THE ASIA-PACIFIC INTEGRATED MODEL (AIM) & POLICY MAKING FOR LOW-CARBON GROWTH IN ASIA

A CASE STUDY OF THAILAND

ASIA LEDS PARTNERSHIP

AIM

MANY COUNTRIES IN THE ASIA-PACIFIC REGION – including China, India, Indonesia, Philippines, Thailand, and Vietnam – have voluntary greenhouse gas (GHG) mitigation policies and initiatives to help address the causes of climate change and achieve sustainable development. However, alternate development pathways require different policy and technology measures that have varying costs and benefits, so it is critical for countries to identify the most cost-effective and locally appropriate policies and actions to achieve their goals.

Several modeling tools[1] have been developed to help governments, researchers, and other stakeholders assess the potential impact of policy and technology options. This case study shows how one of these tools, the Asia-Pacific Integrated Model (AIM), has been used in Thailand to inform policy-making for low-carbon, climate-resilient growth.

> ***MORE THAN 20 TYPES OF AIM MODELS HAVE BEEN DEVELOPED TO HELP ANALYZE THE LINKAGES BETWEEN A COUNTRY'S ECONOMY AND GHG-EMITTING SECTORS.***

1 Other modeling tools commonly used in Asia for GHG emission assessment include the MARKet ALlocation (MARKAL) platform developed by the Energy Technology Systems Analysis Programme (ETSAP) of the International Energy Agency, and the Long-range Energy Alternatives Planning System (LEAP) developed at the Stockholm Environment Institute. These modeling tools are sometimes used in combination or in place of other tools depending on various factors, such as the socio-economic characteristics of the country or sector targeted, availability of data, the policies, targets, or projections involved, and the level of proficiency of the user(s) with the various tools.

THE AIM TOOL

AIM is a set of computer simulation models for assessing options – primarily policy and technology choices – to reduce or slow the growth of GHG emissions. It allows users to model a wide range of social and economic activities over short and long periods of time that contribute to GHG emissions and sequestration, including energy consumption, changing land use, and agricultural and industrial production. AIM models take into consideration the social and economic factors that drive the emission of GHGs, and the resultant effects of GHG emissions on climate, the economy, and human welfare.[2]

AIM was developed by the National Institute for Environmental Studies (NIES) in Japan, in collaboration with Kyoto University, the Mizuho Information & Research Institute, and several other research institutes in the Asia-Pacific region in order to help decision-makers answer questions such as: What are the costs and benefits of policies and measures to develop a low-carbon society? Which GHG mitigation options should be introduced and when? Which sectors offer the greatest potential for cost-effective GHG abatement?[3] AIM is one of the most frequently used models in the Asia-Pacific region for climate change and energy policy analysis.

AIM models are free to use, and Japan's Ministry of Environment (MOE), through the Japan International Cooperation Agency (JICA) and the AIM team at NIES, has supported governments and research institutes in 10 Asia-Pacific countries to apply the tool. It has been used, for example, to inform development of national or subnational policies and plans including energy and GHG emissions targets, Low Carbon Society (LCS) scenarios, Nationally Appropriate Mitigation Actions (NAMAs), and Intended Nationally Determined Contributions (INDCs), as well as variety of research initiatives. More information on the AIM tool is provided in the final section, and a summary of the most commonly used versions can be found at: http://www-iam.nies.go.jp/aim/data_tools/index.html.

WHEN TO USE AIM

AIM is particularly useful to help decisionmakers understand the very complex challenge of climate change, and to develop and access policies and plans to promote low-carbon, climate-resilient growth. Two key advantages are the ability of AIM models to integrate and summarize diverse information from a variety of sectors and sources - such as data on electricity use; costs of new technologies, subsidies or taxes; per capita GDP; and numbers of households. AIM models use this information to calculate the consequences of different assumptions and policies to mitigate GHG emissions or reduce climate change impacts. Like most models, however, the results depend on the quality of data available, and the nature of the assumptions used.

LEDS and green growth strategies. AIM can be very useful as part of the process of developing a national green growth or low emission development strategy (LEDS). AIM models are used primarily for developing a "business-as-usual" or BAU scenario, baseline analysis, and assessment of potential policies and projects, including establishing targets. For LEDS, AIM is used primarily in Stage 3: Analytical Decision Making.[4]

Assessment of climate change and sustainable development policies and plans. National governments have adopted AIM to evaluate the environmental and economic impacts of policies such as carbon taxes, technology subsidies, and changes in consumption behavior; to set GHG emission reduction or energy intensity targets; and to assess the costs and benefits of different combinations of policies in alternative scenarios. AIM has more recently been extended to analyze other sustainable development issues such as water resources management, land use management, and industrial environmental management.

