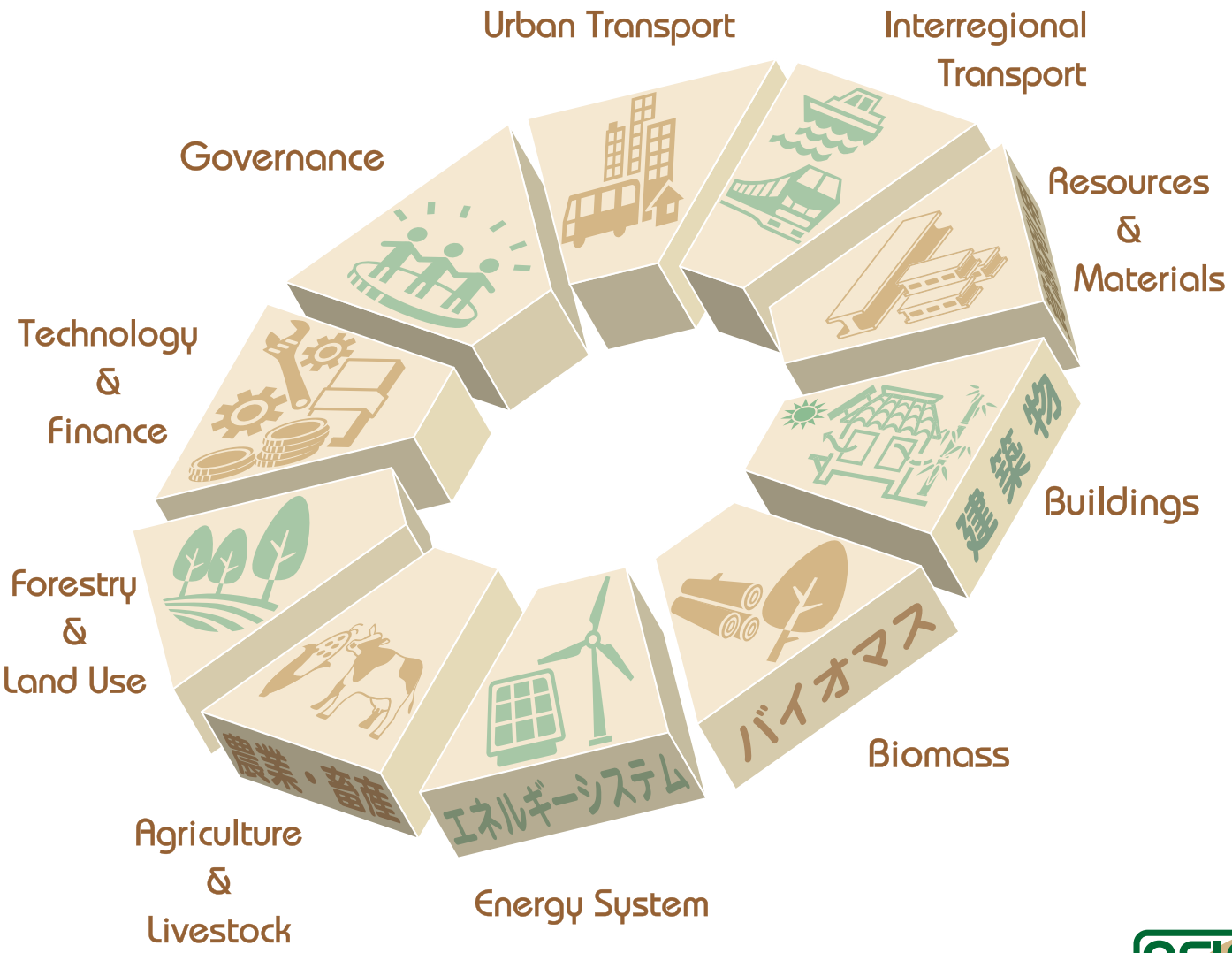
Low-Carbon Asia Research Project

Ten Actions toward Low Carbon Asia



http://2050.nies.go.jp/

ASIA LCS

Why Low Carbon Asia?

The realization of Low Carbon Societies (LCSs) in Asia is imperative in order to achieve both sustainable economic growth and stabilization of climate change. Greenhouse gas (GHG) emissions from the Asian region accounted for approximately 36% of global emissions in 2005. Considering the rapid economic growth expected in the coming decades, the share of emissions from the Asian region is projected to rise further, accounting for about 50% of global emissions in 2050.

If Asian countries are to pursue short-term economic growth and delay actions to tackle climate change, it would lead to the reinforcement of energy intensive infrastructures and make it difficult for the countries to achieve sustainable development. Considering the need of the Asian countries to address a number of environmental and development concerns in parallel, it is necessary to identify leapfrogging development pathways and co-benefits to enable a shift to low carbon emissions and low-resource consumption societies, while simultaneously improving the economic standards of living.

What are the "Ten Actions toward Low Carbon Asia"?

Transition to an LCS is not an easy task. In order to realize an LCS that satisfies the multi-faceted needs and values of each Asian country, it is vital to gain the cooperation of a wide range of stakeholders, including policy makers, international aid agencies, private companies, local communities and NGOs, and share their long-term visions and strategies for an LCS.

"Ten Actions toward Low Carbon Asia" provides a guideline to plan and implement the strategies for an LCS in Asia. It takes into account the interrelationships between individual policies and the sequence in which they should

Action 1 Urban Transport
Hierarchically Connected Compact Cities

Action 2 Interregional Transport
Mainstreaming Rail and Water in Interregional Transport

Action 3 Resources & Materials
Smart Ways to Use Materials that Realize the Full Potential of Resources

Action 4 Buildings
Energy-Saving Spaces Utilizing Sunlight and Wind

Action 5 Biomass
Local Production and Local Consumption of Biomass

Action 6 Energy System
Low Carbon Energy System Using Local Resources

Action 7 Agriculture & Livestock
Low Emission Agricultural Technologies

Action 8 Forestry & Land Use
Sustainable Forestry Management

Action 9 Technology & Finance
Technology and Finance to Facilitate Achievement of LCS

Action 10 Governance
Transparent and Fair Governance that Supports Low Carbon Asia

Ten Actions toward Low carbon Asia

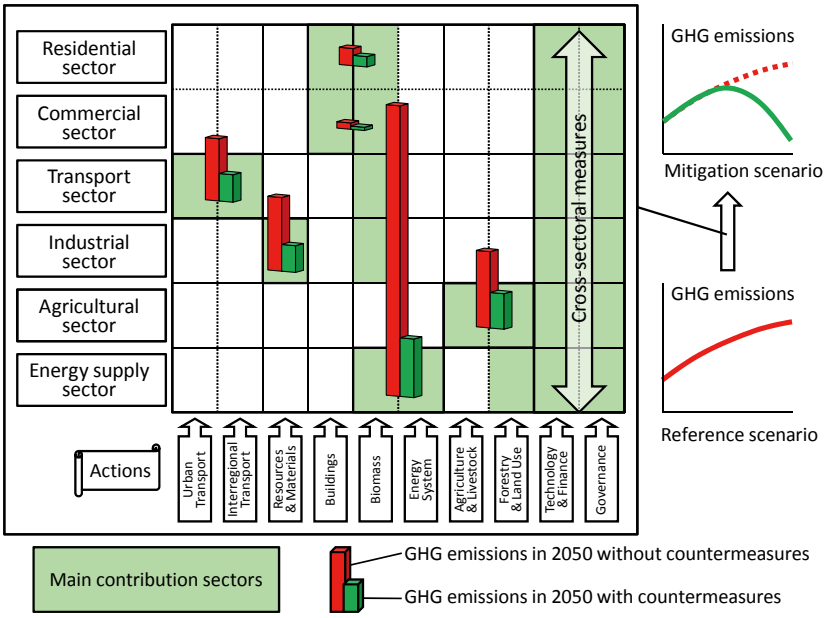
be implemented. It also discusses the necessary actions to be taken by governments, private sector, citizens, and international cooperation agencies on a priority basis.

Actions in individual sectors and their GHG emissions

Actions 1 to 6 focus on the mitigation of carbon dioxide (CO_2) emissions from the use of energy and materials. Such CO_2 emissions accounted for approximately 60% of Asian emissions in 2005 and are expected to increase further. Actions 1 and 2 emphasize the necessity of developing low carbon transport systems with well-designed city structures. Action 3 introduces the strategies for reducing consumption of resources. Actions 4, 5, and 6 focus on energy system both in demand and supply sides, e.g. promotion of energy efficiency improvement in buildings for the demand-side, and improvement of biomass use and development of smart energy systems for the supply side.

Action 7, on the other hand, is targeted at the reduction of nitrous oxide (N_2O) and methane (CH_4) emissions from agriculture. Action 8 deals with the land use related emissions and absorption of CO_2. Non-energy related GHG emissions account for approximately 40% of the total Asian emissions and the emission reduction potential from these sectors should not be underestimated.

Actions 9 and 10 are cross-sectoral; they are proposed to facilitate the previous eight actions and enhance their effects, through providing incentives and financial support for technology development and diffusion, and establishing transparent and fair governance system that is supportive of LCS development, particularly in Asia.



Sketch of GHG emissions reduction of individual sectors

Considerations when applying the actions in each country

The roadmaps described in the "Ten Actions" regard the diverse Asian region as a single entity. Therefore, they should be adapted and modified when applying to each country based on the socioeconomic condition of the society in question as well as the progress of existing climate policies. In addition, it should be noted that the actions presented in this document are not the only pathways to achieve an LCS, and that several others also exist. The important point is to use this document to encourage discussions among the stakeholders and to develop specific actions for each country or area in the Asian region.

The Low-Carbon Asia Research Project* is supported by the Environment Research and Technology Development Fund (S-6) of the Ministry of the Environment, Japan.
*A research project to establish a methodology to evaluate mid- to long-term environmental policy options toward Asian low-carbon societies

Action 1

Hierarchically Connected

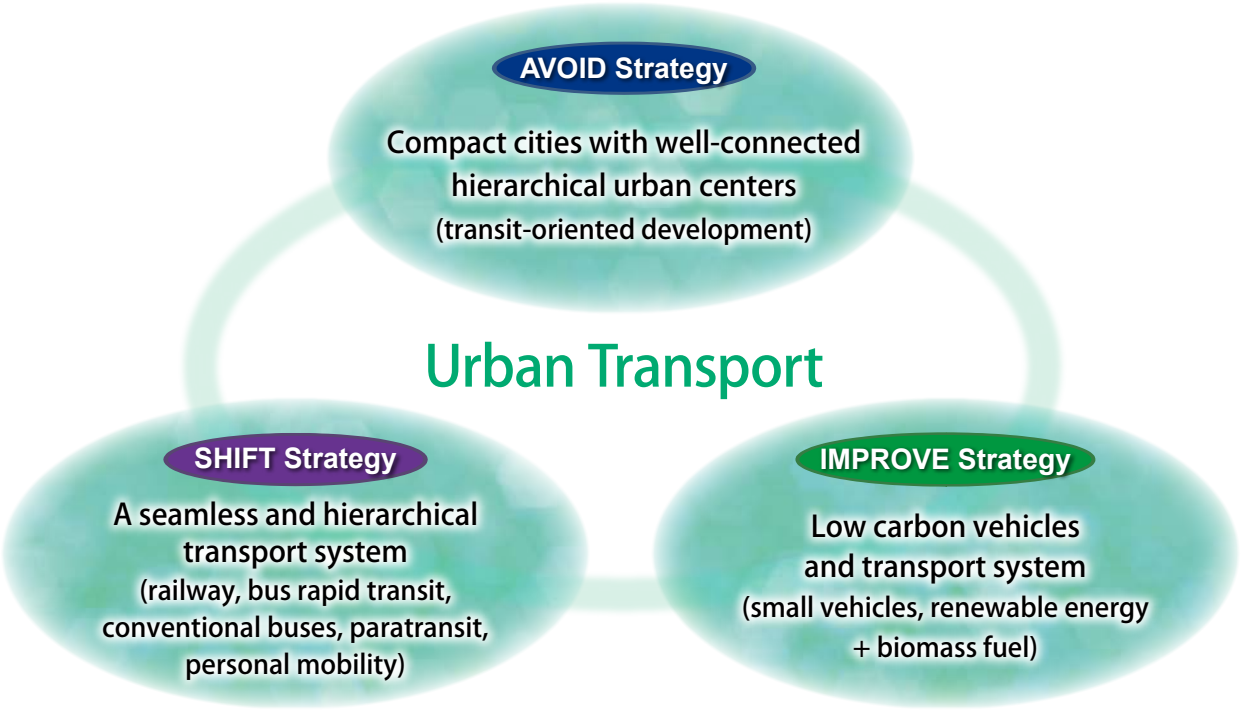


Image of future low carbon urban transport system

Compact Cities

Role of Government

Taking into account the CO_2 emission target of a city, the government is responsible for determining appropriate types of urban structure and urban transport network as well as relevant policies.

Role of Private Sector

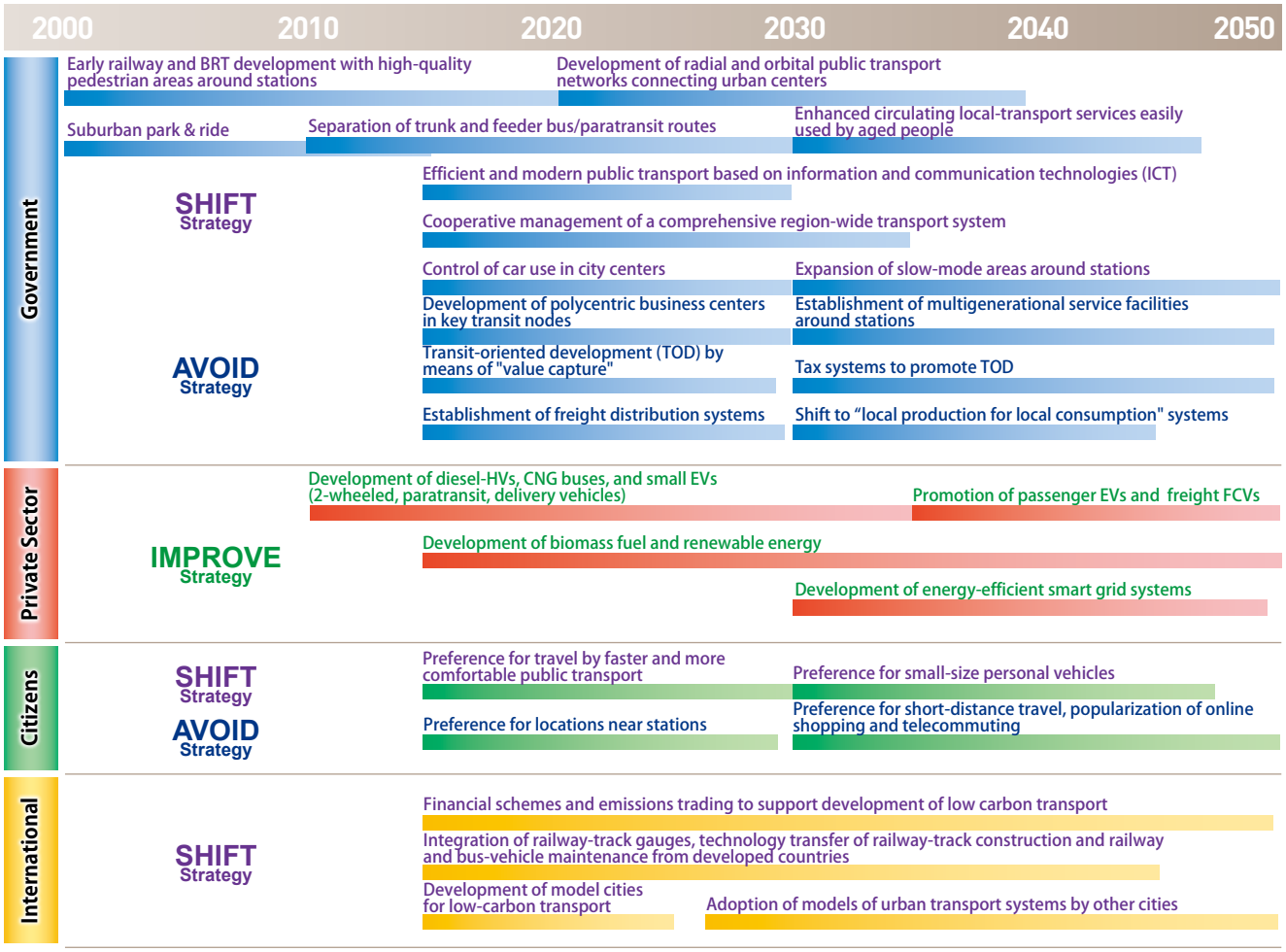
Industries are responsible for developing electrification technologies for personal vehicles to avoid excessive CO_2 emissions and road-space demand from rapidly increasing inner-city movement.

Role of Citizens

Citizens should not follow the conventional path of mobility growth from bicycles and motorcycles to larger cars, but should explore well-balanced use of public transport and smaller private vehicles, which thus leads to a higher quality of life.

International Cooperation

Although developing countries should seek promising ways to realize self-financing, international financing needs to be greatly strengthened. More emphasis should be placed on green development in assessing international financial assistance.



