figure 2.2, CO_2 emissions made a steady increase along with the rising consumption of these fuels.



Source: EIA (2015), re-compiled and calculated by the authors.

Figure 2.2 Global fossil fuel consumption and CO_2 emissions

At the same time, the demand for electricity increased significantly and the share in total energy demand grew compared to other forms of energy as illustrated in Figure 2.3.



Source: IEA (2014a), re-compiled and calculated by the authors.

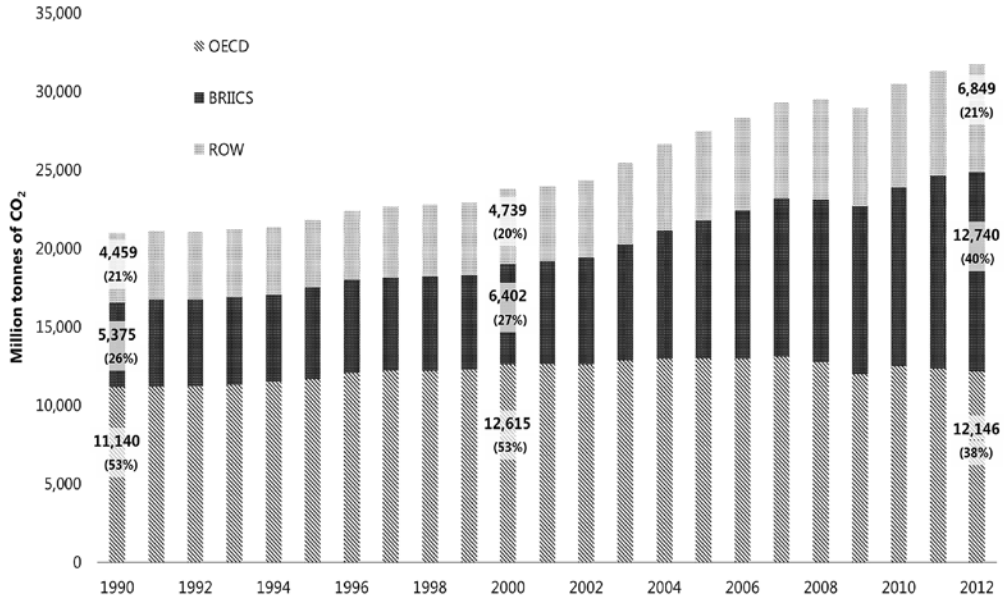
Figure 2.3 Share of energy sources in the final energy consumption at the global level

This trend is partly because electricity — which can be produced not only by fossil fuels but also by other types of low-carbon energy sources today such as renewable energies and nuclear fuels — became an important engine to fuel industrial machinery and household appliances.

2.2 Change in global distribution of CO_2 emissions

Each country now fuels its energy systems with different types and amounts of energy resources based on their development level as well as political, economic, social and technological conditions. These differences are reflected in the recent emissions trends, which are clearly observable when comparing OECD, BRIICS and ROW.

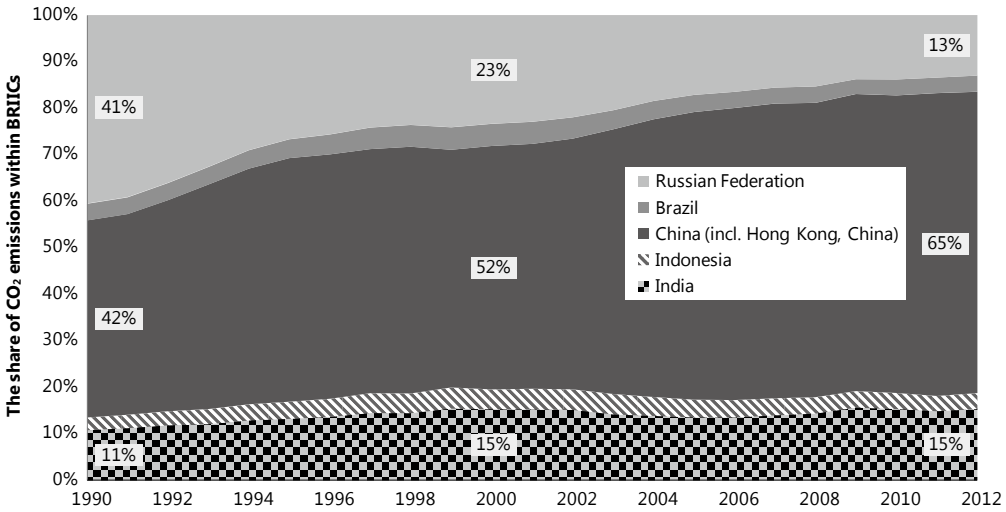
As shown in Figure 2.4, CO_2 emissions from OECD peaked in 2007 at 13,103 million tonnes of CO_2 (Mt CO_2) and saw a slightly declining trend thereafter, resulting in 12,146 Mt CO_2 in 2012. Conversely, CO_2 emissions from BRIICS show a steady and rapid increase compared to the other groups, representing a share of 26 % in 1990 and 40% in 2012. ROW shows an increasing trend from 4,459 Mt CO_2 in 1990 to 6,849 Mt CO_2 in 2012, but the share is maintained at around 20%. Therefore, non-OECD countries increased the share from around 45% in 1990 to around 62% in 2012.



Data source: IEA (2014a), re-compiled and calculated by the authors.

Figure 2.4 CO_2 emissions since 1990

Figure 2.5 presents a closer look at the CO_2 emissions distribution in BRIICS.



Data source: IEA (2014a), re-compiled and calculated by the authors.

Figure 2.5 Energy based CO_2 emissions of BRIICS between 1990 and 2012

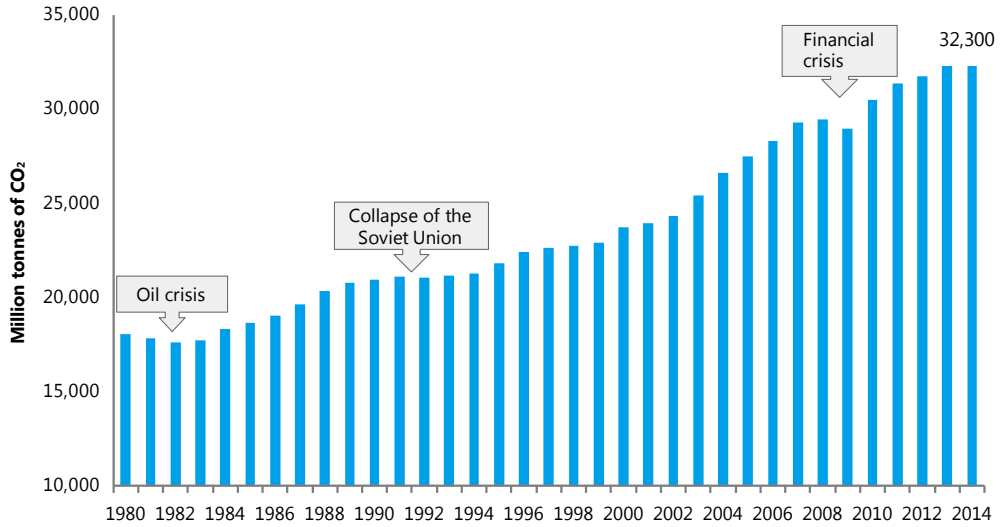
China dominates the share of emissions from BRIICS, with an increase from 42% in 1990 to 63% in 2012, indicating that emissions increased by 3.6 times from 2,277 Mt CO_2 in 1990 to 8,251 Mt CO_2 in 2012, along with the growth of GDP by 7.6 times. The Russian Federation, after the collapse of the Soviet Union, reduced its emissions and its share within BRIICS from 41% in 1990 to 13% in 2012, but maintained approximately 65-80% (1,417 Mt CO_2 in 1997 and 1,660 Mt CO_2 in 2012) of the 1990 leves.

The emission share of India within BRIICS increased by only 4% from 1990 to 2012, although India has significantly increased its emissions from 581 Mt CO_2 in 1990 to 1,954 Mt CO_2 in 2012, which is an increase of 3.4 times. As a whole, energy based CO_2 emissions from BRIICS countries accounted for approximately 25% of the world emissions in 1990 and this share increased to over 40% in 2012, an increase of 2.4 times in 22 years. Therefore, it is critical, considering the share from these countries in the total global emissions, that they peak their emissions as early as possible to achieve the 2°C target.

Although the emissions share of ROW currently remains around 20%, these countries will go through rapid economic growth in the near future and consequently increase their emissions. Therefore, it is important that they leapfrog to the development of a low-carbon society in order to prevent significant amounts of carbon from being locked into the assets of these countries.

2.3 Stalling of CO_2 emissions

These different emissions trends in the developed (OECD), emerging (BRIICS) and developing (ROW) economies resulted in the stalling of CO_2 emissions growth on a global scale in 2014 (IEA 2015). IEA (2015) argues that "(it is) the first time at least in the last 40 years that such an outcome has occurred outside economic crisis" (p.11). According to the IEA, stalling or decreasing emissions has previously been observed several times in correlation with economic stagnation such as during the oil crises in the 1970s and the financial crisis in 2009 (See Figure 2.6).



Data source: IEA (2014a; 2015), re-compiled by the authors.

Figure 2.6 Energy-based CO_2 emissions since 1990

This time, however, the global economy grew by 3%. Based on this fact, the IEA argued that "growth in the global economy and energy-related emissions may be starting to decouple" (IEA 2015; p.11). OECD countries, on average, have demonstrated a continuous trend of strong decoupling in recent years, and now China, the world biggest emitter, is also showing a weakening of the previously persistent link between economy and emissions.

It must be noted that stalling emissions is not enough to achieve the 2°C target and thereby avoid future climate catastrophe. Out of the carbon budget to secure a 50% likelihood of achieving the 2°C target, 3,010 gigatonnes (Gt) of CO_2, almost two-thirds was already consumed by 2014 and the budget will be completely exhausted by 2040 if the current pace of consumption is kept (IPCC 2014; IEA 2015). The level of effort of the submitted INDCs for COP21 or the most likely contents of the expected INDCs from the currently non-submitted nations will only give us another eight months until budget exhaustion, relative to the scenario without INDCs (IEA 2015). This is in line with the analysis from Climate Action Tracker (CAT), an international research consortium, which argues that the current INDC level has "a 92% probability of exceeding 2°C" (CAT 2015).

There already are international discussions taking place on the means to scale up the level of climate efforts to fill this gap towards the 2°C target. The United Nations Environmental Programme (UNEP) Gap Report argues that scaling up and replicating existing climate mitigation actions could reduce 29 Gt CO_2 equivalent (CO_2eq) of GHG emissions in 2030 (UNEP 2014). In order to exploit this mitigation potential, UNEP (2014) calls for creating the right incentives, including carbon pricing, fossil fuel subsidy reform, and the promotion of investment in low-carbon and resource efficient assets. IEA (2015) also suggests the "Bridge Scenario" in which five policy measures are proposed to accelerate the recently observed decoupling trend and to meet the 2°C target. These measures are: (1) improving energy efficiency; (2) reducing the least-efficient coal fired power plants; (3) investing in renewable energies; (4) phasing out of subsidies to fossil fuels; and (5) reducing methane emissions from oil and gas production.

These recommendations are solid and they have been widely accepted as a general policy direction. In order to implement climate actions like these to further reduce emissions, it is critical to demonstrate that additional climate efforts contribute to the benefits of countries in their specific country conditions and needs. In this regard, the next section takes a closer look at the climate/energy policies of three major economies and thus key actors in the international climate negotiation, namely the EU, the US and China, for the purpose of identifying the major driving elements of their decoupling emissions trends.

3. CO_2 emissions trends in the EU, the US and China

This section first reviews the recent emissions trends of the EU, the US and China, and highlights the major driving factors that contribute to their recently observed decoupling trends.[2] While these factors can be diverse, the existing literature (e.g. Amineh and Crijns-Graus 2014; Hayes and Knox-Hayes 2014; and Oberthür and Kelly 2008) often offers arguments based on the following three pillars: (1) energy security; (2) industry and economy; and (3) institutional and social environment. This section applies these pillars to review the three countries/region.

Table 2.1 shows the GDP, CO_2 emissions and CO_2 intensity of the EU, the US and China in 1990 and 2012. The positive growth of GDP is observed in all countries/region, however only the EU records the decrease of CO_2 emissions and shows strong decoupling.[3] On the other hand, CO_2 intensity decreased in the US and China, rather significantly in the latter, which indicates weak decoupling of emissions.

Table 2.1 GDP, CO_2 emissions and CO_2 intensity of the EU, the US and China in 1990 and 2012

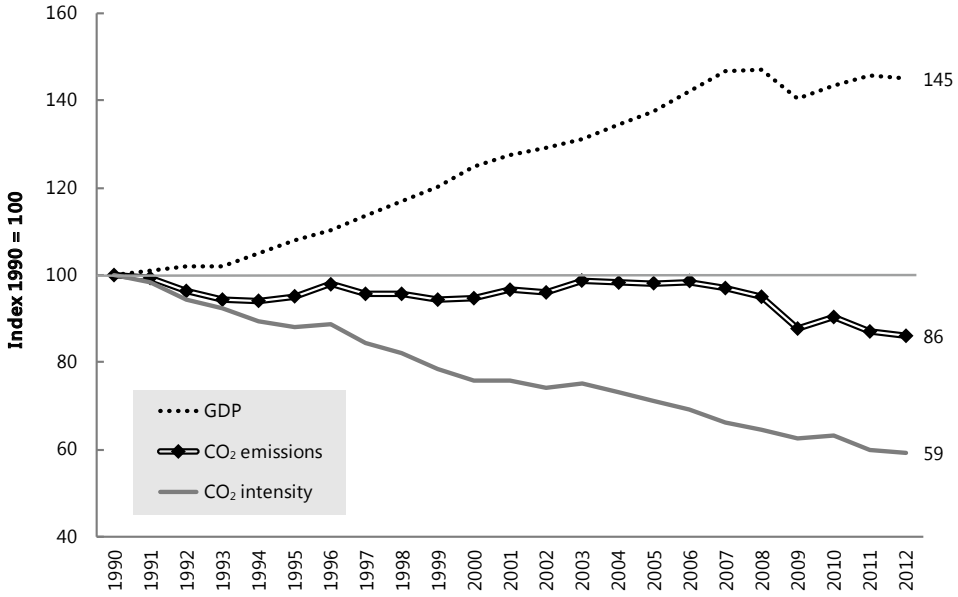
	European Union (EU-28)			United States			China (incl. Hong Kong, China)		
	1990	2012	difference (%)	1990	2012	difference (%)	1990	2012	difference (%)
GDP (billion 2005 US dollars)	10,068	14,614	**45**	8,229	14,232	**73**	626	4,756	**660**
CO_2 Emissions (million tonnes)	4,068	3,505	**-14**	4,869	5,074	**4**	2,278	8,251	**262**
CO_2 Intensity	0.40	0.24	**-41**	0.59	0.36	**-40**	3.64	1.73	**-52**

Data source: IEA (2014a; 2015), re-compiled by the authors.

3.1 EU

3.1.1 Emissions trends and recent climate policy

The EU shows an evident trend of strong decoupling emissions growth from economic growth (see Figure 2.7). In 2012, compared to the 1990 level, the economy in EU member states collectively grew about 45% while CO_2 emissions were reduced by 14% (4,069 Mt CO_2 in 1990 to 3,505 Mt CO_2 in 2012) and emissions intensity was cut by around 40%. The EU explains that this decoupling trend is observed in all the EU member states (EC 2014a).



Source: IEA (2014a), re-compiled and calculated by the authors.

Figure 2.7 Historical GDP, CO_2 emissions and CO_2 intensity in the EU

As for the future reduction targets, the EU adopted the Climate and Energy package in 2009, where it set a goal of a 20% emissions reduction by 2020 compared to 1990 levels. The European Commission explains that the EU is currently on track and will exceed this target through reductions of 21% (EC 2014a). Furthermore, in March 2015, the EU submitted its INDC to the UNFCCC, in which the EU aims to achieve at least 40% reduction by 2030 from 1990 levels (Latvian Presidency of the Council of the European Union and the European Commission 2015).

For the purpose of spearheading the transition to a low-carbon economy and achieving these climate targets, the EU has taken various climate measures. Such measures include: (1) introduction and further implementation of the EU Emissions Trading System (EU ETS); (2) establishment of a stringent energy efficiency standard for buildings, equipment and household appliances; (3) setting an energy mix target with increased share of renewable energies; and (4) mandating car manufacturers to improve fuel efficiency. Today, the EU ETS covers approximately 45% of GHGs emissions from the EU member states (EC 2013a). At the same time, the EU is aiming to increase energy efficiency to 20% by 2020 and at least to 27% by 2030, and to expand the share of renewable energies within its energy mix to 20% by 2020 and at least 27% by 2030 (EC 2014b).

3.1.2 Major driving factors behind decoupling trends

Energy Security – *low endowment of fossil fuels drives renewables investment*

The EU is endowed with a limited amount of fossil fuels within its borders, which makes it politically and economically vital to develop renewable energies as a means to enhance energy supply security (IEA 2014b). According to BP, a major oil and gas corporation headquartered in London, the shares of proved coal, oil and natural gas reserves located within EU borders are 0.3%, 0.8%, and 6.3% respectively out of the total reserves (BP

2015). This makes the region heavily dependent on external energy producers. Around 53% of energy consumed in the region in 2013 was procured from foreign sources, and out of this, the external oil dependence exceeded 88% (EC 2014c). Expanding the share of renewable energies will help the EU move towards greater energy self-reliance and security, although the foreign dependence ratio of respective fossil fuels may increase due to the decreasing trend in internal production of those fuels (Amineh and Crijns-Graus 2014). Indeed, renewable energy gets significant policy and financial support in the EU. In 2013, around USD 70 billion or EUR 52 billion of subsidies were provided for renewable energy, which was equivalent to 57% of total global subsidies for renewable energy (IEA 2014a). There needs to be a more holistic and in-depth analysis when assessing the extent of energy security improvement by increasing renewable energies. However, a study conducted by Jewell et al. (2013) which evaluates the future scenarios of long-term energy security in the major econimies under the various ambition levels of climate policies, shows a positive impact for the EU.

Industry and Economy – *low-carbon economy as a core growth plan*

It is at the heart of EU's industrial policy to revitalise its economy, especially after the financial crisis of 2009, by striving to be a global leader in sustainability (EC 2013b; 2014d). In particular, the development of low-carbon technologies is critical to increase energy efficiency, reduce energy demand and thus strengthen EU's industrial competitiveness. This low-carbon policy also aims to create a new market area and job opportunities. A recent communication from the European Commission states that "EU companies cannot compete on low price and low quality products. They must turn to innovation, productivity, resource-efficiency and high value-added to compete in global markets" (EC 2014d; p.8-9). Out of six areas listed in this context as EU's investment priority for innovation, five are directly related to cleaner production and/or green products, and the other is the so-called Key Enabling Technologies (KETs) which "modernise EU industry and make the transition to a knowledge-based and low-carbon resource-efficient economy" (EC 2013b).[4]

Institutional and Social Environment – *climate policy gives legitimacy and authority to EU*

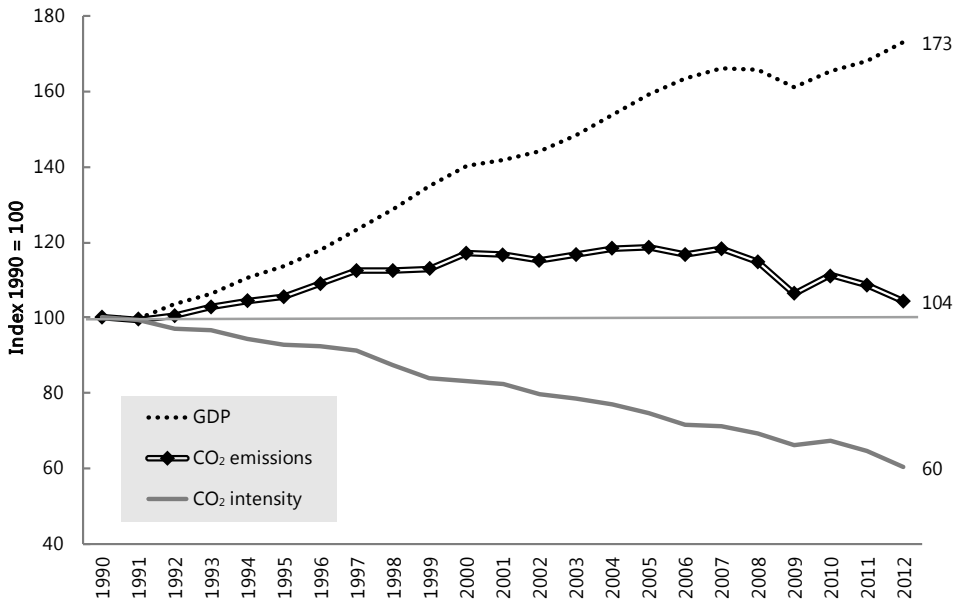
The institutional structure, the role of the public and the societal ideology reinforce each other to push the EU and its member states towards becoming a leader in international climate regime. Climate change is an issue that cannot be solved within national boundaries, but requires collective action among nations. This gives legitimacy to European nations for unification, and to have a centralised authority with an aim to develop coherent policies within the EU member states (Hayes and Knox-Hayes 2014). In addition, Hayes and Knox-Hayes (2014) also argue that there is a political space between EU institutions and EU citizens which enables the EU to develop and exercise ambitious top-down climate policies. Furthermore, there is a shared notion among the member states that the EU should act as a leader of multilateralism (Oberthür and Kelly 2008). In addition, public support on climate policy is fairly strong and stable (See EC 2014e). This social foundation further reinforces the integration of the EU, which contributes to more positive bottom-up movements among the public towards climate goals.

These driving forces are expected to motivate the EU to collectively strive for a further leading role both in internal climate policies and international negotiations. Translating the EU-wide 2020 and 2030 reduction targets into a collection of effective and immediate policy implementations in each member state is significantly challenging, but such a collaborative practice by the EU can provide lessons for the international community to seek even stronger cooperation on a global scale.

3.2 US

3.2.1 Emissions trend and recent climate policy

The US was the largest emitter of CO_2 in the world until 2006 when China took over the position. The US recently started to slow down its growth of CO_2 emissions (see Figure 2.8). In 2012, US CO_2 emissions were 5,074 Mt, which is a reduction of approximately 4% from the previous year and a 12% reduction from 2005.



Source: IEA (2014a), re-compiled and calculated by the authors

Figure 2.8 Historical GDP, CO_2 emissions and CO_2 intensity in the US

In 2010, the US submitted its 2020 target of a reduction of about 17% in GHG compared to 2005 levels (US Department of State 2010). The US communicated to the UNFCCC secretariat that its target will conform with the national climate and energy legislation and that the final target will be submitted "in the light of enacted legislation" and under the assumption that other Annex I country parties and more advanced Non-Annex I parties associated with and submit mitigation actions according to the Copenhagen Accord. At the time, the US Congress was considering the Waxman-Markey bill which proposed GHG emissions reduction of 30% by 2025, 42% by 2030, in line with 83% by 2050, compared with 2005 levels. Although it was passed by the House of Representatives, it was never passed in the Senate.

In March 2015, the US submitted its INDC to the UNFCCC Secretariat to reduce GHG emissions by 26% to 28% below the 2005 level (US 2015). Reaching this target will require a significant increase in the speed of GHG emissions reduction to 2.3-2.8% per year, or an approximate doubling compared to the 2020 target (United States of America 2015).

3.1.2 Major driving factors behind decoupling trends

Energy Security – *domestic shale gas increases security and reduces emissions*

Addressing climate change in the US has not been easy work for the federal government or the President but the decoupling trend has occurred anyway, and it has contributed to strengthening energy security. One example is the increased domestic production of shale gas, which has been a major driver to reduce carbon emissions in the US while also significantly increasing energy security. Shale gas production started around the year 2000 and gross shale gas withdrawals increased from 5 billion to 33 billion cubic feet per day in 2013 (US Energy information administration 2014). At the same time, the relative contributions from coal, natural gas without combined cycle have decreased (De Gouw et al. 2014). Natural gas has approximately half the carbon dioxide coefficient compared to coal, meaning that increased production of domestic natural gas has some benefits for energy supply security and CO_2 emissions reduction.[5] The total CO_2 emissions from fossil fuel power plants decreased rapidly between 2008 and 2012 and a significant fraction of this decrease was attributable to the fuel switch from coal to natural gas (De Gouw et al. 2014). According to Wang and Krupnic (2013), increased shale gas production in the US is attributable to various factors including technology innovation, government policy, private entrepreneurship, land and mineral rights ownership, high natural gas prices, market structure, water availability and infrastructure. The R&D policy of the US led to technology innovation and tax credits encouraged private investment for shale gas production (Wang and Krupnic 2013).

Industry and Economy – *green jobs and energy efficiency vitalise the economy*

Since President Barack Obama took office, solar generation has increased by 20 times and wind power by 3 times (White House 2015). Building on this progress, the White House explains that it has secured USD 4 billion commitments from corporations in investment for clean energy. President Obama announced an increase in the share of renewables to 20% by 2030 (White House 2015). Through improving energy efficiency in buildings, utilities, manufacturers, school districts and businesses have saved an average of 2% per year, which is the equivalent of USD 84 million since 2011. Responding to the challenge for "Better Buildings" issued by the President, more than 250 partners have joined this initiative to increase energy efficiency by 20% in 10 years (US DOE 2015). As energy efficiency leads to savings in electricity bills, industry and the public are more willing to be engaged for economic reasons. Domestically, in his 2013 climate action plan, President Obama announced that the carbon pollution from coal-fired power plants will be regulated. Due to the increased stringency of fuel efficiency standards of 54 miles per gallon by 2025, there is a growing market for more efficient passenger vehicles. According to the US Environmental Protection Agency (EPA) administrator Gina McCarthy, US industry sees an opportunity for the shift towards clean energy and is embracing it (EPA 2015a). The year 2014 saw the US as the second largest investor in the world with renewable energy investment at USD 38.3 billion, a 7% increase from the previous year (Frankfurt School- UNEP Collaborating Centre for Climate & Energy Finance 2015).

Institutional and Social Environment – *scepticism, power relations and leadership*

In the US, climate science and research programmes started before 1970s, and the Global Climate Protection Act in 1987 directed the EPA to propose a coordinated national policy and the Secretary of State to coordinate diplomatic efforts to combat climate change (Weber and Stern 2011). However, the uncertainty of climate science and the denial campaign funded by large fossil fuel companies tried to undermine the legitimacy of

climate change science and policy. The Union of Concerned Scientists (2015) reports that global warming skeptic organisations have been active in causing doubt about climate change. The report lists organisations which were funded by Exxon Mobil and Koch Foundation, for example. Disinformation has long been the reason for inattentiveness or lower support by the public. Additionally, US stakeholders benefiting from coal and oil production had better access to national policy making, compared to environmentally concerned groups, which was a major reason that the US used to take a more favourable position towards industry (Do and Guay 2006). Due to this situation and the political climate, comprehensive climate bills faced major challenges in passing Congress.

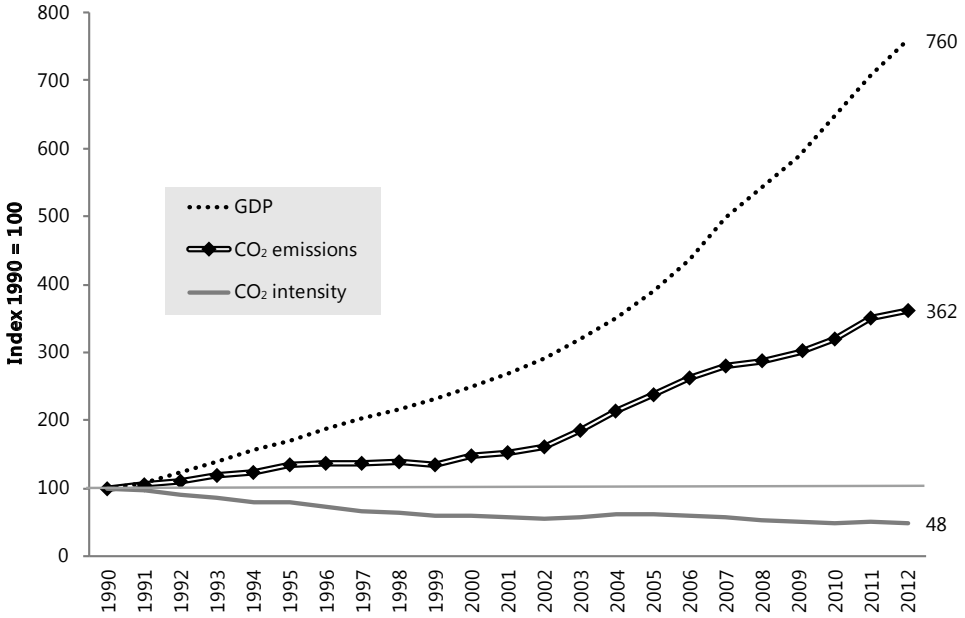
Nevertheless, increasing evidence on climate change was accumulated. For example, the IPCC revealed that anthropogenic GHG emissions are the definite cause of climate change. Climate change impacts, including heat waves, storms and flooding have been widely experienced in the US. In particular, Hurricane Katrina in 2005 and Hurricane Sandy in 2012 were the most damaging on record in the US, costing USD 125 billion and USD 65 billion, respectively (C2ES 2015).[6] From the study conducted by Pew Research Center (2015), the percentage of Americans who consider climate change as a serious problem has increased from 33% in March 2013 to 46% in 2015, showing a growing interest by the US public towards climate change. The industry also seems to be changing its course. In 2015, BP announced that it would cease funding to the American Legislative Exchange Council, a lobbying group misrepresenting climate science to US state legislators (Frumhoff and Oreskes, 2015).

Following the lawsuit of *Massachusetts et al. vs EPA* in 2007, the supreme court ruled that GHGs are air pollutants covered by the Clean Air Act (CAA) and that the EPA must determine whether GHGs endanger public health and welfare. In 2009, EPA announced that the GHGs from new motor vehicles endanger public health and welfare, thus need to be regulated under CAA. In June 2012, the US Court of Appeals D.C. Circuit upheld the EPA's endangerment findings and regulations of GHGs on mobile and stationary sources (e.g. power plants). EPA introduced several measures including emissions standards for passenger vehicles, stationary sources as well as new and existing power plants (EPA 2015b). President Obama often exercises his executive power in dealing with climate change, due to the difficulty in passing a comprehensive climate change bill in Congress. For example, the Obama administration is introducing regulations to cut carbon emissions from existing and new power plants under the Clean Air Act. In August 2015, EPA released the final rules for emissions standards for both new and existing power plants under CAA, namely the Clean Power Plan and Carbon Pollution Standards. States will be submitting their state implementation plans following the rules by September 2016. EPA is also proposing emission standards for heavy vehicles to be finalised by 2016. The US case shows how strong leadership can promote national climate efforts. On the other hand, the Presidential election in 2016 may significantly influence the direction of US climate policies.

3.3 China

3.3.1 Emissions trend and recent climate policy

China's recent emissions show a detaching trend from economic growth. Between 1990 and 2012, CO_2 emissions from China increased around 3.6 times (2,278 Mt CO_2 in 1990 to 8,251 Mt CO_2 in 2012) while the Chinese economy grew more than 6.5 times (IEA 2014a). This contributed to reducing the CO_2 intensity by more than 50% (see Figure 2.9), although it is still 5 and 7 times higher than the US and the EU respectively. Particularly, the rise in CO_2 emissions slowed down after 2005 despite the continued high growth of the economy.



Source: IEA (2014a), re-compiled and calculated by the authors.

Figure 2.9 ***Historical GDP, CO_2 emission, and CO_2 intensity in China***

In 2009 just before COP15, China pledged a carbon-intensity target of 40-45% below 2005 levels by 2020. In March 2011, targets for 16% improvement in energy intensity and for 17% improvement in carbon intensity were included in its 12th Five-Year Plan (2011-2015). Furthermore, in July 2015, China submitted its INDC in which it commits itself to a peak in CO_2 emissions by around 2030, making major efforts to peak early and achieve a reduction in CO_2 emissions per unit of GDP by 60-65% by 2030 from 2005 levels. The country also committed to an increase in the share of non-fossil fuels in primary energy consumption by about 20% by 2030, as well as an increase in the forest stock volume by around 4.5 billion m^3 compared to 2005 levels.

3.3.2 Major driving factors behind decoupling trends

Energy Security - *high growth of economy fuelled by an increase in energy imports*

Energy security is becoming a major concern in China. In the early 2000s, a significant increase in production in energy-intensive industries (e.g. cement and steel) began to erode energy intensity figures that had improved steadily since the early stages of the post-Mao reform era in the late 1970s and 80s. In addition, increasing dependency on foreign energy (coal, oil and natural gas) became a strategic concern among China's leaders (Naughton 2005; Held et al. 2011). While China used to be an exporter of oil and coal, it became a net importer of oil in the early 1990s, mainly from Africa and the Middle East, and a net importer of coal in 2009 mainly from Australia, Indonesia and the US (IEA 2012; Wu et al. 2012).

Industry and Economy - *low-carbon technology entrepreneurs*

China aspires to move from an economy driven by pollution-intensive industries to a nation propelled by clean-technology entrepreneurs; otherwise it would be locked into the most polluting and least profitable segment of the international value chain (Lieberthal and Sandalow 2008).

