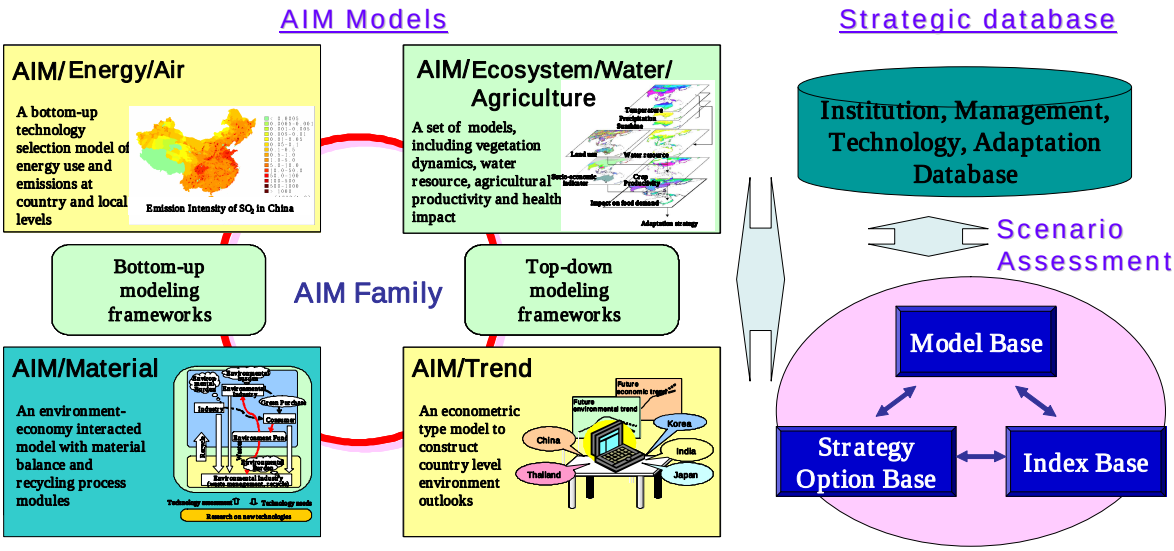
APEIS-IEA Technical Summary

1. What is APEIS-IEA?

The Integrated Environmental Assessment (IEA) sub-project of APEIS has the following objectives:

- Development of IEA tools. IEA tools comprise several models and a strategic database (SDB) developed for the purpose of assessing innovative options for managing environmental problems.
- Diffusion of IEA tools to selected Asia-Pacific countries. IEA tools are passed to researchers and policy makers in selected Asia-Pacific countries, such as China, India, Thailand and Korea, via research collaborations and capacity-building workshops.
- Development of quantitative innovation scenarios. IEA tools are used to develop short- and long-term quantified scenarios in various Asia-Pacific countries and regions for the purpose of assessing environmental innovation options.

A set of IEA tools has been developed to enable comprehensive analyses of environmental problems in the Asia-Pacific region. The tools include (i) the SDB, (ii) the AIM/Material model, (iii) the AIM/Energy and AIM/Air models, (iv) the AIM/Trend model, and (v) the AIM/Ecosystem, AIM/Water and AIM/Agriculture models. Figure 1 shows the connections between these tools. They have distinct utilities and are used in particular combinations depending on the specific environmental issues being assessed and their spatial scope.



Key Messages:

- **Environmental stress is substantial in the absence of innovative strategies**
- **Innovations in technologies, institutions, and management systems are critical to resolving conflict between environment and development**
- **Environmental actions need mainstreaming within development decisions**

Figure 1. IEA Tools: AIM Models and SDB

The SDB is used to store data relating to innovative options for technological, institutional, and behavioral systems in various sectors of a particular country or region. It is also used to assess the potential of such options for reducing emissions or mitigating other environmental problems. AIM/Material is a top-down model of economy–environment–energy linkages. It is used for analyzing macro-economic effects of environmental interventions and impacts of economy-wide policies on the environment. It can effectively assess environmental investments and recycling. AIM/Energy is a bottom-up optimization model of technology–energy–environment systems. It is used for assessing emission mitigation and technology options. AIM/Trend is an econometric model that simulates relationships between emissions and socio-economic indicators. It is used to project future socio-economic and environmental trends. The set of AIM/Ecosystem, AIM/Water and AIM/Agriculture models is used to assess impacts on water, agriculture, vegetation, and health. AIM/Air, a model for simulating air pollutant distribution within a city, takes emission forecasts from AIM/Energy as input. It is used together with AIM/Water to assess health impacts. Table 1 summarizes the characteristics and scope of IEA tools.