Vision of 2050

Urban trunk transport networks, such as railways and bus rapid transit (BRT), are established in accordance with the population density of a city, with a high rate of public transport use. As a consequence of the transition to an aging society from 2030, travel demand within local communities is significant. Accordingly, small-size personal vehicles for short-distance travel are popular, and the urban transport system hierarchically links feeder transport of the bus and paratransit modes to the trunk transport. This transport system is supported by a high-density, polycentric, and hierarchical land-use system, which allocates urban central functions from an existing single city center to key transit nodes. Furthermore, vehicle technologies for automobiles will catch up to well-advanced to a level of CO_2 emissions per passenger-kilometer similar to that of current developed countries.

Current Situation

Economic growth has led to rapid motorization and urban sprawl in major cities in Asia, giving rise to various problems such as traffic congestion and air pollution. Nevertheless, most developing countries lack sustainable and low-carbon city planning. Many developing countries have prioritized road development in response to growing transport demand, resulting in a vicious circle in which even greater car use is induced. Since around 2000, major cities in Asia have begun to undertake urban railway development, but so far the level is not at all adequate. Developing countries are also far behind developed countries in terms of vehicle technologies, as the advanced technologies are not currently affordable.

Challenges

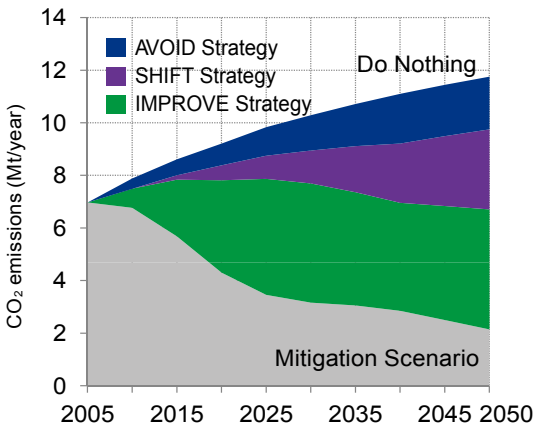
Future economic development in Asia may further increase transport demand. Effective strategies for realizing low carbon urban transport will be to avoid unnecessary transport demand by creating compact cities (AVOID Strategy) and to shift to lower carbon transport modes by developing trunk public transport networks earlier (SHIFT Strategy) before a car-dependent society is formed. In addition, advanced vehicle technologies should be actively introduced (IMPROVE Strategy). It is important to first develop model cities in Asia on a short-term basis for use as a reference, and then to encourage adoption of their systems by other cities. Such development needs to be implemented at an early stage, as extensive infrastructure investment is only available in the growth phase of the economy.

Study of "leapfrog policy" combinations

Policies and technologies for achieving a low carbon transport system have been organized systematically by the World Conference on Transport Research Society (WCTRS) in the form of a matrix called the Comparative study on Urban Transport and the Environment (CUTE) matrix. These policies can be classified into three main categories: AVOID Strategy (avoid unnecessary transport demand), SHIFT Strategy (shift to low carbon means of transport), and IMPROVE Strategy (improve transport energy consumption efficiency). Further classifications are made according to the means by which these policies are achieved; i.e., technological, regulatory, informational, and economic.

Means \ Strategies	AVOID Strategy	SHIFT Strategy	IMPROVE Strategy
Technological	■ Transit-oriented development (TOD) ■ Polycentric development ■ Efficient freight distribution	■ Railways and BRT development ■ Interchange improvement among railway, BRT, bus, and paratransit modes ■ Facilities for personal mobility and pedestrians	■ Development of electric vehicles ■ Development of biomass fuels ■ Smart grid development
Regulatory	■ Land-use control	■ Separation of bus/paratransit trunk and feeder routes ■ Local circulating service ■ Control on driving and parking	■ Emissions standards
Informational	■ Telecommuting ■ Online shopping ■ Lifestyle changes	■ Intelligent Transport Systems (ITS) for public transport operation	■ Eco-driving ■ ITS traffic-flow management ■ Vehicle performance labeling
Economic	■ Subsidies and taxation policies for locations	■ Park & ride ■ Cooperative fare systems among modes	■ Fuel tax/carbon tax ■ Subsidies and taxation policies for low-emission vehicles

The level of implementation of each strategy (AVOID Strategy, SHIFT Strategy, IMPROVE Strategy) was examined to achieve a 70% reduction in CO_2 emissions from urban transport by 2050 for all urban areas in Thailand, as compared to 2005 levels. The results showed that, even if all passenger vehicles are electrified (IMPROVE Strategy) and the urban expansion rate is reduced by 10% from the Do Nothing scenario (AVOID Strategy), large-scale development of trunk public transport will be needed amounting to 4,420 km of railways, 220 km of light rail transit (LRT), and 1,260 km of bus rapid transit (BRT) (SHIFT Strategy). Accordingly, it is important that policies to advance technologies and change the land-use system be extensively implemented earlier as a package in order to develop a low carbon urban transport system in Asian developing countries.



CO_2 emissions from urban passenger cars and mass transit in Thailand (Mt/year)

Action 2

Mainstreaming Rail and Transport

AVOID Strategy

Spatial development driven by a low carbon interregional transport system

Interregional Transport

SHIFT Strategy

A rail/water-oriented intermodal passenger/freight transport system (high-speed passenger railways, freight railways, and maritime/river transport)

IMPROVE Strategy

Low carbon automobile/airplane technologies (electric vehicles, alternative fuels, lightweight vehicles/vessels)

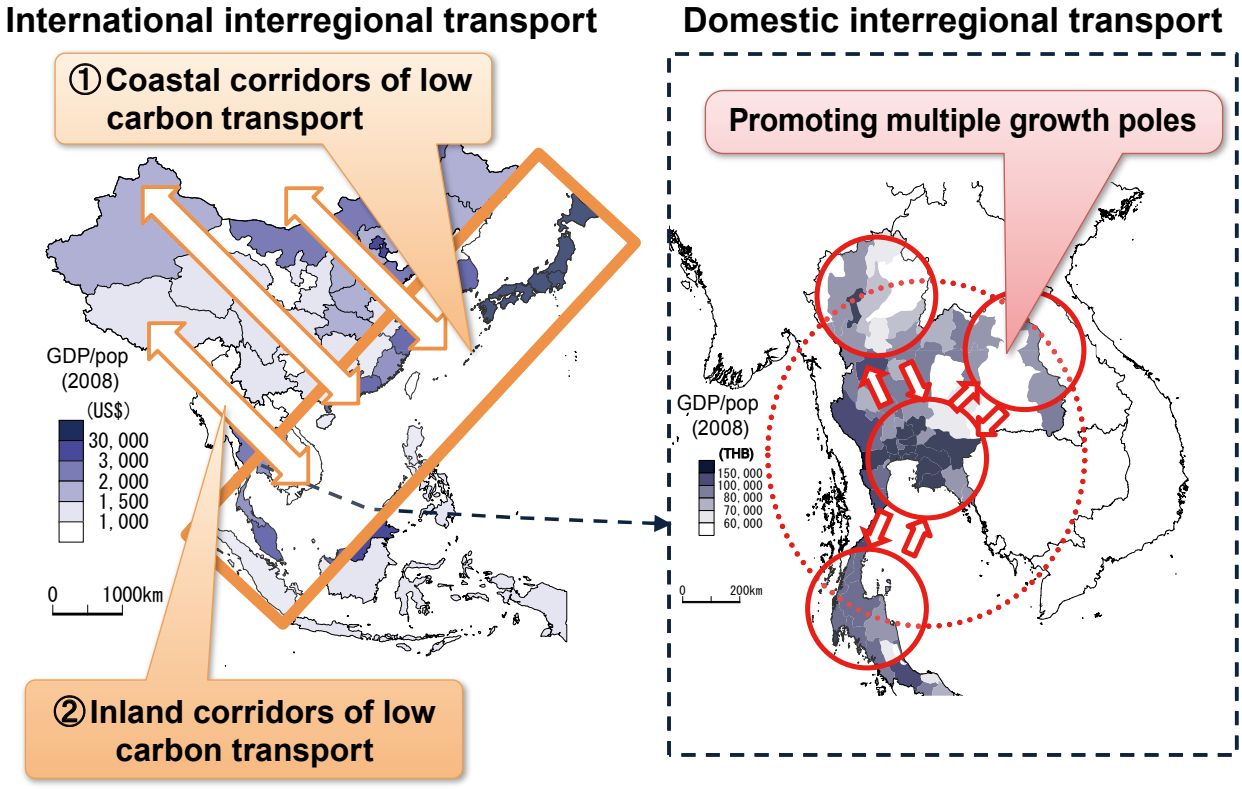


Image of future low carbon interregional transport systems

Water in Interregional

Role of Government

Realize future intermodal low carbon networks for interregional transport including passenger and freight railways and ports, along with inland distribution centers (dry ports), led by backcasting from the CO_2 emission reduction targets for 2050.

Role of Private Sector

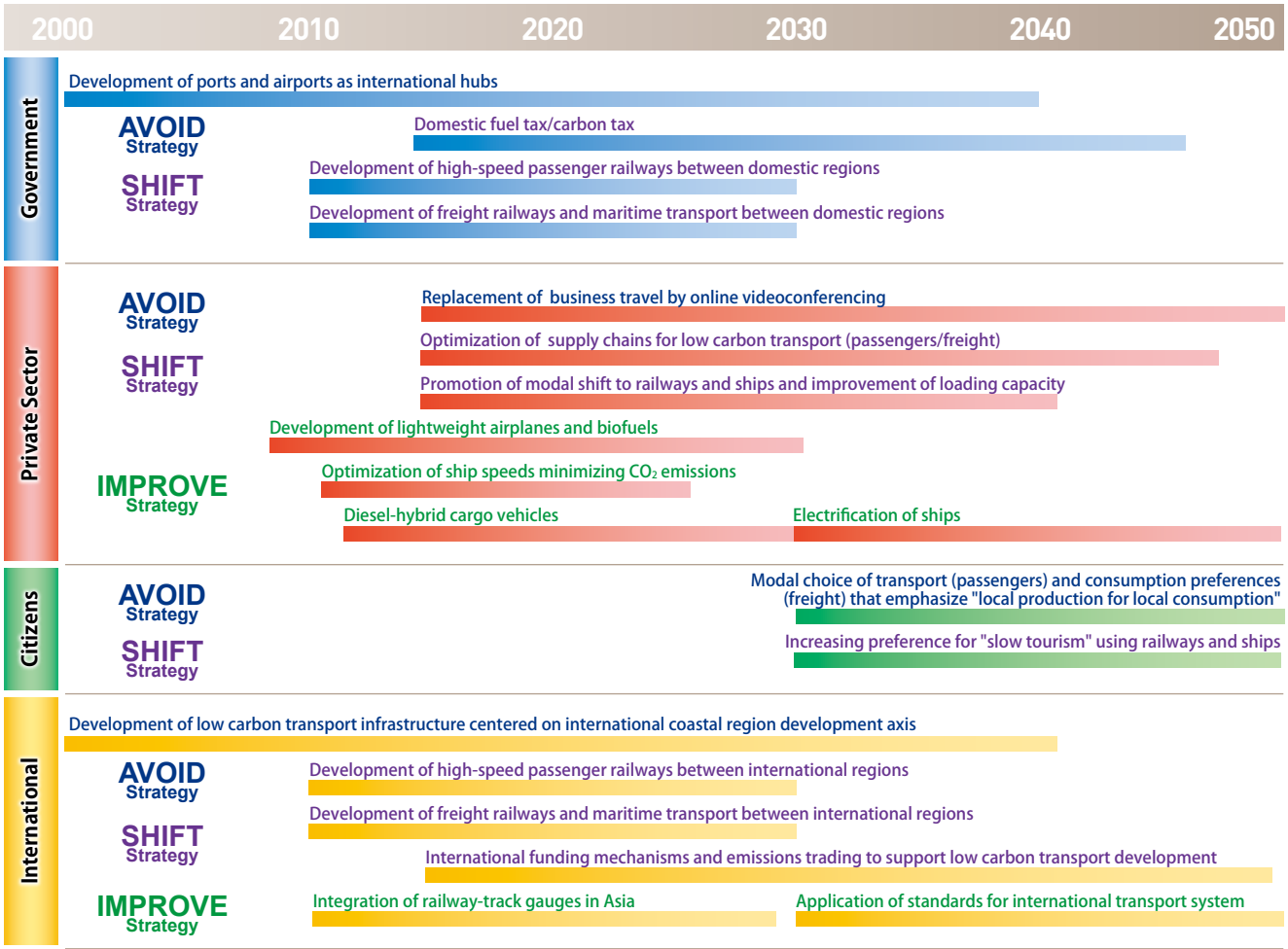
In order to shift to low carbon interregional passenger and freight transport in Asia, for which a great increase in demand is expected as a result of economic growth, the role of industries is to construct low carbon emission supply-chain networks that make intensive use of railways and maritime transport. They also need to promote low carbon transport technologies for automobiles and airplanes.

Role of Citizens

Evaluate and select the transport systems by considering their impact on CO_2 emissions. This includes not only appropriately choosing modes of travel but also consumer goods with a low carbon footprint. Use rail and water transport modes, and shorter distance transport, as much as possible even if it is not the highest speed option.

International Cooperation

Official development assistance (ODA) and other international funding mechanisms should be used to promote low carbonization of interregional transport networks based on rail and water transport in inland routes and offshore corridors.



Vision of 2050

Taxation of environmental loads requires decisions as to where to locate industries and their freight distribution systems, considering both costs and environmental loads. Consequently, regional development is generated according to the development of low carbon interregional transport systems, based on rail and water transport (AVOID Strategy). In coastal zones stretching from Japan and China to Southeast Asia, regional development based on maritime transport is promoted, and these regions are linked by low carbon transport systems such as railways and large trailers equipped with advanced technologies (SHIFT Strategy, IMPROVE Strategy). As economic growth expands from coastal regions, more industrial agglomeration also takes place in inland regions, and low carbon transport systems are introduced to link the coasts with inland regions, forming intermodal passenger and freight transport systems.

Current Situation

Developing countries in Asia currently have the highest rate of growth in demand for passenger air travel and international freight compared with other regions of the world. In overland freight transport within the Greater Mekong Subregion (GMS), truck transport is dominant. While domestic freight transport in China centers around railways, truck transport is on the rise for short and medium distances. International freight transport within the overall Asian region is dominated by maritime transport, which already constitutes low carbon transport. However, in terms of the demand for international passenger transport, the growth of low cost carriers (LCCs) has reduced the average airfare per unit of distance, and as a result, both demand for air transport and CO_2 emissions are increasing. The development of the global economy and the establishment of an ASEAN bloc economy in 2015 (ASEAN Economic Community: AEC) are expected to increase international travel demand above the level of domestic economic growth.

Challenges

As increases in international passenger and freight demand in Asia are unavoidable, implementation of AVOID Strategy is not easy. However, it is necessary to promote development based on rail and water transport for SHIFT Strategy to take place. In passenger transport, it is effective to promote a modal shift from air transport to high-speed railways in the continental region from China to the GMS. In overland freight transport, a modal shift from trucks to rail and river transport must be promoted. On the other hand, as it is not easy to solve all problems by such modal shifts alone, the use of IMPROVE Strategy policies, such as the development of low carbon technologies for large trailers, airplanes, and ships and the development of alternative fuels, is also necessary. Furthermore, the needs for increased investments in roads and air transport infrastructure make the shift to a low carbon transport system difficult. Accordingly, investments in a low carbon transport system must be made early by setting the future vision at the initial stage of economic growth.

Study of "leapfrog policy" combinations

As in the case of inner-city transport, policies and technologies for achieving a low carbon interregional transport system can be organized systematically using the Comparative study on Urban Transport and the Environment (CUTE) matrix proposed by the World Conference on Transport Research Society (WCTRS). In interregional transport, a shift to low carbon transport modes (SHIFT Strategy) and technical innovation of transport-energy efficiency (IMPROVE Strategy) are expected to be particularly effective.

Means \ Strategies	AVOID Strategy	SHIFT Strategy	IMPROVE Strategy
Technological	■ Construction of low-carbon transport infrastructure based on rail and water transport	■ Construction of interregional high-speed railways ■ Construction of coastal region development axis and transport infrastructure ■ Construction of inland interregional railways ■ Freight transport bases (dry ports)	■ Development of low emission ships and airplanes ■ Reduction of fuel consumption for airplane takeoff and landing ■ Shift to electrically powered ships ■ Shift to diesel and hybrid freight vehicles ■ Technical innovations for fuels (biofuels, airplane, automobile, railway, ship)
Regulatory	■ Regulations for location and development that are not based on railways or maritime transport	■ Liberalization of domestic maritime transport ■ Joint delivery ■ Promotion of railway freight transport ■ Promotion of coastal freight transport	■ Emissions standards ■ Establishment of high-carbon-efficiency vessel speeds (ships) ■ Integration of international railway track standards ■ Internationalization of railway track standards in Asia
Informational	■ Use of videoconferencing ■ Education regarding low carbon lifestyles	■ Increased preference for "slow tourism" using railways and ships	■ Navigation systems ■ Labeling of airplane and ship performance
Economic	■ Fuel taxes/carbon taxes (domestic) ■ Emissions trading (international)	■ Fuel taxes/carbon taxes (domestic) ■ Introduction of international funding mechanism ■ Emissions trading (international)	■ Fuel taxes/carbon taxes (domestic)

High-speed railway development
Since the establishment of high-speed railway services in China, Korea, and Taiwan, air transport services have been suspended in the 300-600 km range due to shifting demand from air to high-speed rail. Further development of high-speed railway is planned in Thailand, Vietnam, India, and other countries.

Promotion of coastal freight transport
In the short-distance transport of high-value-added freight, SHIFT Strategy is underway from air to maritime transport (roll-on/roll-off (RORO) ships equipped with deck plates to allow trailers to roll on and roll off by themselves).

