Plenary Session: How We Could Promote Evidence-Based Policymaking by Bridging the Gap between Policymakers and Research Communities?

Introduction of this session:
Model and policy making process

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Asia-Pacific Integrated Model
http://www-iam.nies.go.jp/aim/index.html
Asian countries will update their mitigation target and roadmap to achieve the 2/1.5 degree target reflecting their issues to be solved and the resources to be endowed.

Model can be a collaboration tool between science and decision making process. From the long-term viewpoint, each country will need the capacities to develop model and scenarios by itself.

AIM (Asia-Pacific Integrated Model) has supported Asian countries to develop the integrated assessment model and their long-term low carbon scenarios.
Model as a tool to support environmental policies

Real world

Academic field

Knowledge disciplines

Integrated assessment
Integrated assessment model

Environmental policies

Scientific knowledges

Needs for environmental policies

Meteorology
Geophysics
Biology
Climatology
Geochemistry
Atmospheric chemistry
Policy science
Economics
Hydraulics
Ecology
How to assess future using model?

- Model cannot predict future, but only shows a result corresponding to a set of inputs.
- Model has both subjective and objective aspects.
- Model has both advantages and disadvantages.
  → We will have to use model to meet purpose.
Collaboration with Asian countries; **Scenario approach** towards Low Carbon Society in Asia

Policy makers
Central/regional government administration
Development Agencies
NGOs

*Collaboration for developing LCS scenario and the roadmaps*

Each country’s domestic/local research institute

Request of more practical, realistic roadmaps and also tractable tools for Low Carbon Development Strategies

Application and development to actual LCS processes

Core research members

Development and maintenance of study tools/models
Overall research procedure of our LC Society Scenario approach

- Area
- Base year
- Target year
- Covered sectors
- Actors/Players
- LCS target

Quantifications of parameters:
- Population
- Final demand
- Transport parameters
- Energy service demand generation
- Energy device share
- Power supply assumptions

Setting framework

Qualification of Socio-economic Vision

Quantification of Socio-economic Visions and GHG emission

Trial and error to keep consistency and unity among Socio-Economic policies and LCS targets

Analysis of Alternative LCS scenarios and measures

Design LCS Actions and Roadmaps from the analysis

- Demography
- Lifestyle
- Economy
- Transport
- Building
- Resource efficiency
- Energy strategy
- Power supply

Evaluation of Scenarios / measures:
- Transportation system
- Energy service demand generation
- Energy device share
- Power supply options
- Renewable energy
- Carbon sink
- etc.
How to combine the tools in order to keep consistency and unity among Socio-Economic policies and LCS actions

Extended snapshot tool (ExSS)

An integrating tool of future economic, industrial, social and energy visions with mitigating options.

AIM/CGE

Tool for keeping macro-economic consistency among supply, demand and resource constraints, and for estimating macro-economic impacts.

Economic analysis of LCS

AIM/Enduse

A tool for people and industry’s demand generation processes, technology deployment, and their impacts on GHG emission.

Engineering and financial analysis of LCS

LCS (Low Carbon Strategy) Tools

Tools for connecting model outputs with LCS Action making process logically, and support designing, monitoring and managing the Low Carbon Strategy progress.

Quantification of LCS scenarios

Institutional and logical design of LCS

Low Carbon Development Actions and Roadmaps

Designing Snapshot of LCS visions
Extended Snapshot Tool (ExSS)

- Extended Snapshot Tool (ExSS) is an accounting type, static model consists of simultaneous equations with about 6000 variables.
- It describes socio-economic activity, energy consumption, power generation, technology diffusion and GHG emissions in a future year.
- Coupled with waste and AFOLU model, it can show a comprehensive vision of a country or a region as a low-carbon society.
- Data requirement: Input-output table, energy balance table, demography, and transport data in a base year.

by Dr. Kei Gomi (NIES)
Overview of AIM/Enduse model

Energy
- Coal
- Oil
- Gas
- Renewables
- Electricity

Energy Technology
- Blast furnace
- Power generation
- Air conditioner
- Fluorescent
- Automobile

Energy Service
- Crude steel production
- Electricity demand
- Demand for heating and cooling
- Lighting
- Passenger, freight transport

Flow of real world

Energy Consumption
- CO₂ emission

Technology Selection

Energy Service Demand

Energy Database
- Energy type
- Energy price
- Energy constraints
- CO₂ emission factor

