KEY ELEMENTS OF LOW CARBON TECHNOLOGY TRANSFER

Instruments and case analysis in South and Southeast Asian region

Ministry of the Environment
Government of Japan

Introduction

Development and transfer of low carbon or low emission technologies is one of the key components to enhance mitigation actions in developing countries. In order to facilitate climate technology development and transfer, the United Nations Framework Convention on Climate Change (UNFCCC) has established two organizations, the Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTCN).

The Paris Agreement and its accompanying decision, adopted at the 21st Conference of Parties (COP21) of the UNFCCC in December 2015, will strengthen the activities of TEC and CTCN to undertake further work relating to issues such as technology research, development and demonstration (RD&D), and development and enhancement of endogenous capacities. A technology framework will also be established based on the Paris Agreement to provide guidance to facilitate technology development and transfer. These recent developments highlight the increased importance of the issue.

Based on several case studies in South and Southeast Asian countries, this booklet describes two key elements for the successful technology transfer, i.e. renovation and finance. It also outlines the role of various organizations for technology transfer and Japan's activities on supporting technology transfer, both in public and private sectors.

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1 Background

Analysis of GHG Emissions in the South / SE Asian Region

Increasing energy consumption is especially pronounced in rapidly growing economies in South and Southeast Asia. During the period of 1990 to 2013, per capita energy-related CO_2 emission in the South and Southeast Asian region grew by roughly 150%, compared with about 100% for all developing countries. On an absolute level, however, it is still at around 1.5t-CO_2/capita, roughly one-third of the world average.

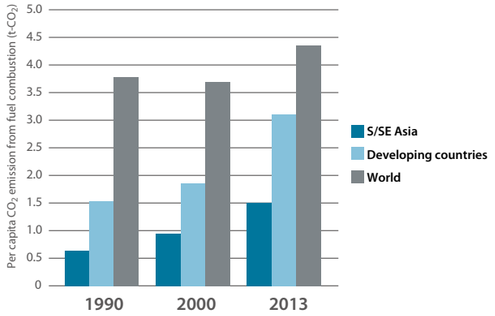


Figure 1 | **Per Capita CO_2 Emission From Fuel Combustion (T-CO_2)**
(Data: International Energy Agency)

Emission sources such as deforestation are still important and need to be addressed, but the share of energy-related CO_2 emission is rising.

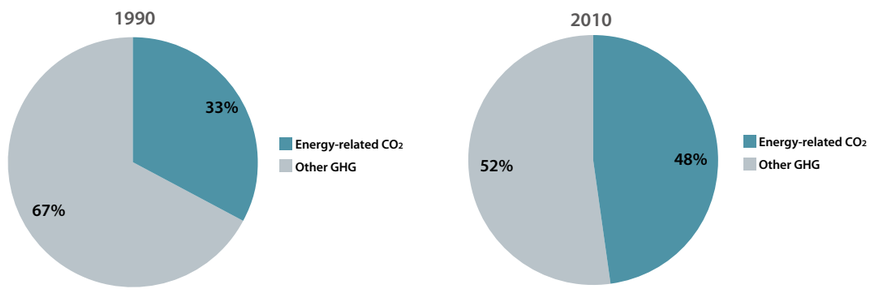


Figure 2 | **Proportion of energy-related CO_2 emission and other GHG emission (non energy-related CO_2 and 5 other GHGs listed in Annex A of Kyoto Protocol) in the South and Southeast Asian region.**
(Data: International Energy Agency)

Curbing energy-related CO_2 emission is high on the agenda of South and Southeast Asian countries, as witnessed by the various policies on renewable energy and energy conservation cited in the recently submitted intended nationally determined contributions (INDCs) which formed the basis of the Paris Agreement.