Freight transport centers (dry ports)
In Europe, the development of dry ports (inland distribution centers) has increased the volume of intermodal freight transport by facilitating the loading and unloading of goods to realize seamless transport combining railways, trucks, ships, and airplane. Dry port development plans are being considered in various parts of Asia.

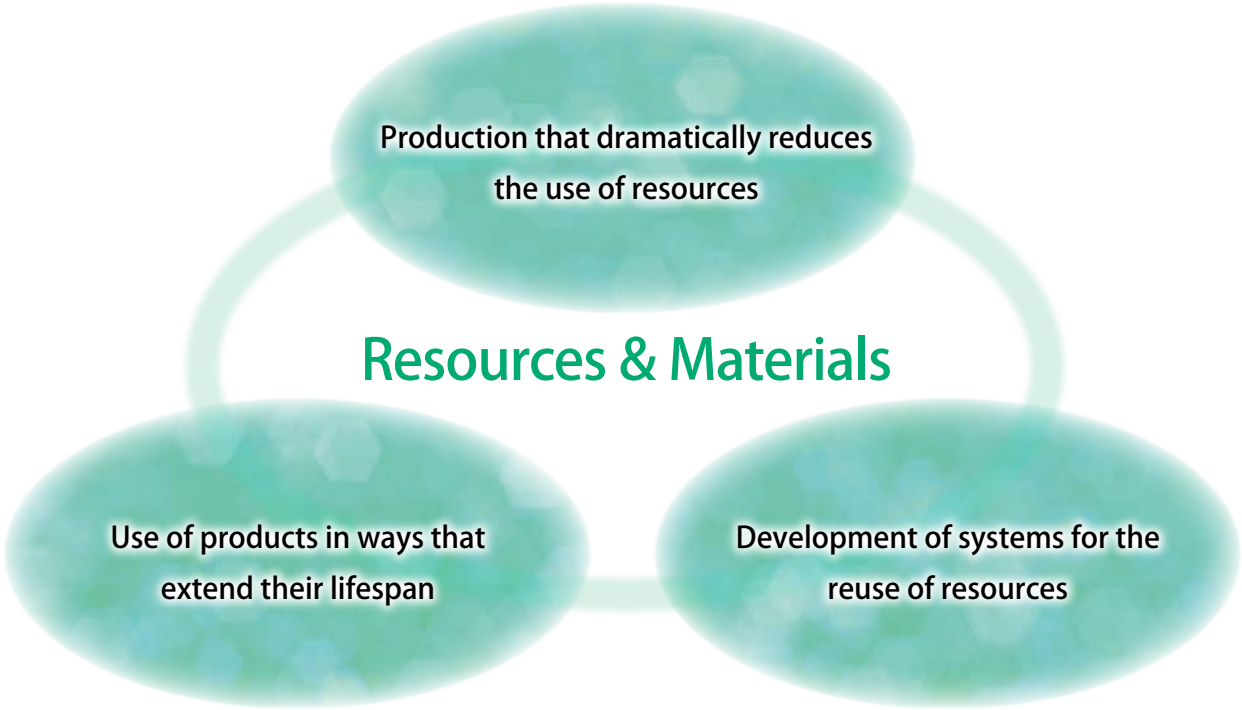

Interregional high-speed railway (Taiwan)


Coastal freight transport (Danube)


Railway freight terminal (Hungary)

Action 3

Smart Ways to Use Mate Potential of Resources



rials that Realize the Full

Role of Government

Design low-carbon cities and national land based on a medium- to long-term perspective, and construct a long-lasting infrastructure. Develop systems for recycling and reusing various articles, and support studies on the effective use of resources.

Role of Private Sector

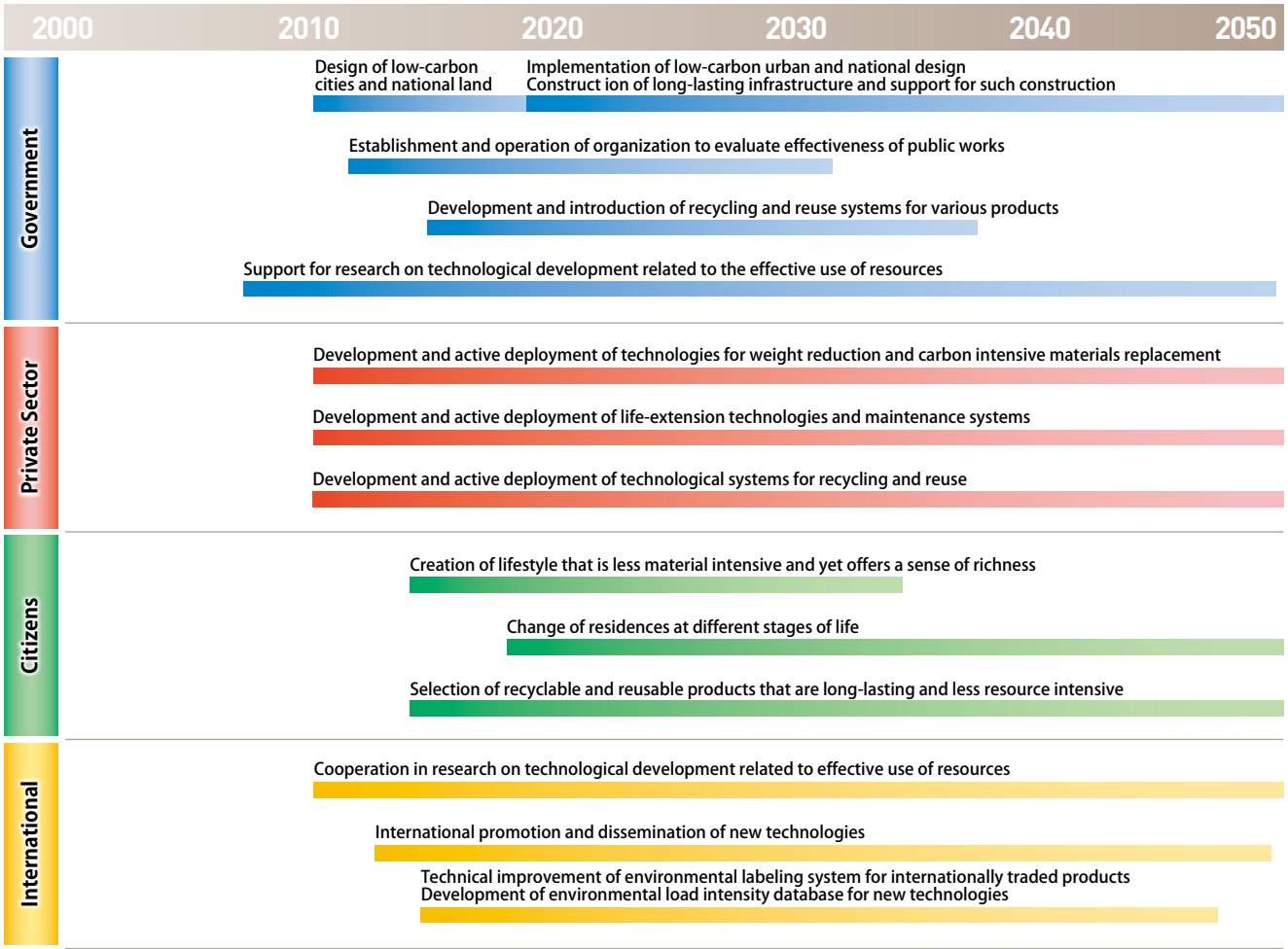
Develop and install technological systems that reduce product weight, replace carbon-intensive materials, extend product life, and achieve recycling and reuse to provide the same services using materials that are less resource intensive and generate a smaller environmental load.

Role of Citizens

Create a lifestyle that is less material intensive and yet offers a sense of richness. Select recyclable and reusable products that are long-lasting and less resource intensive, while changing residences at different stages of life.

International Cooperation

Foster international cooperation in research on technical development related to the effective use of resources as well as promotion and dissemination of new technologies. Technically improve the environmental labeling system for internationally traded products.



Vision of 2050

Infrastructure is developed efficiently under urban and national plans based on a medium- to long-term perspective. The use of materials with higher functionality and efficient product design makes it possible to provide the same services using materials that are less resource intensive and generate a smaller environmental load. Maintenance technologies and systems also improve, helping to achieve product life extension and resulting in a significant reduction in the demand for materials. Materials are recycled using clean energy, and the reuse market is growing. Such systems are supported by citizens.

Current Situation

Development of infrastructure of various types such as housing, transportation, communication, water supply, and sewerage is needed in rapidly developing Asian countries such as China and India, and the dissemination of durable consumer goods such as automobiles, televisions, and refrigerators as well as increased consumption of nondurable goods such as paper and food are expected. This will cause substantial growth of demand for materials with high carbon intensity such as steel, cement, and paper, leading to increased emissions of GHGs. Moreover, rapid diffusion of mitigation technologies, including solar and wind power generation, fuel cells, and storage batteries, might create a shortage of resources used for these technologies.

Challenges

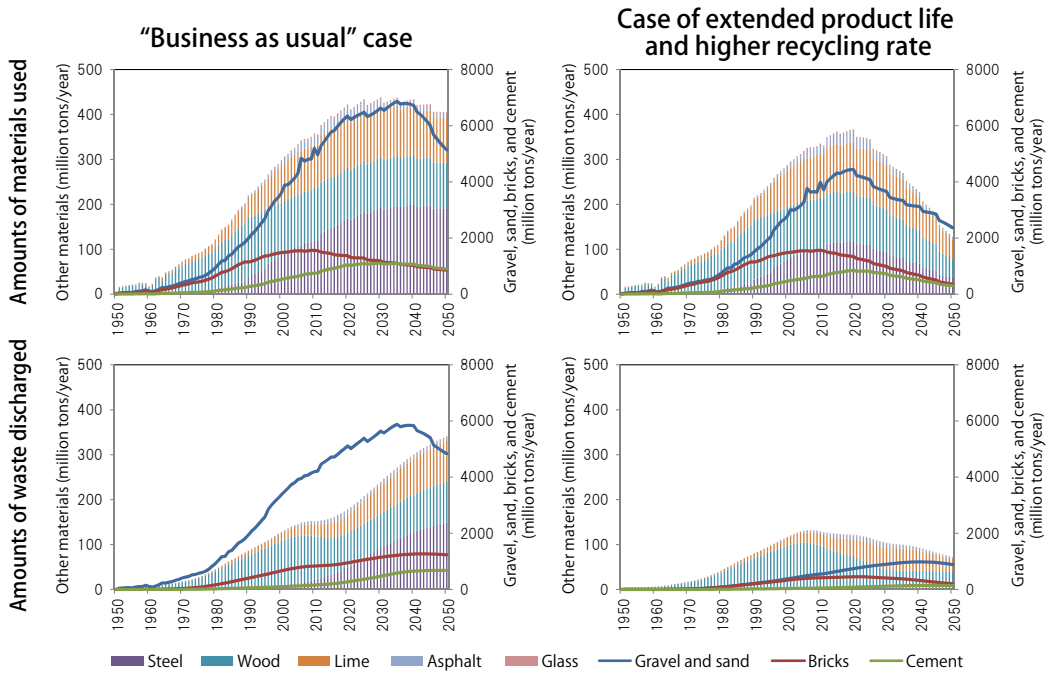
Efficient use of resources and a dramatic reduction in demand for resources themselves are necessary for meaningful reduction of GHGs. To achieve this, infrastructure design must be based on long-term prospects at the urban and national levels. Products must be made lighter, carbon-intensive materials must be replaced, and product life must be extended to reduce resource consumption and the environmental load while providing the same services. Used products must be recycled using cleaner energy, and total demand for resources must be reduced by increasing the practice of reusing used products.

Increase in materials use in China due to economic development and possibility to reduce such materials use

The development of infrastructure, increase in diffusion of consumer durables, and higher use of consumer goods associated with economic development in many Asian countries are expected to require the use of greater amounts of steel, cement, paper, and many other materials. Such an increase in the use of materials is likely to facilitate the growth of GHG emissions associated with those materials (emissions generated from the stage of collecting natural resources to the processing and production of the materials). The percentage of such GHG emissions caused by material use in total GHG emissions is very high. Substantial reductions in the amounts of materials used will therefore contribute greatly to a decrease in total GHG emissions.

In the light of the aforementioned points, the project team has been forecasting demand for infrastructure, consumer durables, and consumer goods in Asian countries; estimating the amounts of materials used to fulfill this demand as well as GHG emissions associated with such material use; and analyzing the feasibility of dramatically reducing the amounts of material use and GHG emissions through the smart ways of using materials. The following paragraphs introduce one of a series of such case studies conducted for China.

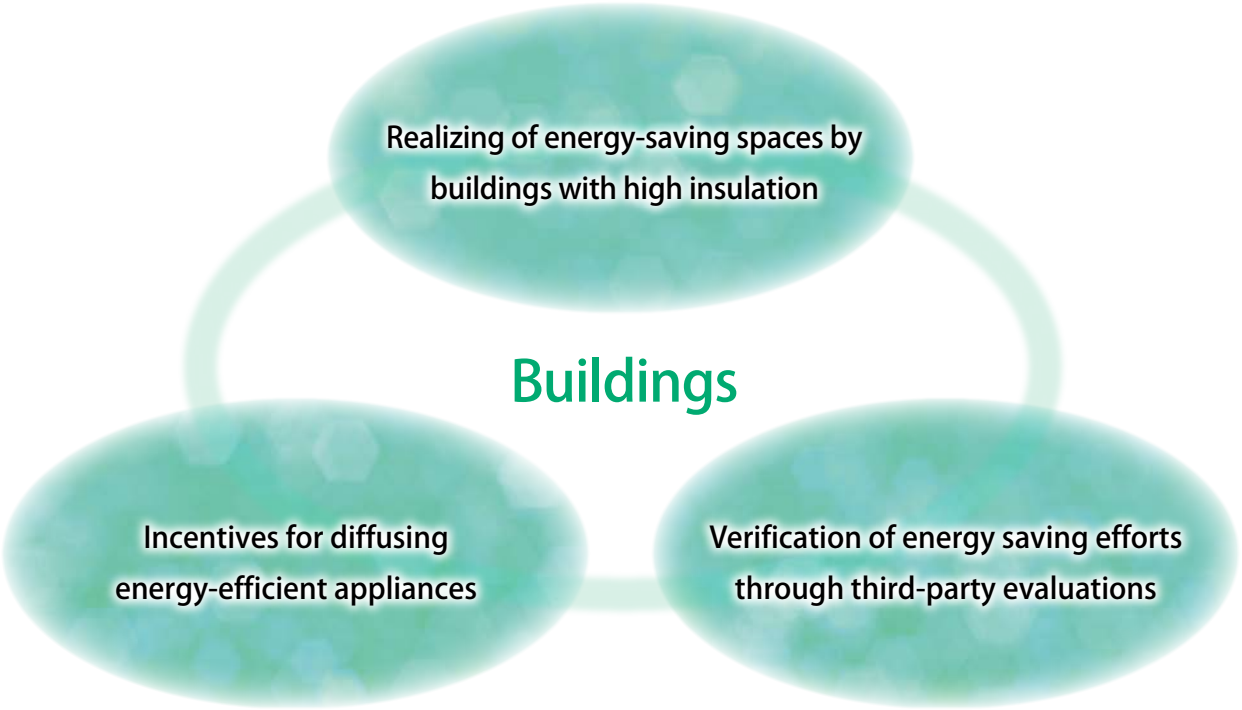
In this case study, a model was developed to analyze material flows and stocks for cement, steel, wood, gravel, and sand used for buildings, roads, and railroads in China. Using this model, the team also estimated the amounts of materials used and waste discharged in the "business as usual" case up to 2050. In addition, changes in the amounts of materials used and waste discharged in the case of extended product life and a higher recycling rate were analyzed by assuming the same level of possession of goods as in the "business as usual" case. The results show that, despite some time required before the effects are notable, these measures are expected to have an impact from approximately 2020 and to bring about a significant reduction in the amounts of materials used by 2050.



Estimated amounts of materials used and waste discharged up to 2050 in China

Action 4

Energy-Saving Spaces Ut and Wind



ilizing Sunlight

Role of Government

Accelerate the design and construction of buildings with high insulation and lower energy consumption by establishing and improving standards and regulations related to buildings, and through establishment of financial and institutional incentives to promote the construction of high-performance buildings.