Assessing new technologies. AIM includes a detailed technology selection module to evaluate the effects of introducing different advanced technologies, making it particularly useful when analyzing the development and diffusion of new 'greener' technologies.

2 For more about AIM, visit http://www-iam.nies.go.jp

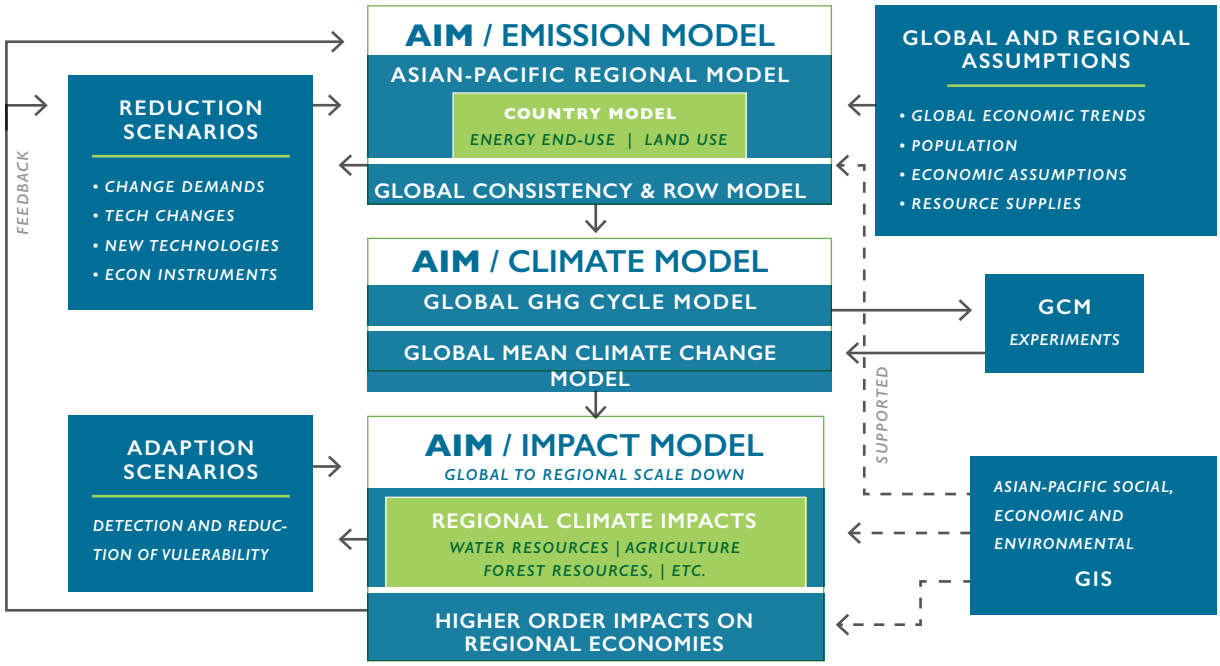
3 Prof. Ram M. Shrestha, Asian Institute of Technology, Thailand. Presentation available at http://lcs-rnet.org/pdf/locarnet_meetings/2012/S1_1_1Shrestha.pdf

4 For a detailed explanation of Stage 3 of the LEDS process, visit http://en.openei.org/wiki/Develop_BAU

The original AIM suite is a large scale integrated computer simulation model comprised of three main versions:

1. **AIM/Climate** is a global climate change model that examines the outcomes of different policy scenarios;
2. **AIM/Emission** is a GHG emissions model that includes data and information on population, economic trends, and government policies, and estimates energy consumption, land use changes, and GHG emissions; and
3. **AIM/Impact** is a climate change impact model that estimates impacts of various climate change scenarios on primary production industries and human health.

FIGURE 1: OUTLINE OF AIM MAIN MODEL[5]



However, more than 20 types of AIM models have been developed to date to help analyze the linkages between a country's economy and "GHG-emitting sectors such as the energy system."[6] These include "top-down" and "bottom-up" models; top-down modeling evaluates an economy or national system from aggregate economic variables, while bottom-up models consider technological options, and/or sector-specific or project-specific mitigation policies.

AIM/Enduse, for example, is a bottom-up technology selection framework that can provide information regarding the potential GHG emission reductions and abatement cost of different types of technologies. Based on the results, model users can prioritize the most appropriate technology and policy actions.[7]

On the other hand, a top-down model like **AIM/ESS** (Energy Snapshot Tool) is used to calculate an entire country's future energy balance and CO_2 emissions based on different assumptions. Similarly the **AIM/CGE** (Computational General Equilibrium) model covers all economic goods while considering production factor interactions, and can link bottom-up modeling to low carbon society plans and roadmaps.