Table 1 | **Examples of policies aimed at reducing energy-related CO_2 emission**
(Source: INDCs submitted to UNFCCC)

Bangladesh	• Deliver 5% of energy from renewable sources by 2015, and 10% by 2020. • 10% energy consumption reduction in the industry sector through efficiency improvement and conservation, incentivized by energy audits.
India	• Achieve 175 GW renewable energy capacity in the next few years, including through policies such as the global solar alliance. • Efficiency measures including replacement of all incandescent lamps by LED bulb in the next few years and rapid expansion of mass rapid transit systems.
Indonesia	• At least 23% of energy derived from new and renewable energy by 2025. • Reduction of waste and utilization of waste / garbage into energy production.
Malaysia	• Introduction of feed-in-tariff mechanism. • Mandatory use of biofuel.
Mongolia	• Increase renewable electricity capacity from 7.62% in 2014 to 30% by 2030 as a share of total electricity generation capacity. • Increase efficiency e.g. by doubling the share of hybrid vehicles, development of BRT, improved stove efficiency.
Myanmar	• Increase in hydropower capacity to 9.4GW by 2030. • Efficiency partnership with UNIDO and GEF trust fund.
Philippines	• Activities based on Biofuels Act of 2006. • Activities based on Renewable Energy Act of 2008.
Sri Lanka	• Increase in hydropower and non-conventional renewable energy. • Establish energy efficient and environmentally sustainable transport systems by 2030 while 25%-40% of public transport is green fueled.
Thailand	• Target to achieve a 20% share of power generation from renewable sources in 2036 (Power Development Plan). • Reduce energy intensity by 30% below the 2010 level in 2036 (Energy Efficiency Plan).
Vietnam	• Change the fuel structure in industry and transportation through measures such as Law on Economical and Efficient use of Energy (2010). • Enhance renewable energy through developing a renewable energy technology market, etc.

This backdrop of rapid increases in energy-related emissions and a commitment to reduce GHG emissions gives rise to an urgent need for transfer of low-carbon technologies.

2 State of the Technology Transfer Policies in Multilateral Framework

1 Technology Needs Assessment (TNA)

The need for increased action in promoting energy efficiency and renewable energy is characterized by the Technology Needs Assessments (TNAs) and Technology Action Plan (TAP), facilitated under the Poznan Strategic Programme on Technology Transfer (2008). Examples of TNAs formulated by the countries in the region are as shown below.

Table 2 | **Examples of TNAs formulated by countries in the Asian region**
(Source: TNAs submitted to the UNFCCC)

Country	Year	Prioritized technologies	Outline of major initiatives
Bangladesh	2011	Technology options for power generation including: • Natural gas combined cycle (NGCC) • Solar home PV • Advanced combustion turbine • Integrated Gasification Combined Cycle (IGCC) • Advanced Pulverized Coal (APC) Technology options for power use include: • Compact fluorescent lamp (CFL) • Linear fluorescent lamp (LF)	The government has set targets for developing renewable energy resources to 5% of total power demand by 2015 and 10% by 2020.
Indonesia	2012	**Forestry:** Measurement and monitoring of carbon sequestration and emission, peat re-mapping, water management **Energy:** Photovoltaic industry, improvement of Public transport (MRT and BRT), efficient electric motor (motor drive) **Waste:** Mechanical Biological Treatment(MBT), in-Vessel Composting (IVC) , low Solid Anaerobic Digestion (LSAD)	The government has set up a vision on renewable energy utilization by 2025, which is targeted to 25% of the total energy use in Indonesia.
Mongolia	2013	**Energy supply:** Large hydropower plant, wind turbines (onshore, large scale), pulverized coal combustion technologies **Residential and commercial subsector:** efficient lighting and improved insulation of panel apartment buildings.	Establish a goal to increase the percentage share of renewable energy in total energy production to reach a 3-5 percent share in national energy supply by the year 2010, and 20-25 percent share by 2020 is established.
Sri Lanka	2011	**Energy** • Conversion of Biomass and Waste to Energy • Smart Grid Technology for Wind & Solar Integration with Hydro • Building Management Systems **Transport** • Integration of Non- motorized transport methods along with regularized public transport system • Promote carpooling and park-and-ride systems • Electrification of the existing railway system **Industry** • Energy Efficient Motors • Variable Speed Drivers for motors • Biomass residue based cogeneration	The government will endeavor to reach by 2015, a minimum level of 10% of electrical energy supplied to the grid from Non-Conventional Renewable Energy (NCRE).
Thailand	2012	• Smart grid • Waste (to power generation) • Second and third generation of biofuels • Energy efficiency in combustion in the industrial sector • Carbon capture and storage (CCS)	Aims to increase in the share of renewable energy to be 20% of Thailand's energy supply by 2022 through the Renewable Energy Development Plan. Aims to reduce energy elasticity from 0.98, to 0.7 in the year 2030, and reduce the energy intensity by 25% in 2030 through the National Energy Efficiency Plan.
Vietnam	2012	**Energy:** Large-scale heat and power, wind power, compact fluorescent lamps **Transport:** Bus rapid transit **Agriculture:** Biogas, wet and dry irrigation, nutrition enhancement for dairy cattle **LULUCF:** Sustainable forest management, afforestation and reforestation, mangrove rehabilitation	Increasing Increase the share of new and renewable energies to 5% and 11% of the total primary commercial energies by 2020 and 2050, respectively. Sets targets of energy saving from 5% to 8% of the total energy consumption during 2011-2015, based on the current predictions of future energy and socioeconomic development in the business-as-usual scenario.