Role of Private Sector

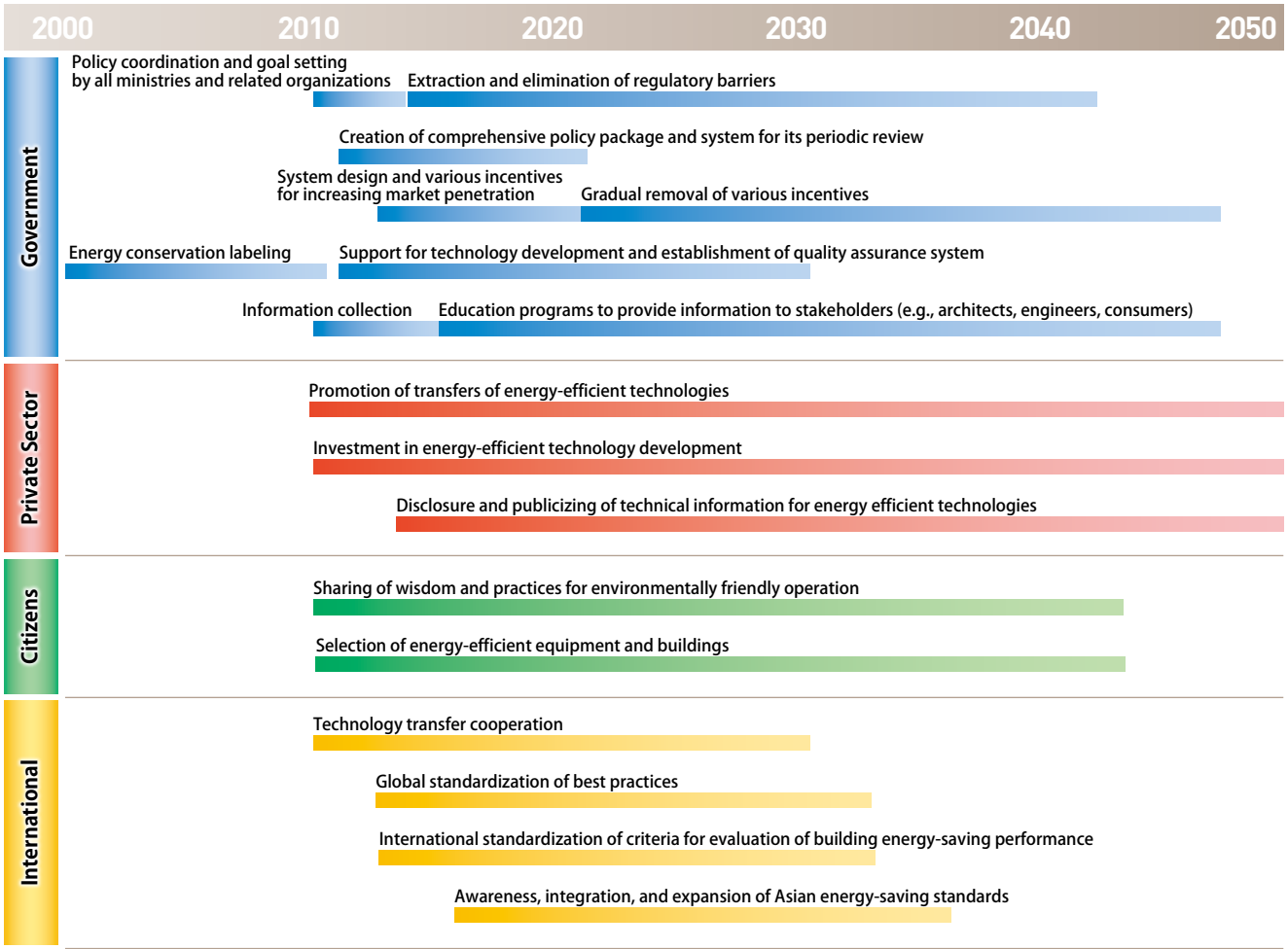
Promote technology transfers of facilities, equipment as well as buildings, and accelerate investment in research and development to encourage domestic production of energy-efficient technologies.

Role of Citizens

Gain knowledge about environmentally friendly products and energy-efficient appliances, and purchase energy-efficient devices when buying new products. Houses that are newly constructed or renovated houses are fitted with high insulation.

International Cooperation

By promoting transfers of energy-efficient technologies, the diffusion of such technologies is accelerated in Asian countries. International best practices are compiled and shared among Asian countries as a common knowledge resource. In addition, by promoting the internationalization of criteria for evaluating the energy and environmental performance of buildings, stakeholders establish localized versions of criteria that reflect well the local situation such as the weather and climate conditions of individual countries. Such localized criteria are a key to the appraisal of efforts to realize low carbon actions for buildings.



Vision of 2050

"Asian" design with low energy consumption is widely disseminated among Asian countries. Such design includes wind corridors and solar insulation, and can maintain sufficient floor space while lowering energy consumption. Appliances are energy-efficient, and used effectively. Buildings have a solar photovoltaic system and solar heating system as a matter of standard. International standards for environmental performance help to visualize efforts to design and construct energy-efficient buildings.

Current Situation

Most Asian countries are located in tropical and subtropical regions, and cooling service demand in the residential and commercial sectors is relatively higher than in other regions such as Europe. Future economic development will lead to growing demand for cooling; however, building design with low energy consumption for cooling that matches the local conditions in different Asian countries are yet to be developed and widely promoted.

The diffusion rate of household and commercial appliances is expected to increase with growing electrification in Asian countries. On the other hand, the energy efficiency of such appliances in most of the Asian region is relatively lower than that in industrialized countries. Therefore, economic, financial, and institutional incentives need to be established to increase the penetration of energy-efficient appliances.

Challenges

There are some challenges to be overcome in order to construct energy-efficient buildings in Asian countries, such as the establishment of architectural design principles matching Asian climate conditions, and the introduction of performance evaluation criteria for buildings and promotion of their widespread use at the building planning stage. Reduction of the cost of energy-efficient appliances in the residential and commercial sectors is also an important challenge in order to achieve a low carbon society. To overcome these barriers, it is important for building designers, owners, and others involved to share information with each other and form a consensus on the benefits of energy-efficient buildings, and to establish institutional and political incentives as well as international support for the installation of energy-efficient appliances.

Performance indicators for buildings in Asian countries – Examples from Japan and Malaysia

It is important to evaluate the performance of energy efficiency in existing buildings and the level of energy efficiency in the building design phase by means of fair rules.

Several building evaluation indicators have been proposed throughout the world, and some of these have been incorporated in actual buildings. Indicators in Japan and Malaysia are described in this column.

One of the typical energy-efficiency indicators in Japan is the Comprehensive Assessment System for Built Environment Efficiency, or CASBEE. CASBEE considers various aspects of buildings, such as comfort, the environmental load, and energy efficiency, then gives a ranking of BEE (Built Environmental Efficiency) based on the environmental quality and environmental load. Figure 1 shows an example of analysis by CASBEE.

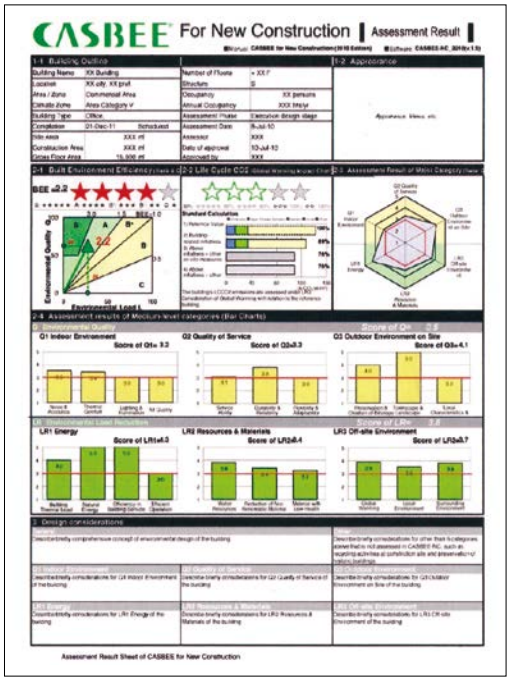


Figure 1. Example of CASBEE Assessment Sheet

In Malaysia, one of the major performance indicators for buildings is the Green Building Index, or GBI. The GBI covers not only energy efficiency levels but also broader aspects of buildings such as water efficiency, materials and resources, and indoor environmental quality. GBI gives a score to buildings as shown in the following table. The total possible score is 100, and each element has a maximum number of points. For example, the energy-efficiency score is limited to a maximum of 35 points, indoor environmental quality is limited to 21 points, and so on. The GBI rating has four categories depending on the total points: certified, silver, gold, and platinum.

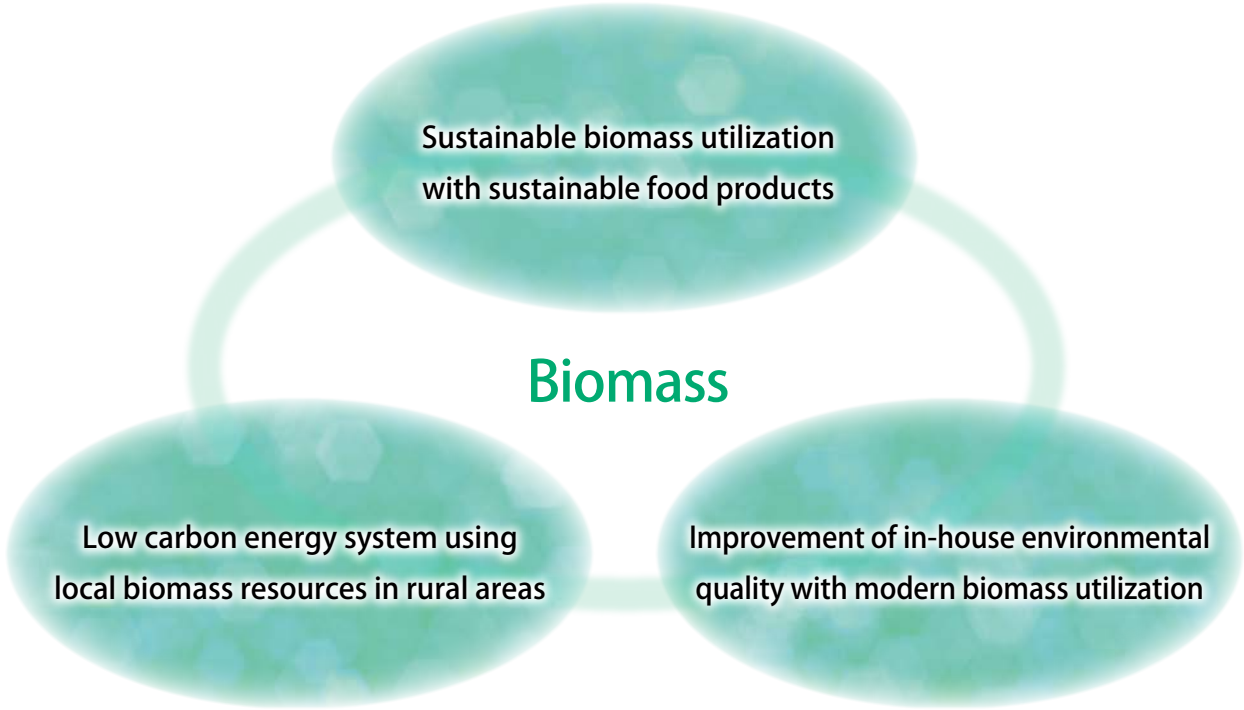
Performance indicators for buildings in Malaysia - the Green Building Index

ASSESSMENT CRITERIA			
PART	ITEM	MAXIMUM POINTS	SCORE
1	Energy Efficiency	35	
2	Indoor Environmental Quality	21	
3	Sustainable Site Planning & Management	16	
4	Materials & Resources	11	
5	Water Efficiency	10	
6	Innovation	7	
	TOTAL SCORE	100	

GREEN BUILDING INDEX CLASSIFICATION	
POINTS	GBI RATING
86+ points	Platinum
76 to 85 points	Gold
66 to 75 points	Silver
50 to 65 points	Certified

Action 5

Local Production and Lo of Biomass



cal Consumption

Role of Government

The implementation of appropriate land use regulations defends against threats to food production such as excessive planting of energy crops. In addition, phasing out of subsidies for fossil fuels will enhance the competitiveness of biomass energy in developing countries.

Role of Private Sector

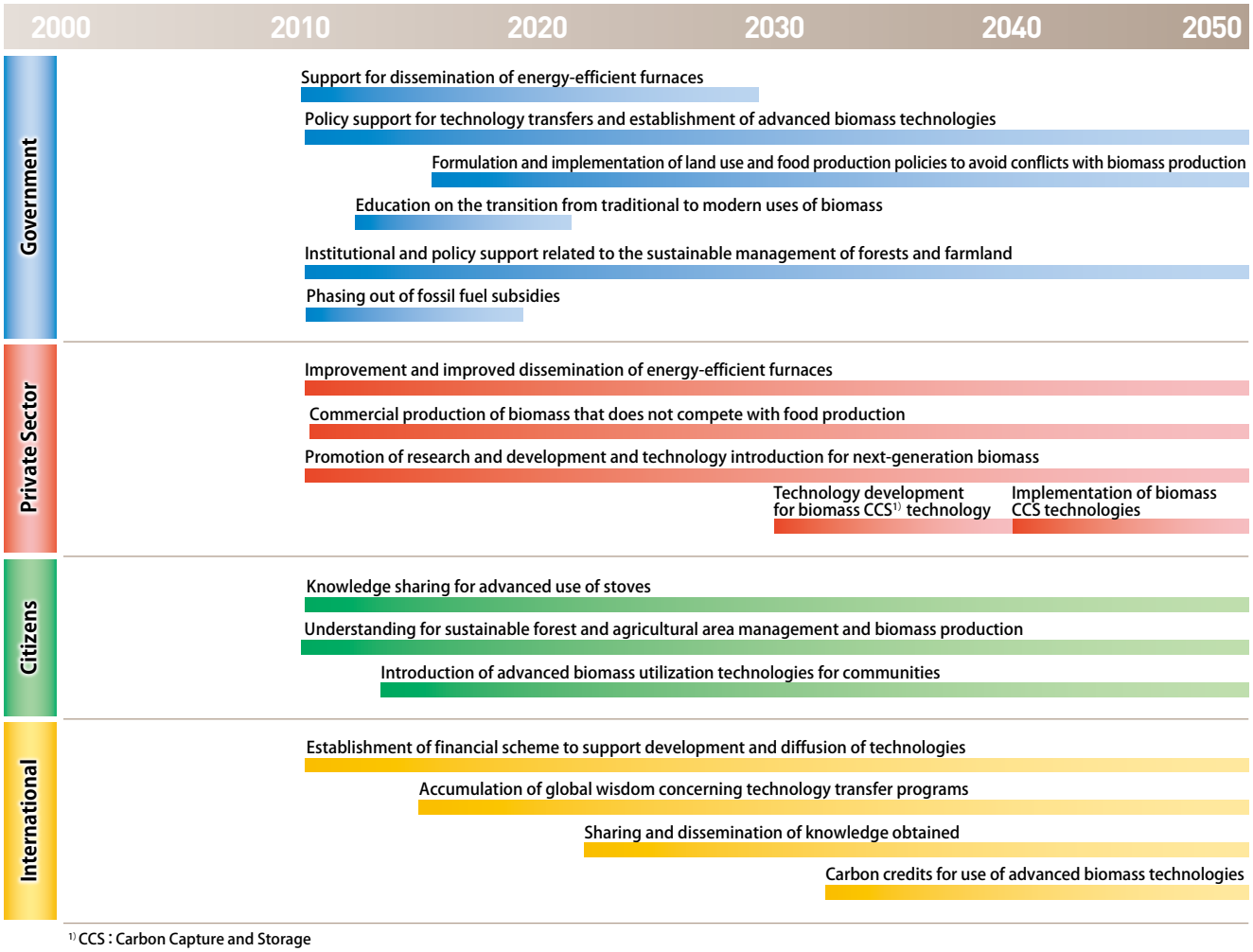
Increasing the productivity of biomass crops through breeding supports the development and commercial production of biomass that does not compete with food production. In addition, research and development to reduce of the cost of high-efficiency furnaces will promote widespread use of biomass.

Role of Citizens

Together with the government, citizens participate in sustainable land use control in order to satisfy the needs of both biomass production and food production through land use management. Citizens also control the amount of forest biomass harvested and encourage the sustainable management of forests.

International Cooperation

International organizations assist in the development of technologies for biomass energy and their utilization, and also promote transfer of best practice technologies to Asian countries based on best practices. Carbon credits for energy conversion using advanced biomass technologies and their utilization will encourage widespread use of such technologies as well as investments in the biomass field from other countries.



1) CCS : Carbon Capture and Storage

Vision of 2050

Rural areas have low carbon energy systems using local biomass. Biomass resources come from forest and energy crops, and a community forest and land use management system is established in order to avoid unnecessary conflict with food production in the area. Improved cooking stoves are installed in all households, contributing to energy self-sufficiency and improvement of health. Some regions export their biomass resources to other regions and companies by producing biofuels and pellets.

Current Situation

In the Asian developing countries, firewood and charcoal are one of the major energy sources for cooking and hot-water supply in the residential sector. The efficiency of utilization of such fuels is not high, and they also cause serious health problems.

Challenges

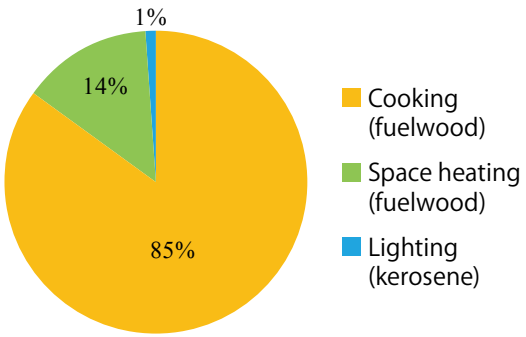
Although it is necessary to introduce advanced technologies for the energy-efficient utilization of biomass, it will take several years or possibly decades to disseminate such technologies to all Asian countries. As the first step, governments should start to disseminate existing energy-efficient technologies such as improved cooking stoves, then gradually promote the installation of more advanced technologies such as biomass boilers and methane fermentation systems. Governments should also support technology development and technology transfers from developed countries.

Improvement of living standards
—Co-benefits of improving the use of biomass

In developing countries, especially in rural areas, most energy consumption is accounted for by wood burning for cooking. For example, 300 million people out of the total population of 1,200 million in India still depend on traditional biomass, and, even in 2030, it is expected that 16.5% of total energy consumption will still depend on the traditional biomass[1]. A survey[2] of an un-electrified rural area in the Indian state of Assam with a population of 5,958 people in 485 households has shown that 85% of energy consumption is accounted for by biomass used for cooking (see the figure below).