Technology Database
- Technology cost
  (Initial cost, running cost)
- Energy consumption
- Service supply
- Diffusion rate
- Lifetime

Socio-economic scenarios
- Population growth
- Economic growth
- Industrial structure
- Employment
- Lifestyle

Flow of simulation

by Dr. Tatsuya Hanaoka (NIES)
Concept of AIM/CGE (Computable General Equilibrium)

Market: supply and demand of every commodity/factor are balanced through price mechanism.
- supply > demand → decreasing price
- supply < demand → increasing price

CGE model can show the economic impacts such as carbon price, GDP change etc. in the case of GHG emission reduction.

Production sector: Maximizing profit under available technology

Available tech.

Production factors

Market

Equilibrium price

Supply

Demand

P

Q

Trade

Production

Trade balance

International market

Household

Final cons.

Fixed cap. formation

Preference

Available tech.

Endowment of factors

Government

Collection of tax

Income distribution

Household: Maximizing utility under income constraint
Examples of brochures introducing Asian Low Carbon Scenarios
Communication and feedbacks of LCS study to real world

http://2050.nies.go.jp/
Training workshop of AIM

For policy makers

• To understand
  • the model concept and meaning,
  • necessary inputs to assess the specific environmental policies,
  • how to use the model results.

• for 2-3 days training

For researchers

• To understand
  • in addition to the points for policy makers,
  • the model detail,
  • how to revise the program to meet the clients' requests,
  • how to explain the model results to the stakeholders.

• at least for several months
Training Workshop to introduce ExSS, Enduse and CGE

- Jan. 30-Feb. 1 2017, SIIT-TU, Thailand
- Bhutan, Cambodia, China, Indonesia, Korea, Malaysia, Nepal, Thailand, Vietnam
Capacity development in Asia by AIM

- **Sep. 4 - Oct. 13, 2017 at NIES: CGE**
  - ✓ Bhutan, Malaysia, Nepal, Thailand and Vietnam

- **Oct. 23 - 27, 2017 at NIES: Enduse**
  - ✓ China, Sri Lanka and Vietnam
AIM team had a training workshop of AIM/Enduse model at SIIT, TU, Thailand from June 11 to 15, 2018.

Beginners course on 11th June: 11 participants including ONEP, CITC/TGO

Advanced course on 12th – 15th June: 5 participants
Training workshop of AIM/CGE model at SIIT, Thammasat University, Thailand

With support from Prof. Bundit Lim, AIM team had a training workshop of AIM/CGE model at SIIT, TU, Thailand from June 26 to July 5, 2018.

Discussion with policymakers in Thailand and JICA

CGE model development for Thailand, Nepal and Bhutan
Stakeholder meeting using AIM/CGE in Bhutan, on May 17-18, 2018
Capacity Building Workshop on Low Carbon Development for Lao PDR and Cambodia
@ National University of Laos, on November 19, 2018
From experiences of Japan

• Model can be a core tool to assess future vision.
  ✓ All stakeholders must understand the model correctly.
  ✓ Model cannot predict the future but only show a consistent figure.
  ✓ By using model, we can experiment.

• Data to be input to model is the most important.
  ✓ Latest technologies will have to be updated continuously, because speed of technology improvement is very rapid.
    Support of business sectors are required.
  ✓ Not only direct mitigation actions but also indirect mitigation actions including preference change become important.
  ✓ Scheduled revision of simulations can support climate policy.

• Not only model but also clear narrative storylines are needed in order to communicate with various stakeholders and disseminate accurate information about simulation results.
Stakeholder dialogue in France

The National Council for Energy Transition (2012-2013):
7 x 16 members

1. Environmental NGOs
2. Consumer Associations
3. Trade-Unions
4. Industry
5. Local authorities
6. Parliament
7. Administration

+ Expert Group
+ Citizen Group

Patrick Criqui (2016) Governance levels, scientific paradigms and policy instruments for Deep Decarbonization Pathways, The 8th LCS-RNet Annual Meeting, Wuppertal
Brief history of climate policy in Japan and AIM