5 Graphic from NIES/AIM website, available at http://www-iam.nies.go.jp/aim/publications/book/aim_enduse/aim_enduse.html
6 See International Panel on Climate Change (IPCC) http://www.ipcc.ch/ipccreports/tar/wg3/index.php?idp=310
7 See NAMA Guidebook, pgs 16, 28, and 31, available at http://lowcarbon-asia.org/english/data/pdf/nama_guidebook.pdf and http://www.iges.or.jp/files/research/sustainable-city/PDF/20141029_2/2-2_Fujino.pdf

CONTRIBUTION OF AIM TO POLICYMAKING IN THAILAND

To better understand how AIM can be used to support policymaking for low-carbon growth, an overview of how it has been used in Thailand is instructive. Thailand is the second largest economy in the Association of South East Asian Nations (ASEAN) and the second-largest emitter of CO_2 in the ASEAN region after Indonesia.[8] For more than a decade the Thai government has applied AIM to assist with development of policies and initiatives to reduce the growth in GHG emissions, improve the efficiency of the economy, and follow a more sustainable development path.

Key Thai policies and plans that relate to GHG emissions include the National Master Plan on Climate Change (2011-2050) prepared by the Natural Resources and Environment Ministry, the Ministry of Energy's 10-Year Alternative Energy Development Plan 2012-2021 (AEDP) and 20-year Energy Efficiency Development Plan 2011-2030 (EEDP), as well as the proposed NAMA. All of these policies include specific measures and targets. For example, the AEDP aims to "promote alternative energy usage to 25% of energy consumption", while the EEDP target is to "reduce energy intensity by 25% in 2030, compared with that in 2005".[9]

SEVERAL VERSIONS OF THE AIM TOOL HAVE BEEN USED IN THAILAND TO INFORM DEVELOPMENT AND IMPROVE THESE POLICIES. KEY EXAMPLES INCLUDE:

- AIM/CGE and AIM/Enduse were used to develop Thailand's NAMA, including the GHG reduction targets and analysis of the possible effects of GHG mitigation actions, such as the potential impacts of CO_2 emissions mitigation measures on energy consumption in Thailand up to 2050.[10]
- The AIM/Extended Snapshot tool (ExSS) was used to help develop the first Low Carbon Society Vision to 2030, and the AIM/Enduse and AIM/CGE models were used to assist with developing the second Low Carbon Society Roadmap to 2050.[11]
- With the objective of informing national energy and transportation policies, and low carbon scenario planning, researchers have used the AIM/Enduse to analyze the implications of GHG emission targets, carbon taxes, and proposed renewable portfolio standards on national energy security, as well as the co-benefits from these policies. AIM/Enduse has also been used for scenario-based analyses of development of the national energy system, and to evaluate the viability and GHG mitigation potential of various clean technologies.[12]

Several organizations and individuals have played central roles in much of the research and analysis involving the AIM tool in Thailand, often in collaboration with NIES staff. The Office of Natural Resources and Environmental Policy and Planning (ONEP) under the Ministry of Natural Resources and Environment has played a central role, in collaboration with the Thailand Greenhouse Gas Management Organization (TGO) and the Sirindhorn International Institute of Technology (SIIT) at Thammasat University. The Ministry of Energy, Ministry of Transportation, and other sectoral ministries, as well as the Asian Institute of Technology (AIT), have also been involved in AIM modeling work.

8 World Bank online database, http://data.worldbank.org/indicator/EN.ATM.CO2E.KT/countries/TH-ID-VN-MY?display=graph International Energy Agency, Southeast Asia Energy Outlook, September 2013, pg 40, https://www.iea.org/publications/freepublications/publication/SoutheastAsiaEnergyOutlook_WEO2013SpecialReport.pdf

9 See http://weben.dede.go.th/webmax/content/10-year-alternative-energy-development-plan http://www.asialeds.org/sites/default/files/resource/file/EEDP_Eng.pdf http://www.enconfund.go.th/pdf/index/EEDP_Eng.pdf. For an overview of Thailand's energy policies, visit http://www.iea.org/policiesandmeasures/renewableenergy/?country=Thailand

10 Discussion with Dr. Bundit Limmeechokchai, March 12, 2015. Also http://www.env.go.jp/en/earth/ap-net/documents/seminar/22nd/06_Thailand_Somnam_01.pdf

11 See http://www.researchgate.net/publication/275552846_Quantitative_Analysis_of_CO2_Mitigation_in_Thai_Low_Carbon_Power_Sector_towards_2050