In areas that depend on traditional biomass, advanced biomass utilization technologies will contribute not only to economic development embodying the low carbon approach but also enhancement of the socioeconomic situation of rural areas such as improvement of health and increased job opportunities.

Indoor utilization of traditional biomass generates respirable suspended particulate matter (RSPM), which is considered to be one of the causes of respiratory disease in developing countries. Women in particular are exposed to RSPM while cooking. The table below summarizes the daily time allocations for women and RSPM concentration by type of cooking and location in houses. Cooking with traditional biomass causes high exposure in the kitchen when cooking, and even in the living area the RSPM concentration is relatively higher than outdoors. Diffusion of biogas cooking equipment as well as improved cooking stoves will help to reduce the levels of exposure to RSPM throughout the entire house.



Percentages of household energy consumption in nonelectrified rural area of Assam, India[2]

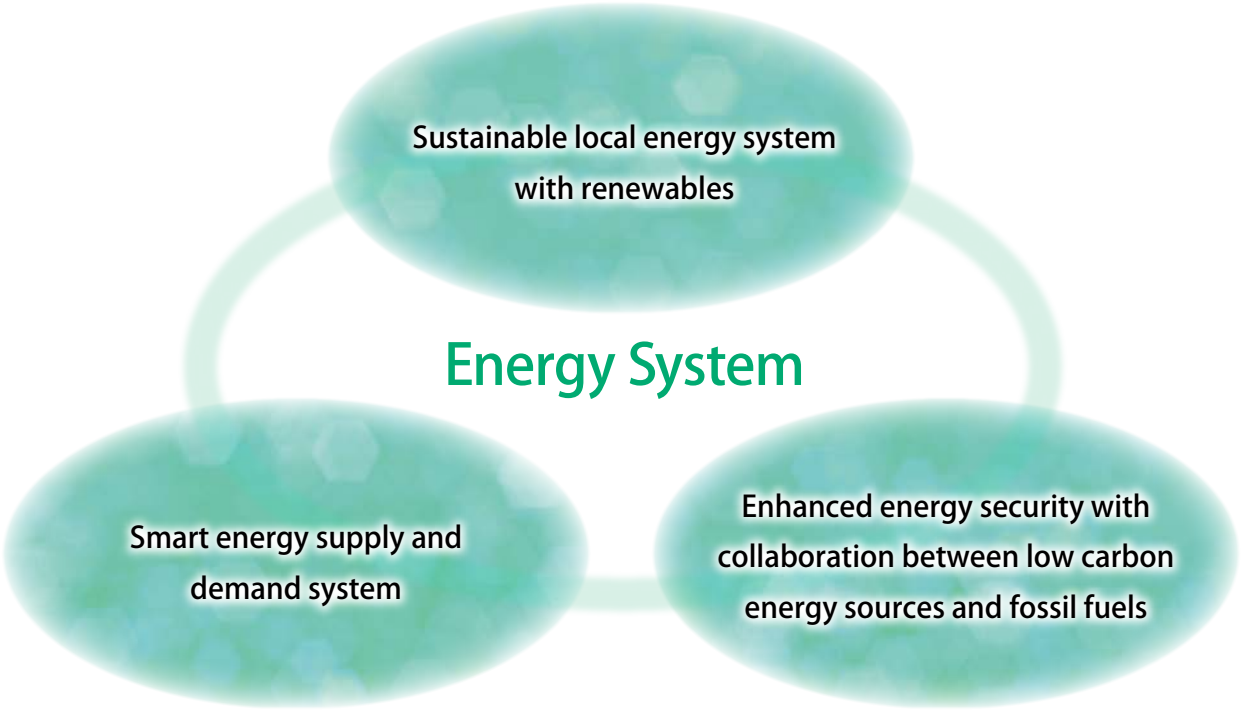
Daily time allocations for women and RSPM concentration in India[3,4]

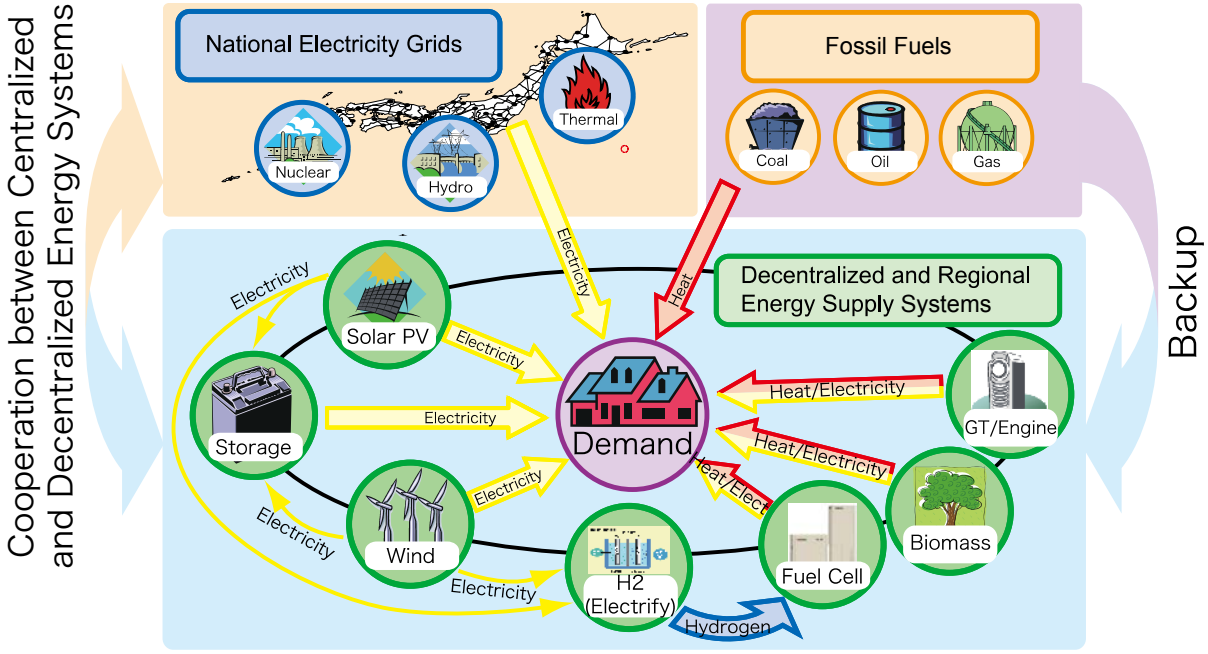
	Cooking period		Non-cooking period		Outdoors
	Kitchen	Living area	Kitchen	Living area	
Time allocation (hours)	3.6	1.3	1.7	12.4	4.8
RSPM concentration (μg/m^3)					
Traditional wood stove	2,150	767	265	262	87
Improved wood stove	1,353	565	265	262	87
Gas stove	122	132	65	62	114

1) IEA, 2011. World Energy Outlook 2011.
2) Sarmah et al., 2002. Energy profiles of rural domestic sector in six un-electrified villages of Jorhat district of Assam.
3) UNDP/ESMAP, 2002. India: Household energy, indoor air pollution, and health.
4) UNDP/ESMAP, 2004. The impact of energy on women's lives in rural India.

Action 6

Low Carbon Energy Syst Resources





Cooperation between centralized and decentralized energy systems

em Using Local

Role of Government

Contribute mainly to the establishment of a low carbon energy system through medium- and long-term policy and planning as well as introduction of supportive regulations, which provides a clear direction to citizens as well as other countries regarding the realization of a low carbon society as a national policy. The government policy includes targeted technological and financial incentives and institutional interventions to accelerate widespread use of local renewable resources.

Role of Private Sector

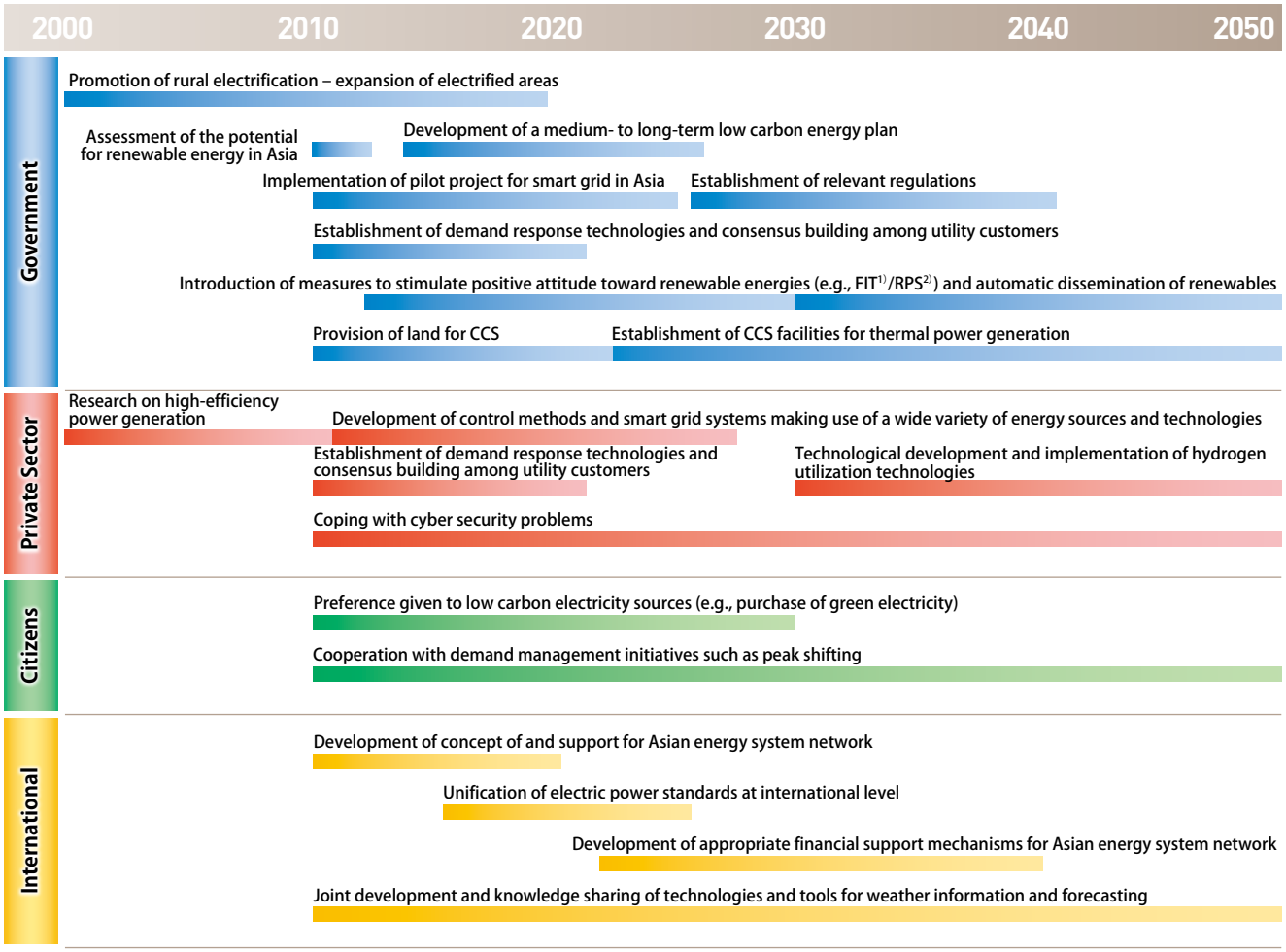
Technological innovation in the industrial sector will accelerate low carbonization of the energy system by means of renewables. The technologies include grid control systems and smart grids with various energy sources such as renewables, cogeneration, and hydrogen. Technology innovations on the demand side are also a key to achieving a low carbon energy system. Key technologies include those for energy efficiency and demand response. The industrial sector will play a central role in consensus building among stakeholders, including households and governments, which will accelerate the diffusion of such innovative technologies.

Role of Citizens

Choose low carbon energy (e.g. renewables) and energy efficient technologies and thereby contribute to reduced energy demand and peak shifting; alter consumption behavior such as increasing their use of non-motorized or mass transport.

International Cooperation

International bodies will promote the establishment of an Asia grid network among Asian countries by using international financing mechanisms. The development of uniform standards and infrastructure are keys to achieving the Asia grid network. In addition, to promote the international dissemination of weather information toward the use of renewable energy, targeting local areas in particular, joint development and sharing of weather information and forecasting tools are necessary to achieve a low carbon energy system in the Asian region.



1) FIT : Feed-in-Tariff
2) RPS : Renewables Portfolio Standard

Vision of 2050

Near-total electrification is achieved across Asia. While the energy supply of urban areas is provided by the core system, that of rural areas is provided by micro-grids powered by renewable energies. Through sophisticated projections of power generation and highly developed power storage technologies, the capacity for utilization of renewable energies has increased significantly. The efficiency of thermal power generation is drastically improved, and effective carbon capture and storage (CCS) is developed for widespread use.

Current Situation

The electrification rate in Asia is nearly 80%; 800 million people do not have access to electricity, particularly in South Asia. The renewable energy technologies are now penetrating in rural areas through market and policy driven dynamics, but they have not reached the stage of serving as core energy resources. While nuclear energy is being promoted as an option for low carbon and large-scale power generation, its prospects in Asia remain uncertain in the aftermath of the nuclear accident in Fukushima, Japan.

Challenges

Challenges for the future are: (1) to develop a power grid connecting all the countries in Asia, in order to improve the energy supply in each country and make flexible power interchanges possible between countries; (2) to promote a decentralized energy supply system, particularly in rural areas, besides providing a stable energy supply through micro-grids connected to the core electricity system; and (3) to facilitate the effective use of renewable energies by introducing power storage systems at the local, regional, and national levels in regions with good weather conditions.

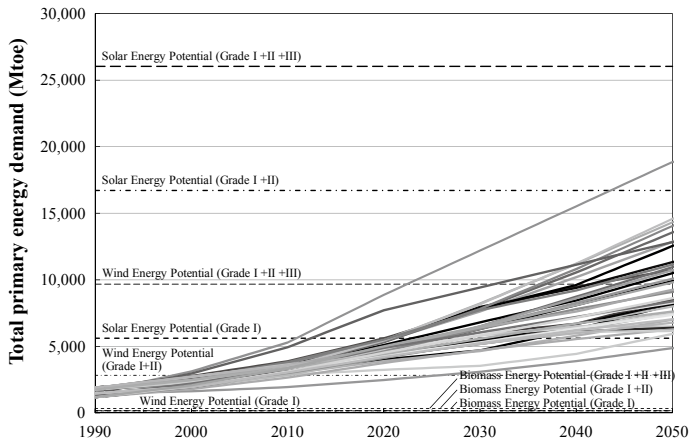
Role of renewables toward the Asian low carbon societies

Toward the realization of the Asian low-carbon societies, it is important to utilize renewables such as solar and wind. On the other hand, since these resources are dependent on certain conditions including solar radiation, wind speed, and land use, it is necessary to understand both the natural conditions and availability of renewables in a given area.

This project assessed the renewable energy potentials of selected Asian countries, and its results are summarized in the table below, focusing on solar, wind, and biomass. The table shows physical potentials that can be determined by natural conditions. Because there are several barriers such as costs and stages of technology developments, a gap persists between technological potentials and market potentials that are effectively usable. However, compared to the projections of primary energy demands in the Asian countries as shown in the figure, the renewable energy resources shall continue to exceed the future primary energy demand. Enhancing the penetration of renewables by overcoming the economic and technological barriers will be a key to a low carbon society transition in Asian countries.