In addition to exploring a new development approach, the leadership also advocated transforming China into an innovation society and low-carbon development became one of main objectives of the 12th Five-Year Plan (KPMG 2011). The plan identifies seven key new strategic emerging industries, five of which (energy conservation, high-end equipment manufacturing, new energy, new material and advanced automobiles) closely relate to low-carbon development and aim to foster these industries' shares of the economy from 1% at present to 8% by 2015 and 15% by 2020 (Schoen and ChinaFAQs team 2013). The emphasis on technological entrepreneurship meshed well with rising energy security concerns in the early 2000s.

Institutional and Social Environment - *air pollution and political legitimacy*

For China's leadership, the overriding concern is the maintenance of the current political rule. Economic growth, poverty elimination and social stability are all critical to maintaining that rule. After three decades of pro-market reforms, however, income disparities, social tensions and environmental stress have gradually chipped away at the legitimacy of the political leadership's claims. In fact, "the number of environmental protests has increased by an average of 29% every year since 1996, while in 2011 the number of major environmental incidents rose 120" (Liu 2013). The air pollution crisis in Beijing and many other major Chinese cities in 2013 further raised public concern about air quality and emerged as a potent political issue (Wong 2013).

In response to the air pollution crisis, China's State Council released an "Airborne Pollution Prevention and Control Action Plan" in September 2013, which included, for the first time, specific coal consumption targets for provinces (MEP 2013). Furthermore, in November 2014, the State Council released an Energy Development Strategic Action Plan to limit coal consumption to 4.2 billion tonnes of coal by 2020. While these plans have significant impacts on China's CO_2 emissions (Nachmany et al. 2015), they were largely motivated by air pollution concerns. Behind such motivation, there is a concern about the impact of the air pollution crisis on political stability.

Additional factor: Changing Perceptions and Learning Processes

The learning processes through which decision-makers gained knowledge of the costs and benefits of climate policy grew and became more refined in China. While political elites had the perspective and authority to bring energy and politics together, a cadre of experts was well positioned to add scientific basis to those actions. In fact, much of the scientific basis reflected the work of experts who mediated between China's national government and transnational academic networks. Growing information and knowledge about climate change and the exposure of Chinese experts to transnational academic networks, including the IPCC, helped agenda-setting and policy formulation (Stensdal 2012).

With regard to climate change impacts, for instance, several internationally-connected Chinese academics were involved in studies concluding that storms, droughts, flooding, sea level rise and other climate change impacts would have an adverse effect on China's

domestic economy, especially when analysed on a regional or sectoral basis (Stern 2006; NDRC 2007; Yin et al. 2012). This conclusion lay in sharp contrast to previous studies that a warmer climate would, on balance, be good for China's economy. More importantly, these scientific data changed the perception of the Chinese leadership on climate change: they became more concerned about the distribution of climate impacts across the country, and, coming back to a familiar theme, about their influence on political stability (Wiener 2008; Lewis 2011).

Over the same period, another group of experts was working on research related to GHG mitigation policy. The most prominent group was using energy models to demonstrate that low-carbon development could be beneficial to China by offering a way to solve resource, energy and environmental challenges at low or even negative costs (Hallding et al. 2009). The idea of low-carbon development therefore matched with the leadership's intention of making China a global player in innovative, clean energy industries (Bradley 2010; Busby 2010).

4. Key elements to strengthen national climate efforts

This section examines the implications of the discussion in Section 3. It further discusses the importance of generating short-term benefits of climate actions as a way to bridge the gap towards the 2°C target.

4.1 Implications from the case studies for further emissions reductions and the importance of bridging national priorities to global objectives

Through examining the EU, the US and China, it has been identified that diverse factors exist for addressing climate change under different political, economic, legal, and social conditions. At the same time, it can be clarified that climate policies are associated with, and often triggered by, other national priorities such as security, economic growth, domestic and international leadership, and welfare of citizens. Some of these priorities are long-term and some are short-term; some are quantifiable and some are not. However, all of these can be categorised as national interests since they are driven mainly by their will to benefit their own countries.

Ostrom (1990) argues that cooperation among diverse actors with varying interests can only be built by ensuring private benefits, in this case national interests, as a primary motivator. Thus the issue is how we can ensure that these individual policies and actions collectively result in solving global issues such as climate change. It is becoming a shared understanding that climate change requires urgent attention and substantive action with strong international cooperation, and that the efforts taken up to now or those currently planned are not enough. Acceleration of efforts is essential even to meet the 2°C target, and some groups of countries argue that this target is insufficient and inadequate to fulfil the ultimate objective of the UNFCCC. More efforts are needed as well as a mechanism to make them happen. In addition, Nives (2001) argues that a national government will not commit to a costly climate policy if it does not have the assurance that global emissions will remain the same or decrease. Even if a country acts and implements an expensive policy measure, if others continue their current behaviour, the country which acted will not benefit. Therefore, it is important to reach an international agreement and re-establish an international climate regime which demonstrates long-term vision, sends clear signals, and incentivise all countries to align their national interests into global climate objectives.

4.2 A way to bridge the gap: short-term tangible benefits of climate actions

National policymakers are concerned about possible economic slowdown and competitiveness loss caused by gearing up climate actions. The core problem is the difference in time scale between climate impacts and economic impacts. A conventional view is that taking strong climate actions will have short-term negative economic impacts, such as slowdown of GDP growth or increased unemployment. These effects may manifest themselves immediately while the benefits from taking such action, namely mitigating climate change, may only become tangible after a relatively long period. This time-scale problem, as well as a high degree of uncertainty about climate risks, makes it challenging to commit and implement stronger climate actions.

The above problem is common to other sustainability issues such as biodiversity loss, land degradation and suspected endocrine-disrupting chemicals. The transition from the current development patterns to sustainable development essentially requires overcoming short-termism and changing policy priority from economy-first to a more holistic and balanced one, by looking wider and further ahead and applying the precautionary principle if necessary (Iverson and Perrings 2012). Still, it is critical to demonstrate the short-term benefits of climate actions to move towards the 2°C target under the current political reality.

The demonstration of short-term tangible benefits of climate actions plays an important role in gearing up climate actions under the current political reality. First of all, it will help provide incentive to policymakers to implement climate actions with such benefits, and secondly it will assist policymakers in convincing various stakeholders including industries to support such actions. There are many climate actions including carbon pricing, reflection of climate risks to investment criteria, and increasing renewable energy share in the electricity grid, that will generate further benefits along with more mitigation effects when these measures become prevalent. Demonstrating the short-term tangible benefits of climate actions will pave the way for this situation.

There is an increasing number of studies that reveal such benefits are obtainable. For example, New Climate Economy, an international research initiative to form a clearer understanding on the relationship between climate actions and economic growth, provides several co-benefit examples of climate efforts as outlined below (Global Commission on the Economy and Climate 2014).

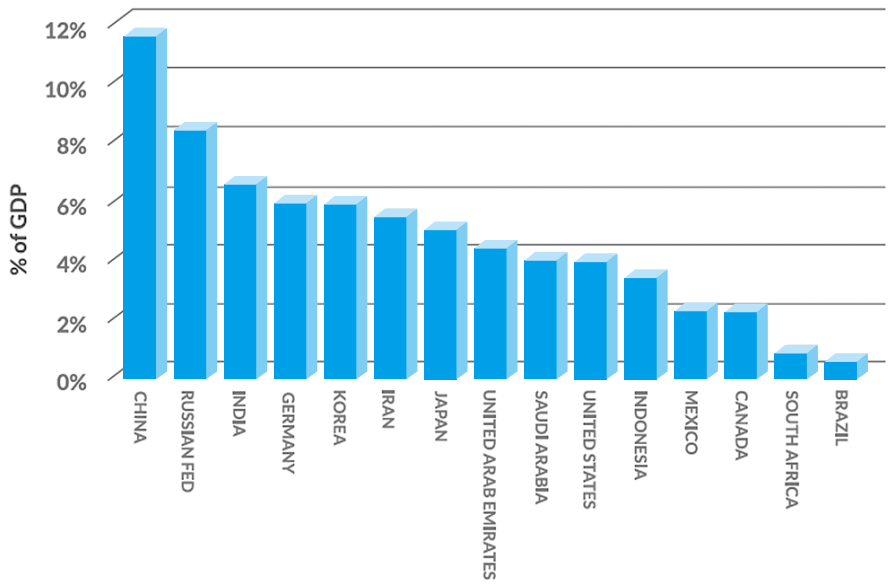
1) Job creation effects of climate actions

Promotion of renewable energy contributes to job creation. The International Renewable Energy Agency (IRENA) emphasises that the renewable energy sector generated almost six million jobs in 2012 (Ferroukhi et al. 2013). Considering the vast potential of renewable energy development in the world, an immense number of new jobs can be generated. Moreover, since renewable energy promotes disintegrated power production, it offers additional income opportunity in remote areas.

2) Benefits to public health and crop yield by reducing air pollution

Another example is the improvement in public health and the reduction of crop yield loss by reducing short-lived climate forcers including particulate matters 2.5 micrometers or less in diameter (PM2.5) through measures including regulating vehicle emissions and modernising cooking equipment.[7] According to Hamilton et al. (2014), outdoor PM2.5 exposure caused severe health impacts equivalent to more than 2% of national GDP in

many countries, rising to th equivalent of 10% in China in 2010, as shown in Figure 2.10. Although the World Health Organization (WHO) sets an air quality standard of below 10 μg /m^3 of PM2.5, more than 80% of the global population is still exposed to a pollution level exceeding this standard (World Bank 2015). UNEP argues that 2.4 million premature deaths could be avoided by 2030 in addition to the potential saving of the annual loss of 32 million tonnes of crops after 2030 if necessary measures are taken to reduce these emissions (UNEP 2011). Climate efforts are expected to have substantial co-benefits in reducing these emissions. For example, the expected health co-benefits of the Clean Power Plan which has recently been finalised in the US, are estimated to be between USD 12 billion to 28 billion in 2030 (EPA 2015c). The reduction of these impacts would consequently lower health care costs and raise the income of farmers.



Source: Hamilton et al. (2014)

Figure 2.10 ***Cost of mortality from outdoor PM2.5 exposure in 2010***

5. Summary and way forward

The persistent linkage between emissions growth and economic growth is weakening. At a global level, CO_2 emissions growth stalled in 2014 while the economy grew by 3%, although the level of contributions varies among nations. However, this decoupling trend is not strong enough, and the effort level of currently submitted INDCs will not secure the achievement of the 2°C target. To this end, this chapter aimed to identify a means to further accelerate international climate efforts by reviewing the historical relationship between economy, energy systems and CO_2 emissions, and takes a closer look at the recent climate/energy policies and the decoupling trends of the world's three biggest emitters: the EU, the US and China.

A set of general recommendations has already been proposed by several international institutions to fill this gap towards the 2°C target. However, there is ambiguity in translating this internationally-sound objective into national priorities. In this regard, it

is important to form a greater understanding on the major driving factors behind the recently observed decoupling trends and other potential short-term benefits of climate efforts in order to promote countries to make more ambitious commitments.

The EU, which shows a strong decoupling trend, leads climate actions to improve energy security, promote economic growth through green investment, and, perhaps most importantly, to secure the legitimacy of unification among European nations while extending the proper level of authority to EU institutions. The US, which began to reduce its emissions over the last decade, is now strengthening its climate actions as a result of strong investment in shale gas development and federal leadership in combating climate change. Such actions have been legitimised and given power by a legal decision to define GHGs as air pollutants. China reduced its CO_2 intensity by more than 50% compared to 1990 levels. Here it was severe air pollution and the consequent rise of a concerned public that gave a push to current political power to act on environmental issues including climate change. The rapid increase in external energy dependence, a political and economic agenda to thrive as a leading nation in low-carbon technologies, and the close engagement of academia in policymaking further promoted China towards strong climate efforts.

It has to be stressed that, at least for now, climate change alone is not considered as a nation's most important political and/or economic agenda in many countries. As seen in the cases of the EU, the US and China, climate actions are associated with, and often triggered by, other national priorities such as security, economic growth, leadership and social welfare. As the findings from New Climate Economy suggest, there are several ways to generate even short-term benefits by decarbonising the economy, such as job creation and human health, and crop yield improvement.

National interests are key to ensuring that countries' climate pledges are ambitious enough to achieve the 2°C target. Another vitally important factor is the establishment of an international climate regime that does not just include all countries, but sufficiently incentivises them to further align their national interests into common climate objectives at a global level. Careful examination should be made of domestic conditions in each country and then relevant experts can inform policymakers of the appropriate way to proceed and strengthen this alignment.

Notes

1. Country/region is in order of the strength in the CO_2 reducing trend thus does not correspond with the amount of CO_2 emitted.
2. The figures of emissions trends do not contain information up to 2014 due to data unavailability from a primary source. This is complemented by referring to secondary sources in texts when available and if appropriate.
3. There is an ongoing discussion on consumption-based emissions, which points out that advanced economies such as the EU have outsourced carbon-intensive production processes outside the territory. For example, the Department for Environment, Food and Rural Affairs of the Government of the United Kingdom (Defra) (2012) reported that territorial emissions of the United Kingdom (UK) reported to UNFCCC have reduced by 27% between 1990 and 2009 while consumption-based GHG emissions of the UK have increased 11% during the same period.
4. Many scholarly articles discuss if a public climate policy can push the innovation of low-carbon technologies (LCTs). Among these, Calel and Dechezleprêtre (2012) found that the EU ETS had only a 1% positive impact on the surge of the new patents related to LCTs since its introduction in 2005. However, they also argue that the policy did encourage firms to install already available LCTs, such as switching to more energy efficient fuels. Thus, one can expect that further reductions could be realized, as long as there are both the economic policies to support the development of LCTs and a climate policy including the aforementioned measures to make them competitive compared to more carbon intensive alternatives.

5. However studies show that due to methane escape during the fracturing and the lifetime of the wells, the footprint from shale gas may be larger over a 20-year timespan and may in fact be comparable to conventional fossil fuels over 100-year timespan (Howarth, et al. 2011). In the long-term, further regulations on GHGs through transition to renewable energies, energy efficient vehicles, as well as banning inefficient power plants will be required to move away from a fossil fuel-based economy.
6. Warmer ocean surface temperature and higher sea levels due to climate change are expected to intensify the impacts of hurricanes. According to the United States Climate Change Action Report, there has been an increase of approximately 0.8°C observed in the average US temperature since 1895, and 2012 was the warmest recorded year in history (US Department of State 2014).
7. In Africa and South Asia, cook stoves are the source of more than 50% of particulate matter.

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Chapter 3

Cycles for Strengthening Mitigation and Support

Kentaro Tamura and Yuqing Yu

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Key Messages

- A cycle for submitting and reviewing subsequent nationally determined contributions (NDCs) after the initial submission should be established in the 2015 agreement.
- For such a cycle to be effective, it is critical to strike the balance between legal stringency and flexibility, as well as deal with different implementation periods (i.e. five years versus ten years). For the former, the 2015 Agreement should contain legal obligations for all Parties submit, implement and regularly update NDCs, while they will be kept in a non-legal instrument (like the INF document for Copenhagen/ Cancun pledges). For the latter, by conducting interim reviews for ten-year period cycle countries, it is possible to have a review process every five years for both ten- and five-year period cycle countries.
- Climate finance for post-2020 should be composed of three key elements: (1) the predictability of future funding scale; (2) developing countries' strategies to enhance enabling environments and scale-up domestic climate finance; and (3) the transparency of financial inputs and resulting impact.
- A quantitative finance target is the first step in providing a certain degree of predictability. To enable the progression of ambition, the quantitative finance target should be developed along with a review process. IGES proposes that the Standing Committee on Finance (SCF) should undertake the review process, taking into consideration inputs from the reviews suggested in the mitigation cycle, and estimate a global aggregate amount needed for 2025 and 2030. Using SCF's estimation as a reference figure, developed countries should communicate their intended financial contributions for 2025 and 2030 and developing countries should communicate their strategies to scale up domestic finance. SCF's global aggregate amount as well as developed countries' intended financial contributions and developing countries' domestic strategies should be reviewed and escalated biennially between 2016 and 2020.
- To increase transparency, the Common Tabular Format for reporting finance provided by developed countries should be improved. The SCF should also develop a common reporting format for developing countries to report financial support received, use of finance, and their efforts and strategies of scaling up domestic finance and improving enabling environments.

1. Introduction

A new, post-2020 international climate agreement is expected to be concluded at the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) in Paris in December 2015. In preparation, Parties have agreed to communicate what post-2020 climate actions they intend to take, known as intended nationally determined contributions (INDCs). The INDCs are the centrepiece of the post-2020 climate regime discussion and will largely determine whether the world achieves an ambitious 2015 agreement and is put on a path toward a 2°C target—holding global average temperature rise at less than 2°C from pre-industrial levels[1].

Given the lessons learnt from the pledges made under the Copenhagen Accord and Cancun Agreements, which were also largely nationally determined emissions reduction pledges, there was a legitimate concern that the aggregation of nationally determined emissions reductions is likely to be insufficient to achieve the 2°C target. There was also a concern that possible diversity of INDCs would make it difficult to properly understand and compare INDCs. However, the decision adopted at COP20 in Lima in 2014 effectively ruled out the formal *ex-ante* process of assessing individual INDCs prior to COP21 (van Asselt et al. 2015). In addition, there was no regularity and predictability of the timing or process for strengthening subsequent contributions. Against these backdrops, growing attention began to be paid to the idea of setting up a cycle process through which subsequent nationally determined contributions (NDCs) will be submitted, reviewed and strengthened over time after the initial submission in 2015.[2]

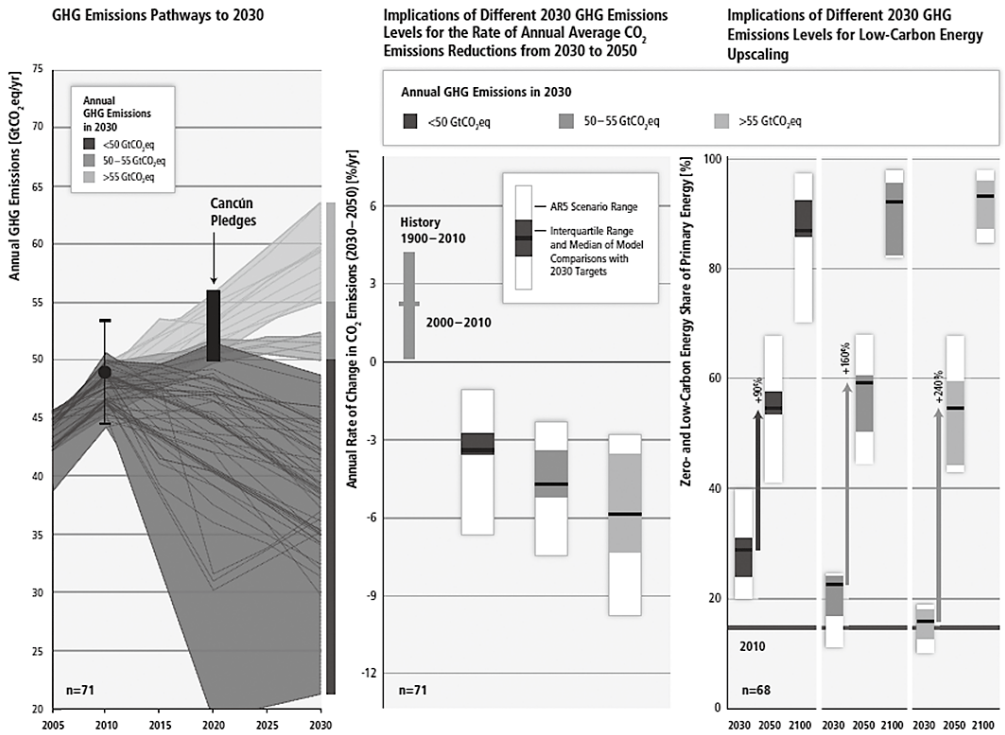
This chapter discusses cycles for enhancing mitigation and finance contributions. Section 2 examines how the 2015 agreement can be structured and the role of INDCs in contributing to 2°C target. Section 3 reviews the current status of INDCs in terms of related decisions as well as the profiles of INDCs submitted. Section 4 reviews the literature on various proposals related to a process or cycle for strengthening subsequent NDCs. Reflecting on the review of the current situation as well as literature, Sections 5 and 6 make proposals for a mitigation cycle and an assistance cycle, respectively. The idea of a five-year cycle for mitigation contributions has been already proposed (Morgan et al. 2014; IEA 2015). This chapter will try to respond to three key questions which were not adequately addressed by the existing proposals. These questions are: (1) How can different implementation periods be addressed; (2) How can legal stringency and flexibility regarding NDCs be balanced; and, (3) What kinds of information and indicators should be used in the cycle? With regard to finance, this chapter will argue that the existing assistance cycles and the finance objectives for the post-2020 period should and can be linked. The chapter will conclude with a brief summary and the way forward.

2. What would be required for the 2015 agreement to achieve the 2°C target?

There is general consensus among Parties that the 2015 agreement will be a package of a core legally-binding agreement and a set of related COP decisions and/or non-legal instruments[3]. The core agreement would be concise and durable, providing key principles and direction, while COP decisions which are legal instruments but non-legally-binding *per se* would provide detailed operational rules. Non-legal instruments include a registry and other communication and/or procedural tools managed by the UNFCCC Secretariat. The question as to how INDCs are anchored or inscribed in the 2015 agreement (for example, either in the core-agreement or in a non-legal instrument) has significant implications for how the post-2020 climate regime actually works toward a transition to a low-carbon, climate-resilient future.

NDCs indicate each Party's contribution to the achievement of the ultimate objective of the UNFCCC. Article 2 of the UNFCCC prescribes the objective of preventing "dangerous" human interference with the climate system. While the UNFCCC does not define what "dangerous" human interference is, the Cancun Agreements adopted at COP16 incorporated the so-called 2 degrees Celsius (2°C) target (i.e. to hold the increase in global average temperature below 2°C above pre-industrial levels). This target can be seen as a political interpretation of the ultimate objective of the UNFCCC.

The delay in GHG emissions reductions makes it difficult to transition to a low-carbon economy, and narrows the range of options to attain the 2°C target. To contribute to the achievement of the 2°C target, INDCs need to contain immediate and substantive actions. As the left panel of Figure 3.1 shows, "[c]ost-effective mitigation scenarios that make it at least *as likely as not* that temperature change will remain below 2°C relative to pre-industrial levels (2100 concentrations between about 450 and 500 ppm CO_2eq) are typically characterized by annual GHG emissions in 2030 of roughly between 30 $GtCO_2$eq and 50 $GtCO_2$eq" (IPCC AR5 WG3 SPM, p.13, emphasis in original).[4] As global GHG emissions in 2010 were about 49 $GtCO_2$eq, it is required that NDCs collectively peak global emissions as soon as possible and hold them at less than the 2010 levels by 2030.



Source: IPCC AR5 WG III Figure SPM.5

Figure 3.1 ***GHG emissions pathways to 2030 (left panel), implications of different 2030 GHG emissions levels for the rate of CO_2 emissions reductions (middle panel) and low-carbon energy upscaling from 2030 to 2050 (right panel) in mitigation scenarios reaching about 450 to 500 (430-530) ppm CO_2eq concentrations by 2100***

It should also be noted that NDCs are only part of the longer effort to transition to low-carbon economies. Even if global emissions are held at around 2010 levels in 2030, continuous emissions reduction by approximately 3.5% per year would be required at the global scale between 2030 and 2050 (IPCC 2014). If global emissions exceed 2010 levels in 2030, a much higher rate of annual reduction, which is historically unprecedented, would be required from 2030 to 2050 (Figure 3.1, middle panel). Regardless of whether the current NDCs end in either 2025 or 2030, robust mitigation actions are required continuously beyond 2025/2030.

This implies that short-term NDCs should be carefully implemented with a long-term perspective. There are many possible pathways to reach an emissions reduction target in 2030, but not necessarily all of them are compatible with substantial, say 80%, reductions in 2050 (IPCC 2014). For example, although the introduction of high efficient coal-fired power plants with a 40-year operation period might play a certain role in achieving a moderate mitigation target in 2030, its carbon lock-in effects effectively hinder the achievement of 80% emissions reduction in 2050 (see Chapter 5 for further discussion). This underpins the importance that in addition to INDCs, Parties develop indicative long-term deep decarbonisation pathways, which provide long-term thinking alongside each round of short-term INDCs (SDSN and IDDRI 2014).

In a nutshell, NDCs are part of the way towards achieving a long-term goal. A continuous process or cycle of making short-term NDCs consistent with such a long-term goal over time is required. Interestingly, the US-China Joint Announcement on Climate Change, made on 12 November 2014, explicitly referred to these points:

> Today, the Presidents of the United States and China announced their respective post-2020 actions on climate change, recognizing that these actions are *part of the longer range effort to transition to low-carbon economies, mindful of the global temperature goal of 2°C*… Both sides intend to *continue to work to increase ambition over time*.[5] [Emphasis added]

However, the question remains as to what kind of an international process can encourage Parties to revisit and strengthen their INDCs over time after their initial submissions. The institutional arrangements for mitigation pledges under the Copenhagen Accord and the Cancun Agreements expected unilateral or uncoordinated adjustment of pledges by mainly improving mutual understanding among Parties through a clarification process and simultaneously allowing for easy updating of the pledges. However, the lessons learnt from that experience indicate that Parties are unlikely to increase the level of mitigation efforts unilaterally.[6] Indeed, this collective action problem of climate change would require coordinated adjustments of NDCs (Maljean-Dubois et al. 2014; Morgan et al. 2014). In other words, given the necessity for continuously strengthening mitigation action beyond 2015, this highlights the importance of establishing regular sequential rounds (e.g. every five years) of collective action to increase the level of NDCs' mitigation action in the context of predictable and coordinated cycles.

In addition to a mitigation cycle, cycles for enhancing assistance to developing countries should also be established. Although none of the developed countries which submitted their INDCs so far have indicated their intended financial contributions, the 2015 Agreement should include a finance component and establish assistance cycles to address the financial implications of decarbonisation and building climate resilience. In terms of investment needs from a low-carbon transition, the Green Growth Best Practice Initiative (GGBP) estimates that the incremental cost of investment in infrastructure in a green growth scenario is USD 0.7 trillion per year by 2020 (GGBP 2014); and the New

Climate Economy (NCE) estimates that a low-carbon transition across the entire economy could require USD 4.1 trillion of net incremental upfront investment from 2015-2030, a 5% increase in investment compared to a baseline scenario (NCE 2014). The finance component in the 2015 Agreement will therefore play two critical roles—to provide the means and incentives for countries to achieve the 2°C target, and to send signal of political intent to rebuild confidence and trust among the parties (ACT 2014; 2015). Furthermore, to enhance mitigation action by developing countries, it is also critically important to establish a link between the mitigation cycle and the assistance cycles to support the progressive upgrading of ambition by both developed and developing countries.

The current developments regarding INDCs as well as climate finance pose many challenges for establishing cycles to enhance mitigation and finance, respectively. Many efforts are required to overcome such challenges. With this question in mind, the following section examines the current status of INDCs.

3. The current status of INDCs

3.1 What has been decided regarding INDCs?

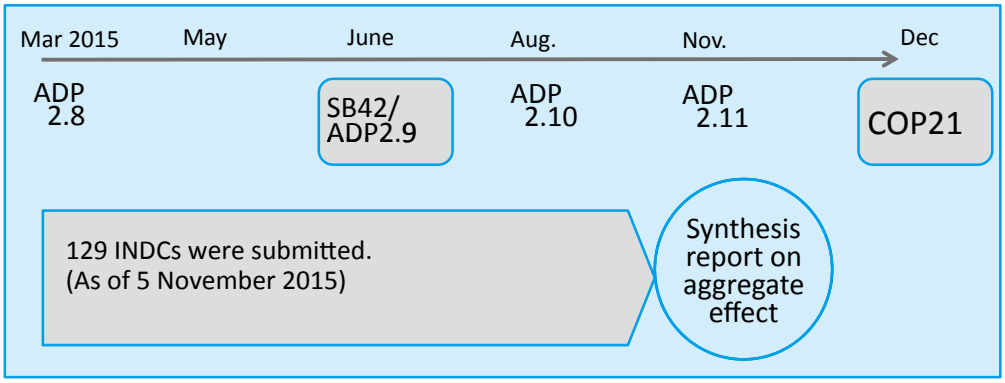
At COP19, all Parties were invited "to initiate or intensify domestic preparations for their intended nationally determined contributions, without prejudice to the legal nature of the contributions, in the context of adopting a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all Parties" (Decision 1/CP.19, para. 2). All Parties were also invited "to communicate them well in advance of the twenty-first session of the Conference of the Parties (by the first quarter of 2015 by those Parties ready to do so) in a manner that facilitates the clarity, transparency and understanding of the intended contributions." At COP20, Parties also agreed that INDCs should represent a progression beyond current mitigation efforts and prevent backsliding (Decision 1/CP.20, para. 10).

As seen below, INDCs reflect the diversity of national circumstances and therefore will be multiform. This underscores the importance of providing upfront information on INDCs to make them transparent, understandable and clear. To this end, Parties agreed on several options regarding the upfront information, which Parties can provide together with their INDCs. Such information may include (as appropriate), *inter alia* (Decision 1/CP.20, para. 14):

- Quantifiable information on the reference point (including, as appropriate, a base year), time frames and/or periods for implementation, scope and coverage;
- Planning processes;
- Assumptions and methodological approaches including those for estimating and accounting for anthropogenic greenhouse gas emissions and, as appropriate, removals; and
- Ways in which the Party considers that its intended nationally determined contribution is fair and ambitious, in light of its national circumstances, and how it contributes towards achieving the objective of the Convention as set out in its Article 2.

Communicated INDCs will be published on the UNFCCC website, and a synthesis report on the aggregate effect of the INDCs communicated by Parties by 1 October 2015 will be prepared by the UNFCCC Secretariat by 1 November 2015 (Decision 1/CP.20, para.

16).[7] However, any further work on the synthesis report is not required by COP21. Thus, it is uncertain how the synthesis report can actually contribute to the discussion over individual NDCs at COP21.



Source: Authors

Figure 3.2 ***Schedule for intended nationally determined contributions (INDCs)***

The word "intended" implies that INDCs would be subject to *ex-ante* consultation at the international level before they are formalised as NDCs. Some argued that such *ex-ante* consultation should assess individual INDCs and take into account various equity aspects (Haites et al 2013, Tamura et al 2013, Morgan et al 2014). However, the COP20 Decisions effectively ruled out any formal *ex-ante* assessment and review of individual INDCs. But, the abovementioned requirement of self-explanation about fairness and ambition of INDCs opens up the possibility for fairness/equity as well as adequacy as criteria in assessment after COP21 (van Asselt et al 2015).

3.2 Profiles of communicated INDCs

As of 5 November, 129 INDCs have been communicated. All the INDCs communicated so far contain mitigation components. There are different types of mitigation contributions—absolute targets (absolute reduction from base year emissions), BAU targets (emissions reduction from BAU scenarios), emission intensity targets (reduction against per unit of GDP) and peak year targets (a specific year when economy-wide emissions will level off). Some countries like China and Singapore announce multiple types of INDCs. Notably, the Chinese INDC includes a peak year target, an emission intensity target, a share of non-fossil fuels in primary energy consumption and forest stock volume. Among Parties with absolute targets, some like Norway and Switzerland explicitly declare that they will use a carbon budget approach (a control of cumulative emissions over multiple years), and others like the US say that they will use a single year target. BAU targets and emission intensity targets require further accountability from Parties toward their BAU scenarios and GDP projections. In addition, the treatment of the land-use, land-use-change and forest (LULUCF) sector as well as international transferable units or market mechanisms varies across countries. These differences in forms of mitigation contributions highlight the importance of establishing robust procedural arrangements ensuring greater transparency of action toward the implementation of diverse and complex NDCs.

Table 3.1 Overview of INDCs communicated (selected)

Absolute target			BAU target		Emission intensity target & peak year target		Emission intensity target		
Country	Base year	Target year	Country	Target year	Country	Target year	country	Base yeast	Target year
Brazil	2005	2025 (2030)*	Gabon	2025	China**	2030	India***	2005	2030
Canada	2005	2030	Indonesia	2030	Singapore	2030			
EU	1990	2030	Kenya	2030					
Japan	2013	2030	Mexico	2030					
Marshall Islands	2010	2025 (2030)*	South Korea	2030					
Norway	1990	2021-2030	Thailand	2030					
Switzerland	1990	2021-2030	Viet Nam	2030					
US	2005	2025							

Source: INDC Portal at http://unfccc.int/focus/indc_portal/items/8766.php

Note: * Brazil and Marshall Islands presents 2030 targets as indicative ones.
** In addition to the intensity target and the peak year target, China sets the share of non-fossil fuels in primary energy consumption as well as forest stock volume as parallel targets.
*** In addition to the intensity target, India sets the share of non-fossil fuels in electric power installed capacity as well as some qualitative targets.