12 See Climate Change Response Strategies – Perspectives in Modeling of Developing Economies, available at http://www.researchgate.net/publication/222676550_Scenario-based_analyses_of_energy_system_development_and_its_environmental_implications_in_Thailand and Thailand's power sector is modeled using Asia-Pacific Integrated Model (AIM/Enduse), http://www.sciencedirect.com/science/article/pii/S1876610214009187 http://www.researchgate.net/publication/275552846_Quantitative_Analysis_of_CO2_Mitigation_in_Thai_Low_Carbon_Power_Sector_towards_2050

Most recently, AIM/Enduse has been used to help develop Thailand's INDC by modeling the impact of alternative GHG mitigation measures and identifying potential co-benefits.[13]

Contribution to Thailand's NAMA. Several AIM models were used to support development of Thailand's NAMA, which was submitted to UNFCCC in December 2014. The NAMA includes a variety of initiatives and policies, from multi-sector strategies to single pilot projects, with a focus on developing alternative and renewable energy sources; improving energy efficiency in buildings, industry, transportation and power generation; increasing biofuel use in transportation; and creating an environmentally-sustainable transport system.[14]

A formal NAMA process began in 2011 and included a team led by ONEP and involving TGO, SIIT, and other stakeholders. A key focus was on developing feasible GHG reduction targets and appropriate measures to achieve the targets.

The modeling team initially reviewed several alternative tools and selected AIM due to ease of use, cost (free), and opportunity for training of relevant staff and researchers by NIES.[15]

The government felt it was important to use existing policies and plans as a framework for the NAMA, primarily those focused on renewable power generation; energy efficiency in industries; and waste to energy.

Working within this framework, the modeling team used AIM to develop the "business-as-usual" scenario (BAU) and to run a series of scenarios assessing alternative GHG mitigation measures. This process helped to identify the optimal abatement course and feasible targets. The results showed, for example, that fuel switching and waste-to-energy measures (e.g., biomass) had the potential to reduce emissions quite significantly compared to some renewable energy alternatives such as solar and wind.[16]

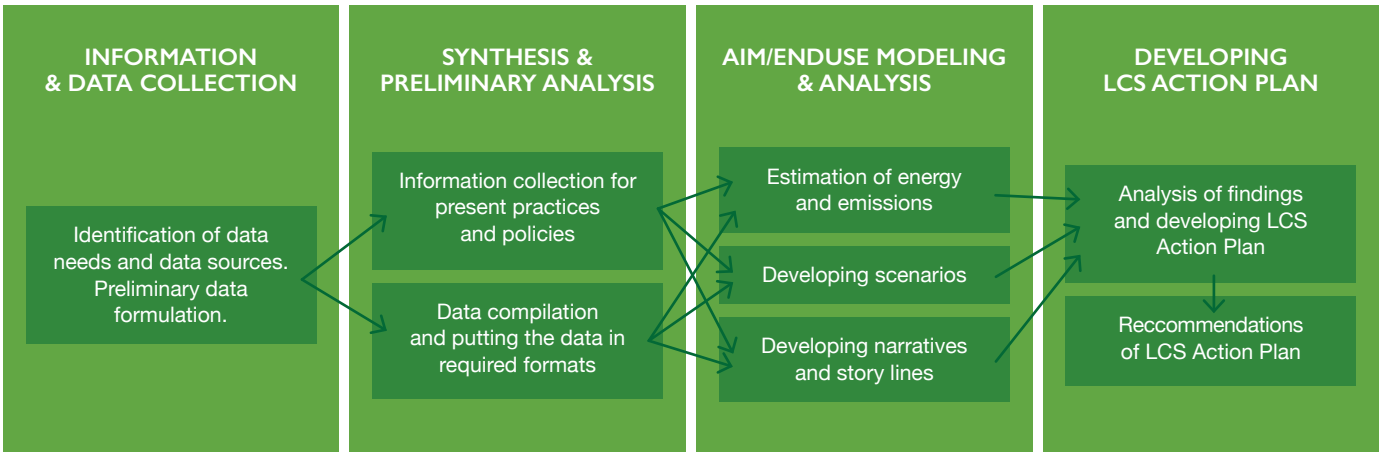
Based on the AIM-supported modeling and existing and proposed domestically supported actions and policies, the team determined that a minimum $C0_2$ reduction of 7% from the BAU case by 2020 (from the 2005 base year) was the most realistic. This would be equivalent to a reduction of about 25 million tons of CO_2 equivalent (CO_2e) in 2020. With international support for additional proposed measures, the maximum could be a 20% reduction in 2020.[17]

The NAMA team held consultation workshops with stakeholders almost every month starting in 2012 to discuss the selected mitigation measures. These included greater use of renewable and alternative energy sources, energy efficiency improvements, use of bio-fuels in transportation, and development of a sustainable transit system.