Solar, wind, and biomass renewable energy potentials of several Asian countries

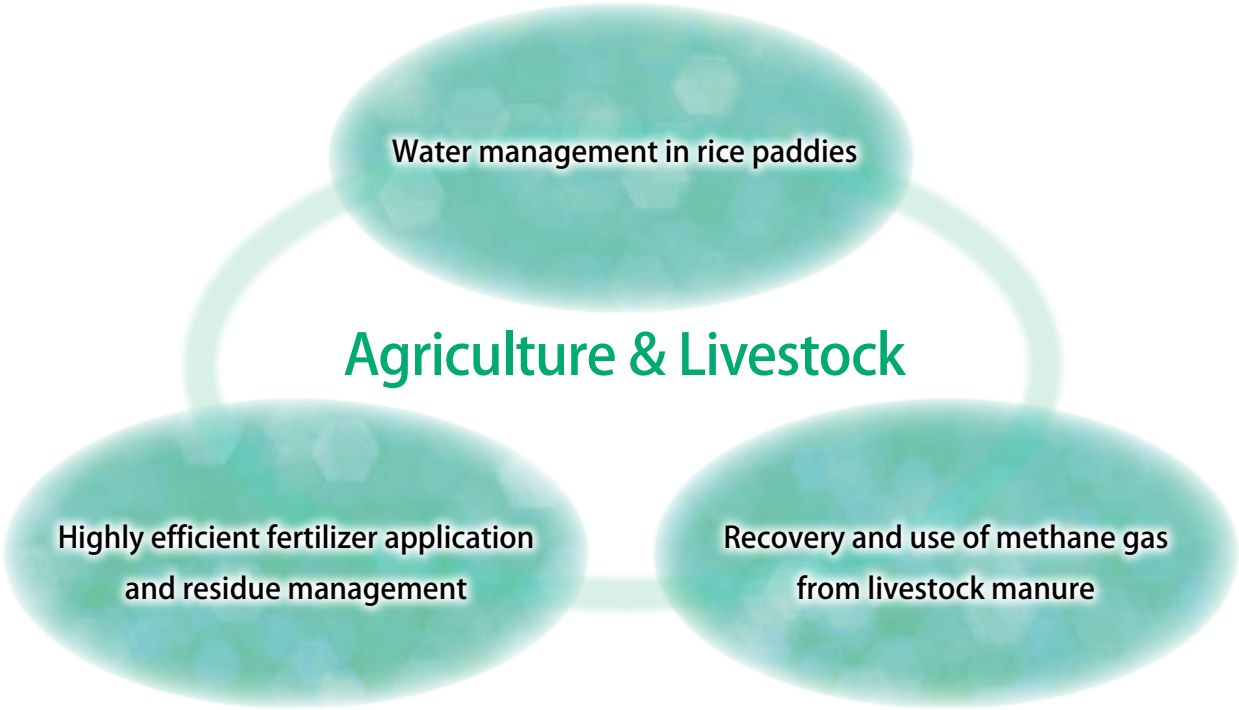
	Solar Potential (TWh/yr)				Wind Potential (TWh/yr)				Biomass (TWh/yr)			
	Grade I 2200-2600 (kWh/m^2/y)	Grade II 1800-2200 (kWh/m^2/y)	Grade III 0-1800 (kWh/m^2/y)	Total	Grade I 40-100 (%)	Grade II 30-40 (%)	Grade III 0-30 (%)	Total	Grade I	Grade II	Grade III	Total
Japan	0	465	39,692	40,157	0	38	26	64	109	15	15	139
China	434	32,845	45,610	78,889	337	1,925	3,318	5,580	735	51	51	837
India	4,255	46,136	169	50,560	0	177	721	898	577	8	8	593
Indonesia	5	1,625	3,699	5,329	0	0	45	45	121	7	7	135
Korea	0	3,759	6,604	10,363	0	0	17	17	25	3	3	31
Thailand	0	10,322	881	11,203	0	0	38	38	79	1	1	80
Malaysia	0	1,243	2,361	3,604	0	0	5	5	47	1	1	48
Vietnam	0	1,278	535	1,813	0	3	60	63	19	5	5	29
Philippines	0	1,304	9	1,313	0	0	42	42	39	1	1	40
Singapore	0	1,180	776	1,956	0	4	88	92	1	0	0	1



Future primary energy consumption and renewable energy potential in Asia

Action 7

Low Emission Agricultur



al Technologies

Role of Government

Expand irrigation for water management in rice paddy and implement manure management plants for diffusion of low emission agricultural technologies. Promote the dissemination of appropriate information on fertilization. In particular, in areas with excessive reliance on fertilizers, gradually shift to the management of fertilization at the proper times and in the proper quantities.

Role of Private Sector

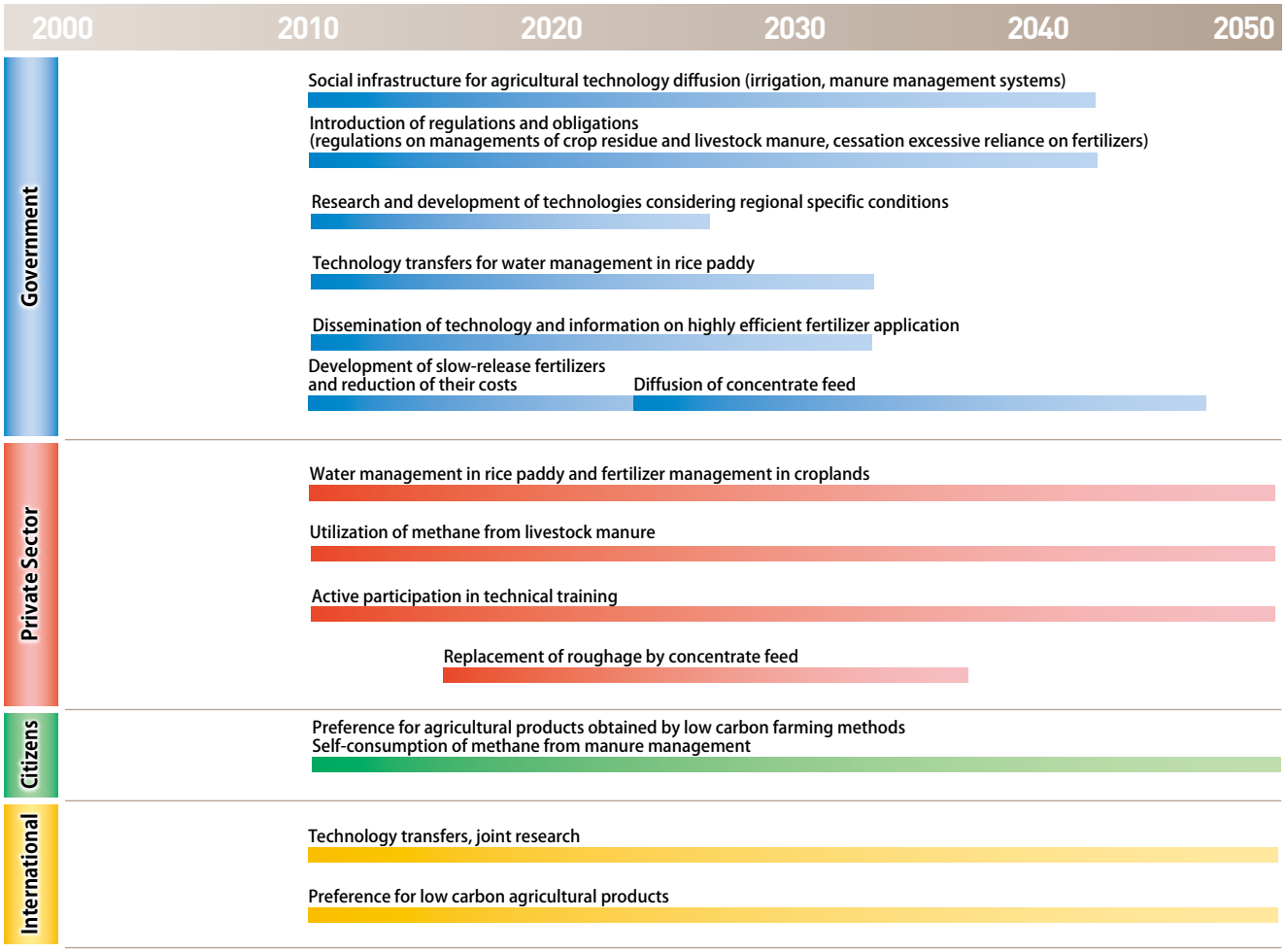
Adopt low carbon water management such as midseason drainage by paddy farmers and collection of manure and management of fertilizer and crop residue. Additionally, actively use the methane gas emitted from manure as energy. Positively adopt new technologies with the aim of achieving compatibility between productivity improvement and reduction of emissions.

Role of Citizens

Select locally cultivated or raised products to contribute to the vitalization of local agriculture. Display a preference for agricultural products produced by low carbon farming methods, which will enhance their market value.

International Cooperation

Promote the international joint development of low emission agricultural technologies such as improvement of feed, improvement of the productivity of livestock, technologies for paddy field management, and so on. Additionally, encourage the introduction of international certification for low carbon agricultural products and the promotion of their dissemination.



Vision of 2050

Water management in paddy fields, such as midseason drainage and alternative flooding and drainage or appropriate incorporation of rice straw, is well disseminated among paddy farmers to reduce methane (CH_4) emissions. In dry fields, highly efficient fertilizer application (split fertilization, slow-release fertilizers, etc.) sharply reduces nitrous oxide (N_2O) emissions. Most livestock manure is appropriately managed, and CH_4 from manure decomposition is captured and used as fuel for cooking and lighting or for generation of electricity. Improvement of livestock feed leads to reductions of ruminant CH_4 emissions and improvements of livestock productivity.

Current Situation

Even though there are various sources of emission and various countermeasures in the agriculture sector, such countermeasures and information about them are not sufficiently widespread. In most countries of the Asian region, since improvement of the quality of life and economic development are high-priority issues, people tend not to pay attention to countermeasures for mitigation of climate change, with the result that information is not widely disseminated to farmers. In some countries or areas, fertilizer is distributed by the government for free or at a low price as a subsidy. This distribution of low-priced fertilizer without sufficient information may cause excessive fertilizing and increases in N_2O emissions.

Challenges

Not only technology development but also sufficient funding and enhanced information sharing are required to appropriately transfer agricultural technologies for climate change mitigation and to overcome different economic and climate conditions at the local level. Additionally, appropriate support of information and funding, development of social infrastructure and improvement of education and training of local people are required in order for farmers to implement these technologies. Systems involving the national and local governments, farmers, and companies need to be established. At the rural community level, "agriculture cooperative producer organizations" consisting of small farmers also play an important role in this action.

Various countermeasures for emission reduction in the agricultural sector

Countermeasure against CH_4 emissions from rice cultivation (midseason drainage)

Fields that are continuously flooded during the entire cultivation period cause more CH_4 emissions than fields that are not flooded the whole time. Such "midseason drainage" involves the removal of surface water from the field during the cultivation period. This is a longstanding custom to prevent root decay and increase crop yield in Japan. Moreover, alternative flooding and drainage is also applied to manage crop growth and avoid lodging. Recently, this practice has also come to be considered as a means of reducing CH_4 emissions. The compatibility of productivity improvement and control of emissions can be expected from this technique.

Countermeasure against N_2O emissions from cropland (efficient use of fertilizer)

In the soil, N_2O is generated from the biological reaction of microbes with nitrogen fertilizer applied to croplands. Avoiding excessive use of nitrogen fertilizer and increasing the efficiency of nitrogen use reduce N_2O emissions from croplands. "Split fertilization" (the application of small amounts of fertilizer several times) is considered a good practice for efficient utilization of fertilizer to meet the nitrogen demand of crops.

Countermeasure against CH_4 emissions from enteric fermentation

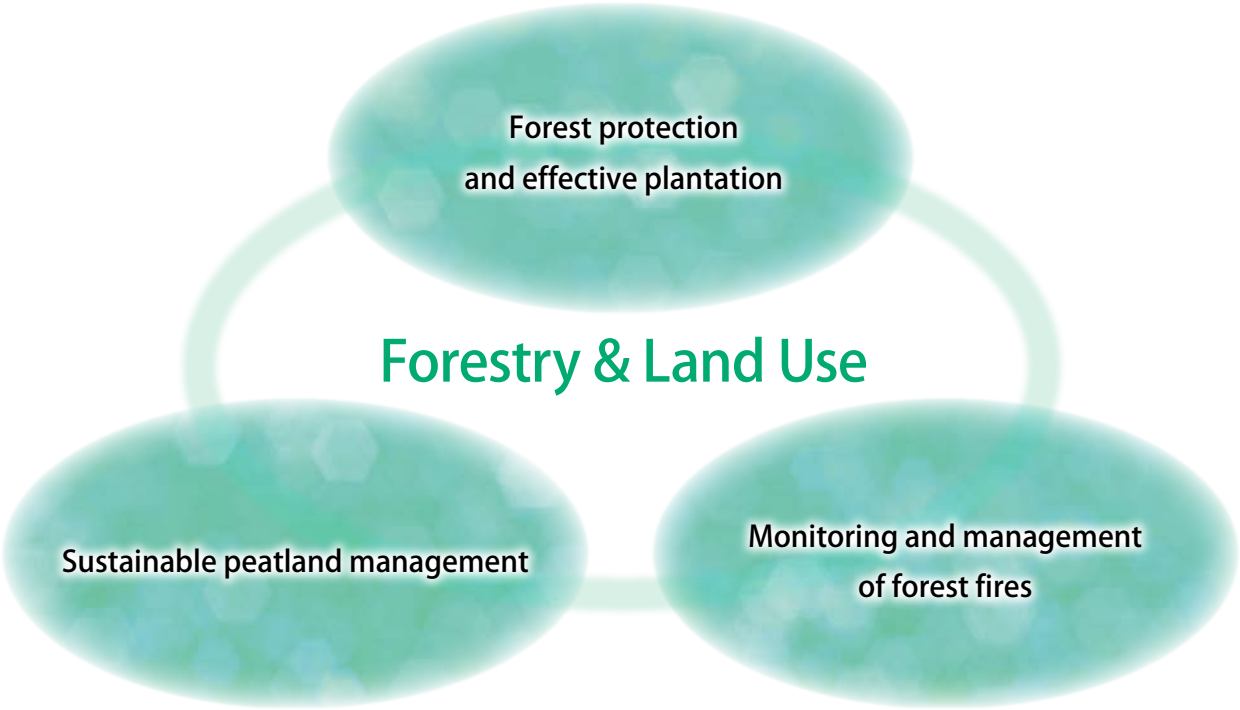
Ruminant livestock such as cattle and sheep are one of the sources of CH_4. Changing feedstuff from roughage (fresh forage, hay, straw, and so on) to concentrate feed containing higher energy and less fiber and water improves productivity of milk and meat and makes it possible to reduce the population of livestock. The addition of fatty acid calcium or polyphenols to feed also reduces CH_4 fermentation.

Countermeasure against CH_4 emissions from manure management

Untreated manure releases CH_4 emissions into the atmosphere due to anaerobic decomposition. Therefore, the use of CH_4 derived from manure as energy realizes compatibility between GHG emission reduction and energy supply. In some Asian countries, there are examples of simple, low-cost, and small-scale unheated digesters and tubular digesters in a hole dug underground being used to recover CH_4 from manure management, with the CH_4 mainly being consumed as fuel for cooking and lighting or for generation of electricity.

Action 8

Sustainable Forestry Ma



nagement

Role of Government

Implement land-use zoning and manage usage status of land for forest protection and for stopping illegal logging and unplanned land clearance. Eliminate wood products made from illegal logged timber and regulate exportation of the products. In illegal logging areas, support economic independence by enhancing the level of education of the poor, etc. Introduce licenses for plantations and land clearance to give incentive to landowners for sustainable land use.

Role of Private Sector

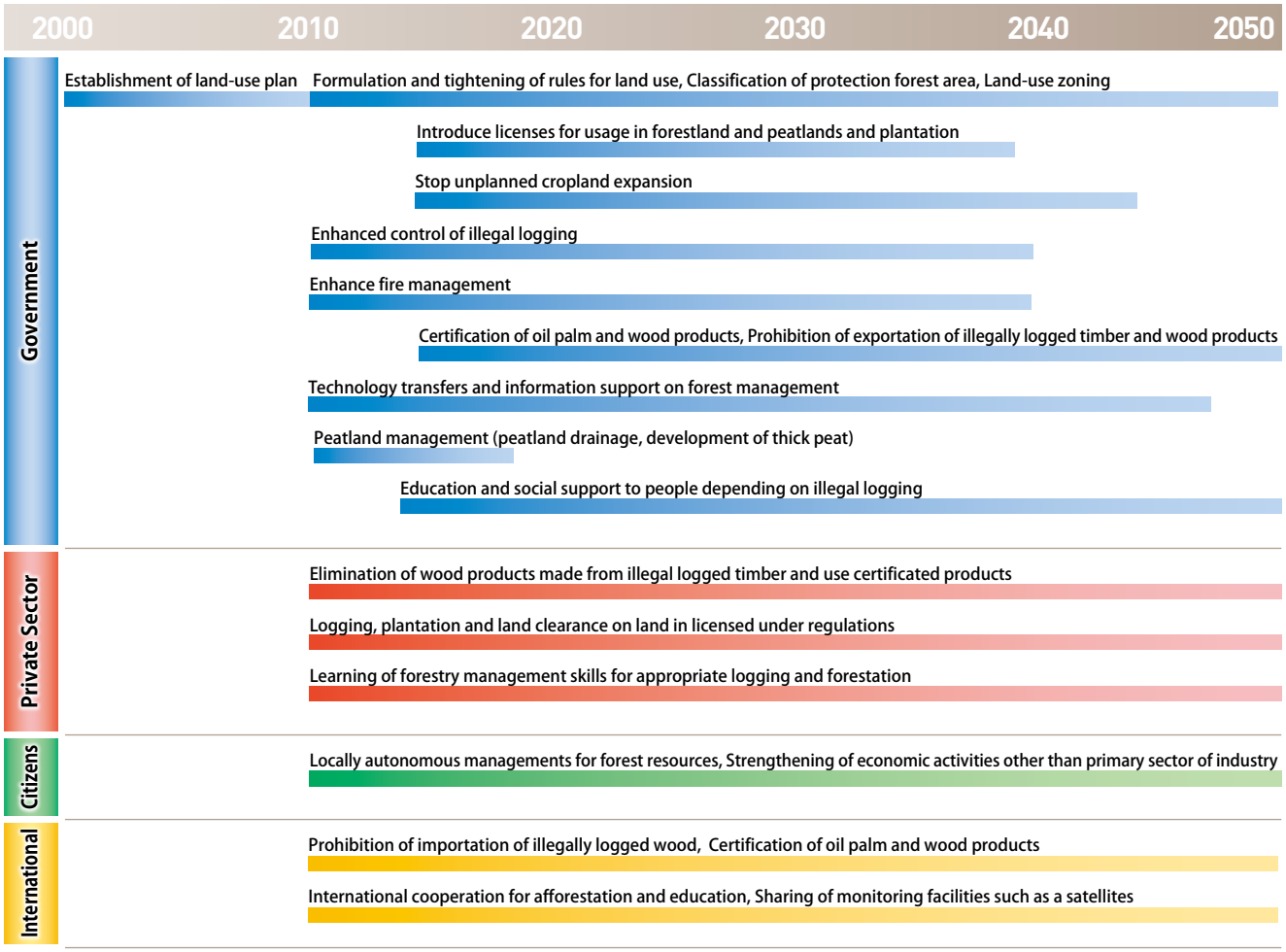
Operate logging and plantation on land licensed under regulations, and prevent disorderly land clearance. Manage fires lit to clear the land, and encourage the learning of forestry management skills aimed at appropriate logging and forestation and the maintenance of land after logging for forest regeneration. Abstain from illegal logging and not consume illegally logged timber.