Arguably, what most matters for the design of an NDCs cycle is a different time frame or target year. In order to allow a collective assessment of ambition and an understanding of comparable efforts, there were opinions for setting a common end year for every country contribution. However, some Parties prefer a five-year period of NDCs, arguing that a short cycle can prevent locking in low ambition for too long. Others prefer a ten-year period, stating that longer implementation periods can provide greater long-term certainty for investors. In the end, Parties were not able to agree on a common time frame for NDCs at COP20. In fact, while a few INDCs (for example, those of Brazil, Gabon, Marshall Islands and the US) have a five-year implementation period (2020-2025), the majority has a ten-year implementation period (2020-2030).[8] How to deal with the difference in the length of implementation periods is one of key challenges for designing an INDC cycle.

Parties can communicate their undertakings on adaptation in their INDCs. Although almost all the INDCs from developing countries include adaptation components, no Annex I Parties' INDCs include adaptation components. It should also be emphasised that no developed countries have included their contributions to the provision of means of implementation (finance, technology and capacity building) in their INDCs so far. At COP20, some developing countries argued that developed countries should include information on contributions of financial, technological and capacity-building support in their INDCs. However, developed countries opposed this and no consensus was reached at COP20. The absence of the information on financial, technological and capacity-building support in developed countries' INDCs reflects their negotiation stance. The fact that no INDCs of developed countries include a financial contribution poses a challenge for establishing a link between the mitigation cycle and the assistant cycle.

4. Review of Parties' views on an NDC process/cycle

Many Parties recognised the importance of a process or a cycle process in order to raise the ambition level of NDCs. Seven Parties made submissions which included some details of the *ex-post* process or cycle for NDCs (See Table 3.2). In addition, some Parties including Canada, Republic of Korea, the least developed countries (LDCs), Mexico, Norway, Switzerland and Turkey argued for regular *ex-post* review process but did not provide detailed descriptions on the review process. These proposals were made before COP20 so they did not reflect the Decision at COP20 and development thereafter. It should also be noted that there are countries which are not so supportive to the idea of the process for ratcheting up ambition periodically. In particular, the Like-Minded Developing Countries (LMDCs), which had strongly opposed to the establishment of an *ex-ante* consultation process at COP20, expressed some concerns that such a periodic process for ratcheting up ambition could dilute the differentiation between developed and developing countries.[9] This section reviews different views on the cycle from three viewpoints: approaches for raising the level of contributions; the anchoring of NDCs; and scope of the cycle.

Table 3.2 ***Parties' views on ex-post process / cycle***

	Scope	Process of raising ambition	Anchoring of intended nationally determined contributions (INDCs)
AILAC	—	• Improvement in transparency • No backsliding	• To be kept in a non-legal instrument, while the 2015 Agreement should contain legal obligations to "submit" and "implement" NDCs
Brazil	Mitigation and support	• Improvement in transparency • No backsliding • Obligation of adjustment of each country's contribution	• To be kept in a non-legal instrument, while the 2015 Agreement should contain legal obligations to "present" and "periodically adjust" NDCs
EU	Mitigation	• Improvement in transparency • No backsliding	—
Japan	Mitigation	• Improvement in transparency	—
Marshall Islands	—	• Improvement in transparency • No backsliding	• To be inscribed in a core agreement or another legal instrument
South Africa	Mitigation and support	• Improvement in transparency • No backsliding • Mandatory adjustment	• To be formally inscribed in a legal instrument after adoption
US	Mitigation	• Improvement in transparency	• To be kept in a non-legal instrument, while a core agreement would provide for each Party to "submit" NDCs

Source: Submissions from AILAC (2014), Brazil (2014), the EU (2014), Japan (2014), the Marshall Islands (2014), South Africa (2014) and the US (2014).

Note: AILAC stands for the Association of Independent Latin American and Caribbean states, which is a negotiation group consisting of Colombia, Chile, Costa Rica, Guatemala, Panama and Peru.

4.1 Approaches for raising the level of contributions

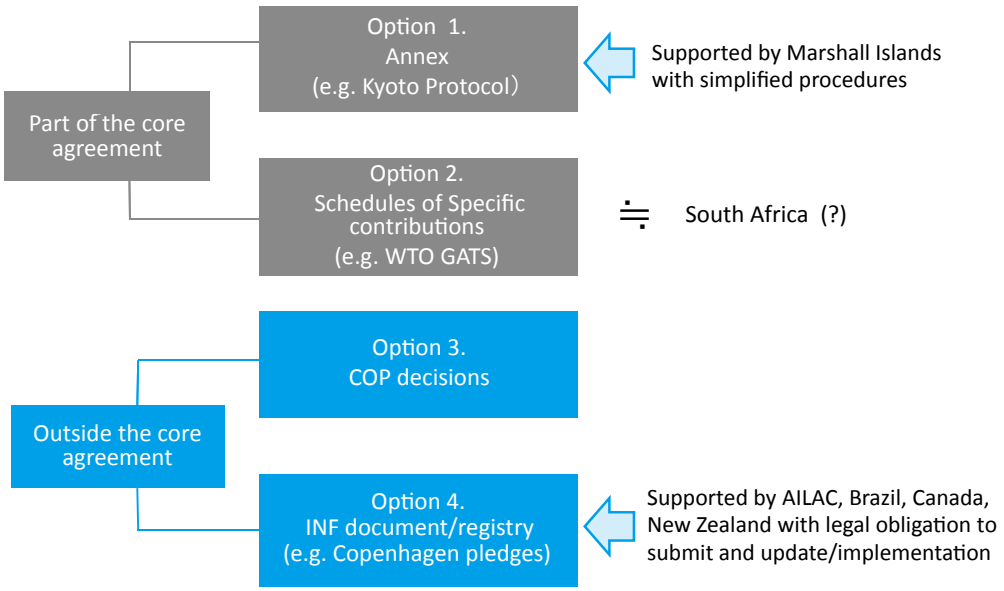
All seven Parties converge on the improvement in transparency, which is seen as a foundation for Parties to raise their ambition level of their INDCs. Transparency is expected to form the basis of the so-called "reciprocity" in which a country adjusts

its efforts to reflect others' efforts (Axelrod 1984; Keohane 1984). In the context of international climate negotiations, "multilateral reciprocal scrutiny" can be designed as an international process to facilitate such reciprocity (Schelling 2002). By improving mutual understanding about NDCs and their implementation, this international process is expected to provide a basis for collective action to increase the level of NDCs.

However, some Parties envision more proactive roles in international processes. Brazil, South Africa, the Marshall Islands, AILAC and the EU support the concept of "no-backsliding", something Parties also managed to agree on at COP20 (Decision 1/CP.20, para. 10). Furthermore, AILAC and South Africa propose that the result of the *ex-post* process should trigger a compliance mechanism. Brazil proposes that Parties would be legally obliged to adjust their NDCs in light of the outcomes of the *ex-post* assessment process. These issues are related to the legal nature of NDCs, which has not been intensively discussed by Parties so far since they insisted on first discussing substance.

4.2 The anchoring of NDCs

How INDCs are anchored or inscribed in the 2015 agreement has implications for the flexibility of revisiting and strengthening them, thereby influencing the design of the cycle. This flexibility is key, but at the same time legal clarity and stringency is also important in terms of collective action as well as domestic effects. Maljean-Dubois et al. (2014) identified several options for anchoring NDCs in the 2015 agreement. These options can be categorised into two groups: one contains options for anchoring NDCs inside the core agreement (e.g. a new protocol); and the other contains options for anchoring NDCs outside the core agreement. Each group has two distinct options. These options will be examined from legal clarity and flexibility.



Source: Adapted from Maljean-Dubois et al. (2014).

***Figure 3.3* Options for anchoring NDCs and some Parties' views**

Option 1 Annex: With the first option, NDCs would be inscribed in either a core agreement itself or one of several annexes of the core agreement (or another legal instrument). The annex or annexes would be an integral part of the protocol (or another legal instrument), and would have the same legal force as a legally-binding treaty. A typical example of this option is Quantified Emission Limitation and Reduction Objectives (QELROs) of the Kyoto Protocol.

One of the advantages of this option is legal stringency. Forming part of a treaty, NDCs would be legally binding for Parties to the agreement. This option has three disadvantages, however. First, it requires that NDCs of all Parties need to be ready for inscription by the time of COP21. Thus, there is less flexibility in terms of the timing. Second, this option is rather rigid in terms of amendment and ratification, since the revision and amendments of the annex requires consensus in principle, but a three-fourths majority vote of the Parties present and voting at the meeting (see UNFCCC Art. 15).

The Marshall Islands support this option, though it is not clear whether NDCs would be inscribed in a new Protocol or its annex (Marshall Islands 2014). It should also be noted that the Marshall Islands' proposal argues for the use of a simplified adjustment procedure, similar to the "ambition mechanism" utilised for the Kyoto Protocol second commitment period.[10]

Option 2 Schedules of specific commitments: With this option, each Party's NDC would be kept in its national schedule of contributions, which is not part of the legally binding agreement at the time of its adoption, but will be integrated into the agreement afterwards.[11] By doing so, contributions would not be easily withdrawn. "Schedules of specific commitments" under the General Agreement on Trade in Services (GATS) are the model of this option. GATS also allows Parties to add to or improve their commitments at any time.

Compared with the first option, this second option has a distinct advantage: it is less constraining in terms of timing, while maintaining the same legal clarity as the first option. Like the first option, however, the legally binding nature of NDCs may be difficult for some countries to accept domestically. This could also be one disadvantage of this second option.

Albeit not explicitly using the term national schedules, the South African proposal contains the basic idea of this second option: NDCs would be formally inscribed in a legal instrument (in case of their proposal, annex to the 2015 agreement) after adoption and such an instrument would form an integral part of the 2015 agreement (South Africa 2014). The South African proposal foresees that the 2015 agreement will integrate NDCs after adoption by a specific clause that forms an integral part of it.

Option 3 COP decisions: This option is to inscribe NDC in a COP decision. Under this option, at COP21 or subsequent COP meetings, a COP decision inscribing NDCs would be adopted, and would be endorsed at COP/MOP1 of the new protocol (if the 2015 agreement is a protocol). Revised or new NDCs could also be included in following COP or COP/MOP decisions.

One of the merits of this option is some degree of bindingness. Though COP and COP/MOP decisions are legal instruments, they are not legally binding by themselves. Since the adoption of COP and COP/MOP decisions is based upon consensus, however, Parties have a moral obligation to apply them in good faith. In addition, COP and COP/MOP

decisions have some legal effects, since such decisions serve as implementing measures of the international treaty and Parties to the treaty are expected to sincerely follow the decisions. Flexibility is another merit. However, no Parties seem to explicitly support this option.

Option 4 Non-legal instrument: The fourth option is to keep NDCs in a non-legal instrument, such as a registry maintained by the UNFCCC Secretariat, outside the legally-binding agreement. This option is similar to the mitigation pledges under the Copenhagen Agreements. The Copenhagen pledges were compiled in an INF document, and the NAMA registry has also been developed to record developing countries' nationally appropriate mitigation actions (NAMAs).[12] This option allows flexible timing for some adjustments after COP21, as well as the updating of NDC in a subsequent period without any legal and ratification processes.

The US seems to support this option. It proposed that the COP21 outcome should include a core agreement, related COP decisions, and a compilation of NDCs, and that the core agreement would provide for each Party to submit, upon joining the agreement, and to maintain thereafter, a schedule reflecting its mitigation contribution (US 2014). While several Parties support the idea of inscribing NDCs in a non-legal instrument, there is some variation on such instruments: "repository of country contributions" (AILAC 2014); "an online registry of national mitigation targets, actions and/or schedules" (Brazil 2014); "national schedules" (Canada 2014, New Zealand 2014a and 2014b)[13]; and "schedules" (US 2014).

This option has the greatest flexibility among the four options, but the weakest in terms of legal effects. To address this problem of weak legal stringency, some Parties proposed that the core or legally binding agreement would contain legal obligation for all Parties to "submit" and "implement" an NDC (AILAC 2014), "present" and "periodically adjust" an NDC (Brazil 2014), and, "put forward" and "regularly update" an NDC (Canada 2014). These ideas intend to provide a legal basis for NDCs, while making it more flexible for NDCs to be updated afterward.

Though the four options examined above have pros and cons, with a view to establishing a long-standing and dynamic cycle of mitigation contributions, Option 4 combined with a provision in the core, legally-binding agreement merits serious and further consideration. On the one hand, the core agreement would legally mandate Parties to submit, implement and regularly update NDCs. On the other hand, submitted NDCs would be kept in a registry outside the core agreement, which could allow Parties to adjust and update without re-negotiation and ratification. This approach could effectively strike the balance between legal robustness and flexibility. The core or legally-binding agreement should provide a legal basis for NDCs, and, in particular, the agreement should provide for each Party to not only submit, but also implement and regularly (five-year cycle) update its NDC. These arrangements can strike a balance between legal clarity and flexibility, thereby providing a foundation for collective action for adjusting NDCs in a regular manner.

4.3 Scope

With regard to the scope of the *ex-ante* process/cycle, there was divergence among Parties. Brazil and South Africa explicitly referred to the assessment and ratcheting-up of developed countries' support in the improvement cycle (Brazil 2014; South Africa 2014). On the other hand, the EU, Japan and the US prefer to limit the scope of the *ex-post* process/cycle only to mitigation contributions (EU 2014; Japan 2014; US 2014). As

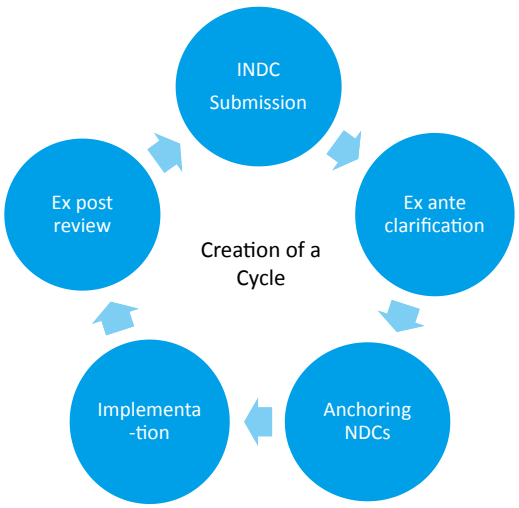
examined in the previous section, no INDCs from developed countries include support components so far. This reality makes it difficult to establish an *ex-post* process/cycle for support based upon NDCs. It is also worth mentioning that there is also discussion of adaptation cycles (Morgan et al. 2014).

5. Proposal for a mitigation cycle

Reflecting the review of various opinions and options related to the design of the cycle, this section proposes a concrete design for the cycle.

5.1 Five-year cycle with scientific inputs

A cycle can consist of five stages: (1) the first stage is the submission of NDCs; (2) the second stage is *ex-ante* clarification. Though Decision 1/CP.20 significantly narrowed the scope of a formal *ex-ante* clarification process in the lead-up to COP21, there should be adequate time for future contribution cycles to include this *ex-ante* process; (3) at the third stage, NDCs are anchored in an international agreement, which means the formalisation of NDCs. As discussed in the previous section, NDCs should be anchored in a non-legal instrument, like a registry, outside the core agreement, while the core agreement provides legal obligations to communicate, update and implement NDCs on a regular five-year basis; (4) the fourth stage is the actual implementation; and (5) the fifth stage is *ex-post* review of implementation. The results of such *ex-post* review could be inputs to subsequent NDCs.



Source: Prepared by authors.

Figure 3.4 ***A cycle through which nationally determined contributions are submitted and strengthened***

Through the cycle process of NDCs, each Party's NDC needs to be reviewed from three viewpoints: (1) equity (including the principle of common but differentiated responsibilities and respective capabilities); (2) mitigation potential (an assessment of untapped mitigation potential in each country); and (3) opportunities (an assessment of

the benefits that domestic climate action can deliver). In addition, a periodic assessment of aggregate ambition or adequacy of NDCs should also be incorporated into the cycle (Aldy et al. 2014; Höhne et al. 2014a; Höhne et al. 2014b).[14]

An equity viewpoint cannot be eliminated from the current negotiations. Some Parties oppose the idea of creating the mitigation cycle, because they have concerns that such a mechanism could dilute the differentiation between developed and developing countries, and could impose inequitable burdens on developing countries. To alleviate such concerns, the cycle mechanism should take equity into account. Indeed, the allocation of a global carbon budget among countries based upon equity and other indicators can provide benchmarks for assessing each Party's relative contribution to the 2°C target in terms of equity and adequacy.

However, an equity discussion may turn out to be a zero-sum game over the allocation of the right to emit among countries, and the discussion would be brought to a standstill. To avoid such a deadlock, two other viewpoints—mitigation potential and opportunities—are important. Identifying mitigation potential which is untapped by NDC is one starting point for the ratcheting-up of individual NDCs.

An assessment of opportunities and benefits that mitigation actions can bring is another vital piece of information for the proposed cycle. The New Climate Economy Report (2014) 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. 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 mitigation efforts.

5.2 Synchronising two different contribution periods

The next question is how to deal with different time lines of NDCs. As examined earlier, all the INDCs that have been communicated, except those from Gabon and the USA, regard 2030 as the end of implementation period (2020-2030). Gabon and the USA have a five-year implementation period (2020-2025). Among those Parties which have a ten-year implementation period, the EU proposes a five-year cycle of regular review of the ambition of mitigation efforts (EU 2014, ENB 2015). However, it is not clear how the ten-year implementation period and the five-year cycle of regular review are interlinked, and more specifically how the results of review will be used for the next round of NDCs. Therefore, it is necessary to set out details on the modalities of the cycle which can synchronise different implementation periods.

One approach could be to have an interim review every five years for ten-year period NDCs in parallel with *ex-post* review of five-year period NDC every five years. Chronological flows are as follows:

2018/2019: Those Parties with five-year period NDCs are requested to submit their NDCs for the next round of implementation period (i.e. 2025-2030). Those Parties with ten-year period NDCs are requested to provide information on the projected level of emissions for 2025-2030. Both 2025-2030 NDCs and the 2025-2030 projected emissions should reflect the latest status of domestic mitigation policy as well as be based upon the latest scientific knowledge.

2024: Those Parties with five-year period NDCs are requested to inscribe their NDCs for 2025-2030 in a registry, and to adjust upward, if possible.

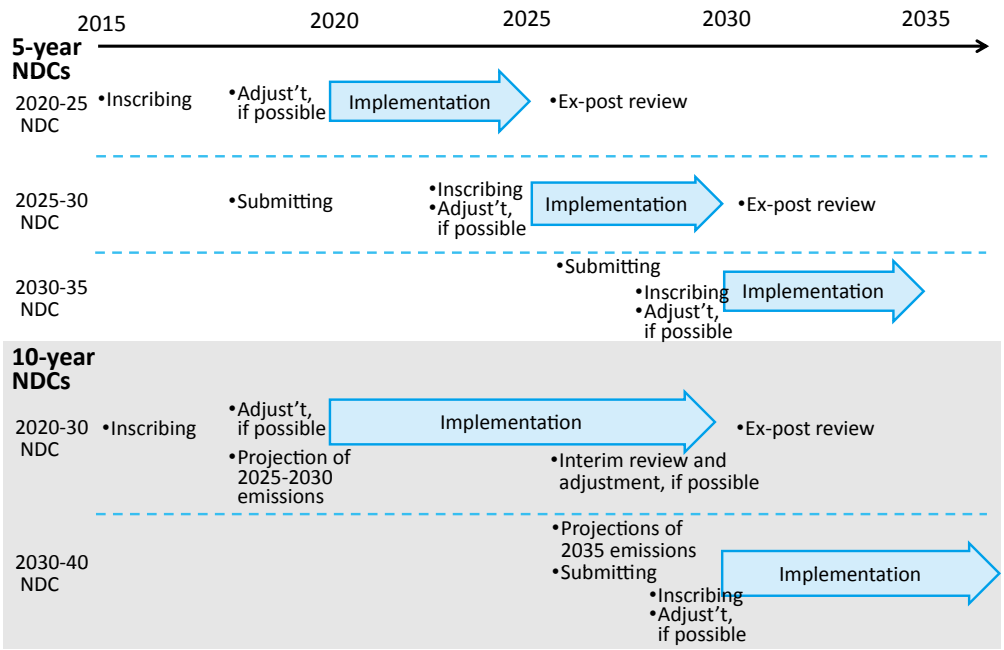
2026/2027: Those Parties with five-year period NDCs are subject to an *ex-post* review of the implementation of 2020-2025 NDCs. Reflecting the results of the *ex-post* review, they are expected to submit NDCs for 2030-2035.

Those Parties with ten-year period NDCs are subject to an interim review of 2020-2030 NDCs. They are also required to adjust their 2020-2030 NDCs upwards, if possible, reflecting the results of the *ex-post* review. Furthermore, they are expected to submit NDCs for 2030-2040. The results of the interim review of 2020-2030 NDCs as well as the latest scientific knowledge would become inputs to the formulation of their 2030-2040 NDCs.

2029: Those Parties with five-year period NDCs are requested to inscribe their NDCs for 2030-2035 in the registry.

2031/2032: Parties with five-year period NDCs will follow the same procedures for 2026/2027. They are subject to an *ex-post* review of 2025-2030 NDCs. Reflecting the results of the *ex-post* review, they are expected to communicate NDCs for 2035-2040.

Those Parties with ten-year period NDCs are subject to an *ex-post* review of their 2020-2030 NDCs. They are also required to communicate projected emissions for 2035-2040. Furthermore, they are expected to submit NDCs for 2030-2040.



Source: Prepared by authors.

Figure 3.5 ***Synchronising two different implementation periods***

These arrangements could synchronise review processes of different implementation periods and make regular reviews in the same year. They also provide regular opportunities for both five-year cycle and ten-year cycle Parties to revisit NDCs on a regular basis. In other words, collective efforts to increase the level of mitigation contributions will take place in a five-year cycle.

6. Proposal for a finance cycle[15]

Various climate finance-related cycles have been created during the pre-2020 period. These cycles include the biennial assessment (BA) cycle of financial flows undertaken by the Standing Committee on Finance (SCF); the every-four-year replenishment cycle of the operating entities of the Financial Mechanism of the UNFCCC, namely the Global Environment Facility (GEF) and the Green Climate Fund (GCF); and the biennial reporting cycle of developed countries' Biennial Reports (BRs) and developing countries' Biennial Update Reports (BURs). The existing assistance cycles are crucial vehicles for mobilising climate finance and enhancing finance transparency for pre-2020 and should be kept and enhanced for post-2020.

The finance component for the post-2020 period can be composed of three key elements: (1) the predictability of future funding scale; (2) developing countries' strategies to enhance enabling environments and scale up domestic climate finance; and (3) the transparency of financial inputs and resulting impact. Although no INDCs submitted include information on assistance, a link between the mitigation cycle and the finance cycle can be established so as to support the progression of ambition for post-2020. The 2015 Agreement therefore should encourage Parties to making contributions at an increasing scale every five years, using both bilateral and multilateral channels (ACT2015, 2014a).

6.1 Predictability of future funding scale

Collectively, developed countries are committed to provide long-term, scaled-up, new and additional finance and to jointly mobilise USD 100 billion annually by 2020, with funding from public and private, bilateral and multilateral, including alternative sources (UNFCCC 2011). The USD 100 billion target has created the momentum to ramp up overall climate finance, although it has not yet been decided how to define the key terms such as "additional" and "private" as well as the end point and the pathway to achieve this commitment.

For the post-2020 period, a quantitative target is the first step in providing a certain degree of predictability. To enable the progression of ambition, the quantitative finance target should be developed along with a review process. The SCF is the UNFCCC entity that has the mandate to assist COP in exercising its functions with respect to the Financial Mechanism, and as such, should undertake the review process biennially during 2016-2020, taking into consideration inputs from the reviews suggested in the mitigation cycle.

The SCF should develop a finance synthesis report, in a similar way that the UNFCCC Secretariat prepares the INDC synthesis report, in its second BA in 2016. Although none of the developed countries included support components in their INDCs, many developing countries proposed conditional INDCs, indicating the volume of funding needed for implementation. For example, Cambodia states that it would require USD 1.27 billion to support the implementation of activities included in the sectoral climate change action plans up to 2018 (Cambodia, 2015); and Ethiopia suggests that the full

and effective implementation of the Green Economy Strategy requires an estimated expenditure of more than USD 150 billion by 2030 (Ethiopia, 2015). The SCF therefore should synthesise this financial information and provide an analytical backing for the quantitative finance target. Meanwhile, developed countries should communicate their intended contributions for 2025 and 2030 as well as their intended distribution channels in their BRs. Furthermore, those developing countries that proposed conditional INDCs should communicate their estimation of international support needed and domestic strategies to scale up domestic climate finance and enhance enabling environments in BURs.

Based on the first review of NDCs suggested in the mitigation cycle, the SCF should then assess the gap between international support indicated by developed countries and the finance needs for realising the 2°C target in its third BA in 2018. The SCF should also assess the gap between available international support and developing countries' expectations and suggest an estimation of a global aggregate amount needed by 2025 and 2030 to implement developing countries' NDCs in its third BA in 2018. Developed countries should consider SCF's figure as a reference and communicate their increased level of intended contributions for 2025 and 2030 in their BRs and developing countries should update their national strategies to scale up domestic finance and enhance enabling environments in BURs.

The SCF should evaluate again whether developed countries' increased level of intended contributions could bridge the finance gaps in its fourth BA in 2020. If the finance gaps continue to exist, the SCF should investigate alternative finance sources for post-2020. Meanwhile, developed countries should finalise their 2025 commitment and report their plans for disbursement during 2020-2025. Developed countries should also indicate whether they intend to increase their contribution level for 2030.

Another approach of ensuring funding predictability is to make sure that the GCF can channel developed countries' commitments. It should be noted that the Parties to the UNFCCC are not strictly legally bound by the GCF and their obligations to the GCF are not enforceable, because the GCF is constituted through a soft law (a COP decision), not a hard law (ratified treaty text). Moreover, the USD 100 billion pledge, relevant for the pre-2020 period, is not directly linked to the GCF and the level of precision regarding how much money will be made available to the GCF is low. For the post-2020 period, clear replenishment targets will definitely enable the GCF to plan, programme, and implement activities in a more efficient and effective way. The GCF therefore should establish no-backtracking replenishment targets and communicate these targets in their reports to the COP. Countries should also agree to establish a replenishment process for the GCF every four years with a view to achieving GCF's replenishment targets (ACT2015, 2014b).

6.2 Transparency of finance

In addition to funding predictability, clarity and transparency of financial inputs and resulting impacts should be another centrepiece of the 2015 Agreement. The SCF has a mandate to enhance guidelines for MRV of support provided by developed countries and could be given another mandate at the upcoming COP21 in Paris to develop methods for developing countries to report financial support received and use of finance. Table 3.3 summarises potential areas for improvement to increase transparency of finance.

Table 3.3 ***Areas for improvement to increase transparency of finance***

Entity	Area	Improvement
Developed countries	Common tabular format	Clarity on point-of-measurement (committed vs. disbursed)
		Definition of multilateral climate funds and a complete list of multilateral climate and non-climate funds
		Clarity on what proportions of contributions to certain funds as climate-specific core contribution and definition of climate-specific contribution
		Inclusion of project-level information
		Definition of mobilised private finance
	Additional information	Strategies for ensuring a balanced allocation between mitigation and adaption
		Intended contributions to the collective achievement of the USD 100 billion pledge
Developing countries	Receipt of finance	Sources of finance, sectors receiving finance, and types of finance
	Use of finance	Mitigation (including REDD+) and adaptation
	Domestic finance	Developing countries' strategies for scaling up domestic climate finance and enhancing the enabling environment
MDBs	Government contribution	Finance flows to developing countries and resulting impacts
	Other channels of resource mobilisation	Clarity on the proportion of non-government contributions in MDBs' finance flows.

Sources: Various submissions for consideration at SBSTA 42 under Views on methodologies for the reporting of financial information, as referred to in decision 2/CP. 17, para 19. Synthesised by the authors

6.2.1 Developed countries

Developed Parties are using the Common Tabular Format (CTF) for reporting finance provided. However, it should be noted that finance reporting should not be limited to the CTF and more information should be provided. Additional information such as developed countries' strategies for ensuring a balanced allocation between mitigation and adaptation and their intended contributions to the collective achievement of the USD 100 billion pledge should be reported together with the CTF. Although the CTF has presented a snapshot of the supply-side of global climate finance, it has several areas that need improvement:

First, it should provide further clarity on the point-of-measurement used for the basis of reporting, such as whether finance reported in a given year X reflects the committed amount or disbursed amount. Financial commitments indicate funding decisions of a donor country, whereas disbursements are the result of existing decisions. Considering that different countries use different budget cycles for budget appropriation, it is suggested that commitment rather than disbursement should be used for point-of-measurement in future finance reporting. The CTF should add another item for reporting disbursement.

Second, the CTF only lists a handful of multilateral channels/funds and does not provide a definition of climate funds. Without such a definition, some countries report their contributions to the Montreal Fund in the CTF, while others do not. Moreover, as the

CTF lacks a definition for multilateral finance, providers do not differentiate facilities managed by multiple stakeholders (partnerships among various countries managed by multiple stakeholders, such as the Global Climate Partnership Fund) from multilateral entities (institutions managed by one stakeholder, such as the World Bank and regional development banks). Making a distinction between multilateral and multiple-stakeholder facilities will increase consistency and comparability in finance reporting.

Third, the CTF does not indicate what proportion of contributions to certain funds should be reported (i.e. whether all contributions to the GEF could be considered as core contribution or only the proportion that is climate-specific could be considered as core contribution) and does not provide a definition of climate-specific contribution (i.e. whether climate should be the primary or co-benefit objective). Consequently, Germany reports 40% of its GEF contribution as climate-specific, core contribution, while other countries count their entire contributions to GEF as core contribution without clarity on the climate-specific proportion.

Fourth, the CTF only provides an aggregate figure of finance provided and does not require reporting on project-level information. Although several countries have supplemented the CTF with project-level information, many countries have not. Without project-level information, it is not possible to implement verification.

Finally, the CTF should provide a definition and method of accounting mobilised private finance. As developed countries are using very different definitions, it is extremely difficult to compare private finance across developed countries.

6.2.2 Multilateral development banks

A group of seven multinational development banks (MDBs) now report jointly on their climate finance flows to developing countries on an annual basis. Since the finance flows of MDB is mainly from government contributions from developed countries, an appropriate reporting avenue should be created to avoid double counting of Parties' contributions across MDBs. Because the MDBs cannot be required to report to the UNFCCC, a body under the UNFCCC should take the responsibility of initiating and facilitating the discussion with MDBs on this process.

The MDBs have also increased their efforts of evaluating the impact of climate finance. As the GCF is developing its Results Management Framework (RMF) (GCF 2014), it is suggested that the MDBs adopt the GCF's RMF so that a coherent framework is used for the evaluation of climate finance effectiveness across MDBs as well as assessing the alignment between finance provided and developing countries' nationally identified needs.

In addition to government contributions, the MDBs capitalise on their capacity to leverage additional resources from multiple sources—public and private—and mobilise funding on international capital markets. There is a lack of clarity on the proportion of non-government contributions in MDBs' finance flows, so the picture of MDBs will be clearer if this information is provided.

6.2.3 Developing countries

Finance information released from BURs indicates a lack of clarity and consistency on the receipt and use of finance as well as finance mobilised domestically in developing countries. The SCF therefore should develop a common reporting format for developing

countries, taking into consideration the capacity of different countries. With regard to the receipt of finance, information such as sources (multilateral, bilateral, other sources, and providers), sectors receiving finance (energy, transportation, water, agriculture), and types of finance received (concessional, non-concessional, loans, grants) should be reported.

With regard to the use of finance, developing countries should report how much money received from international sources is spent for mitigation (including REDD+) and adaptation in a given year X. The GCF, the GEF and other MDBs should provide supplementary information regarding the resulting CO_2 reduction impacts and outcomes according to their Results Management Framework.

Finally, country ownership of international climate finance will not be fulfilled without the appropriate enabling environments and domestic institutional arrangements in developing countries. The gap will not be closed between available international finance, developing countries' expectations, and finance needs from the 2°C target, if developing countries do not develop robust national strategies for scaling up domestic climate finance. The BURs therefore should include developing countries' efforts to mobilise domestic climate finance and their strategies for enhancing enabling environments.

6.3 Proposed timeline

IGES proposes the following cycle for 2016-2030 to enhance the link between the existing finance vehicles and the need for increasing predictability and transparency of finance (Figure 3.7). The finance cycle for 2016-2030 can be divided into three phases, each of which has a duration of five years. The three phases are—Phase 1 (2016-2020) for the progression of ambition; Phase 2 (2021-2025) for the implementation of the 2025 commitment; and Phase 3 (2026-2030) for the implementation of the 2030 commitment.

Phase 1 (2016-2020): Progression of ambition

2016: The SCF, in its second BA, should develop a finance synthesis report, in a similar way that the UNFCCC Secretariat prepares the INDC synthesis report

Using SCF's synthesis report as the analytical backing, developed countries should communicate their intended contributions for 2025 and 2030 as well as their intended distribution channels in their BRs. Developing countries should communicate the amount of international support needed by 2025 and 2030 and their strategies to scale up domestic climate finance.

The GCF should make decisions on policies, procedures and documents necessary for the first formal replenishment process.

