Time for Action towards an Ambitious Decarbonised World

International Research Network for Low Carbon Societies

LCS-RNet 10th Annual Meeting

9:00-17:30, 17 July 2018 at Pacifico Yokohama, Japan

IGES

Cover page (front and back): Abstract Polygonal Blue Background. Designed by Vexels.com

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About LCS-RNet

What is LCS-RNet?

The International Research network for Low Carbon Society (LCS-RNet) is an open community of researchers and research organisations contributing directly to policymaking and implementing processes, as well as like-minded relevant stakeholders, such as national and local policymakers, international organisations, business and financial entities and civil society. Together, the community facilitates the formulation and implementation of science-based policies for low carbon development around the world.

Who has been participating?

Currently, 16 research institutes in Japan, Germany, France, Italy and the U.K., in cooperation with researchers from Brazil, China, India, and Korea, play a core steering role in the network, promoting cooperation and activities with research communities in developed and developing countries.

How did it come about?

The LCS-RNet began with a proposal from Japan at the Kobe G8 Environmental Ministers' Meeting (EMM) in 2008. The 2016 G7 EMM in Toyama then reaffirmed the growing importance of the role of the science community and research network to support the Paris Agreement.

Features & added value of LCS-RNet

As a platform linking science with policy towards decarbonised societies, LCS-RNet offers additional value that distinguishes LCS-RNet from other networks.

- Comprehensive research ability to promote the transition to decarbonised societies: LCS-RNet is a network of research institutes promoting solution-oriented, multilateral, and cross-cutting research.
- Close cooperation with policymaking and implementation: LCS-RNet member researchers and research institutes have worked in close collaboration with government agencies in charge of national climate policies, and have the connections to translate inputs into policies.
- Collaboration with international activities: LCS-RNet member institutes have worked with international organisations such as the IPCC, UNFCCC and UNEP, and have conducted substantial international joint research, including the DDPP. The LCS-RNet has strong ties with international society.
- Knowledge accumulation for the transition to decarbonised societies: While operating as a community of like-minded researchers, LCS-RNet also shares important research directions by promoting close cooperation, collaboration and knowledge exchange, leads researchers and experts, takes initiatives for joint research, and accumulates knowledge for joint policy recommendations.

LCS-RNet Steering Group Members

Published in 2019

LCS-RNet Secretariat

Secretary General: **Mikiko Kainuma**
Deputy Secretary General: **Tomoko Ishikawa**
Institute for Global Environmental Strategies (IGES), Japan

c/o Institute for Global Environmental Strategies (IGES)
2108-11, Kamiyamaguchi, Hayama, Kanagawa, Japan, 240-0115
Email: lcs-rnet@iges.or.jp
Website: http://lcs-rnet.org

International Research Network for Low Carbon Societies LCS-RNet 10th Annual Meeting

9:00-17:30, 17 July 2018 at Pacifico Yokohama, Japan

1. Main theme of the 10th annual meeting

Time for action towards an ambitious decarbonised world

The Talanoa Dialogue was started in order to gain an understanding of greenhouse gas (GHG) emission reductions on a global scale and to examine the increased ambition towards a decarbonised world. Trends show that various actions must be implemented urgently to achieve decarbonised societies. The Nationally Determined Contributions (NDCs) are certainly the first step, but they are not sufficient to realise the 1.5/2 °C targets. More ambitious GHG reduction scenarios are required, roadmaps, and actions to achieve net-zero carbon. In this regard, at the annual meeting, we will share proposed actions towards an ambitious decarbonised world in various regions and sectors, and we will discuss how to implement these actions effectively.

2. Background idea of each breakout session

(1) 1.5/2 °C targets and long-term low-carbon global development strategies

The 1.5 °C target and 2 °C target are the main goals of the Paris Agreement, but the present NDCs are insufficient. In order to meet these goals, more ambitious targets are requested globally. One of these efforts is “long-term low-carbon development strategy”, and another is the Talanoa Dialogue as a precedent of the global stocktake. We will discuss the implementation of these actions from a long-term perspective.

(2) Actions in the developing world

Actions taken in developing countries will be the key to achieving a decarbonised world, because it is expected that GHG emissions from developing countries will increase more rapidly than those in developed countries. Discussion points include the kinds of actions requested in developing countries, how the actions will be promoted, and how developed countries can support those actions in developing countries.

(3) Innovation and transition

The breakout session will feature a discussion on what kind of innovation is needed to implement the actions. This includes not only technological innovation, but also institutional innovation with regards to foci such as lifestyle.

(4) Impact and adaptation

GHG mitigation actions are essential to realise a decarbonised world, but actions related to adaptation will also be needed to ensure sustainable decarbonisation. Through the discussion in this breakout session, we will discuss advanced actions related to adaptation.

3. Agenda

<table>
<tr><td colspan="3">17 July, 2018</td></tr>
<tr><td>9:00-
10:30</td><td colspan="2">Plenary 1: Opening
Opening address
- Michihiro Oi, Director, Research and Information Office, Policy Planning Division, Global Environment Bureau, Ministry of the Environment, Japan (MOEJ)
- Hideo Harasawa, Vice President, National Institute for Environmental Studies (NIES), Japan
- Hideyuki Mori, Executive Director, Institute for Global Environmental Strategies (IGES), Japan

Keynote speech
- Priyadarshi R. Shukla, Distinguished Professor, Ahmedabad University, India

Rapporteur:
- Ambiyah Abdullah, NIES, Japan</td></tr>
<tr><td>10:30-
11:00</td><td colspan="2">Break</td></tr>
<tr><td>11:00-
13:00</td><td>Breakout session 1A:
1.5/2 °C target and long- term low-carbon global development strategy

Chair:
- Christophe Cassen, CIRED, France

Speakers:
- Christophe Cassen, CIRED, France
- Yann Briand, IDDRI, France
- Ken Oshiro, MHIR, Japan
- Julia Terrapon-Pfaff, Wuppertal Institute, Germany</td><td>Breakout session 1B:
Impact and adaptation

Chair:
- Kiyoshi Takahashi, NIES, Japan

Speakers:
- Celine Phillips, ADEME, France
- Rizaldi Boer, IPB, Indonesia
- Yasuaki Hijioka, NIES, Japan
- Taehyun Kim, KACCC / KEI, Korea

Rapporteur:
- Marissa Malahayati, NIES, Japan</td></tr>
</table>

	Discussant: - Diego Silva Herran, IGES, Japan Rapporteur: - Alexis R. Rocamora, IGES, Japan	
13:00- 14:00	Break	
14:00- 16:00	Breakout session 2A: ***Innovation and transition*** Chair: - Stefan Lechtenböhmer, WI, Germany Speakers: - Jim Watson, UKERC - Matilda Axelson, Vrije Universiteit Brussel, Belgium - Ichiro Kutani, IEE, Japan - Hideyuki Mori, IGES, Japan Rapporteur: - Alexis R. Rocamora, IGES, Japan	Breakout session 2B: ***Actions in developing countries*** Chair: - Toshihiko Masui, NIES, Japan Speakers: - Bundit Limmeechokchai, SIIT-TU, Thailand - Jiang Kejun, ERI, China - Nicola Tollin, University of Southern Denmark - Ambuj Sagar, CTCN Advisory Member – RINGO representative - Kei Gomi, NIES, Japan, and Yuki Ochi, E-Konzal, Japan - Miho Kamei, IGES, Japan Rapporteur: - Ambiyah Abdullah, NIES, Japan
16:00- 16:30	Break	
16:30- 17:30	**Plenary 2: Closing** Summary of each breakout session. Discussion on future work and proposal toward decarbonised society. Closing remarks - Mikiko Kainuma, Secretary General, International Research Network for Low Carbon Societies (LCS-RNet)	

Presentations

Please refer to the LCS-RNet website at:

https://lcs-rnet.org/lcsrnet_meetings/2018/04/2534

4. Keynote speech

Mitigation of Climate Change: Taking Stock of Ambitions, Actions and Challenges

Priyadarshi R. Shukla, Distinguished Professor, Ahmedabad University, India/IPCC WGIII co-chair

Role of the IPCC

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 to provide policymakers with regular scientific assessments on the current state of knowledge about climate change.

The IPCC neither conducts any primary research nor monitors climate-related data or parameters. Its role is to assess on a comprehensive, objective, and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of the risk of anthropogenic climate change, its observed and projected impacts, and options for adaptation and mitigation. IPCC reports should be neutral with respect to policy, although they must objectively address policy-relevant scientific, technical, and socioeconomic factors. They should be of a high scientific and technical standard, and aim to reflect a range of views, expertise, and geographical coverage.

The IPCC has published five Assessment Reports and various Special Reports. The First Assessment Report (AR1) published in 1990 led to the United Nations Framework Convention on Climate Change (UNFCCC). The Second Assessment Report (AR2) published in 1995 provided scientific bases for the Kyoto Protocol. The Third Assessment Report (AR3) published in 2001 focused attention on the impacts of climate change and the need for adaptation. The Fourth Assessment Report (AR4) published in 2007 analysed the greenhouse gas (GHG) emissions pathways to limit the temperature increase to 2°C above pre-industrial levels. The Fifth Assessment Report (AR5) published in 2014 provided valuable inputs for the Paris Agreement. The 6th Assessment Report (AR6) will be published in 2021/2022.

Emissions scenarios to limit temperature increase

There were many mitigation efforts implemented over the last 30 years. Yet, even with all the interventions to date, we still find that emissions are increasing. If this trend continues, we are heading towards a 4 to 5^{o}C temperature increase relative to the pre-industrial levels in 2100. To stem this, the Paris Agreement reached a consensus to limit the temperature increase to 2^{o}C and also mentioned 1.5^{o}C.

Scenarios to keep temperature change below 2°C relative to pre-industrial levels include substantial cuts in anthropogenic GHG emissions by mid-century through large-scale changes in energy systems and potentially land use.

Delaying mitigation shifts the burden from the present to the future, and insufficient adaptation responses to emerging impacts are already eroding the basis for sustainable development. Both adaptation and mitigation can have distributional effects locally, nationally, and internationally, depending on who pays and who benefits. The process of decision-making about climate change and the degree to which it respects the rights and views of all those affected are also concerns of justice.

The share of low-carbon electricity supply needs to increase from the current share of approximately 30% to more than 80% by 2050, and fossil fuel power generation without CCS is to be phased out almost entirely by 2100.

Key measures to achieve such mitigation goals include decarbonising electricity generation, enhancing efficiency, and changing behaviours, in order to reduce energy demand compared to baseline scenarios without compromising development.

We have already consumed 76% of the carbon budget to stay below 2°C over roughly the last 130 to 140 years. There is little left in the budget. At the same time, we still find that there is still around three times the amount of coal buried underground than that which we have mined to date. As energy systems have been built on fossil fuels in the 20th century, transitioning away from fossil fuels is not easy. However, we need an unprecedented transition that brings new innovations and investments that can lead to a sustainable world.

The Paris Agreement and the global stocktake

The Paris Agreement adopted in 2015 aims to strengthen the global response to the threat of climate change by holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels. Additionally, the Agreement aims to increase the ability to adapt to the adverse climate impacts. To achieve these ambitious goals, Member States have agreed on establishing appropriate financial flows consistent with a pathway towards low GHG emissions and climate-resilient development.

Member States submit Intended Nationally Determined Contributions (INDCs) to UNFCCC, which outlines their intended commitments to reduce GHGs to reach the Paris Agreement's long-term temperature target. However, the current NDCs are inadequate to ensure that global

warming stays well below 2°C and/or below 1.5°C.

NDC updates will be informed by global stocktakes, the first of which will take place in 2023, leading to the revised NDCs by 2025. The Talanoa dialogue in 2018 is an important precursor to the global stocktakes. It is convened by the UNFCCC as an inclusive, participatory, and transparent dialogue about future ambitions and current actions, designed to take initial stock of countries' collective efforts and inform the preparation of new or updated NDCs to be communicated by 2020.

Main products during the IPCC AR6 cycle

The IPCC is currently in its Sixth Assessment cycle. During this cycle, the Panel produced a Special Report on Global Warming of 1.5°C and will produce two more Special Reports, a Methodology Report on national greenhouse gas inventories, and the Sixth Assessment Report (AR6). The AR6 will comprise three Working Group contributions and a Synthesis Report that will be rolled out in 2021 and be finalised in the first half of 2022 in time for the first global stocktake under the Paris Agreement.

Mitigation of Climate Change: Taking Stock of Ambitions, Actions and Challenges

Priyadarshi R. Shukla and Jim Skea
IPCC WGIII Co-Chairs

Presented in: LCS-RNet 10th Annual Meeting, Pacifico Yokohama, Japan 17 July 2018

The role of the IPCC is …

"… to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation."

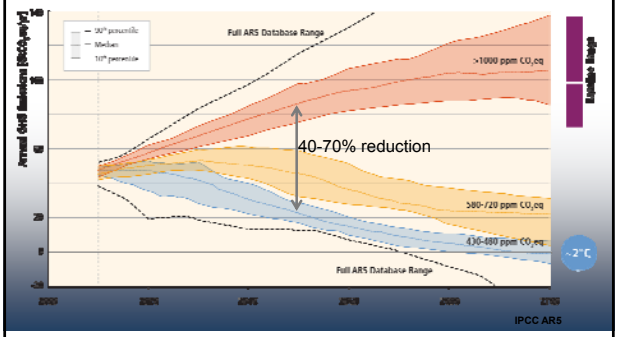
"IPCC reports should be neutral with respect to policy, although they may need to deal objectively with scientific, technical and socio-economic factors relevant to the application of particular policies."

Principles Governing IPCC Work, paragraph 2
Source: http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles.pdf

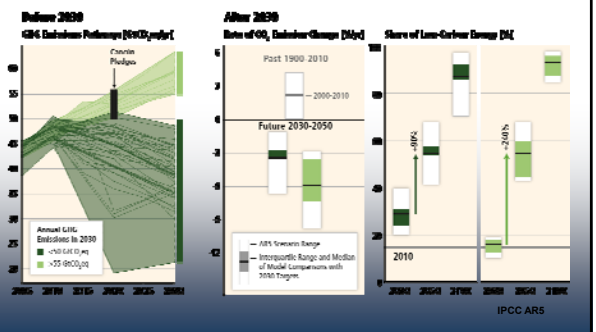
…that have made an impact

FAR (1990)	led to	UNFCCC
SAR (1995)	input for	Kyoto Protocol
TAR (2001)	focused attention on	Impacts of climate change and need for adaptation
AR4 (2007)	input for	Decision on 2°C limit; basis for post Kyoto Protocol agreement
AR5 (2013/2014)	input for	

Stabilising the atmosphere means moving away from business-as-usual – regardless of how ambitious we are.



Delaying mitigation until 2030 increases the difficulty and narrows the options for limiting warming to 2°C.



Mitigation Measures (IPCC AR5)

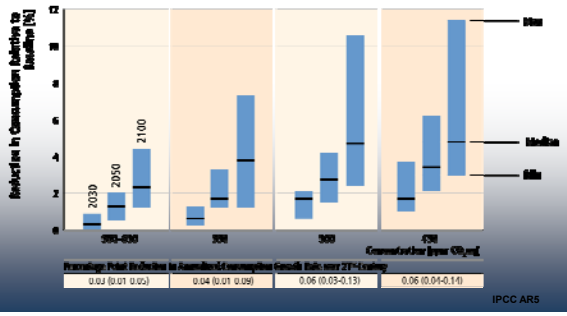
More efficient use of energy

Greater use of low-carbon and no-carbon energy
- Many of these technologies exist today

Improved carbon sinks
- Reduced deforestation and improved forest management and planting of new forests
- Bioenergy with carbon capture and storage

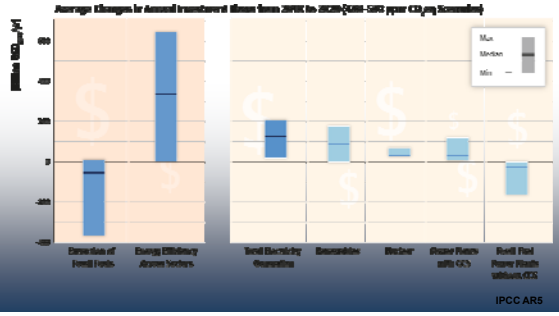
Lifestyle and behavioural changes

Global costs rise with the ambition of the mitigation goal.



7 | Working Group III contribution to the IPCC Fifth Assessment Report

Substantial reductions in emissions would require large changes in investment patterns.



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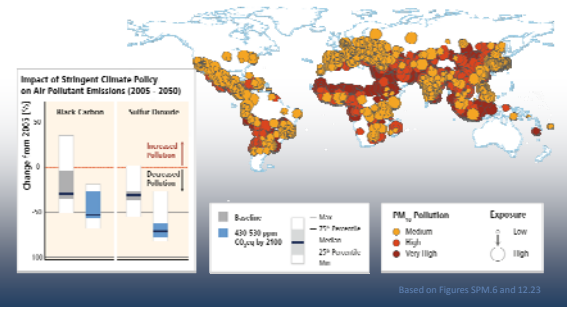
Climate change mitigation can bring co-benefits – health, energy security and other societal goals.



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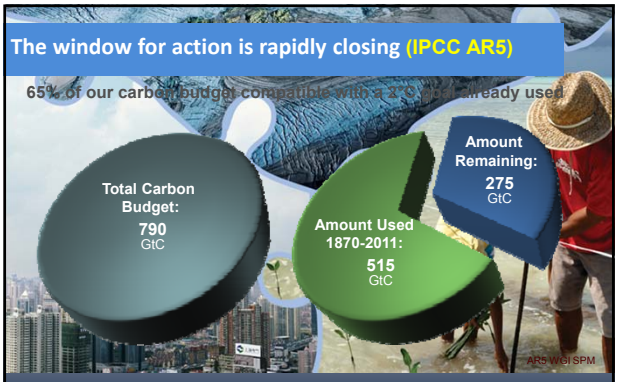
The window for action is rapidly closing (IPCC AR5)



Working Group III contribution to the IPCC Fifth Assessment Report

The key aims of the Paris Agreement – Article 2

This Agreement…. aims to strengthen the global response to the threat of climate change ...by:

(a) Holding the increase in the global average temperature to ***well below 2 °C above pre-industrial levels*** **and** ***to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels***, recognizing that this would significantly reduce the risks and impacts of climate change;

(b) ***Increasing the ability to adapt*** to the adverse impacts of climate change and ***foster climate resilience*** and ***low greenhouse gas emissions development***, in a manner that ***does not threaten food production***;

(c) Making ***finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development***

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Peaking and "Net Zero": Paris Agreement Article 4.1

In order to achieve the long-term temperature goal set out in Article 2, Parties … ***aim to reach global peaking of greenhouse gas emissions as soon as possible,***

recognizing that peaking will take longer for developing country Parties, … ***and to undertake rapid reductions thereafter*** in accordance with best available science,

...so as to ***achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century***, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

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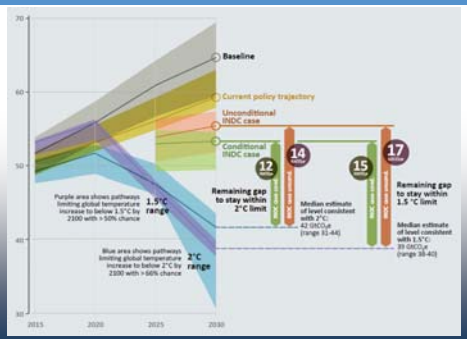
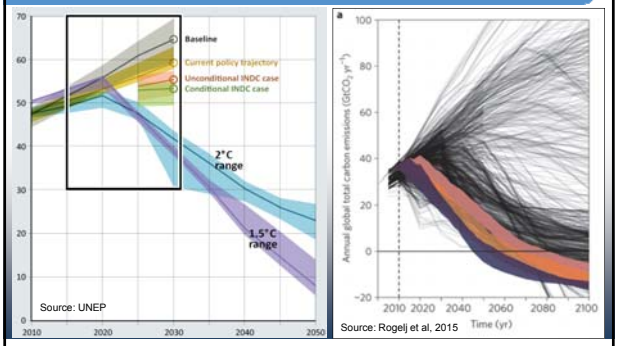
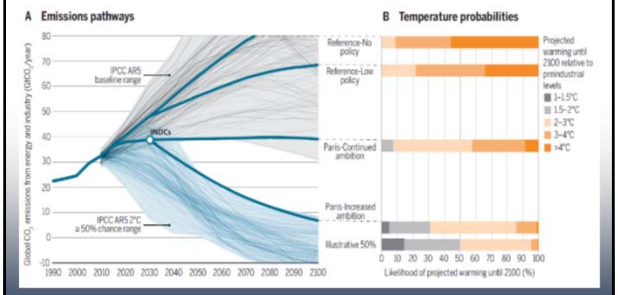
Current NDCs are not enough



The view to 2050 and beyond



On what path the NDCs take us? What aspects of socio-economic development and ambition persist beyond 2030?



Fawcett et al., Science 2015

Ratcheting up ambition? The Global Stocktake

- Once every five years, starting in 2023
- **Raising Ambition:** Every revised NDC must be more ambitious than the previous
- **Global stocktake zero**: the "facilitative dialogue" by end-2018 (after the IPCC Special Report on Global Warming of 1.5°C)
- Aka the "**Talanoa Dialogue**"

The Talanoa Dialogue

"Talanoa is a traditional word used in Fiji and across the Pacific to reflect a process of inclusive, participatory and transparent dialogue. The purpose of Talanoa is to share stories, build empathy and to make wise decisions for the collective good. The process of Talanoa involves the sharing of ideas, skills and experience through storytelling"

Main Products during the IPCC AR6 cycle (1)

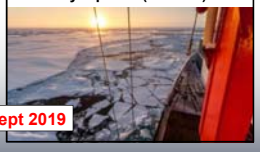
Special Reports

Special Report on Global Warming of 1.5°C (SR15)

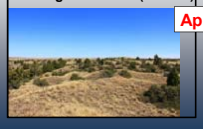
Approval October 2018

PARIS2015 COP21-CMP11

Special Report on Ocean and Cryosphere (SROCC)



Special Report on Climate Change and Land (SRCCL)

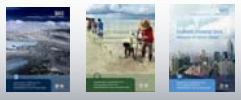


Approval Sept 2019

Main Products during the IPCC AR6 cycle (2)

2) A Methodology Report (Inventories)

3) Three Working Group Reports



4) A Synthesis Report

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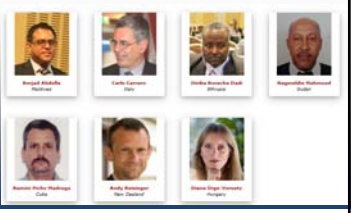
ipcc intergovernmental panel on climate change

IPCC WG III (Mitigation) - Bureau



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ipcc intergovernmental panel on climate change

5. Session 1A

1.5/2 °C target and long- term low-carbon global development strategy

Chair: Christophe Cassen (CIRED, France)

Description

The 1.5 °C and 2 °C targets are the main goals of the Paris Agreement, but the current National Determined Contributions (NDCs) are insufficient to meet these goals. The core objective of the hybrid architecture of the Paris Agreement is to increase global ambition for climate action. The Talanoa Dialogue that will be concluded at COP24 (Katowice) is supposed to facilitate the dialogue among Parties and to inform the global stocktake that will be held every five years. At the same conference, the IPCC Special Report on Global Warming of 1.5°C will be reported and discussed.

The challenge is all the more significant in that achieving an emissions pathway compatible with these objectives would require unprecedented changes in the economy, as well as energy use and supply. In particular, limiting temperature increase to 1.5°C implies an early transition to net zero carbon emissions worldwide. Given the uncertainty surrounding the possibility to achieve negative emissions at scale, early decarbonisation of the economy may be warranted as well.

In line with the main theme of the 2018 annual meeting, this session will discuss some of the main challenges that underlie the implementation of these targets.

- How will the transition toward 2°C/1.5°C affect emission trajectories (at the global and sectoral level)?
- What are the options for countries to raise their levels of ambition (transformation of energy systems, changes in behaviour and lifestyles, development of negative emission technologies etc.) and articulate short- and long-term development strategies?
- How can international negotiations support raising the ambition towards climate action by fostering the low carbon transition?
- How can research contribute to better articulated objectives and clearer programme monitoring and evaluations at the national level?

Keywords: 1.5/2°C target, drivers, raise in ambition

The transition in energy demand sectors to limit global warming to 1.5°C

An overarching modeling approach and its policy implications

Christophe Cassen and the IMACLIM team

cassen@centre-cired.fr

CIRED-CNRS

10th Annual Conference LCS-R net Yokohama 17th July 2018

Context

- Paris Agreement : towards well below 2°C
- Recent scenario litterature (Rogelj et al. 2015, 2018; Van Vuuren et al. 2018) : global optimal 1.5°C scenarios : immediate global emission peak, fast CO2 emission reductions, net zero and large negative emissions beyond 2050
- BUT Resumption of CO2 emissions growth in 2017 after three year "plateau" (IEA, 2018)

→ Global emission peak / rate of decline and related energy transition until mid-century?

Questions

Implications of delayed peak for energy transition feasibility?

Role of energy-demand patterns/policies in early peaking?

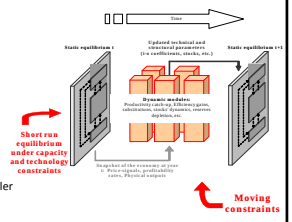
What decarbonization pattern at sector scale with emphasis on energy-demand sectors?

Mejean, A., Guivarch, C., Lefèvre, J., and Hamdi-Cherif, M. (2018). The transition in energy demand sectors to limit global warming to 1.5°C. Energy Efficiency. 1–22.

IMACLIM-R: macro-energy transitions in a "second-best world"

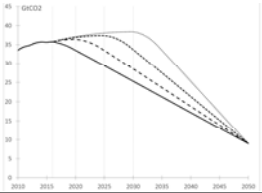
- Multi-region, multi-sector hybrid CGE model : **top-down economic equilibria / bottom-up sectoral modules** (power generation, LDVs, buildings)
- **Constrained flexibility** of technical systems (capital inertia, speed of technology diffusion) and interplay with **"second-best" macroeconomic trajectories** (imperfect markets and expectations)
- Transport and building sectors **inertia**
- Induced technical and structural change, consumption patterns and mobility/housing services
- CO2 only and decarbonization through carbon price

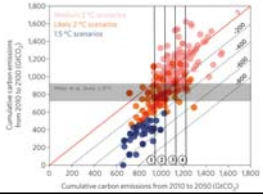
→ A "low-response" IAM emphasizing mid-term transition issues (Kriegler et al. 2015



Four families of mid-century scenario

- Contrasted date and level of global CO2 emission peak (2016, 2020, 2025 and 2030)/ Same emission level in 2050 (-65% CO2 emissions in 2050 compared to 1990)
- Can be evaluated against 1.5 - 2◦C scenario litterature (Rogelj et al. 2018; Millar et al. 2017)





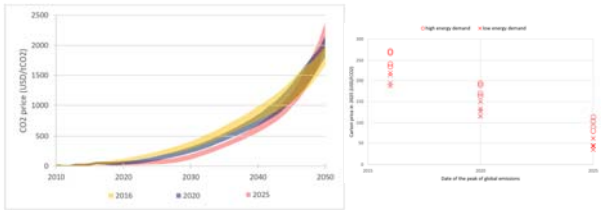
A total set of 32 scenarios

- Alternative assumptions about energy demand, fossil fuel ressources and low carbon technologies
- Low energy demand patterns triggered by sector specific demand-side policies

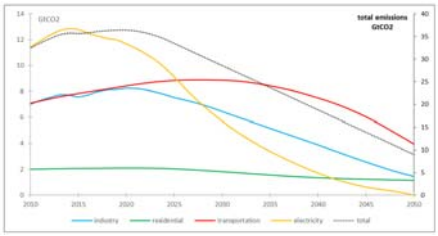
Parameter family	Sector or technology	High	Low
Energy demand			
Energy efficiency	Agriculture, industry, construction, services	Slow induced energy efficiency improvement	Fast induced energy efficiency improvement
Development patterns	Transport, buildings, consumption of industrial goods	Asymptotic catch-up of developing countries with the US development pattern	A less carbon-intensive development pattern
Fossil fuel resources			
	Coal, gas	Relatively abundant and cheap	Relatively scarce and expensive
	Coal-to-liquids	High penetration	Low penetration
Low carbon technologies			
	Low carbon electricity technologies (renewables, nuclear)	High availability, fast learning	Low availability, slow learning

Date of global emission peak and carbon prices

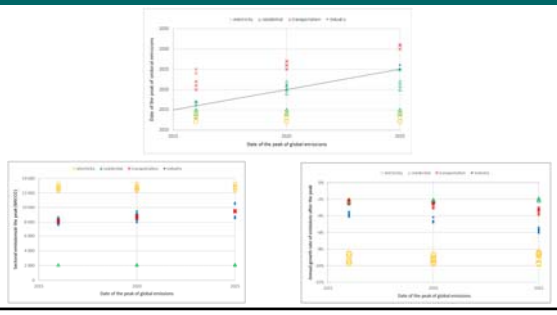
- All 2030-peak scenarios **"infeasible"** whatever the assumptions about energy demand, fossil fuels and low carbon technologies



Sectoral decarbonization patterns



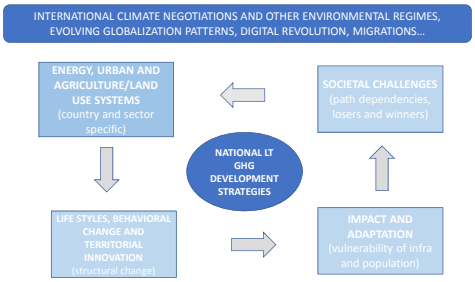
Sectoral implications of shifting global emission peak



Overall conditions for a feasible transition compatible with 1.5°C

- Delaying emission peak until 2030 may imply **unfeasible** mid-century socio-technical transition needed to be compatible with 1.5°C target
- **Stringent policies in energy-demand sectors** — industry and transportation especially — are needed in the short run to trigger an immediate peak of global emissions and increase the probability to reach the 1.5°C target
- Early global emission peak implies early emission reductions in energy demand sectors —**mainly industry and transportation** - beyond the fast decarbonization of the electricity sector

Elements of long term strategies GHG development strategies of ecodevelopment…



AND ITS POLICY IMPLICATIONS

- Connect demand side policies with SDGs
- Design fair distributive policies (e.g. recycling options of carbon revenues towards households and firms)
- Develop means to accelerate the transition (e.g financing mechanisms to derisk investments…)
- Search for national policy agenda momentum articulated with the stocktake process (pre-2020 actions)
- Improve connections btw IPCC, international research/decision making platforms (TWI2050, 2050 Pathways platform, DDPP, LCS-R net…) and other networks (ICLEI, C40…)

➡ *Some ingredients for a fair and inclusive transition in a turmoil geopolitical and fast changing technological context*

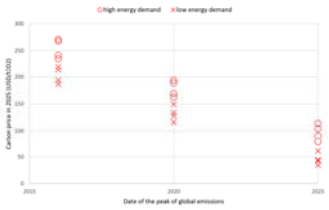
THANK YOU FOR YOUR ATTENTION!

cassen@centre-cired.fr

Mejean, A., Guivarch, C., Lefèvre, J., and Hamdi-Cherif, M. (2018). ***The transition in energy demand sectors to limit global warming to 1.5°C****. Energy Efficiency. 1–22*

Cassen, C., Cotella, G., Toniolo, J., Lombardi, P., Hourcade, J-C., (2018). ***Low Carbon Scenarios for Europe. An evaluation of upscaling pioneer experiences in a low carbon context,*** *Sustainability 2018, 10(3), 848 ; doi:10.3390/su10030848*

Impact of energy demand patterns on carbon prices in the short run



Deep decarbonization pathways compatible with national priorities and global climate objective

Lessons from a sectoral perspective: Transport

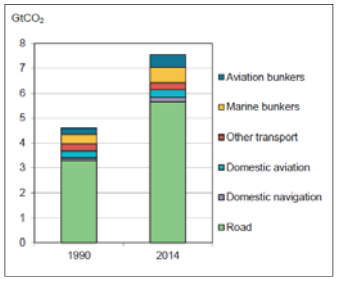
Yann Briand,
Deep Decarbonization Pathways for Transport,
Climate Program

July 17th 2018

If nothing changes, CO2 emissions from the transport sector is expected to explode and reach 12 GtCO2 by 2050

Since 1990, CO2 emissions from transport sector increased by more than 60%:

- Road transport remains the dominant emitter (+~65%)
- International marine due to global trades (+69%)
- International and national aviation grow even faster (+95%).