Following stakeholder consultations, the National NAMA Sub-Committee reviewed and approved the proposed NAMA, and it was then approved by the Cabinet.

Thailand is now beginning implementation of the NAMA, including developing specific actions that will depend on global support for their preparation and implementation.

FIGURE 2: THAILAND'S METHODOLOGY: ROADMAP FOR NAMA AND LOW CARBON SOCIETY USING AIM[18]



13 Email to author from Dr. Bundit Limmeechokchai, June 30 2015. See also: http://www-iam.nies.go.jp/aim/aim_workshop/aimws_20/presentation/s02_06_bundit_ppt.pdf

14 See: http://climate-l.iisd.org/news/thailand-submits-nama/

15 Discussion of author with Dr. Bundit Limmeechokchai, March 12, 2015.

16 Assessment of GHG Mitigation Measures on Energy, Environmental and Economic Aspect in Thailand towards 2050 using, various authors, AIM/CGE Model: http://eneken.ieej.or.jp/3rd_IAEE_Asia/pdf/paper/128p.pdf http://www.unescap.org/sites/default/files/Session%202%20-%209.%20Thailand%20Dr.%20Bundit.pdf http://www-iam.nies.go.jp/aim/aim_workshop/aimws_09/presentation/s05_shrestha_ppt.pdf

17 The MARKAL and LEAP tools were also used for some aspects of the modeling.

18 Graphic from presentation by Mikiko Kainuma, NIES, available at: http://lcs-rnet.org/pdf/locarnet_meetings/2012/S1_1_2Kainuma.pdf

Contribution to energy policies and plans. AIM modeling for Thailand's NAMA included an integrated assessment of existing national energy and climate change policies in order to better understand which measures would be most appropriate and feasible for Thailand going forward. Key policies the NAMA team analyzed included the 10-Year AEDP, and 20-year EEDP.

Based on new AIM modeling, the NAMA team proposed to ONEP some revisions to the polices, including moving the target year to 2020 from 2030 for both policies, setting a renewable energy target of 25% of total energy consumption (from approximately 8% in 2014), and improved measurement, reporting, and verification (MRV) systems for these policies. ONEP recommended that the Ministry of Energy adjust the policies accordingly.

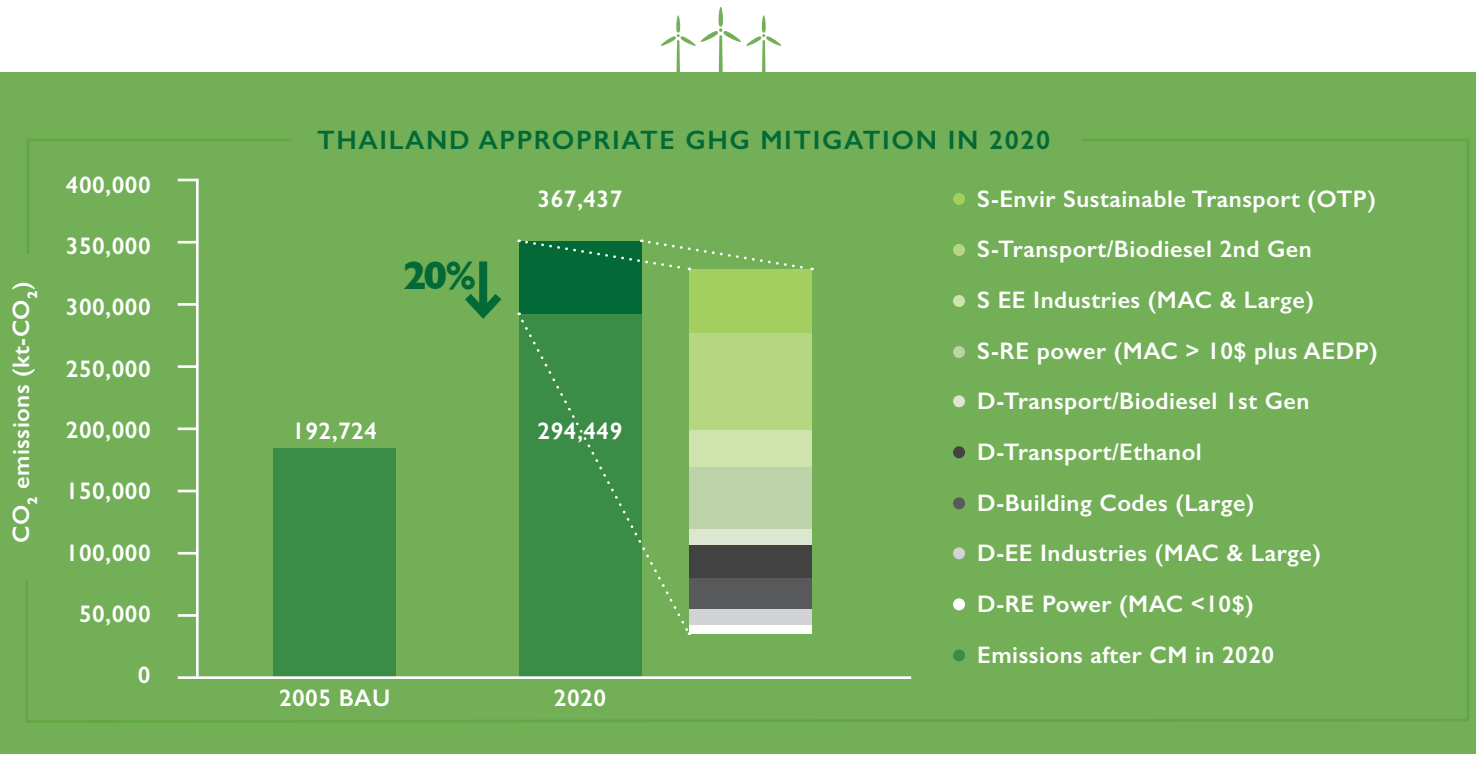
Since 2014 the Ministry of Energy and National Energy Policy Council (NEPC) have been revising several key polices. In August 2014 the NEPC announced revisions to the national Power Development Plan (PDP) in order to "better integrate the AEDP and EEDP and create a more comprehensive approach for integrated energy planning," and in early 2015 the Ministry of Energy agreed to set up a Working Group for MRV for renewable energy and energy efficiency. The new PDP (2015-2036) focuses mainly on the increasing use of cleaner fuels and reduced reliance on natural gas, with the proportion of renewable energy targeted at 20% by 2036.

