AIM models in Asia
http://www-iam.nies.go.jp/aim/index.html

Junichi FUJINO

December 5th 2015, Japan Pavilion, COP21@Paris

National Institute for Environmental Studies (NIES)
    Toshihiko Masui, Junichi Fujino, Kei Gomi and Tran Thanh Tu

Institute for Global Environmental Strategies (IGES)
    Shuzo Nishioka and Tomoko Ishikawa
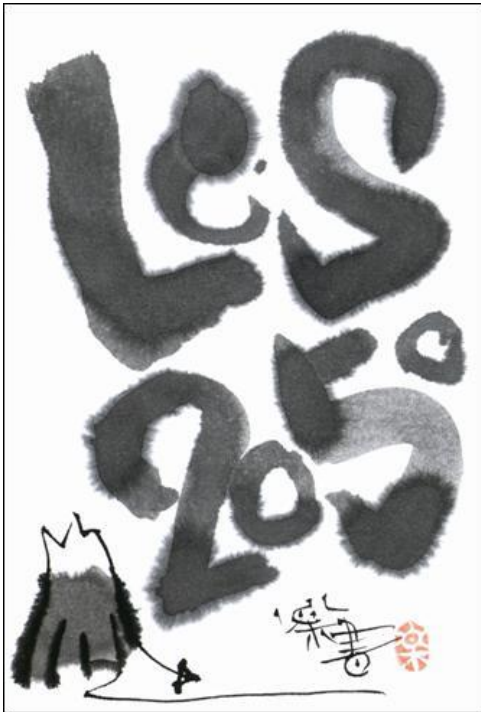
Kyoto University (KU)
    Yuzuru Matsuoka and Nguyen Thai Hoa

E-konzal
    Tomoki Ehara and Yuki Ochi

Mizuho Information & Research Institute (MHIR)
    Go Hibino, Kazutaka Oka, Kazuya Fujiwara and Aya Naito

Drawn by Mr. Hajime Sakai

AIM: Asia-Pacific Integrated Model

AIM is Simulation Model

- Technology Bottom-up model including more than 400 options

- Economic Top-down model to evaluate economic impact

- Detailed sector-wise model for population, residential, transport, Industry, energy supply, etc

AIM is Human Network

- Start international collaboration since 1994 and we have the 21st annual int.ws in Nov 2015, Tsukuba

- Researchers and policy-makers in China, India, Korea, Thailand, Indonesia, Malaysia, Vietnam, Nepal, Cambodia, Bangladesh, Taiwan, Australia, NZ, USA, EU, etc and Japan.

January 23-24, 2015
Ohyama Memorial Hall, NIES
Tsukuba, Japan

The 21st AIM International WS Nov 13-15, 2015, Tsukuba

The 20th AIM International WS January 23-24,

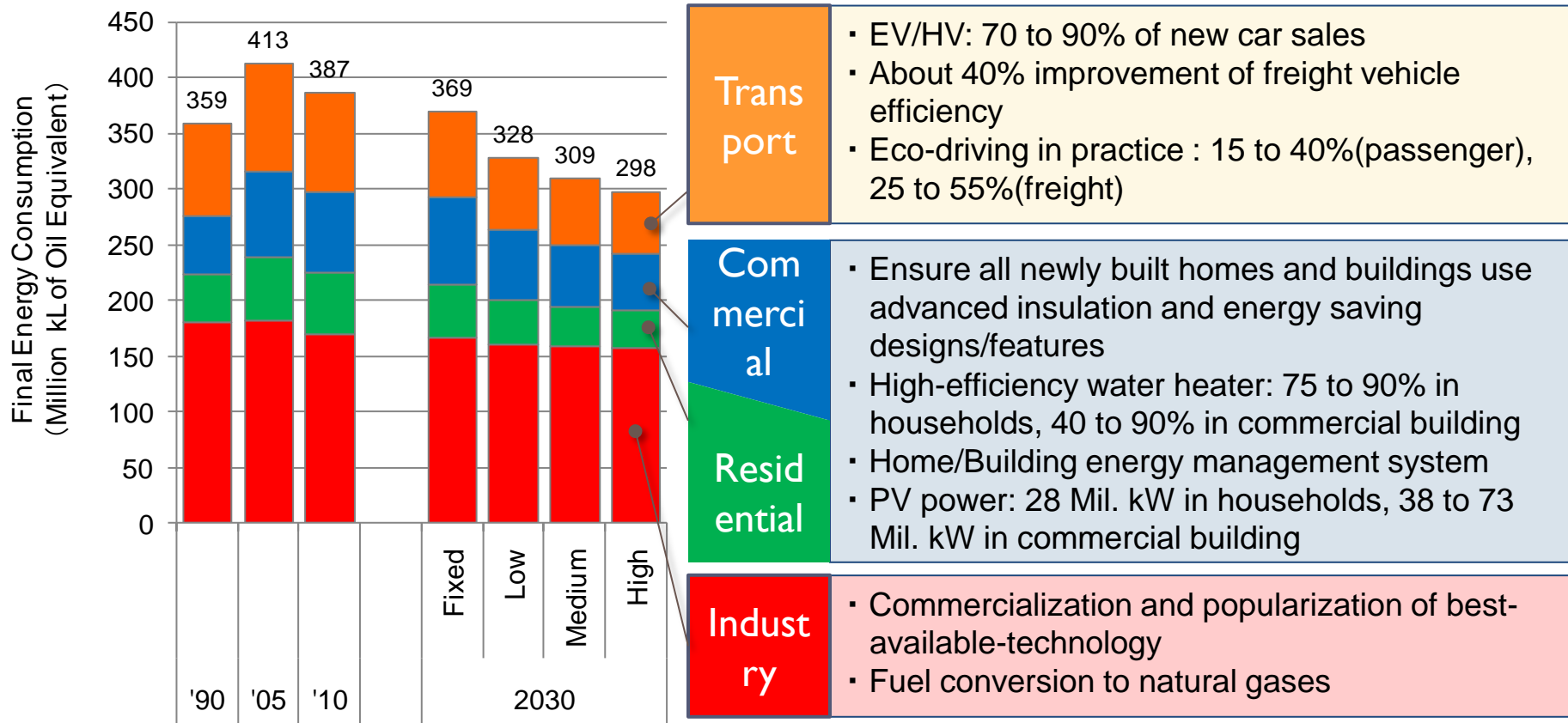# AIM (Asia-Pacific Integrated Model) Chronology and Japanese CC Policy