Table 1. Characteristics and scope of IEA tools

IEA Tool	Characteristics	Scope
SDB	Innovative options database	Innovative technology, institutional and management options
AIM/Trend	Econometric projection model	Socio-economic framework
AIM/Material	Combination of national economic model and material balance model	Macro-economy, environmental investments and material recycling
AIM/Water	Process-type water use and supply model	Water
AIM/Energy	Bottom-up-type energy-emission model	Energy
AIM/Air, AIM/Water	Process-type models	Health
AIM/Agriculture	Process-type crop productivity model	Agriculture
AIM/Ecosystem	Combination of process-type eco-service model and national-scale economic model	Biodiversity

The motivation behind the IEA sub-project is to assess the potential for innovative strategies to resolve pressing environmental problems and simultaneously circumvent the trade-offs between economic development and environmental improvement. Conventional approaches assume rigid trade-offs, as shown in the left panel of Figure 2. These approaches are based on the belief that any action toward environmental improvement has a cost to the economy, and conversely, strategies toward economic development will necessarily affect the environment adversely. The alternative approach, however, begins by looking at innovative strategic options that can overcome the trade-offs and result in win–win solutions for both the environment and the economy. It is rooted in the proposition that innovative strategies, by definition, push the frontiers of technological, institutional or behavioral systems, and enable the crossover to a superior economy–environment relationship. Thus, they offer improvement in both dimensions simultaneously.

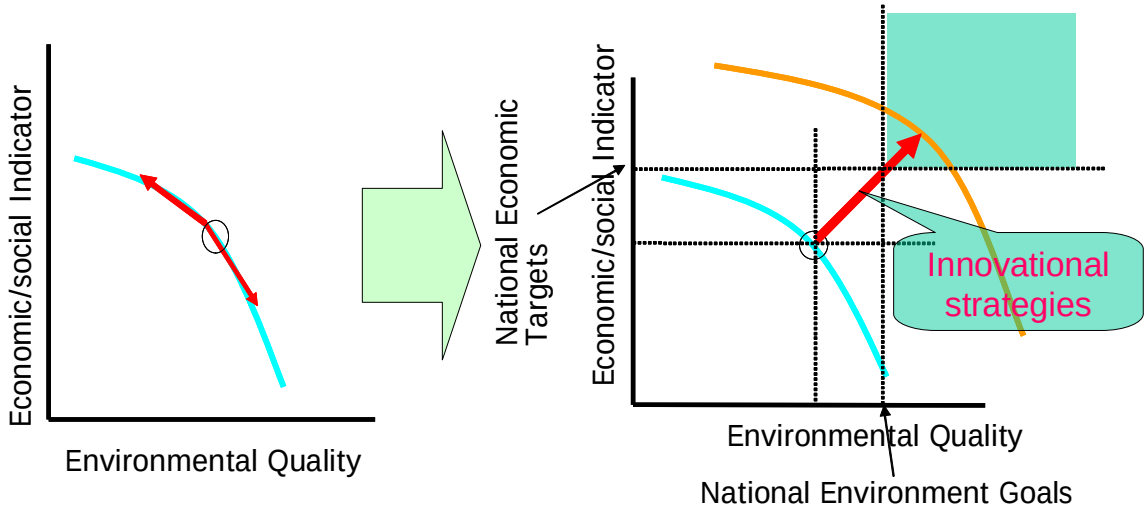


Figure 2. Circumventing economy–environment trade-off with innovative strategies

The IEA sub-project identifies and analyses such innovative options to manage local, regional, and global environmental problems. Problems relating to climate change, local air pollution, waste, water, health, and other issues have been analyzed. Such problems are complex by virtue of having multiple interlinkages among themselves as well as with the larger economic, institutional, societal, and technological systems. They also have a temporal dimension that makes them dynamic and gives them several uncertainties. The combinations of IEA tools have proved effective in dealing with such complexities.