Sources: IEA, CO2 emissions from fuel combustion, 2016; IPCC, AR6, Chap Transport, 2014

Only 10% of Parties provided a transport mitigation target

"NDCs provide CO2 reduction ambitions, but not yet clear pathways or measures to reach ambitions set by the Paris agreement."

"**Often, measures** in the NDCs are desired outcomes and remain **vague at the best**. In some cases, the mitigation potential of identified "measures" is contestable."

"The transport ambitions for CO2 reductions of such countries especially **need to be intensified** to ensure that the "Well-below 2 degree" ambition, as defined at COP21 in Paris in 2015, can be achieved."

Sources: ITF-OECD, Transport CO2 and the Paris Climate Agreement, April 2018

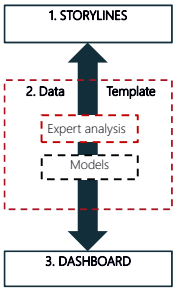
Key lessons from DDPP - How to raise the ambition and make the link with SDGs!

1. **Pathways developed by independent and in-country research teams**	to ensure consistency with global 2°C climate objective and domestic development priorities
2. **Long term pathways by 2050**	to inform concrete short-term action plans and think the transition towards the 2050-goals
3. **Sectoral pathways**	to reveal other key "non-energy" indicators and "non-technological" drivers to understand the levers of action

DDPP DEEP DECARBONIZATION PATHWAYS PROJECT

Why developing sectoral pathways is a good approach to raise the ambition of NDCs?

Describing concrete sectoral transformations
-> to inform policy makers and reveal relevant determinants of transformations



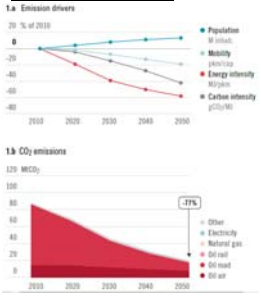
- Open a dialogue on sectoral transformations by providing a disagregation of sectoral emissions and other transformation indicators (Dashboard)
- Describe all technological and non-technological determinants of transformations and articulate them consistently (Storylines & Data template)

DDPP DEEP DECARBONIZATION PATHWAYS PROJECT

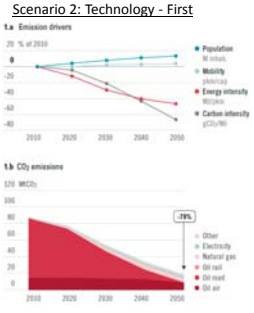
Compare national and international scenarios and structure policy dialogues - DASHBOARD

Sectoral dashboard = more than 60 indicators !
Indicator chosen with parties of transport policy dialogue

Scenario 1: Mobility - First



Scenario 2: Technology - First



Sources: Dashboards, Pathways to deep decarbonization of the passenger transport sector in France, 2017

Develop a consistent scenario of transformations integrating all transport determinants - STORYLINE

Analysis framework based on litterature review
Integrating national priorities, sustainable and transport-related determinants

1. **demographic and economic changes**
2. **human settlement, land development and spatial organization**
3. **sociocultural practices and lifestyles**
4. **vehicles technological assumptions**
5. **fuel generation and energy carbon content changes**
6. **car stock and low carbon vehicle penetration**
7. **modal distribution and modal costs**
8. **speeds, infrastructure and time**

Refined level of disagregation needed !

Indicator examples of the Dashboard:

Sources: Dashboard for scenario Mobility-first, Pathways to deep decarbonization of the passenger transport sector in France, 2017

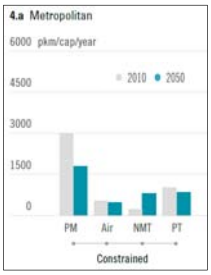
Transport-relevant indicators needed !

Indicator examples of the Dashboard:

Sources: Dashboard for scenario Mobility-first, Pathways to deep decarbonization of the passenger transport sector in France, 2017

Articulate consistenly Storylines and Dashboard indicators and formulate bottum up assumptions

Dashboard



Elements of storyline – modal shift

- Density: population and services
- Space reallocation and city infrastructures for NMT & PT
- Speed changes between the different modes improving NMT & PT
- Cost increase for air tickets

Sources: Scenario Mobility-first, Pathways to deep decarbonization of the passenger transport sector in France, 2017

Sectoral Deep Decarbonization Pathways: what is next ?

In 2017:

4 country reports (France, Japan, Mexico, UK): "Pathways to deep decarbonization of the passenger transport sector"

- Authored by in-country research teams, independent of their governments
- Presents and discusses several country-driven sectoral deep decarbonization pathways for each country

Iddri Issue Brief: "Beyond emission targets: how to decarbonize the passenger transport sector?"

- Authored by the DDPP-T consortium, led by IDDRI
- Discusses cross-cutting messages derived from the country analyses

In 2018/19:

- **Freight transport studies (France, Japan):** "Pathways to deep decarbonization of the freight transport sector"
- **Other sectoral studies (India, China, South Africa, European countries, Brazil, Mexico…):** agriculture, transport, electricity generation, industry…
- **DDP Tool:** Development of simplified online tool to build decarbonization scenarios
- **Monitoring indicator development:** "Monitoring the French Transition"
- **Prospective Dialogues**
- **Adaptation trajectories for small islands**

…

Thank you for your attention !

DDPP DEEP DECARBONIZATION PATHWAYS PROJECT

yann.briand@iddri.org

Mid-century low emission pathways in Japan

Given the invitation for the countries to communicate their mid-century strategies by 2020 based on the Paris Agreement, the AIM project team has provided scenario analyses on low emission pathways in Japan. The analysis using AIM/Enduse [Japan] has explored the following policy implications for mid-century climate policies; first, the importance of three pillars of decarbonization are reconfirmed, namely energy efficiency, low-carbon electricity, and switch to low-carbon energy carriers. Second, there are wide gap in the transformation in energy supply sector between the 1.5°C and 2°C scenarios, while energy demand sectors also require to enhance the mitigation effort in the 1.5°C scenario. Third, according to the multiple global and national models, Japan's 2050 goal can be an effective milestone toward the global 2°C goal, to the extent that net-zero emissions in the second half of this century are met.

Ken Oshiro, Mizuho Information & Research Institute (MHIR), Tokyo, Japan. ken.oshiro@mizuho-ir.co.jp

Introduction

Prior to the 21st session of the Conference of Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Paris in 2015, Japan submitted its Nationally Determined Contribution (NDC) on July 2015, which is to reduce GHG emissions by 26.0% in 2030 below the 2013 level. In addition, in the Plan for Global Warming Countermeasures published on May 2016, Japan aims to reduce greenhouse gas emissions by 80% by 2050 as its long-term goal. More recently, given the invitation for the parties to communicate mid-century strategies based on the Paris Agreement, the government has embarked on discussions about the national mid-century strategy, such as the long-term low carbon visions published by the Ministry of the Environment in 2017, while Japan has not yet communicated the mid-century strategy as of July 2018.

Since 1997, the Asia-Pacific Integrated Model (AIM) has examined several mid- to long-term scenarios to inform national climate policies in Japan. These scenarios are also provided to the international research collaborations, such as Deep Decarbonization Pathways Project (DDPP), as well as to the internal policy discussions in Japan. Given the current political backgrounds including the Paris Agreement, we examine the following elements by using AIM/Enduse [Japan] (Oshiro and Masui, 2015).

- Key mitigation options to meet the current NDC and the 80% reduction goal by 2050, that are likely to be considered in developing the national mid-century strategies.
- Gap between these national targets and the net-zero emission pathways by 2050 implied by the global 1.5°C goal, given the provisions of the Paris Agreement.
- Mid-century emission pathways in Japan in terms of the consistency with the long-term temperature goal of the Paris Agreement.

Key pillars for the 80% reduction goal by 2050 in Japan

We assessed the 2030 target included in the NDC to reduce GHG emissions by 2030 by 26.0% relative to the 2013 level, and explored its implications for the long-term goal of 80% emission reductions by 2050 using AIM/Enduse [Japan] (Oshiro et al. 2017a). Scenario analysis by 2030

suggests that implementation of the NDC could consolidate a transition from the baseline trajectory, which is mainly derived from improved energy efficiency and low-carbon electricity. The 2030 target is still technically feasible even if nuclear power is constrained or totally phased-out by 2030, due to additional deployment of renewable energies. However, these pathways incur carbon price hikes of over 160 US$/t-$CO_2$, and need effective policy supports.

Over the long-term, pathways that meet both 2030 and 2050 targets also appear technically feasible, though additional efforts beyond the 2030 target are required. These pathways also require a huge and rapid transformation in the energy system after 2030, including large-scale deployment of variable renewable energies and carbon capture and storage, and improvement of energy efficiency and electrification. Early actions and policies before 2030, including RD&D in innovative technologies and development of the market would be needed for commercial realization of these options.

Energy system transformation associated with the global 1.5°C goal

This study attempts to identify gaps between the 80% reduction goal that was informed by the global 2°C goal, and the national emission pathways implied by the 1.5°C goal in 2050 (Oshiro et al. 2017b). As the national scenarios corresponding to the Paris Agreement's global climate goal of pursuing effort to limit the temperature rise to 1.5°C, we examined emission pathways aimed at net-zero emissions by 2050 in Japan.

Scenario analysis suggests that Japan's energy supply sector requires a huge transformation, including carbon dioxide removal options such as bioenergy with CCS (BECCS) to attain net-zero emissions by 2050 without substantial social changes. By contrast, the gap between the 1.5°C and 2°C scenarios is relatively moderate in the demand sectors. For example, the building sector may need to be decarbonized even in the 2°C case, whereas the transportation sector will require additional challenges in the 1.5°C scenarios, such as electrification and penetration of biofuel. Reaching net-zero emissions by 2050 is a huge challenge, since the price of carbon in the net-zero emissions case increases by a factor of four or five over that in the 2°C case. Moreover, the absence of early action as well as limited use of low-carbon energies would exacerbate the mitigation effort considerably. Given these challenges and uncertainties, assessment of the potential of other mitigation options, such as drastic social change, large-scale afforestation and international emissions trading, merit consideration.

National mid-century pathways corresponding to the long-term temperature goal

We examined mid-century emission pathways in Japan associated with the long-term temperature goal of the Paris agreement to holding average temperature increase well-below 2°C above the pre-industrial levels, based on multiple global and national integrated assessment models (IAMs) (Oshiro et al. 2018), as a part of the CD-LINKS project (www.cd-links.org). In this study, the high and low budgets scenarios are assessed that are consistent with 50% and 67% chances to hold the temperature increase below 2°C in 2100, considering the impact of implementation of the near-term climate policies such as the NDC.

According to the emission pathways estimated by the multiple IAMs, the low budget scenarios require to reduce CO_2 emissions by about 75% in 2050 with respect to the 2010 level. It implies that Japan's 80% goal in 2050 goal could be an effective milestone for the long-term

temperature goal of the Paris Agreement. However, in the low budget scenarios, cumulative emissions in Japan in the second half of this century need to be nearly zero. This suggest the importance of addressing the residual emissions mainly in the energy demand sectors, and introduction of negative emission technologies after 2050. Unless the enhancement of near-term action beyond the NDC is implemented, deeper emission reduction would be needed in the second half of this century.

Conclusions

According to the scenario analyses on the long-term low emission pathways in Japan, we have explored the following implications for the mid-century strategies.

- The importance of energy efficiency, low-carbon electricity, and switch to low-carbon energy carriers, are reconfirmed to meet the 80% goal by 2050 in Japan.
- The net-zero emission pathways by 2050, that are implied by the global 1.5°C goal, suggest that energy supply sector needs large-scale transformation that may include negative emission options compared with the 80% reduction goal, while energy demand sectors also require to enhance the mitigation effort in the 1.5°C scenario.
- The 80% reduction goal by 2050 can be an effective milestone for the long-term temperature goal of the Paris Agreement, while the emission pathways need to reach net-zero in the second half of this century.

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Climate change mitigation strategies: Nationally Determined Contributions and potentials for further greenhouse gas mitigation in Morocco

Julia Terrapon-Pfaff and Sarra Amroune, Wuppertal Institute, Wuppertal, Germany. Contact: julia.terrapon-pfaff@wupperinst.org

In the frame of the Paris agreement and its objectives to keep the global temperature increase well below 2°C and make efforts to limit the temperature rise even further to 1.5°C, nearly all countries have proposed climate change mitigation actions, so-called Nationally Determined Contributions (NDCs). However, the sum of the proposed greenhouse gas emission reductions by all parties will not be sufficient to keep climate change at a secure level. Accordingly, all countries will need to revisit their NDCs and are compelled to identify options to strengthen them. While industrialised countries will have to take the lead in climate change mitigation, it is also essential to support emerging and developing countries to expand their mitigation actions. The research presented in this paper therefore analyses quantitative and qualitative information on climate protective policies and actions as well as future options for deeper emission cuts in the case of Morocco.[1]

Introduction

Morocco is one of the leading countries worldwide when it comes to climate change mitigation and adaption strategies. The Kingdom has not only set itself ambitious targets but it has also established policies that support its climate change agenda and it is implementing it in a timely fashion. One of the drivers for the ambitious climate strategies is certainly the fact that Morocco is highly vulnerable to both the long-term effects of climate change as well as to catastrophic events due to climate variability. Many of the country's regions are already affected by negative impacts of climate change such as average temperature rise, droughts, desertification, heat waves, flooding, a rising sea level and changing rainfall patterns (Heinrich-Böll-Stiftung 2017; GoM 2016a). Another reason for Morocco's ambitious strategies especially in the energy sector is that the country is currently highly dependent on fossil fuel imports. To date, Morocco imports over 90% of its energy (95% in 2014), making the country the largest energy importer in the North African region. The reliance on fossil fuels and the

[1] The presented research is part of the project "Implementation of Nationally Determined Contributions: Framework Conditions and Transformative Challenges in Selected Focus Countries (FKZ 3716 4111 80). In the frame of this two-year project (2016-2018) country reports on the NDC implementation in ten countries (Colombia, Ethiopia, Georgia, Indonesia, Iran, Kenya, Marshall Islands, Morocco, Peru, and Viet Nam) are prepared in cooperation between the Wuppertal Institute and the NewClimate Institute. The project is supervised by the German Environment Agency and financed by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. The responsibility for the content of this publication lies with the author(s). More information on the project as well as the country reports are available on the following website: https://www.umweltbundesamt.de/themen/klima-energie/internationale-eu-klimapolitik/zukunft-der-klimapolitik/zehn-laenderstudien-zu-einer-ambitionierteren

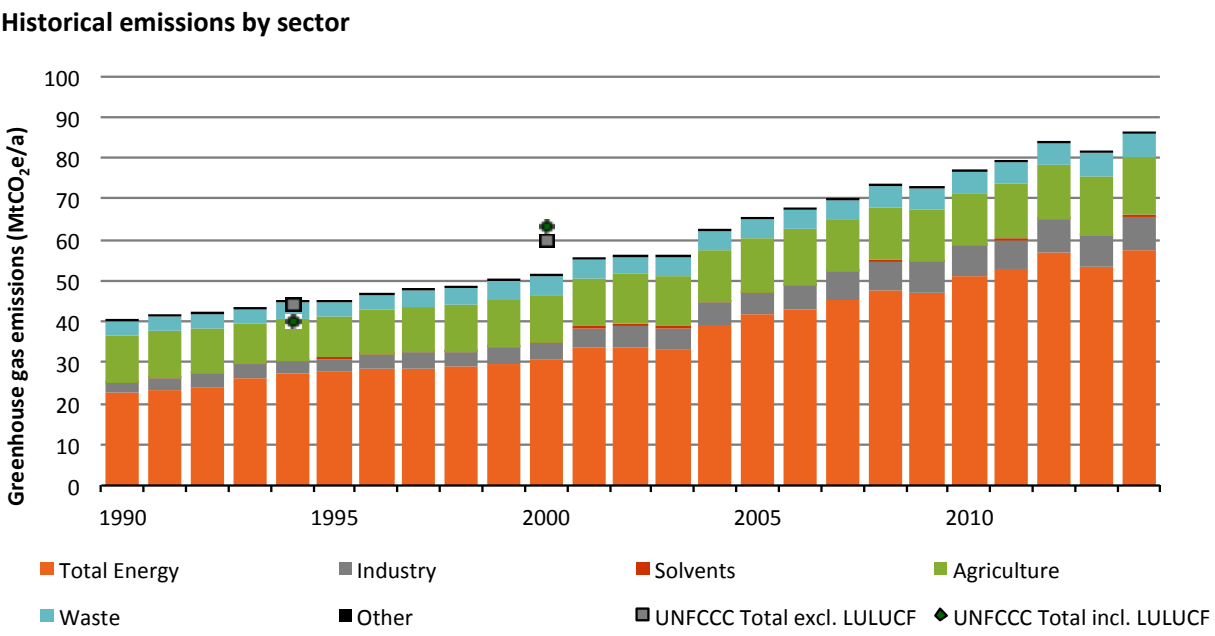
high import dependency places a huge burden on both the national budget and the country's energy security. At the same time, the energy demand is growing as a result of population growth, urbanisation and economic development. To ensure a stable and affordable energy supply, the Moroccan government has therefore taken steps to diversify its energy mix by making use of the country's significant renewable energy potentials.

Yet, despite Morocco's ambitious climate strategy, potential challenges continue to exist in achieving the set objectives. Morocco currently has a very low GHG emission rate, which is projected to increase considerably in the coming decades in course of the country's continuing economic development. Fortunately, Morocco has additional potential to even further extend its already far-reaching efforts and strategies for a low-carbon development. A promising approach could be the focus on the energy- and emission-intensive mineral sector. Another sector with a sizeable additional potential for GHG emissions reductions in Morocco relies in the urban centers as administrative entities. And also the transport sector, which has been the sector with the fastest growing emission rate, representing the second largest source of emissions in Morocco behind the electricity sector, offers additional mitigation potential. However, to limit the GHG emission increase and to mitigate emissions, the country will need substantial financial support, depending on the availability of climate funding and support from the international community.

Overview greenhouse gas emissions Morocco

Morocco's greenhouse gas (GHG) emissions amounted to 86 $MtCO_2e$ (excluding LULUCF) in 2014 accounting for about 0.1% of global emissions. The energy sector is responsible for 67% of these emissions, followed by agriculture (17%) and industry (10%) (Fig. 1). Albeit Morocco's emissions being comparatively low, there has been a severe rise since 1990. This emission growth is mainly attributable to the increase in energy-related emissions. In terms of per capita emissions, this corresponds to an increase of 58% compared to 1990. However, at the same time, the emissions intensity of the economy has noticeably decreased, by 41%.

Fig. 1 Morocco's greenhouse gas emission development



Data source: Gütschow et al. (2016a); UNFCCC (2016)

Morocco's NDC

In regard to mitigation actions Morocco has far-reaching plans. In its NDC, submitted to the UNFCCC in 2016, the country commits to an unconditional target of 17% reduction of GHG emissions by 2030 compared to a "business as usual" scenario. Conditionally, Morocco pledges 42% GHG reductions by 2030 (GoM 2016b). In the unconditional case, realising the commitments would mean that the emission levels continue to increase until 2030, but more slowly than in the BAU scenario, whilst in case of the conditional targets, GHG emissions would remain steady compared to today's level until 2030. Morocco's conditional target would represent a fair share of global emission reductions in line with the objectives of the Paris agreement (CAT 2017). To reach the conditional and unconditional GHG emission reduction targets by 2030, the country provided a comprehensive list of 55 activities. The listed activities include all sectors (energy, agriculture, forest, transportation, waste, industry as well as actions in the residential and commercial sector). However, the most significant reductions are related to the transition of Morocco's energy sector. With ambitious targets for the deployment of renewable energies (52% of power shall be generated from renewable sources by 2030) and energy efficiency measures (e.g. 15% energy savings by 2030), the National Energy Strategy is key for the implementation of Morocco's mitigation contributions (GoM 2016b).

Potential fields to strengthen mitigation efforts in Morocco

Morocco has additional potential to even further extend its already far-reaching efforts and strategies for a low-carbon development. One field for additional mitigation actions is the industry sector. Within the industry sector, large amounts of GHG emissions can be allocated to mineral production and processing (4C Morocco 2014). Hence, the mineral sector is one of the industry segments with a sizeable potential for GHG emissions reductions in Morocco. Key segments of the mineral sector that are both energy- and emission-intensive and that are expected to grow further in the next decades are the phosphate and cement industry. Therefore these industry segments offer a high replication potential for mitigation actions. Another field for mitigation actions is the urban environment as cities account for a large share of GHG emissions due to their high levels of energy consumption. However, the Moroccan NDC addresses the urban environment only to a limited extent directly and so far no national urban mitigation strategy is being implemented albeit the existence of individual measures. Against this background a promising strategy for further mitigation actions in the urban environment would be to foster cooperation between administrative levels, including municipalities, in order to elaborate a comprehensive sustainable urban development strategy. Connected to the urban development but also beyond that, on a regional or national level, the transport sector represents a potential field for mitigation actions. A high share of GHG emissions is stemming from the transport sector and the rapid growth rates of the sector will result in further increases of GHG emissions and energy consumption. Especially the need to expand the transport infrastructure in light of increasing demand for passenger as well as commercial vehicles and other transport services offers opportunities to implement measures and projects that avoid or reduce GHG emissions (CTF 2009).

Conclusion

Morocco is one of the leading countries in the MENA region when it comes to climate change mitigation strategies. Nevertheless, barriers to realize the full potential continue to exist in

addition to the potential to further extend the mitigation efforts to even overachieve the existing targets.

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6. Session 1B

Impact and adaptation

Chair: Kiyoshi Takahashi (NIES, Japan)

Description:

Mitigation actions are essential to make a decarbonised world a reality. However, given that the impacts of climate change have already been observed in various places and are expected to further exacerbate in the future, implementing adaptation actions is indispensable for ensuring sustainable decarbonisation.

The purpose of the session is to share the most recent adaptation policies (planning and implementation) in each country at the national or sub-national levels.

Potential topics covered by this session could include:

- What are the (missing) factors or conditions that are important for accelerating the implementation of adaptation initiatives?
- For supporting and realising the implementation of proper adaptation, what kinds of international cooperation or coordination are needed?
- Are there any examples of adaptation policies in other countries that warrant sharing with the participants in the session?

Keywords: Adaptation, international cooperation, national and sub-national policies

French multi-level governance of climate change adaptation

The facilitating role of the French Environment and Energy Management Agency (ADEME)

Céline Phillips

Plan

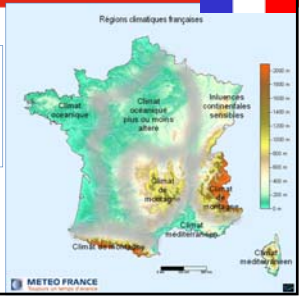
- The Geography and Climate of France
- French Multilevel Governance of Climate Change Adaptation and Mitigation
- ADEME's facilitating role
  - Facilitating the Development and Transfer of Knowledge
  - Building Capacity at the Local Level

The Geography and Climate of France

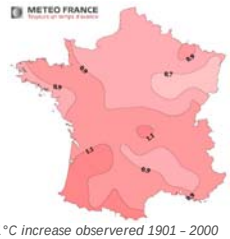
Population: 66 million

Area: 551 600 km² (675 000 km² including overseas territories)

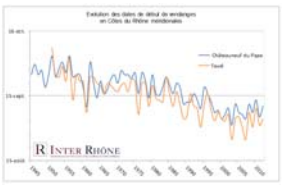
Summit: 4 810 m (Mont Blanc)



Some impacts of climate change can already be observered



+1°C increase observered 1901 – 2000



Impact : earlier grape harvests

Multilevel Governance of Climate Change Adaptation and Mitigation

- Legal requirements, 2010
  - Regional level
    - Scheme pour planning, sustainable développement and territorial equality
  - Local level
    - Climate Air Energie Plan: all inter-municipalities > 20 000 inhabitants
    - Local Urban Plan
    - Territorial coherence scheme
- Multi-level Governance
  - European - National - Regional - Local

Multilevel Governance of Climate Change Adaptation and Mitigation

National Climate Plan (axis 19 national adaptation plan) — *Ministries*

National Low-Carbon Strategy | National Adaptation Plan

Regional Land Planning and Sustainable Development Framework (Schéma Régional d'Aménagement et du Développement Durable du Territoire SRADDT) — *Regional governments and representatives of the state.*

- Climate change vulnerability analysis
- Framework for climate change adaptation

Local Operational Climate Plan (Plan Climat Air Energie Territorial, PCAET)

Local planning documents: Territorial Coherence Scheme (SCoT); Local Urban Plan (PLU) — *Regions, departments, urban communities , agglomerations, communes, communities of communes over 20 000 inhabitants*

Climate Change Adaptation Planning at the National Level

- 2006: National Climate Change Adaptation Strategy
- 2009 & 2010 : "Grenelle" laws
  - Formal framework for the multilevel governance
  - Legal requirements for subnational governments
- 2011: National Climate Change Adaptation Plan (2011-15)
  - Direct mobilisation of sectorial ministries
  - Priorities:
    - knowledge development
    - "no-regret" adaptation measures
- 2015 : Evaluation of the first National Climate Change Adaptation Plan
- Preparation of a 2nd National Plan underway (Adoption forseen July 2018)
  - Overarching objective
    - Be adapted to the regional climate in mainland France and its overseas territories by the middle of the 21st century, in line with a worldwide temperature rise of +1,5 / 2°C compared to the pre-industrial conditions.
  - New priorities
    - Sub-national adaptation (territorialisation)
    - Overseas territories
    - Nature based approaches
    - Economic sectors

The facilitating role of the French Environment and Energy Management Agency (ADEME)

The French Environment and Energy Management Agency ADEME at a glance

- Public Agency under the authority of
  - Ministry for an Ecological and Solidary Transition
  - Ministry for Higher Education, Research and Innovation
- Mission
  - encouraging, supervising, coordinating, facilitating and undertaking operations with the aim of protecting the environment and managing energy
  - ADEME funds projects, from research to implementation
- Policy areas
  - waste management ; soil conservation ; energy efficiency ; renewable energy ; raw materials savings ; air quality ; noise abatement ; circular energy transition ; food wastage abatement
- Budget
  - 2018 operating budget : 540 M€
  - 2010-2020: 4,5 Billion € for the « Investment for the Future » programme
- Staff
  - ~ 1000
  - 3 central sites (~50%), 17 regional directions, 3 representations in overseas territories, office in Brussels (European Union)
- Mandate to facilitate Climate Change Adaptation since 2009
  - Strategy for climate change adaptation : 2010
  - Founding principles:
    - Mainstreaming and embedding of adaptation
    - **Synergy with, and co-benefits for mitigation**

Facilitating Climate Change Adaptation

- Support from ADEME's national offices
  - Development of the knowledge base and transfer to decision-makers
    - funding of research
    - publication of technical documents
    - seminars
  - Capacity Building
    - Reviews of international experience
    - Impact'Climat and Objectif'Climat tools
    - Training sessions
  - National conferences
  - National Adaptation Competition "Trophées..."
- Support from ADEME's regional offices
  - Support for regional authorities
  - Animation of infra-regional networks of local authorities
  - Funding of local projects

Facilitating the Development and Transfer of Knowledge

Facilitating research

- Integrating climate change adaptation into ADEME's existing research programmes addressing mitigation and other environmental issues
  - Doctoral research programme
  - Buildings: « Bâtiments responsables »
  - Urban planning tools : « MODEVAL URBA »
  - Agriculture: GRAINE « Gérer, produire et valoriser les biomasses : une bioéconomie au service de la transition écologique et énergétique »
  - Social and human sciences: « Transitions écologiques, économiques et sociales »
- E.g. Cooling
  - The challenge: develop cooling techniques
    - **Zero or low greenhouse gas emissions;**
    - Low environmental impact (pollution, noise, anthropogenic heat)
  - in buildings (CLIMSOL, Clim du futur...), vehicles, urban areas
- Support to the Ministry's research programme (Gestion des Impacts du Changement Climatique, GICC)
  - Steering committee, scientific committee
  - Funding of projects

Facilitating the Development and Transfer of Knowledge

Example : Urban Cooling

- Analysis of the local Urban Heat Phenomenon: methodological developments funded by ADEME
  - 2 theses, DIACLIMAP research project
- Urban Cooling Solutions: Comparison of the
  - 2012 call for proposals « Evaluation of Urban cooling solutions »
  - 4 projects funded: Epicure, TERRACES, IFU, EVA
- 2017: Analysis of the state of the art and seminar
- 2019: Call for proposals, MODEVAL URBA programme

Facilitating the Development and Transfer of Knowledge

Example : Agriculture (1/2)

- Publication of the results of the Climator research project (2010)
  - INRA – ANR 2007-2010
  - Presentation of scientific knowledge on the impacts of climate change on French crops and identification of adaptation solutions
- Contribution to the AFClim foresight project (2012)
  - CEP – Centre Etudes et prospective, of the Ministry in charge of agriculture
  - Analysis of the possible climate change adaptation strategies for agriculture and forests in metropolitan France on the basis of 15 case studies
- Funding and expertise for the Climate Action Network publication « Climate Change Adaptation of agriculture – local experience » (2014)
  - *Réseau Action Climat « Adaptation de l'agriculture aux changements climatiques – Recueil d'expériences territoriales »*
  - Synthesis of key knowledge on impacts and challenges, 5 case studies

Facilitating the Development and Transfer of Knowledge

Example: Agriculture (2/2)

- Funding of regional projects ORACLE and Agriaccept
  - Led by the regional chambers of agriculture (1st phase of ORACLE in Poitou-Charentes, 2012)
  - Objective: local data on climate change and its impacts on the agriculture of the region, with a view to informing adaptation strategies.
  - ORACLE : trends in observered climate change and agroclimatic in 6 regions
  - Agriaccept : statistical climate change projections (eg. 2040) in 4 regions
- European Project LIFE Agriadapt
  - 2017 – 2020
  - Financial support for the French participant, Solagro
  - Development and application of a vulnerability analysis tool for agriculture
- Agro-food value chains
  - 2018-2019
  - Threats and opportunities due to climate chance for the French agro-food chains? Development of a methodology and application with 3 French agro-food value chains.