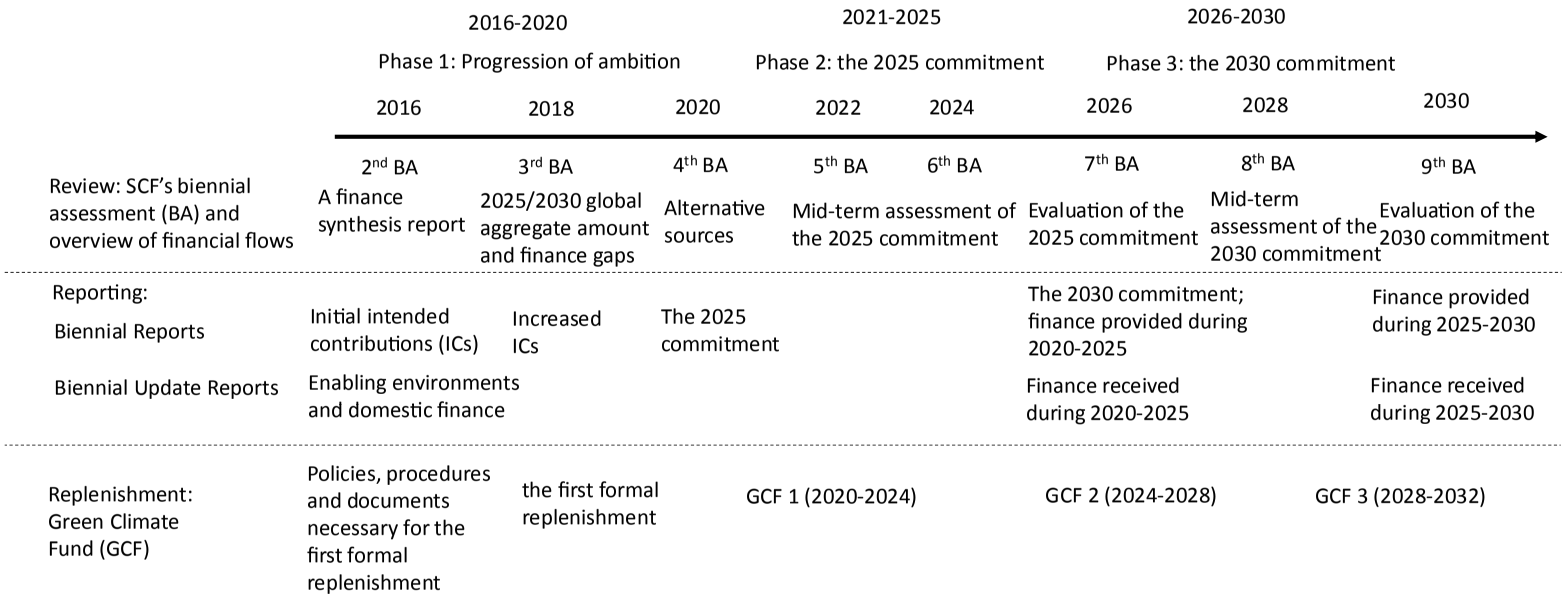


Figure 3.6 ***The finance cycle***

2018: The SCF should undertake its third BA, taking into consideration of inputs from the first review of NDCs suggested in the mitigation cycle. The SCF should assess: (1) the gap between available international finance and developing countries' expectations; (2) the gap between the global 2025/2030 aggregate amount and the finance needed to realise the 2°C target; and (3) the alignment of finance delivery and developing countries' national priorities. Based on the assessment, the SCF should suggest an escalated target for 2025 and 2030.

Developed countries should communicate their increased level of intended contributions by 2025/2030 and their intended distribution channels in their BRs. Developing countries should update the amount of international support needed and their strategies to scale up domestic climate finance in their BURs.

The GCF should trigger its first formal replenishment process.

2020: The SCF, in its fourth BA, should investigate the alterative financial sources that could bridge the finance gaps aforementioned, if these gaps continue to exist after developed countries increase their contribution level and developing countries enhance their domestic finance strategies.

Developed countries should finalise their intended 2025 contributions, communicate whether they intend to increase the 2030 contribution level, and report their plans for disbursement for 2020-2025 in their BRs. Developing countries should communicate their intended investment plans in their BURs.

The GCF should implement programmes, activities, and actions during the GCF-1 period.

Phase 2 (2021-2025): Implementation of the 2025 commitment

2022 and 2024: The SCF, in its fifth and sixth BAs, should provide an overview of finance flows and give a mid-term/preliminary assessment of resulting impacts and outcomes.

Developed countries and developing countries should report finance information in BRs and BURs.

The GCF should trigger the second replenishment process.

Phase 3 (2026-2030): Implementation of the 2030 commitment

2026: The SCF should undertake its seventh BA, taking into consideration of inputs from the *ex-post* assessment of 2020-2025 NDCs suggested in the mitigation cycle. The SCF should assess the implementation and effectiveness of the 2025 finance commitment.

Developed countries should report their delivery of the 2025 finance commitment and finalise their 2030 contributions in their BRs. Developing countries should report finance received, the use of finance, and domestic climate finance during 2020-2025 in their BURs.

The GCF should implement programmes, activities, and actions during the GCF-2 period.

2028: The SCF, in its eighth BA, should provide an overview of finance flows and give a mid-term/preliminary assessment of resulting impacts and outcomes.

Developed countries and developing countries should report finance information in BRs and BURs.

The GCF should trigger the third replenishment process.

2030: The SCF, in its ninth BA, should assess the implementation and effectiveness of the 2030 finance commitment.

Developed countries should report their delivery of the 2030 finance commitment in their BRs. Developing countries should report finance received, the use of finance and domestic climate finance during 2025-2030 in their BURs.

7. Summary and way forward

By overviewing the current status of INDCs, related decisions and various proposals, this chapter argued that the 2015 agreement should establish a cycle for reviewing and submitting subsequent NDCs through which each Party's NDCs' ambition will be ratcheted up. Concrete recommendations were made related to the five stages of the cycle, including the anchoring of NDCs in the 2015 agreement and synchronising two different implementation periods.

The cycle can consist of five stages: (1) submission of INDCs; (2) *ex-ante* clarification; (3) anchoring NDCs in an international agreement; (4) actual implementation; and, (5) *ex-post* review. The results of such *ex-post* review could be inputs to the subsequent NDCs. For such a cycle to be effective and dynamic, it is critical to strike a balance between legal stringency and flexibility, as well as deal with different implementation periods (i.e. five years versus ten years). For the former, the 2015 Agreement should contain legal obligations for all Parties to submit and implement NDCs, while they will be kept in a non-legal instrument (like the registry for Copenhagen/Cancun pledges). For the latter, by conducting interim reviews for ten-year period cycle countries, it is possible to have a review process every five years for both ten- and five-year period cycle countries.

A dynamic cycle for reviewing and submitting subsequent nationally determined contributions (NDCs) after the initial submission should be established in the 2015 agreement. NDCs targeting 2025 or 2030 are part of longer-term efforts to transition to low-carbon societies. In addition, an ambition gap between expected emissions based upon INDCs and global emissions pathways consistent with 2°C target is likely to remain in 2025/2030. Thus, continuous efforts to raise the level of ambition after the initial submission of INDCs are imperative.

Through the cycle process of NDCs, in addition to an assessment of aggregate NDCs, each Party's NDC needs to be reviewed from three viewpoints: (1) equity (including CBDR-RC); (2) mitigation potential (an assessment of untapped mitigation potential in each country); and (3) opportunity (an assessment of the benefits that domestic climate action can deliver). Chapter 4 will discuss further how these inputs can be generated through a consortium of research institutes.

In addition to the mitigation cycle, this chapter also discussed approaches to enhance climate finance. The finance component for post-2020 should be composed of three key elements: (1) the predictability of future funding scale; (2) developing countries' strategies to enhance enabling environments and scale-up domestic climate finance; and (3) the transparency of financial inputs and resulting impacts. Although no INDCs submitted

include information on assistance, a link between the INDC cycle and the finance cycle should be established so as to support the progression of ambition for post-2020.

IGES therefore proposes a three-phase cycle during 2016-2030 to enhance the link between the existing finance vehicles and the post-2020 objectives of predictability and transparency. These three phases include the first phase (2016-2020) of enabling the progression of ambition, the second phase (2021-2025) of implementing the 2025 commitment, and the third phase (2026-2030) of implementing the 2030 commitment.

Finally, IGES proposes several areas that need improvement regarding developed countries' finance reporting, including further clarity on point-of-measurement used for the basis of reporting (committed amount vs. disbursed amount), clearer definitions of climate-specific contribution and multilateral climate funds, inclusion of project-level information, and improved methodologies for tracking mobilised private finance. The SCF should also develop a common reporting format for developing countries, taking into consideration the capacity of different countries, to report financial support received, use of finance, and their efforts and strategies to scale-up domestic finance and improve enabling environments. Information-sharing on finance flows channelled by multilateral development banks (MDBs) should also be enhanced to provide a more complete picture of international climate finance.

Notes

1. It should be noted that INDCs can also include adaptation. There are proposals for a cycle for strengthening adaptation actions. See, for example, Morgan et al. 2014.
2. In this chapter, INDCs refer to initially submitted NDCs before COP21, and NDCs refer to nationally-determined contributions after COP21.
3. See, for example, "Co-Chairs' Tool: A Non-Paper Illustrating Possible Elements of the Paris Package" Available at http://unfccc.int/bodies/awg/items/9176.php
4. According to the definition used by IPCC AR5, the term "as likely as not" means 33%-66% probability.
5. https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change
6. A notable exception is Denmark. Its new government announced to reduce its GHG emissions by 40% from 1990 levels by 2020 through domestic action in October 2011. See http://www.wri.org/blog/2011/10/denmark-committed-40-emissions-reduction-2020
7. http://unfccc.int/focus/indc_portal/items/8766.php
8. See http://unfccc.int/focus/indc_portal/items/8766.php Brazil and Marshall Islands present 2030 targets as an indicative one.
9. The LMDCs group is a loose negotiation group consisting of for example Bolivia, China, Cuba, India, Nicaragua, Malaysia and Venezuela.
10. Regarding the second commitment period of the Kyoto Protocol, the adjustment "shall be considered adopted by the Conference of the Parities serving as the meeting of the parties to this Protocol unless more than three-fourths of the Parties present and voting object to its adoption." In addition, its entry into force is automatic (i.e., does not require Parties' ratification).
11. Though Maljean-Dubois et al. (2014) called this option "national schedules," the concept of "national schedules" was put forward by Australia in 2009 with different meaning (which rather similar to the option 4 in this paper) and supported by Canada, New Zealand and others in the context the current negotiation. To avoid confusion, this paper calls the second option "schedules of specific contributions," drawing on the model of "schedules of specific commitments" of the WTO GATS.
12. An Information document (INF document) is an official document prepared by the UNFCCC to compile and communicate specific information. For further detail of the NAMA registry, see http://unfccc.int/cooperation_support/nama/items/7476.php.
13. What Canada, New Zealand and the U.S. called "national schedules" or "schedules" is different from Option 2. "[N]ational schedules are necessary to and sit alongside the legal agreement but are not part of it" (New Zealand 2014b). For further details, see footnote 6.
14. For further discussion on inputs to the cycle, see Chapter 4.
15. Finance, technology and capacity building are not clearly distinguishable forms of assistance and these three ways are referred as "means of implementation". Although we recognise the importance of technology and capacity building for post-2020, this chapter focuses on climate finance.

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Chapter 4

Roles of Scientific Community in a Cycle for Enhancing Mitigation Contributions

Kentaro Tamura,
Takeshi Kuramochi and Yuqing Yu

Chapter 4

Roles of Scientific Community in a Cycle for Enhancing Mitigation Contributions

Kentaro Tamura, Takeshi Kuramochi and Yuqing Yu

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.

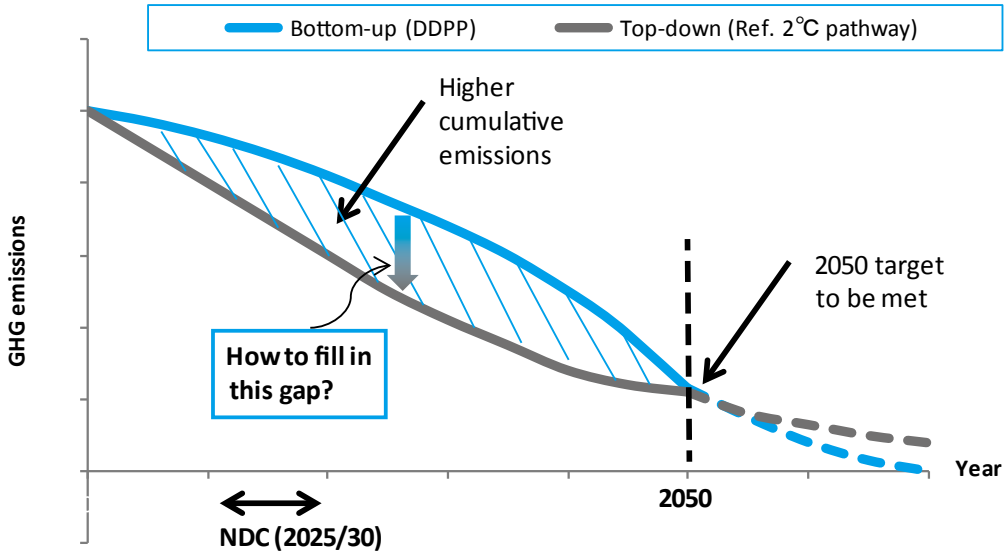


Figure 4.1 ***Two modelling approaches to quantify sufficient mitigation contributions for the 2025/30 period***

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.

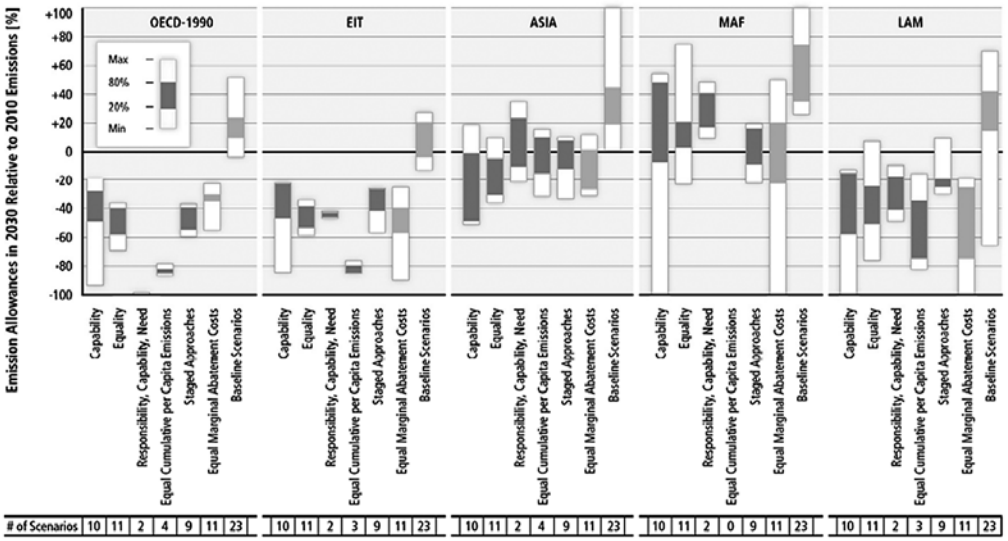
The bottom-up mitigation pathways underpinned by a long-term mitigation target, as conducted by the DDPP, can serve as benchmarks to which Parties can refer when proposing their INDCs. A consortium can bring together all existing bottom-up long-term mitigation pathway analyses, thus offering the Parties 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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Chapter 5

How Do We Evaluate the Ambition Level of INDCs *Ex-ante*? An Initial Assessment on Japan

Takeshi Kuramochi

Chapter 5

How Do We Evaluate the Ambition Level of INDCs *Ex-ante*? An Initial Assessment on Japan[1]

Takeshi Kuramochi

Key Messages

- This chapter discusses how the ambition levels of intended nationally determined contributions (INDCs) can be assessed *ex-ante* with some examples of assessments conducted by IGES on Japan's INDC.
- There is a wide range of approaches to evaluate INDCs proposed in the literature and these are complementary to each other. IGES conducted three analyses on Japan's INDC based on a number of evaluation approaches: (1) comparison of economy-wide and sector-specific decarbonisation indicators with the US and the EU; (2) remaining emissions allowances under different effort-sharing principles; and (3) mitigation potential and policy effort.
- All three IGES analyses are based on a large number of scenarios reported in the literature, rather than on a single modelling exercise. This synthesis analysis-type approach takes account of various uncertainties regarding greenhouse gases (GHG) emissions modelling, and thus enhances the acceptability of the results by countries. This inclusiveness can be enhanced by the participation of local research institutes and think tanks through their provision of additional data provision as well as their feedback on the collected data.
- Considering the establishment of an evaluation process of INDCs comprised of research institutes, the research consortium as proposed in Chapter 4 could gather a range of studies and scenarios from international, regional and local research institutes. The research consortium could also encourage the research community to conduct national assessments for developing countries, where GHG mitigation pathway analyses are not readily available.

1. Introduction

In the lead-up to 21st Conference of the Parties (COP21), Parties to the United Nations Framework Convention on Climate Change (UNFCCC) are submitting their intended nationally determined contributions (INDCs). It is highly likely that there will be a large gap between the aggregate of INDCs and the emission levels required in the post-2020 period for the world to stay on a 2°C pathway (e.g. Climate Action Tracker 2015a). It is important for the international community to ensure that the aggregate of post-2020

mitigation actions will keep the world on a 2°C pathway, and an *ex-ante* assessment of INDCs at both collective and individual levels as well as the 'five-year cycle' proposed in Chapter 3 is an important step to achieve this.

While Parties may agree to carry out an *ex-ante* assessment of INDCs at an aggregate level, it is unlikely that a country-level assessment will be conducted under the UNFCCC because no Party seems to support the idea[2]. It is, therefore, crucial that the research community provides independent assessments on INDCs of individual Parties outside the UNFCCC process and inform policymakers on 'what more can be done' for the international community to stay on a 2°C pathway (e.g. Tamura et al. 2013).

Against the aforementioned backdrop, IGES has conducted a number of analyses to quantitatively assess the post-2020 mitigation levels under different assessment criteria for the case of Japan. This chapter provides an overview of IGES' recent analyses on Japan's future greenhouse gases (GHG) mitigation pathways and their implications on the level of post-2020 mitigation commitments that may be considered 'ambitious' in the global efforts to achieve the 2°C target. This chapter is structured as follows. Section 2 briefly describes Japan's INDC and the underlying electricity mix target for 2030. Section 3 provides an overview of approaches for evaluating INDCs. Section 4 presents some examples of IGES research related to the evaluation of Japan's INDC. Lastly, Section 5 summarises the key findings from IGES research and identifies steps forward.

2. Japan's INDC and electricity mix target for 2030

Figure 5.1 shows Japan's historical GHG emissions (excluding land use, land use change and forestry (LULUCF)) and mitigation targets for 2020, 2030 and 2050. On the 17 July, 2015, the Japanese government submitted its INDC to reduce the country's GHG emissions by 26% by 2030 from 2013 levels (Government of Japan 2015). The INDC excludes LULUCF from the base year emissions and includes LULUCF in the target year emissions.[3] With regard to underlying assumptions, the draft INDC is calculated on the basis of the recently-developed electricity mix plan for 2030 (Ministry of Economy, Trade and Industry 2015a): 20-22% nuclear, 22-24% renewables, 26% coal, 27% natural gas, and 3% oil, and the future GDP growth rate is assumed to be on average 1.7% per year for 2013-2030 based on the government's growth target (Ministry of Economy, Trade and Industry 2015b).

INDCs as well as 2020 mitigation targets should serve as milestones for countries' long-term deep decarbonisation. For the long-term future, Japan aims to reduce its GHG emissions by 80% from 1990 levels by 2050 (Ministry of the Environment 2012a).[4] As for 2020 mitigation targets, Japan aims to reduce its GHG emissions by 3.8% by 2020 from 2005 levels (a 3.1% increase from 1990 (Kyoto Protocol Base year levels)) including LULUCF and the use of emission credits (Government of Japan 2013). This target, announced in 2013 at COP19 in Warsaw, Poland, replaced the conditional 25% reduction from 1990 levels, which was pledged at COP15 held in Copenhagen in 2009 (Government of Japan 2010), following the Fukushima nuclear disaster.

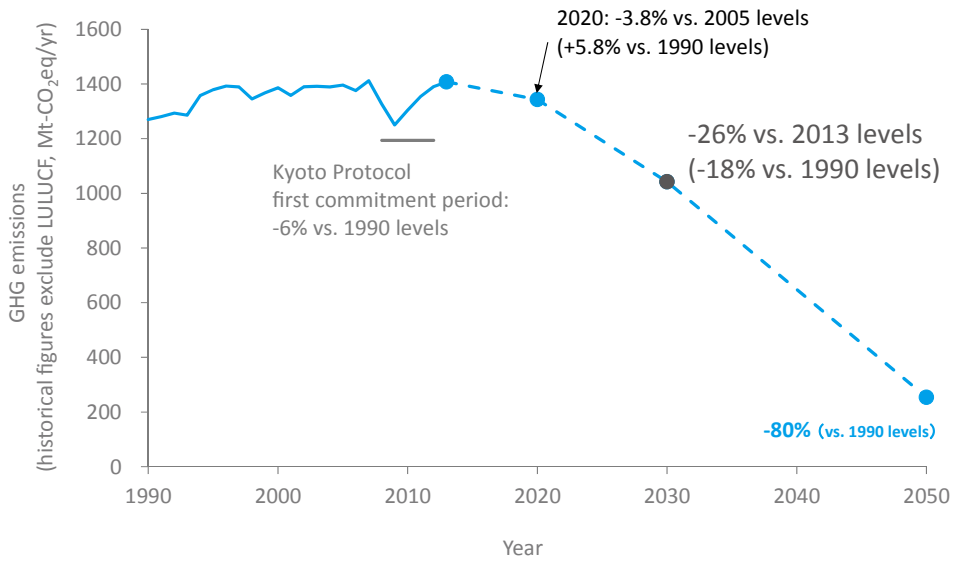


Figure 5.1 ***Japan's historical GHG emissions (excluding LULUCF) and mitigation targets for 2020, 2030 and 2050***

3. Approaches to evaluate INDCs

Many analyses have been conducted on countries' mitigation efforts since COP3 held in Kyoto in 1997 (Aldy et al. 2015). There are several approaches and associated indicators to evaluate the ambition level of an INDC (e.g. Höhne, et al. 2014a; Höhne et al. 2014b; Aldy and Pizer 2014). Based on the aforementioned literature, this paper identifies six approaches to evaluate the ambition level of INDCs, which are presented in Table 5.1. All approaches have their pros and cons, and all six approaches can be applied to evaluate the ambition level of INDCs.

Table 5.1 Overview of approaches to evaluate the ambition level of INDCs

Evaluation criteria	Description	Challenges
(i) Comparison with BAU	An INDC in comparison with a 'business-as-usual' (BAU) pathway can be a good indicator of ambition. Larger deviation from the BAU scenario indicates higher ambition level.	'BAU' can have different definitions; it may assume that all currently existing policies continue or it may assume that no policy take place at all.
(ii) Decarbonisation indicators	Many decarbonisation indicators have been used to assess or compare the ambition levels of country-level mitigation targets. Country-level indicators include CO_2/GHG emissions and energy use per capita or per GDP as well as carbon intensity of a country's energy mix. Sector-level indicators include carbon intensities of electricity and major industrial products such as crude steel and cement. These indicators do not depend on BAU or other counterfactual scenarios, which are sensitive to underlying assumptions. These decarbonisation indicators can be used not only to evaluate a country's progress on mitigation over time, but also to compare across countries to evaluate, e.g. to what extent a country is catching up with the top-runners.	Per GDP indicators require economic growth forecasts. Moreover, the choice between purchasing power parity or current currency exchange rate upon converting GDP from local currencies to a single currency. In addition, modelling may be required for countries with commitments that are not absolute targets. Furthermore, many factors that are unrelated to mitigation policies can affect these indicators (Aldy, Pizer, and Akimoto 2015).
(iii) Energy price indicators	Fossil energy prices, which comprises all cost components from mining to transport to various taxes, are a key driver for energy demand and supply as well as investment in energy efficient technologies in the end-use sectors. Energy prices allow for a comprehensive assessment of all policies implemented in the country. Carbon prices can be explicit or implicit in energy pricing. Energy prices themselves do not indicate the level of progress on GHG mitigation in any particular country. Nevertheless, they do indicate, especially when compared with those in other countries, whether the country's energy market conditions are optimal for driving significant energy efficiency improvement.	There are large regional disparities in natural gas and coal prices due to the differences in fossil energy resource availability. There is also question of whether to look into prices of individual energy sources in different sectors or take the average energy prices of the entire economy.

Table 5.1 ***Overview of approaches to evaluate the ambition level of INDCs (cont.)***

Evaluation criteria	Description	Challenges
(iv) Effort sharing	An INDC can be compared to the emissions allowances based on an agreed global carbon budget and effort-sharing approaches. Effort-sharing approaches include historical responsibility (i.e. historical GHG emissions), cost-effectiveness, capability (e.g. expressed in GDP per capita or Human Development Index), and equality (i.e. equal emission rights per capita), as well as the combination of more than two of the above four approaches. While most studies calculated country- or region-specific emissions allowance trajectories up to a certain future year (2050 or 2100), some studies also calculated remaining cumulative emissions allowances (e.g. Kuramochi et al. 2015; de Vos et al. 2014).	The range of possible emissions allowances is wide due to the different focus of the effort-sharing approaches. There is also large uncertainty and debate as to the level of global carbon budget to achieve the 2°C target with a relatively high probability.
(v) Mitigation potential (cost-effectiveness)	Modelling exercises can identify and quantify available mitigation opportunities and the costs to realize them. For example, a contribution could be assessed as to whether it captures (Fekete et al. 2013b): (a) 'No-regret' measures available at negative or zero costs, (b) measures with moderate positive costs or at higher costs but with significant co-benefits (if not expressed in monetary terms), and (c) ambitious measures that are available at higher costs. An INDC can be considered ambitious if it is in the range of levels (b) or (c).	The calculation of mitigation potentials depend on many assumptions, including the extent to which co-benefits are considered in monetary terms as well as the accounting of various costs of inaction. This results in limited transparency of the calculations and large differences of the results across models or studies.
(vi) Policy package or a policy menu	Examples of good policy packages and menus include many policy measures (e.g. renewable energy support policies and building energy efficiency standards) that are best in class. An INDC can be considered as ambitious if the policy package/menu includes many best practice policies.	There may be a debate over a list of policies to be evaluated.

Source: (Höhne et al. 2014b; Höhne et al. 2014c; Aldy et al. 2014; Aldy et al. 2015).

4. Assessment on Japan's future mitigation pathways

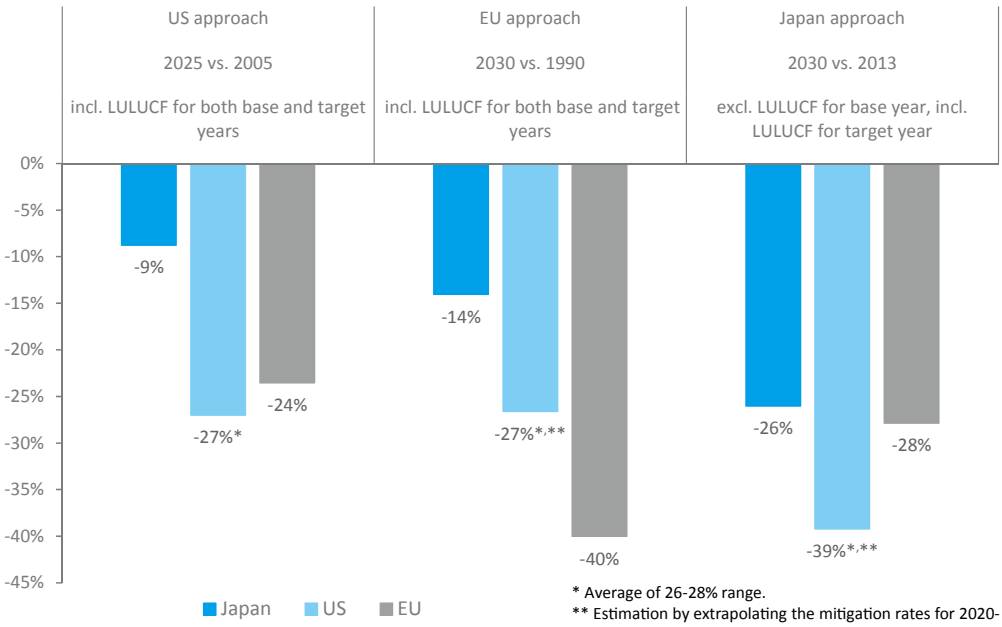
At IGES, three sets of analyses were recently conducted on Japan's possible mid- and long-term GHG emissions pathways to assess the level of contributions required in the global efforts to limit the global temperature increase within 2°C compared to the pre-industrial period. First, a number of decarbonisation indicators derived from or underlying the INDCs are compared for Japan, the US and the EU (Kuramochi 2015), which addresses the evaluation criterion (ii) in Table 5.1. Second, a comparative assessment of Japan's long-term carbon budget under different effort-sharing approaches is presented (Kuramochi et al. 2015). This analysis addresses the evaluation criterion (iv) in Table 5.1. Third, a comparative assessment of GHG mitigation scenarios for 2030 reported in the

literature that took into account varying levels of policy effort levels as well as technical and economic constraints specifically for Japan are presented (Kuramochi, Wakiyama, and Kuriyama 2015). This assessment addressed elements of evaluation criteria (iv) and (vi) in Table 5.1.

4.1 Decarbonisation indicators

Various forms of decarbonisation indicators derived from or underlying an INDC, e.g. emission intensity indicators derived from INDCs as well as underlying energy-related indicators at economy-wide and sectoral levels can be compared across countries to evaluate the relative ambition level of the INDC.

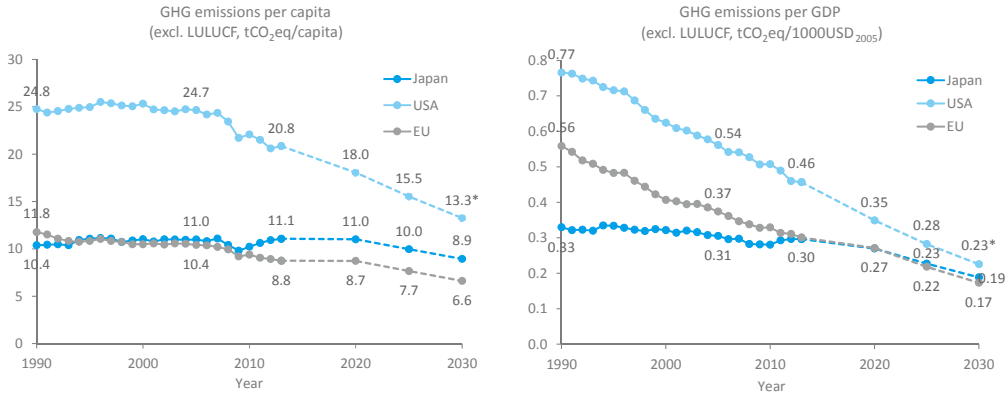
In case of Japan's INDC, it can be compared to that of peer developed countries and regions such as the United States (US) and the European Union (EU) to assess its relative ambition level. In March 2015, the US and the EU submitted their INDCs to reduce their GHG emissions by 26-28% by 2025 from 2005 levels and 40% by 2030 from 1990 levels, respectively (EU 2015). The INDCs of these three countries and regions are, however, not directly comparable because they differ on the base year, target year as well as the accounting of LULUCF (see Table 4.1 in Chapter 4). When they are made comparable, it can be seen in Figure 5.2 that Japan's INDC is comparatively less ambitious than that of the US and the EU, irrespective of how the base year, target year and the LULUCF accounting are defined.



Source: Adapted from Kuramochi (2015).[5]

Figure 5.2 ***Comparison of INDCs of Japan, the US and the EU under different base year, target year and LULUCF accounting***

On the other hand, when the INDCs of the three countries and regions are compared on the basis of emission intensity indicators, Japan will still lag behind the EU but maintain lower emissions per capita and per GDP than the US in 2030 (see Figure 5.3).