1990; AIM project started.
- 1997; Toward UNFCCC COP3, Japan technology model (AIM/Enduse) model was used to assess the mitigation target in Japan.
  - GHG mitigation target in Japan: **-6% compared to 1990 level**
2004; Japan LCS research started (in 2009, Asia LCS research started).
- 2008; At G8 Toyako Summit, at least 50% reduction of global emissions by 2050 was agreed.
- 2008; Based on three types of models (global technology model, Japan technology model and Japan economy model), options of Japan’s middle-term target (2020 target) on GHG reduction were calculated.
  - Role of model was to provide 6 options as GHG mitigation target. (Final decision was done by policymakers.)
  - GHG mitigation target in Japan: **-15% compared to 2005 level (-7% to 1990 level)**
- 2009-2011; By using Japan technology model and Japan economy model, the possibility of **“25% reduction in 2020 compared to 1990 level”** was assessed.
  - Role of model was to show how to achieve the -25% target.
- Great East Japan Earthquake and Fukushima Dai-ichi Nuclear Power Plant Accident in 2011
  - The new mitigation target in 2020 was decided to be **“-3.8% compared to 2005 (+3.1% to 1990 level)”** on November 15, 2013.
  - Assumption: No nuclear power in 2020.
  - As a Japan's mitigation target, "**26% reduction compared with 2013 level**" was endorsed by the Cabinet on July 17, 2015.
    - Unfortunately, these days, models have no role to play for decision of mitigation target.
- In 2016, Cabinet decided **80% reduction of GHG in 2050 compared with present level.**
- Since 2016, MOEJ started to discuss long-term low carbon vision in Japan.
- In August 2018, Long-Term Strategy under the Paris Agreement as Growth Strategy started at the Prime Minister's Office.
- In July 2018, the 5th Strategic Energy Plan was approved by the Cabinet.
Sectoral GHG emissions in Japan in 2030
High economic growth case estimated by AIM/Enduse model

- **GHG Emissions [Mil. tCO2-eq]**
- **Level of GHG mitigation measures**
- **Share of nuclear power to total electricity supply in 2030**

Data: Central Environment Council, as of June 2012
Necessary additional costs and saved energy costs estimated by AIM/Enduse model

Investment options to reduce GHG emissions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Energy intensive industries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Industrial furnace, boiler, etc</td>
</tr>
<tr>
<td>Residential</td>
<td>High insulation house</td>
</tr>
<tr>
<td></td>
<td>High efficient &amp; solar water heater</td>
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<tr>
<td></td>
<td>High efficient appliances &amp; HEMS</td>
</tr>
<tr>
<td>Commercial</td>
<td>Energy efficient building</td>
</tr>
<tr>
<td></td>
<td>High efficient &amp; solar water heater</td>
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<tr>
<td></td>
<td>High efficient appliances</td>
</tr>
<tr>
<td>Transportation</td>
<td>Next generation vehicles</td>
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<tr>
<td></td>
<td>Low fuel consumption</td>
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<tr>
<td>Energy</td>
<td>PV</td>
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<tr>
<td></td>
<td>Wind power</td>
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<tr>
<td></td>
<td>Small scale hydro &amp; geo-thermal</td>
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<tr>
<td></td>
<td>Biomass power</td>
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<tr>
<td></td>
<td>power system stabilization</td>
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<tr>
<td></td>
<td>Gas pipelines</td>
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<tr>
<td></td>
<td>CCS</td>
</tr>
<tr>
<td>Others (Non-Energy)</td>
<td>Agriculture</td>
</tr>
<tr>
<td></td>
<td>Waste</td>
</tr>
<tr>
<td></td>
<td>F-gas</td>
</tr>
</tbody>
</table>

Cumulative additional investment and saved energy costs by 2020 and 2030 (unit: tri. yen)

Low carbon society will need the new investment.

Data: Central Environment Council, as of June 2012

Low carbon society will need the new investment.
Results of AIM/CGE as of June 2012

Additional investment to GHG mitigation will contribute to a domestic demand increase. As a result, the GDP loss will be mitigated.