	AIM mitigation scenarios	Japanese PM's Decision
1989	AIM start	
1997	15% cut in 2010	6% cut in 2010 by PM Hashimoto
2007	70% cut in 2050	Cool Earth 50 by PM Abe
2008	12 actions towards LCS	60-80% cut in 2050 by PM Fukuda
2009	7/15/25 % cut in 2020	8% cut in 2020 by PM Aso 25% cut in 2020 by PM Hatoyama
2011	East Japan Earthquake and Fukushima Accident	
Now	INDCs, 2030 target	26% cut in 2030 by PM Abe

AIM members support IPCC as CLAs, LAs, and REs since the FAR.
AIM provides RCPs (Representative Concentration Pathways).

4

Analysis by AIM/Enduse in Japan

Final energy consumption in 2030 (low growth case)

Transport
- EV/HV: 70 to 90% of new car sales
- About 40% improvement of freight vehicle efficiency
- Eco-driving in practice : 15 to 40%(passenger), 25 to 55%(freight)

Commercial
Residential
- Ensure all newly built homes and buildings use advanced insulation and energy saving designs/features
- High-efficiency water heater: 75 to 90% in households, 40 to 90% in commercial building
- Home/Building energy management system
- PV power: 28 Mil. kW in households, 38 to 73 Mil. kW in commercial building

Industry
- Commercialization and popularization of best-available-technology
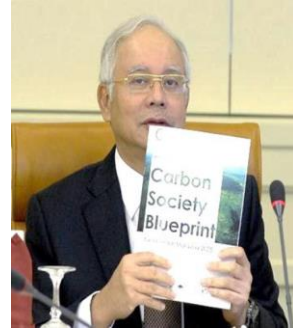- Fuel conversion to natural gases

International Cooperation toward Low Carbon Society

Contribute to IPCC AR5 process developing SSPs (Socio-Economic Scenarios) and RCPs (Representative Concentration Pathways) using AIM
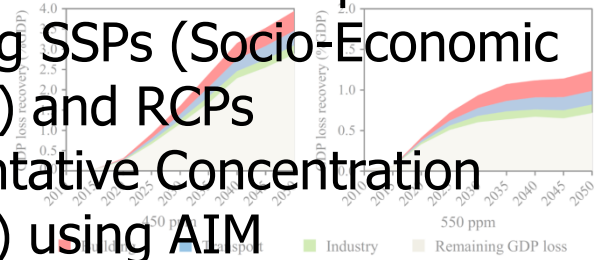
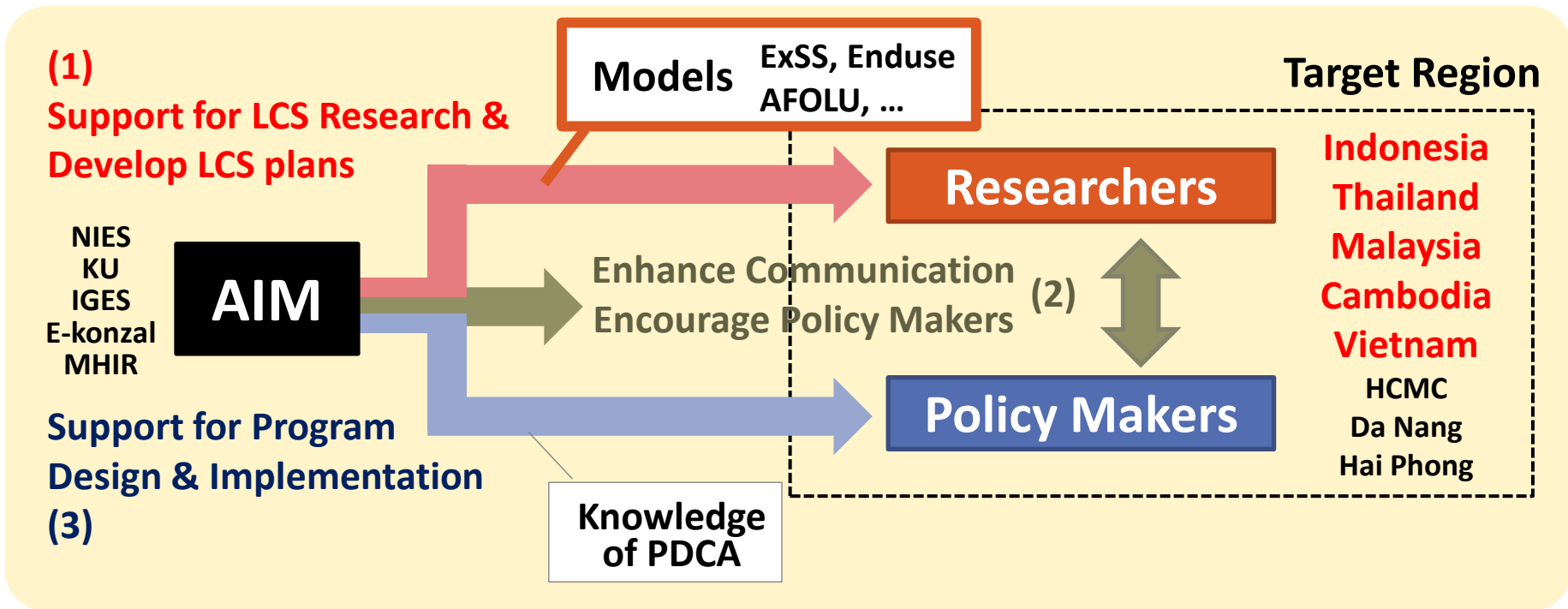Adopted as Iskandar Malaysia Low Carbon Society Blueprint by Prime Minister, and move forward