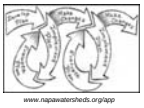
Developing Know-How at the Local Level

ADEME's key messages

- Impact Analysis
  - Adopt a global approach
  - Use participative methods
- Choosing adaptation actions
  - Combine different approaches
    - « gray », « green » and « soft » measures
    - sectorial and transversal
  - Use multi-criteria evaluation methods
- Planning
  - Adjustment and Transformation
  - Dynamic planning methods (e.g. Pathways)
- Implementation
  - Adaptive management
  - Mainstreaming and Embedding

ZAC Lucilline Rives de Seine, Rouen

Parc Ougadougou, Grenoble



www.napawatersheds.org/app

Impact Assessment Tool

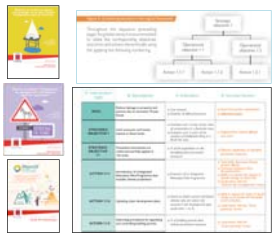
Impact' Climat

- Objective
  - identification of local priorities for climate change adaptation
- Approach
  - Use the existing knowledge base
  - Global approach : qualitative analysis of **all** sectors of activity and climate parameters
  - Guidelines on communicating the results and engaging the decision-makers
- Methodology
  - Exposure to climate change
    - Observed and future trends and extremes : national climate change projections and natural disaster data
  - Sensitivity to climate change

Planning, M & E Tool

Objectif' Climat

- Objectives
  - design : strategy, action plan, monitoring and evaluation system
- Approaches
  - problem and solutions trees
  - logical framework
  - identifying success factors
  - monotoring
  - evaluation
- Current developments
  - Choosing the best adaptation actions
  - Planning the actions in time (pathways)



Urban overheating

Assessment methods

- Overview of existing assessment methods which local governments can use
  - Measurements
  - Models
  - Vulnerability analysis using local data
- 5 case studies


Thank you for your attention!
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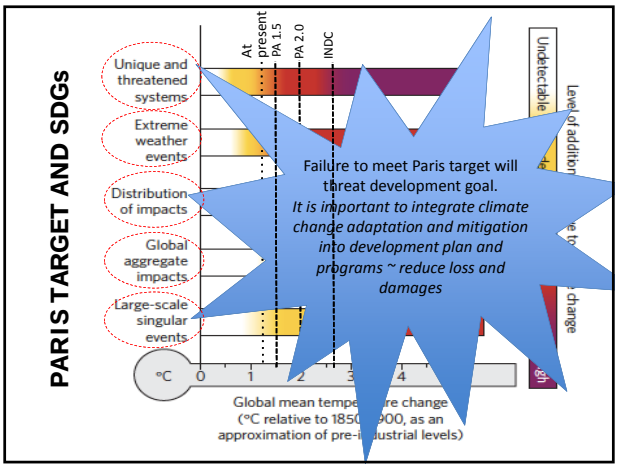
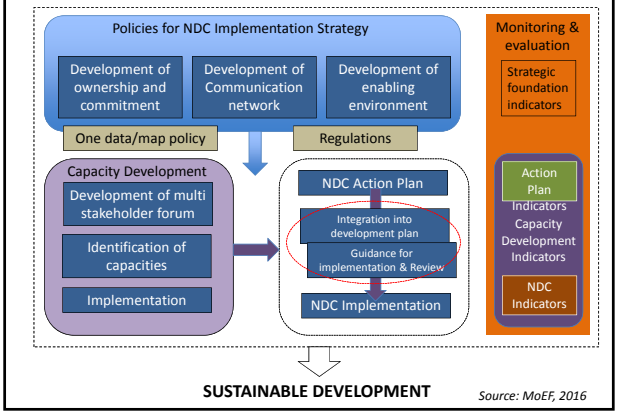
LCS-RNET 10th Annual Meeting, Yokohama, Japan, 17th July 2018
19

Integration of Climate Change Adaptation and Mitigation into Development Plan

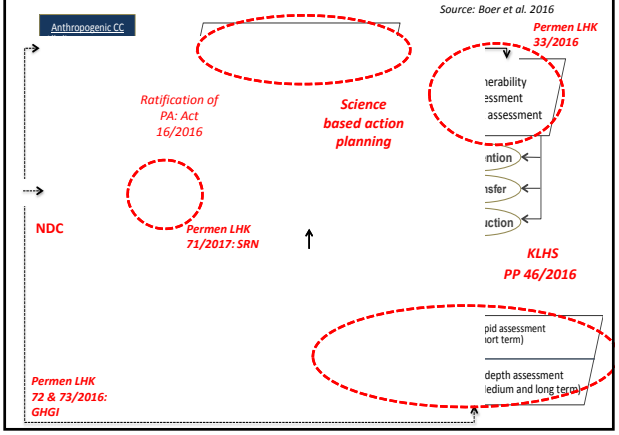
RIZALDI BOER AND AKHMAD FAQIH
Centre for Climate Risk and Opportunity Management Bogor Agricultural University
COP23 Side Event-Japan Pavilion
Linkage between NDC and SDGs – synergies and trade-offs
9 November 2017



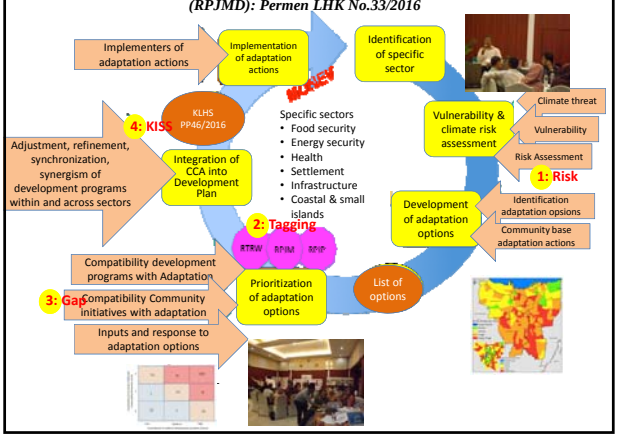
NDC Implementation Strategy



FRAMEWORK FOR LOW CARBON AND CLIMATE RESILIENCE DEVELOPMENT



Integration Process of CCA Plans into Regional Medium-Long Term Development Plan (RPJMD): Permen LHK No.33/2016



Process Integration CCA and SDGs in Development Plan

Source: Boer et al. 2016

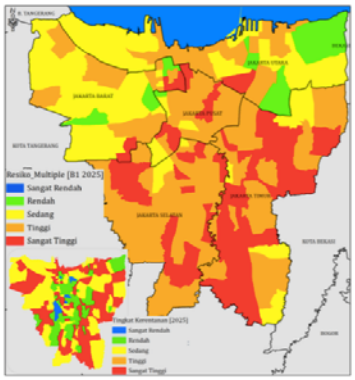
1. Analysis of emission risk and cc vulnerability/impact – Mapping driving factors for emission and vulnerability & priority locations
2. Identification of Development Programs (*Tagging*) and its linkage with CC and SDGs
3. Gap Analysis for Program Enhancement, and establish synchronization & Synergy of Programs within and across sectors
4. Setting mechanisms for coordination on programs synergy, synchronization and integration and MRV

1: Analysis of emission risk and climate risk – Mapping driving factors for emission and vulnerability & priority locations

- Facilitating local governments to analyze historical and future emission trend and to understand drivers of emissions using tool (SIGN SMART: http://signsmart.menlhk.go.id/signsmart_new/web/home/) and vulnerability (SIDIK: http://182.253.238.238/administrator/dashboard)
- This process produces information on main driving factor & hot spot (*high risk*) area
- Two steps of analysis include
  - Assessing historical risks
  - Identifying drivers and hot spot areas (prioritizing locations for CCA&CCM) by evaluating future emission and climate risks

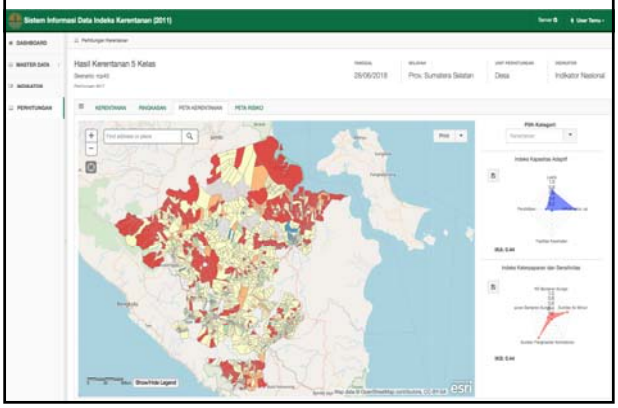
Climate risk assessment at village level (SIDIK), function of vulnerability and change of probability of extreme climate events

Prob. of ECE / Vulnerability	Increase	Constant	Decrease
V. High			
High			
Medium			
Low			
V. Low			



Level of Priority: Very High, High, Medium, Low, Very Low

SIDIK: http://182.253.238.238/administrator/dashboard

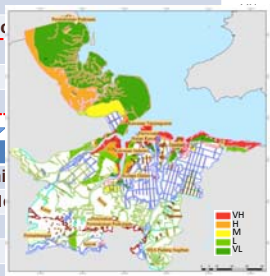


Mapping Emission Risk: Land Base

Matrix of emission risks (historical emission)-Step 1			
Rate / Trend	Increasing	Co	
High	VH (5)		
Medium	H (4)		
Low	M (3)		

Location prioritization-Step 2			
Level of risks (Historical)	Projection of emi High	M	
Very high (5)	VH		
High (4)	VH		
Medium (3)	H		
Low (2)	M	L	VL
Very low (1)	L	VL	VL

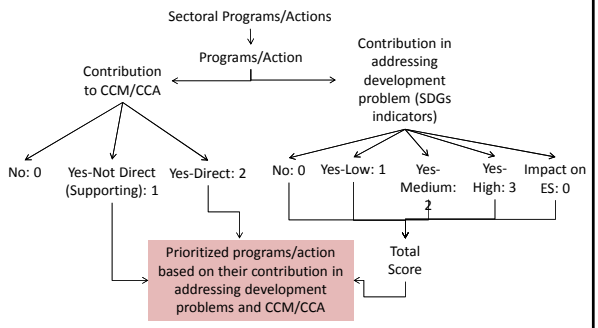
Note:
- Very High
- igh risk; ledium
- w risk; /ery Low
- Very High ty; igh priority ledium ty;
- L – Low priority;
- VL – Very Low priority



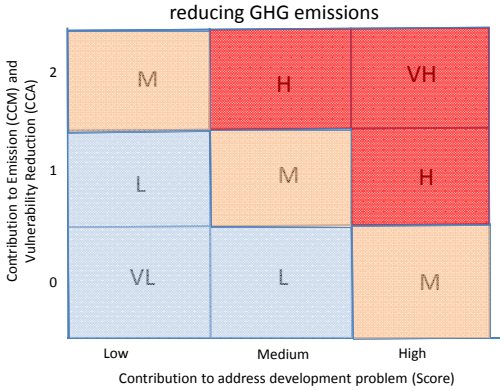
2: Identification of Programs (*Tagging*)

- Assisting local governments
  - to better understand programs that will contribute to address not development problems but climate change mitigation and adaptation (CCM/CCA)
  - To evaluate their programs in term of their contribution in addressing development issues (poverty alleviation, livelihood, education, governance, infrastructure, health, etc) and climate change mitigation and adaptation (CCM/CCA) & co-benefit (ES)

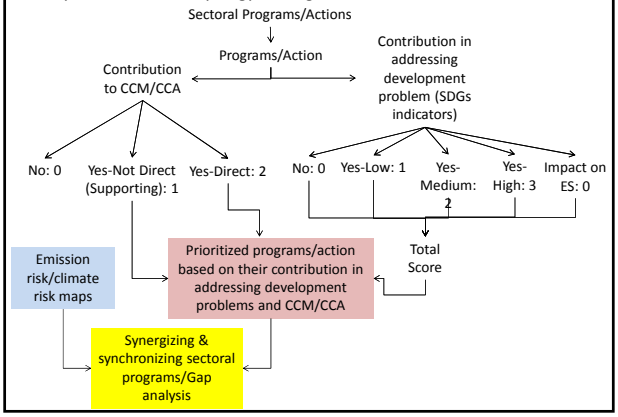
2: Identification of Programs (*Tagging*)



Categorizing Program/Activities of Sector in term of their contribution in addressing development problem and reducing GHG emissions



3: Gap Analysis for Program Enhancement, and establish synchronization & Synergy of Programs within and across sectors

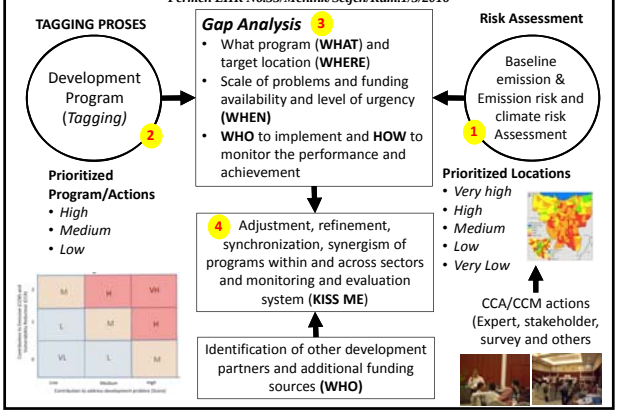


4: Setting mechanisms for coordination on programs synergy, synchronization and integration and MRV

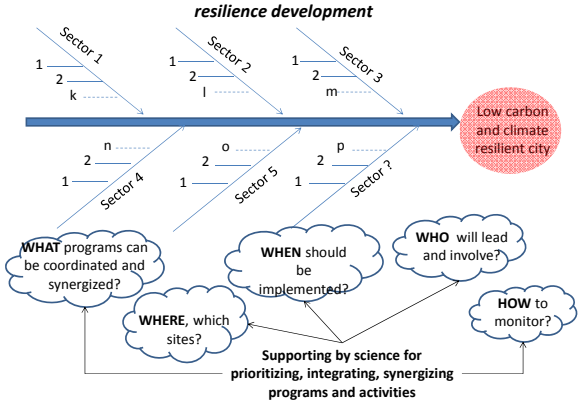
Planning Unit	Priority Locations	Main Program (PU)	Supporting Program (PP)	Beneficiries	Main Agency and Supporting Agencies
Conser-vation zone	ST (1)	PU1	PP1, PP2, PP3 etc	Communities surrounding forest etc.	Agency A/Agencies B, C, D
Develop-ment zone	T (2)	PU2	PP1, PP2,	Masyarakat sekitar hutan	Agency B/Agencies A, D, F
Etc	Etc	Etc	Etc	Etc	Agency C/Private-y
...	...	...	...	...	...

Four Steps: Integration Process of CCA and CCM Action Plans into Regional Medium-Long Term Development Plan (RPJMD):

Permen LHK No.33/Menlhk/Setjen/Kum.1/3/2016



Coordinating, Synergizing, integrating Programs and activities across sector and partners that contribute toward low carbon and climate resilience development



Epilogue

- Availability of tool is very useful for assisting the local government in the process of synchronizing climate actions and SDGs
  - Increasing understanding on linkage between climate actions and SDGs
  - Designing short-medium and long-term strategy for addressing development issue but also GHG emission and climate risk under multi-stakeholder setting
  - Facilitating process of synergizing, syncronizing and integrating sectoral programs
  - Facilitating coordinated actions in addressing the development problems and implementing low carbon and climate resilience development
  - Assisting in defining funding needs toward low carbon development and climate resilience development

Japan's Experiences for Climate Change Adaptation

Yasuaki Hijioka, National Institute for Environmental Studies, Ibaraki, Japan. hijioka@nies.go.jp

National Adaptation Plan was formulated on November 2015 and climate change adaptation act was approved on June 13th, 2018. Development of scientific methodologies and accumulation of scientific knowledge have strongly support to establish the plan and the act. Local governments increasingly rely on A-PLAT for their planning, and the officers contact A-PLAT to seek assistance; ask for data to consider future impacts in their region, request scientific review of their newly-created plan before its publication and so on. Bolstered by the success of A-PLAT, the MoEJ has started a three-year project to project and assess future impacts in region and has assigned NIES as its secretariat so that A-PLAT can work closely with the consortium. The MoEJ also plans to expand the function of A-PLAT to cover the Asia Pacific region. It is evident that A-PLAT has been leading adaptation actions in Japan.

Introduction

In response to our changing climate, Japan formulated its first National Adaptation Plan (NAP) in 2015. Subsequently to the formulation, Climate Change Adaptation Act was approved and will be enforced at the end of 2018. The act states the obligation of local governments to develop their own local adaptation plan. To support their planning, National Institute for Environmental Studies (NIES) developed an information portal site named A-PLAT, and distributes information needed for the planning. Two-year operation of the portal site has demonstrated its value, and local governments increasingly rely on the information on A-PLAT.

Background

Japan formulated its first NAP in response to the Paris agreement and announced it at 22nd Conference of the Parties to the UNFCCC (COP 22). In NAP, seven sectors are specified where adaptation is to be promoted: ①Agriculture, Forestry, Fisheries, ②Water Environment and Resources, ③Natural Ecosystems, ④Natural Disasters, ⑤Human Health, ⑥Industries and Economic Activity, ⑦Life of Citizens. NAP also identifies the importance of information related to climate change, its impacts and necessary actions to adapt to the changes as well as roles of information platforms that enables easy-to use data analysis, data processing and data provision for local governments and relevant stakeholders. A-PLAT was developed by NIES to meet the demand.

Climate Change Act and local adaptation

Climate Change Act was approved by the government on 13th of August 2018. Considering its unanimous agreement, which is rare in today's political condition, adaptation strategies are imminent issues in this country. The purpose of this Act is to promote climate change adaptation, thereby contributing to the health and cultural life of the Japanese people, both now and in the future. The act comprises of comprehensive adaptation programmes. Firstly, set up clear roles of national and local governments, private sectors and citizens to promote

climate change adaptation efforts, and National government shall formulate NAP to promote adaptation in all sectors and should develop methodologies for monitoring and evaluation of the progress of adaptation efforts. Finally, Ministry of the Environment (MoEJ) shall implement climate change impacts assessments every five years and NAP needs to be revised accordingly.

The Act presents the role of local government as follows: prefectures and municipalities should formulate Local Adaptation Plans and should assign “Climate Change Adaptation Center” to assemble data and information needed while local stakeholders can organize Reginal Councils to cooperatively promote adaptation measures in region.

Role of A-PLAT

A-PLAT has developed and operated by NIES since 2016 in response to the formulation of NAP and supported local adaptation activities. Started with only 10,000-page views, the platform has the accumulative page views of 590,000 as of August in 2018. Main targets of A-PLAT are local government, private sectors and citizens as these stakeholders are specified in NAP. A-PLAT is a “one-stop” online resource of information on climate change and its impacts in Japan. It aims at being a platform for adaptation actions of local governments, business and citizens while collecting and providing climate risk information and best practices, tools. Since adaptation actions are inter-related among many sectors, its operation involves relevant ministries. These relevant ministries are main information providers. The information includes the ministries’ adaptation plan, observed climate data, and project outcomes. The most visited content shows the list of local adaptation plans. The list also provides links to each local adaptation plan and many officers testify that other plans are most useful guideline for their planning.

Project on Impact assessment in Japan

A-PLAT offers climate-change project outcomes, mainly on impact assessment. The first main project is “Comprehensive Assessment of Climate Change Impacts to Determine the Dangerous Level of Global Warming and Appropriate Stabilization Target of Atmospheric GHG Concentration, from fiscal year of 2005 to 2009. This project was followed by the significant project of “S-8” with the title of “Comprehensive Study on Impact Assessment and Adaptation for Climate Change”, from fiscal year of 2010 to 2014. The project was draw public attention because it offers relatively small resolution. For instance, impacts assessment on rice yields is provided with 1-km mesh. This five-year project involved 140 researchers and has indices in the field of water resources, ecosystems, agriculture, coastal disaster prevention and human health. A-PLAT has web-GIS system to illustrate the outcomes of S-8, and local governments utilizes the data for adaptation planning as well as Global Warming Projection volume 9 of Japan Meteorology agency, which is also available on the web-GIS of A-PLAT.

Contents of A-PLAT

A-PLAT offers various kind of information for stakeholders specified in NAP. Primary target is local governments. Aside from the list of local adaptation plans and project outcomes that support local adaptation planning, A-PLAT offer articles based on interviews with officers who are responsible for adaptation planning about lessons learned as well as local practitioners such as farmers, fishers and local researchers in the field of adaptation implementation. The second audience is private sectors. Ministry of Economy, Trade and Industry offered information regarding companies whose business is related to adaptation measures. A-PLAT introduces such companies along with useful publication both at home and abroad to promote

adaptation actions in business sectors. As for citizens, A-PLAT originally created interactive webpage to enlighten citizens understanding of adaptation and its necessity. The page demonstrates what causes climate change and how it affects our daily life and why we need to adapt the change and impacts in an easy-to-read manner.

Further actions based on A-PLAT

After the development of A-PLAT, MoEJ started three-year project to assess local impacts and promote adaptation in region. In the project, regional consortiums have established and not only local government but also research institute such as universities has participated. In the project, indices that are important in the region, such as agricultural product or hear stress have been selected and been assessed. Based on the outcome, municipalities in the region will formulate their local adaptation plan. NIES has been appointed the secretariat of the project and worked closely with the participants to collect information. The outcomes of the project will also be provided on A-PLAT.

Another notable activity is international cooperation. In response to the Paris Agreement, MoEJ states its intention to support adaptation actions in ASIA through developing Asia-Pacific adaptation information platform, or AP-PLAT, in 2020. NIES has developed the portal site that will be the basement of the supportive activity and presented its demonstration version in COP 23. Currently MoEJ and NIES are considering supporting in developing national information platforms in some Asian countries, such as Thailand and Indonesia.

Conclusion

Impacts posed by climate change are significant in Japan. Consequently, the government unanimously approved Climate Change Act in 2018 following the formulation of NAP in 2015. Before these national decision, NIES has conducted researches regarding climate change impacts, and based on its experience, developed A-PLAT. As a national research institute, NIES has a network with relevant ministries and research institute and that helps in collecting information needed for local adaptation planning. Local governments increasingly rely on such information since after the enforcement of the act, they are recommended to formulate their local adaptation plan. NIES has responsibilities for supporting such activities as well as international cooperation by developing AP-PLAT.

References

Cabinet Decision (2015): National Plan for Adaptation to the Impacts of Climate Chang

10th Annual Meeting of International Research Network for Low Carbon Society (LCS-RNet)

Previously presented by Dr. Hoon CHANG, Director of KACCC, at the 10th International Symposium on Climate Change Adaptation on July 10th at Press Center in Seoul, Korea

KACCC's Experiences for Climate Change Adaptation in the Republic of Korea

17 July 2018

Taehyun KIM

CONTENTS

I. Overview of KACCC

I-1. Korea Environment Institute (KEI)

Korea's leading think tank on environmental policy and environmental impact assessment (EIA), as a part of the Korea Council of Economic and Social Research Institutes under the Prime Minster's Office.

I. Overview of KACCC

I-2. Korea Adaptation Center for Climate Change (KACCC)

[Purpose]

- Strategic research and policy support for adapting to climate change and the National Climate Change Adaptation Plan

[History]

- KACCC was established on July 1, 2009, based on MOE Instruction No. 850
- The operation of KACCC was legalized by "the Clean Air Conservation Act" in 2012

I. Overview of KACCC

I-2. Korea Adaptation Center for Climate Change (KACCC)

II. Key Roles and Achievement of KACCC

II-1. Policy Research and Support

1) Policy Support for the Central Government

	1st National Climate Change Adaptation Plan* (2010.10)	2nd National Climate Change Adaptation Plan (2015.12)
Vision	To build safe society and support green growth through climate change adaptation	
Periods	2011-2015 (5years)	2016-2020 (5years)
Implementing Ministries	13 ministries	20 ministries
Features	<Key Changes>	
	• Suggest an adaptation plan to achieve a long-term vision →	• Differentiate mid and long-term goals for climate change adaptation at the national level
	• Limited to the effects for climate change adaptation →	• Aim at creating co-benefits of mitigation and adaptation
	• Prepare a plan based on existing adaptation issues →	• Harness science-based approach with impact and risk assessment of climate change
	• Regular monitoring of the implementation status →	• Enhance monitoring on climate change impact and integrated performance assessment

II. Key Roles and Achievement of KACCC

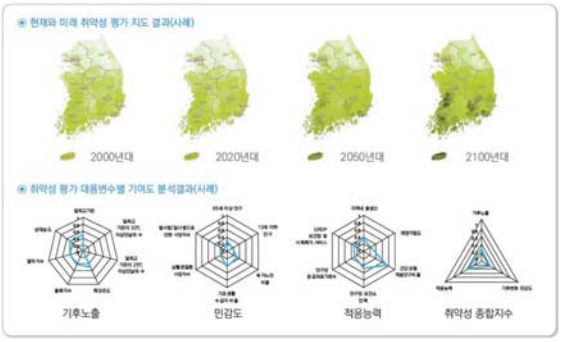
II-1. Policy Research and Support

2) Policy Support for the Local Governments

II. Key Roles and Achievement of KACCC

II-1. Policy Research and Support

3) Various Researches on Adaptation



[The results of vulnerability assessment on cities]

II. Key Roles and Achievement of KACCC

II-2. Supporting Major Adaptation Groups

1) Support Program for the Public Infrastructure

- Providing support to the public institutions that manage the major public infrastructure such as power plants, roads, airports, etc
  - Providing manuals/guidelines and supporting tools
  - Providing training and consulting services
  - Providing the results of impact assessments

II. Key Roles and Achievement of KACCC

II-2. Supporting Major Adaptation Groups

2) Support Program for the Private Sector

- Providing support to the private sector to enhance its adaptive capacity
  - Disseminating the web-based climate change risk assessment system for the private sector called CRAS(Climate Change Risk Assessment System)
  - Providing training to the private sector

II. Key Roles and Achievement of KACCC

II-2. Supporting Major Adaptation Groups

2) Support Program for the Private Sector

- Fostering the adaptation industry
  - Publishing the casebook of the adaptation businesses
  - Selecting the major potential adaptation business partners and developing an adaptation business model
  - Establishing a roadmap for the development of adaptation industry
  - Supporting small enterprises to extend their adaptation businesses abroad

II. Key Roles and Achievement of KACCC

II-2. Supporting Major Adaptation Groups

3) Support Program for the vulnerable groups

- Providing support to the vulnerable groups to enhance their adaptive capacity
  - Identifying and managing the vulnerable groups to climate change
  - Developing and operating the direct support program for the vulnerable groups

13

II. Key Roles and Achievement of KACCC

II-3. Supporting Decision-Making

1) Web-based Climate Change Vulnerability Assessment Tool (VESTAP)

14

II. Key Roles and Achievement of KACCC

II-4. Cooperation and Public Awareness

1) Domestic and International Cooperation

- Building a domestic and international network on adaptation
- Sharing knowledge and experiences on climate change adaptation
- Holding capacity building programs for developing countries
- Holding various international events including the Asia NAP EXPO, A-P Adaptation Forum, etc
- Support for adaptation efforts by other countries
- Participating in the international adaptation society such as IPCC, UNFCCC, etc

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II. Key Roles and Achievement of KACCC

II-3. Cooperation and Public Awareness

2) PR & Public Awareness

- Issuing and disseminating a periodic newsletter and brief on adaptation
- Raising awareness of adaptation through SNS
- Developing educational materials on adaptation
- Responding to media in relation to adaptation
- Holding PR events such as Talk Concert

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III. Challenges and the Way Forward

III-1. Main Challenges

- Wide work scope
  - Vertical : from the central level to the lower local level
  - Horizontal: various stakeholders from the governments to the civil society
  - Multidisciplinary: 10 sectors
- Position between science and policy
  - Different language and working style
- Long-term goal
  - Difficulty in making a tangible outcome

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III. Challenges and the Way Forward

III-2. The Way Forward

- Strengthening the monitoring and evaluation
- Encouraging more stakeholders to participate, and creating an open environment
- Aiming for the long-term goal, but making some tangible outcome in the short and medium term

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THANK YOU!

KEI

7. Session 2A

Innovation and transition

Chairs: Jim Watson (UKERC, UK) and Stefan Lechtenböhmer (Wuppertal Institute, Germany)

Description:

The transition to low carbon societies will require fundamental changes to technologies, infrastructures, business models, institutions, and policies. Whilst many countries have already made some progress, particularly in the power sector, there is a long way to go. So far, innovation has already played an important role in this transition. For example, it has delivered cheaper renewable electricity technologies that are now being deployed worldwide; it has driven improvements in energy efficiency; and it is starting to change road transport through improvements in electricity storage and electric vehicles. Further innovation will be required to meet the ambitious goals.