Role of Citizens

Understand the importance and multiple functions of forestry ecosystem and manage forest at local level. Strive to select products made of certificated wood as much as possible. In deprived areas, actively participating in programs of the government, NPOs, international society, etc. and economic activities in non-forestry sectors will diversify income sources and reduce excessive dependence on forestry.

International Cooperation

Establish an international system to certificate sustainable management of biofuel production and wood production, and regulate the importation of products that do not meet the criteria. Additionally, promote international cooperation for forestation and capacity development in timber-producing areas. Introducing high efficient agricultural technologies (i.e. high-yield crop species) will contribute to reduce land clearance and deforestation.



Vision of 2050

Logging and plantation is operated only on land licensed under regulations based on land-use zoning. Producers of timber and palm oil have motivation for sustainable land management. Local people understand the importance and multiple functions of the forestry ecosystem and stop most illegal logging and land clearance. Countermeasures are implemented and a robust social infrastructure is established for forest and ecosystem protection and for sustainable production of agricultural and wood products.

Current Situation

The area of forests in Asia decreased until 2000 then recently increased during the period 2000 to 2010. Even though illegal logging still continues in protected forest areas, it is difficult to implement countermeasures because the livelihoods of some local people depend on illegal logging. In addition to this, in Indonesia and Malaysia, high demand for palm oil and wood products in the global market may promote excessive logging, land clearance and deforestation for exports of such products. Emissions from peatlands and peat fire are also a serious problem in the countries concerned. Peatland drainage to expand cropland areas and peatland fires started from fires lit to clear land are major sources of the emissions from peatlands.

Challenges

Based on land use zoning including protected forests, illegal logging and land clearance must be strictly controlled. Regulations on forestry and plantations need to be appropriately implemented and an infrastructure to control licenses for plantations and land clearance should be established. Companies producing palm oil and wood products should operate plantations only on land that is licensed under the regulations. These actions will take a long time to realize, but it is essential that they will be implemented by educating and training local people in forest management and creating jobs to provide their livelihood. At the rural community level, "agriculture and forestry cooperative producer organizations" consisting of small farmers also play an important role in this action.

Various strategies related to forestry and land use change

Afforestation/Reforestation

Afforestation is the establishment of forest cover in an area where there was no forest. Reforestation is the reestablishment of forest cover in an area where there was forest. Under the Kyoto Protocol, both the plantations are allowed as Clean Development Mechanism. Afforestation, reforestation and forest management leads to strengthened carbon sequestration.

Forest protection/Avoid deforestation

Deforestation causes CO_2 emissions through soil disturbance. The reduction of logging and forest protection holds the carbon in the forest and reduces CO_2 emissions. "Avoid deforestation" is not permitted as countermeasures under the Kyoto Protocol. A new international framework including avoid deforestation may promote participation of countries with large emission from deforestation.

Reduced impact logging

The continued existence of degraded forests after inadequate logging causes reduction in productivity or damage to biomass growth in the future. Improved logging techniques such as suppressing the disturbance of soil when logging minimize damage to the forest, reduce CO_2 emissions, and increase carbon sequestration.

Peatland management/Fire management

Peat oxidation resulting from peatland drainage for expansion of cropland area causes CO_2 emissions. Fires lit to clear land can rapidly spread out of control. Peatland fires cause huge amounts of CO_2 emissions. Conservation and rehabilitation of peatland are essential not only for mitigation of GHG emissions but also for conservation of forest ecosystems and biodiversity.

Action 9

Technology and Finance Achievement of LCS

Stable incentives for companies to invest in technology research and development

Technology & Finance

Adequate financial support for technology diffusion

Incentives for enlightened consumers to choose low-emission products

to Facilitate

Role of Government

Governments are expected to set up an institution that enables private companies to invest in technology development for the LCS. At the same time, governments may provide financial support to promote the fastest possible diffusion of low-GHG-emitting products.

Role of Private Sector

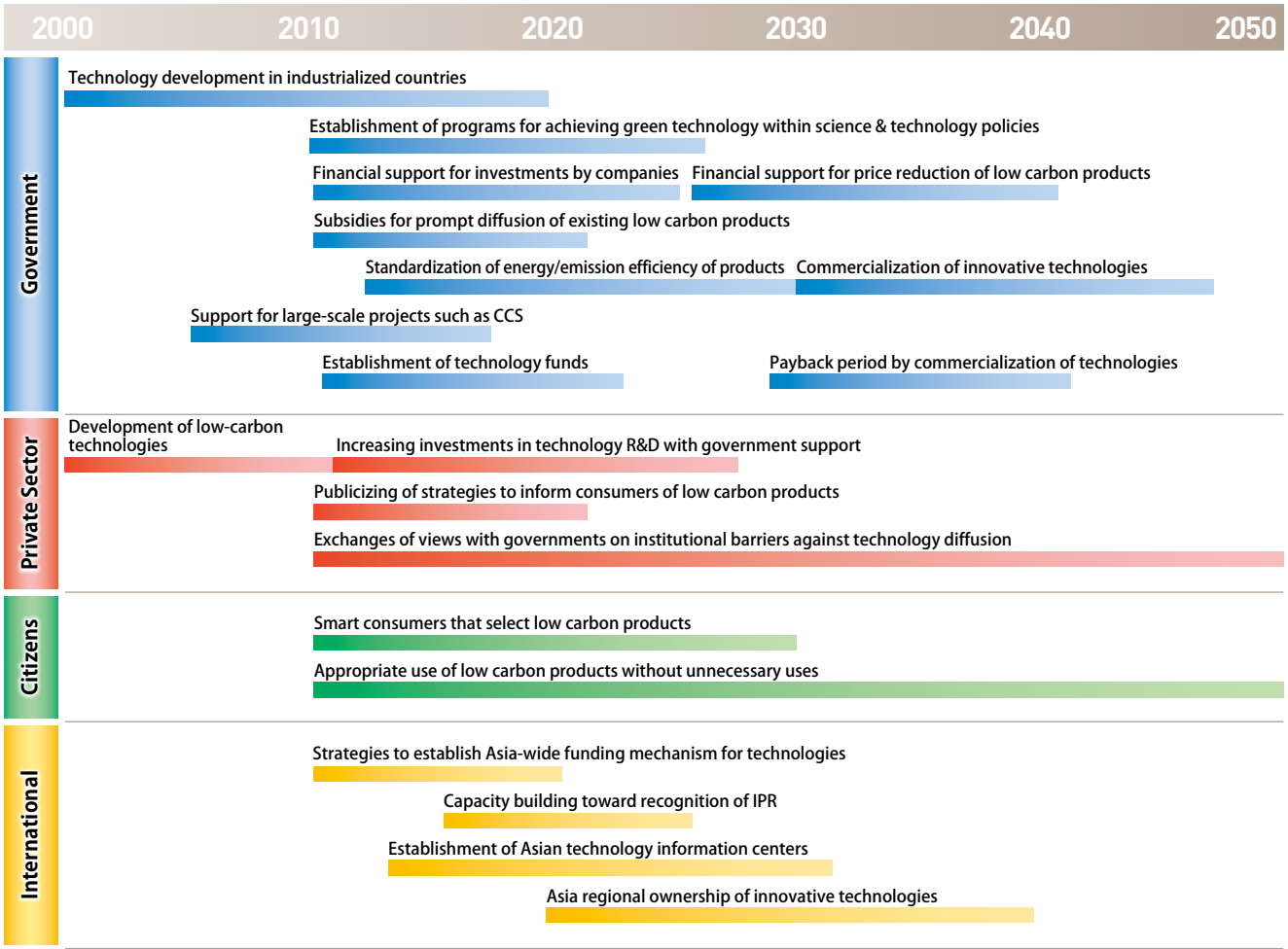
Private companies play a central role in technology development and diffusion. With the support of their governments, the industrial and commercial sectors are expected to draw attention to institutional barriers against the smooth diffusion of technology. These sectors are also expected to formulate marketing strategies to promote low carbon products.

Role of Citizens

Citizens are expected to be smart consumers that purchase low carbon products even if they are more expensive than other, less environmentally friendly products. They are also expected to support government policies that give priority to the development and diffusion of low carbon technologies.

International Cooperation

A financial mechanism to support technological development and diffusion in the Asian region is needed. Technology information centers will contribute to the sharing of knowledge on the latest technologies. The establishment of carbon efficiency standards will promote trading of the best available carbon technologies in Asia.



Vision of 2050

Gaps between countries in Asia in terms of economic development have decreased. Products of the best available technology are used in all countries. These products are subsidized, so that the prices are lower than those of products with higher GHG emissions. Low carbon businesses flourish in many countries. Private companies and research institutes compete for innovative technologies that further reduce GHG emissions. Investments for technological development are financially supported by private investments and international funding mechanisms.

Current Situation

Rapid transfer and diffusion of existing technologies, as well as the development of innovative new technologies, are indispensable for the Asian countries to achieve an LCS. Today, however, there are many factors that hamper such diffusion and development. There is a need to eliminate these hurdles, while increasing positive incentives for private companies to invest in new technology development. There is also a need for financial support for private companies and the least developing countries, to stimulate technology development and diffusion.

Challenges

The development of institutions for swift technological development and diffusion in Asia is necessary. Meanwhile, it is also essential to consider sufficient protection of intellectual property rights (IPR) and other related rights. The challenge for Asia is to achieve a society where all necessary technologies to decrease GHG emissions are diffused by 2050. Financial assistance from developed countries is not sufficient for the required investments in technological development and diffusion. All countries need to play their respective role in technological investment and diffusion.

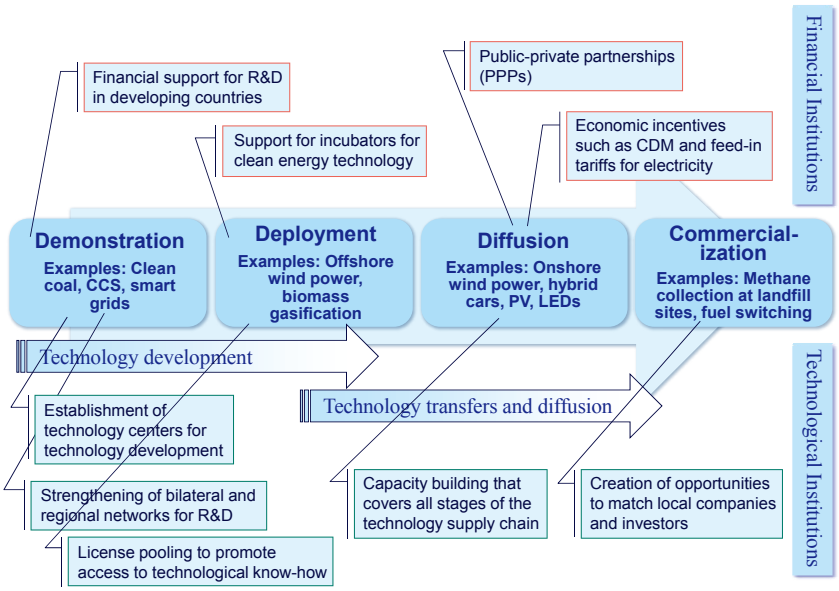
What are the best institutions to promote development and diffusion of low carbon technologies?

Many initiatives have been taken at the international level since the early 2000s toward the development and diffusion of low carbon technologies. There have been strong calls for low carbon technologies not only under the United Nations Framework Convention on Climate Change (UNFCCC), but also in other forums such as the G-8, G-20, APEC, and ASEAN. Possibilities for public-private partnerships (PPPs) are also being investigated. The effectiveness of these technological initiatives, however, is viewed as unsatisfactory.

One of the reasons for the disappointing assessment of current initiatives is the existence of a large gap between technologies owned by the private sector, and government policies aimed at controlling the use of these technologies. In addition, the institutions necessary for technologies differ according to the type of technology and the stage of the technology's life cycle (R&D stage, commercialized stage, etc.).

In the case of technologies that are still at the R&D stage, such as carbon capture and storage (CCS), institutions should focus on establishment and strengthening of technological information networks aimed at facilitating R&D. On the other hand, technologies that are already at the diffusion stage need other types of institutions. Policies in India and China to promote wind power plants, for example, are considered to be successful, but expensive royalties related to the technology are said to be a barrier to their faster diffusion. Many bioenergy-related technologies are already at the diffusion stage in Asia, but a lack of capacity in the hosting countries in terms of skilled workers and technical knowledge is considered to be another barrier against technological diffusion. In such cases, intellectual networking is needed to connect producers and host countries.

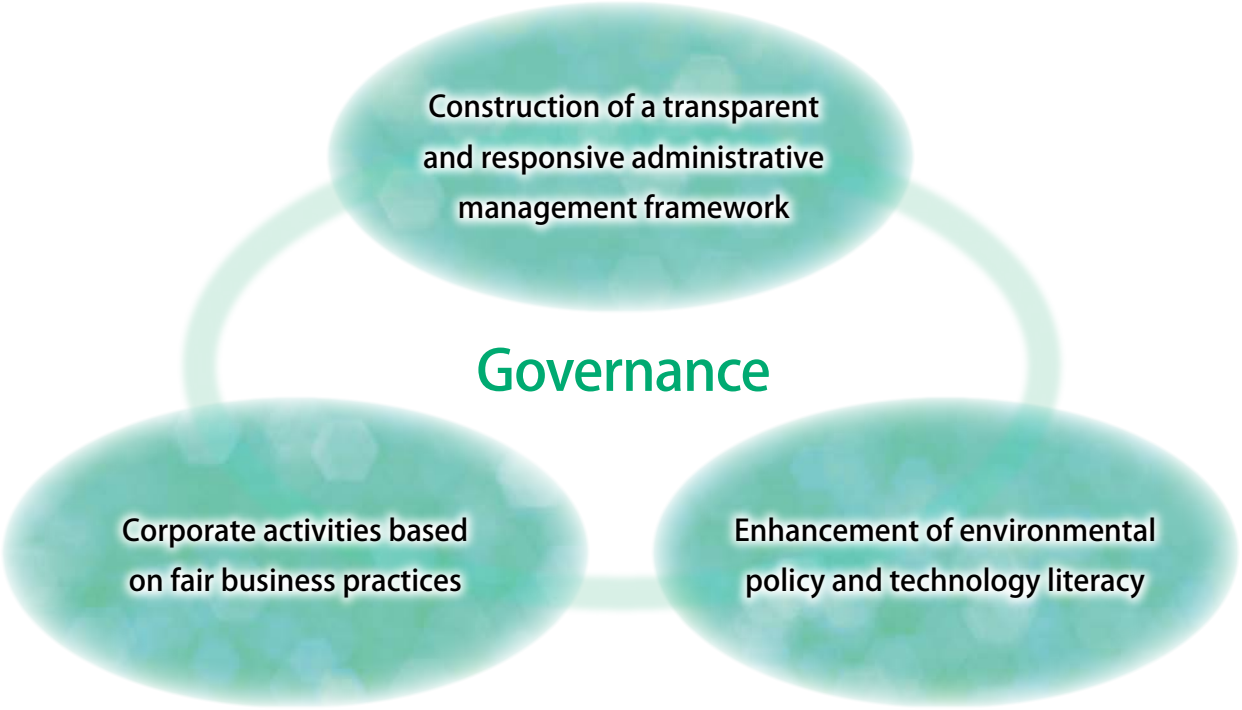
In recent years, an agreement has been reached to establish the Climate Technology Centre and Networks (CTCN) under the UNFCCC framework, and the UN Environment Programme (UNEP) has started to investigate effective institutions for such technologies. An agreement was also reached under the UNFCCC for a new financing mechanism, the Green Carbon Fund (GCF), that is expected to collect 100 billion USD a year by 2020. These mechanisms can become "hubs" of international technological cooperation, constructing a technology-promoting regime both at the multilateral and regional levels.