Malaysia
Putrajaya
Cyberjaya
Iskandar Malaysia

India
Bhopal
Ahmedabad

Vietnam
Bangladesh
Indonesia
Cambodia

Japan
Kyoto
Shiga

China
Guan Zhou
Dalian

Thailand
Ratchaburi
KhonKaen

S. Korea
Kyonggi-do

Asian Low Carbon Scenarios developed by simulation models: AIM (Asia-Pacific Integrated Model)

6

Overall Activity of Country Level
Low Carbon Society Research Project

Low Carbon Society Research (LCSR) Project

- The following diagram shows the overall structure of LCSR project which is funded by Ministry of the Environment Japan (MoEJ).

- AIM team has collaborated with researchers to develop national/city-level LCS plans and roadmaps (1), and communicated policy makers to make actual policy (2).

- AIM team is also trying to collaborate researchers and policy makers to design practical programs and implementation arrangement for mitigation actions (3).

(1)
Support for LCS Research & Develop LCS plans

Models ExSS, Enduse AFOLU, …

Target Region

NIES
KU
IGES
E-konzal
MHIR

AIM

Researchers

Enhance Communication Encourage Policy Makers **(2)**

Policy Makers

Indonesia
Thailand
Malaysia
Cambodia
Vietnam
HCMC
Da Nang
Hai Phong

Support for Program Design & Implementation (3)

Knowledge of PDCA

Supported by MoEJ

- Quantitative scenario approach with AIM has been applied to more than 20 regions in Asia, and LCS plans and roadmaps are developed for each region.
- In FY 2015 (Apr. 2015 – Mar. 2016), main target regions for development of LCS plans are Thailand, Indonesia and cities in Vietnam (Ho Chi Minh, Hai Phong and Da Nang).

http://2050.nies.go.jp/LCS/index_j.html

- The following table shows the outcome of the LCSR project in each country so far and its contribution on climate change policy.

Target Region	Description
Indonesia	• C/P researchers : **Prof. Rizaldi (IPB), Dr. Ucok and Dr. Retno (ITB)** • **National scale LCS policy** including not only energy sector but also agriculture, land use change, etc. has developed. **They are evaluating existing climate change action plans, i.e. RAN GRK and INDC by AIM**.
Thailand	• C/P researchers : **Prof. Bundit (SIIT-TU) and Prof. Shrestha (AITM)** • The team developed LC Roadmap towards 2050 and performed intensive dialogues with policy makers**. The outcomes of their LCS study contribute to the process for investigation of Thailand NAMAs and INDC**.
Vietnam	• C/P researchers : **Dr. Lam (ISPONRE)** • LCS scenario towards 2030 including sectors of waste, agriculture and land use as well as energy was developed.
Nepal	• C/P researchers : **Prof. Ram Shrestha (AITM)** • LCS study towards 2050 including agricultural sector as well as energy sector.
Cambodia	• C/P researchers : **Dr. Mao (MoEC)** • LCS study towards 2050 was completed and published.
Malaysia	• C/P researchers : **Prof. Ho (UTM)** • Main focus of current activity is implementation of LCS policy.

10

Country Case Studies

- Indonesia energy team is involved in the development of ExSS, Enduse and CGE models.

- The team is evaluating existing national climate change action plans, i.e. RAN GRK and INDC by those models.

INDONESIA

INDC

The 29% GHG emissions reduction target are planned to be achieved with three different focus-sectors. The following figures are represented in "Dokumen Pendukung Penyusunan INDC Indonesia (Draft 11.08.15) "

Actions	Emission Reduction Target 2020-2030		
	Ambitious	Optimistic	Fair
Land-use based policies scenario	750 MtonCO2 in 2030	627 MtonCO2 in 2030	596 MtonCO2 in 2030
Energy sector policies scenario	393 MtonCO2 in 2030	258 MtonCO2 in 2030	222 MtonCO2 in 2030
Waste sector policies scenario	45 MtonCO2 in 2030	36 MtonCO2 in 2030	30 MtonCO2 in 2030

*the reduction targets are then adjusted into the model, since the model base data are not re-calibrated with Indonesia current conditions and development plans.