In line with the main theme of the 2018 annual meeting, this session will focus on *actions* that are already having an impact – particularly on how policy has driven innovation to help some countries, sectors, or regions to make progress with their low carbon transitions. Potential topics covered by this session could include:

1. National or sectoral success stories: What government policies, strategies, etc. have led to innovation and progress with low carbon transitions? Examples could include the rapid growth of renewables (e.g. China, Germany); overall emissions reductions (e.g. the UK); transitions that take into account both support for low-carbon and dealing with fossil fuel legacies (e.g. Norway).
2. Lessons from national approaches to innovation in terms of institutional arrangements, financing, and implementation of 'innovation systems' approaches: This could focus on particular national approaches or on more strategic or comparative analyses.
3. Public innovation policy to support clean technologies, including particularly breakthrough technologies, that may be needed to decarbonise difficult sectors such as processing industries, airborne transport, and agriculture: Innovation and particularly disruptive innovation have been highlighted in public policies, e.g. by the EU; France and Germany's joint initiative on disruptive and mission-oriented innovation (JEDI).
4. Social innovation: For example, we could include a speaker on socio-technical innovation in road transport that includes both vehicle innovation (e.g. EVs) and the emergence of new mobility services (integrated public transport, ride sharing, etc). Other social innovation could be national processes such as climate protection plan in Germany, climate change law in the UK, processes in France, or action in Japan to save electricity directly after the Fukushima nuclear accident.

Keywords: Innovation, transition, public innovation policy, renewables, lifestyle

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Innovation and transitions to low carbon societies: lessons from the UK

Jim Watson, Director, UKERC

LCS-RNet Annual Meeting, Yokohama 17th July 2018

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Overview

1. UK policy context
2. Innovation: a systems perspective
3. Three case studies of UK policy
4. Conclusions and policy lessons

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UK policy context

Climate Change Act 2008

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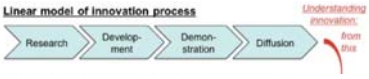
Innovation systems

Linear model of innovation process



Source:
Global Energy Assessment

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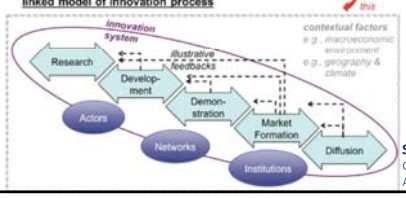
Innovation systems

Linear model of innovation process

Systematic representation of innovation with chain-linked model of innovation process



Source:
Global Energy Assessment

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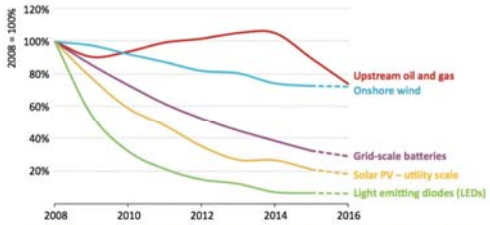
Meeting global climate targets

Innovation is already making an impact



Cost deflation has affected diverse technologies across the energy spectrum

Source: IEA World Energy Outlook (2016)

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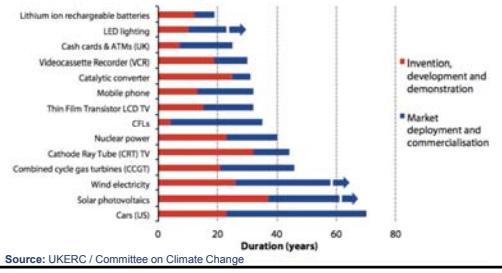
Meeting global climate targets
But: innovation takes time



Source: UKERC / Committee on Climate Change

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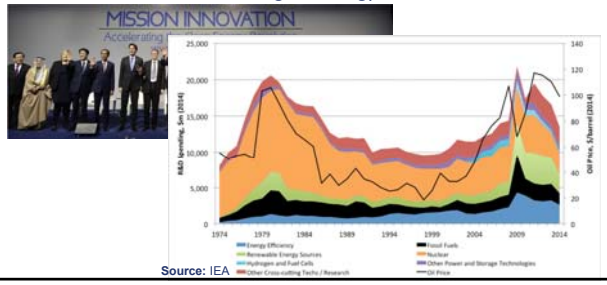
Meeting global climate targets
Public funding for energy R,D&D



Source: IEA

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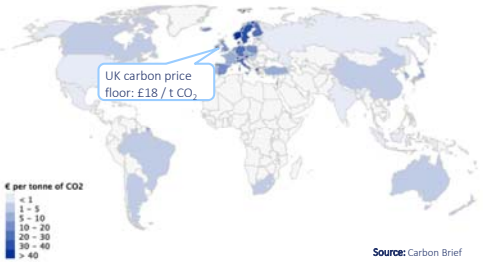
Meeting global climate targets
Carbon pricing



Source: Carbon Brief

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Markets and technologies are diverse: one price doesn't fit all

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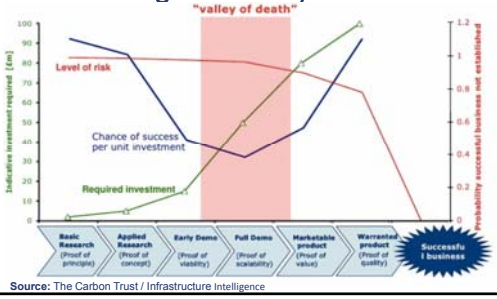
There is often a need to bridge the 'valley of death'



Source: The Carbon Trust / Infrastructure Intelligence

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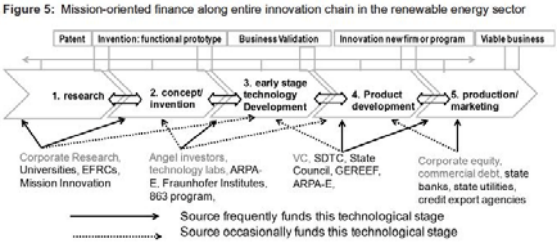
Different types to public and private finance also required

Figure 5: Mission-oriented finance along entire innovation chain in the renewable energy sector



Source: Mazzucato and Semieniuk, 2017

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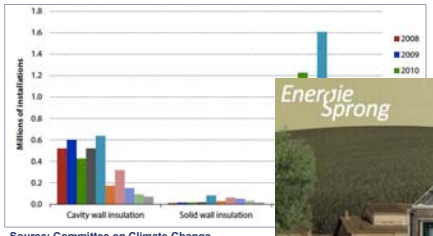
UK case studies
Energy efficiency in buildings



Source: Committee on Climate Change

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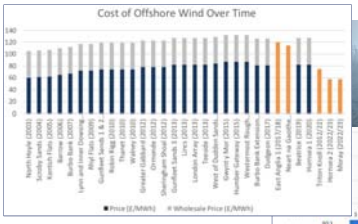
UK case studies
Offshore wind



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UK case studies
Low carbon vehicles

June	Total	Diesel	Petrol	AFV
2018	234,945	74,361	145,035	15,549
2017	243,454	103,564	129,169	10,721
% change	-3.5%	-28.2%	12.3%	45.0%
Mkt share 2018		31.7%	61.7%	6.6%
Mkt share 2017		42.5%	53.1%	4.4%

Year-to-date	Total	Diesel	Petrol	AFV
2018	1,313,994	428,612	812,535	72,847
2017	1,401,811	613,985	729,168	58,658
% change	-6.3%	-30.2%	11.4%	24.2%
Mkt share 2018		32.6%	61.8%	5.5%
Mkt share 2017		43.8%	52.0%	4.2%

Source: Society of Motor Manufacturers and Traders

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Lessons for policy

- Government policies shape the rate and direction of energy innovation, but national policies need to account for global trends
- Public funding of innovation is important, and needs to go beyond R&D to support demonstration and scaling up
- Carbon pricing necessary but not sufficient to create markets: specific policies, financing and institutions also required
- The UK has embraced a more 'mission-oriented' approach at a conceptual level, but implementation is very mixed

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Exploring the current state-of-the-art production processes for enabling a low-CO_2 transition of the EU energy intensive industries[1]

Matilda Axelson, Isobel Robson, Gauri Khandekar, Tomas Wyns, Vrije Universiteit Brussel (VUB) – Institute for European Studies (IES), Brussels, Belgium. matilda.axelson@vub.be

The EU energy intensive industries are large emitters of greenhouse gases, and will require new, breakthrough innovations in their production processes to enable decarbonisation. This paper presents findings from a study (Axelson et al., 2018) exploring the current state of play of ongoing developments in EU low-carbon dioxide (CO_2) production technologies in five energy intensive industries; iron and steel, chemicals, cement and concrete, pulp and paper, and ceramics.

Decarbonising the energy intensive industries

The EU energy and materials intensive industries have significantly reduced their greenhouse gas emissions over the past decades, but further major reductions will be required in order to meet the goals of the Paris Climate Agreement and to successfully transition to a circular economy. Although challenging, such emission mitigation will be possible only if current industrial processes are (at least in part) replaced by new low-CO_2 process innovations that can radically reduce the amount of greenhouse gases that are released into the atmosphere. (See also Bataille et al., 2018; IEA, 2018; Nilsson et al., 2017; Material Economics, 2018; Wyns & Axelson, 2016). The following sections discuss such breakthrough low-CO_2 production technologies currently under development in five energy intensive industries.

Low-CO_2 steel production technologies

The EU steel industry is currently investigating low-CO_2 production technologies in projects on hydrogen-based steelmaking, carbon capture and utilisation, as well as a number of other sustainable steelmaking processes. In addition, several low-CO_2 enabling technologies with potential to contribute to decarbonisation of the sector are being explored, for example carbon capture and valorisation technologies.

Most of the breakthrough steelmaking technologies show significant CO_2 mitigation potential but are currently on average at low level of technology readiness (TRL), and require significant funding to be further developed. Several of the innovations imply strong synergies with other industries, and their success rate will depend on breakthroughs in other sectors. For example, technologies using electricity show promise for major emissions reductions but depend firmly, for commercial viability, on low-cost (and renewable energy-based) electricity and/or hydrogen production.

Low-CO_2 chemical production technologies

[1] This short paper draws largely on recent research by the authors, published in the report 'Breaking Through' in July 2018. See Axelson et al. (2018).

Ongoing research on low-CO_2 chemical production technologies is primarily based on direct use of low-carbon electricity, hydrogen or CO_2-based production routes (including ethylene and propylene via hydrogen-based methanol), or biomass as feedstock.

The TRLs of the innovations range from medium to high, but energy demand of some of the breakthrough technologies is several times higher than conventional production processes, and hence mass implementation will require a large amount of affordable renewable energy. This requires capital and infrastructure investments also in other technologies that are essential for successful implementation, for example commercially viable hydrogen making technologies.

Low-CO_2 cement and concrete production technologies

Low-CO_2 developments in the EU cement and concrete industries include both new production technologies such as using alternative binders as substitute for Portland cement, but also innovative production practices based on changes in the concrete composition through optimised aggregate packing, concrete recycling, and CO_2 utilisation in concrete.

Deep emission reductions will have to come from a well-aligned set of technologies, techniques and downstream usage interventions. The alternative binder technologies have high TRLs and several are already available commercially. The issue for the sector is instead to a large extent related to upscaling: only few of the options show potential for upscaling on EU and global level, and barriers to further dissemination of these technologies require policy reforms in other parts of the value chain, e.g. in form of improved standardisation measures. Also raw material costs and availability will play a key role in determining the financial viability of these innovations.

Low-CO2 pulp and paper production technologies

Low-CO_2 solutions in the pulp and paper industry include routes related to fuel switching, increased material and energy efficiency, and production through 100% electricity. Significant research, development and demonstration is needed to further develop these technologies from their current generally low TRLs, and must take place within the next few years if they are to reach commercial scale by 2050. Industrial emissions in the sector can be significantly reduced through application of electrification technologies, provided that the electricity grid is decarbonised and that synergies with the electricity market are captured.

Low-CO_2 ceramic production technologies

Low-CO_2 technological development in the EU ceramic industry is currently on average at medium TRL and primarily based on new kiln designs, alternative energy sources and end-of-pipe processes. Some of these innovations have high abatement potential but still require fundamental research, development and demonstration. The industry is principally composed of small and medium-sized enterprises, which makes investments in large-scale innovation projects challenging and limits rapid development of breakthrough technologies without external support.

Enablers of change

Even though many of the assessed technologies demonstrate high potential to tackle greenhouse gas emissions, significant research, development and demonstration is still

needed to progress breakthrough low-CO_2 technologies and meet the long-term decarbonisation targets. A combination of private sector investments, industry-wide collaborations and EU funding mechanisms are expected to play key enabling roles to develop these technologies further. Next, barriers to market entry must be removed in order to enable commercialisation of these innovations, and once commercially viable, market mechanisms must allow for upscaling of uptake of low-CO_2 processes and products compared to high-emitting alternatives.

No single technology can independently solve the decarbonisation challenge, and a portfolio of different technologies in parallel with other mitigation strategies will be needed. Notably, several of the low-CO_2 production technologies currently under development in these industries are dependent on developments by other system-level actors in other sectors, due to mutual dependency between technologies and synergies from industrial symbiosis. Furthermore, the success rate of technically advancing these innovations is contingent also on external factors, such as access to large volumes of (affordable) renewable energy. Hence, the decarbonisation challenge requires a holistic approach that involves collaboration between all different stakeholders to the energy intensive industries – including strong political support and high industrial ambition.

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Enabling a low-CO_2 transition through innovation

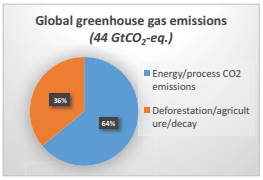
Industrial Low-CO_2 Technologies on the Horizon

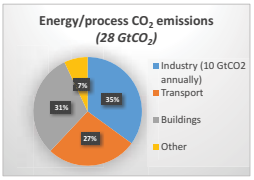
LCS-RNet Annual meeting, Yokohama 17 July 2018

Matilda Axelson
Doctoral Researcher
Matilda.Axelson@vub.be
Twitter: @MatildaAxelson

INSTITUTE FOR EUROPEAN STUDIES

The energy and material intensive industries account for approximately one third of global GHG emissions





Industrial sectors
- **Steel**
- **Cement**
- **Glass**
- **Aluminium**
- **Chemicals**
- **Plastics**
- **Non-ferrous metals**
- **Pulp and paper**

See also:

- Allwood, J. M., Cullen, J. M., Carruth, M. A., Cooper, D. R., McBrien, M., Milford, R. L., Moynihan, M. C. and Patel, A. C. (2012). Sustainable Materials: With Both Eyes Open. UIT Cambridge Ltd.
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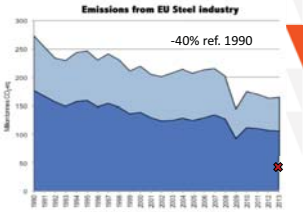
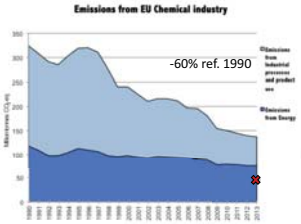
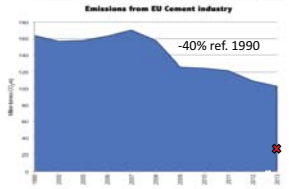
Industrial decarbonisation to date (ref. 1990)

- **80-95% emission reduction until 2050 (ref. 1990)**
- **Significant reductions to date**
- **A socio-economic challenge**
  - Major contributors to EU GDP; large employers
  - Global value chains; strong interlinkages upstream and downstream



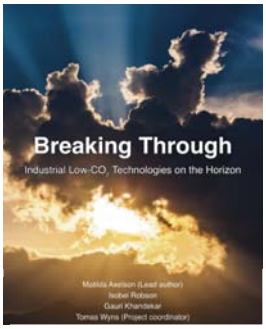




New Report: 'Breaking Through' - Industrial Low-CO2 Technologies on the Horizon

Iron and steel

Chemicals



Cement

Ceramics

Pulp and paper

Full report available at:
https://ies.be/other/breaking-through-%E2%80%93-industrial-low-co2-technologies-horizon

Mapping low-CO2 production technologies currently under development

- Technology readiness level (**TRL**)
- **Emission** mitigation potential
- **Energy** demand
- **Costs** (CAPEX and OPEX)

- Mapping based on secondary sources
  - Industry reports
  - Project websites
  - Media articles
  - (Peer-reviewed articles)

- Scope limited to development inside the EU

Mapping low-CO2 production technologies currently under development

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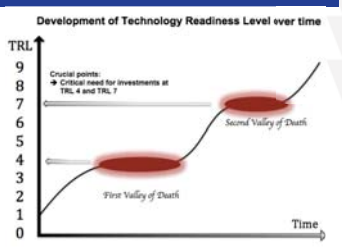

See also

- H2020 (2014). HORIZON 2020 – WORK PROGRAMME 2014-2015. General Annexes. Available at: https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf
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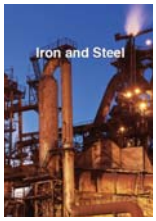
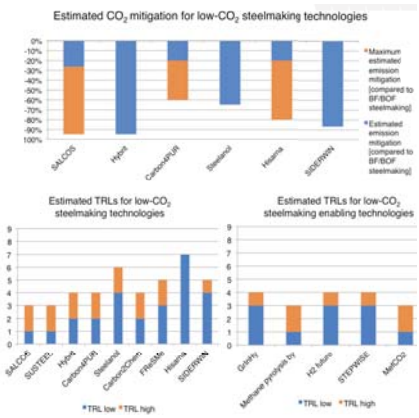
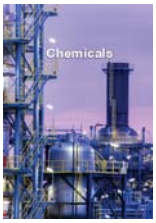


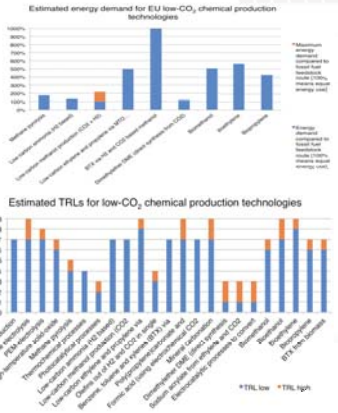
- **Hydrogen-Direct Reduction of Iron**
  - Enabling technologies for hydrogen-making
- **CCU**
- **Electrolysis**
- **New furnaces**

- Low TRL: Major investments needed for upscaling
- Strong industrial symbiosis
- Strong dependency on the availability of hydrogen and renewable energy

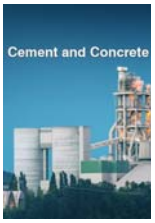




- Direct use of **low-carbon electricity**
- **Hydrogen/CO2-**based production routes
- **Biomass** as feedstock
- Ethylene via ethanol from **syngas**



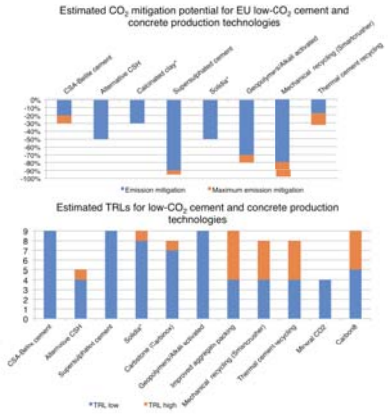
- High TRL; Decades of industrial experience
- Availability of renewable hydrogen
  - Infrastructure; technologies
- Large additional energy demand
  - Availability of renewable energy and/or biomass

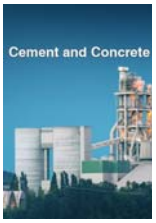


Special routes due to nature of cement:

- Minimising emissions in the **production** processes
- Optimising the **content** of concrete products
- Efficient **recycling** of final products.
- **CCU** and **CCS**

- Very high TRL; delimitations instead in scalability
  - Scarcity of raw materials (in the EU)
  - Hampering European standards (EN 197-1)





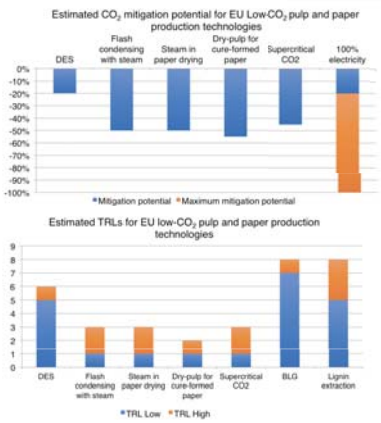
Challenge: Few options can be scaled up to EU/global level

Technology name	Estimated theoretical emission mitigation	Applicability at large scale (Own estimations)
CSA-Belite cement	20-30% (compared to CEM I)	Limited availability of substitute
Alternative CSH	50% (compared to CEM I)	Limited applicability of product and scaling of process
Calcinated clay	30% (compared to Portland cement)	Relatively wide availability of raw material (globally, EU)
Supersulphated cement	90-95% (compared to CEM I)	Limited availability of substitute
Solidia	60% (compared to Portland cement)	n.a.
Carbstone/ Carbinox (Registered Trademark)	Twofold mitigation impact: - Replacement of clinker and carbonation during production process. - Net negative emissions due to absorption of CO_2 (-0.15 to -0.20 tons CO_2/m3 carbstone concrete) (compared to concrete 0,155 tons CO_2/m3 concrete)	Limited to availability of steel slag
Geopolymers/ Alkali activated	min. 70-80% (compared to CEM I)	Limited to availability of raw materials
Improved aggregate packing	20-40% less cement in concrete for non-constructive purposes; 0-5% less cement for constructive concrete	Relatively wide availability (global scale, EU)
Mechanical cement recycling (Smartcrusher)	80%, by using a mix of crushed concrete and CEM III; Up to 90%, by using only crushed concrete (compared to CEM I)	Limited to availability of concrete waste, but possible sector-wide application across EU concrete industry
Thermal cement recycling	17,5-32,5% (compared to CEM I)	Limited to availability of concrete waste
Mineral CO_2	40-60 kg CO_2 can be captured per m3 of concrete.	Limited applicability
Carbon8	n.a.	Limited to availability of raw materials

Only two of the technologies have (relatively) wide applicability at large scale

- **Deep Eutectic Solvents** (DES) in pulping
- **Steam** technologies
- **Dry-pulp for cure-formed paper**
- **Electrification**

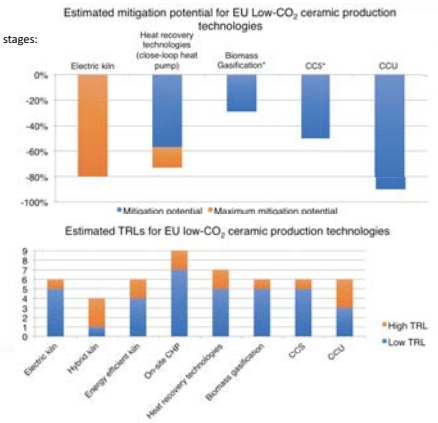
- Low TRLs; significant funding needed
- Availability of renewable electricity;
  - Sector largely affected by developments on the electricity market
- National conditions and regulations



Innovations across production stages:

- **Preparation**
- **Drying**
- **Firing**
- **Finishing**

- Medium TRLs
- High percentage of SME's and high capital expenditures
- Sector would benefit from CCU/CCS technology development (by other sectors)

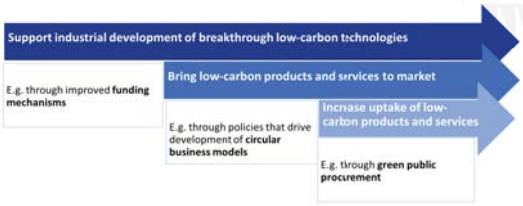


Three steps towards successful facilitation of industrial decarbonisation

Barrier

- New breakthrough technologies needed
- Distance to market; no market access
- Lack of demand; barriers to scalability

Enabler



Improve funding mechanisms (EU and MS) for breakthrough innovation

Expected sustainable outcome:
Improved industrial development of breakthrough low-CO_2 technologies (for Technology Readiness Levels 1-9)

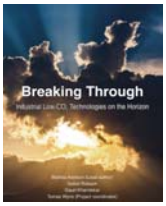
Develop policies for circular business models

Expected sustainable outcome:
Bringing new low-CO_2 products and services to market

Increase utilization of green public procurement

Expected sustainable outcome:
Increased uptake and scaling of low-CO_2 products and services

Recommended further readings



Full report available at: https://ies.be/other/breaking-through-%E2%80%93-industrial-low-co2-technologies-horizon

Full report available at: http://www.ies.be/files/The_Final_Frontier_Wyns_Axelson_0.pdf

Full report available at: http://materialeconomics.com/publications/the-circular-economy

Full report available at: http://i2-4c.eu/wp-content/uploads/2018/03/Low-Carbon-Innovation-for-Sustainable-Infrastructure-The-role-of-public-procurement_v2.2_web.pdf

Thank you!

Matilda Axelson

Doctoral Researcher
Institute for European studies
Vrije Universiteit Brussel

Matilda.Axelson@vub.be
Twitter: @MatildaAxelson

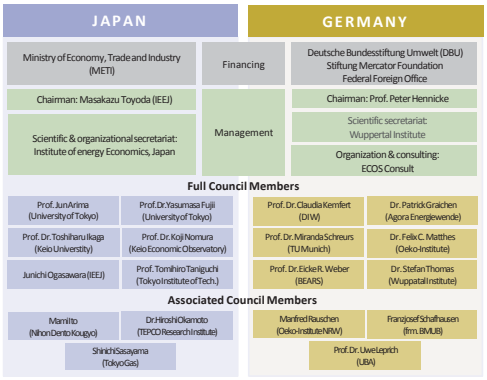
GJETC as a role model of bilateral cooperation

Breakout session 1A:
1.5/2 degree target and long- term low-carbon global development strategy

Ichiro Kutani
Senior economist, Manager, Global Energy Group 1
The Institute of Energy Economics, Japan

What is GJETC?

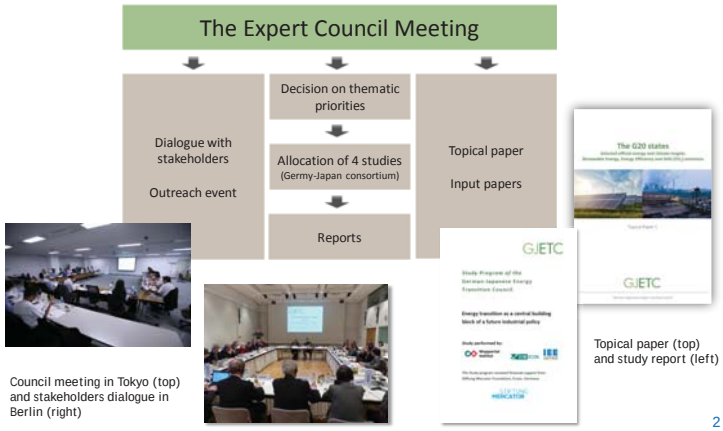
- GJETC (German-Japan Energy Transition Council) is an unique platform to catalyze scientific discussion providing recommendation for stakeholders to accelerate energy transition in respective countries.



Structure of the GJETC
Source: GJETC

How it work?

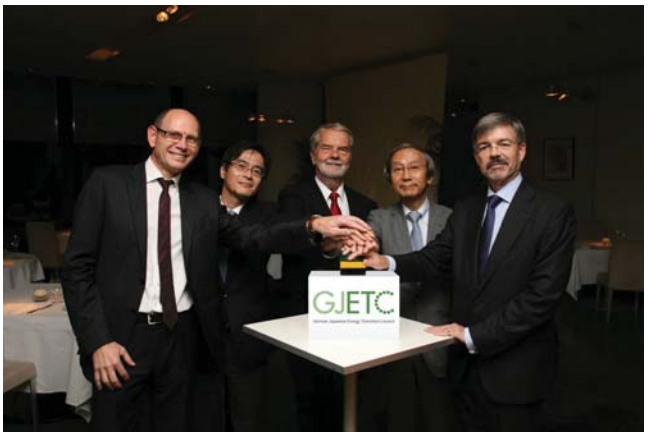
- Consist of deep scientific studies and diverse communication channels.



Council meeting in Tokyo (top) and stakeholders dialogue in Berlin (right)

Topical paper (top) and study report (left)

Started in September 2016



Inauguration ceremony at the presence of ambassador of Germany to Japan and deputy commissioner of ANRE, METI

Our 2 years record

Sep 2016	Inauguration, the 1st council meeting in Tokyo Stakeholders dialogue: Industry
Jan 2017	The 2nd council meeting in Berlin Stakeholders dialogue: Decentralized energy / player
Sep 2017	The 3rd council meeting in Tokyo Stakeholders dialogue: Energy efficiency
Feb 2018	The 4th council meeting in Berlin Outreach event: panel discussion
Apr 2018	Publication of "GJETC Report 2018"

Jan 2017 — *Inception*

4 thematic studies

Oct 2017 — *Final report*

4 thematic studies

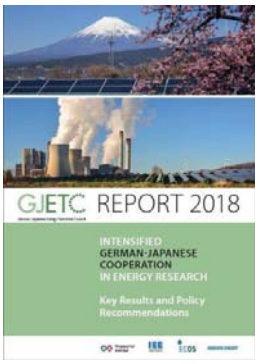
Topic	Contractor
ST 1 Energy transition as a central building block of a future industrial policy - Comparison and analysis of long-term energy transition scenarios	Wuppertal Institut (DE) DIW Econ (DE) IEEJ (JP)
ST 2 Strategic framework and socio-cultural aspects of the energy transition	IZES (DE) Arepo Consult (DE) IGES (JP) Nagoya University (JP)
ST 3 New allocation of roles and business segments of established and new participants in the energy sectors currently and within a future electricity market design	IZES (DE) JEPIC (JP)
ST 4 Energy end-use efficiency potentials and policies and the development of energy service markets	Ecofys (DE) IAE (JP)

Input papers

Topic	Author
The costs of integrating variable renewables in a transforming power system	S. Mocker, D. Pescia, P. Graichen (2018)
Study on health co-benefits to promote energy-efficient housing retrofit in Japan	T. Ikaga (2018)
The coupling of energy sectors – a promising strategy to a decarbonized world?	K. Purr, M. Werlein, U. Seel, U. Leprich (2018)
Extensive introduction of intermittent renewabled in Japan's power system	Y. Fujii (2018)
Nuclear power in Europe is not competetive nor required	C. Kemfert, C. von Hirschausen, C. Lorenz, C. Gerbaulet, P. Oei, B. Wealer (2018)
The role of energy efficiency for the energy transition – A brief overview	P. Hennicke, S. Thomas (2017)
Japan's Energy and Climate Quadlemma	J. Arima (2017); Reviewer: F. Schafhausen
Ambitious climate targets – the prerequisite for a successful, future-oriented climate change policy – A Comparison	F. Schafhausen (2017); Reviewer: J. Arima
Comprehensive Energy Security in the Age of Globalization and ICT Revolution	T. Taniguchi (2017)

6

Our result



Scenes from the outreach even in Berlin in February 2018

7

Key recommendations

- Joint effort to decarbonize the energy system
- Thorough analysis and periodical review
- Renewable energies and system integration
- Energy efficiency governance
- Restructuring the electricity and gas sector
- Integrate energy and resource efficiency policy
- Efficiency and sufficiency
- Energy renovation of building
- Centralized and decentralized energy system
- Robust and accountable target/goal, strategies, and the corresponding policy mix
- Continuous evaluation and involvement of all stakeholders
- Disseminating low-carbon technologies to other countries
- Joint scenario modeling
- Bilateral agreement on an educational exchange program

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Value of GJETC

- Scientifically independent
- Controversial topics
- Continuity and depth of research
- Dissemination for better informed decision-making
- Joint development and deployment of innovations
- Deepening of personal network

9

What next?