Macro economic impact compared to reference case in 2030, Low growth case
Long-term Low-carbon Vision by MOEJ

• Background: “Simultaneous solution” of economic and social problems such as population decrease and aging issue etc., and climate change
  ✓ Contribution to global reduction as well as domestic reduction
  ✓ Innovation (on technology, socioeconomic system and lifestyle) is the key

• Actions to reduce GHG by 80% by 2050
  ✓ Energy efficiency,
  ✓ Low-carbon energy supply, and
  ✓ Switch to low-carbon energies in end-use

• Taking into account "Carbon budget"

• Avoiding "Lock-in" effects

• Introducing "Carbon Pricing" as a policy to strengthen market competitiveness

Some Asian countries' NDCs

- Bhutan: To remain carbon neutral.
- Cambodia: 27% reduction in the year 2030 compared to the baseline.
- China: To reduce carbon intensity by 60% to 65% by 2030 below 2005 levels;
- India: To lower the emissions intensity of GDP by 33% to 35% by 2030 below 2005 levels.
- Indonesia: An unconditional 2030 GHG emissions reduction target of 29% below BAU including LULUCF emissions and a conditional 41% reduction below BAU by 2030 (with sufficient international support)
- Japan: To reduce emissions by 26% below 2013 emission levels by 2030.
- Korea: To reduce greenhouse gas emissions by 37% below BAU by 2030.
- Malaysia: To reduce GHG emissions intensity of GDP by 45% by 2030 relative to the emissions intensity of GDP in 2005.
- Nepal: 50% reduction in dependency to fossil fuels by 2050.
- Thailand: An unconditional 20% reduction in emissions by 2030, compared to BaU levels. This could increase to 25%, conditional upon the provision of international support.
- Vietnam: An 8% reduction in emissions by 2030, compared to BaU. This could be increased to 25% conditional upon international support.

- USA: To reduce economy wide emissions by 26% to 28% below 2005 domestically.
- EU: To reduce greenhouse gases emissions by at least 40% domestic below 1990 by 2030.
## Long-term low GHG emission development strategy

<table>
<thead>
<tr>
<th>Country</th>
<th>Date submitted</th>
<th>GHG reduction target</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>Nov. 16, 2016</td>
<td>80% reduction of GHG in 2050 compared to 2005 level</td>
</tr>
<tr>
<td>Mexico</td>
<td>Nov. 16, 2016</td>
<td>50% reduction of GHG in 2050 compared to 2000 level</td>
</tr>
<tr>
<td>Canada</td>
<td>Nov. 17, 2016</td>
<td>80% reduction of GHG in 2050 compared to 2005 level</td>
</tr>
<tr>
<td>Germany</td>
<td>Nov. 17, 2016</td>
<td>80-95% reduction of GHG in 2050 compared to 1990 level</td>
</tr>
<tr>
<td>France</td>
<td>Dec. 28, 2016</td>
<td>75% reduction of GHG in 2050 compared to 1990 level</td>
</tr>
<tr>
<td>UK</td>
<td>April 17, 2018</td>
<td>80% reduction of GHG in 2050 compared to 1990 level</td>
</tr>
</tbody>
</table>

In addition to above countries, Benin, Czech Republic, Ukraine and Republic of the Marshall Islands have already submitted their strategies.
GHG emissions in Japan; trend and future targets

Toward 2 °C target / 1.5 °C target

• Present NDCs are not enough to achieve 2/1,5 °C target.
  ✓ Paris agreement: peak out as soon as possible, and net zero during latter half of 21st century.
  ✓ SR1.5: Reduction after 2020, and net zero emissions during 2040-2055.

• GHG mitigation targets of all countries should be strengthened.

Source: http://unfccc.int/resource/docs/2016/cop22/eng/02.pdf
How to update mitigation target?

We need

- Narrative storyline,
- Consistent quantification,
- Stakeholders participation, and
- Concrete roadmap.

The above process includes

- Future vision,
- Role of each stakeholder, and
- Necessary innovations.

→ Model is a core tool to discuss the zero carbon society. "To develop model and scenarios with your own hands" is the most important.
Speakers and topics

Some Asian countries started to discuss roadmaps toward decarbonized society and sustainable development based on models. Following speakers will explain their experiences on scientific assessments and contribution to climate/environmental policies.

- Prof. Bundit Limmeechokchai, SIIT-TU, Thailand
  Climate mitigation policies and role of models in Thailand

- Mr. Phuntsho Wangdi, NEC, Bhutan
  Carbon neutral target and role of models in Bhutan

- Prof. Ho Chin Siong, UTM, Malaysia
  Climate development and model in ISKANDAR Malaysia

- Dr. Tsuyoshi Fujita, NIES, Japan
  SDGs and national policies

- Discussion: How to bridge the gaps between policymakers and research communities toward 2/1.5 °C target.