- The following figure shows the example of the analysis, which is extracted from the brochure.

Figure 9 shows the primary energy supply mix and the associated GHG emissions projections for the year 2030 and 2050, which are derived from ExSS model results that are then used for reference in end-use model analysis. Figure 10 shows the transportation demand projections in freight and passenger transportations, based on mode of transports for the year 2030 and 2050. Figure 11 shows the final energy demand projections by fuel and sector view for the year 2030 and 2050. These information are then used as reference for the end-use model as a basis of estimating the energy service demand allocations in end-use input database.
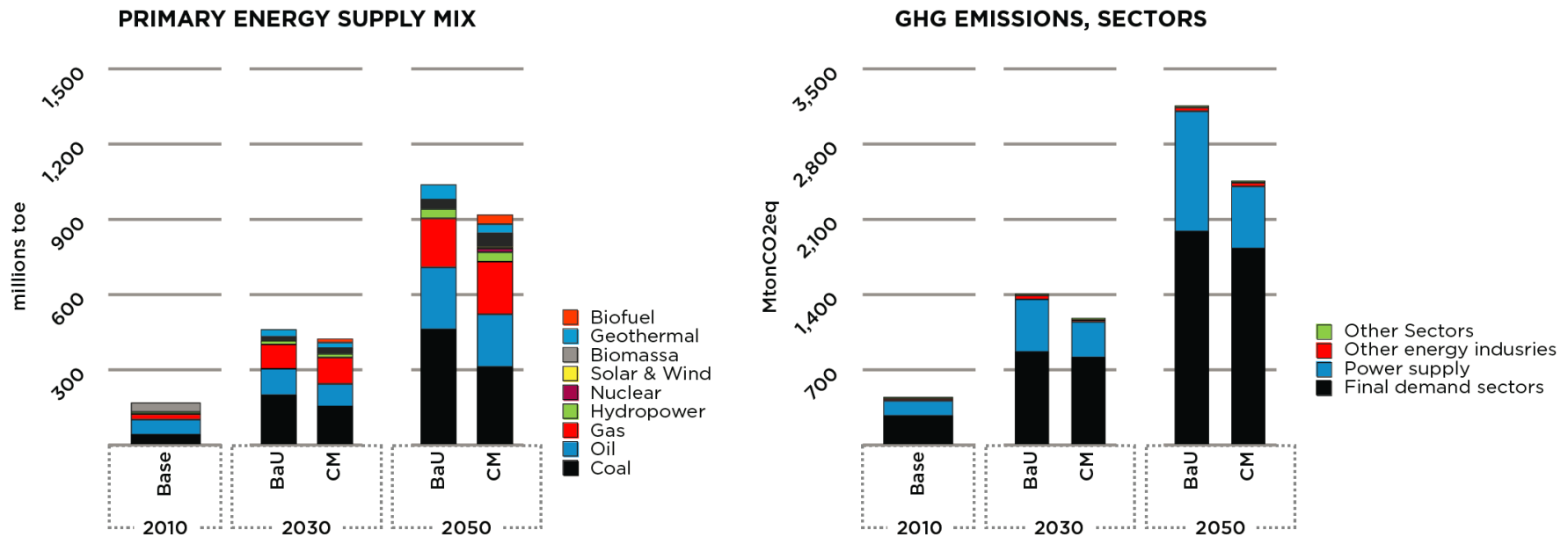

Figure 9 Primary Energy Mix and GHG emissions projections
(2030 and 2050) ExSS

- The following figure shows the example of the analysis, which is extracted from the brochure (case in power sector).

Key Technology to Realize Indonesia LCD Conditions
1. Increase in Gas Powered electricity generation–replacing stock Oil powered plants. While significant reduction in Coal Powered electricity generation due to end-users energy efficiency and conservancy measures.
2. New Gas Combine Cycle Power Plant introduced in additional Power Generation required from Gas Powered electricity.
3. Introduction of Nuclear Power in 2030 CM scenario
4. Higher rate of Hydro Power electricity generation in 2030 CM scenario
5. Higher use of Biomass in CM using Existing Steam Turbine and Combined Cycle Biomass Plants due to limitation in other renewable introduction
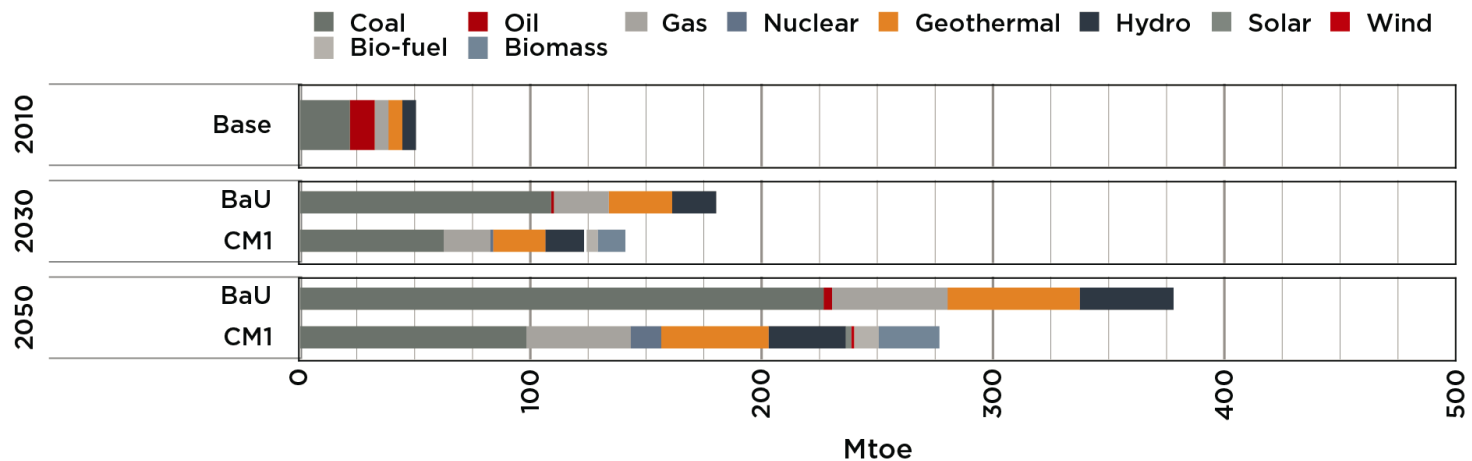* note that there are changes in power grid emission factor