- Anticipate continue and extend our beneficial joint activity.

Benefit for Germany and Japan	Benefit for other countries
• Gain useful lessons from the other that enable and even accelerate energy transition in a country.	• Refer GJETC as a role model for their bilateral cooperation.

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Please visit;

GJETC http://www.gjetc.org/

We provide part of our cutting-edge research results on energy and the environment on our website free of charge.

IEEJ Website
http://eneken.ieej.or.jp/en

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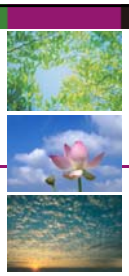
Overview: Environmental Innovations in Japan



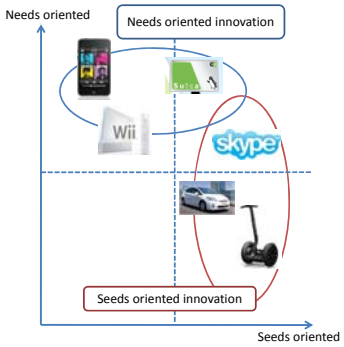
Breakout session 2A
"Innovation and Transition",
LCS-Rnet 10th Annual Meeting
17 July 2018, Yokohama, Japan

Hideyuki Mori
Executive Director
IGES

LCS·R Net
IGES Institute for Global Environmental Strategies

Innovation: Seeds and Needs

(Source) Nikkei Shinbun 18 August 2009

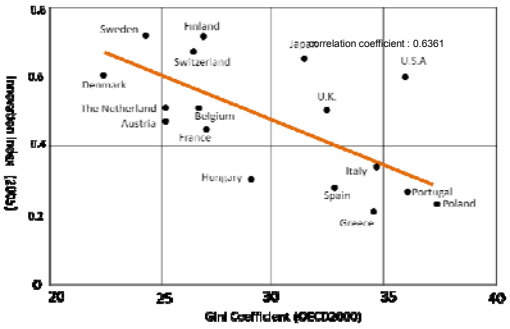


Innovation in Short

A slogan found in the Ministry of Industry, Myanmar
"Resources are limited."
"Innovations are unlimited."

Knowledge generation in a sustainable world
"Limitations create innovations." (Porter hypothesis, and Planetary Boundary by J. Rockstrom)
"Dialogues generate inspirations/ideas."

Knowledge Generation in Society
Higher Social Capitals Generates More Innovations



Source: Noboru Konno "Shiawase na Shokoku Oranda no Yume" PHP Interface, 30 Jan. 2012

Innovation in Practice

Innovation tends to occur:

(i) in a complex set of **processes** that links not only developers and users, but a wide variety of intermediary organizations such as **standards bodies (or even regulatory bodies).**

(ii) at the **boundaries of organizations** and industries where the needs of users, and the potential of technologies can be linked together in a creative process.

Collapse of Social Bonds through Extreme Individualization
- Eating Alone -

Source: Sincho Weekly 26 Jan. 2012

Collapse of Social Bonds through Extreme Individualization
- Karaoke: Singing Alone -

Source: Sincho Weekly 26 Jan. 2012

Overview

Three cases are to be reviewed: i.e. Low emission vehicles, Energy efficiency, and SDGs and Innovation.

Overall Trend would be:

(i) From Mandatory (all companies) through Best Practices to Voluntary (individual companies), and

(ii) From Production to Consumption including lifestyle changes.

Cace 1
Development of Low Emission Vehicles

US Muskie Act

- The Muskie Act of US was introduced in 1970, making mandatory to reduce emissions (CO, HC, and NOx) from automobiles by 90 %.
- In response, the same emission control was intended to be introduced in Japan, in 1971.
- Due mainly to strong oppositions from the Big Three, US discarded the Muskie act in 1974.
- Japan, nevertheless, introduced the emission control in 1973, which made the Japanese auto industry very competitive (i.e. Porter Hypothesis).

Seven Major Cities Joint Investigation Team on Automobile Emissions

- Aug. 1974: the Investigation Team established in 1974 by mayors of seven major cities (Tokyo, Yokohama, Nagoya, Osaka etc.)
- The Team consists of 7 experts handed by Prof. Shibata, President of the Tokyo Metropolitan Pollution Institute.
- Sep-Oct. 1974: An interim and the final reports prepared after intensive interviews with each of major automobile companies, and others.
- The reports clearly indicated it would be feasible for companies to comply with strengthened emission standards.
- Two major companies were opposing to the new regulations, while Honda and a couple of other companies were more positive.

Serious air pollution case in Tokyo

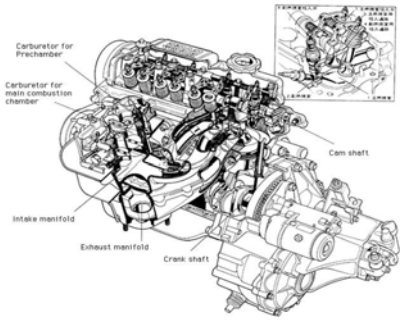
1.Photpchemical smog in Rissho High School in Tokyo in 1970, making 150 students sick.
2. Air pollution alarms in Tokyo: 9 in 1970, 51 in 1971, 67 in 1972, 100 in 1973, and 74 in 1974

Pres. S. Honda announces development of new engine (CVCC)

Source: Honda homepage

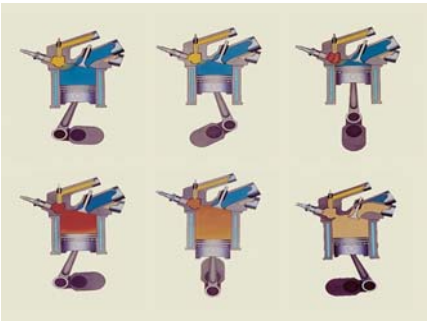
Basic Design of CVCC

(Source: Honda Homepage)



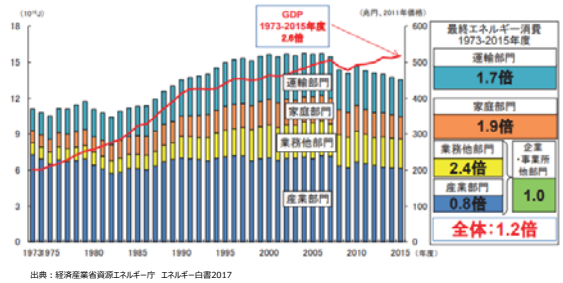
Concept of CVCC

(Source: Honda Homepage)



Cace 2
Japan's Experiences to Promote Energy Efficiency

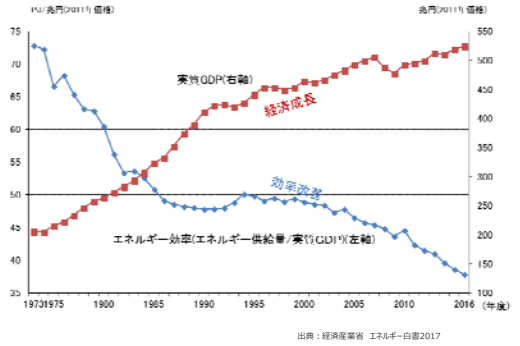
Total Energy Consumption in Japan



出典：経済産業省資源エネルギー庁 エネルギー白書2017

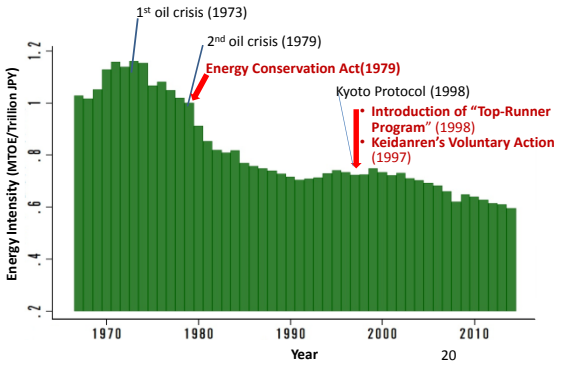
The East Japan Disaster in Mar. 2011

Decoupling between GDP and Energy Effieiency



出典：経済産業省 エネルギー白書2017

Major Events and Energy Intensity Trend of Japan



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Mandatory Measures to Achieve Energy Efficiency

Energy Conservation Act (introduced in 1979 and amended 7 times)

✓Covering **90%** of finial energy consumption in the **industrial sector**, **70%** in the **residential sector** and the **50%** in the **commercial sector**.

✓Containing mandatory measures:

- **Requirement of energy management** in industrial and commercial sectors.
- **Energy efficiency standards** for machinery and equipment.
- **"Top Runner Standards"** in 1998 for electric appliances and vehicles, as well as for residential and commercial buildings.

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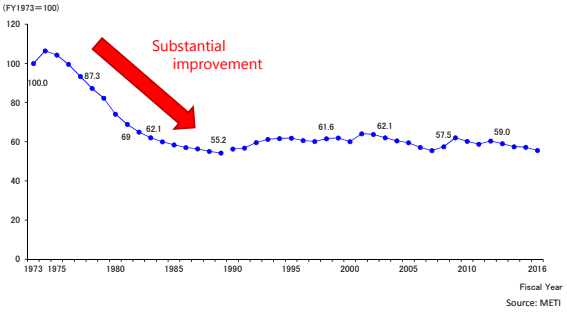
Effects of Mandatory Energy Efficiency Standards

Trend in Energy Intensity of the Manufacturing Sector
(energy amount needed to produce a unit of production)



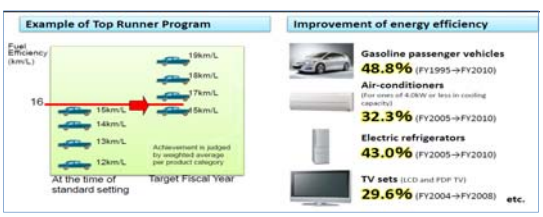
Source: METI

Effects of Top Runner Program

Introduced in 1998, revision of the Energy Conservation Act

✓ Dynamic in two ways:

- Standard setting : **First attempt in the world** to establish the **highest energy efficiency in a given industry** as the standard for entire industry
- Expanding coverage: **11 product in 1998**, and now **31 energy-consuming products** and building materials



Conclusion

- Japan has improved its energy efficiency by **approximately 40%** after the oil crises since 1970s;
- Proactive actions **by both public and private** sectors taking **mixed set of measures: mandatory, incentives, voluntary, campaigns,** etc.;
- **The PDCA-cyclic process** has been considered when taking actions (by stakeholders incl. Gov't) with precise manuals/guidance/guidelines;
- Japan will continue to enhance its energy efficiency through drastic reduction targets **especially at "Commercial & other" and "Residential" sector;**

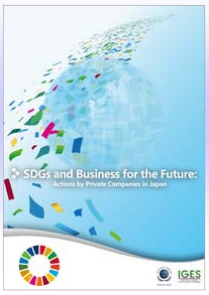
Case 3
SDGs and Innovation in Japan

"SDGs and Business for the Future: Actions by Private Companies in Japan"

by
Global Compact Network Japan (GCNJ)
and
Institute for Global Environmental Strategies (IGES)

Mar. 2018

(English version just released in July 2018!)



https://pub.iges.or.jp/pub/sdgs-and-business-future-actions-private

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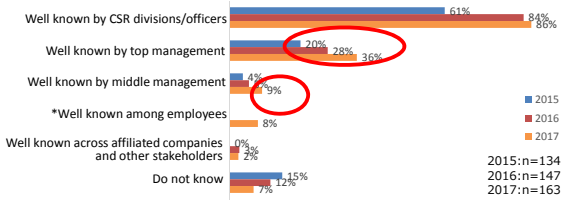
SDGs Awareness in Surveyed Companies/Organizations

- SDGs awareness is steadily increasing at top management reaching 36% in 2017.
- Low level of SDGs awareness at middle management remains a challenge.

Please select applicable status of SDGs awareness in your company/organization (multiple choice, *newly added in 2017)



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Integrating SDGs into Core Business I - Organization

- Philosophy ①Corporate philosophy/vision
- Leadership ②Understanding/commitment of top management
- Strategy ③Medium and long-term management plan and goal setting
- Structure ④CSR division, executive committee
- System ⑤Mechanism to facilitate solutions to social problems, ⑥Reward system
- People ⑦Understanding of middle management/business units

The dimension of "Organization" that enables sustainability and SDGs to be embedded within business operations and management.

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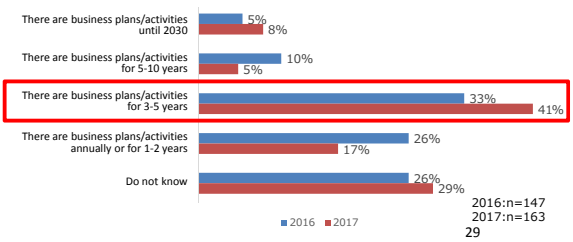
Integrating SDGs into Core Business I - Organization (cont.)

Strategy ③Medium and Long Term Management Plan and Goal Setting

- It is essential to link mid-term management plans with sustainability plans, and to engage relevant divisions in planning processes.

Please indicate the status of your company/organization's business planning related to the SDGs



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Integrating SDGs into Core Business I - Organization (cont. II)

System ⑤Mechanism to facilitate solutions to social problems

DSM – ECO+ solutions & People+ solutions

- Based on the lifecycle assessment
- Measure environmental impact (CO2 emission, resource collection, disposal, etc.) and certify highly evaluated product groups as "ECO+ solutions"
- Measure social impacts (working conditions, health condition, etc.) and certify highly evaluated product group as "People+ Solutions"

Brighter Living Solutions

Innovations and products that are better for the planet (Eco+) and people (People+) based on a product life cycle approach

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Integrating SDGs into Core Business II - Corporate Activities

⑧Core Business（Capturing and expanding business opportunities）
⑨Core Business（Addressing management risks）
⑩Social business with small profit / Philanthropic activities associated with core business
⑪Improving market environment ← Development of regulations/standards and industry-specific norms, participation in initiatives etc.

- Companies should aim to contribute to SDGs through their "core business"
- But it is also important to engage in ⑩ and ⑪ to realize a sustainable society.

Dimensions of "corporate activities" contributing to solving social problems.

Integrating SDGs into Core Business II - Corporate Activities (cont.)

⑧Core Business（Capturing and expanding business opportunities）
KONICA MINOLTA – Development of "Care Support Solutions®"

- Japan is facing a super-aging society with shrinking working age population.
- Identified the shortage of nursing care staff and increasing burden on them as an urgent challenge.
- Collected data on actual status of nursing care services on site, and identified challenges.
- Transformed workflow by using smartphone etc. Significantly reduced the amount of nursing staff activities and working hours.
- Improved work productivity, the quality of nursing and care services

Konica Minolta's Care Support Solution

Integrating SDGs into Core Business II - Corporate Activities (cont. II)

⑪Improving market environment
DAIKIN – Strategically Creating a New Market

- Introduced an index and labeling system for proper evaluation of energy performance, supported disseminating a next-generation HFC-32 refrigerant, and allowed free access to Daikin patents in emerging countries.
- Promote this effort through collaboration with governments, international organizations and other companies in the same industry.
- Contributed to ozone layer protection as well as climate change mitigation and simultaneously disseminated air conditioners which is Daikin's core business.

Key Messages

✓ SDGs helps companies identify social problems and corporate risks. Considering these problems/risks as business opportunities, companies can aim to strengthen and expand existing businesses, and to develop new businesses (In particular, ICT and AI technologies etc. have huge potential, and key to capture business opportunities).

✓ An effective measure to boost this approach is to give incentives to SDGs-related activities through the establishment of a mechanism to facilitate solutions to social problems (awards, remuneration, evaluation system etc.) within a company. This could be useful to increase SDGs awareness among middle managers.

✓ Approaches to improve market environment, social business with small profit and philanthropic activities associated with core business could be regarded as useful measures to capture new business opportunities. These should be implemented aligned with core business operations.

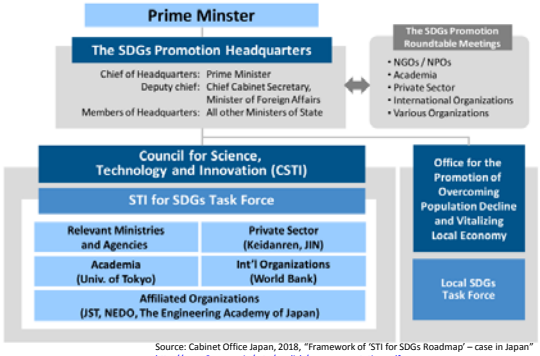
✓ In order for these activities to be considered as investment rather than cost, it is necessary that SDGs elements are incorporated into mid- and long-term plans and strategies. Desirably, mid- and long-terms goals should be set ambitiously, rather than limiting them to readily achievable.

Concept of "Society 5.0" by Japanese Government

- The basic concept: "human-centered" society pursuing human well-being and happiness released from physical restrictions
- Same idea aimed at SDGs which is " No one will be left behind"

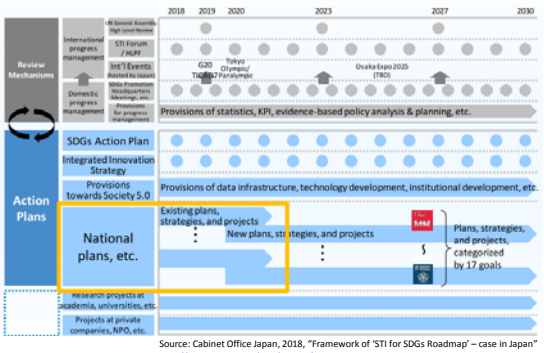
Source: Cabinet Office Japan, 2018, "Framework of 'STI for SDGs Roadmap' – case in Japan"
http://www8.cao.go.jp/cstp/english/egm_presentation.pdf

Overview Structure for SDGs Initiative



Source: Cabinet Office Japan, 2018, "Framework of 'STI for SDGs Roadmap' – case in Japan"
http://www8.cao.go.jp/cstp/english/egm_presentation.pdf

STI for SDGs Roadmap（draft） by Japan



Source: Cabinet Office Japan, 2018, "Framework of 'STI for SDGs Roadmap' – case in Japan"
http://www8.cao.go.jp/cstp/english/epm_presentation.pdf

STI for SDGs Roadmap（draft） by Japan

*Contents in yellow square in the previous page

Source: Cabinet Office Japan, 2018, "Framework of 'STI for SDGs Roadmap' – case in Japan"
http://www8.cao.go.jp/cstp/english/epm_presentation.pdf

International Contribution as of Japan

Contribution on Roadmap

- Extracting principal elements and co-developing 'Guideline' on how to formulate STI for SDGs Roadmap at country and international levels, taking into account various experiences including Japan

Contribution on Seeds-Needs matching

- Essential characteristic of international contributions from Japan i.e., Win-Win approach through nourishing burgeoning business ⇔ one time ODA, unsustainable infrastructure, etc...

Source: Cabinet Office Japan, 2018, "Framework of 'STI for SDGs Roadmap' – case in Japan"
http://www8.cao.go.jp/cstp/english/epm_presentation.pdf

Thank you very much for your attention.

Hideyuki Mori
Executive Director

IGES
Institute for Global Environmental Strategies

8. Session 2B

Actions in Developing Countries

Chair: Toshihiko Masui (NIES, Japan)

Description:

Implementation of mitigation and adaptation programs in developing countries are key components to realising a decarbonised, resilient world. Greenhouse gas emissions from developing countries are, in fact, expected to increase dramatically in a business-as-usual scenario, as these countries attempt to address their development imperatives. Hence, ensuring that developing countries have the opportunity to leapfrog to sustainable development pathways is critical to simultaneously addressing both climate and development goals.

During this session, the following issues will be discussed:

1) What kind of sustainable development pathways and actions including Nationally Determined Contributions (NDCs) are being considered and/or implemented in developing countries?
2) What would it take to make effective progress towards sustainable development, and how might developed countries support such transitions in developing countries?
3) How can actions in urban areas support the implementation of NDCs in developing countries?

Keywords: SDGs, Technology Transfer, NDC

Thailand's NDC Roadmap and 1.5 Degree Scenario

Bundit Limmeechokchai

Sirindhorn International Institute of Technology, THAMMASAT University, Thailand
Email: bundit@siit.tu.ac.th; bundit.lm@gmail.com

Abstract

Thailand's Nationally Determined Contribution (NDC) proposes mitigation intention in the energy and transport, industrial processes and product use and waste sectors to reduce emissions by 20 percent in 2030 below the Business-as usual (BAU). Then, we investigate its emission reduction projection when extended to 2050 to comply with the global climate goal under proposed countermeasures. The AIM/Enduse is employed to investigate Thailand's 1.5 degree scenario. Results suggest that CO_2 emission taxes of US$500 – US$1,000/tCO_2 will be a significant policy instrument to foster CO_2 reduction. The carbon capture and storage (CCS) technology will play a key role to abate higher CO_2 emissions. Moreover, electric vehicle and biofuel used in the transport sector shows opportunities to lower CO_2 emissions. Finally, the 1.5 degree climate target is feasible for Thailand; however, uncertainties remain.

Introduction

Thailand is one of the countries facing severe impact of climate change, which may influence country's sustainable development in the future. On July 14, 2015, the council of minister approved the Thailand's climate change master plan 2050, which is a long-term plan supporting Thailand to provide the concrete framework for resolving the climate change problem and achieving its vision in 2050, that Thailand is immune to climate change and has a low carbon emission growth in line with sustainable development. In addition, Thailand has ratified to be a party to the United Nations Framework Convention on Climate Change and signed the Kyoto protocol and the Paris agreement, which increases the importance of long-term planning development for resolving the climate change problem, especially for achieving the greenhouse gas emission reduction commitment.

On December 29, 2014, Thailand has submitted its Nationally Appropriate Mitigation Action (NAMA) plan to lower greenhouse gas emissions below its business as usual by 2020. Thailand's NAMA proposes action in the energy and transportation sectors, that are high potential and readiness for mitigation measures, to reduce emissions between 7 to 20 percent below projections for 2020.

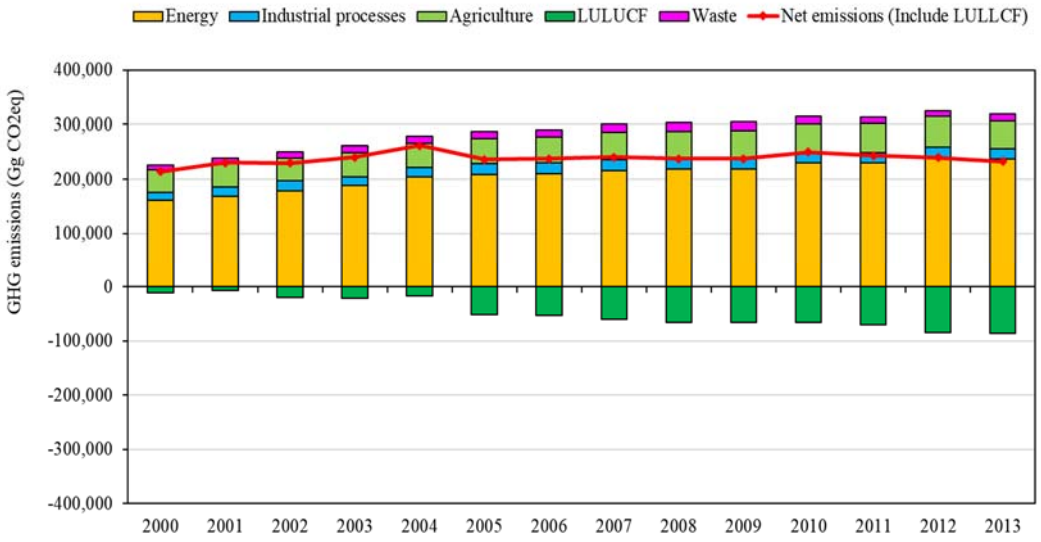
On September 30, 2015, the council of minister approved the Intended Nationally Determined Contribution (INDC) of Thailand. The Kingdom of Thailand, which is the one of non-Annex I countries and a party to the UNFCCC, submitted its new climate action plan on October 1, 2015. Thailand's NDC proposes mitigation intention in the energy and transport, industrial processes and product use and waste sectors to reduce emissions by 20 percent in 2030 below its projection level. Its mitigation potential is up to 25 percent with technology transfer, financial resource and capacity building supports under the UNFCCC agreement.

Based on the Cabinet's resolution on 23 May 2017, the main implementing agencies of Thailand's NDC Roadmap 2030 of the energy, transportation, Industrial Processes and Product Use (IPPU) and waste management are Energy Policy and Planning Office (EPPO), Office of Transport and Traffic Policy and Planning (OTP), Department of Industrial Works (DIW) and Pollution Control Department (PCD), respectively.

Thailand national greenhouse gas emissions

During 2000–2013, total emissions (excluding those from the LULUCF sector) increased from 226,086 $GgCO_{2eq}$ in 2000 to 318,662 $GgCO_{2eq}$ in 2013 (see Fig.1) The net removal of CO_2 increased from 11,995 $GgCO_{2eq}$ in 2000 to 86,102 $GgCO_{2eq}$ in 2013. Therefore, the net GHG emission increased from 214,091 $GgCO_{2eq}$ in 2000 to 232,560 $GgCO_{2eq}$ in 2013, with annual increase of 0.64%. When the LULUCF sector is included, the net emission in 2013 increased by 8.63% when compared with the net emission in 2000. The major source of GHG emissions was the energy sector, which increased from 161,005 $GgCO_{2eq}$ in 2000 to 236,936 $GgCO_{2eq}$ in 2013, an increase of 47.16%.

Fig.1: Trend of National GHG emissions/removals during 2000-2013.



Methodology

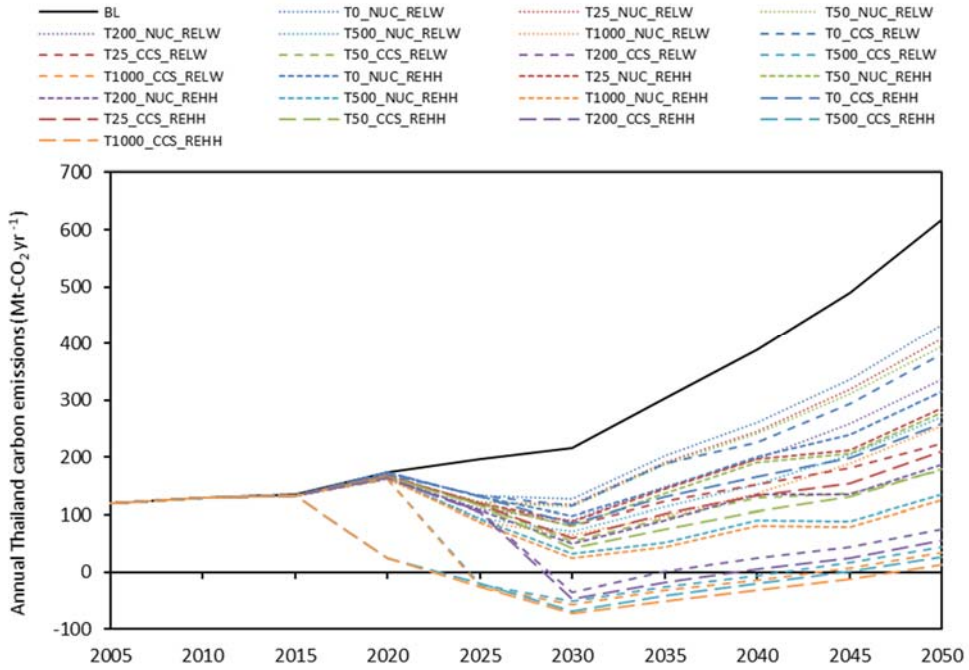
The Asia-Pacific Integrated Assessment Model (AIM) was developed through the collaboration between the National Institute for Environmental Studies (NIES), Kyoto University, the Mizuho Information & Research Institute, and other Asian researchers (Oshiro, Kainuma, and Masui 2016). The AIM model does not only focus on the characteristic of Asia-pacific economy and its energy system but also on relevant policies to support low-carbon pathways (Kainuma, Matsuoka, and Morita 2011; Kainuma et al. 2017). In this study the AIM/Enduse is selected to quantify climate change assessment and relevant policies action to mitigate CO_2 emissions.

The 1.5 degree study considers emissions from energy sector and CO_2 emissions absorption by forestry areas. The Royal Forest Department announced that forest areas will be increased by approximately 40% by 2026 (The Royal Forest Department, 2014). Emissions in the BAU is presented in Fig.2.

Results

Figure 2 reveals emission pathways of Thailand towards 2050**.** It suggests that early actions should be taken to achieve net zero CO_2 emissions. CO_2 emissions should peak in 2015 at US$1,000/$tCO_2$ in the CCS_REHH scenario. However, CO_2 emissions can peak five years later in the CCS_RELW scenario at US$1,000/$tCO_2$**.** Results reveal that CO_2 emissions peak five years later in the CCS_RELW scenario when compared to the CCS_REHH scenario.

Fig. 2. Thailand annual CO_2 emissions in 2050.



Notes: T25 = 25 US$1,000/$tCO_2$ Tax, T50 = 50 US$1,000/$tCO_2$ Tax, T200 = 200 US$1,000/$tCO_2$ Tax, T500 = 500 US$1,000/$tCO_2$ Tax, T1000 = 1000 US$1,000/$tCO_2$ Tax, CCS = Carbon capture and storage, NUC = Nuclear, REHH = High renewable energy, RELW = Low renewable energy.

Conclusions

Results suggest that carbon taxes of US$500 and US$1000/tCO_2 can help achieve the 1.5 degree climate target before 2050. CO_2 emissions will be completely removed from the power sector due to the CCS technology in 2020. Renewable energy, especially wind and solar power, play an important role in CO_2 mitigation. However, total CO_2 emissions will not achieve zero CO_2 emissions due to unavoidable use of fossil fuel in the transport and industrial sector. The study suggests that Thailand can achieve the zero CO_2 emission by 2050 if the carbon tax is greater than US$1000/$tCO_2$.