2 Technology Mechanism Established Under the UNFCCC

Overview

Technology Mechanism is a group of activities in UNFCCC established by the Cancun Agreements in 2010. It is intended to facilitate enhanced action on technology development and transfer to support action on mitigation and adaptation.
The Mechanism consists of two key components: a Technology Executive Committee as the policy arm and a Climate Technology Centre and Network (CTCN) as the operational arm. In other words, specific activities for technology transfer under the Technology Mechanism have been carried out by CTCN.

Activities of CTCN: Responding to Requests from Member Countries

CTCN adopts a unique bottom-up approach, where inquiries on technologies are submitted to CTCN through focal points in each country (Nationally Designated Entities, or NDEs). Such submissions (requests) are then forwarded to CTCN, which subsequently allocates such requests to one or more of the 13 leading research institutions of the world (consortium organizations). Therefore, requests through CTCN enable the inquirer to obtain state-of-the-art analysis free of charge.

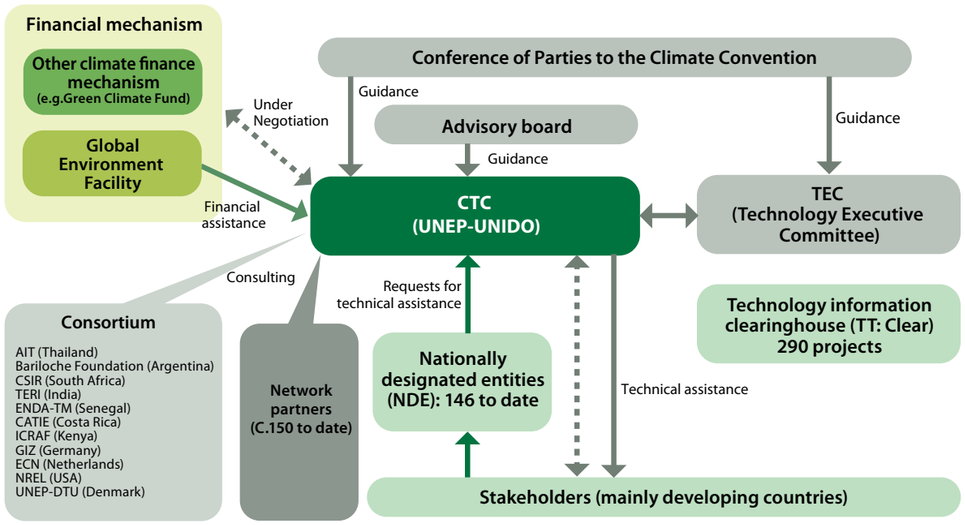


Figure 3 | Schematic diagram of CTCN and related institutions
(Source: information from the CTCN website)

To date, about 90 requests have been submitted from various regions of the world. These requests are being assisted by consortium members, especially those located in Asia (Asian Institute of Technology and The Energy and Resources Institute). An overview of mitigation-related requests submitted by the countries in the region is listed as follows. They span a wide diversity of areas, but few concern end-use efficiency of energy.