Figure 15 Power Generation energy demand projection
(2030 and 2050) End-Use, by type of fuel

14

- Thailand team is involved in the development process of Thailand official NAMA and INDC.
- Analysis though AIM contributes very much for their investigation process.

COP20 Lima, 9 December 2014

Minister of MONRE pledged Thailand's NAMA in Lima COP20

"………. Thailand will lower CO_2 emissions in the range of 7-20% in 2020 when compared to the BAU"

UN NY, 30 Sept 2015
PM applauds 2030 Agenda, pledges work towards a sustainable Thailand including INDC 2030

"…. On Thailand's part, we reaffirm our commitment under the **Intended Nationally Determined Contributions (INDCs)** to reduce our GHG emissions between **20 and 25% by 2030**"…

- The following figure shows the preconditions for developing Thailand's INDC (by utilizing AIM).

Development of BAU in Thailand's INDC

INDC UFI is used to develop Thailand's INDC

Base year	2005
Target year	2030
Sector	Power, transportation, buildings, residential, manufacturing industries, wastes, agriculture, industrial processes
Gases	Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF_6)
Global Warming Potential	IPCC Fourth Assessment (AR4)
Modeling tool	Asia-Pacific Integrated Model (AIM/Enduse)
Modeling Approach	Bottom-up/End-use approach (by technologies and CO_2 countermeasures)
GDP growth	3.94% p.a. (revised by TH Govt in 2015)
Population growth	0.03% p.a. (revised by TH Govt in 2015)
Energy prices	Oil prices (International Energy Agency, 2015)

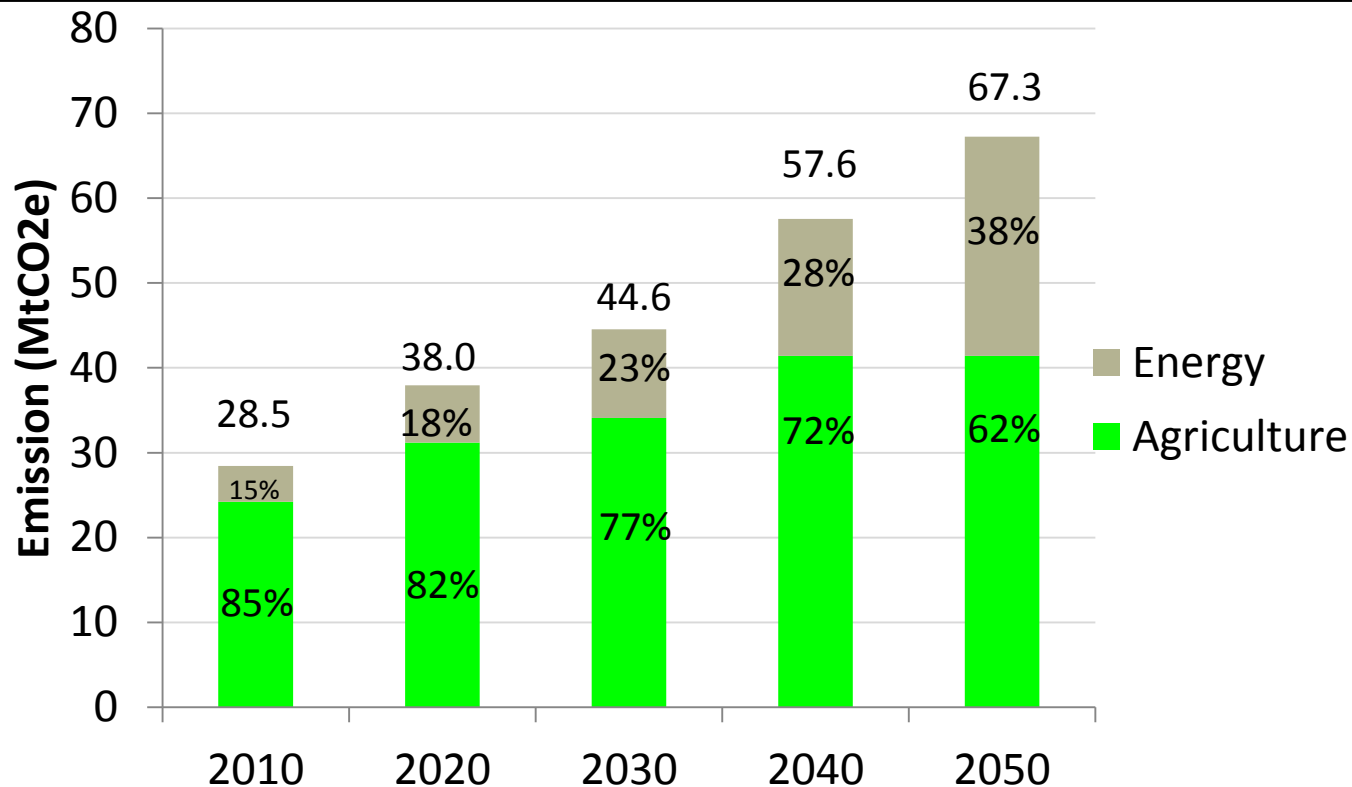- The following figure shows the example of the analysis for post 2020 LCS analysis by Thai team.