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Oshiro, Ken, Mikiko Kainuma, and Toshihiko Masui (2016). Assessing decarbonization pathways and their implications for energy security policies in Japan. Climate Policy 16 (sup1): S63-S77. DOI: 10.1080/14693062.2016.1155042.

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10th Annual Meeting of International Research Network for Low Carbon Society (LCS-RNet)

17 July 2018
Yokohama, JAPAN

Actions in the Developing World: Decarbonized Thailand

Bundit Limmeechokchai
Sirindhorn International Institute of Technology
Thammasat University, Thailand

SEAC Sustainable Energy & Low Carbon Research Unit

Thailand's Climate Change Master Plan 2050

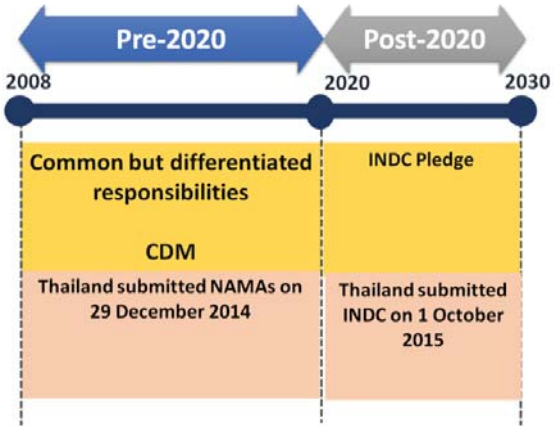
Vision

"Thailand can achieve adaptation to climate change and will be a low carbon society in sustainable approach"

Approved by Cabinet on 14 July 2015

2

Thailand CO_2 emission targets



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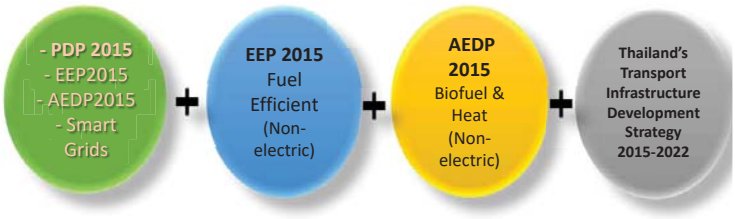
Innovation of Thailand's NDC Roadmap 2030



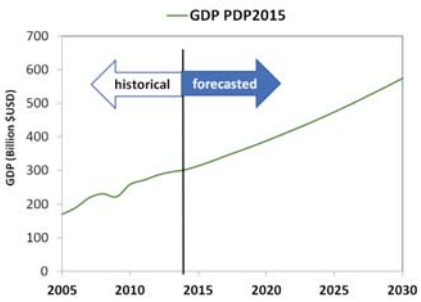
4

Long-Term Economic Growth (2015-2036)

Year	2015	2016	2017	2018	2019	2020	2021	2022
GDP	4.0	4.4	4.7	4.3	4.1	4.2	4.2	4.1

Year	2023	2024	2025	2026	2027	2028	2029	2030
GDP	4.0	4.1	4.0	4.0	4.0	3.9	3.8	3.8

Source: PDP2015



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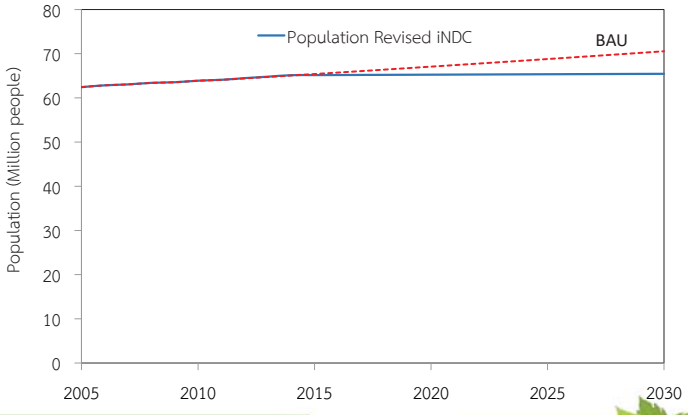
Socio-economic: estimated population



SEAC

The Estimated Fuel Requirement for The PDP2015

Fuel types	2014 (%)	2026 Installed capacity (MW)	2026 (%)	2036 Installed capacity (MW)	2036 (%)
Import	7	6,421	10-15	12,347	15-20
Clean Coal & Lignite	20	6,480	20-25	8,133	20-25
Renewable Energy (include Hydro)	8	15,654	10-20	20,279	15-20
Natural Gas	64	33,362	45-50	26,298	30-40
Nuclear	-		-	2,000	0-5
Diesel and Fuel oil	1	342	-	1,277	-
Total		**62,260**		**70,335**	

Source: Thailand Power Development Plan 2015 (English Version)

Alternative Energy Development Plan: AEDP2015

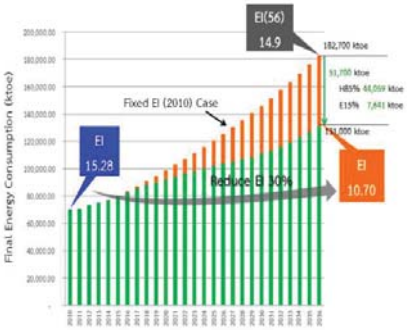
Fuel type	2014 (MW)	2036 (MW)
1 Municipal Solid Waste	65.72	500.00
2 Industrial Waste	-	50.00
3 Biomass	2,451.82	5,570.00
4 Biogas (Waste Water/Waste)	311.50	600.00
5 Small Hydro	142.01	376.00
6 Biogas (Energy Crops)	-	680.00
7 Wind	224.47	3,002.00
8 Solar	1,298.51	6,000.00
9 Large hydro	-	2,906.40
Total Installed Capacity (MW)	**4,494.03**	**19,684.40**
Total Electricity Generation (GWh)	**17,217**	**65,588.07**
Total Electricity Demand (GWh)	174,467	326,119.00
Generated Electricity Ratio by RE (%)	**9.87**	**20.11**

Alternative Energy Development Plan: AEDP2015

Fuel type	2014 ML/day	2014 ktoe	2036 ML/day	2036 ktoe
1.Biodiesel	2.89	909.28	14.00	4,404.82
2. Ethanol	3.21	872.88	11.30	2,103.50
3. Pyrolysis	-	-	0.53	170.87
4. Compressed Biogas (ton/day)	-	-	4,800.00	2,023.24
5. Other Renewable Energy	-	-	-	10.00
Total (ktoe)		**1,782.16**		**8,712.43**
Total Bio-fuel in Transport Sector		26,801.00		34,798.00
Bio-fuel Ratio in Transport Sector		**6.65**		**25.04**

Energy Efficiency Plan: EEP2015

- **PDP2015 already included the electricity demand from EEP**
- **30% energy intensity reduction in 2030 compared to 2010**

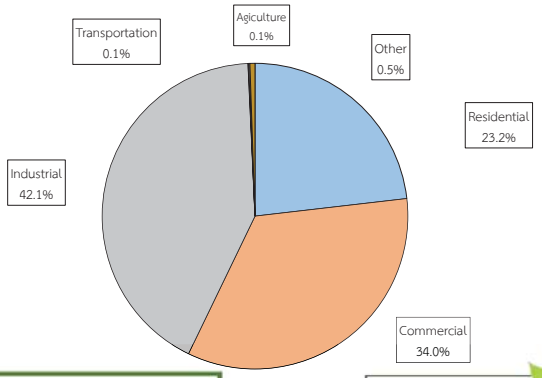


Final Energy Consumption Target by EE

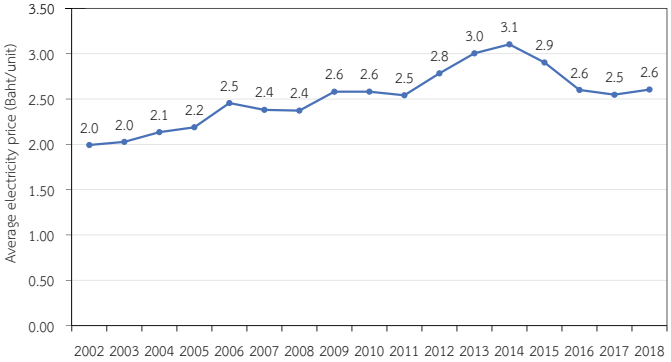
Source: Thailand Power Development Plan 2015 (English Version)

Electricity consumption by economic sectors

190,504 GWh in 2016



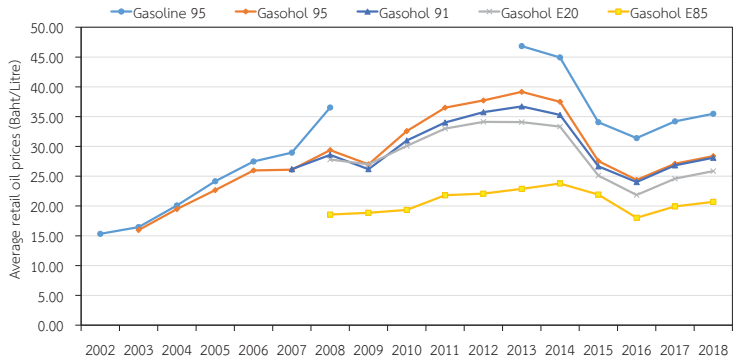
Average electricity price (Including Ft)



Note: 1 USD = 33 Baht

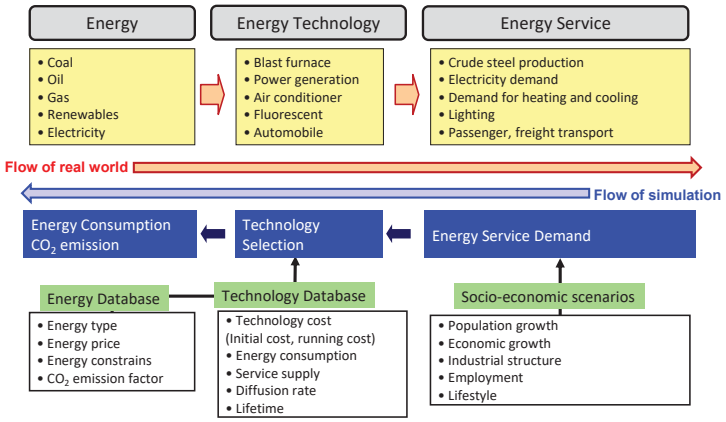
Source: Thailand's third national communication

Average retail oil prices



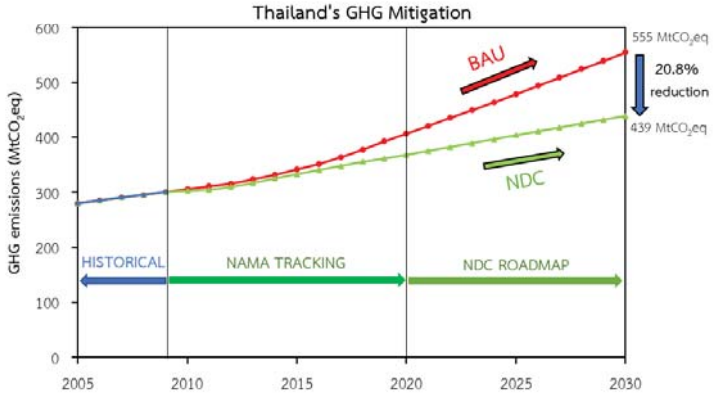
Source: PTT Public Company Limited

Modeling tool: AIM/Enduse



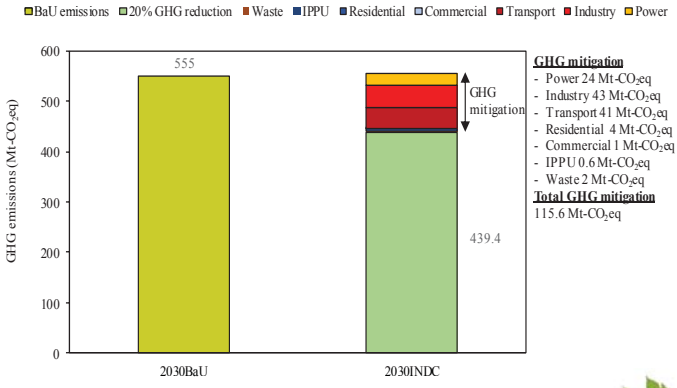
Source: AIM (NIES, 2018)

Thailand's GHG mitigation: NAMA 2020 and NDC 2030

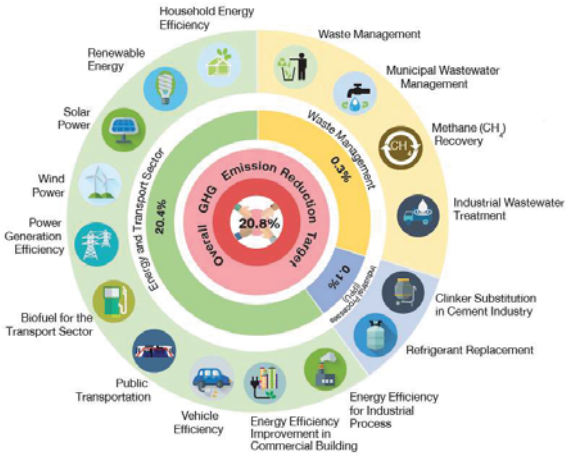


Source: Thailand's third national communication

GHG reduction target in NDC 2030



Thailand NDC's Roadmap 2030: ALL SECTORS



Source: ONEP (2017)

CMs in Energy sector and Transport Sector

Unit: Mt-CO_2e

Measure	2020	2025	2030	
Electricity generation sector	14.62	20.71	24.00	
1. Energy efficiency improvement	2.87	5.84	6.00	4.3%
2. Implementation and deployment of renewable energy (e.g. biomass, ground-mounted solar farm, wind, MSW, hydropower)	11.75	14.87	18.00	
Residential sector	1.63	2.82	4.00	
3. Energy efficiency improvement (e.g. lighting and cooling system etc.)	1.19	2.06	2.79	0.7%
4. Renewable energy and alternative energy deployment	0.44	0.76	1.21	
Commercial sector	0.19	0.56	1.00	
5. Energy efficiency improvement (e.g. heating system and cooling system etc.)	0.19	0.56	1.00	0.2%
Manufacturing industrial sector	13.82	27.92	43.00	
6. Energy efficiency improvement (e.g. heating system, cooling system etc.)	2.82	8.27	11.00	7.4%
7. Renewable energy and alternative energy deployment (e.g. solar rooftop)	11.45	19.65	32.00	
Transport sector	9.37	23.83	41.00	
8. Energy efficiency improvement (e.g. engines efficiency improvement)	7.08	18.02	31.00	7.8%
9. Biofuel used in vehicles	2.28	5.81	10.00	
20.4% Total	39.63	75.83	113.00	

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CMs in Waste sector

Unit: Mt-CO_2e

Measure	2020	2025	2030	
Municipal Solid Waste (MSW) management	0.36	0.79	1.30	0.2 %
10. MSW reduction				
Waste water management				
11. Collect methane gas from industrial waste water to increase biogas capacity	0.20	0.43	0.70	0.1 %
12. Other Industrial waste water management				
13. Domestic waste water management				
0.3% Total	0.56	1.22	2.00	

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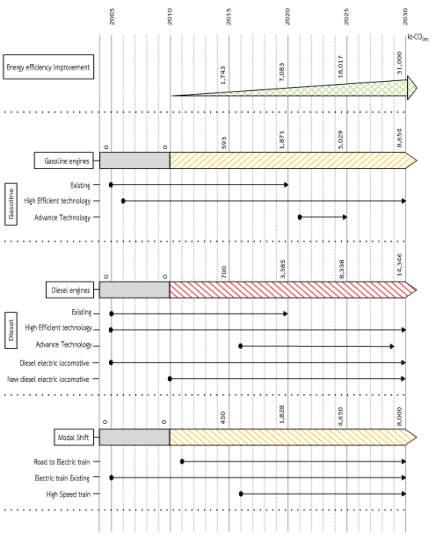
NDC Roadmap in Transport

EE

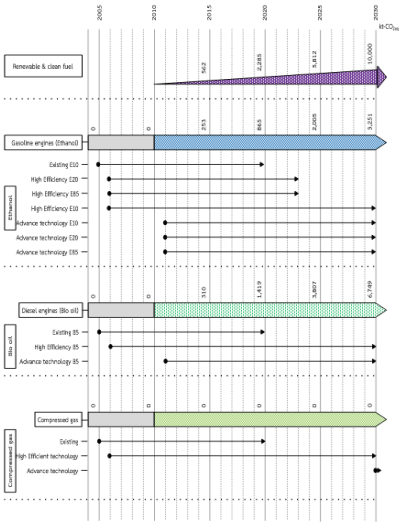
Energy Efficiency Measures



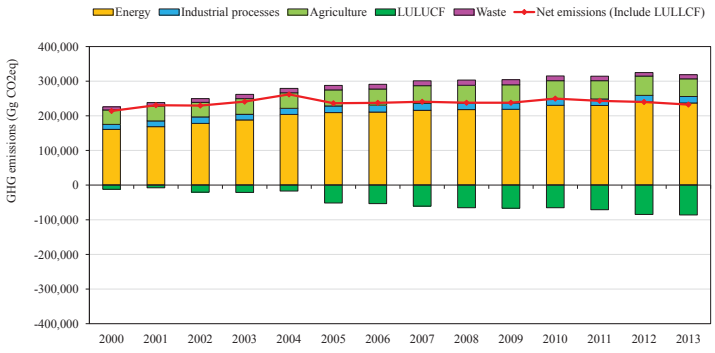
NDC Roadmap in Transport

RE

Bio-fuel Measures

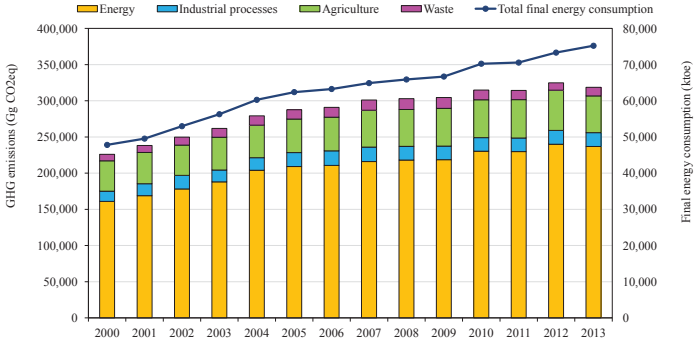


Trends of GHG emissions/removals: 2000-2013



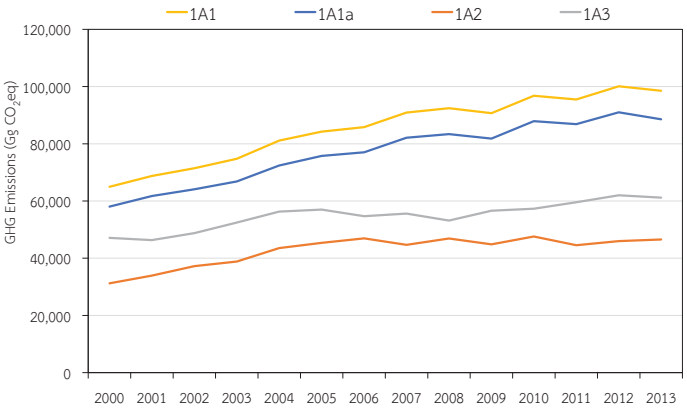
Source: Thailand's Second BUR

Trends of national GHG emissions vs Total final energy consumption: 2000-2013



Source: Thailand's third national communication

Trends of GHG emissions in Public Electricity and Heat Production (1A1a)

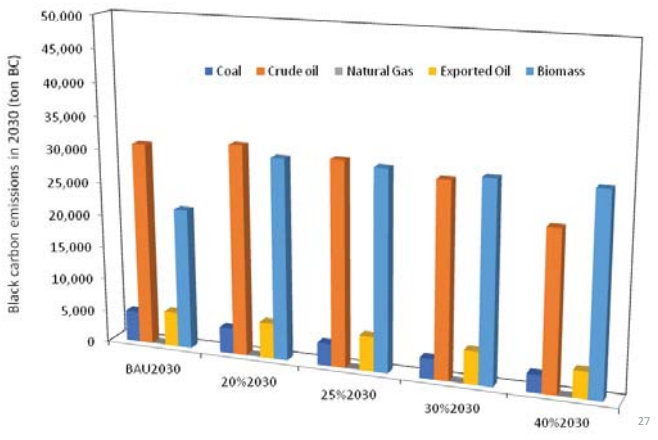


Source: Thailand's Second BUR

Actions besides NDC Roadmap in Thailand

Actions besides NDC Roadmap in Thailand

AIM/CGE Analyses:
Co-benefits of GHG mitigation targets
Black Carbon in 2030



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AIM Training Workshop in Thailand

AIM/Enduse Training Workshop at SIIT-TU, Thailand
11 June 2018 (Beginning level for Policy Makers)

AIM Training Workshop in Thailand

AIM/Enduse Training Workshop at SIIT-TU, Thailand
12-15 June 2018 (Advanced Users)

Updates on Nepal's Enduse Model

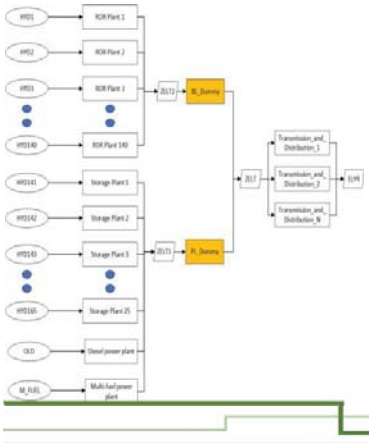
1. Revision of Power sector
2. Revision of Brick sector

Further modification required in Nepal's Enduse Model

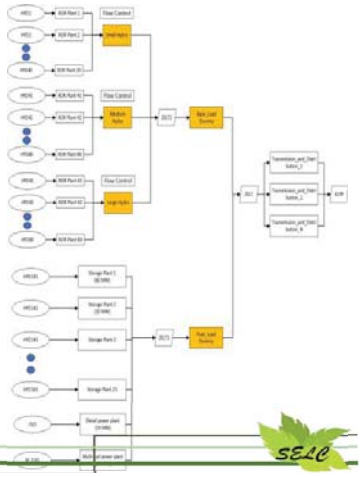
1. Addition of CCS in cement industry
2. Addition of Bioenergy with CCS (BECC) in power sector

Changes in Power Sector: Nepal

Previous flow diagram

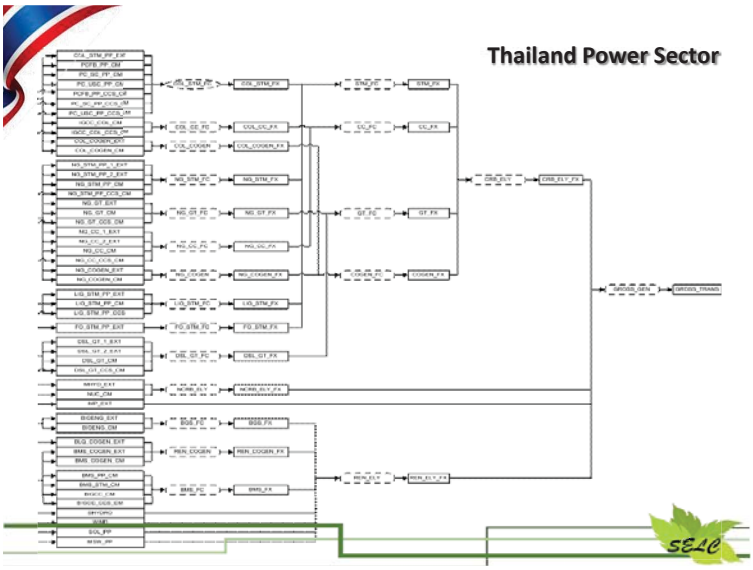


Revised flow



Current Situation of Thailand AIM/Enduse

- Thai AIM/Enduse model was already integrated in both the supply side and the demand sides
- The CCS technology was already introduced in the power sector
- The EV was already adopted in the current model version
- The 1.5 degree climate goal was already provided
- Energy efficiency policies was already adopted



1.5 Degree Study: Thailand

Net CO_2 emissions = CO_2 Sources – CO_2 Sinks

Time frame: 2010 – 2050

Modeling tool: AIM/Enduse

CM: Ctax, RE, Bio-fuels, EE, Adv Technologies, CCS

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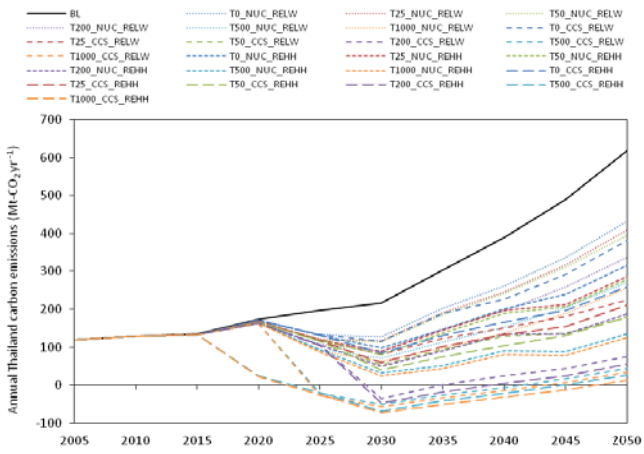
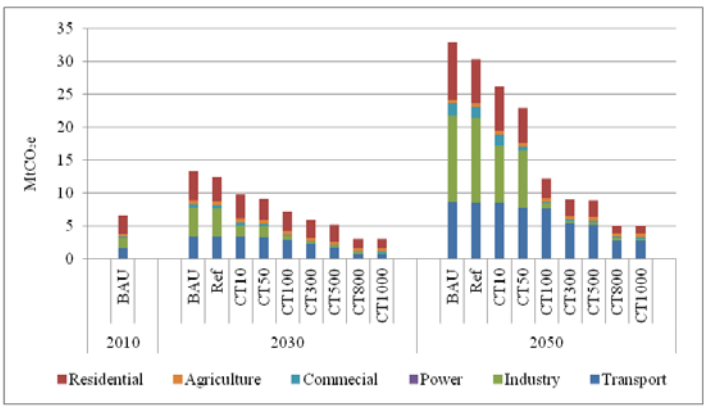
1.5 Degree Study: Thailand



1.5 Degree Study: Nepal



36

AIM Training Workshop in Thailand

CGE Training Workshop at SIIT-TU, Thailand
26 June 2018 (Beginning level for Policy Makers)

Participants: Bhutan, Thailand: ONEP & CITC, SIIT-TU, JICA-Thailand

AIM Training Workshop in Thailand

CGE Training Workshop at SIIT-TU, Thailand
26 June 2018 (Policy Dialogue: Climate Policy Assessment)

AIM Training Workshop in Thailand

CGE Training Workshop at SIIT-TU, Thailand
27 June-5 July 2018 (Advanced Users)

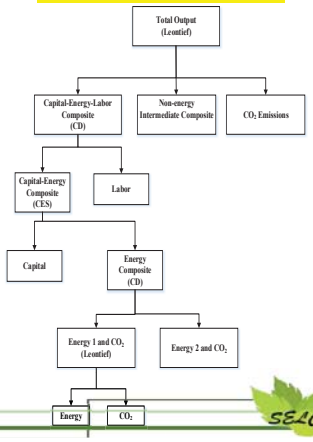
AIM Training Workshop in Thailand

CGE Training Workshop at SIIT-TU, Thailand
27 June-5 July 2018 (Advanced Users)

Present Status of Thai and Nepal CGE Models

- Development of both Thai and Nepal CGE models – Base case
- Assessment of macro-economic implications of imposing NDC targets of GHG emission reductions by 20-25% by 2030 in case of Thailand

Nested Production Structure



Acts for Earth

THANK YOU

Moving Towards to Low Carbon Future: Energy Transition in China

Jiang Kejun

Energy Research Institute, China

International Research Network for Low Carbon Societies
LCS-RNet10th Annual Meeting
17 July 2018 at Pacifico Yokohama, Japan

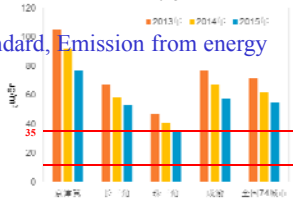
Energy Policy Overview: National Strategy

- Energy Revolution
- Renewable energy development policy package
- Energy Reforming
- Clean Air Action Plan

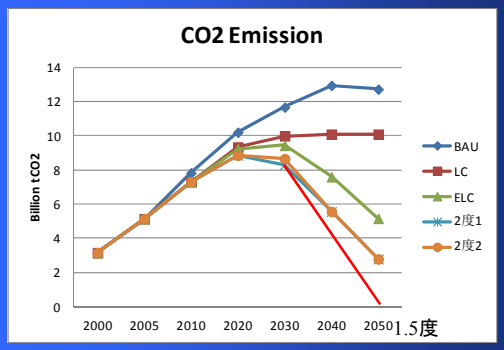
$PM_{2.5}$ Concentration is much higher than standard

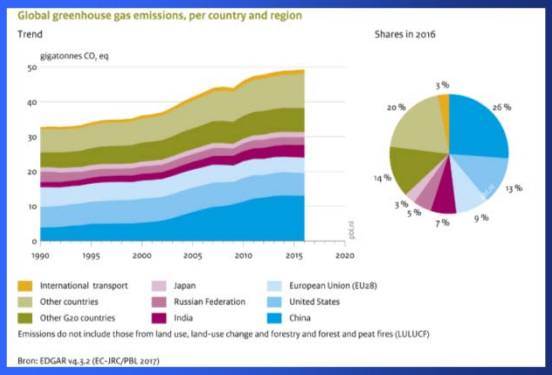
PM2.5 concentration of 74 cities in 2013

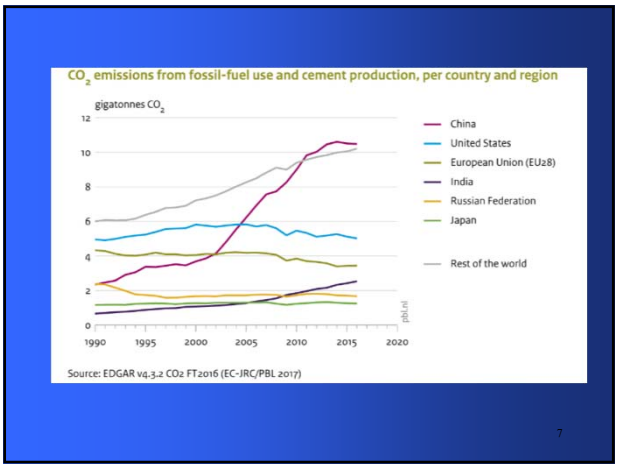
PM2.5 annual concentration from 2013-2015