Table 3 | Examples of requests on mitigation submitted from East and Southeast Asian countries, as of January 2016
(Source: CTCN)

Country	Bhutan	Indonesia	Indonesia	Mongolia	Thailand	Vietnam
Date	2014/10/21	2015/2/5	2015/2/5	2015/4/5	2015/11/30	2015/7/1
Topic	Reducing GHG Emissions from Transport by Improving Public Transport Systems through Capacity Building and Use of Technology	The Development of Anaerobic Digester Technology for Palm Oil EFB Waste in Indonesia	Development of Integrated Carbon Measurements Methodology on Peatlands in Indonesia	Revision of existing Renewable Energy Law of Mongolia and developing framework of activities for enactment of draft Law of Mongolia on Energy Conservation	High resolution regional climate model projections for Thailand	Bio-waste minimization and valorization for low carbon production in rice sector
Geographical focus	National	National	National	National	National	Subnational
Sector	Transport	Waste management	Forestry	Energy supply	Cross-sectoral	Industry
Problem statement (summary)	NA	Difficult barrier of using EFB as a source of energy is its high moisture content. Therefore, anaerobic digester technology is desired. Currently, there is lack of knowledge.	Need for an accurate observation system to monitor and calculate carbon stock and emission throughout the country, in view of its high share in emission.	Implementation of Renewable Energy Law of 2007 has faced some difficulties in its implementation, such as denomination of FIT, maximum limit of PPA, categories to be included.	Need for an integrated climate data centers to enhance the efficiency of climate data collection and to distribute information to relevant agencies.	Abundance and availability of rice husks as organic material, growing demand of energy for Vietnamese industry.
Assistance requested (summary)	NA	Identification of the best technology for EFB waste processing and the technology transfer for the best anaerobic digester technology for EFB waste treatment, including development of a demonstration plant.	Support the development of integrated forest-peat carbon measurement and monitoring (CMM) system. Assistance is sought on discussion among stakeholders, pilot project demonstration, and capacity building through training workshops.	Revision of existing Renewable Energy Law and suggestions for revisions, including protocols for competitive bidding, government special fund, renewable portfolio standard. Development of Energy Conservation Law including regulations and procedures.	Technical assessments to select appropriate instruments, models and scope, provide tools and methodologies for downscaling, build capacities of staffs.	Technical assistance (e.g. for optimizing and selecting the appropriate technology options for paddy drying, briquette production and combustion) as well as for identifying business development strategy for industrial use or exportation of rice husks.
Expected benefits (summary)	NA	Reform the existing approaches on EFB waste treatment, help reduce GHG emission.	Improvement of sustainable forest management through increased awareness among key stakeholders.	Promotion of energy conservation and alignment of conservation and renewable energy policy is anticipated.	Assist agriculture, water resource management sectors.	Support decision and investment of 2 state-owned milling companies, scaling up by demonstration.
Post-technical assistance plans (summary)	NA	Finding a partner for implementing the proposal for feasibility study, implementation of first full scale project.	Coordination with Ministry of Environment and Forestry, designing a MRV system, policy and regulation to support MRV system.	NA	Application of climate data and models in developing adaptation and mitigation strategies, integrate data into agriculture and water resource management sectors.	Can be applied to 100 further similar milling companies in Vietnam.
Expected timeframe	NA	12 months	12 months	12 to 18 months	6 months	24 months
Technical assistance service providers	Technical University of Denmark (DTU), Asian Institute of Technology (AIT)	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	TBD	UDP, National Renewable Energy Laboratory (NREL, USA)	TBD	TBD

CTCN has also launched a feature called "technology library[1]" , where technology providers can upload information of their technologies to the CTCN website, which can subsequently be viewed by possible users of such technology. More than 400 technologies have been included.