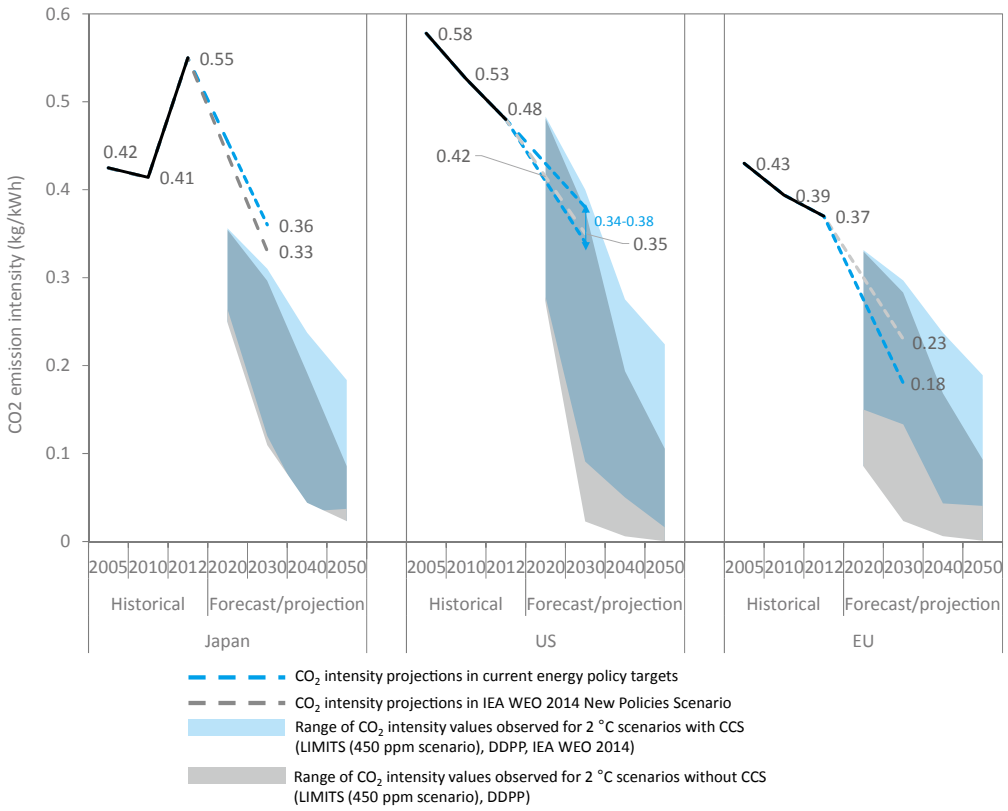


Note: Future projections are based on the INDCs of the three countries.

Source: Adapted from Kuramochi (2015). For GDP, historical figures up to 2012 were taken from OECD (2014) and the projections up to 2030 were taken from IEA (2014). For population, both historical figures (1990-2010) and future projections (2011-2030, medium fertility case) are taken from United Nations (2013).

Figure 5.3 GHG emissions per capita (left) and per GDP (right) for Japan, the US and the EU

Alternatively, we can also look into sector-level decarbonisation indicators. Kuriyama and Kuramochi (2015) compared the likely future emission intensity values in 2030 for electricity generation in Japan, the US and the EU under their current energy policy targets as projected by the International Energy Agency (IEA) World Energy Outlook 2014 (IEA 2014). The emission intensity projections were also compared with the emission intensity ranges observed for scenarios consistent with a 450 ppm CO_2 equivalent (CO_2eq) stabilisation (Tavoni et al. 2013). It can be seen in Figure 5.4 that in 2030, CO_2 intensity per kilowatt-hour (kWh) electricity for Japan under the current policy targets will be on a par with that for the US and will lag far behind the EU. Moreover, the CO_2 intensity for Japan's electricity generation will be much higher than the level observed for 450 ppm CO_2eq stabilisation scenarios. Although Japan had to revise its mid- to long-term climate mitigation policy that relied largely on considerable expansion of nuclear power due to the Great East Japan Earthquake and the Fukushima nuclear disaster, the results presented here indicate that Japan would need to raise the ambition level for the emissions reductions in the power sector.

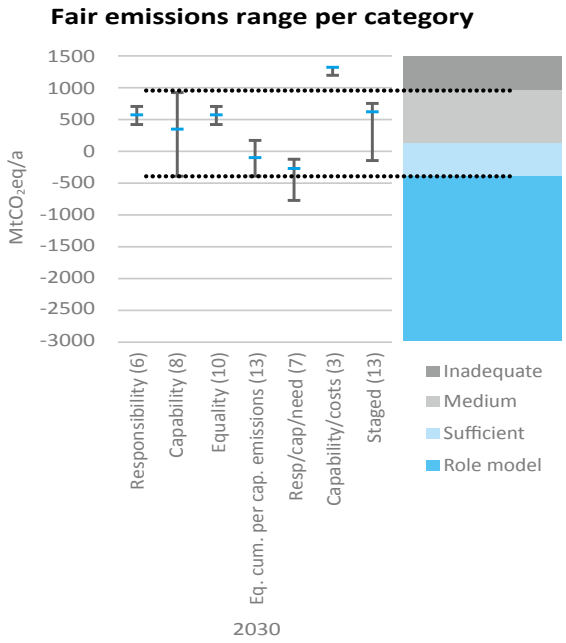


Source: Adapted from Kuriyama and Kuramochi (2015).

Figure 5.4 Comparison of electricity CO_2 intensity up to 2030 under currently planned policies for Japan, the US and the EU in comparison with the levels required under 450 ppm CO_2eq stabilisation scenarios

4.2 Japan's long-term carbon budget under different effort-sharing approaches

The allocation of long-term global 'carbon budgets' that are consistent with a global 2°C target to countries or regions have extensively been investigated for various effort-sharing approaches, and the ranges of emissions reduction levels for specific future years, e.g. 2030 and 2050, reported in the literature have been compiled and compared at regional level in Höhne et al. (2014a). The range of country-level emissions reduction levels under different effort-sharing approaches has been analysed and compared with the national mitigation targets by the Climate Action Tracker. Figure 5.5 shows an example of Japan, which indicates that Japan would need to reduce its GHG emissions by more than 24% from 1990 levels to be evaluated to a 'medium' effort level and 89% to be evaluated to a 'sufficient' level (Climate Action Tracker 2015b).[6] However, there are relatively few studies that investigated the remaining cumulative carbon budgets at a country-level toward the end of the 21st century consistent with a long-term global 'carbon budget' that would maintain a relatively high probability to limit the temperature increase within 2°C (e.g. WBGU 2009; Horstmann and Scholz 2011; BASIC experts 2011; Höhne and Moltmann 2009; Fekete et al. 2013a; de Vos et al. 2014).

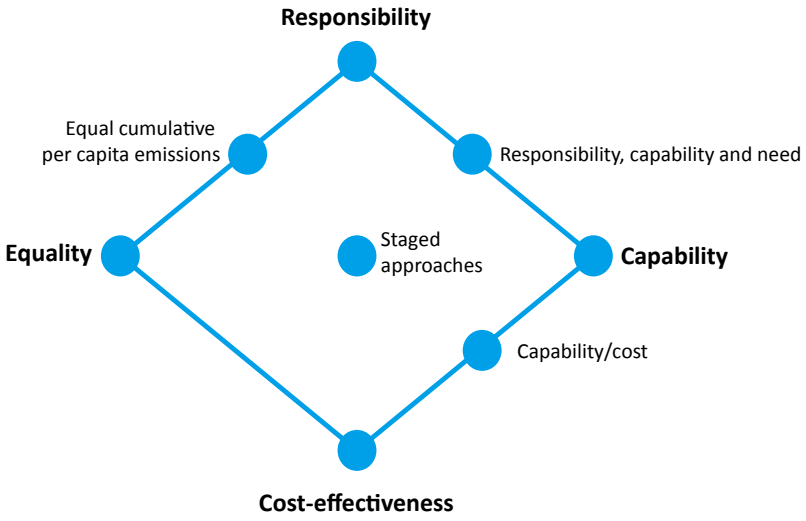


Source: Climate Action Tracker (2015b)

Figure 5.5 ***Ranges of emissions allowances for Japan in 2030 under different effort-sharing approaches***

Kuramochi et al. (2015) assessed Japan's carbon budgets up to 2100 in the global efforts to achieve the 2°C target under different effort-sharing approaches based on long-term effort-sharing scenarios published in thirteen studies. The study compared scenarios from the literature that were calculated for long-term stabilisation levels between 450 ppm and 550 ppm CO_2eq in 2100. Stabilisation levels between 450 ppm and 550 ppm CO_2eq correspond to the temperature increase (in 2100 relative to 1850–1900 levels, 10th to 90th percentile) of 1.5–1.7°C with a 12–37% probability of exceeding 2°C and 2.0–2.3°C with a 54–84% probability of exceeding 2°C, respectively (Clarke et al. 2014).

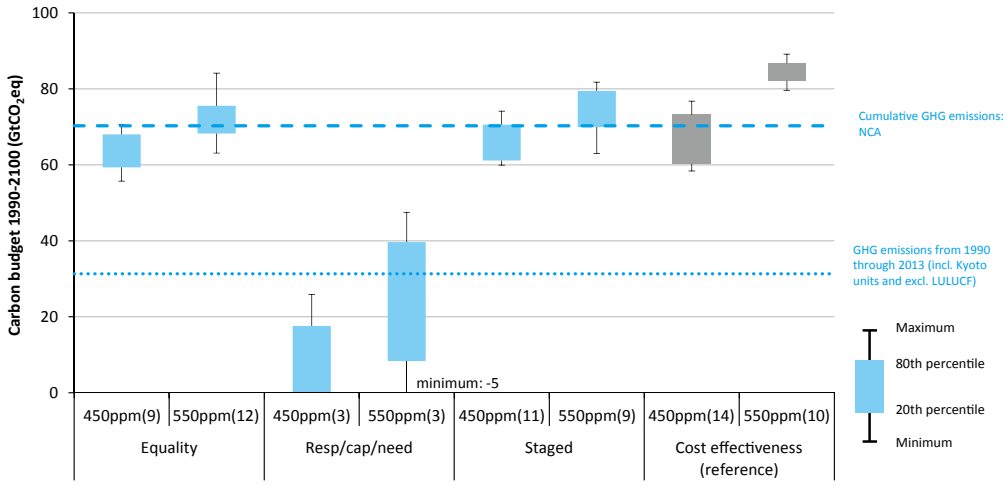
The GHG emissions allowances investigated in this study include all GHGs from all sectors except for land use, land use change and forestry (LULUCF). In order to make the scenario results from the literature comparable, data harmonisation was performed (for details, see Kuramochi et al. (2015)). Scenarios from the literature were categorised into one of the eight effort-sharing categories as shown in Figure 5.6. Detailed description of the eight effort-sharing categories can be found in Appendix 5.1.



Source: Kuramochi et al. (2015)

Figure 5.6 Eight categories for effort-sharing approaches

Of the eight effort-sharing categories presented above, the literature data allowed for an in-depth analysis on four effort-sharing categories ('Equality', 'Cost-effectiveness', 'Responsibility, capability and need', and 'Staged'). The results are presented in Figure 5.7 and Table 5.2. For a 450 ppm CO_2eq stabilisation level, the remaining carbon budgets for 2014–2100 were negative for the effort-sharing category that emphasises historical responsibility and capability ('Responsibility, capability and need').[7] For the other three including the reference 'Cost-effectiveness' category, which showed the highest budget range among all categories, the calculated remaining budgets (20th and 80th percentile ranges) would run out in 21–29 years if the current emission levels continue. A 550 ppm CO_2eq stabilisation level increases the budgets by 6–17 years-equivalent of the current emissions, depending on the effort-sharing category.



Source: Kuramochi et al. (2015).

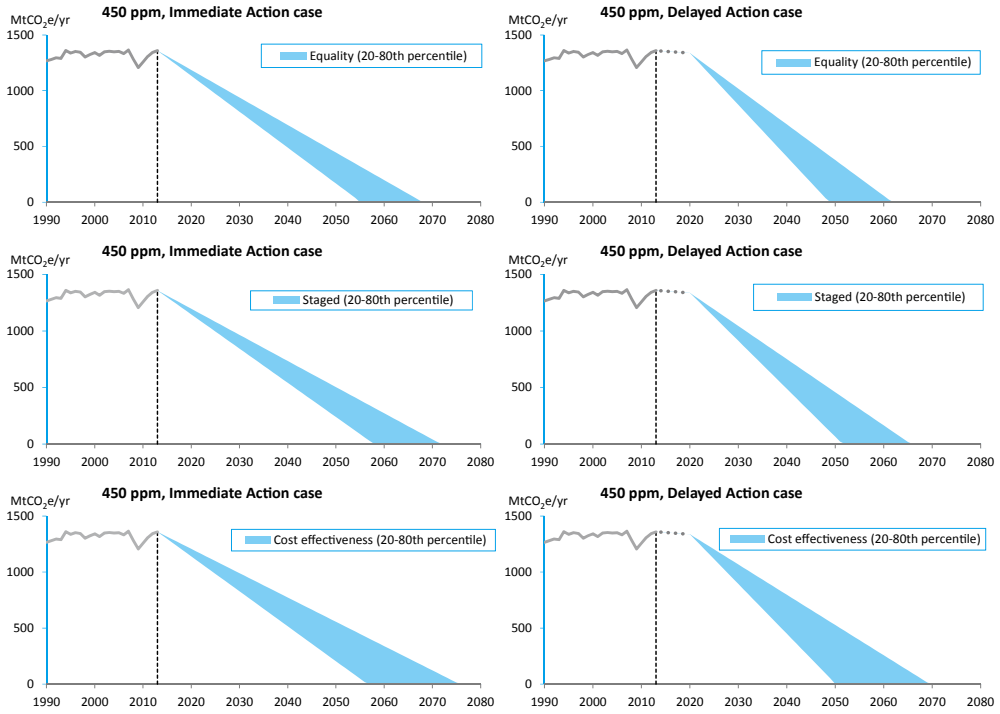
Figure 5.7 ***Carbon budgets between 1990 through 2100 calculated from scenarios reported in the literature*** [8,9]

Table 5.2 ***Japan's remaining carbon budgets*** [10]

Effort-sharing category	Total budget 1990–2100 (20^{th}/80^{th} percentile range: $GtCO_2eq$)	Remaining budget 2014–2100 ($GtCO_2eq$)	The year the budget runs out if 2013 emission levels continue
450 ppm scenarios			
Equality	59–68	28–37	2034–2040
Staged	61–71	30–39	2035–2042
Cost-effectiveness (reference)	60–73	29–42	2034–2044
550 ppm scenarios			
Equality	68–76	37–44	2040–2046
Staged	70–79	39–48	2041–2048
Cost-effectiveness (reference)	82–87	51–55	2050–2054

Source: Adapted from Kuramochi et al. (2015)

Exemplary emissions trajectories staying within the calculated budgets were also analysed for 'Equality', 'Staged' and 'Cost effectiveness' categories (Figure 5.8). For a 450 ppm CO_2eq stabilisation level, for example, Japan's GHG emissions would need to phase out sometime between 2045 and 2080 and the emissions reductions in 2030 would need to be at least 16–29% from 1990 levels even for the most lenient 'Cost-effectiveness' category and 29–36% for 'Equality' category. The figure also indicates that Japan's GHG emissions would converge to zero between 2049 and 2076, depending on the effort-sharing category and the start year for accelerated mitigation action towards the convergence to zero emissions. The mitigation trajectories become steeper in the Delayed Action case (i.e. drastic emissions reductions start in 2021) than in the Immediate Action case (i.e. drastic emissions reductions start in 2014), and the year of emission convergence needs to be moved up by about 5 years.



Source: Kuramochi et al. (2015).

Figure 5.8 ***Japan's exemplary GHG emission pathways both for Immediate Action case (starting from 2014) and Delayed Action case (starting from 2021) for carbon budgets under three effort-sharing categories at 450 ppm CO_2eq stabilisation[10]***

These results indicate that Japan's INDC, which is equivalent to a 15% reduction from 1990 levels when excluding LULUCF, may not be considered sufficiently ambitious in the global efforts to stabilise the atmospheric GHG concentration level at 450 ppm CO_2eq.

4.3 Mitigation potential and policy package

Kuramochi et al. (2015) conducted a comparative assessment of GHG mitigation scenarios for 2030 reported in the literature that investigated the GHG mitigation potential under varying policy effort levels, taking into account technical and economic constraints specifically for Japan.

The mitigation scenario data were collected from selected studies published since 2011 that provided results for 2030 and met the following criteria: (1) publication based on a detailed bottom-up assessment of technology deployment potentials for all sectors taking into account foreseeable policy measures; (2) published or co-authored by the research institutes that provide energy and GHG emissions scenarios to the government or by other internationally accredited energy research institutes; or (3) published in the peer-reviewed literature. These criteria were set to filter out the scenarios that make overly optimistic (or pessimistic) assumptions on low-carbon technology deployment as well as societal and economic transitions that are not widely accepted by experts.

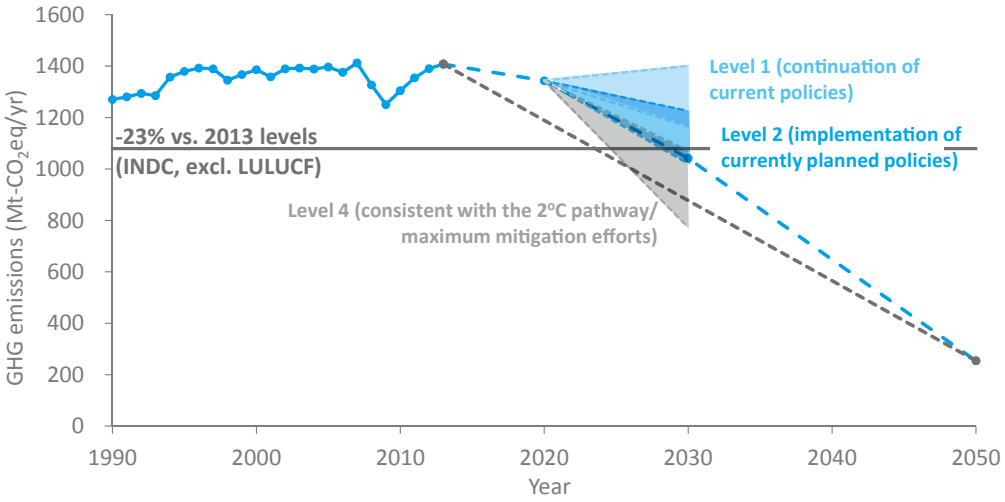
As a result, this study covered in total 48 scenarios from seven studies (Ministry of the Environment 2012b; IEEJ 2013; IEA 2014; Takase and Suzuki 2011; IEEJ 2014; IEEJ 2015; SDSN and IDDRI 2014). A number of data harmonisation procedures were taken in this study to make all data comparable. The scenarios were categorised into four mitigation effort levels and assessment was made of the value ranges for GHG emissions (excluding LULUCF) as well as the key underlying energy-related indicators for each effort level category (Table 5.3). Level 1 represents the lowest mitigation effort assuming the continuation of currently existing policies at the time of publication of the referenced literature and no additional policy implementation.[11] Level 1 can be considered as a BAU. Level 2 takes into account the policies that are currently in planning or consideration in addition to those considered for Level 1. Level 4 represents the highest mitigation effort. The mitigation scenarios that indicate any of the following were classified as Level 4: (i) consistency with the global 2°C target; (ii) consistency with the long-term target of 80% reduction of GHG emissions from 1990 levels by 2050; or (iii) maximum deployment of advanced technologies based on bottom-up techno-economic potential assessments. It should be noted that the three criteria are not fully comparable, and there are wide ranges of interpretations within each criterion. All scenarios that considered stronger policies than Level 2 but do not meet the criteria for Level 4 are categorised as Level 3.

***Table 5.3* Categorisation of GHG emissions scenarios by effort level**

Level 1	Level 2	Level 3	Level 4
Continuation of currently existing policies and actions and no additional policy implementation	Takes into account the policies and actions that are currently in planning or consideration in addition to those considered in Level 1.	More aggressive policies and actions compared to Level 2, including those that are not currently considered, but it does not meet the criteria for Level 4.	Indicate one or more of the following: (i) consistency with the global 2°C target, (ii) consistency with the long-term target of 80% reduction of GHG from 1990 levels by 2050, (iii) maximum deployment of advanced technologies based on techno-economic potential assessments.

Source: Kuramochi et al. (2015)

Figure 5.9 presents the GHG emissions reduction ranges for mitigation effort Levels 1, 2, and 4 in comparison with the historical emissions as well as the two linear reduction pathways to achieve the 80% reduction in 2050: one with immediate action from 2014 and the other with delayed action until 2020. For the scenarios that are categorised to assume the highest level of mitigation efforts including those consistent with a global 2°C target, GHG emissions levels ranged between 16-39% below 1990 levels (23-44% below 2005 levels) with the nuclear power share ranging between 0-29%. As shown in Table 5.4, the wide range observed for GHG emissions is also attributable to the differences in assumptions and projections on the share of renewable electricity and carbon capture and storage-equipped electricity (hereinafter, "RE/CCS electricity"), the share of unabated coal-fired electricity, the reduction level of energy end-use (12-28% from 2010 levels), which is partly influenced by the future economic growth rates, as well as the electrification rates. In contrast, for the scenarios that were designed to reflect the continuation of existing and currently planned policy measures – as opposed to consistency with the 2°C target – the GHG emissions reductions ranged at 3-20% below 1990 levels (12-26% below 2005 levels)



Source: Updated from Kuramochi et al. (2015)

Figure 5.9 ***Historical GHG emissions, emission ranges for mitigation effort Levels 1, 2 and 4, as well as two linear reduction pathways to achieve 80% reduction in 2050***

These results also indicate that Japan's INDC does not have sufficient ambition in the global efforts toward the 2°C target not only in terms of GHG mitigation levels but also in terms of target levels for the power sector. It is evident from Table 5.4 that the unabated coal-fired electricity share is on the higher end of all values observed across the four effort Levels in the literature and the RE/CCS electricity share corresponds with the range observed for Level 2 scenarios, which are not in line with the global 2 °C target.

Table 5.4 ***The value range of key indicators related to GHG emissions reductions for 2030 observed in the literature***

Effort level category (number of scenarios)	Electricity mix: shares in total power generation (%)			Total final consumption as a change from 2010 levels (%)	GHG emissions as a change from 1990 levels (excluding LULUCF: %)
	Nuclear power	RE/CCS power	Unabated coal-fired power		
Level 1 (3)	10 – 15	14 – 22	25 – 30	-8 – -9	+10 – -8
Level 2 (9)	0 – 25	21 – 26	17 – 29	-9 – -15	-3 – -20
Level 3 (12)	0 – 30	21 – 35	10 – 25	-10 – -20	-11 – -30
Level 4 (24)	0 – 29	27 – 47	1 – 28	-12 – -28	-16 – -39
Japan's INDC/energy mix target for 2030	20 – 22	22 – 24	26	-14	-15

Source: Kuramochi et al. (2015)

5. Summary and way forward

This chapter provided an overview of IGES' recent analyses on Japan's future GHG mitigation pathways and their implications on the level of post-2020 mitigation commitments that may be considered 'sufficiently ambitious' in the global efforts to achieve the 2°C target.

Among the six approaches identified in this chapter to evaluate INDCs, IGES conducted analyses using three approaches to evaluate Japan's INDC. Each of the three analyses provides a unique picture and they collectively present a multifaceted nature of Japan's INDC. For future work, it is recommended for other evaluation approaches to be applied to Japan's INDC and such assessments to be conducted for other countries' INDCs.

It should also be stressed that all three IGES analyses are based on a large number of scenarios reported in the literature and thus, a relatively wide range was observed for all results. Nevertheless, these results combined indicate that Japan's INDC may not be considered sufficiently ambitious in the global efforts to achieve the 2°C target. The synthesis analysis-type of approach takes into account various uncertainties regarding GHG emissions modelling and thus enhances the acceptability of the results by countries. This inclusiveness can be enhanced by the participation of local research institutes and think-tanks through their provision of additional data provision as well as their feedback on the collected data. In the *ex-ante* evaluation process of INDCs proposed in Chapter 4, the proposed research consortium could gather a range of studies and scenarios from international, regional and local research institutes. The research consortium could also encourage the research community to conduct national assessments for developing countries, where GHG mitigation pathway analyses are not readily available.

Last but not least, many studies published to date emphasise the level of "efforts required" or "burden borne" by each country to achieve the global 2°C target. By contrast, there are a limited number of studies that focused on long-term benefits delivered through the transition to low-carbon economy. One of the few examples include the recent New Climate Economy reports (New Climate Economy 2015; New Climate Economy 2014a), which investigated a range of economic opportunities that can be seized in the global transition to a low-carbon economy such as the increase in agricultural productivity, energy efficiency improvement and improved quality of life in cities through low-carbon urban infrastructure development.

It would be useful and important to include indicators of such development benefits, which are "forward-looking", in the assessment of INDCs. However, country-level in-depth analyses on the benefits of the transition to low-carbon economy are currently available only for a few countries (e.g. China (New Climate Economy 2014b)). Therefore, the research consortium could play an important role in developing the aforementioned benefit-based indicators.

Notes

1. This chapter is a compilation of the following materials published earlier by IGES researchers (Kuramochi 2015; Kuramochi et al. 2015; Kuramochi, Wakiyama and Kuriyama 2015; Kuriyama and Kuramochi 2015). Part of Kuramochi et al. (2015) is reused with permission from Taylor & Francis.
2. http://www4.unfccc.int/submissions/Lists/OSPSubmissionUpload/106_128_130773935819571701-Aide%20m%C3%A9moire_Paris%20informal%20mtg_%206-8%20may%202015.pdf

3. The emissions reduction rate would become smaller if it is calculated on a net-net basis (i.e. including LULUCF for both the base year and the target year) or on a gross-gross basis (i.e. excluding LULUCF for both the base year and the target year). The consequences are presented in Section 4.1.
4. In the original Japanese version, the base year is not clarified. In the English version, however, it is indicated that the base year is 1990 (Ministry of the Environment 2012a).
5. For the EU, LULUCF is included for both base year and target year emissions. Historical emissions up to 2013 were taken from respective GHG inventory reports (Ministry of the Environment and Greenhouse Gas Inventory Office of Japan 2015; EPA 2015; EEA 2014). The 2025 emissions projections for Japan and the EU are linearly interpolated between 2020 and 2030 mitigation targets, and the 2030 emissions projections for the US are linearly extrapolated from 2020 and 2025 mitigation targets. The future projections for carbon sequestration in the LULUCF sector are taken from Biennial Reports submitted to the UNFCCC for Japan and the US (average of high and low projections)(Government of Japan 2013; U.S. Department of State 2014), and from European Commission (2014).
6. A country's INDC is evaluated as 'medium' when 'the emissions resulting from its proposal are in the upper half of the range of what could be considered as "fair"' and as 'sufficient' when the resulting emissions are in the lower half of the range. 'Medium' level is defined as the level that 'would only be 2°C compatible if other countries moved to the more ambitious end of their effort sharing range'.
7. This is a result of Japan's high historical responsibility, i.e. high cumulative historical GHG emissions, and high capability for taking mitigation actions, i.e. high GDP per capita. The number of scenarios for the 'responsibility, capability and need' category is smaller than the other three categories investigated, but this effort-sharing approach generally allocates very small carbon budgets to developed countries (Höhne et al. 2014a).
8. For the 'Responsibility, capability and need' category, 20th percentile and minimum values were -16 $GtCO_2eq$ and -31 $GtCO_2eq$, respectively, for 450 ppm CO_2eq scenarios (therefore not shown here). Cumulative GHG emissions between 1990 through 2013 (including Kyoto units) as well as the Nationally Committed Amount (NCA) are also presented.
9. In addition to the GHG mitigation scenarios produced in the literature, we also calculated the amount of cumulative GHG emissions expected under the current 2020 and 2050 mitigation targets in Japan, which we refer to as the 'Nationally Committed Amount' (NCA). The NCA assumed that Japan adheres to the currently existing future GHG mitigation targets. Japan's current 2020 mitigation target (Government of Japan 2010) aims to reduce its GHG emissions by 3.8% below 2005 levels and the country's long-term mitigation target is a 80% reduction by 2050 below 1990 levels (Ministry of the Environment 2012a).
10. The results for 'Responsibility, capability and need' are not presented here because the discussions based on negative remaining carbon budgets do not lead to any constructive policy recommendations.
11. This effort level accounts for policies and measures that are not yet fully implemented, but does not account for the mitigation impacts that would have been delivered in case they are fully implemented.

Appendix 5.1 Description of effort-sharing approaches

Effort-sharing approaches investigated in the literature are often based on one or more of the following four basic dimensions (Kuramochi et al. 2015):

- *Responsibility*: This category includes approaches that are based on historical contributions to global emissions or warming, originally proposed by Brazil in the run-up to the Kyoto negotiations (UNFCCC 1997) to differentiate commitments among Annex I countries. The proposal was later elaborated for global application by introducing a per capita income threshold for participation of non-Annex I regions (den Elzen and Lucas 2005; den Elzen et al. 2005), thus taking some account of 'Capability' dimensions.
- *Capability*: This category concerns the ability to pay for mitigation, which is represented by GDP per capita or Human Development Index (HDI). An example of approaches under this category is the Emission Intensity Target approach, which assumes that all Parties adopt emission intensity targets after reaching a certain income threshold (den Elzen and Lucas 2005).
- *Equality*: The approaches in this category assume the convergence to equal emission allowances per capita immediately or over time, depending on studies and scenarios.
- *Cost-effectiveness*: This category is in most cases represented by the application of an equal carbon pricing ('equal marginal abatement cost') across countries in an economic model.

In addition to the above four, this study identified the following four effort-sharing categories that combine two or more of the above four dimensions:

- *Responsibility, capability and need ('Res/Cap/Need')*: This category includes approaches that combine indicators for *Responsibility* (i.e. historical cumulative emissions) and *Capability* (e.g. GDP per capita) as well as the need for sustainable development to allocate emissions allowances, for example by applying weighting factors (e.g. Baer et al. 2008; Knopf et al. 2012). Under the approaches in this category, wealthier and higher emitting countries receive a much smaller share of the budget than poorer and less emitting countries.
- *Equal cumulative per capita emissions*: This category includes approaches that calculate country-level emissions allowances by allocating equal cumulative per capita emissions. The definition of 'cumulative per capita emissions' of a country, however, differ across studies.
- *Capability/cost*: This category uses equal costs or welfare losses GDP to allocate emissions allowances across countries and essentially combines 'Capability' and 'Cost-effectiveness' dimensions.
- *Staged approaches* ('*Staged*'): This category includes a wide range of approaches where countries take differentiated commitments in various stages by taking account of multiple principles. Indicators used for differentiating emissions allowances are tuned to keep the atmospheric GHG concentration level below given long-term goals. Examples include the Common but Differentiated Convergence approach (Höhne, den Elzen, and Weiss 2006) and the Multi-Stage approach (e.g. Berk & den Elzen 2001; den Elzen et al. 2003), in which developing countries are required to gradually scale up their mitigation commitments based on their per capita GDP and/or emission levels. 'Staged' category also includes the 'Triptych' approach, which calculates future emissions allowances based on a long-term convergence of per capita emissions for the domestic sector and sector-level energy and CO_2 performances for other sectors (Phylipsen et al. 1998; Groenenberg, Blok, and van der Sluijs 2004). The Triptych approach contains elements of 'Cost-effectiveness' in that sectors with high emissions or poor energy efficiency have to reduce more, while taking account of 'Capability' by allowing for a long period of time for sector-level performances to catch up with the best performers and elements of 'Equality' for the domestic sector.

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Chapter 6

Key Accounting Issues in Developing Countries for the Use of Market-based Mechanisms

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Key Messages

- Accounting for the use of market-based mechanisms under the framework for various approaches (FVA) to contribute to the 2°C target in a post-2020 climate regime should contain two key aspects: one is to ensure environmental integrity, and the other to incentivise mitigation actions by both developing and developed countries. An accounting framework for the FVA should be designed under a post-2020 regime to enable the realisation of these aspects, taking into account different national capacities and needs.
- Using the example of the Joint Crediting Mechanism (JCM), currently being discussed under the FVA, it is evident that developing countries are likely to encounter unique challenges at different stages of accounting, namely issuance of credits, transactions of credits, and accounting towards a country's nationally determined contributions (NDCs). Major obstacles highlighted in this chapter are related to their varying capacities and the provision of the current reporting framework for developing countries under the United Nations Framework Convention on Climate Change (UNFCCC).
- In this regard, the accounting framework for the FVA should accommodate the needs and capacities of developing countries and promote support provided for them. More concretely, we propose: (1) capacity building should be included as an essential element for various mechanisms under the FVA; (2) review/coordination by a team of experts of the FVA to avoid a risk to environmental integrity and enhance a country's capacity; (3) simplified registry systems for countries without sufficient capacity; (4) synergies with other market mechanisms; and (5) enhanced reporting on the use of credits through Biennial Update Reports (BURs) in a gradual manner.
- It is recommended that accounting of the FVA should consider these points so that all developing countries can have the opportunity to choose market-based mechanisms as an instrument to mitigate climate change, while ensuring environmental integrity. In this regard, progress in the UNFCCC negotiation on the FVA and its accounting framework is vital for developing countries to make decisions on whether to utilise market-based mechanisms under the FVA for their fulfilling NDCs.
- Capacity building is necessary to enable the accounting of market-based mechanisms in developing countries. It can also help to reduce emissions, which otherwise could not be achieved. Emissions reduction through capacities that have been built under the FVA should be considered as additional, contributing to the achievement of net emissions reduction for global climate.

1. Introduction: diversification of market-based mechanisms

Market-based approaches are one of the essential policy instruments in the international response to climate change. Under the Kyoto Protocol (KP), Clean Development Mechanism (CDM), Joint Implementation (JI) and International Emissions Trading (IET), were established as market-based mechanisms. All of them were governed by the bodies established under the United Nations Framework Convention on Climate Change (UNFCCC). It was only Annex I Parties to the Kyoto Protocol which applied the mechanisms to meet their commitments. The Kyoto accounting rules were developed for assessing their use of the Kyoto market-based mechanisms towards their commitments (UNFCCC 2002).