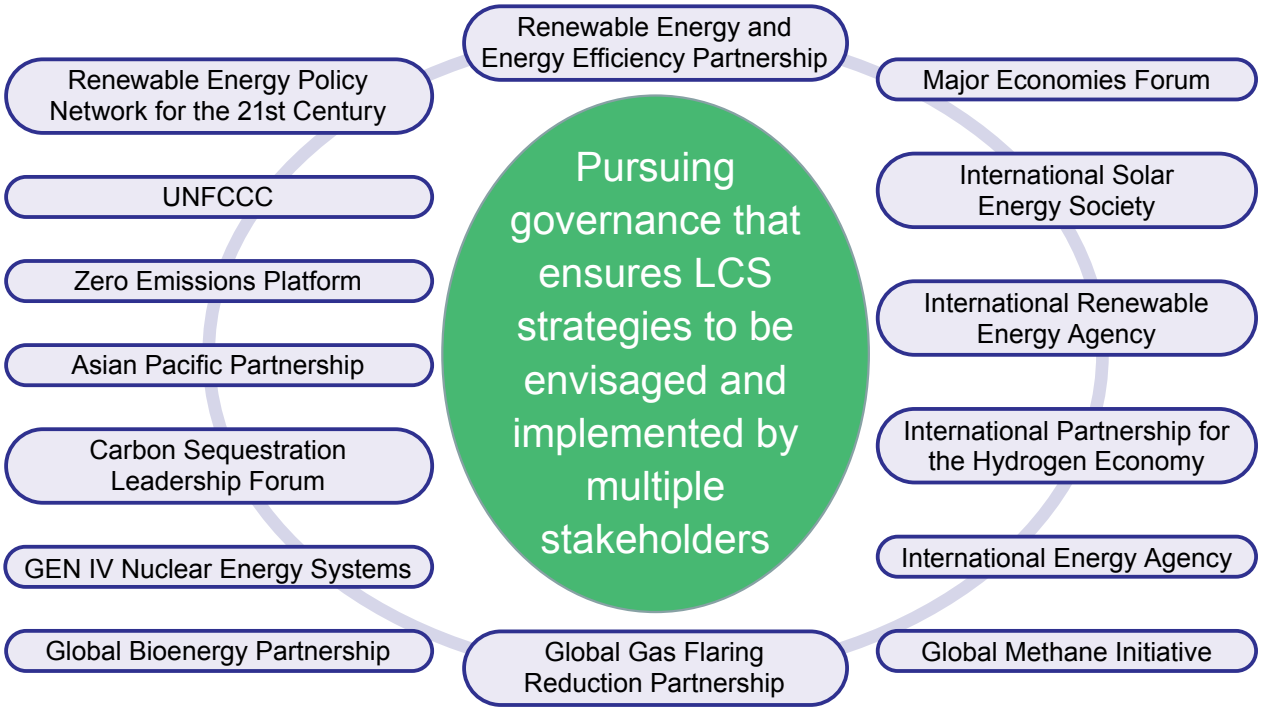


Examples of Technological and Financial Institutions for Each Stage in the Technology Life Cycle

Action 10

Transparent and Fair G
Supports Low Carbon





overnance that Asia

Role of Government

Deliver socio-technological infrastructure for the LCS, through an efficient administrative management framework in which multiple stakeholders can fulfill their own expected roles and responsibilities.

Role of Private Sector

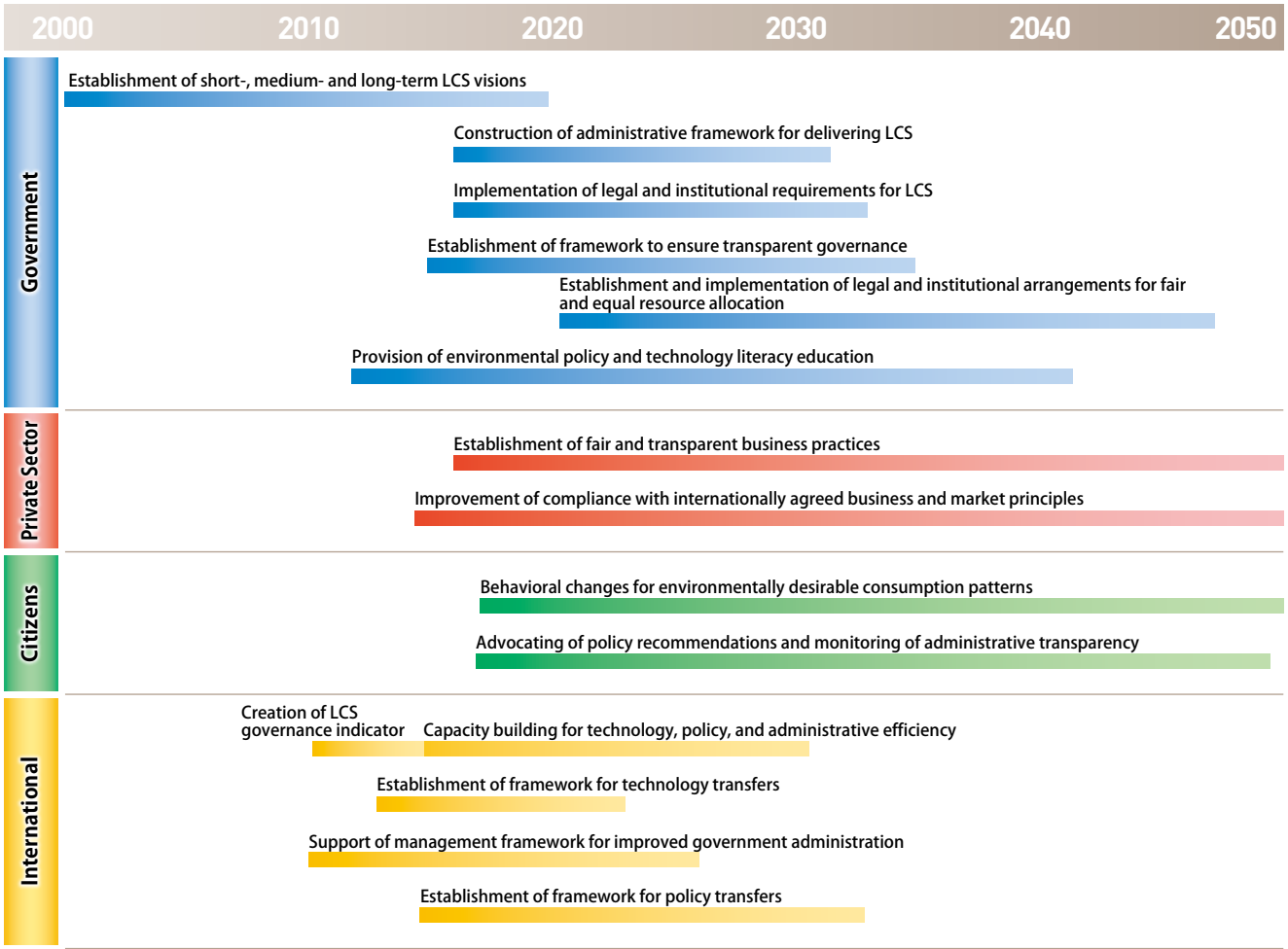
Carry out activities based on fair business practices in accordance with internationally agreed market principles and complying with international business rules on, for example, accounting regulations and intellectual property rights.

Role of Citizens

Based on improved literacy with respect to environmental policies and technologies, citizens have higher awareness of sustainability issues. They engage in sustainable consumption patterns, participate in policy formulation and implementation, and monitor transparency of the national and local administrations.

International Cooperation

In order to increase the transparency and efficiency of national and local governments in Asia, international cooperation supports policy development and implementation in these countries by assisting in the realization of administrative capacity and a framework for better governance.



Vision of 2050

An efficient governance management framework prevails in Asian countries. Fair and transparent decision-making processes are ensured, and thus corruption and illegal practices are excluded from governments and societies. The governance framework is designed in such a way that government personnel with higher motivation are appropriately rewarded, contributing to smoother policy implementation. Business communities and citizens at large have sustainability awareness, and a higher degree of participation in policy formulation and implementation. The improved governance leads to more international technology and financial cooperation among countries.

Current Situation

Currently, there are several Asian countries that have established action plans addressing a low carbon society. These plans, however, are not necessarily being implemented effectively. Due to the lack of the required legal and/or governance framework, as well as administrative transparency, physical, economic, and human resources are not effectively mobilized. The governance framework is mechanisms that ensure authorities to be accountable for better development results. The less effective governance framework often leads to a lack of information sharing among different government agencies, which results in duplicated policies.

Challenges

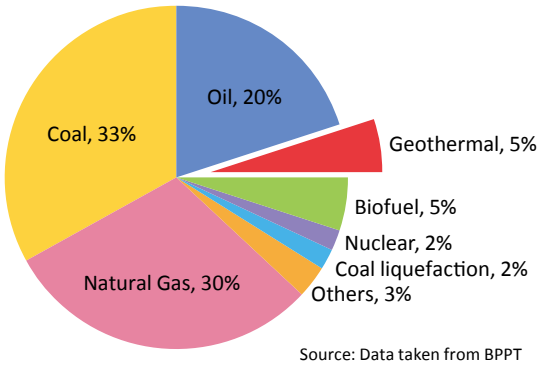
In order to improve organizational and institutional transparency, an effective administrative management framework needs to be established. International cooperation currently recognizes the importance of technology transfers, but must also emphasize the importance for building the capacity to formulate and implement policies by supporting the establishment of a governance framework in Asian countries. The aim of such international support will be to enable the governments of Asian countries to play a pivotal role in creating transparent and fair societies and markets.

Addressing the role of governance
—The case of Indonesian geothermal development

Indonesia has approximately 40% of the world's geothermal energy reserves, with 27,000 MW potential. Currently, it is ranked as one of the top five countries in the world for geothermal energy consumption, together with the U.S. the Philippines, Mexico and Italy. The Indonesian government recently established the goal of increasing geothermal resources by 9,500 MW by 2025, to make it one of the world's largest producers of geothermal energy.

It seems, however, that the Indonesian government is at the stage of seeking to find ways to achieve the target. In order to make the geothermal target feasible, it would be important that the Indonesian geothermal roadmap specifies what policies are requested by when, and who will implement them through various policy options, spanning political, economic and social issues. For example, the issues such as reducing subsidies for fossil fuels to increase the competitiveness of geothermal energy, preparing risk hedge programs, should be considered upon formulating governance strategies to overcome the structural problems in the energy industry and to invite more players to join the Indonesian geothermal business.

In order for the Indonesian national and local governments to achieve this ambitious geothermal target, the international community is expected to play an important role in supporting the emergence of an improved governance framework to deal with the barriers ahead of the Indonesian energy transition.

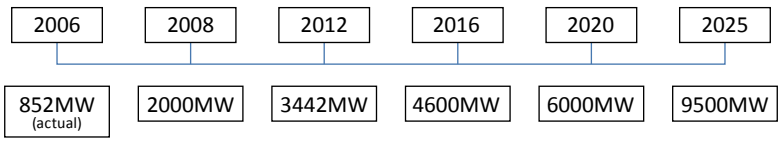


Source: Data taken from BPPT

Indonesia National Energy Mix 2025

Reference

Darma, S., Harsoprayitno, S., Setiawan, B., Hadyanto, Sukhyar, R., Soedibjo, A.W., Ganefianto, N., and Stimac, J. (2010) Geothermal Energy Update: Geothermal Energy Development and Utilization in Indonesia. Proceedings of World Geothermal Congress, Bali, Indonesia, April 25-30, 2010. Available at: http://www.geothermal-energy.org/pdf/IGAstandard/WGC/2010/0128.pdf



Source: PLN Geothermal

The Development to 9500MW in the Year of 2025

Low-Carbon Asia Research Project

Project Leader	Mikiko Kainuma (National Institute for Environmental Studies (NIES))	
Advisory Board	Ryokichi Hirono (Professor Emeritus, Seikei Univ.)	Masahiro Kawai (Dean and CEO, Asian Development Bank Institute)
	Li Zhidong (Professor, Nagaoka Univ. of Tech.)	Shuzo Nishioka (Senior Research Advisor, Institute for Global Environmental Strategies (IGES))
Program Officer	Kenji Fukuyama (Association of International Research Initiatives for Environmental Studies)	

S-6-1 LCS Scenario Development

Team Leader	Toshihiko Masui (NIES)	
	Junichi Fujino (NIES) (Project Manager)	Tatsuya Hanaoka (NIES)
	Kiyoshi Takahashi (NIES)	Yasuaki Hijioka (NIES)
	Yuko Kanamori (NIES)	Shuichi Ashina (NIES)
	Shinichiro Fujimori (NIES)	Yumiko Asayama (NIES)
	Diego Silva Herrán (NIES)	Miho Kamei (NIES)
	Tomoko Hasegawa (NIES)	Dai Hancheng (NIES)
	Tomoki Ehara (E-KONZAL)	Hu Xiulian (Energy Research Institute, China)
	Jiang Kejun (Energy Research Institute, China)	P. R. Shukla (Indian Institute of Management Ahmedabad, India)
	Manmohan Kapshe (School of Planning and Architecture, Bhopal, India)	Aashish Deshpande (National Institute for Technical Teachers' Training and Research, Bhopal, India)
	Rahul Pandey (Integrated General Systems Analysis Laboratories, India)	Rizaldi Boer (Bogor Agricultural University, Indonesia)
	Ho Chin Siong (Universiti Teknologi Malaysia, Malaysia)	Ram M. Shrestha (Asian Institute of Technology, Thailand)
	Bundit Limmeechokchai (Sirindhorn International Institute of Technology, Thammasat University, Thailand)	Sirintornthep Towprayoon (King Mongkut's University of Technology, Thonburi, Thailand)
	Yuzuru Matsuoka (Kyoto Univ.)	Gakuji Kurata (Kyoto Univ.)
	Reina Kawase (Kyoto Univ.)	Kei Gomi (Kyoto Univ.)
	Janice J. Simson (Kyoto Univ.)	Go Hibino (Mizuho Information & Research Institute, Inc. (MHIR))
	Kazuya Fujiwara (MHIR)	Yuko Motoki (MHIR)
	Kazuyo Oyamada (MHIR)	Kokichi Ito (The Institute of Energy Economics, Japan (IEEJ))
	Yukari Yamashita (IEEJ)	Shen Zhongyuan (IEEJ)
	Yuji Matsuo (IEEJ)	Yu Nagatomi (IEEJ)
	Shigeru Suehiro (IEEJ)	Yoshiaki Shibata (IEEJ)
	Ryoichi Komiyama (The Univ. of Tokyo)	Jusen Asuka (IGES)
	Kentaro Tamura (IGES)	Eric Zusman (IGES)
	Nanda Kumar Janardhanan (IGES)	Takeshi Kuramochi (IGES)
	Zhen Jin (IGES)	Shinji Kaneko (Hiroshima Univ.)
	Masaru Ichihashi (Hiroshima Univ.)	Daisaku Goto (Hiroshima Univ.)
	Akimasa Fujiwara (Hiroshima Univ.)	Junyi Zhang (Hiroshima Univ.)
	Satoru Komatsu (Hiroshima Univ.)	Phetkeo Poumanyvong (Hiroshima Univ.)
	Jin Chen (Beijing Normal University, China)	Makoto Chikaraishi (Hiroshima Univ.)

S-6-3 Institutional Architecture for LCS

Team Leader	Norichika Kanie (Tokyo Institute of Technology (Tokyo Tech.), United Nations University - Institute of Advanced Studies (UNU-IAS))	
	Masahiko Iguchi (Tokyo Tech.)	Yasuko Kameyama (NIES)
	Izumi Kubota (NIES)	Kanako Morita (NIES)
	Masachika Suzuki (Kansai Univ.)	Shunji Matsuoka (Waseda Univ.)
	Chaewoon Oh (Waseda Univ.)	Kazuhiko Takemoto (UNU-IAS)
	Aki Suwa (UNU-IAS)	Sohail Ahmad (UNU-IAS)
	Manu Mathai (UNU-IAS)	Joni Jupesta (UNU-IAS)
	Ping Jiang (Fudan Univ., China)	

S-6-4 Resources Management for LCS

Team Leader	Yuichi Moriguchi (The Univ. of Tokyo)	
	Shinsuke Murakami (The Univ. of Tokyo)	Seiji Hashimoto (Ritsumeikan Univ.)
	Tao Wang (Ritsumeikan Univ.)	Shigekazu Matsui (MHIR)
	Minoru Yoshikawa (MHIR)	Shigesada Takagi (MHIR)
	Arisa Murata (MHIR)	Keisuke Nansai (NIES)
	Kenichi Nakajima (NIES)	Hiroki Tanikawa (Nagoya Univ.)
	Feng Shi (Nagoya Univ.)	

S-6-5 Low Carbon Transport System

Team Leader	Yoshitsugu Hayashi (Nagoya Univ.)	
	Hirokazu Kato (Nagoya Univ.)	Kazuki Nakamura (Nagoya Univ.)
	Kei Ito (Nagoya Univ.)	Aoto Mimuro (Nagoya Univ.)
	Atsushi Fukuda (Nihon Univ.)	Hideyuki Ito (Nihon Univ.)
	Tetsuhiro Ishizaka (Nihon Univ.)	Tuenjai Fukuda (Nihon Univ.)
	Matthew Barth (Univ. of California, Riverside, U.S.A.)	Sittha Jaensirisak (Ubon Ratchathani Univ., Thailand)
	Varameth Vichiensan (Kasetsart Univ., Thailand)	Thaned Satiennam (Khon Kaen Univ., Thailand)
	Paramet Luathep (Prince of Songkla Univ., Thailand)	Nuwong Chollacoop (National Metal and Materials Technology Center, Thailand)
	Viet Hung Khuat (Univ. of Transport and Communications, Vietnam)	Nguyen Van Truong (Univ. of Transport and Communications, Vietnam)
	Allexis Fillone (De La Salle Univ. Philippines)	Shinya Hanaoka (Tokyo Tech.)
	Kumiko Nakamichi (Tokyo Tech.)	Fumihiko Nakamura (Yokohama National Univ.)
	Toshiyuki Okamura (Toyo Univ.)	Takaaki Okuda (Chubu Region Institute for Social and Economic Research)

As of September 30, 2012

Scenario Task Force

S-6-1 Tomoki Ehara, Shuichi Ashina, Kazuyo Oyamada	S-6-3 Yasuko Kameyama, Aki Suwa
S-6-4 Seiji Hashimoto, Shigekazu Matsui	S-6-5 Hirokazu Kato, Kazuki Nakamura

Contact: Low-Carbon Asia Research Project

National Institute for Environmental Studies
16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan
E-mail: lcs_project@nies.go.jp

October, 2012

Secretariat: Chie Shiraishi (NIES)
Cover designed by Information and Public Relations Group,
Center for Global Environmental Research, NIES