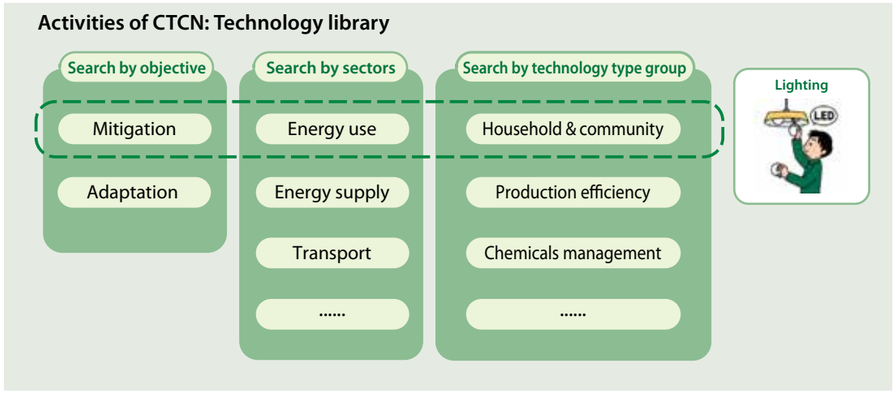


Figure 4 | Schematic diagram of CTCN library
(Source: CTCN Library)

Contributions by Network Members of CTCN in South and Southeast Asian Region

The Energy and Resources Institute (TERI)[2]

The Energy and Resources Institute (TERI) is a non-profit organization established in 1974 with headquarters in Delhi, India. Its vision is "Creating Innovative Solutions for a Sustainable Future".

As one of the consortium organizations of the CTCN, TERI has been involved in various activities related to CTCN. These include contributions to the Knowledge Management System of CTCN, development of templates and model requests during the initial stages, capacity building sessions for NDEs, conducting webinars and responding to the requests from NDEs. TERI has been involved in the response plans for Iran (PV cell design), Thailand (High Resolution Regional Climate Model Projections), Vietnam (Rice Sector) and Nepal (Request Incubator Program).

Asian Institute of Technology (AIT)[3]

The Asian Institute of Technology (AIT) is an institution specializing in postgraduate education and research / outreach activities, with an aim to promote technological change and sustainable development in the Asian-Pacific region. Located near Bangkok, Thailand, AIT has more than 500 research and support staff from more than 30 countries, offering more than 1,000 courses.

As one of the consortium organizations of the CTCN, AIT has been involved in responding to the request "Reducing GHG Emissions from Transport by Improving Public Transport Systems through Capacity Building and Use of Technology" from Bhutan, in cooperation with Technical University of Denmark (DTU).

1) https://www.ctc-n.org/technology-library

2) http://www.teriin.org/
3) http://www.ait.ac.th/

3 Renovation
The Key Element for Applying Appropriate Technologies

1 Elements of Renovation in Low Carbon Technology Transfer

Technology closely reflects the place it is developed and applied. For example, air conditioning technology developed in a country with a cold climate may not be suitable to countries with hot climates. Each country is different in many ways such as climate, culture and lifestyle of citizens. Therefore renovation of technology, i.e. transformation or modification of a technology to suit to the specific situation in the country where they are transferred, is important for successful technology transfer.

Approaches of such technology renovation can vary according to market, resource, environment, regulation. Figure 5 and Table 4 shows the typology and approaches of renovation.

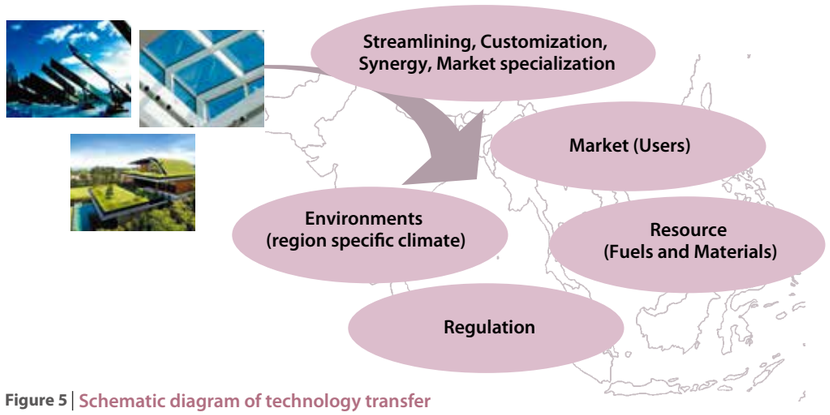


Figure 5 | Schematic diagram of technology transfer

Various approaches on renovation can be conceived. Here, renovation is divided into streamlining, customization, synergy, and market specialization.