Thailand's Post2020 Scenarios

Low Emission Pathway and Peak CO_2 Scenarios
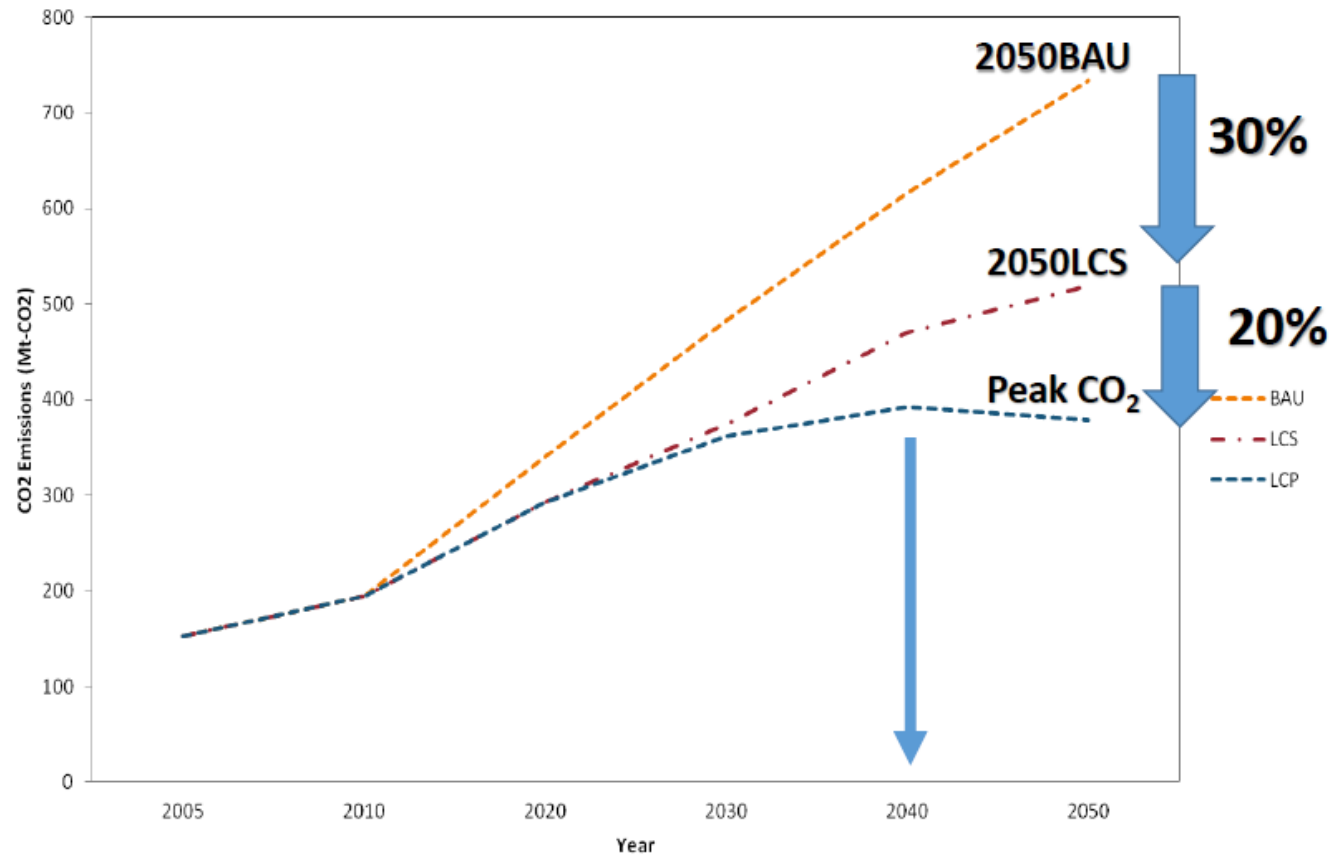
- Nepal team is trying to develop Nepal LCS scenario towards 2050 by utilizing models of AFOLU and Enduse.

- One BaU and several scenarios (one no-regret and four types of emission tax imposing cases) are developed.

- The following figure shows the GHG emission from from Agriculture and Energy using Sectors in BAU.