The AEDP is currently being revised, though the AEDP target has been presented during public hearings of the PDP.[19]

Contribution to Low-Carbon Society planning. AIM modeling has also supported LCS planning in Thailand. The Road Map for a Low-carbon Thailand towards 2050 was developed jointly by Thammasat University's SIIT, AIT, NIES, Kyoto University, and the Mizuho Information and Research Institute in Japan. Starting in 2010, research using AIM/Enduse was undertaken to identify the most cost-effective GHG mitigation options for supporting Thailand's transition towards a low-carbon society.

The modeling provided recommended actions and potential GHG mitigation targets for the LCS road map. It was reported that, "In 2050, the AIM/Enduse results estimate that total GHG emissions in Thailand will be reduced from 769,896 kt-CO_2 in the BAU scenario to 551,575 kt-CO_2 in the 2050 LCS (a reduction of 28.4% of total GHG emissions) through the adoption of countermeasures for GHG emissions in the actions of clean power generation, green industries, effective freight transport, smart passenger transport, modern buildings, and Thai-style comfortable houses. In the 2050 LCS, the green industry measures account for the largest proportion (45.5%) of the CO_2 reduction, followed by smart passenger transport (38.2%), Thai-style comfortable houses (35%), modern buildings (34.6%), clean power (18.1%) and efficient freight transport (13.2%)".[20]

FIGURE 3: THAILAND'S CLEAN ENERGY FUTURE[21]



19 See http://www.thai-german-cooperation.info/download/20150520_pdp_re_%20policy%20factsheet.pdf

20 See http://www.nationmultimedia.com/business/Road-map-for-a-low-carbon-Thailand-30207310.html

21 Figure from presentation by Bundit Limmeechokchai, available at http://www.asialeds.org/resources/energy-leds-webinar

LESSONS LEARNED

Associate Professor Bundit Limmeechokchai, Head of the School of Manufacturing Systems and Mechanical Engineering at SIIT and a core member of the Thailand NAMA modeling team, stresses that convincing policymakers and other stakeholders of the suitability of modeling tools like AIM is important but can be challenging. In the past in Thailand some researchers conducted AIM modeling but had problems applying the findings because policymakers did not adequately understand the process and trust the outcomes. It is critical, Dr. Limmeechokchai stresses, to adequately explain the modeling process to policymakers, including the data and other inputs used.

For the NAMA process in Thailand, the team made significant investments in consultations and meetings with stakeholders. During 2012 through early 2015 the NAMA team had a series of workshops with government officials, representatives from the business community, and academics and researchers, in order to promote adoption of their approach. The meetings included presentations on how AIM contributed to the NAMA process and how GHG mitigation measures were selected, including how the 7% GHG emissions reduction minimum target was calculated.