Table 4 | Approaches of renovation in low carbon technology transfer

Approaches	Nature of the renovation approach
Streamlining	Technology or product developed in one country may have features and functions that are not needed for application in another country. On the other hand, the largest barrier to transfer of low-carbon technologies is often the high initial cost. In these cases, technologies can be made more competitive by "streamlining" i.e. by omitting features and functions that are not necessary for application in another country. Streamlining has to be conducted with caution, for the following reasons. ・The market becomes more competitive, since the product tends to become less distinguishable from others. ・Streamlining may necessitate operation of multiple production lines, which runs counter to the original intent of cost reduction. Thus, streamlining is best suited to areas where the above two issues are averted. The example of waste-to-energy shown in chapter 3.2.1 is an example.
Customization	Technologies or products developed in one country needs to adapt to the various conditions of the country of adoption. Examples of customization are as follows: ・**Social customs:** technologies or products must adapt to social customs. For example, design of refrigerators have been tailored to the needs of individual countries, where more space is allocated to foods purchased occasionally and stocked, in place of foods purchased freshly on a daily basis. General tendency of taste (e.g. preference of certain color) could also be a factor. ・**Infrastructure:** technology transfer to developing countries often entails adapting to inadequate infrastructure, such as fluctuating electricity voltage and rough roads. Customization therefore may require installing a more robust power unit or suspension, etc. ・**Climate:** north-to-south technology transfer often must suit the climactic conditions specific to their country of adoption. Air conditioning and refrigeration or technologies may need to adjust to increased external temperature and humidity. Window glasses may need to adjust to more vertical solar angle. Electronic equipments may need to be more heat resistant. ・**Regulation:** countries may have specific regulation (environmental or otherwise) which technologies must adapt to. This could be simple issues such as electric outlet shapes, or complex ones such as adapting to building codes. ・**Resource and fuel:** technologies are better adapted if both physical and human resources are abundantly available in the country of adoption. Combustion technology often has specific requirement for fuels, in order to secure stable combustion. Transferred technology must suit the fuels in its country of adoption. Decision on customization is not always simple, as significant customization can be a factor to increase cost.
Synergy	Technologies which face difficulties in being transferred alone may be more easily incorporated if combined with other technologies, due to synergies which enhance the value of each technology.
Market specialization	Technology or products developed in one country may face markets that are highly competitive. In such cases, one strategy is to focus on a specific niche where such technology or product can compete under the most advantageous circumstances.

Pathways of renovation can be schematically described as follows:

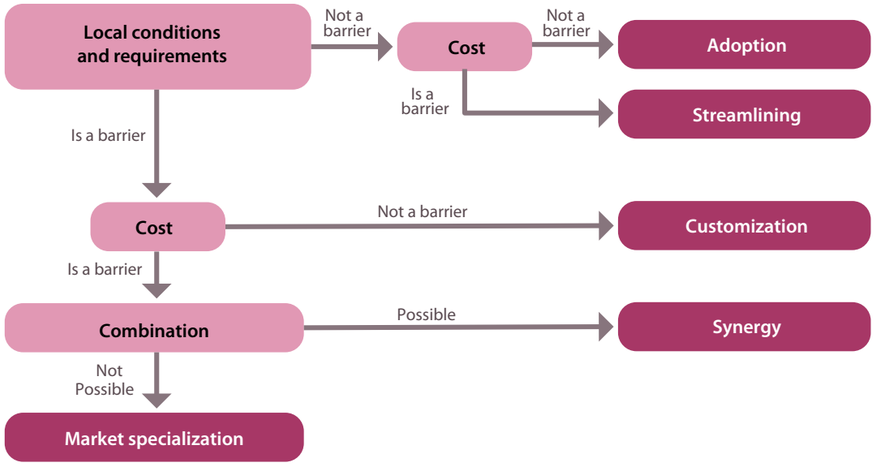


Figure 6 | Schematic diagram of various forms of renovation in technology transfer