Since the 2007 Bali Action Plan, there has been diversification of market-based approaches, including discussion on the 'Framework for Various Approaches (FVA)' (UNFCCC 2007). The FVA consists of bottom-up approaches, including those market-based, that Parties "individually or jointly propose to implement to enhance the cost-effectiveness of, and to promote, mitigation actions" (UNFCCC 2011). Modalities and procedures under the FVA are currently being discussed, with the expectation of decisions to be adopted at the 21st Conference of the Parties (COP21) in December 2015. Other than those centrally governed by the UNFCCC, the FVA would enable all Parties, regardless of their development stage, to use various market-based mechanisms to meet their emissions reduction targets. These targets are known as "intended nationally-determined contributions ((I)NDCs)" in the context of "a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all Parties from 2020" (UNFCCC 2013a).

Developing countries may encounter unique challenges in accounting for the use of market-based mechanisms towards their NDCs for two major reasons. First, the reporting framework for developing countries under the UNFCCC is not currently prepared for assessing either their achievement of national targets or their use of instruments in fulfilling those targets. Second, lack of capacity in developing countries could be an obstacle for them to respond to the international accounting rules, if those rules are commonly applied to all under a post-2020 climate regime.

This chapter aims to contribute to the on-going discussions in the FVA by addressing two questions:

(1) What are the issues around the accounting of market-based mechanisms in the FVA for developing countries?

(2) What could be possible solutions for resolving those issues in designing an accounting framework for the FVA?

In doing so, we use the Joint Crediting Mechanism (JCM) as an example currently being discussed under the FVA. The JCM is the mechanism that Japan and a partner country develop and implement to reduce emissions by introducing low-carbon technologies and that partially uses the reductions as credits to meet their targets. As of September 2015, 15 developing countries have signed a bilateral document to initiate the JCM with Japan (JCM 2015). If it is decided that the JCM is included in the FVA and the FVA is operationalised as a means for Parties to achieve their targets (UNFCCC 2014a), it will be the Governments of Japan and partner developing countries that can utilise credits through the JCM to meet their NDCs.

2. Market-based mechanisms under the FVA in the context of NDCs

To highlight issues related to accounting of market-based mechanisms under the FVA towards NDCs, it is important to understand how the two can be related in the context of a post-2020 regime for developing countries.

2.1 What are market-based mechanisms under the FVA?

Various approaches, including opportunities for using markets, appeared in the UNFCCC negotiations for the first time as part of the Bali Action Plan in 2007 within the process for long-term cooperative action, notably under the Ad Hoc Working Group on Long- term Cooperative Action (AWG-LCA) (UNFCCC 2007). At COP16, Parties agreed to establish one or more market-based mechanism to enhance the cost- effectiveness of, and to promote, mitigation actions and decided on seven principles to guide their implementation (UNFCCC 2010). Two possible approaches emerged at the following COP17: the FVA, consisting of bottom-up approaches proposed and implemented by countries; and the new market-based mechanism (NMM) based on a more top-down approach overseen by COP (UNFCCC 2011). The decision adopted at COP17 stresses that approaches under the FVA must meet standards that ensure the environmental integrity of mitigation outcomes (UNFCCC 2011).

After COP18 in Doha, a work programme to elaborate the FVA was implemented under the Subsidiary Body for Scientific and Technological Advice (SBSTA). Five elements are currently considered as part of that work programme,: (1) the purposes of the framework; (2) the scope of approaches; (3) a set of criteria and procedures to ensure the environmental integrity of approaches; (4) technical specifications to avoid double counting; and (5) the institutional arrangements for the framework (UNFCCC 2012a).

It has therefore not yet been decided which approaches, including the ones that are market-based, are to be included in the FVA. It is also not clear what the set of criteria and procedures is that candidate approaches must meet so that they can be recognised under the FVA. Further, whether mechanisms, once recognised under the FVA, could be used for Parties to achieve their NDCs needs to be elaborated along with the work of the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP).

The UNFCCC document supporting the SBSTA work programme provides options to define the scope of the FVA: those adopted under the Convention and its instruments (e.g. CDM, JI); and those developed by Parties. Those developed by Parties can be further classified into ones crossing borders of countries (e.g. JCM, linked emission trading system (ETS)) and ones domestically operated (e.g. non-linked ETS) (UNFCCC 2013b). Among the Party submissions in response to a call at SBSTA40 in 2014, there were only two submissions that introduced existing real-life mechanisms, developed and implemented by Parties, for consideration: one is the JCM through the submission by Japan, and the other is provincial cap-and-trade systems in Canada (UNFCCC 2015a).

Nonetheless, it should be noted that both developed and developing countries are increasingly engaged with market mechanisms through regional, national and sub-national schemes and voluntary carbon schemes (Kossoy et al. 2015). This trend suggests the possibility that more mechanisms implemented by Parties could have influence on domestic policy implementation in developing countries (Klein et al. 2015). The FVA could be one channel to connect these efforts with a country's compliance with NDCs. To this end however, progress in UNFCCC negotiations is required, along with technical clarifications on several issues. Among these is accounting for mitigation outcomes of various mechanisms towards NDCs (UNFCCC 2014a).

2.2 JCM

As mentioned above, the JCM is the only mechanism that appeared in the Party's submissions to the FVA negotiation and involves developing countries as a joint implementing country. The JCM started operations in 2013. Since then, 15 countries have signed the bilateral document to implement the JCM with Japan, and seven JCM projects have been registered (as of September 2015). An overview of the JCM is summarised below, based on Schneider et al. (2014a). The JCM is a bilateral mechanism so, precisely speaking, the JCMs between Japan and one country and another are not exactly the same. The box below is based on the JCM between Japan and Indonesia.

Box 6.1 Overview of the JCM scheme

Type of mechanism: Project-based mechanism

Scope (sectors): 15 sectors, including energy, industry, transport, waste, forestry (afforestation, reforestation, REDD+[1]), and agriculture.

Participation requirements (Project level): Eligibility criteria are defined in an approved methodology for the JCM, which cover requirements for the project to be registered as a JCM project (JCM Indonesia – Japan 2015b).

Regulatory authority: Joint Committee (JC), consisting of representatives from both governments.

Third party assessment: The JC appoints entities accredited under ISO 14065 or designated operational entities (DOEs) or operational entities accredited by the Executive Board under the CDM are considered for designation as a Third Party Entity (TPE) for the JCM (JCM Indonesia – Japan 2015).

Length of crediting: Until the operationalisation of a new international framework under the Convention (i.e. 2020) with possible extension, taking into account the progress of negotiations under the Convention (JCM Indonesia – Japan 2015c).

Additionality assessment: For the project to be registered as a JCM project, its methodology has to be approved by the JC, and that methodology should contain eligibility criteria. The eligibility criteria cover requirements for the project to be eligible for a JCM project (JCM Indonesia – Japan 2015b). Examples of such criteria include specification of design efficiency of a particular technology (e.g. output/kWh) or a particular technology (e.g. air conditioner with inverter, photovoltaics combined with battery).

Baseline setting: emissions reduction to be credited is defined as the difference between reference emissions, calculated to be below business-as-usual (BAU) emissions, and project emissions. Reference emissions may be derived from examples such as the current situation and performance, average historical performance, or best available technology in a partner country (JCM Indonesia – Japan 2015b).

2.3 How are international market mechanisms related to submitted (I)NDCs of developing countries?

This sub-section reviews how market-based mechanisms under the FVA are incorporated into the submitted (I)NDCs of developing countries. As mentioned above, to date, it is only the JCM that involves developing country Parties, and the JCM that appears in FVA discussion as a concrete example. Therefore, the submitted (I)NDCs of JCM host countries are surveyed. As of September 2015, 34 Parties have made submissions on their (I)NDCs to the UNFCCC secretariat. Among them, three JCM host countries were included: Ethiopia; Kenya; and Mexico (Table 6.1). In addition, Parties only formally began preparation of (I)NDCs after COP19 in December 2013. Therefore it is enough to find out how the host countries refer to international market mechanisms in general, rather than specifically to the FVA or JCM, in their (I)NDCs.

All of these three countries indicated their intention to use international market mechanisms towards their (I)NDCs. None of them specified that the mechanisms cover the JCM, although Mexico mentioned the mechanisms include bilateral ones for its achievement of conditional goal (i.e. 40% reduction for the year 2030).

Nationally appropriate mitigation actions (NAMAs) or mitigation actions in general are an instrument for developing countries to achieve (I)NDCs (Boos et al. 2015). Among the JCM host countries, Viet Nam stated that the JCM is an instrument as part of its NAMAs in its first Biennial Update Report (BUR) submitted in December 2014. It also mentioned implementation of voluntary carbon schemes, such as Verified Carbon Standard (VCS) and Gold Standard (GS), as its NAMAs (Ministry of Natural Resources and Environment 2014).

Some developing countries foresee the use of international market mechanisms towards their NDCs. This includes international market mechanisms as the way to receive international support for their mitigation actions. The mechanisms might fall in categories of the FVA, like the JCM or other regional, bilateral, national or sub-national mechanisms with possibility of credits crossing borders. Accounting of credits from these mechanisms is important to assess the fulfilment of and progress towards NDCs by developing countries. It is also crucial for developed countries, because credits from these mechanisms may be shared and used by both developing and developed countries.

Table 6.1 ***INDCs and use of international market mechanisms in three JCM host countries (as of September 2015)***

Country	INDC	Use of international market mechanisms
Ethiopia[1)]	To limit its net GHG emissions in 2030 to 145 Mt CO_2e or lower	Intends to sell carbon credits during the period to contribute towards achieving its Green Economy Strategy.
Kenya[2)]	To abate its GHG emissions by 30% by 2030 relative to the BAU scenario of 143 MtCO_2eq	Does not rule out the use of international market-based mechanisms in line with agreed accounting rules.
Mexico[3)]	• To reduce unconditionally 25% of its GHGs and Short Lived Climate Pollutants emissions (below BAU) for the year 2030 • To make a 40% reduciton in a conditional manner, subject to a global agreement	Its unconditional INDC commitment will be met regardless of such mechanisms, although these would assist cost-effective implementation. Achieving its conditional goal will require fully functional bilateral, regional and international market mechanisms.

Source: 1) Federal Democratic Republic of Ethiopia (2015), 2) Ministry of Environment and Natural Resources (2015), 3) Mexico (2015)

3. Elements of an accounting framework

3.1 Defining the framework

The UNFCCC technical paper refers to accounting as "rules for how a Party's fulfilment of a commitment, pledge or contribution under the Convention and its instruments is assessed" (UNFCCC 2014a). In this chapter, we define an accounting framework as a series of accounting elements, systems and procedures, which are necessary to implement these rules for the use of market-based mechanisms with credits transferable across borders.

We will use the JCM as a case study to explain the accounting framework, which is considered in the context of a post-2020 framework. Based on Prag et al. (2013), we divide the structure of the framework into three parts: (1) issuance of credits; (2) transaction of credits; and (3) accounting of credits towards NDCs.

We focus on three elements that are necessary in the JCM host country (Figure 6.1).

- **Joint Committee (JC):** The executive body of the JCM, consisting of representatives from two governments, Japan and a host developing country. Each host country has a separate JC. The JC plays an important role in making a number of decisions, including the ones relevant for credit issuance.

- **Registry:** A necessary system to be constructed in the JCM to record credits issued to both countries (JCM Indonesia - Japan 2015c). The JCM registry in host countries is currently under development (Government of Japan 2015).

- **Biennial Update Reports (BURs):** Parties agreed that developing countries would prepare BURs to enhance their reporting in national communications on mitigation actions and their effects and supports received (UNFCCC 2010, 2011). BURs should also provide information on international market mechanisms.

There are other elements that need to be considered in the framework, including national greenhouse gases (GHG) inventories and assessment of NDCs against mitigation efforts, including the use of market mechanisms. Although these elements are vital in consideration of the accounting framework, they are relevant to the accounting of any types of mitigation actions and their effects, not limited to the FVA. Hence, these elements are separately discussed in Section 3.4.

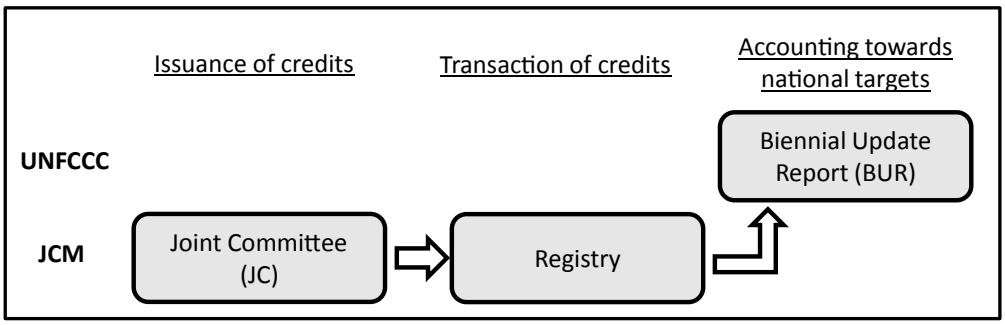

Figure 6.1 ***Elements of the accounting framework adopted for the JCM in a host developing country, based on Prag et al. (2013)***

3.2 Functions of the framework

Once the accounting framework is defined, it is important to clarify its functions in this study. To do this, it is useful to review what has been discussed on the principles of the FVA, from which emerges the essence of the accounting framework.

At COP16 in Cancun in 2010, Parties agreed on the principles to guide the implementation of market-based mechanisms in the FVA. These principles include:

- ensuring voluntary participation, supported by the promotion of fair and equitable access for all Parties;
- complementing other means of support for Nationally Appropriate Mitigation Actions (NAMAs) by developing countries;
- stimulating mitigation across broad segments of the economy;
- safeguarding environmental integrity;
- ensuring a net decrease and/or avoidance of GHGs;
- assisting developed countries to meet their targets; and
- ensuring good governance and robust market functioning and regulation (UNFCCC 2010).

From the perspective of accounting in developing countries, it is possible to highlight two outstanding features out of these seven guiding principles:

(1) On the one hand, it is clear that the environmental integrity of emissions reduction needs to be ensured and strengthened by all participating Parties. COP17 in 2011 emphasised that various approaches in the FVA "must meet standards that deliver real, permanent, additional and verified mitigation outcomes, avoid double counting of effort, and achieve a net decrease and/or avoidance of GHGs" (UNFCCC 2011). The accounting framework to be designed under the FVA ought to ensure that all countries, including developing countries, are able to fulfil this requirement at a satisfactory level.

(2) On the other hand, the accounting framework for the FVA should be formed to incentivise mitigation actions by developing and developed countries. In the previous section, it was highlighted that market-based mechanisms are expected to be part of mitigation efforts by developing countries through mitigation actions or NAMAs and towards NDCs. The accounting framework in the FVA should encourage mitigation actions by developing countries, taking into consideration existing capacities and needs in each country.

In summary, it is our view that the accounting framework for the use of market-based mechanisms under the FVA should serve a minimum of two functions. One is ensuring environmental integrity, and the other is incentivising mitigation actions of developing countries with varying capacities and needs. If adequately applied, the second function of the accounting framework could lead to additional reductions in emissions, because actions that lead to those reductions could not have occurred otherwise.

Clearly, the FVA as a framework under the UNFCCC and individual mechanisms to be included in that framework should work together to serve these functions (Figure 6.2). It is important to consider what the respective roles of the FVA and individual mechanisms are and what they ought to cover in the accounting framework, as well as whether existing arrangements are sufficient to fulfil those roles.

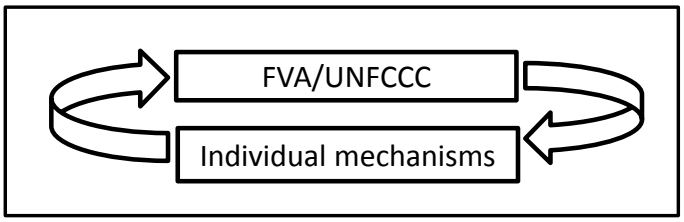

Figure 6.2 ***Roles of FVA and individual mechanisms in accounting***

4. Key issues around accounting elements: the case of the JCM

In this section, we will look carefully at each element in turn to discover what kind of issues are likely for developing countries, concentrating on risks for environmental integrity and incentives for mitigation actions. We will use the JCM as a case study.

4.1 Joint Committee (JC)

The JCM, like other market mechanisms, has a number of design components that affect the quantity and quality of credits, ranging from governance, project cycles and regulations to methodologies used and involvement of third party entities (see for example, Klein et al. 2015). When it comes to an accounting element necessary particularly in a host developing country, it is the decision of the JC, an institution represented by the governments of both countries. The JC takes on a number of important decision-making functions relevant for issuing credits, including:

- adopting rules and guidelines;
- approving methodologies;
- appointing a Third Party Entity (TPE);
- registering projects; and
- notifying credits, issued by the governments, from the JCM (JCM Indonesia - Japan 2015).

The technical capacity of the JC needs to be sufficient to cope with all of these decisions. The JC also has an influence on the smooth operation of a JCM project cycle. Depending on how the JC is structured and managed, the number of projects to be considered for registration and how fast they are registered is likely to be affected. Assuming the outputs of the JC are derived from inputs from both countries, there may well be differences in the effectiveness of procedures to issue credits through JCs, depending on JC capacity.

To cope with this high demand for JC capacity, some partner developing countries decided to establish additional institutions to the JC. For example, Indonesia created a dedicated JCM Secretariat for Indonesia (JCM Indonesia Secretariat 2015). Viet Nam set up a technical advisory board, consisting of experts from various sectors, to support the technical role of the JC (Tuan 2015). In other countries, it is still not clear whether extra institutional settings will be likewise made, except for a few government officers assigned to be responsible for the JCM.

The Government of Japan, through its Ministry of the Environment (MOE) and Ministry of Economy, Trade, and Industry (METI), has provided a number of capacity-building activities related to the JCM. Among others, supporting model projects and feasibility studies is central to those capacity-building programmes (Government of Japan 2015). Although these programmes have directly or indirectly contributed to the enhancement of capacities of the JC, their effects are not clearly identified nor is reporting on the effects of capacity building mandated under the FVA.

4.2 Registry

Each side of the JCM establishes a registry, and project participants who wish to hold credits issued open an account in the registries of both sides. Credits are issued to the respective account of the two registries (JCM Indonesia - Japan 2015d). Allocation of credits between the two accounts is determined by project participants, depending on how much each project participant contributed to the realisation of a project. The registries for the JCM of the two countries become the basis for avoiding double issuance and double use (Schneider et al. 2014b).

A registry for the JCM is currently under development. Its technical features will be based on the national registry under the Kyoto Protocol (Government of Japan 2014). One interpretation of this is that the JCM registries are required to conform to detailed technical standards, such as data format, data exchange and communication between registries, data security, and serial numbers of credits issued (UNFCCC 2008).

As an Annex I Party to the Kyoto Protocol, Japan has an established national registry, while most of the JCM partner countries do not currently have the relevant experience to set up such a registry. One possible approach is to start developing a simplified registry system, which has basic functions on the basis of common specifications to be agreed under the JCM (Government of Japan 2015). Further functions could then be added, as needs arise and the country's capacities grow.

Exceptions would be JCM countries with domestic market-based mechanisms, such as Thailand and Indonesia. These countries likely have experiences which are relevant to the establishment of registries for market-based mechanisms. In addition, market mechanisms can also be applied to other mitigation actions, such as reducing emissions from deforestation and forest degradation (REDD+). If countries are to introduce market-based mechanisms under REDD+, synergies among different mechanisms should be identified to efficiently use existing resources. Similarly, utilisation of the CDM registries for recording credits could also be possible, though this would require arrangements to interlink and connect with other registries.

For countries without experience in setting up registries, there needs to be substantial support provided both institutionally and technically. It is likely that the Government of Japan will offer support for building up a registry for the JCM in partner countries and also provide capacity building on to how to manage it. As mentioned earlier however,

even if support is provided, how this support is linked with emissions reduction is recognised only bilaterally.

4.3 Biennial update reports (BURs)

Those countries choosing to use credits through the JCM towards their NDCs must transparently report the amount of claimed credits at the international level. Currently, only biennial reports (BRs) of developed countries have a respective reporting section for the use of units from market-based mechanisms, including the Common Tabular (UNFCCC 2012b). Similar specifications ought to be made for BURs of developing countries, so that developing countries can report on the use of credits to the UNFCCC in an explicit manner. In addition, countries should report any support provided to achieve reductions through the JCM in BURs. It is necessary to clearly distinguish reductions claimed as reductions by JCM host countries with support from reductions claimed as reductions by Japan to avoid double purpose (Schneider et al. 2014b).

BURs are subject to the international consultation and analysis (ICA), including the technical analysis of BURs (UNFCCC 2011). The accountability and transparency of information provided on the use of market-based mechanisms can be enhanced through ICA. Reporting on the use of credits and support provided by both developed and developing country sides can help to ensure that double claiming is avoided by the two Parties (Prag et al. 2013).

It is important to note that developing countries are at different stages of preparation for BURs. Only 10 developing countries were able to follow the agreed timeline for submitting their first BURs to the UNFCCC by December 2014 (UNFCCC 2015b), while others are in the process of acquiring funds for their preparation of BURs (UNFCCC 2014b). There is a considerable gap between required reporting by the UNFCCC and the existing capacity of developing countries.

4.4 Other issues

National GHG inventories would be the basis for accounting whether NDCs have been ultimately attained by countries, including the use of market-based mechanisms. The national GHG inventories of developing countries are currently considered less accurate than those of developed countries, mainly for two reasons. First, it is not mandatory for developing countries to apply the most recent IPCC guidelines. Second, national inventories of developing countries are not subject to the international review process. Instead, their BURs are subject to ICA, which is conducted in a non-intrusive, non-punitive manner, respecting national sovereignty (UNFCCC 2010). This lack of accurate national inventories makes it difficult to track the progress of mitigation actions in a comprehensive manner in developing countries.

Another issue is a link between NDCs and the impacts of mitigation actions. Developing countries prepare their NDCs as capacity permits. It is anticipated that developing countries with advanced capacity will determine their NDCs in the form of economy-wide emissions reduction goals, while others may choose to select NDCs as a collection of policies, programmes and mitigation activities, which generally are sector-specific and can be counted in non-GHG forms (e.g. capacity of renewable energy installed, land use area avoided from deforestation and forest degradation) (Boos et al. 2015). Accounting of credits from market mechanisms towards NDCs is meaningful when both are comparable. In this regard, a clearer link needs to be made between NDCs and different mitigation actions taken in developing countries (e.g. scope, assumptions and methodologies, unit, time frame).

4.5 Summary

Based on the above paragraphs, Table 6.2 below summarises key issues around the three accounting elements of market-based mechanisms, from a developing country's perspective. The issues are identified as possibly having risks for ensuring environmental integrity and incentivising developing countries to engage with mitigation actions through market-based mechanisms.

Table 6.2 Key issues in the accounting of market-based mechanisms in developing countries

Issue	Risk	Response
Insufficient capacities of the executive body	An increased risk for lowering the quality of credits issued. Fewer emission reductions due to a smaller number of projects and the slower pace of procedures.	• Identification of capacity needs • Incentive for supporting capacity building
Lack of an appropriate registry	Emissions reduction could be claimed twice by Japan and a partner country. If due to a lack of an appropriate registry, participation in a mechanism is prevented, developing countries without registries or capacities to build registries are likely to be discouraged to participate in market mechanisms.	• Incentive for supporting capacity building • Use existing systems, if any • Proposal for intermediate solutions
Lack of international reporting via BURs	Unclear picture of the use of credits towards NDCs. This could lead to an increased risk of double claiming at the international level. Given a considerable gap between requirements to prepare for BURs and existing country's capacities, it would not be feasible to depend only on BURs for international reporting of use of credits.	• Enhance reporting requirements in BURs • Propose intermediate solutions

5. Proposed solutions

The above sections have shown that there are potential issues around accounting elements due to both varying capacity in developing countries and also the existing accounting framework. Without addressing these issues, it is possible there would be increased risks to the environmental integrity of achieved emissions reductions and their use in fulfilling NDCs. At the same time, there is an increased risk that developing countries might limit their participation, because only a handful of developing countries are able to meet the requirements that are commonly set for all.

The role of the FVA could be to provide options for accounting from which countries with different capacities can choose, while ensuring environmental integrity. In this section, we will propose possible solutions for the FVA accounting framework to strengthen this role.

(1) **Capacity building as an essential element for various mechanisms under the FVA:** Clearly, engagement of developing countries in the use of market-based mechanisms requires support as necessary. In accounting, this should include support for the establishment of the executive body, registries, and for international reporting through BURs. With a bilateral agreement, such as the JCM, it is the implementing country which mainly provides such support. If the support is recognised as an essential part of the mechanisms to be included in the FVA, it can encourage implementing countries and ensure that developing countries with limited capacities can receive necessary support.

(2) **Review/coordination by a team of experts of the FVA:** A technical review of individual mechanisms is needed in order to avoid risking environmental integrity, due to insufficient capacity of the executive body of a mechanism in a developing country, for example. The review can also assess how a country's capacity is enhanced through its engagement with the mechanism, as well as identify additional needs. Moreover, the expert team can coordinate with other market mechanisms, if any, in the country to bridge institutions (e.g. registries) and know-how. The technical review can be arranged under the UNFCCC and its team members can be composed of market mechanism experts from UNFCCC roster of experts. The role of validation and verification bodies in this review process can be further considered.

(3) **Simplified registry systems:** A simplified registry system can support countries that do not have the experience and capacity to develop a standardised registry by themselves. For those countries, a simplified registry system, for example, using spreadsheets, can be useful and simpler to manage. Making it possible to use simplified systems and integrating these to the accounting of the FVA would enable countries with less capacity to participate in market mechanisms.

(4) **Synergies with other market mechanisms:** Market-based mechanisms are expected to play a role in other mitigation actions, such as REDD+, in the context of NDCs. In accounting under the FVA, it is essential to create synergies among these various market-based mechanisms both technically and institutionally, thereby helping countries to use existing resources efficiently. Further research is necessary to identify what the common elements are among those mechanisms in terms of accounting and how a developing country can be prepared in a post-2020 framework.

(5) **Enhanced reporting on the use of credits through BURs in a gradual manner:** Transparently reporting the use and transfer of credits needs to be done by both the developing and developed country. In this way, the risk for double claiming at the international level can be minimised. Specifications for reporting, including the use of the Common Tabular, need to be made for BURs. However, there exists a gap between international requirements for BURs and a country's available capacity to respond to those requirements. It is therefore important not to make BURs a necessary condition for participation in market-based mechanisms by developing countries. Rather, it is reasonable and realistic to focus on the establishment of a registry, while reporting through BURs can be gradually enhanced. The technical review proposed above can serve to ensure that registries function in countries without deteriorating the environmental integrity of emissions reductions achieved.

In our view, the FVA negotiation process focusing on accounting needs to consider these five points as a way to enable the wider participation of countries (especially developing countries) and to ensure environmental integrity of each mechanism. Such progress will help developing countries to organise their NDCs, including an option to use market-based mechanisms, because they can get a clearer idea about how it is possible for them to utilise market-based mechanisms, given their national conditions, and how that utilisation affects other parts of their mitigation actions, e.g. REDD+, with respect to accounting under a post-2020 climate regime.

6. Conclusions

Market-based mechanisms are a work in progress. It is important to continue to consider how these different approaches can be harmonised under the FVA to ensure

environmental integrity and incentivise mitigation actions by both developing and developed countries. This chapter has focused on the accounting framework for the FVA, concentrating on key issues for developing countries.

It is likely that developing countries will encounter unique challenges when carrying out accounting of their use of market-based mechanisms towards NDCs. These challenges are derived from the current reporting framework and varying capacities of developing countries. This means that unless these deficiencies are appropriately addressed under a post-2020 framework, there is a chance that environmental integrity of credits cannot be safeguarded and mitigation actions by developing countries cannot be promoted.

Therefore we propose several points: (1) the accounting framework for the FVA should identify the needs of capacity building and incentivise support provided for developing countries; (2) a team of experts in the FVA should technically review the mechanisms both for environmental integrity and capacities that have been built; (3) the team should also play a role in coordinating among different market mechanisms, which are expected to operate in a developing country such as REDD+; and (4) the FVA should allow for simplified registry systems, so developing countries with limited capacities can participate in the mechanisms. At the same time, reporting on the use of credits needs to be reflected in BURs. Together with BRs of developed countries, this will avoid double claiming at the international level. However preparation for BURs by some developing countries takes time, so enhancement of reporting on the use of market mechanisms through BURs should be seen as part of the gradual improvement.

It is recommended the accounting elements of the FVA should consider these points so that all developing countries can have the opportunity to choose market-based mechanisms as an instrument to mitigate climate change. In this regard, progress in UNFCCC negotiations on the FVA and its accounting framework is vital for developing countries to make a choice on whether to utilise market-based mechanisms under the FVA.

It is clear that capacity building is necessary to enable accounting of market-based mechanisms in developing countries. Without it, it would be difficult for countries to jointly develop and implement mechanisms and share credits towards NDCs. Capacity building can also assist with emissions reduction, which otherwise could not be achieved. Emissions reduction through capacity that has been built under the FVA should be considered as additional, contributing to the achievement of net emissions reduction for global climate.

Notes

1. REDD+ : Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

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Chapter 7

Loss and Damage Associated with Climate Change: What and Why, Stakeholder Perspectives, and a Way Forward

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and Muneyuki Nakata

Chapter 7

Loss and Damage Associated with Climate Change: What and Why, Stakeholder Perspectives, and a Way Forward

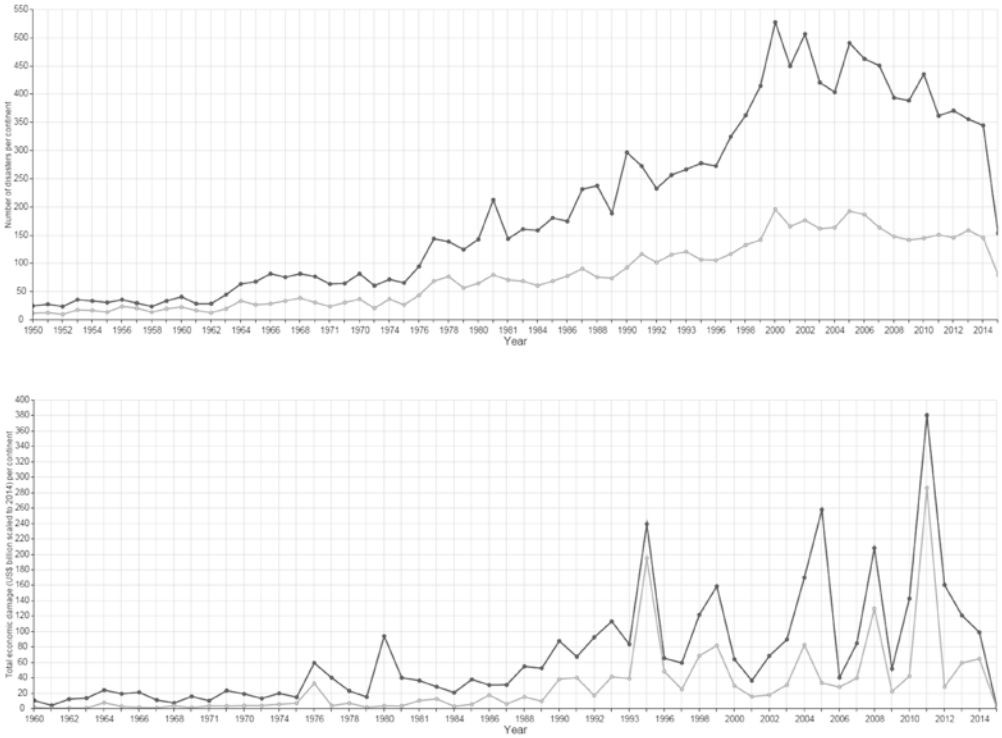
Sivapuram V.R.K. Prabhakar, Ketaki Kamat, Aibek Hakimov, Yohei Chiba and Muneyuki Nakata

Key Messages

- Loss and damage (L&D) associated with climate change is inevitable due to a combination of factors operating in tangent with each other. These include the failure to achieve desired greenhouse gas (GHG) mitigation levels by a set period of time beyond which there are high risks of the climate system entering into an irreversible phase, and failure to achieve effective adaptation amongst vulnerable people.
- Stakeholders engaged in L&D have a clear but diverse understanding of the definition of L&D and how it can be mitigated. While there appears to be some agreement on L&D being defined as the residual losses and damages after implementing adaptation actions, others call for the need to apply a more broadly-based definition, with L&D providing the impetus for stronger mitigation and adaptation outcomes.
- Several proposals to address L&D were made to the processes under the United Nations Framework Convention on Climate Change (UNFCCC). It has been found that the principles which countries support for international negotiations and the scope of L&D for a country are largely governed by its potential vulnerability to climate change and the predicted impact of climate change. It is evident that the economic power of a country largely determined its support of risk insurance and related funding mechanisms.
- Despite the high emphasis on risk insurance and related financial risk management options, in the current discussion on L&D there is little evidence on how risk insurance will help reduce L&D, especially non-economic L&D (NELD). There is a need in the design of risk insurance products to optimise L&D reduction outcomes.
- Decision makers need to be provided with a set of simple tools/formats to help capture major NELD that impacts decision-making for optimal climate change adaptation (CCA) and disaster risk reduction (DRR) outcomes.