2. What has APEIS-IEA achieved?

2.1 Enhancement and application of IEA tools

The SDB has been enhanced as a tool to comprehensively assess environmental innovations. It is now an advanced interactive tool that (i) stores an extensive database of country-level inventories of existing and new innovative countermeasures in technological, social, institutional, and management systems, and (ii) assesses the cost and environmental effectiveness of specific innovations. It provides a framework that allows policy makers and other stakeholders to conveniently build scenarios and evaluate options.

The SDB involves the setting up of an innovational countermeasures database and a country-specific database in continuous collaboration with stakeholders such as policy makers and research institutions. Development of the SDB is an iterative process that involves identification of innovative options; simulation, assessment, and design of environmental innovation strategies; development of quantitative countermeasure scenarios; and revision of the set of innovative options for assessment (Figure 3).

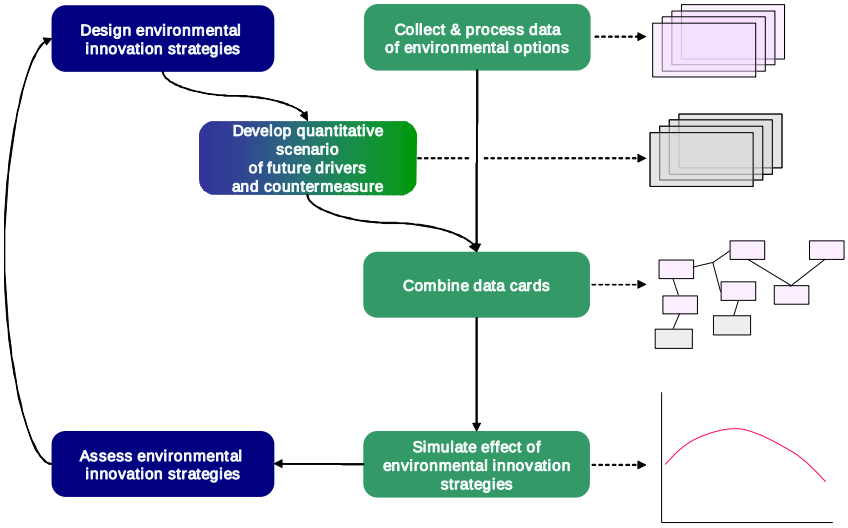


Figure 3. Process of development of the SDB

Figure 4 shows the SDB flow diagram developed for the transportation sector. Several options in the realms of technology, institutions, and management have been identified. These options have been quantified and used for environmental assessment. The SDB has also been used in a complementary relationship with the AIM/Material model to enable more integrative assessments. The development and use of the Water Management Model, explained in Section 2.3, is such an example.

The bottom-up modeling framework of IEA has been enriched by the development of AIM/Air, which takes emissions forecasts from the AIM/Energy model as input and simulates the extremely disaggregated distribution of air pollutants within a city. For instance, it can estimate the impact of road traffic on air quality through a mathematical simulation using a GIS framework that considers disaggregated factors such as land use and distribution of traffic on roads.

Specific combinations of IEA tools have been used for integrated studies of various issues of environment, energy, health, and sustainability in selected Asia-Pacific countries, as summarized in Table 2. The following sections discuss some of these applications and their results.