2 Examples of Renovations in Technology Transfer

Streamlining: Waste-to-Energy

Waste-to-energy projects in Japan require complex facilities for containment due to limited space availability and proximity to residential areas. A leading company of Waste-to-Energy plants (Hitachi Zosen Corporation) has developed its design to suit the situation in India and other Asian countries.
According to the manufacturer, stoker type incineration can handle a wide range of refuse types and refuse treatment volumes (maximum of 1,000t/day at each incinerator) with a power generation efficiency of 24-28%.

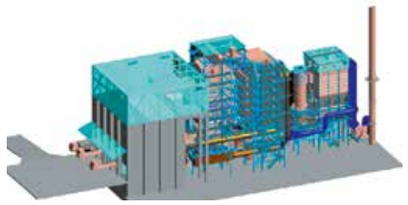


Figure 7 | Waste-to-Energy plant for low and low-to-mid calorific waste in emerging markets
(Source: Hitachi Zosen Corporation)

Customization: Transformers

Some industries have built-in mechanisms for suitability. A leading manufacturer for amorphous alloy for transformers (Hitachi Metals Ltd.) exports amorphous alloy to countries where transformers using amorphous alloy are produced, to be suited to local regulations and conditions. In Vietnam, cooperation with local transformer manufacturers has resulted in the adoption of transformers with amorphous alloys to be used in the Vietnamese electric power grid.

Figure 8 | Transformers containing amorphous core
(Source: Hitachi Metals Co. Ltd.)

Customization: Combustion Processes

Technologies containing combustion processes must be adapted to fuel specifications of the country or industry which adopts such technologies, in order to ensure stable combustion. An example is utility systems in industrial factories aiming to improve its efficiency by utilizing waste heat. Specification of waste heat varies greatly according to their heat source, and combustion systems must be renovated in order to be adaptive to byproduct fuels. Technologies such as the Organic Rankine Cycle (ORC) can be customized to waste heat temperature, even though diverse combustion fuels are anticipated.

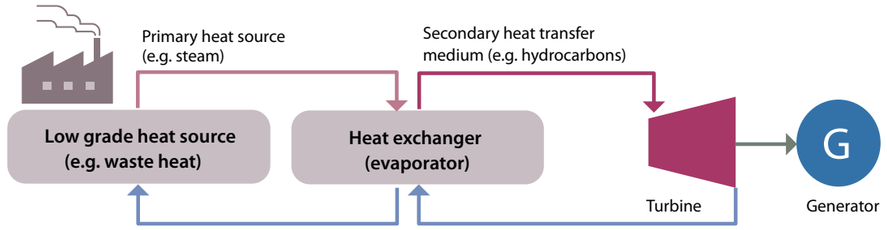


Figure 9 | Schematic diagram of an ORC plant

Customization: Power Electronic Equipment

Efficient electricity transformation systems contribute a broad area of energy conservation, because they are applied to any equipment that produces or consumes electricity. On the other hand, electricity transformation systems must be securely operated. One of the necessary specifications is heat-resistance. Required heat-resistance is diverse by climate such as outside temperature or humidity.
In the South and Southeast Asian region, the climate is generally hot and humid. Therefore the device must be renovated to adapt to its hot and humid climate. For example the required heat-resistance in Thailand is 50°C, as opposed to 40°C in Japan. Electrical equipment companies developing electricity transformation systems must adapt to local climactic conditions.