As a result of the consultations, the NAMA team recommended modifying or removing some GHG mitigation measures that were not acceptable to all stakeholders. In addition, some private sector representatives expressed concern that certain recommendations would become new policies; the NAMA team explained that their recommended measures were in line with existing government policy.

Dr. Limmeechokchai also notes that it is critical that careful modeling using the best available data is undertaken before establishing policies with specific GHG emission reduction measures, targets, and accompanying incentives or penalties. In Thailand, some analysis conducted and targets developed prior to 2011 were too ambitious, for example, because they were not based on detailed modeling and analysis.

With good modeling, engagement with stakeholders, and implementation of recommended policies, AIM modeling can contribute to green growth and sustainable development goals.

Dr. Limmeechokchai notes that there has been a significant increase in investment in renewable energy and energy efficiency, and a bilateral mechanism with Japan is being set up to support investment in energy efficiency in Thailand. He believes that Thailand's low-carbon plans and policies, particularly energy policies, will result in transformational changes to both the supply side and demand side of the economy.

PHOTO: ROADMAP TO THAILAND'S NAMAS 2010 [22]
(OCTOBER 2014)

"IT IS CRITICAL TO ADEQUATELY EXPLAIN THE AIM MODELING PROCESS TO POLICYMAKERS, INCLUDING THE DATA AND OTHER INPUTS USED."

– DR. BUNDIT LIMMEECHOKCHAI

22 Photo from presentation Thailand NAMA Roadmap INDC and Peak CO2 Scenarios in 2050 by Bundit Limmeechokchai, Sujeetha Selvakkumaran, and Chontichaprin Nithitsuttibuta, available at: http://www-iam.nies.go.jp/aim/aim_workshop/aimws_20/presentation/s04_03_bundit_ppt.pdf

USE OF AIM IN OTHER ASIA-PACIFIC COUNTRIES

The AIM team at NIES has supported application of the AIM model in government agencies and research institutes in many Asian countries since 1995, and has helped develop national or subnational LCS scenarios since 2009. In addition to domestic modeling in Japan, assistance has been provided to partners in Bangladesh, Cambodia, China, Indonesia, Korea, Malaysia, Thailand, and Vietnam.

SELECTED EXAMPLES

INDONESIA. AIM was used for modeling the implications of a carbon tax on energy sector development; the implications of a CO_2 emissions reduction target; impacts of introducing Renewable Portfolio Standard (RPS) in Indonesia; for development of a low carbon society scenario toward 2050; and for a national low-carbon study using coupled AIM/Energy and AIM/AFOLU models.[24]

INDIA. AIM//Enduse has been used to assess potential co-benefits of CO_2 and SO_2 mitigation policies. AIM was used to construct national scenarios comparing "conventional mitigation" and "sustainable development" policies corresponding to global 2° Celcius scenarios.[25]

KOREA. The AIM-Korea Model included various scenarios to help analyze GHG mitigation policy options, with simulations up to the year 2020. The major policy implications were that the adoption of energy-saving devices should be further encouraged, as the simulation results showed that providing subsidies leads to the most effective reduction in CO_2 emissions, as opposed to imposing only a carbon tax. In addition, according to the simulation results, the marginal cost of mitigating CO_2 emissions varies according to the sector, with the transportation, residential and commercial sectors identified as potential candidates.[26]

MALAYSIA. AIM/ExSS and AIM/AFOLU models were used for developing projections in the Malaysia Low Carbon Society 2020 and 2030 scenarios. At the subnational level, AIM was used to develop the Low Carbon Scenario for Iskandar, Malaysia. The Low Carbon Society Blueprint for Iskandar 2025, officially launched by the Primate Minister and adopted by the Iskandar Regional Development Authority (IRDA) in 2012, set a target for 50% reduction in carbon intensity in 2025 as compared to the 2005 level, and recommends a total of 283 strategic policies towards minimizing carbon emissions. The blueprint included identification of 12 practical actions to achieve a 40% emission reduction from BAU by 2025 (using 2005 as a base year). Other applications of AIM included for estimation of CO_2 emissions from the transport sector in Malaysia over the period 2000-2020, and use of AIM/ExSS and AIM/AFOLU for extending the GHG emissions reduction plan in Malaysia's 2nd National Communication.[26]

VIETNAM. AIM/Enduse has been used for a studying the effects of national CO_2 emission reduction targets, and for analysis of energy-related and AFOLU-related GHG emissions. AIM/ExSS and End/Waste were used in development of the low carbon scenarios for Ho Chi Minh City 2030.[27]

23 Graphic from presentation by Mikiko Kainuma, NIES, available at: http://lcs-rnet.org/pdf/locarnet_meetings/2012/S1_1_2Kainuma.pdf

24 Modeling undertaken by AIT in Thailand, and the Institut Teknologi Bandung and Bogor Agriculture University, Indonesia.