1. Introduction

Until recently, the focus of international negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) has largely been on climate change mitigation. It was the Bali Action Plan in 2007 that shed a spotlight on the need to enhance climate change adaptation (CCA). One of the factors that contributed to the focus on CCA has been the fact that a significant increase has been observed in the number of disasters and their impacts over the past several decades (see Figure 7.1). This increase has largely been attributed to weather-related events. The realisation that emissions reduction efforts have not been enough to prevent climate change impacts is now evident.



Source: EMDAT 2015

Figure 7.1 ***The number of natural disasters (above graph) and their economic impact (lower graph) on all continents (black line) and in Asia (gray line)***

The loss and damage (L&D) associated with climate change has emerged as one of the important issues needing urgent attention at both national and international levels for a number of reasons. Important factors contributing to L&D are associated with limitations in curtailing greenhouse gases (GHG) emissions (to levels that will not exacerbate the climate change impacts), limitations in scaling and ability to maximise effective adaptation, and the inability to develop effective mitigation and adaptation interventions. While there are no definitive research findings that provide an indication of the extent of the L&D that may occur (due to deficits in mitigation and adaptation), it is expected that there will still be significant residual L&D. It will be crucial to take this scenario into

consideration in all kinds of developmental planning interventions because it will enhance the capacity of stakeholders to deeply understand the issues associated with mitigation and adaptation, and possibly develop innovative solutions to push the boundary of mitigation and adaptation to levels that have not been considered before. The concept of L&D has been developed within the UNFCCC's adaptation framework in the context of climate change and is one of the more recent work streams of the international climate change regime (Surminski and Eldridge 2013).

Keeping in view the fact that L&D has emerged as an urgent issue to be addressed, this chapter aims to review the ongoing discussion on L&D, to identify adaptation barriers and limitations of the current L&D approaches, and to suggest a way forward to overcome such limitations, drawing on the findings of ongoing IGES work on stakeholder positions and perceptions related to L&D. The remainder of this chapter is organised as follows. Section 2 begins by describing the what and why of L&D, including factors that may have led to L&D, stakeholder perceptions on L&D as found in the literature, and the barriers to adaptation that have implications for L&D. Sections 3 and 4 present the methodology and the results of two sets of IGES research on L&D: one is a survey of stakeholders engaged in CCA and disaster risk reduction (DRR) about how different stakeholders perceive the issues of L&D and related solutions; and the other is a regression study on factors that may explain the position taken by various countries in the L&D related negotiations under the UNFCCC. Based on observations from these surveys, Section 5 discusses the limitations of the current approaches being promoted to address L&D, and Section 6 suggests a way forward for addressing L&D.

2. What and why of loss and damage

The term loss and damage has often been referred to by both the DRR and CCA communities. However, there is no common definition that all stakeholders agree upon and hence the understanding about L&D can vary from stakeholder to stakeholder engaged with development, CCA and mitigation fields. Under the UNFCCC, L&D has often been referred to as 'L&D associated with the adverse effects of climate change.' In addition, UNFCCC literature indicates that L&D has also often been placed within the context of extreme events, both slow and sudden onset disasters. To a certain extent, this comes from the observation that most often the DRR community looks at L&D from the perspective of dealing with sudden onset disasters while the CCA community tends to focus more on the slow-onset disasters. Since it is being discussed within the context of climate change, many issues raised in relation to adaptation and mitigation also have relevance to L&D; issues such as historical responsibility, vulnerability, polluter pays principle, common but differentiated responsibilities, etc. For the CCA community, L&D has emerged as an issue that could undermine the adaptation achieved on the ground. This is a critical issue that questions the sustainability of interventions and one that could leapfrog the adaptation to a level from incremental to transformative gains in achieving significant reductions in climate risk.

The term loss and damage has also been widely used within the DRR community to refer to the impacts that disasters cause on society, infrastructure and the natural environment. However, as in the case of the climate change community, no common definition is adhered to in the assessment of L&D, and reaching a consensus has become a critical component of the work of professionals engaged in DRR. Often, the L&D caused by disasters in the immediate past has determined the resources to be allocated for preparing for future disasters within the planning cycles of governments, although such planning has largely been limited to the '3Rs' of DRR (rescue, relief and rehabilitation).

Only recently, efforts have been made to understand the available information to design and implement robust risk reduction strategies from a strategic point of view.

While there is no agreed definition of the term loss and damage under the UNFCCC, the Cancun Agreement reached in 2010 set boundaries by referring to impacts from extreme weather and slow onset events (UNFCCC 2015). These include sea level rise, increasing temperatures, ocean acidification, glacial retreat and related impacts, salinisation, loss of biodiversity, land and forest degradation as well as desertification.

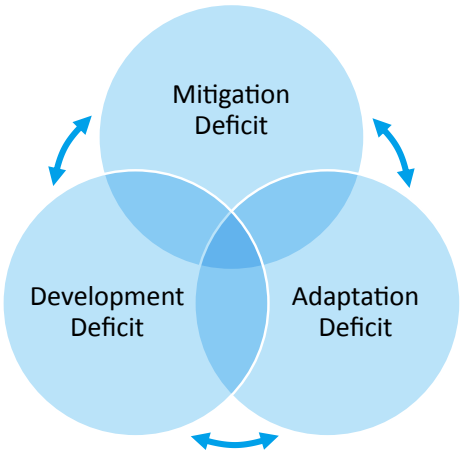
Some attempts at elaborating the meaning of L&D have been made. According to Germanwatch (2012), the concept of L&D represents the actual and/or potential indication of negative impacts caused by climate change that affect human and natural systems. The term "damage" is classified as negative impacts that can be repaired and/or restored; an example would be damage to coastal embankments caused by severe flooding. The term 'loss' can be characterised as negative impacts that cannot be repaired or restored; an example would be loss of culture or heritage, loss of local habitat etc. due to climate change.

Warner et al. (2012), under the work supported by the Climate and Development Knowledge Network (CDKN), examined L&D as a result of inability to adapt or insufficiency in the adaptation process itself. Warner concluded that the existing CCA measures are not enough to avoid L&D and that these measures have costs that are not strictly economic but also social, cultural and associated with health. Non-economic loss and damage (NELD) even though fuzzy and hard to measure can have one of the most "significant and far reaching consequences" (Warner et al. 2013). Economic loss and damage refers to all those losses and damages accrued to assets and resources that have direct economic value in the market. NELD refers to losses and damages accrued to those elements of society that do not have direct economic value in the current market but still play an important role in the overall wellbeing of the society, often socially.

Based on the above discussion, this section illustrates the factors that lead to L&D. This is done by describing three deficits leading to L&D in the first sub-section. The second sub-section further elaborates on various barriers and limits to adaptation that hinder us from achieving the fullest adaptation possible leading to L&D. The third sub-section further elaborates on the governance issues that reflect how various stakeholders approach the issues of adaptation and L&D.

2.1 Three deficits leading to loss and damage

L&D associated with climate change can be attributed to three deficits: a) development deficit; b) mitigation deficit; and c) adaptation deficit (Figure 7.2). These three deficits are related with each other (overlaps in the Venn diagram) and one deficit can have impact on other kinds of deficits (hence the bi-directional arrows in Figure 7.2).



Source: Authors

Figure 7.2 ***The three deficits leading to loss and damage associated with climate change***

Development deficit refers to development that is needed in a country but has not taken place largely due to information imperfections (players often may not know what works the best), governance failures (failures in organising and implementing actions on the ground) and limited capacities (financial, human resources etc.). The mitigation deficit is the gap between global temperature increase that is likely to occur as a result of current mitigation efforts and the target of no more than 2°C temperature rise by the end of the 21st century. It is becoming clearer that reaching this goal does not seem to be possible when judged by current GHG emissions trends (Sanford et al. 2014). GHG emissions continue to rise, with emissions in the past decade accounting for more than 50% of the total emissions from 1,750 to 2,010 (IPCC 2014). Several countries have failed to achieve carbon emission targets agreed under the Kyoto Protocol (UNFCCC 2012a) and the pledges made under intended nationally determined contributions (INDCs) fall well below the levels required to stabilise GHG emissions at 2°C (CAT 2015). Hence, GHG emissions are likely to exceed the 2°C target as per Representative Concentration Pathway scenarios 4.5, 6.0 and 8.5 (IPCC 2014). This is expected to have serious consequences in terms of climate change impacts.

The adaptation deficit refers to the gap between actual adaptation and the level of adaptation that is required to adjust to climate change impacts (without incurring L&D) that are the consequence of a mitigation deficit. The adaptation deficit has been widely discussed in a discontented manner among the climate change community in terms of the deficit in financing for adaptation (Prabhakar 2013), insufficient scaling up of adaptation (Nambi et al. 2015) and lack of capacity to plan, design and implement appropriate adaptation interventions (ND-GAIN 2015). The adaptation deficit could also be understood in terms of how poor countries are disproportionately impacted by climate change compared to rich countries due to the differences in vulnerabilities and associated risks (Frankhauser and McDermott 2013) and the possible negative outcomes of adaptation including maladaptation (Barnet and O'Neill 2013). It is to be noted that developed countries are also prone to adaptation deficit as is evident from the increasing impacts of climatic events and growing emphasis on adaptation planning in these countries. Adaptation deficit could also occur due to our limited understanding as to what

extent technologies could contribute to reducing vulnerabilities and the related shortfall in their performance when they are actually implemented on the ground. All these situations will only exacerbate the climate change impacts leading to higher L&D outcomes.

2.2 Barriers for addressing L&D

The development, mitigation and adaptation deficits all have implications for L&D. Building upon the previous section, this section elaborates barriers that hinder adaptation leading to L&D.

According to Adger et al. (2008), on a larger scale there are three dimensions that could characterise CCA limits: ecological and physical limits; economic limits; and technological limits. Analysing CCA from the point of view of ecological and physical limits to adaptation provides the possibility of investigating agriculture and biodiversity under changing climates with the help of physical modelling. In terms of economic limits to adaptation, one could investigate cost-effectiveness and cost-benefit of the adaptation in connection to L&D. Finally, approaching limits to adaption from a technological point of view gives an insight into future construction and innovation analysis, for example coastal defence or building design.

Given the unpredictable and ever-changing nature of the global climate, adaptation will always be challenging. The process of adaptation must be continuous, where lessons are drawn from the past and different aspects of CCA can be equally investigated for their future relevance. The greater the increase in temperature the more damage can be anticipated; consequently the less prepared we are for adaptation, the more L&D we experience (ActionAid et al. 2012). The limits of how far humans and ecosystems can adapt to some slow-onset impacts such as rises in sea levels, rises in temperature, loss of biodiversity and desertification are very real. Because of the magnitude of these impacts such as sea level rise, *in situ* adaptation becomes gradually impossible since the territory itself will become uninhabitable.

There is also a view among some researchers concerning climate change and its limitations in terms of scientific predictability. It is very hard to scientifically predict and evaluate exactly the course of events for the future when dealing with climate change. According to Dessai et al. (2009), the uncertainties arise from limitations in knowledge, such as cloud physics, randomness (due to the chaotic nature of the climate system) and intentionality. All these factors combined make it very hard to quantify and model the future of climate change, which leaves predictions based heavily on assumptions. This so-called 'explosion of uncertainty' becomes even more evident when conducting climate change impact assessments with the purpose of devising national or local planning for CCA.

Climate science has proven that unless both natural and anthropogenic forcing are included, climate model simulations cannot simulate the observed global changes in the surface temperature and other phenomena related to climate and its bio-geophysical factors of the last 100 years. There will always be a trade-off between accuracy and precision, where certain projections can have high accuracy (being correct in all details) but low precision, which can be characterised as the standard deviation of the measurements (Desai et al. 2009). This makes forecasts harder to analyse for scientists and harder for policymakers to take appropriate measures for CCA.

Lack of technical and scientific information and the capacity to use it at the local level is one of the most important barriers to adaptation. This is why decision makers need to assess adaptation options in the context of climate change effects on the local community

and infrastructure (Corfee-Morlot et al. 2010). Engaging the local stakeholders in CCA discussions is a challenge in itself. There is no single approach that can work in different contexts since CCA is highly contextualised. In addition, adaptation is also a multi- and inter-sectoral issue which could raise governance challenges akin to other environmental issues.

Society and social values also impact adaptive capacity and adaptation options chosen. The structure of societies, values, knowledge, relationship between individuals, institutions and the state all affect adaptation (Adger et al. 2008). Since change is going to be evident between different societies, the limits to adaptation may vary as well. Social structure can be divided into four metadomains that need to be explored from a social perspective: ethics (how and what we value); knowledge (how and what we know); risk (how and what we perceive); and culture (how and why we live) (Adger et al. 2008). Together, these domains represent how we view and value risks and impacts connected to climate change, and also how much we know about them. This is also influenced by how we live.

Social barriers to adaptation are generally associated with the social and cultural processes that govern how individuals respond to climate change related stimuli. According to Jones and Boyd (2011), there are three types of barriers in connection to social adaptation: cognitive, normative and institutional characteristics. The cognitive barriers to adaptation relate to the thought processes and psychological effect on the actions of different actors in a climate debate. How individuals act in accordance to climate change and adaptation will depend on their thought processes, values and ethics, as well as how well they adapt psychologically. For instance in many regions of South Asia, gender and caste are two of the main social institutions which inherit many predefined norms, rules and values that have an influence over how the individual may behave in response to unexpected (extreme) event and deal with the shock and stress.

2.3 Adaptation governance and the role of stakeholders

Adaptation is essentially an issue where multiple stakeholders, who may differ in their opinions and positions, are engaged to find solutions and hence it is pertinent here to discuss the roles of different stakeholders in the overall governance of adaptation in general and L&D specifically, at international and national levels. This sub-section elaborates various adaptation governance issues and the role played by various stakeholders. In particular, the section stresses the need for greater agreement and continuity of actions between international and national levels for effective adaptation governance.

Climate change issues are governed through national and international level structures. These are influenced by various stakeholders and hence their opinions assume importance in the way issues are addressed. International cooperation in general has not been very successful when it comes to the issue of global commons due to the conflict and asymmetry between countries that bear the cost of action and those who benefit from action (Corfee-Morlot et al. 2010). The issue of international cooperation is even more pronounced in the case of CCA and mitigation, as this deals with a global common where actions have to be taken both globally and locally, creating tensions over who should invest resources where. L&D faces a similar challenge to that of adaptation and mitigation regarding international governance.

At the international level, the UNFCCC, the decisions of the Conferences of the Parties (COPs) such as Kyoto Protocol and Warsaw International Mechanism for Loss and Damage, constitute important mechanisms for addressing these issues. At the national

level, laws and guidelines are set by various ministries and departments, and work is implemented by government agencies, non-governmental organisations, consortiums and networks. These constitute important stakeholders that could influence the way adaptation and mitigation interventions are designed and implemented. At the local level, adaptation actions and decisions are taken in an uncoordinated manner by households, firms and organisations; there is no governance beyond this.

The governance of adaptation manifests itself at all levels, from international to local. Hence, interaction is important across all these levels including between national and local governments as well as nongovernmental organisations (Paavolaa and Adger 2005). At the local level, community organisations, businesses as well as urban planners or water resources managers invest in adaptation measures that influence the decision-making and policy-planning process. Without continuity and agreement on decisions made from higher levels to local levels, there could be a negative impact on the collective response to climate change (Corfee-Morlot et al. 2010).

According to Corfee-Morlot et al. (2010), there are three basic layers of decision-making and influence that are divided across different levels of policymaking. The outer periphery consists of public decision-making by institutions that represent the government, such as city authorities, judicial system and or parliamentary bodies. The inner periphery is made up of a range of self-governing institutions such as universities, professional agencies, associations and foundations. There is no one level where decision-making should happen. These complex hierarchical institutional structures and engagement of multiple stakeholders complicates matters when addressing the issue of adaptation and L&D.

The institutional hierarchy could affect the ability of local institutions to adapt to climate change. The main limit could be that policy plans are usually set at higher levels of governance, leaving local level authorities with limited freedom as their roles are often limited to implementing plans and policies set by those higher up the hierarchy with not much room for innovation in addressing emerging issues such as climate change. Municipalities are often highly constrained in terms of their financial capacity; they are in a way just delegate agents of a higher power (Measham et al. 2011). However, things are changing with local governments becoming proactive in addressing long-term climate change impacts in response to local needs (Tsurita et al. 2013). Another related governance challenge in adaptation and climate change governance is the fact that much of it includes long-term policy problems with time lags between policy planning and implementation, and the effects of the policies; it could take several generations before effects are manifested. The policy planning and measures are a part of a very complex system and our understanding of this particular system is still incomplete and filled with uncertainties (Underdal 2010).

Due to above described hierarchies and related governance challenges, reaching an agreement at international and national levels could be challenging especially for contentious issues such as liability and compensation for L&D. The issue of "liability" assumes importance both at the international and national level. At the international level, liability has been discussed in the context of providing support to vulnerable countries for the damages caused through climate change (Huq 2014). In fact, negotiations to evolve a mechanism to address climate change have been taking place under UNFCCC since 1992 (UN 1992) and more specifically on L&D from 2007 onwards (Schafer and Kreft 2014). In Article 4 of the UNFCCC Convention, Paragraph 3 states that developed countries are liable to cover the costs of developing countries to meet their obligations under the Convention. This includes preparing national inventories of sources and sinks of GHGs (Paavolaa and Adger 2005). At the national level, national governments are

expected to provide support mechanisms for the affected individuals and communities that have experienced some sort of L&D due to climate change. However, it is not clear how national governments should address the issue of supporting those affected in the context of L&D and it looks like the issue is expected to be covered by the existing DRR (to a large extent) and CCA (to a limited extent) processes which necessitates greater coordination between these communities.

The compensation issue in itself is very complicated since it is difficult to scientifically pinpoint the exact cause and effect factor with climate change (Trenberth et al. 2015). Because of this complexity, there is a chance that countries which contribute the most GHG emissions can easily deny that their emissions are associated with specific weather events. Science and policy aspects play an important role here; the policy-science interaction has to involve three main criteria: credibility, legitimacy and finally salience. All three factors depend on the reliability and accuracy of science predictions in a field of uncertainty and ambiguity that are a part of climate change predictions (Corfee-Morlot et al. 2010). Despite their importance, science-policy linkages are poorly developed in most countries, and policy making has often been based on political promises made by the elected constituents, rather than based on objective assessment of policy options at hand for the overall wellbeing of the society. This could mean a greater failure in adaptation interventions, necessitating an even greater science-policy linkage.

3. Methodology for analysing stakeholder perspectives on loss and damage

As set out in the introduction, insights into the stakeholder positions and opinions on the issue of L&D can help us to obtain greater understanding so as to develop appropriate solutions. Two approaches were followed to assess the stakeholder perceptions associated with the issue of L&D: a) analysis of submissions made to the Conference of the Parties to the UNFCCC (UNFCCC-COP); and b) an online structured questionnaire survey of stakeholders engaged in CCA and DRR. While the first approach is based on an analysis of submissions made to the UNFCCC on the subject of L&D (indirect), the second approach is based on a survey of stakeholders engaged in CCA and DRR (direct). The difference in approach was partly due to conducting these studies under different projects, as well as a lack of sufficient means to approach stakeholders engaged in climate change negotiations under the UNFCCC. The methodology adopted in both these studies is presented in this section.

3.1 Analysis of submissions to UNFCCC-COP

The submissions to UNFCCC-COP were analysed with the aim of understanding factors influencing country positions on L&D. Whereas most related studies have environmental output variables as their subject of analysis (e.g. carbon dioxide emissions or the number of environmental treaties signed) (Bailer and Weiler 2014), this analysis focused on the choice of bargaining positions in climate change negotiations and the question of which factors explain the choice of these positions. The study used a multiple linear regression method to assess the potential relation between the country positions on L&D in international negotiations and selected independent variables. The reason for choosing multiple linear regression as against methods such as document analysis and interview, among others, has been that these methods suffer from several limitations as outlined by Bailer and Weiler (2014). In addition, regression analysis provides a means of statistically testing the relationship between factors that may influence the negotiation positions and the specific positions taken by countries.

The UNFCCC work programme on L&D has on several occasions called for submissions asking participating countries and observers to give their views and inputs on specific topics. The data for country positions on L&D derives from individual and group submissions to UNFCCC in the years 2011 and 2012: a) on possible elements to be included in the recommendations on L&D (UNFCCC 2012b); b) on what to consider under the three thematic areas of the work programme on L&D; and c) views and information on elements to be included in the work programme on L&D.

For the purpose of this study, data from 31 countries including the group submissions for the European Union (EU), the Alliance of Small Island States (AOSIS) and Least Developed Countries (LDCs) was scored. It is important to highlight the limitation of data at this point as this is a very marginal representation of the 190-plus countries participating in international negotiations. It should be noted that economically similar countries have submitted group submissions which for this study have been considered as single submission. Based on the elements emerging from the text of these submissions, the data for the 31 countries was coded for the dependent variables presented in Table 7.1. Table 7.2 presents the list of explanatory factors that could possibly provide a logical framework to explain the position taken by different Parties to the Convention on the subject of L&D.

The predictors of a forecasting analysis of UNFCCC agreements should reflect the variables most pointed to as explanatory factors of climate change negotiations (Genovese 2012). The underlying arguments for choosing these explanatory factors are discussed below.

The most economically powerful countries drive the negotiation strategies. The first explanatory factor emerging from the literature is the endowment of economic resources, otherwise referred to as economic capabilities. Power dynamics undoubtedly play an important role in climate change negotiations (Bailer 2012). Most argue that 'rich' states face the highest opportunity costs from bargaining, which leads them to have more influential positions over climate policy integration than 'poor' states (Ott et al. 2008).

It is economic power that steers countries to take less cooperative positions in international negotiations. International negotiations bring countries to a common consensus in addressing crucial environmental issues such as CCA. To understand the influence of the future trends on these discussions and countries' decisions, projected economic growth and predicted impact of climate change have also been considered as explanatory factors.

Countries highly vulnerable to climate change will take a more cooperative stand in climate change negotiations. Another significant factor emerging in the climate change negotiations literature is the risk of natural devastation, or what can be referred to as climate vulnerability. This factor, contingent to climate change, represents a strong bargaining power (Genovese 2012; Bailer 2014).

The predicted impact of climate change on the country will influence the countries' position. Countries tend to position their arguments and negotiations depending on the expected climate change impacts on their country to safeguard their future interests.

Countries with stronger democracy will be less aggressive in negotiation positions. Strong domestic interest in environmental negotiations might funnel a state to use rather hard strategies in order to demonstrate its determination to constituents. Accountability to voters might result in representatives being more resolved to reach their negotiation goals (Bailer 2012; Jung 2004).

The dependent variable scores were categorised on a scale of 0-3; where 0 is for least ambitious goal, 1 for low ambitious goal, 2 for moderate goal and 3 for ambitious goal. Although efforts were made to ensure gradual hierarchical scores, due to the varying principle on which the countries have based their opinions, it was difficult to get clear hierarchical scores. Based on this scale, all the 31 country submissions were scored independently for each of the eight elements. Regression analysis was carried out to verify the influence of various explanatory factors on the elements of the UNFCCC submissions on L&D.

Table 7.1 ***List of dependent variables and meaning of the scale assigned***

Dependent variable	Scale and its meaning
1. Principle supported by the country	0 - Countries have not clearly identified any principle 1 - Countries showed least dependence on principles such as polluter pays principle 2 - Common but differential responsibility 3 - Principle of historic burden, with demand for financial contribution from the developed nations.
2. Scope of loss and damage (L&D)	0 - No mention of definite scope for L&D 1 - L&D is the residual risk after mitigation and adaptation efforts have been implemented 2 - L&D after the implementation of mitigation efforts 3 - Need for assistance from the developed nations for L&D.
3. Gaps in assessing L&D	0 – No clear gaps are identified 1 - Lack technical knowledge and tools to assess L&D 2 - Lack of data to assess L&D 3 - Financial and technical capacity to initiate data collection and knowledge of tools to assess L&D
4. Risk insurance and risk management	0 - Least supportive or negative approach towards risk insurance as a tool for risk management 1 - Countries supporting risk insurance if it is nested along with the existing risk management approaches 2 - Increased support for risk insurance mechanism with low burden on the developing countries 3 - Complete support for a separate risk insurance for L&D funded but the developed countries
5. Compensation and rehabilitation	0 - Emphasis on prevention through mitigation and adaptation efforts than on measures for compensation 1 - Consider compensation as post disaster measure already addressed in CCA 2 - Expressed need for further discussion on L&D 3 - Compensation as an essential component for losses due to impacts of climate change with funding from the developed nations
6. Funding mechanism for L&D	0 - Not in favour of compensation as funding mechanism 1 - Consider rehabilitation funding to be drawn from the existing CCA funds 2 - Support compensation and willing to voluntary contribute for separate fund for rehabilitation and post disaster L&D 3 - Funding for rehabilitation and compensation should be met by the developed nations
7. Institutional setup for L&D	0 - No specific mention for the institutional setup 1 - Continue with the current setup to of the work programme for L&D 2 - Assign the role to the 'Adaptation Committee' 3 - Create a separate subsidiary body under the convention
8. Stakeholder involvement in international climate change negotiations	0 - No stress on involvement of stakeholders for discussions under UNFCCC 1 - Involvement of private stakeholders in the discussions at UNFCCC 2 - Involvement of experts and private stakeholders 3 - Engagement of all stakeholders including citizens, implementing authorities and experts

Source: Authors

Table 7.2 ***Details of the explanatory factors and the null hypothesis (H_0) used for this study***

Name	H_0	Data	Source
Environmental standards in the country	Environmental standards have no association with L&D positions of parties	Environmental Performance Index	2012 Environmental Performance Index (Yale University)
Countries' potential vulnerability to climate change	Potential vulnerability dose not influence L&D positions of parties	Climate Vulnerability Index	ND-GAIN Vulnerability Index (2013)
Countries' commitment to climate change mitigation	Commitment to mitigation does not influence L&D positions of parties	Share of renewable energy in the total energy consumed	Renewable Energy Status Report, 2013 (REN21)
Countries' democratic status	Democratic status does not influence L&D positions of parties	Economic Freedom Index	World Economic Freedom Index 2012 (The Heritage Foundation)
Economic status of the country	Economic status does not influence L&D positions of parties	GDP per capita value	World bank GDP data, 2013
Projected economic status of the country	Projected economic status does not influence L&D positions of parties	Projected GDP per capita	World bank projected GDP (2013 data projected for 2030)
Predicted impact of climate change	Predicted impacts do not influence the L&D positions of parties	Maximum temperature rise due to climate change	IPCC Fourth Assessment Report (A2 Storyline scenario, 2045-2056)

Source: Authors

3.2 Online structured questionnaire survey

An online structured questionnaire survey was conducted, using surveymonkey, to elicit the opinions of practitioners engaged in DRR and CCA on various issues associated with L&D (Prabhakar and Nakata 2014). The questionnaire consisted of 13 subject-related questions, out of which 12 were multiple choice questions, and nine were questions related to the background of respondents. Specific questions were included to understand the current scientific knowledge to address L&D, areas where significant knowledge gaps exist, as well as current institutional mechanisms that could help in addressing L&D and identifying pertinent gaps. Although the survey uses largely multiple choice questions, an option was also given to respondents to note additional information and thereby capture details that may have not been envisaged by the study team when designing the questionnaire. Analysis was done only on specific questions for the purpose of comparison and presentation in this chapter. Responses were analysed using Microsoft Excel and the results were expressed as a percentage of total responses and a percentage of the analysed groups wherever applicable.

The survey was completed by 102 respondents (n=102) representing governmental departments, non-governmental organisations, universities and academic institutions, donor agencies, and the United Nations (UN) and intergovernmental agencies. Most respondents were from non-governmental developmental organisations (38%) followed by government departments (15%), independent think tanks (14%), universities (11%) and governmental think tanks (9%). Most respondents were in the age group of 30-50 (56%) followed by 50-60 (21%) and 18-30 (17%). 38% of the respondents have worked in CCA,

30% in environmental management and 12% in DRR. For the purpose of analysis, the responses were grouped into those associated with the Asia Pacific Adaptation Network (APAN) and those not associated with APAN, governmental and non-governmental respondents and respondents representing countries from Australia (4%), Bangladesh (13%), India (17%), the Philippines (13%) and Viet Nam (6%) as these were the largest representing groups among the survey responses. Analysis was done for selected questions for the purpose of focus and the results were presented as the percentage of responses.

4. Results and discussion

4.1 Submissions to UNFCCC

Tables 7.3, 7.4 and 7.5 provide the results obtained from the multiple linear regression analysis between the country positions as dependent variables with various explanatory factors using the R software. The result of the country position analysis shows that potential vulnerability to climate change and economic drivers tend to determine the kind of principle supported by the country (Table 7.3). The regression analysis highlights that more importance is given to a country's potential vulnerability to climate change than merely its economic power. The analysis brings to light the stronger influence of vulnerability to climate change among LDCs and AOSIS. Highly vulnerable countries have been rather bold and expressive in the negotiations (in some cases probably out of despair) (Bailer 2012). Although not very significant, projected economic growth could also influence what principle the country supports.

Scope of L&D: Regression analysis reflects less significant R-squared values. However, it could be observed that there was a stronger influence of actual potential vulnerability of the countries and the environmental protection standards in supporting the scope and definition for L&D of a country. Political and democratic freedom was found to have no significant role in defining the countries views on L&D. The negative estimate of the vulnerability index implies that less developed countries have supported a more ambitious scope, defining that any loss due to extreme events or slow onset events should be considered in the scope of L&D to impacts of climate change.

Table 7.3 ***Explanatory factors and the association with the country positions***

Independent Variables	Country positions									
	Scope of L&D		Compensation and Post disaster rehabilitation		Funding mechanisms		Gaps in addressing L&D		Institutional Setup	
	P	R^2	P	R^2	P	R^2	P	R^2	P	R^2
Environmental Standards	0.6890	0.0056	0.5033	0.0150	0.2256	0.0502	0.0729	0.1060	0.4121	0.0233
Vulnerability to climate change	0.0137 *	0.1920	0.0045 **	0.2460	0.0000 ***	0.4770	0.0852	0.0980	0.1899	0.0580
Commitment to mitigation	0.9150	0.0004	0.5480	0.0125	0.9140	0.0004	0.8840	0.0007	0.2642	0.0420
Democratic status	0.0869	0.0970	0.0053 **	0.2380	0.0008 ***	0.3250	0.2880	0.0380	0.0461 *	0.1300
Current economic status	0.0400 *	0.1375	0.0231 *	0.1650	0.0001 ***	0.4110	0.0194 *	0.1740	0.5254	0.0140
Projected economic status	0.0440 *	0.1320	0.0185 *	0.1760	0.0001 ***	0.4200	0.0209 *	0.1700	0.5010	0.0157
Projected climate change impact	0.0419 *	0.1350	0.1465	0.0710	0.0429 *	0.1330	0.1100	0.0855	0.8200	0.0018

Note: *** significance level (P) at 0.001, ** significance level at 0.01, * significance level at 0.05. Values without stars are non-significant

Source: Authors

Risk insurance: Factors having significant influence in determining countries' positions on risk insurance are climate vulnerability and the predicted impact of climate change in terms of temperature rise (Table 7.4). Countries assess the need for assistance and mechanisms to deal with global environmental challenges based on their potential vulnerability and the predicted impact due to climate change.

Table 7.4 ***Explanatory factors found to have significant association with the principle supported by the countries***

Independent Variables	P value	R^2
Environmental Standards	0.2058	0.0546
Potential Vulnerability to Climate Change	0.0000 ***	0.4438
Commitment to Climate Change Mitigation	0.7620	0.0032
Democratic status	0.0035 **	0.2581
Economic status	0.0012 **	0.3060
Projected Economic status	0.0009 ***	0.3186
Predicted impact of Climate Change	0.3201	0.0340

Note: *** significance level (P) at 0.001, ** significance level at 0.01, * significance level at 0.05. Values without stars are non-significant

Source: Authors

When comparing environmental standards, mitigation measures and economic factors, it was seen that the current economic status of a country is a strong determining factor for influencing the importance assigned to risk insurance (Table 7.5). In comparison to the potential vulnerability of the country, the driver that influences negotiation decisions is the future impact of climate change on the country. AOSIS and Gambia, on behalf of least developed countries, have voiced very strong opinions for the requirement of international risk insurance based on the future impacts the countries will face due to climate change.

Table 7.5 ***Explanatory factors found to have significant association with the position on risk insurance mechanism***

Independent Variables	P value	R^2
Environmental Standards	0.2196	0.0080
Potential Vulnerability to Climate Change	0.0000 ***	0.4860
Commitment to Climate Change Mitigation	0.6370	0.0070
Democratic status	0.0042 **	0.2490
Economic status	0.0001 ***	0.4020
Projected Economic status	0.0001 ***	0.4060
Predicted impact of Climate Change	0.0091 **	0.2120

Note: *** significance level (P) at 0.001, ** significance level at 0.01, * significance level at 0.05. Values without stars are non-significant

Source: Authors

Compensation: Here the results were found to be not significant. No explanatory factors have shown to have influence on the countries' choice of compensation for L&D due to climate change. However, the political and democratic freedom of countries could be highlighted as key drivers of parties' position on compensation for L&D.

Funding mechanism: This reflects countries' views on the sourcing for the funding mechanism. Vulnerability to climate change, predicted temperature rise or existing environmental protection standards are found to have very low significance in determining the funding mechanism. However, existing economic power could play a crucial role in influencing the opinions of countries. It was seen that Annex I countries have chosen funding for more mitigation oriented approaches to address L&D.