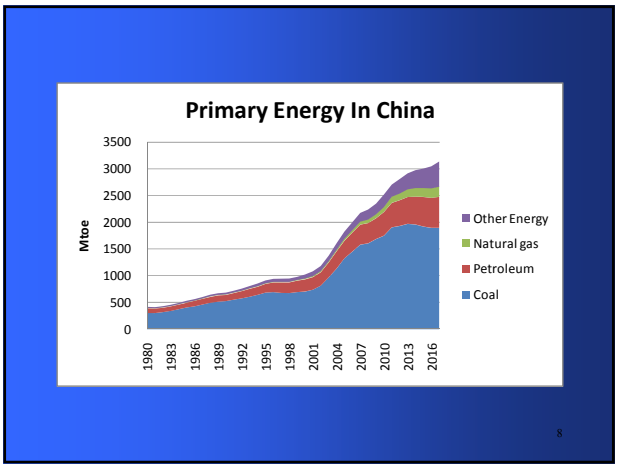


➢ 2013年京津冀地区所有城市$PM_{2.5}$年均浓度均超标，区域内$PM_{2.5}$年平均浓度达106μg/m³，虽2014、2015年空气质量有所改善，但仍大幅超过国家空气质量二级标准。









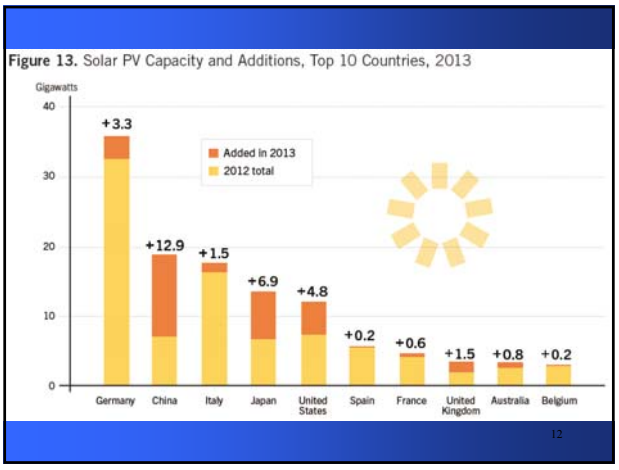
四、影响电动汽车发展的主要制约因素分析

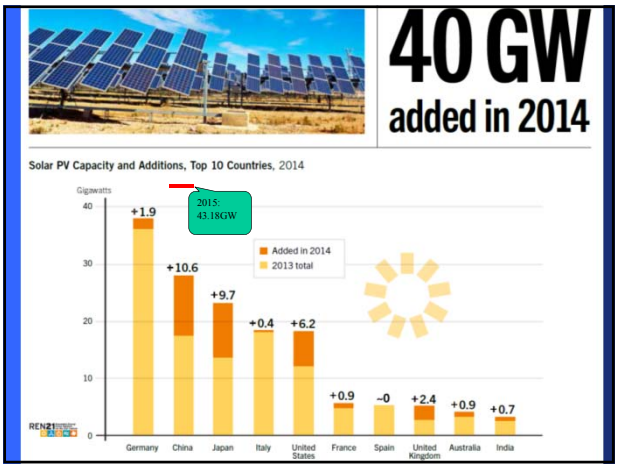
4. Analysis Major Constraints Factors

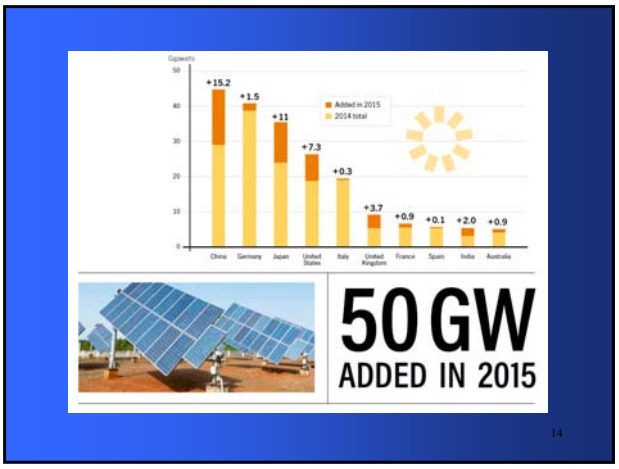
- 3.3 电动汽车实现经济性的趋势分析 Trend Analysis on EVs

电动汽车与先进汽油和柴油车成本变化趋势分析	2006-2010	2011-2015	2016-2020	2021-2025	2026-2030
电动汽车Evs					
电池充满电时总容量(kWh	16	24	48	80	112
电力销售价格（元/kWh）	0.48	0.60	0.75	0.94	1.18
单位里程耗电量（kWh/km）	0.13	0.13	0.08	0.08	0.07
单位里程耗电费用（yuan/km）	0.09	0.08	0.06	0.08	0.08
电动汽车燃料成本（yuan/car）	43200	39067	30104	37694	41299
单位电池容量成本(USD/kWh)	750	375	130	75	30
Evs车电池组成本(yuan/car)	80400	60300	41808	40200	22512
电池组寿命（年）	3.6	5	11	22	22
电池组更换次数（set/year）	4.1	2.8	1.4	0.7	0.7
EV全寿期电池成本（yuan/car）	413256	226728	99503	67938	38045
EV全寿期电耗和电池总成本（yuan/car）	456456	265795	129607	105632	79345
每年费用（yuan/car）	30430	17720	8640	7042	5290
先进汽油汽车ICE					
汽油销售价格（yuan/liter）	6.6	8.3	10.2	11.0	11.8
柴油销售价格（yuan/liter）	6.4	8.3	9.9	10.6	11.4
单位里程耗汽油（L/km）	0.050	0.039	0.031	0.024	0.020
单位里程耗柴油（L/km）	0.047	0.038	0.030	0.024	0.020
全寿期行驶里程（km）	500000	500000	500000	500000	500000
先进汽油车燃料成本（yuan/car）	165000	167550	158356	133574	117738
先进柴油车燃料成本（yuan/car）	150400	155333	149317	128100	114170
每年费用	11000	11170	10557	8905	7849
比较（Evs车费用－ICE车费用）	291456	98245	-23749	-27941	-33394

By 2016, There are 260million electric bike in China

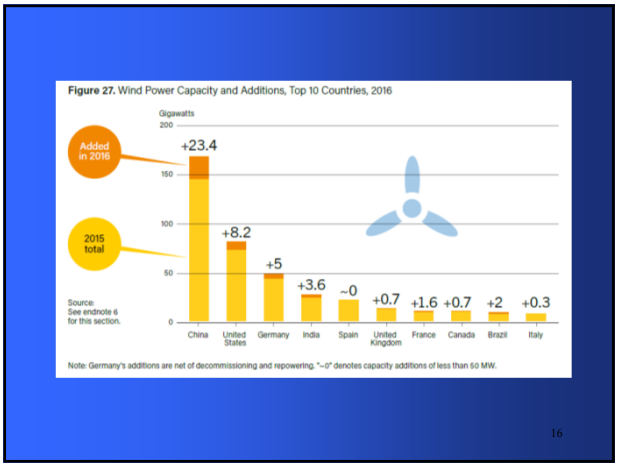






+53GW in 2017

+24.5GW from Jan. to June 2017



NASA images show stunning progress of China's vast 850 MW Longyangxia Solar Park

2013 2017

19

INDC+/NDC for China

- Peak CO2 emission in 2030, **try to peak earlier**

  peak 2020-2022

- 60% to 65% carbon intensity reduction by 2030 with comparison with 2005

  70%-75% carbon intensity

- 20% non-fossil energy in TPE

  25%, based on NEA's picture

20

China's National ETS

- Launched in Dec. 19, 2017
- Cover Power generation sector
- Use bench-mark method for allowance allocation
- The market will then enter a trial period in 2019
- Free allowance

21

China's National ETS: what is the future

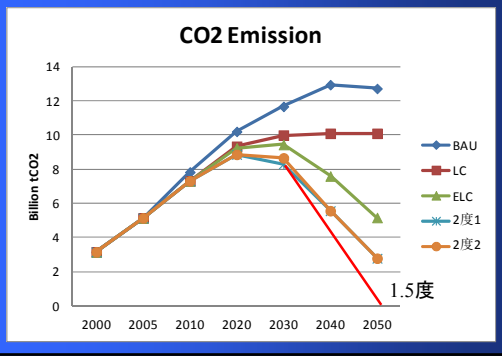
- No message when it will be no free allowance
- The National Development and Reform Commission (NDRC) enlisted 10 sectors to start providing data on their historical greenhouse gas emissions
- Expect to cover more sectors in future
- Carbon pricing could play key role in future's deep cut of CO2 emission in China

22

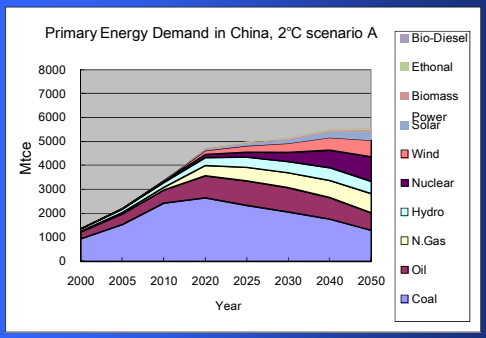
The expected big changes in energy system in China

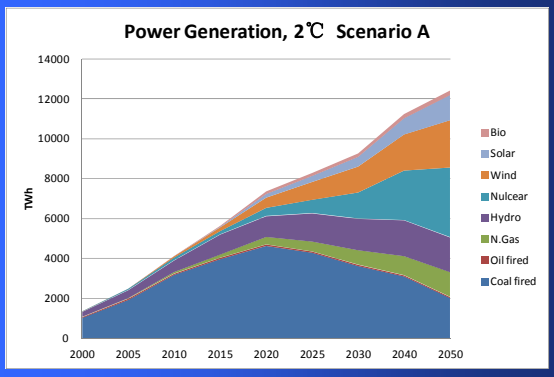
- Coal consumption start to decrease, coal industry should be ready for it, and make own long-term strategy: local manufacture, export/import, security, clean coal use.
- Much more natural gas demand, need to work out for the supply
- Much faster progress on renewable energy, both centralized and distributed
- Grid should be reconstructed to support the system
- Energy price increase, to cover energy environment externality.
- Large scale of nuclear in near future
- Much lower growth rate for energy demand in China

23



We Need Rapid Transition: Put that into 13th Five Year Plan
Primary Energy Demand





A 2 degree Asia: A good way to understand the global target

Scenario Analysis:
Japan
Korea
China
India
Thailand
Malaysia
Indonesia
Nepal
Vietnam
Cambodia
Laos
Philippine

LCS-RNet
10th Annual Meeting

LCS·R Net

Urban Actions to support NDCs implementation

Prof. Dr. Nicola Tollin

Professor wsr in Urban Resilience
Civil and Architectural Engineering CAE
University of Southern Denmark SDU

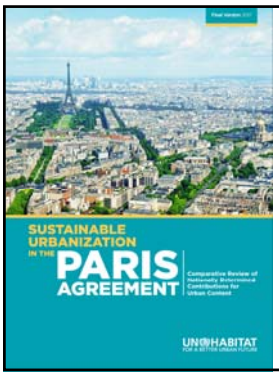
nto@iti.sdu.dk

Yokohama, 17 July 2018

CITIES-IPCC 2018 Conference joint statement

Cities account for over 70% of global energy-related CO2 emissions and are vulnerable hotspots of climate change impacts

The scale of ongoing urban expansion (and associated infrastructure and buildings that are yet to be built) provides a unique opportunity for cities to 'bend the curve' to avoid further dangerous climate change. Cities and regions may also be powerhouses of ambitious mitigation and adaptation measures that are hard to legislate and implement at the national level. Cities can play a key role in safeguarding our collective human future

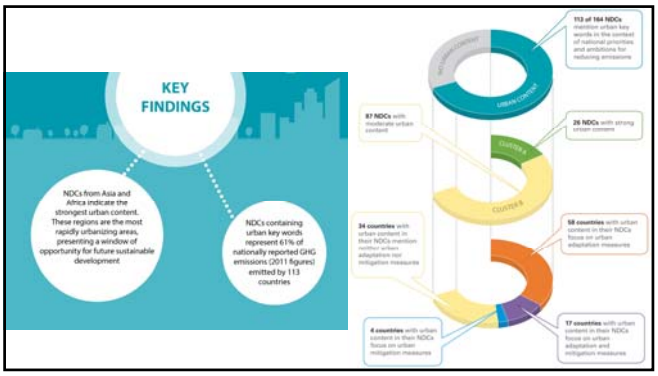


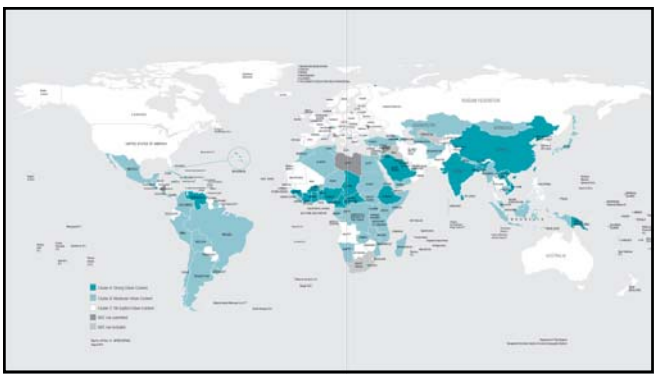
Tollin N., Hamhaber J., et al.
Sustainable Urbanization in the Paris Agreement
UN-Habitat
2018

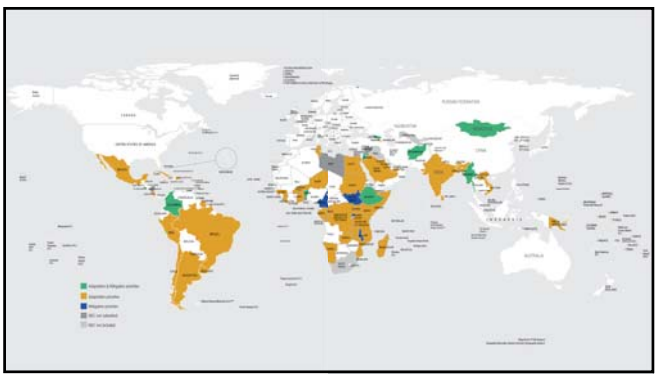
MARRAKECH COP22 CMP12
UN CLIMATE CHANGE CONFERENCE 2016

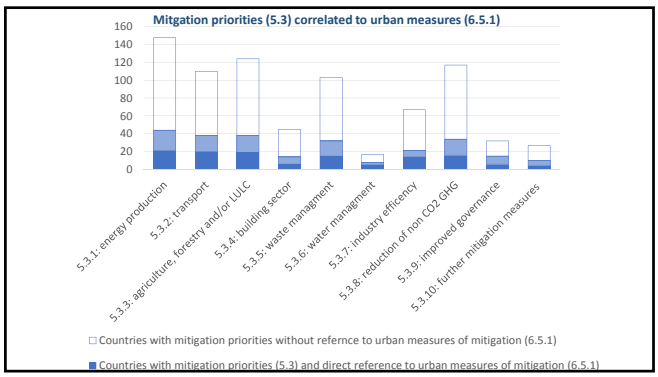
COP23 FIJI
UN CLIMATE CHANGE CONFERENCE
BONN 2017

https://unhabitat.org/books/sustainable-urbanization-in-the-paris-agreement/









MALAWI

Urban Challanges Mitigation (direct)
"Management of municipal solid wastes (MSW) is a big challenge to existing and new urban establishments, resulting in the emission of GHGs" (p.4)

Urban Measures Mitigation (implied)
Because it has been stated that **waste** is a big urban problem (see p.4, see 6.3.2), it can be assumed that at least some of the 4 mitigation/waste measures will be carried out in cities/urban localities. (p.8)

Urban Requests Finance/Technology/Capacity
Request are made, but none specifically for urban projects. (p. 8,10)

CAMEROON

Urban Challenges Mitigation (direct)
The upcycling of urban waste a into a source of energy is seen as an issue and a means to grow the share of renewables in the energy matrix. The issue of urban waste-energy production is thus included in the mitigation section of the document(p.6)

Urban Measures Mitigation (direct/implied)
Revision of **building** codes in order to increase energy efficiency, certification process; Reorganize the value chain associated to low consumption construction/renovation. (p.6)
Limit **mobility** pressure and develop an offer of low-carbon transport. - Integrate the energy/climate dimension in documents related to territorial planning, trying to limit distances and work on mixed functionality development and propose policies for efficient public transport. (p. 7)
Energy will be produced through the recycling of urban (and other) **waste**.(p.6)

Urban Requests Finance/Technology/Capacity
None

EL SALVADOR

Urban Challanges Mitigation (direct)
"Low-carbón development Will not only reduce GHG emissions but also increase economic competittivity in urban áreas, reducing also urban health issues related to air contamination and heat waves ..."(p. 7)

Urban Measures Mitigation (implied)
"The National Climate Change Plan defines as key priorities the urban and coastal Resilient and low-carbón development ...." (p. 7)

Urban Requests Finance/Technology/Capacity
El Salvador requires for the implementation of NDCs effective Access to financial resources e.g. through GCF and technological capacity e.g. through CTC-N ..."(p. 14)

MYANMAR

Urban Challenges Mitigation (direct)
"Myanmar recognises a number of important emerging themes which are key to addressing both future emission reductions and adaptation to climate impacts, including the need for sustainable urban development; a more consistent inclusion of civil society perspectives(...)." (p.4)

Urban Measures Mitigation (direct)
Policy area objectives: "To ensure that increasing urbanisation takes place in a sustainable manner." (p. 10)

Urban Requests Finance/Technology/Capacity
"Myanmar requires significant support from the international community for **capacity building**, **technology** development and transfer and **financial** resources to implement the actions proposed in this NDC." (p.4)

Key challanges for Urban Actions to support NDCs implementation

Lack of focus on small/intermediate cities

Lack of finance and access to national-international finance

Lack of access to appropriate technologies

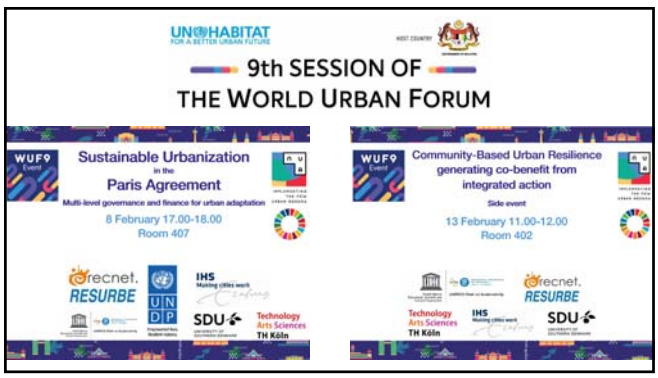
Lack of institutional and technical capacities

Lack of data availability and data mining capacities (GHG inventory)

Lack of integration of mitigation/adaptation actions (co-benefits)

Lack of vertical integration between national policies and local actions

Lack of horizontal integration at local level



CITIES IPCC

The session aims at defining key knowledge and research gaps on:

- the **horizontal integration of national policies** coupling climate change, sustainable development, disaster risk reduction and urban development, in relation to global policies.
- the horizontal integration of sub-national, regional and local policies and actions to generate co-benefits and to developed integrated actions; also considering the limitations and needs financial, technological and institutional capacities.
- the vertical integration of local actions and national policies, through enhancing the urban content of NDCs and NAPs; also defining how local actions can contribute to the achievements national policies, and how national policies can support local actions.

Cities & Climate Change Science Conference

CITIES IPCC

Identification of challenges and knowledge/research gaps

How NDCs can be used to integrate sectorial approaches at local and national level, also to improve the understanding of sectorial and multi-scale trade-offs?
Challenge 1: foster cross sectorial and multi-level approach

How multilevel governance can be strengthen, integrating local action and national policies, taking into account current governance structures, political cycles and decision making processes?
Challenge 2: improve multi-level governance

What are the key barriers and enablers in providing the necessary financial, technological and institutional capacity at national and local level, also for small and medium sized cities, and small states?
Challenge 3: strength access to finance, technology and institutional capacity

How to empower stakeholders for a/their paradigmatic transition toward systemic, integrated and collaborative actions?
Challenge 4 empower stakeholders' systemic collaborative action

Recommendations

How NDCs and NAPs can be used to monitor the increasing ambitions and progress for both national policies and local actions?
Rec.1: Monitoring urban content of NDCs and NAPs **as instrument to assess ambitions and progress of national policies and local actions, and** develop guidelines and training to increase urban content of NDCs and NAPs.

How to foster the integration potential of adaptation and mitigation measures, and sectorial actions, of both national policies and local actions, within the NDCs and NAPs?
Rec.2: integrate adaptation and mitigation, and sectorial actions within NDCs and NAPs

How to create and use multi-stakeholder and multi-level governance collaborative platforms to create common (system) understanding, problem-definition?
Rec. 3: create multilevel governance, multi-stakeholder collaborative platforms for NDCs and NAPs development and implementation

Can urban resilience approach be used as an assessment framework that integrates both climate mitigation and adaptation, and that systemically address other global challenges and adapting to specific local and national circumstances?
Rec. 4: the use of urban resilience framework and urban resilience observatories **to define common but differentiated assessment framework for specific national/local circumstances.**

University of Southern Denmark

LCS-RNet
10th Annual Meeting

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nto@iti.sdu.dk

LCS·R Net

Yokohama, 17 July 2018

Facilitating a low-carbon transition in the developing world

Ambuj Sagar
Vipula and Mahesh Chaturvedi Professor of Policy Studies
Indian Institute of Technology Delhi
asagar@iitd.ac.in

Time for action towards an ambitious decarbonised world:
10th Annual Meeting of the LCS-RNet,
July 17, 2018

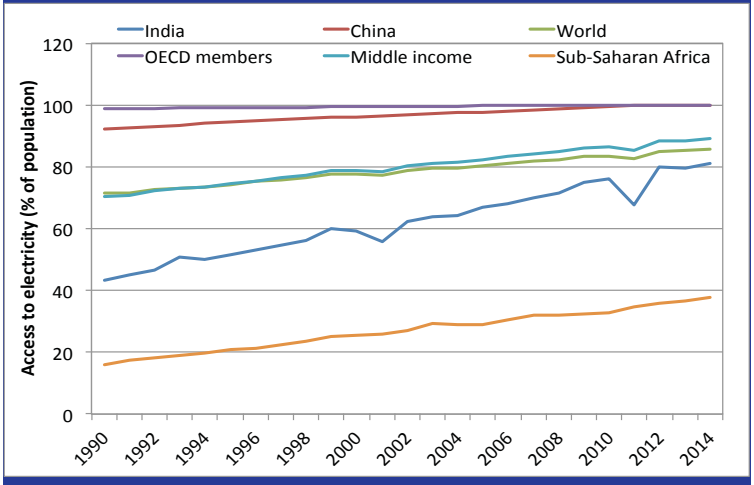
The energy, climate, and S&T context in developing countries

Energy and climate imperatives for developing countries

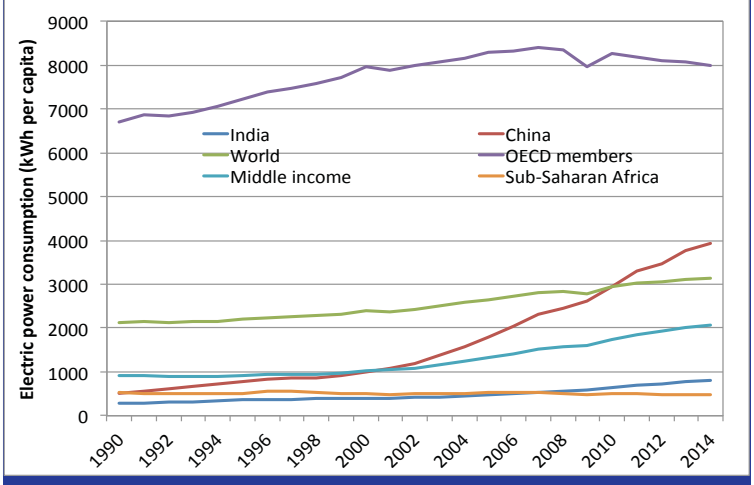
- Very ambitious NDC plans for most developing countries – both mitigation and adaptation
  - Energy key area of focus (low-carbon generation; energy efficiency)
- Major energy challenges (expansion, access, affordability)
- Requires deployment of suitable energy technologies - effective, fast and at scale
- Major deviation from business-as-usual: new/improved technologies and the need to simultaneously address climate and energy (and other developmental) imperatives

Complexities of the energy/climate technology transition

- Successful innovation and diffusion requires addressing not just technology (availability and operation) but also suitable economics, finance, markets/demand, and policy (i.e., supply, demand, and facilitation) – taking into account local context
- Local human, organizational, and institutional capabilities are critical (especially given long-term nature of challenges)

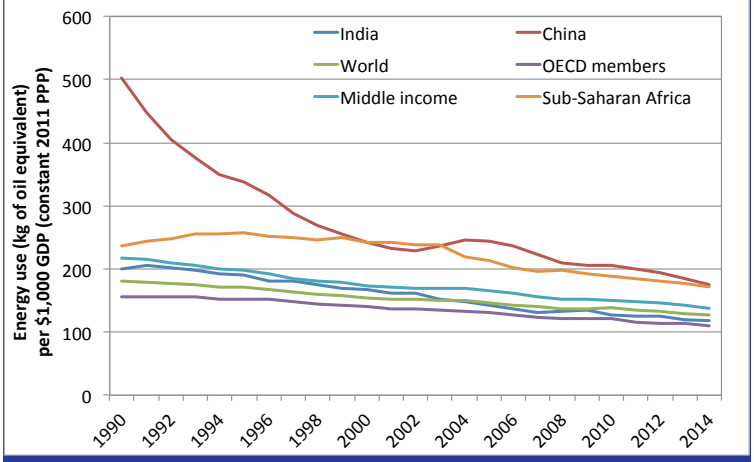


Source: World Development Indicators



Source: World Development Indicators

Low-carbon transition in the developing world



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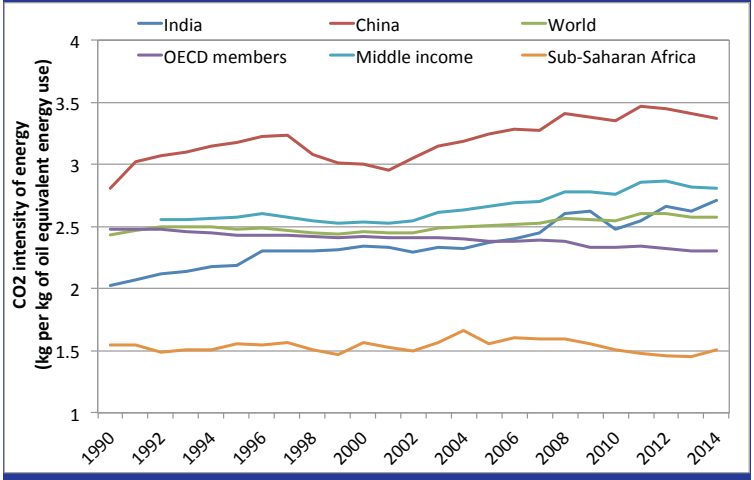
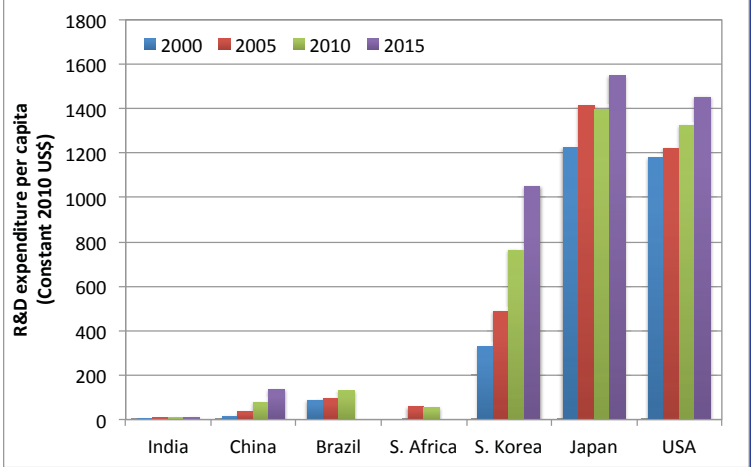
Low-carbon transition in the developing world



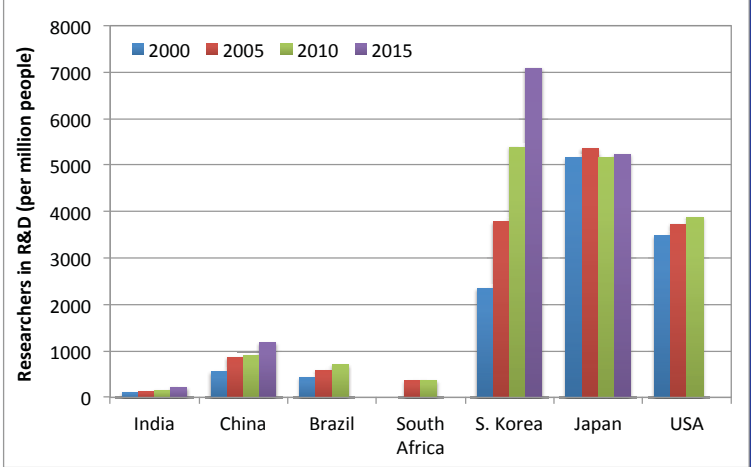
Source: World Development Indicators

Low-carbon transition in the developing world



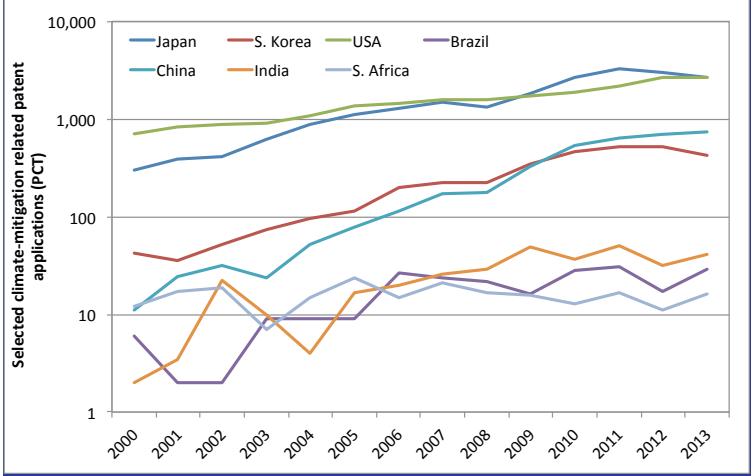
Source: World Development Indicators

Low-carbon transition in the developing world



Source: World Development Indicators

Low-carbon transition in the developing world



Source: OECD Stat

Low-carbon transition in the developing world

Facilitating a low-carbon transition
In developing economies

The interconnected 4 Cs of emerging and developing economies

- [nature of developmental and climate] Challenges
  - Overall developmental objectives – and weights assigned to them – vary across countries
  - Nature and scale of climate challenges varies across countries
- [National] Context and Capabilities
  - Size and nature of economy, population, resources
  - Technical, financial, business, policy capabilities and actors
- Choices
  - Balance among climate and developmental objectives; prioritization among options; technology and implementation pathways

Key elements of effective energy/climate transition

- Framing the problem: clarifying objectives and strategies
- Designing implementation pathways: developing and choosing amongst options (technologies, business models, early market creation, scale up, transition pathways), designing across technology cycle
- Effective implementation of climate technologies: marshaling actors, networks, and resources relevant to specific technologies – and coordinating actions across stages of technology cycle
- Learning from experience: systematic assessment and analysis of experiences

Suitable domestic policies and international cooperation needed to support these activities and build relevant capabilities

International Cooperation – What and How?