25 Modeling conducted by the Indian Institute of Management, Ahmedabad, India.

26 See https://unfccc.int/files/bodies/application/pdf/japan-presentation-indc-final.pdf modeling conducted by Alam Sekitar Malaysia (ASMA), Pusat Tenaga Malaysia (PTM), Universiti Putra Malaysia (UPM), Malaysia, and Undertaken by Universiti Teknologi Malaysia.

27 Application of AIM/Enduse to Vietnam: A Study on Effects of CO2 Emission Reduction Targets. http://www-iam.nies.go.jp/aim/book/AIMbook/09_Enduse_Vietnam.pdf modeling conducted by the Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE); Institute of Meteorology, Hydrology and Environment; and the Ministry of Natural Resources and Environment.. See http://2050.nies.go.jp/report/file/lcs_asialocal/HCMC.pdf

SNAPSHOT OF THE AIM TOOL

OBJECTIVE. The main goal of AIM modelling is to assess policy options for reducing GHG emissions and avoiding the impacts of climate change, particularly in the Asia-Pacific region. AIM models have been used for a variety of purposes, but generally the applications focus on analysis of (i) climate policy, (ii) GHG emission scenarios, and (iii) development of national-level energy outlooks.

WHEN TO USE AIM

AIM is most applicable when:[28]

- Optimizing the modeling is important;
- A large number of complex and interacting technology options need to be assessed;
- The users have enough technical and statistical data;
- The users have a deep understanding of the reference energy system and optimization technique;
- Research is related to energy taxes; CO_2, SO_2, and/or NO_x taxes; energy constraints; or CO_2, SO_2 and NO_x constraints; and
- Users can attend training and can benefit from understanding the model development and calculation process from beginning to end.

DISTINCT CHARACTERISTICS

The AIM suite of tools can:

- Integrate GHG emission, climate, and climate change impact models;
- Support both country modules for detailed evaluation at the state and national level and global modules to ensure consistency across individual modules;
- Integrate bottom-up national modules with top-down global modules;
- Assess alternative policies;
- Evaluate the effect of introducing advanced technologies;
- Use detailed Geographic Information System (GIS) data to evaluate and represent the distribution climate change impacts at the local level; and
- Draw on a collaborative network of international research institutes in the Asia-Pacific region.

Cost: Free

Software: Various versions of the model are available for download at:

http://www-iam.nies.go.jp/aim/data_tools/index.html

User interface: Spreadsheet. Requires GAMS and Microsoft Access. http://www.gams.com/

Inputs: Socio-economic data and information such as population size, economic trends, government policies, energy consumption, gross domestic product, and number of households.

Outputs: GHG emissions estimates (CO_2, SO_2, NO_x), total primary energy supply, electricity generation by fuel-type, sector-wise energy consumption, economic output (gross domestic product), identified sectors where emissions reductions are most cost-effective, and list of prioritized GHG reduction measures for different scenarios.

Training and skills required: User manuals are available, as well as training from organizations such as NIES. Experience with economic modeling software is recommended. The level of expertise required is considered advanced.

AIM Website: More information about the AIM suite of tools is available at:

http://www-iam.nies.go.jp/aim/index.html

23 Climate policy assessment using the Asia–Pacific Integrated Model, Cambridge University Press, available at http://ebooks.cambridge.org/chapter.jsf?bid=CBO9780511619472&cid=CBO9780511619472A042a and http://lowemissionsasia.org/sites/default/files/pdf_file/Evaluation%20of%20LEDS%20Models%20-%20Charles%20Marpaung.pdf

ABOUT THE ASIA LEDS PARTNERSHIP

The Asia LEDS Partnership is a voluntary network of government and nongovernmental partners working to advance LEDS and green growth in Asia. It builds on, and cooperates with, existing regional Asian networks and initiatives, and links efforts in Asia with related work in other regions. Representatives from over a dozen Asian countries are actively engaged in the Asia LEDS Partnership, as well as numerous international partners. Membership is free and is open to individuals or organizations. For more details, visit: **http://www.asialeds.org**

This case features the following Asia LEDS Partnership members:

Japan International Cooperation Agency (JICA)
Office of Natural Resources and Environmental Policy and Planning (ONEP), Thailand
Sirindhorn International Institute of Technology (SIIT), Thammasat University, Thailand
Asian Insitute of Technology (AIT)

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