Institutional setup and stakeholder involvement: None of the explanatory factors were found to influence the position of Parties on the nature of institutional setup and the necessity to have stakeholder involvement. The coefficients were rather small and insignificant. Considering the complexity of negotiations, and the number of factors influencing the choices a government has to make, this is not surprising. Certainly, this study suffers – as do other quantitative studies – from methodological shortcomings and the possibility that country behaviour in any international negotiations can only be measured approximately (Bailer 2012).

4.2 Eliciting expert views on loss and damage

In general, the results have indicated differences in opinion among the analysis groups i.e. nature of association with a network (such as APAN), representing country and organisational affiliation, while few responses for questions were uniform across the groups which is understandable in a survey of this nature. In terms of definition of L&D, most respondents preferred the definition to cover the entire actual and potential impacts rather than to limit the definition only to residual impacts after implementing adaptation and mitigation actions (Prabhakar and Nakata 2014). Lack of sufficient modelling tools and insufficient understanding on the past and current climate change impacts appeared to be the most important bottlenecks in understanding the L&D associated with climate change. While most respondents felt the need for improved understanding and knowledge in all the key sectors relevant to adaptation, those not associated with APAN activities preferred to focus on livelihoods and urban areas while those related to APAN thought that the knowledge gap is higher in the area of biodiversity and agriculture. Most governmental respondents (17%) thought there is a significant dearth of knowledge to address L&D in the agriculture sector while most non-governmental respondents (11%) felt biodiversity needs more attention for understanding L&D.

All is not lost in terms of institutional capacities. The survey has revealed that current institutional capacities created to address CCA and DRR could come in handy in addressing L&D. Most respondents felt that the experience from DRR and indigenous knowledge could be helpful in addressing L&D while the governmental respondents opined that only CCA specific experience will be helpful to address L&D. Most respondents have opined that investing in capacity building and implementing mechanism for collection and dissemination of data would be most effective in addressing L&D. The current institutional mechanisms were reported to be helpful, but issues such as lack of coordination at the local governments and among non-environmental ministries appeared to pose major limitations.

In response to the question on important intervention that could be effective in addressing the L&D, capacity building (45%) was chosen followed by data and information

gathering and sharing (41%) and financial measures such as insurance (15%). Trends were similar among the governmental and non-governmental respondents, both preferred data gathering and sharing followed by capacity building and insurance approaches. Respondents felt greater need for investing in early warning systems, information sharing not just among the scientists but also among vulnerable communities impacted by the climate change through networks by reaching out to the needy.

Respondents also thought that research and academic organisations constitute important stakeholders for working with national governments in effectively addressing L&D, followed by NGOs and other CCA-related institutions. Others felt that existing institutions lacked access to grassroots level issues and thus there is a need to implement local level climate change action plans which will enable concerted actions to be put in place at the local level. Surprisingly, very few respondents, irrespective of the group they belonged to, selected the private sector as an important ally in assisting governments in addressing L&D.

The survey participants asked the network to focus more on sharing scientific knowledge (climate change impacts and vulnerability assessments) and sharing on-the ground experiences of implementing adaptation projects and initiating pilot research projects on L&D. The need for implementing pilot projects to address L&D appeared significantly as an important gap in the current agenda of the network.

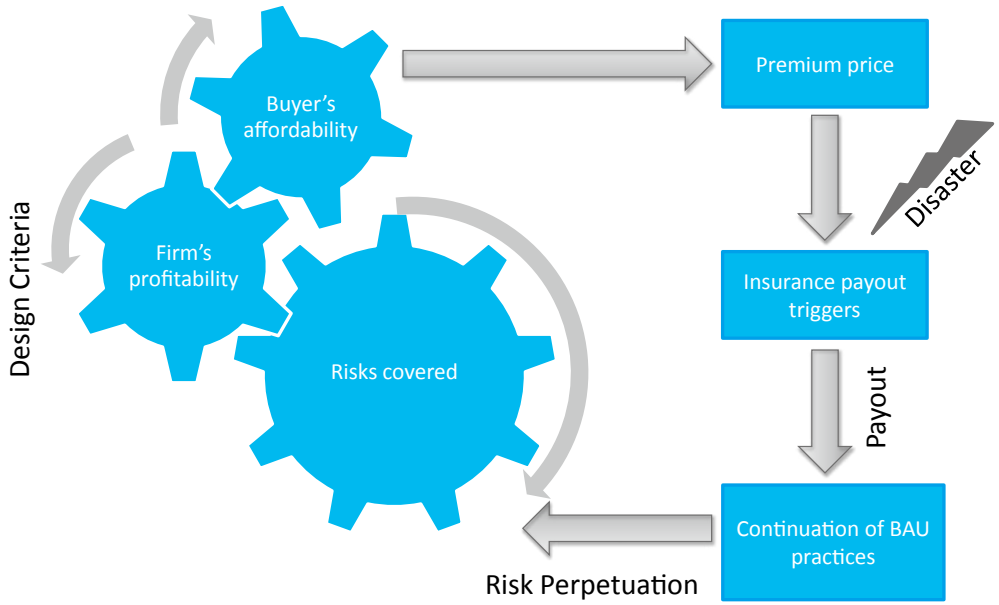
Among the individual countries, all respondents from Australia (100%) felt that there is insufficient scientific understanding on the issue of L&D. Respondents from India (94%), Bangladesh (85%) and Philippines (69%) reported a lack of scientific understanding to address L&D more in terms of insufficient modelling tools to project the future climate and impacts, insufficient understanding on the past and current climate change impacts, a lack of tools for downscaling the projected risks to a specific location, and no means to address the uncertainty. Others felt that tools related to estimating economic L&D are equally lacking, as are tools for projecting the physical impacts. Respondents from Australia identified livelihoods as an important area lacking sufficient understanding and knowledge to address L&D while respondents from other countries chose multiple areas lacking scientific knowledge. For example, respondents from India identified the water sector as lacking sufficient scientific knowledge while responses from Viet Nam identified water and livelihoods as important areas needing scientific research to generate knowledge.

5. Insurance potential for addressing loss and damage

Climate change has brought a new dimension to human development. Stakeholders across the broad spectrum of development have to address climate change concerns in their developmental efforts and various approaches have been tried and tested in pursuit of addressing the issue of CCA. From the foregone discussion, it is evident that risk insurance has emerged as an important approach among both the CCA and DRR communities. Risk insurance has been advocated as one of the most important measures to address issues of DRR and CCA (Warner et al. 2009) and L&D (Kreft 2013). The assumed benefits provided by insurance to the management of both climatic and non-climatic risks have attracted CCA and DRR practitioners to consider it as an important risk management tool. Despite the efforts by various stakeholders, the communities whose livelihoods are most vulnerable to climatic vagaries have often not been reached by insurance. Several bottlenecks remain unaddressed, such as the high cost of insurance relative to ability to pay, poor overall progress on risk mitigation, lack of awareness among

the communities, lack of an enabling policy environment etc. From a deeper perspective, there is a lack of robust evidence as to what CCA and DRR benefits accrue from risk insurance and how they compare with other risk management opportunities that exist or can be developed as an alternative to risk insurance (Prabhakar et al. 2015). There is a lack of clear assessment and recognition of insurance benefits and costs in terms of DRR, CCA and sustainable development in existing research. Specifically, there is no evidence to suggest that the current form of insurance provides long-term risk reduction. On the contrary, insurance programmes are currently designed and implemented in ways that do not provide the full potential benefits that risk insurance offers.

With regard to promoting risk insurance to address L&D, there is only a certain limit to which insurance can help in addressing L&D and hence it cannot be treated as a silver bullet. Figure 7.3 shows the elements in insurance design and implementation that pose limitations leading to a cycle of risk perpetuation rather than risk reduction. This is more pronounced in the case of agriculture insurance which is often implemented with limited resources, lower efficiency and often with limited reach. First and foremost, today's risk insurance products targeting the agriculture sector do not convey the proper risk price signal and suffer from moral hazards and adverse selection issues. Insurance pay-outs have not led to investments in risk mitigation options and the lack of sufficient incentives has rather led to continuing business as usual.



Source: Prabhakar et al. 2015

Figure 7.3 ***Need for the current risk insurance regime to discourage risk perpetuation by addressing insurance design and motivational issues***

Insurance contracts have traditionally been designed largely to address economic losses. However, NELD that could account for as much as 50% or more of the total damages of a natural disaster, especially in the case of developing countries, are often not covered by the insurance products. There has been some advancement in measuring NELD including post-traumatic stress disorders, loss of social capital, ecosystem health and services as well as loss of cultural heritage, and insurance product designs must take advantage of

these advancements and start addressing NELD. Only then can the insurance industry contribute to holistic risk reduction.

Analysis of various adaptation options for their potential to address NELD was carried out by the authors using Analytic Hierarchy Process (AHP) in Bangladesh and Japan (Figure 7.4). The results indicated that risk insurance has the least potential to address any of the potential issues associated with NELD in both countries. It is interesting to see that insurance has not been shown to have potential irrespective of the economic status of the country in question. The main factors for insurance not being able to address NELD include: a) high opportunity and operational costs for communities, industry and governments which could have otherwise been invested in interventions that could directly address issues of NELD better than insurance can; and b) no guarantee of pay-outs being invested in NELD-relevant areas, and improved income stabilisation not necessarily leading to improvements in NELD outcomes. This raises questions on the extent to which this tool can be promoted as a solution, and caution is required in seeing it as the silver bullet, in the way it has been promoted both in DRR and CCA. From these results, it can be recommended that putting more emphasis on preparedness planning could be more effective than risk insurance (Figure 7.4) for addressing NELD.

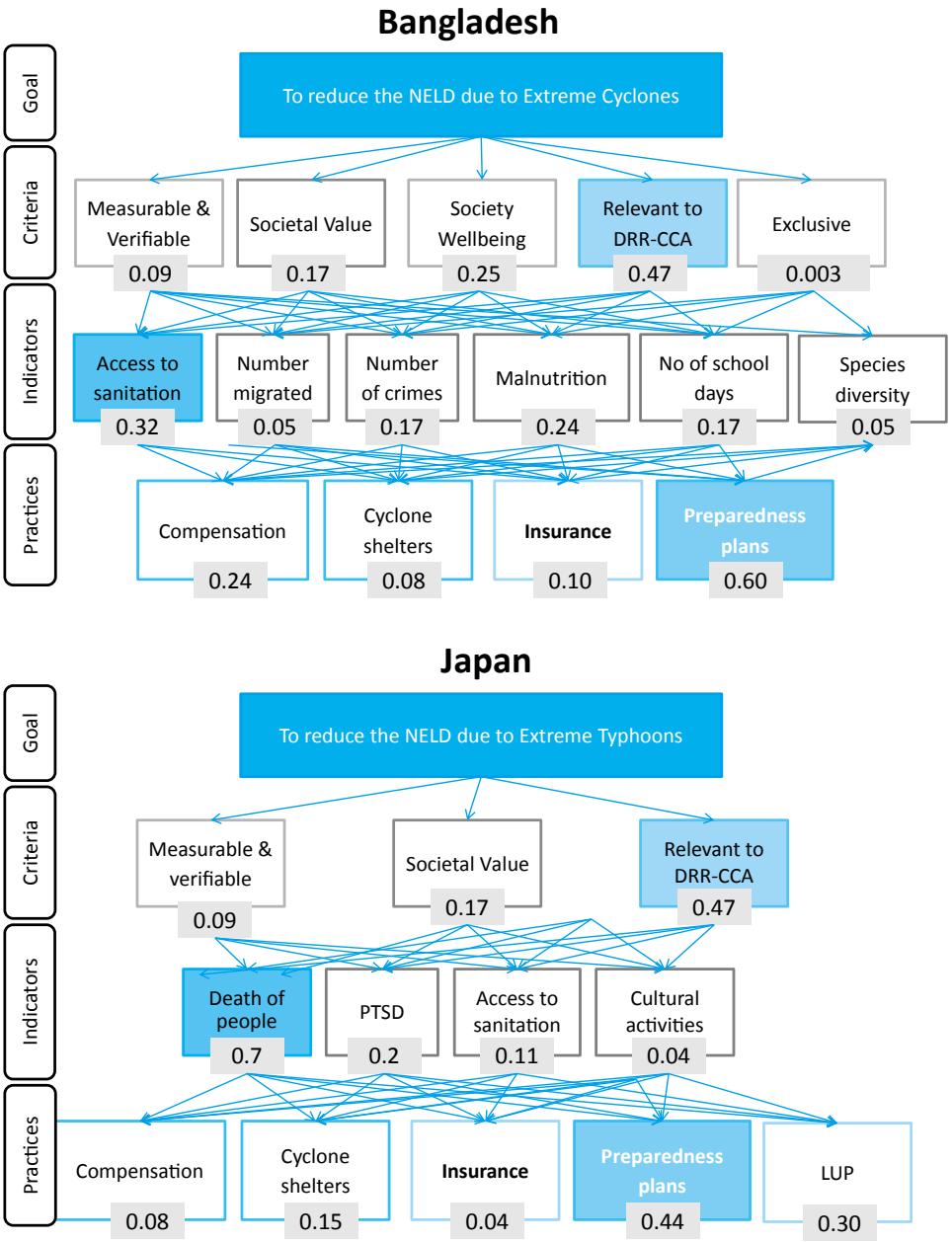
6. Summary and way forward

The global community has come to the recognition that there will still be considerable L&D irrespective of our current level of efforts to mitigate and adapt to climate change. Although the issue of L&D received attention in the sixteenth session of the Conference of Parties in Cancun in 2010 leading to its inclusion in the Cancun Agreements, scientists have long warned about the possibility of residual damages from climate change (Prabhakar and Nakata 2013). The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) released in 2007 clearly identified the reasons why CCA, as we know it today, may fall short of expectations.

Reasons for L&D could include the inability to implement adaptation actions to the degree and timing they are needed, policy imperfections that may work counter to adaptation practices, limited understanding on the effectiveness of known options, and inability of some adaptation practices to last longer. Barriers such as limited technical capacity to design and implement adaptation projects, limited financing and limited adaptation options further contribute to the problem. The inability to identify and scale good adaptation practices is a major limitation in itself.

It is evident that there is limited agreement towards forming a common definition of L&D at international and national levels. This makes it even more difficult for those stakeholders engaged in addressing the issues associated with L&D, often leading to ambiguity and disengagement. This may be symptomatic of the fact that research is still in the nascent stages, as is the relative understanding of the scope and extent of losses and damages that could occur.

The positions of 31 countries were analysed using multiple linear regression analysis. Based on the outputs of the regression, it has emerged that the principles which countries support for international negotiations and the scope of L&D is largely governed by the potential vulnerability to climate change and its predicted impact. A country's stance on risk insurance and funding mechanisms for L&D is determined by the economic power of the country. This is seen in particular in te Annex I countries which tend to support adaptation and mitigation actions. The strong influence of projected economic wellbeing



Source: Authors; PTSD: post-traumatic stress disorder; DRR: disaster risk reduction; CCA: climate change adaptation; LUP: land use planning

Figure 7.4 ***Relative position of risk insurance among various options tested for their efficacy to address non-economic loss and damage (NELD) in Bangladesh (above) and Japan (below)***

and predicted temperature rise has highlighted the importance of scientific study and research when countries make choices in international negotiations. LDCs and AOSIS Parties have expressed strong opinions based on future impacts of climate change and their limitations due to existing vulnerabilities. More research is needed to determine what drivers influence country positions on institutional setups and stakeholder involvement in international discussion.

Research being carried out at IGES indicates that not all types of NELD have been measured and reported in the aftermath of a disaster in most countries (Prabhakar et al. 2015). Without knowing the nature of L&D and without measuring all the important variables, it is difficult to identify suitable interventions. For example, insurance and related mechanisms are not designed to fully compensate L&D if they only target the measurable and economic kinds of losses which may constitute only a part of the total L&D incurred in a particular disaster. We are already aware of the fact that not every insurance product being offered covers the full economic losses and the 'compensation deficit' will be even higher if we consider NELD from the perils under consideration. In order to address this gap, there is a need for the DRR measures to account for NELD as well.

It appears that preparedness planning could have greater impact on NELD. These measures have already been promoted by the DRR communities, although they are still in the beginning stages. It is not clear to what extent the currently available solutions, especially risk insurance, can help address L&D. Our assessment of available options using multi-criteria decision tools showed limited potential for risk insurance to address NELD which could constitute a large proportion of the total L&D caused by climatic events. On the contrary, approaches such as preparedness planning could have greater impact on NELD.

Decision makers need to be provided with a set of simple tools/formats to help them capture major NELD that make a major difference in decision-making and in CCA and DRR outcomes. There is a need to develop cases of identifying, prioritising and quantifying important NELD and incorporating them into the decision-making at all levels by working closely with the relevant stakeholders. IGES in collaboration with its partners aims to achieve these outcomes one step at a time.

Science-policy linkages should be strengthened, since they are becoming more important. Strengthening these linkages could be facilitated through national, regional and international networks. They could play a greater role in bringing together various stakeholders and engage them towards developing problem-specific and location-specific solutions.

There is a need to build the capacities of stakeholders engaged in DRR and CCA to handle NELD-related issues including understanding, measuring and using the related data in decision-making. The qualitative and non-economic quantification work being done in the fields of biodiversity and ecosystem services, social sciences and other related fields could provide us with useful tools for quantifying NELD. However, the actors engaged in DRR, especially those who collect the data using rapid assessment tools on the ground and those who use this data for decision-making are not well versed in these techniques and hence need certain capacity building.

The data collection formats at the local level and data archival systems at the national and sub-national systems need major revisions to accommodate important NELD indicators that are currently missing. The national level guidelines pertaining to insurance and other

risk management tools also need revisions in order to accommodate NELD into decision-making.

The process of policymaking and future planning concerning L&D and CCA is also heavily dependent on the aspect of science, which at the moment has many gaps in knowledge, and our understanding and projections are far from accurate. This poses a very serious limit, even though many researchers argue that it should not affect CCA policymaking and planning.

Developing win-win solutions that work well across a wide range of uncertainties and have several outcomes and scenarios is crucial. Despite the uncertainty associated with climate change projections, policy measures and policy planning cannot be delayed. Institutions and policymakers can take decisions and plan according to the several model scenarios that are presented, similar to the procedure in other fields of policy planning such as finance and budget (Dessai et al. 2009). Therefore, it is still plausible to use climate change scenarios based on assumptions and in fact it is assumed that the predictions are not necessarily realised in the future.

One should not forget the role of international cooperation where countries have to collaborate and help each other on the subject of CCA. International cooperation is important in areas of strengthening adaptation planning based on science and evidence including addressing uncertainties associated with climate projections for adaptation decision-making, putting in place regional and international risk reduction and financing mechanisms, not just limiting to risk insurance, that are effective in addressing both economic and NELD and sharing related experiences for developing location- and issue-specific solutions on the ground.

In conclusion, there are many adaptations to CCA and there are many limitations to the extent to which adaptation can take place. Many of them involve hard, physical as well as ecological limits, factors that are potentially out of our control. There are also the soft, intangible factors that play a major role when devising policies for future CCA. The way the public perceives the threats and risks, how the problem is communicated to the people, the culture of the society as well as society's current knowledge play an important role in the extent we can address the problem of L&D.

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Chapter 8

Key Recommendations and Way Forward

Satoshi Kojima and Kentaro Tamura

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The Paris climate agreement to be concluded at COP21 is expected to establish a solid foundation of global climate actions to achieve the 2°C target. However, an ambition gap between expected emissions based upon a nationally determined contribution (NDC) approach and global emissions pathways consistent with 2°C goal is likely to remain even until 2025/2030. The emissions gap between the full implementation of the intended nationally determined contributions (INDCs) submitted by 1 October 2015 and the least-cost emission level for a pathway to achieve the 2°C target is estimated to be 12 gigatonnes of carbon dioxide equivalent (Gt CO_2eq) in 2030 and 5 Gt CO_2eq in 2025 (UNEP 2015).

This report discusses possible ways to bridge this gap between the 2°C target and the NDC approach, and presents concrete proposals to address this issue, looking not only at the Paris climate agreement but also at the follow-up to the agreement. In this concluding chapter we summarise our key recommendations under four headings. Following these recommendations would be an important step forward to change the current reality to ensure success in achieving the 2°C target and in realising a sustainable world.

1. Key recommendations

1.1 Recommendations for mitigation and finance

To strengthen mitigation beyond 2015, a process for reviewing and submitting subsequent nationally-determined mitigation contributions after the initial submission should be established in the 2015 Agreement. For such a cycle to be effective, it is proposed that the 2015 Agreement should contain legal obligations for all Parties to submit, implement and regularly update NDCs, while they should be kept in a non-legal instrument (like the registry for Copenhagen/Cancun pledges) so as to strike a balance between legal stringency and flexibility. It is also proposed to have a review process every five years for both ten- and five-year period cycle countries by conducting interim reviews for ten-year period cycle countries.

The three key elements of the post-2020 international finance component are the predictability of the scale of future funding, the transparency of financial inputs and resulting impacts, and developing countries' strategies to enhance enabling environments and to scale-up domestic climate finance. The existing assistance cycles including those

for funding replenishment, finance reporting and finance review, are crucial vehicles for mobilising climate finance and enhancing finance transparency for pre-2020 and should be enhanced post-2020. To ensure funding predictability, quantitative, aggregate financial targets should be communicated on a five-year cycle (for 2025 and 2030). These targets should be reviewed and assessed subsequently in the context of the 2°C target, along with domestic factors in developing countries such as capacity and enabling environments. To increase transparency, the Common Tabular Format for reporting finance provided by developed countries should be improved. The Standing Committee on Finance should also develop a common reporting format for developing countries to report financial support received, their use of finance, and their efforts and strategies to scale up domestic finance and improve enabling environments.

1.2 Recommendations for the scientific community

There is increasing scientific knowledge on the extent to which each Party needs to reduce its greenhouse gases (GHG) emissions to achieve the 2°C target corresponding to various equity and other indicators, but this knowledge is not necessarily effectively communicated to policymakers at the national and international levels. The research community is expected to play a vital role to fill this gap by providing the following scientific inputs to the proposed cycle for strengthening mitigation contributions:

- Basic comparison and assumption checks: A framework to provide a common basis for comparing the NDCs and check their underlying assumptions and economic drivers;

- Equity-based assessment: A top-down, equity-based assessment (i.e. allocating emission allowances across countries based on a specific formula of equity such as responsibility, capability, equality in per capita emissions, and so on) 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 important 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 to understand the status of implementation.

There are various approaches to evaluate NDCs which are complementary to each other. Synthesis analysis covering multiple evaluation approaches can take account of various uncertainties regarding GHG emissions modelling, so that the evaluation results are more likely to be acceptable to all countries.

It is proposed to establish a consortium of research institutes with good regional representation which can gather a range of studies and scenarios from international,

regional and local research institutes. This consortium can be organised on an ad hoc basis, using the existing institutes. Involvement of local researchers is crucial to ensure that any assessment corresponds better with national and regional conditions through their provision of additional data as well as their feedback on the collected data. The research consortium could also encourage the research community to conduct national assessments for developing countries, where GHG mitigation pathway analyses are not readily available.

1.3 Recommendations for an accounting framework for the Framework for Various Approaches (FVA)

Market-based approaches have been recognised as one essential policy instrument to tackle climate change, and the Kyoto Protocol established a set of market mechanisms, such as the Clean Development Mechanism (CDM), with accounting rules to assess the use of these mechanisms. Since the 2007 Bali Action Plan there has been an on-going discussion on market-based approaches and the 'Framework for Various Approaches (FVA)'. FVA offers bottom-up options for a post-2020 climate regime as various mechanisms can be proposed by all Parties, regardless of their development stage. Parties can propose mechanisms either individually or jointly, thereby promoting mitigation actions in a cost-effective manner. To fulfil such expectations, an accounting framework for the FVA in a post-2020 climate regime should contain two key aspects: to ensure environmental integrity, and to incentivise mitigation efforts by both developed and developing countries.

It is crucial to design an accounting framework for the FVA under a post-2020 regime to enable the realisation of these aspects, taking into account different national capacities and needs of developing countries in particular.

To do so, we propose: (1) capacity building to be included as an essential element for various mechanisms under the FVA; (2) review/coordination by a team of experts on the FVA to avoid any risk to environmental integrity and to enhance a country's capacity; (3) simplified registry systems for countries without sufficient capacity; (4) synergies with other market mechanisms; and (5) enhanced reporting on the use of credits through Biennial Update Reports (BURs) in a gradual manner.

These aspects will help developing countries to develop their NDCs, including an option to use market-based mechanisms, because they will be able to get a clearer idea about the possibility of using market-based mechanisms, given their national conditions, and how this will affect other parts of their mitigation actions.

1.4 Recommendations for loss and damage (L&D)

The global community has recognised that there will be considerable loss and damage (L&D) due to deficits in development, adaptation and mitigation. The post-2020 climate regime should address the issue of L&D to cover the complete set of building blocks that will also help realise low-carbon, climate resilient development. There remain many challenges in addressing L&D such as limited technical capacity to design and implement adaptation, limited financing and limited adaptation options. Currently there is limited agreement on a common definition of L&D, making it more difficult for stakeholders to effectively tackle this issue. It was found that the principles that countries support in international negotiations related to L&D and the scope of L&D for the country are often influenced by their potential vulnerability to climate change and the predicted impact of climate change. This indicates that understanding and addressing vulnerabilities and impacts, both current and future, are crucial first steps to address L&D.

Non-economic loss and damage (NELD) needs greater attention at the both national and local levels in terms of measuring such losses and damages and using the related information in identifying appropriate risk reduction measures. Based on IGES research, it has been indicated that not all types of NELD, which could constitute a large proportion of the total L&D caused by climatic events, have been measured and reported in the aftermath of a disaster in most countries. Scientific studies to estimate and project L&D under different climate change and capacity scenarios with a focus on NELD are crucial for countries to make appropriate choices. Decision makers, especially those engaged in disaster risk reduction, are often not very familiar with NELD and they need to be provided with a set of simple tools/formats to help them identify major NELD so they can make appropriate decisions. Certainly, data collection formats at the local level and data archival systems at the national and sub-national levels need major revisions to accommodate important non-economic losses and damages. It is also going to be essential to revise the national level guidelines pertaining to insurance and other risk management tools.

In addition, there is a need for coordinated action and support to prevent L&D on a global scale. Risk-transfer of insurable L&D has emerged as one of the major candidate areas for international coordination. IGES research has indicated that the existing risk insurance has limited potential to address NELD. Instead, preparedness planning could have greater potential to address NELD which calls for a cautious approach in promoting risk insurance as a silver bullet to address L&D. The expected roles of international mechanisms include evaluation of the existing risk transfer approaches, including regional mechanisms, and monitoring their scope and ability against increasing severity and frequency of extreme events. The post-2020 climate regime is expected to promote the necessary internationally-coordinated action to address L&D.

2. Way forward

The key recommendations outlined above intend primarily to raise the ambition level of the short-term climate actions to be included in the Paris climate agreement given the current reality of international climate negotiations. Many decision makers still hold the outdated conventional view that there is a trade-off between the ambition level of climate efforts and economic growth, and emphasis is put on short-term tangible benefits generated by climate actions in order to improve acceptability and feasibility of the recommendations. Our recommendations are designed to leverage the dynamic nature of the climate regime to increase the level of ambition, not only in terms of following up the Paris climate agreement, but also to seek opportunities to change the rules of the game. This is one implication of "beyond" in the title of this report.

Firstly we need to overcome short-termism and change policy priority from economy-first to a more holistic and balanced approach, by looking wider and further ahead. To do so, the precautionary principle must be one of the key rules. For the long term there is wide consensus about the necessity to simultaneously achieve decent quality of life for all as well as substantial GHG emissions reduction, but in the short term no country has strongly committed to make serious efforts to realise such an economic system, or in other words to establish a model of sustainable development. This is because many economic and social systems are designed based on short-termism. Business executives are strongly motivated by institutions such as stock markets and banking systems to raise short term quarterly profits. The existence of environmental externalities under this motivation mechanism discourages strong climate actions. As a result, the current international climate negotiations are a sort of blame game without the genuine solution of a model of sustainable development.

The scientific community can play a crucial role in changing this situation by both identifying risks and threats caused by environmental externalities, and by providing innovative solutions to address them. Further, history tells us that our perception of the world and our preference system, such as short-termism, can be influenced by various factors including education and scientific knowledge. To ensure sustainability in the mid to long run, changing our mind set consistent with sustainability requirements is necessary.

In this regard it should be noted that there is a growing number of reports on the financial implications of climate change for investors, presenting significant portfolio risks as well as new market opportunities.[1] The Bank of England, for example, warned that insurance companies with investment portfolios of fossil fuel companies could suffer a "huge hit" if such investments are rendered worthless by climate actions.[2] This concern was triggered by scientific knowledge that the majority of fossil fuel reserves are unburnable if climate change is to be stabilised at the level of 2°C warming or even 3°C warming (McGlade and Ekins 2015). Indeed, there is an emerging and notable trend among institutional investors to divest from fossil fuels, especially coal, and invest in renewable energy. Examples include Norway's USD 900 billion sovereign wealth fund, Aviva which has USD 384 billion in assets, and California's two largest pension funds (with USD 292 billion and USD 191 billion in assets, respectively). Though it is still challenging to make this type of long-term, forward-looking portfolio management common across the world, robust commitment to climate action beyond COP21 could send a stronger signal to investors. In addition, internationally coordinated initiatives such as the information disclosure initiative proposed by the Governor of the Bank of England, which aims to "design and deliver a voluntary standard for disclosure by those companies that produce or emit carbon"[3], are necessary to effectively redirect private investment from carbon intensive assets to low-carbon/carbon-free ones. These kinds of initiatives can also be complemented by the announcement by governments of possible carbon price paths, which potentially sparked by COP21, as well as the development of stress-test technology to future implications of physical risk, liability risk and policy risk associated with climate change, which are embedded in a wide range of firms and investments.

Secondly, we need to facilitate actual actions by various actors toward the realisation of low-carbon and climate resilient societies. Achieving the 2°C target requires fundamental changes in infrastructure, institutions and individual behaviour. To make such substantial changes, of course, central governments can and should play key roles in providing long-term signals as well as policy frameworks to enhance short-term actions. At the same time, local communities must also play their part. The importance of these stakeholders has already been recognised by the UNFCCC process. Additionally, the Non-State Actor Zone for Climate Action (NAZCA), where companies, cities, subnational authorities and investors can register and showcase their commitments to address climate change, was launched at COP20 in Lima in 2014. Policy research is needed to see how this can be further promoted, what the barriers would be to further actions and commitments, and how such barriers could be removed or alleviated.

The importance of cities and local communities can also be highlighted in terms of interlinkage between climate change and Sustainable Development Goals (SDGs) that aim to end poverty, hunger, injustice and environmental destruction. Many actions will contribute simultaneously to SDGs and climate change mitigation/adaptation. Such actions include, for example, decentralised renewable energy systems and land use plans to alleviate traffic congestion, and they can generate synergies between SDGs and climate. It is the city and local community level at which such actions can be effectively designed and implemented. Policy research needs to identify locally appropriate actions to create mitigation and adaptation synergies, thereby assisting and promoting actual actions at the local level.

The Eye on Earth Summit is an important data collection initiative to monitor sustainable development. It collects and distributes data from civil society stakeholders, thereby supplementing official data collection and dissemination and thus ensuring that progress towards sustainable development is constantly being monitored. It is worth exploring possible lessons learnt from this initiative, in particular for adaptation as well as loss and damage issues. Further policy research is required to address how we can promote and strengthen data collection by stakeholders, so that it can also be used in the decision making process in the climate change area.

Finally, it is worth considering the establishment of a climate management system or one-stop platform where we can find comprehensive information on climate change. Currently, the Intergovernmental Panel on Climate Change (IPCC) reviews and compiles the latest scientific knowledge. UNEP's emission gap reports are also annually updating information on the gap between actions required to attain the 2°C target and actions actually taken. There are various initiatives by research institutes, such as the Climate Action Tracker, to evaluate individual countries' commitments. Under the UNFCCC process, the reporting system on actions was established, but there is room for improvement in terms of, for example, the adherence and the content. The abovementioned NAZCA provides information on climate commitments by non-state actors. This kind of information is rather scattered. Thus, a one-stop platform can be designed to collect relevant information and provide annual reports. This setting should be valuable to all, since we are now about to move from the negotiation stage to the implementation stage to realise low-carbon, climate resilient societies.

Notes

1. For example, the Economist Intelligence Unit (24 July 2015) "The cost of inaction: Recognising the value at risk from climate change" <http://www.economistinsights.com/financial-services/analysis/cost-inaction>; Citi GPS (August 2015) "Energy darwinism II: Why a low carbon future doesn't have to cost the earth" <https://ir.citi.com/5%2BD3LAj%2Ba5yhsTAE9%2FJU0FQGOiQPJvnrPrLhR%2BdUSVMRjVsSyhROJBwV0st2%2F1TE>
2. The Guardian (3 March 2015) http://www.theguardian.com/environment/2015/mar/03/bank-of-england-warns-of-financial-risk-from-fossil-fuel-investments
3. A speech by Mark Carney (Governor of the Bank of England) given at Lloyd's of London on 29 September 2015. Accessed 9 November 2015. http://www.bankofengland.co.uk/publications/Pages/speeches/2015/844.aspx

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