Table 2. Issues addressed using IEA tools

Issues Considered	IEA Tools	Examples
Integration of millennium development goals, global environmental problems, and sustainability	AIM/Material AIM/Energy AIM/Agriculture	India's assessment of innovative options for meeting both millennium development goals and climate change objectives
MDG, water, and sanitation	AIM/Water AIM/Material SDB	Asia-Pacific countries' water and sanitation developments and national health improvements
Renewable energy, rural electrification, and municipal solid waste management	AIM/Energy AIM/Trend SDB	Thailand's and Korea's environmentally sound energy innovations
City air pollution management	AIM/Air	Beijing city air management

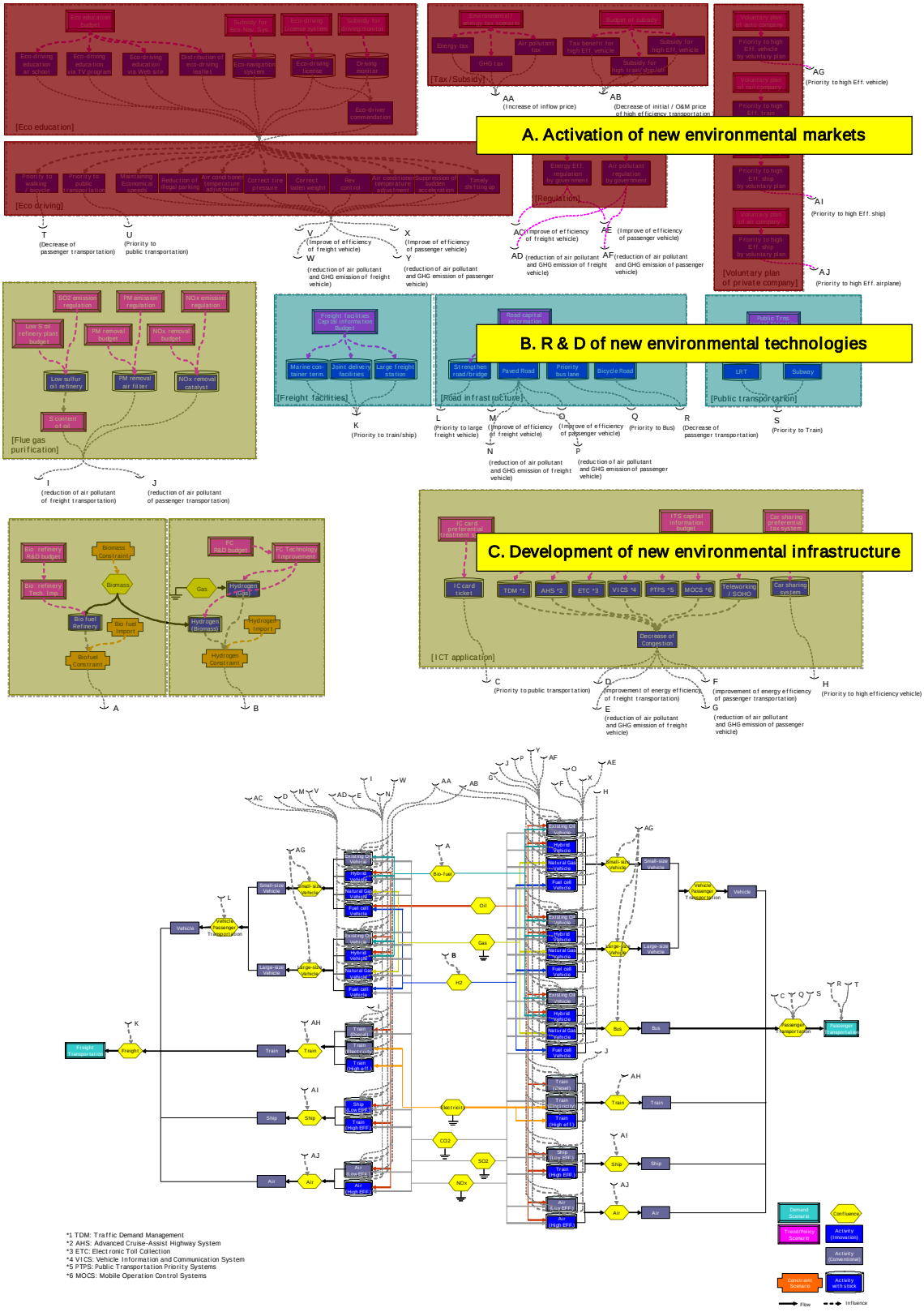


Figure 4. SDB flow diagram for the transportation sector