- The following figure shows the GHG emission from agriculture during 2010-2050 in BAU case.
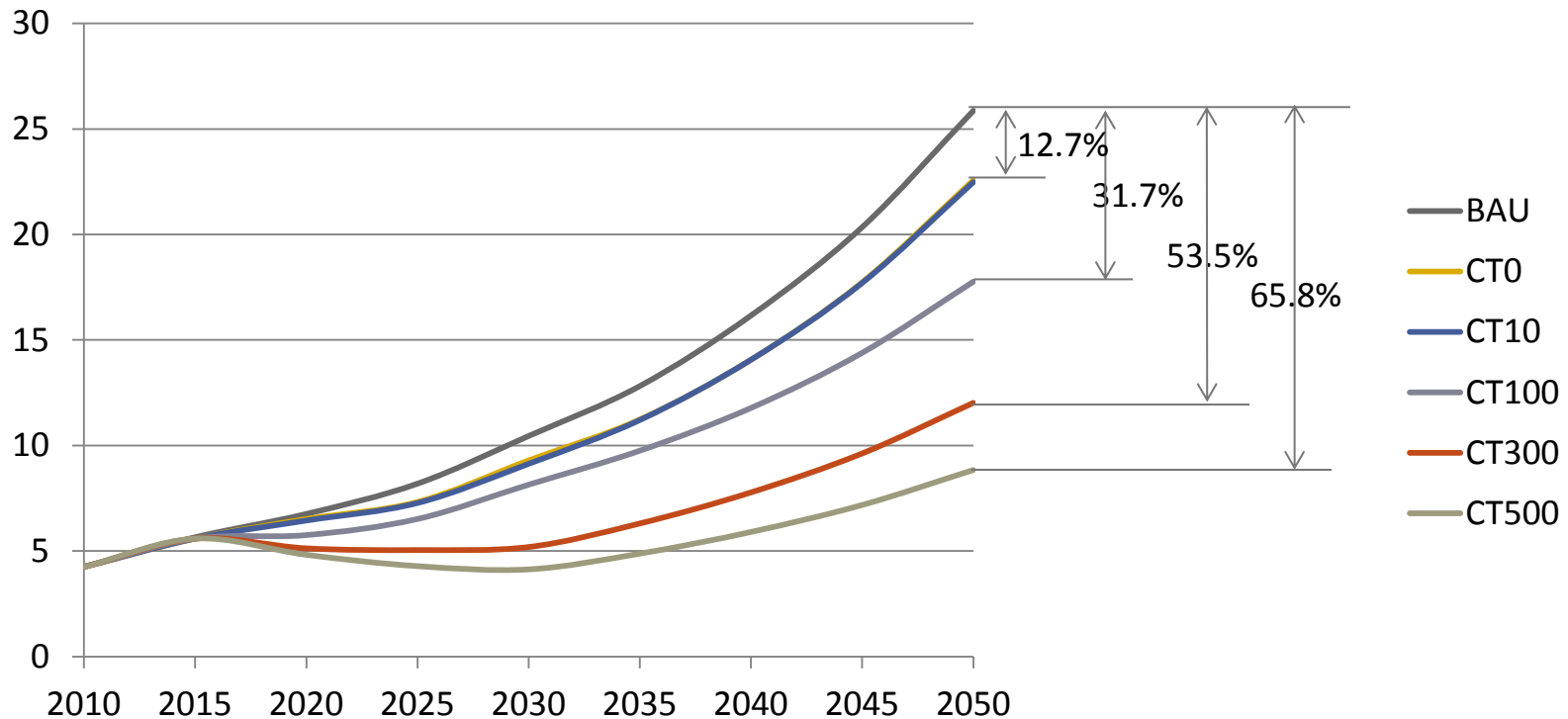
- **Emission increases from 4.3 MtCO2e in 2010 to 25.9 MtCO2e in 2050 in the BAU case.**
- **Cumulative GHG reduction during 2010-2050 in CT0, CT10 would be 10.8%, 11.1%, respectively**
- **At CT100, CT300 and CT500 it would be 23.3%, 44.1% and 53.9% respectively**
- **➔ low emission tax elasticity of GHG reduction.**

- Mitigation options in each sector are also evaluated case by case. The following figure shows the example in building sector.