Key functions of international cooperation:

- Facilitating (availability of) and access to suitable technologies* (new and existing) to address climate and energy challenges
  - Flows of technology; strengthening domestic R&D in developing countries; collaborative R&D* where needed
- Supporting effective deployment through provision of suitable finance, technical, and other support (best practices, lessons, etc.) – appropriate to specific technologies, stages of technology cycle and local context
  - flows of finance, knowledge, and services

Key functions of climate technology cooperation (contd):

- Strengthening national capacity on multiple dimensions (actors, linkages, and institutions)
  - Technical, business model development, design of policy and financial support instruments, human resources – multiple actors on both sides
  - Coordination between various activities and actors for various stages of tech cycle, e.g., CIC approach
  - Strategic approach to climate technology (prioritization and implementation pathways)

Examples of international cooperation

- Planning and Strategy
  - Technology Needs Assessment (UNEP) and INDC preparation (GIZ)
- Research and Product Development
  - US-India and US-China Clean Energy R&D Centers
  - Moser Baer technology partnership with Applied Materials for solar PV; assistance from TI for LED heat sink design and integration (India)
  - Mission Innovation (22 major economies)
- Market creation/development
  - CLASP and SEAD assistance for designing energy-efficient appliance labeling and standards program (India)
  - Performance risk guarantee for commercial energy-efficient equipment loans (India, with GEF)

Examples of international cooperation (contd.)

- Cross-cutting:
  - IEA Technology Collaboration Programs (inventions, pilot plants, demonstration projects, databases, and development of standards)
  - World Bank Climate Innovation Centers, supported by DFID, DANIDA. AusAID, Norway, Netherlands, World Bank (seed financing, policy interventions, and network linkages, as well as technical and business training)
  - UNFCCC Climate Technology Center and Network (technical assistance, access to information and knowledge, fostering collaboration among stakeholders)

Particular role of S-S cooperation:

- Developing, implementing, and assessing pathways – mutual learning
- Knowledge/experience sharing – effective practices/models in similar contexts
- (Strategic, implementation, and assessment) capacity building
- Exploring implementation synergies (e.g., cooperative R&D, coordination of implementation, pooled markets/risks, joint resource raising, shared organizational resources, common research and analysis programs) – globally and regionally
- Coordinating inputs for, and shaping/strengthening, intl technology cooperation within and outside UNFCCC

Broad commonality of background and interests very helpful

Thanks!!

Comments/Suggestions/Questions:

asagar@iitd.ac.in

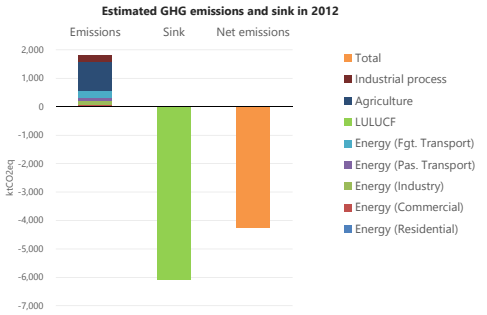
Carbon neutral developmet in Bhutan towards 2050

17 June, 2018

Kei Gomi National Institute for Environmental Studies, Japan
Yuki Ochi E-Konzal Co. Ltd.

About Bhutan Carbon Neutral Scenario

- Bhutan is a carbon neutral country. The government of Bhutan declared that Bhutan remain **carbon neutral** in future in their NDC.



1

Framework of the Scenario simulation

Region	■ Bhutan • Thimphu • Rest of Bhutan (ROB)
Base year	■ 2012
Target year	■ 2050
Types of scenarios	■ BaU scenario ■ CM scenario
Target activities	■ Energy use • Commercial sector • RIndustry sector • esidential sector • Transport sector ■ Industrial processes ■ AFOLU • Agriculture • Landuse

2

Scenarios

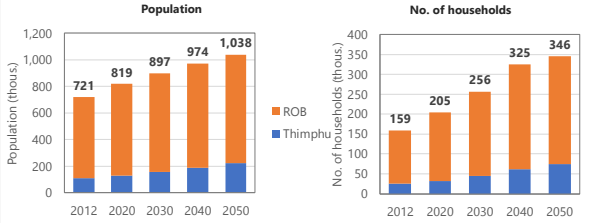
BaU (Business as Usual) Scenario
- Social and economic development based on future plan of the region
- Without implementation of LCS policy in future

CM (Countermeasure) Scenario
- Same assumption as BaU scenario about social and economic development
- With implementation of LCS policy

3

Population and Households

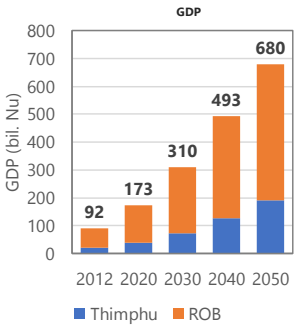
- Population of Bhutan will amount to 1 million in 2050.
- Population of Thimphu will become twice as large as that in 2014.



4

Economy (GDP growth)

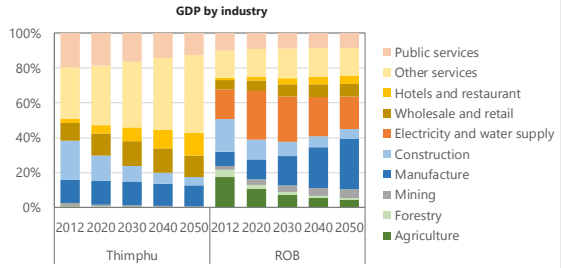
- GDP will grow by 5.4%/year on average in Bhutan.



5

Economic structure

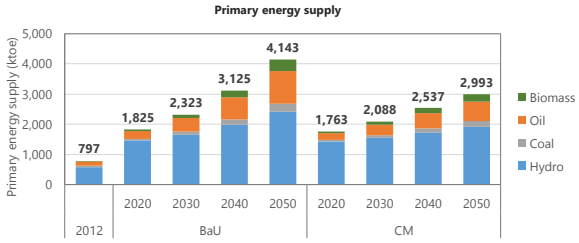
- Tertiary industry leads economic growth in Thimphu.



6

Primary energy supply

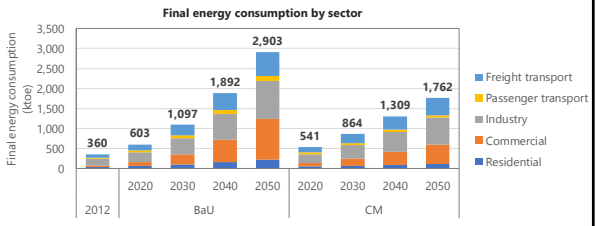
- Primary energy supply will increase more than 5 times from 2012 level in 2050 BaU.
- The largest energy source is Hydropower in both scenarios in all years.
- Oil consumption of oil will increase mainly because of transport demand increase.



7

Energy demand by sector

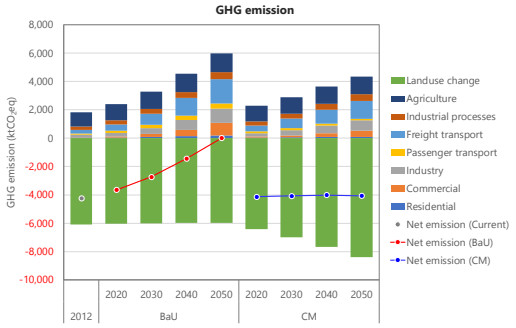
- Final energy demand will increase more than 8 times from 2012 level in 2050 BaU.
- Energy consumption in commercial sector will grow remarkably.
- A lot of energy demand in passenger transport sector will be reduced in CM scenario owing to improvement of fuel economy, diffusion of EV and modal shift to buses.



8

GHG Emission

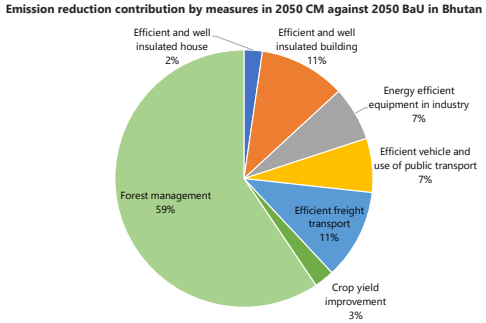
- In the BaU scenario, GHG emissions will exceed carbon sequestration, changing into positive in 2050.
- GHG emission will also increase in CM scenario, but net emission can keep negative up to 2050, due to implementation of low-carbon measures and increase in carbon sink.



9

GHG Reduction

- The most contributed measure is forest management. Its carbon reduction is more than half of total reduction.
- Commercial sector and transport sector also have large potential to reduce emission.



10

Quantification of future GNH

- We intend to quantify a variety aspects of GNH.
- We would like to collaborate with Bhutan in this research.

		Sectors and Variables in the model							
		Demography	Economy	Transport	Energy	Agriculture	Land-use	Waste	GHG
GNH Domains	Psychological wellbeing	Household structure **Household size 4.5 ➡ 3.0**	Employment		Electrification - both on and offgrid	Food self-sufficiency	Land ownership and recreation facilities		
	Health	Age structure	Healthcare services	Walking facilities	Electrification - both on and offgrid	Organic farming	Urban plan whereby there is a provision for footpath and recreation area	Proper waste management	GHG emission **4.3MtCO2eq**
	Time use	Family time	Work life balance	Smooth traffic movement		Farm mechanization			
	Education	Literacy in traditional knowledge and values		Awareness in the mass transit		Traditional knowledge and values		Awareness in waste management	
	Cultural diversity and resilience	Household structure **Household size 4.5 ➡ 3.0**				Indigenous farming	Protection of cultural landscape		
	Community vitality	Social network and family support		Mass transit and car pooling			Provision of green spaces and community centers	Community based waste management	
	Good Governance	Lietracy rate	Employment	Well managed public transport		Government subsidy /incentives		1. Waste management 2. Segregation of wastes (3Rs)	
	Ecological diversity and resilience		Climate resilient development	Energy Efficiency Road Construction (EFRC) practices	Renewable and hydropower energy	Organic farming		Waste management	GHG emission **4.3MtCO2eq**
	Living standard	Employment rate	1. GDP **680 trilNu** 2. Income distribution		Energy efficiency building	Commercial farming	Provision for affordable housing		GHG emission **4.3MtCO2eq**

11

Conclusion

- In Bhutan, GHG emission will exceeds carbon sink in 2050 in BaU scenario.
- Hydropower will always be main energy source, however, oil demand will increase remarkably in 2050 in BaU.
- In the CM scenario, Bhutan can remain carbon neutral. More than half of the emission reduction is by forest management. b
- Considering GNH in the quantification is the next challenge.

12

appendix

13

Framework of the Scenario

Framework

Region	Bhutan ■ Thimphu ■ Rest of Bhutan (ROB)
Base year	2012
Target year	2050
Types of scenarios	■ BaU scenario ■ CM scenario
Target activities	■ Energy use • Industry sector • Commercial sector • Residential sector • Transport sector ■ Industrial processes ■ AFOLU • Agriculture • Landuse

Scenarios

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- Without implementation of LCS policy in future

CM (Countermeasure) Scenario
- Same assumption as BaU scenario about social and economic development
- With implementation of LCS policy

14

Data Preparation

- A variety of data and information of Bhutan were collected to estimate current status and future vision.
- We estimated regional data of Thimphu and ROB by downscaling of national statistics when regional data is not available.

	Source
Demography	■ National Statistics Bureau (2009): Population Projections of Bhutan 2005-2030 ■ National Statistics Bureau (website): Dzongkhag Population Projection 2011-2015 ■ Gross National Happiness Commission, Bhutan (2013): Eleventh Five Year Plan ■ National Statistics Bureau and Asian Development Bank (2012): Bhutan Living Standards Survey 2012 Report ■ World Bank (2016): World Development Indicators
Economy	■ National Statistics Bureau (2015): National Accounts Statistics 2015 ■ National Statistics Bureau (2013): Statistical Yearbook of Bhutan 2013 ■ Gross National Happiness Commission, Bhutan (2013): Eleventh Five Year Plan
Transport	■ Ministry of Information and Communications: Current Status of National Transport Polices, Systems and Projects in Bhutan ■ National Statistics Bureau (2015): Statistical Yearbook of Bhutan 2015
Energy	■ National Statistics Bureau (2015): National Accounts Statistics 2015 ■ Department of Renewable Energy and United Nations Development Programme (2012): Bhutan Energy Efficiency Baseline Study Final Report ■ Ea Energy Analyses and COWI (2012): Bhutan: A national strategy and action plan for low carbon development Final report ■ S. Jamtsho (2015): Energy Efficiency & Conservation Initiatives in Bhutan ■ Bhutan Statistical Services & Environmental Consultancy: Assessment of Fuel Consumption and Baseline Health Impact Study in Bhutan
Agriculture	■ Ministry of Agriculture & Forests (2015): Bhutan RNR Statistics 2015
Landuse	■ Ministry of Agriculture & Forests (2015): Bhutan RNR Statistics 2015

5

Collected Data

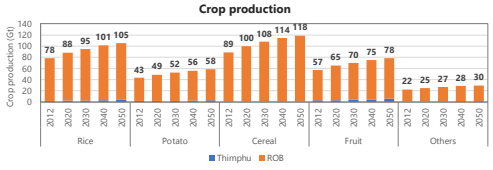
	Base year		Future	
	Bhutan	**Thimphu**	**Bhutan**	**Thimphu**
Demography	■ Population ■ No. of households	■ Population ■	■ Population ■	X
Economy	■ GDP ■ No. of firms	■ No. of firms	■ GDP growth rate	X
Transport	■ No. of vehicles ■ Modal share by vehicle type ■ No. of Drivers Licenses Issued	X	X	X
Agriculture	■ Crop production ■ Cultivated area	■ Crop production ■ Cultivated area	X	X
Landuse	■ Land area	■ Land area	X	X
Energy	■ Energy consumption ■ Power generation	■ Electricity consumption	X	X

X: cannot find yet

16

Agriculture

- Crop production in Bhutan in 2050 will become twice as much as that in 2012.
- Most of crops are produced in ROB now and in future.
- Rice and fruit are main crops made in Thimphu.



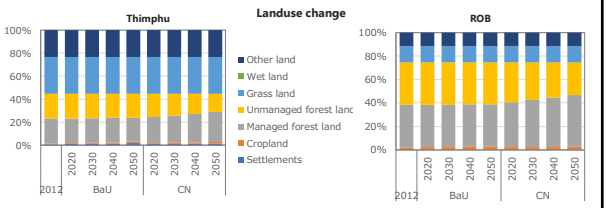
Reference and Assumption

2012	2050
Source	**Assumption**
■ Ministry of Agriculture & Forests (2015): **Bhutan RNR Statistics 2015**	**BaU and CM** ■ Crop production and cultivated area will increse in proportion to population **CM** ■ Yield will be improved.

17

Landuse

- Landuse is different between Thimphu and ROB. Share of forest in Thimphu is much less than that in ROB.
- Settlements and cropland will expand with population growth. However, Increase of these area is controlled in CM scenario by urbanization and improvement of crop yield.



18

Population and Households

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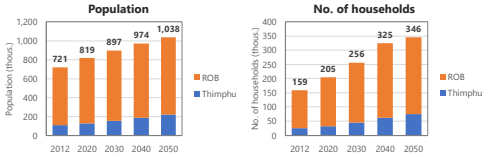
- Population of Thimphu will become twice as large as that in 2014.



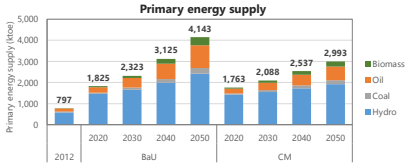
Reference and Assumption

2012	2050	
Source	Source	Assumption
■ National Statistics Bureau, Bhutan (2009): **Population Projections of Bhutan 2005-2030** ■ National Statistics Bureau, Bhutan (website): **Dzongkhag Population Projection 2011-2015** ■ National Statistics Bureau, Bhutan and Asian Development Bank (2012): **Bhutan Living Standards Survey 2012 Report**	■ Gross National Happiness Commission, Bhutan (2013): **Eleventh Five Year Plan**	■ Population will increase. ■ Population growth rate of Thimphu continues to be higher than ROB. ■ Household size decreases.

19

Energy

- Primary energy demand will increase more than 5 times from 2012 level in 2050 BaU.
- The largest energy source is Hydropower in both scenarios in all years.
- Oil consumption of oil will increase mainly because of transport demand increase.



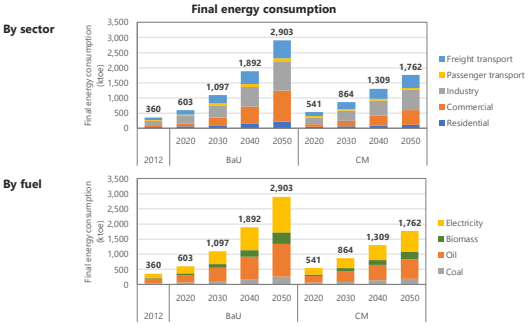
Reference and Assumption

2012		2050
Source	Assumption	Assumption
■ National Statistics Bureau (2015): **National Accounts Statistics 2015** ■ Department of Renewable Energy and United Nations Development Programme (2012): **Bhutan Energy Efficiency Baseline Study Final Report** ■ S. Jamtsho (2015): **Energy Efficiency & Conservation Initiatives in Bhutan**	■ Energy consumption except electricity was downscaled to the regions using proxy indices such as population and number of firm	**BaU** ■ Same as the base year **CM** ■ Energy efficiency will be improved. ■ Share of electricity will increase in demand side fuel composition.

20

Energy demand

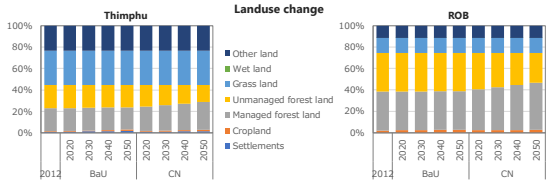
- Final energy demand will increase more than 8 times from 2012 level in 2050 BaU.
- Energy consumption in commercial sector will grow remarkably.
- A lot of energy demand in passenger transport sector will be reduced in CM scenario owing to improvement of fuel economy, diffusion of EV and modal shift to buses.



21

Landuse

- Landuse is different between Thimphu and ROB. Share of forest in Thimphu is much less than that in ROB.
- Settlements and cropland will expand with population growth. However, Increase of these area is controlled in CM scenario by urbanization and improvement of crop yield.



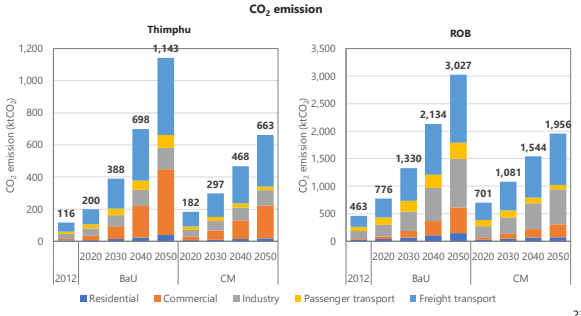
Reference and Assumption

2012		2050
Source	Assumption	Assumption
■ Ministry of Agriculture & Forests (2015): **Bhutan RNR Statistics 2015**	■ Half of forest land is managed.	**BaU and CM** ■ Area of settlement will increse in proportion to population. **CM** ■ Population density becomes higher. ■ Managed forest land will increase.

22

CO_2 Emission from Energy Use

- Commercial sector and Freight transport sector will be main emitters in Thimphu.
- Industry sector and Freight transport sector will be main emitters in ROB.
- CO_2 emission in 2050 CM can be reduced by 42% in Thimphu and 35% in ROB compared with BaU.



23

Relation matrix between GNH and ExSS

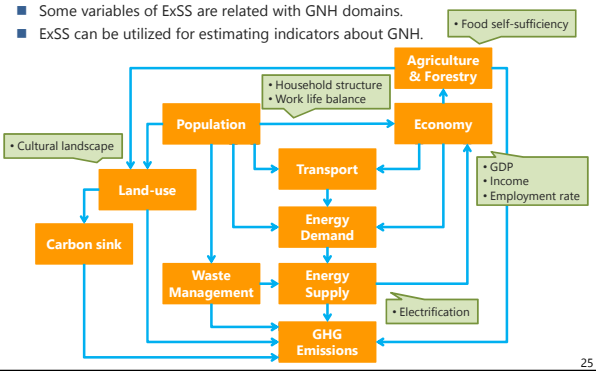
- We developed a relation matrix between GNH domains and variables in ExSS in the Training Programmme on Climate Change for Bhutanese Policymakers on Feb. in Japan.

GNH Domains		Sectors and Variables in the model							
		Demography	Economy	Transport	Energy	Agriculture	Land-use	Waste	GHG
	Psychological wellbeing	Household structure	Employment		Electrification - both on and offgrid	Food self-sufficiency	Land ownership and recreation facilities		
	Health	Age structure	Healthcare services	Walking facilities	Electrification - both on and offgrid	Organic farming	Urban plan whereby there is a provision for footpath and recreation area	Proper waste management	GHG emission
	Time use	Family time	Work life balance	Smooth traffic movement		Farm mechanization			
	Education	Literacy in traditional knowledge and values		Awareness in the mass transit		Traditional knowledge and values		Awareness in waste management	
	Cultural diversity and resilience	Household structure				Indigenous farming	Protection of cultural landscape		
	Community vitality	Social network and family support		Mass transit and car pooling			Provision of green spaces and community centers	Community based waste management	
	Good Governance	Lietracy rate	Employment	Well managed public transport		Government subsidy /incentives		1. Waste management 2. Segregation of wastes (3Rs)	
	Ecological diversity and resilience		Climate resilient development	Energy Efficiency Road Construction (EFRC) practices	Renewable and hydropower energy	Organic farming		Waste management	GHG emission
	Living standard	Employment rate	1. GDP 2. Income distribution		Energy efficiency building	Commercial farming	Provision for affordable housing		GHG emission

24

Connect ExSS with GNH

- ExSS describes future change of not only GHG emissions but also social and economic aspects.
- Some variables of ExSS are related with GNH domains.
- ExSS can be utilized for estimating indicators about GNH.



25

Bhutan's Fundamentals for Happiness: 'Sustainability' transition pathways

Bhutan is a rapidly growing economy currently undergoing swift and extensive rural-to urban migration. Looking at how to maintain the country's carbon neutrality and unique Gross National Happiness (GNH) objectives, this study outlines a sustainability pathway (SSP1) for Bhutan to achieve regionally-balanced development as well as conserving traditional culture values, a strong sense of community, and local natural resources.

Miho Kamei, Institute for Global Environmental Strategies, Japan. kamei@iges.or.jp

Introduction

Most cities in the world face a number of complex social and physical problems. These overlapping and interrelated social issues require comprehensive analysis and the integration of sustainable solutions. Climate research teams have developed Shared Socioeconomic Pathways (SSPs) which can analyse the dynamic, social long-term transitions in global-based mitigation and adaptation measures（O'Neill et al., 2014, Riahi et al., 2017). The presenting author has previously developed socio-economic pathways for cities based on global SSPs (Kamei et al, 2016 and 2019). The city-scale SSPs were added to the urban-form factors; more detailed lifestyle factors are to be linked with concrete local implementation plans.

However, there is also a strong need to analyse the land-use planning effects on climate policy and sustainable development for the long-term future. Considering not only the socio-technological changes but also the social-value changes, such as those pertaining to social capital and well-being, driving forces and new urbanisation patterns can be assumed as different from conventional ones.

Bhutan has been selected as a case study for analysing the sustainable urbanisation pathway. The country has gained popularity in terms of developing and adopting a unique GNH (Gross National Happiness) index for national policy strategies. However, it is very likely that a number of large developments and densely populated areas will emerge, which may cause the expansion of social disparity and social segregation, along with the destruction of natural resources and local identities. Therefore, this research aims to identify the key driving forces which help to enhance Bhutan's regional-specific features related to GNH indicators with regards to maintaining decentralised local culture and natural resources. It will then try to develop long-term dynamic land-use planning pathways towards carbon neutral and sustainable development while increasing the overall rate of social happiness.

Figure1. Left/ Bhutan histrical builidng/ Middle left, Thimphu city scape/ Middle right:Thimphu urbanised area/ Right:Ongoing construction (Thimphu) (all pictures were taken by author)

The socioeconomic pathways for Bhutan (SSPs for Bhutan)

Bhutan is a rapidly growing country and it is well-known due to the fact that it has developed and adopted a unique GNH (Gross National Happiness) index for national policy strategies. However, rapid urbanisation is beginning to occur, which is likely to lead to a number of large developments and densely populated areas, and this may cause the expansion of social disparity and social segregation, along with the destruction of natural resources and local identities. Therefore, SSP2: Business As Usual (BAU) scenario assumes an increase of highly populated areas, with a work force that is concentrated in the capital city. This rapid concentration of people may lead to unplanned and less harmonised development. In addition, buildings may gradually become high-rise, with an increased use of concrete materials rather than traditional materials (see Figure2).

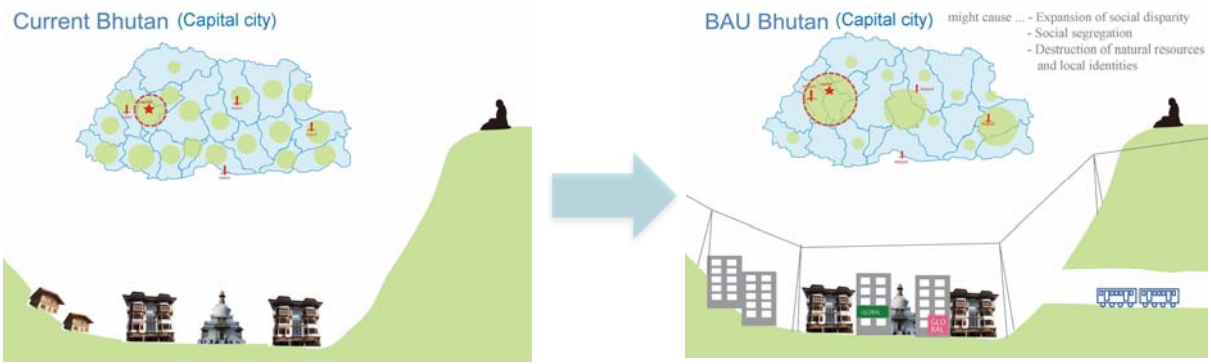


Figure2. Business As Usual scenario (SSP2) Bhutan (developed by author)

On the other hand, conserving local areas is a key factor for SSP1: Sustainability scenario which represents decentralised urbanisation strategies. This sustainability scenario might be seen as a contradiction to efficient urban growth strategies; however, it actually suggests each city and region requires their own pathways which fit to a specific local context. There is also the potential to reconsider how to achieve an efficient lifestyle. In the case of Bhutan, traditional industries, local agriculture and natural resources are vulnerable assets which have to be maintained by local inhabitants. This traditional spirit has cultivated a unique local context. As most settlements are located in the steep-walled river valleys, well-planned disaster risk management is essential. This is of fundamental importance to maintain the country's happiness indicators for securing safe living conditions. The sustainability scenario also highlights decentralised education clusters and deployment of renewable energy. A combination of new and appropriate technologies such as EV, electrification, ICT, as well as traditional hydro and kotatsu (Japanese foot warmer). (see Figure3) (This Bhutan SSP scenario is referred in the TWI2050 report, 2018)

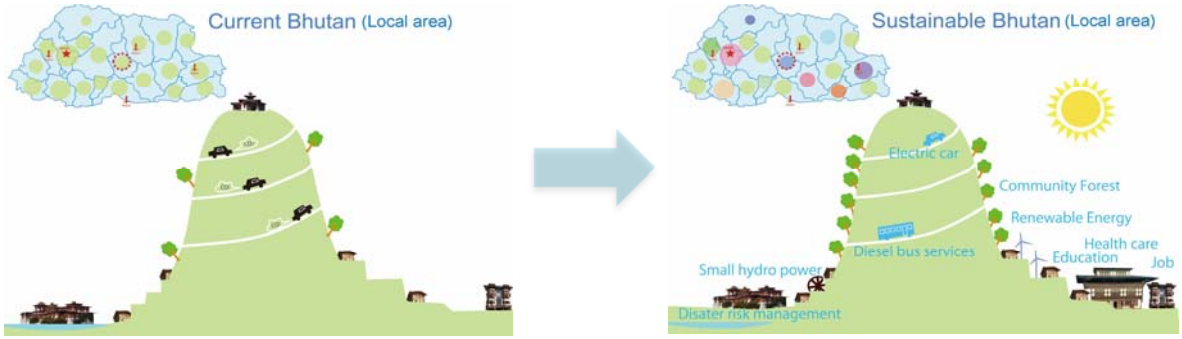


Figure3. Sustainability scenario (SSP1) Bhutan (developed by author)

Conclusions

A key consideration of Bhutan's future urbanisation is how new development and deployment of new technologies can be harmonised with local culture and society while maintaining carbon neutrality. The other concern is that highly energy-efficient technologies are not yet affordable for most Bhutanese households. Therefore, the sustainability scenario (SSP1) suggests extensive collaborations and partnerships based on effective knowledge sharing globally. Furthermore, agriculture in Bhutan has a significant role for maintaining local land and forests. These natural resources have to be preserved and maintained by local communities. Therefore, SSP1 emphasises decentralised and regionally balanced development.

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Institute for Global Environmental Strategies