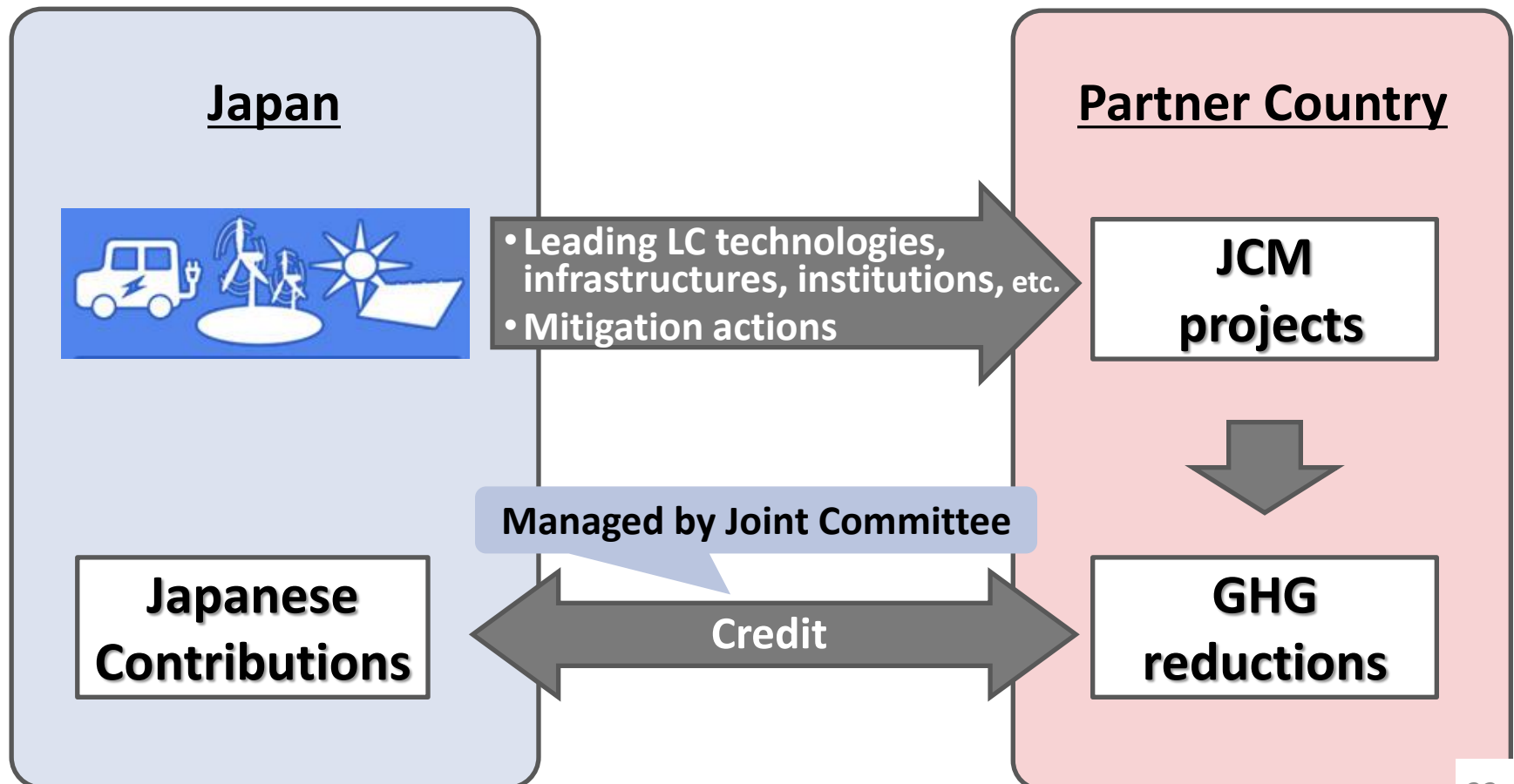## Cost-effective mitigation options in residential and commercial sectors

	Emission tax ($/tCO$_2$e)				
	CT0	CT10	CT100	CT300	CT500
Cost-effective options	Biogas cooking				
	Electric cooker				
	EE LPG stove				
	Solar water heater				
	Energy efficient bulbs (CFL & LED)				

Supplement information:
JCM (Joint Crediting Mechanism)

Joint Crediting Mechanism (JCM)

- Government of Japan has proposed JCM which aims to facilitate mitigation actions, and contributes to sustainable development in partner countries.
- LCSR is one of the projects supported by MoEJ, which is expected to provide useful information to enhance and diffuse JCM scheme to developing countries.

Japan

Partner Country

- **Leading LC technologies, infrastructures, institutions, etc.**
- **Mitigation actions**

JCM projects

Managed by Joint Committee

Japanese Contributions

Credit

GHG reductions

JCM Partner Countries

- Japan has established the JCM with 16 countries (Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Vietnam, Lao PDR, Indonesia, Costa Rica, Palau, Cambodia, Mexico, Saudi Arabia, Chile, Myanmar and Thailand), and seven JCM projects is registered.

Mongolia
Jan. 8, 2013
(Ulaanbaatar)

Bangladesh
Mar. 19, 2013
(Dhaka)

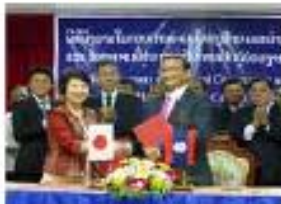Ethiopia
May 27, 2013
(Addis Ababa)

Kenya
Jun. 12, 2013
(Nairobi)

Maldives
Jun. 29, 2013
(Okinawa)

Viet Nam
Jul. 2, 2013
(Hanoi)

Lao PDR
Aug. 7, 2013
(Vientiane)

Indonesia
Aug. 26, 2013
(Jakarta)

Costa Rica
Dec. 9, 2013
(Tokyo)

Palau
Jan. 13, 2014
(Ngerulmud)

Cambodia
Apr. 11, 2014
(Phnom Penh)
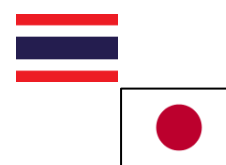
Mexico
Jul. 25, 2014
(Mexico City)

Saudi Arabia
May 13, 2015

Chile
May 26, 2015
(Santiago)

Myanmar
Sep. 16, 2015
(Nay Pyi Taw)

Thailand
Nov. 19, 2015
(Tokyo)

Let's develop Sustainable and Low Carbon Societies!

Asia LCS

藤野　純一

Junichi FUJINO

fuji@nies.go.jp