Synergy: Buildings

Some technologies can work better in combination, and therefore it is better for some technology providers to work in cooperation. For example, high efficiency lighting such as LED reduces the heat load inside the building, reducing air conditioning needs. Combining efficient lighting with efficient air-conditioners which can adjust to variable loads (such as those equipped with inverters) can further save energy and reduce emissions. Efficient air conditioners in turn work better with better insulated buildings where, once cooled down, load can be adjusted downwards. Better insulation further requires improvement in windows (e.g. double glazing), wall material and building design. Therefore, it can be said that energy efficiency in buildings is maximized with a coordinated effort of several technologies.
There are such coordinated efforts taking place in the Southeast Asian region. In one example, suppliers of glass, construction material, lighting and air-conditioning appliances have formed an alliance under a planning/architect company, to create a landmark energy saving building in Southeast Asia. One such landmark is expected to reduce energy consumption by more than 30% compared with similar buildings which do not use these technologies, resulting in a payback period far shorter than the lifetime of the building. The large expected reduction is the result of the synergy of the technologies used in combination.

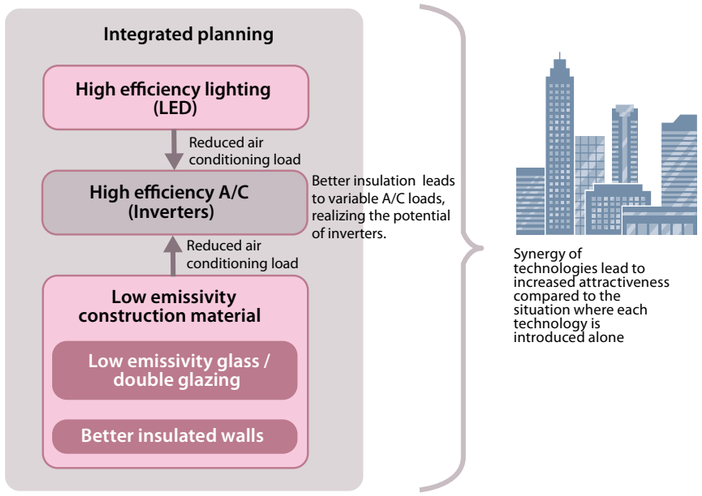


Figure 10 | Example of synergy created by combination of energy-efficient technologies

Synergy: Integrated Power Supply

Synergy of technologies can work within a single company, where the company itself possesses multiple technologies. An example of such synergy is a combination of a photovoltaic generator, and a battery to provide integrated power supply to remote islands which cannot be connected to the grid. When such devices are connected to schools, power can be supplied for lighting, operation of fans, and audiovisual equipment such as TV and personal computers to provide a learning environment. Figure 11 demonstrates an example of a 3kW photovoltaic unit mounted on a marine container, installed in a school in Indonesia.

Figure 11 | Example of synergy created by combination of renewable energy and efficient appliances: power supply container
(Source: Panasonic Corporation)

Market Specialization: Various Examples

Some technologies can be introduced only under favorable conditions. Examples of such market specialization and enabling conditions are as follows:

Requirement for quality:

- **Battery-operated motorcycles** may be particularly suited to locations where the preferred mode of local transportation is motorcycle-driven taxis; especially those which tow passenger cars where passengers face exhaust gas emission. Such battery-operated transportation may be further suited to areas which attracts tourists, especially where historical monuments (which face risk of corrosion) are located.
- Compared to household use, a higher quality of lighting is required in medical uses or displays in showrooms. Therefore, high quality **LED lighting systems** which command a price higher than the market may be specialized in these areas.

Economic conditions

- In India, **gas heat pumps** are most promising in areas where electricity price are high and a gas pipeline is available. In other areas, introduction faces higher obstacles.

Example of unfavorable conditions

- **Environmental:** Icemakers with natural refrigerants (e.g. ammonia) are suited to locations where ice-making facilities are remote from residential areas. Communities where many small-scale icemakers are located within residential and commercial areas are not deemed to be suitable for ammonia-based refrigeration, even though the risk of leakage can be small. Requirements for quality of window frames are more relaxed in tropical regions where annual and diurnal temperature variation is small. Japanese manufacturers have had difficulty penetrating such markets.
- **Economic:** Equipment which enables efficient use of gas face hurdles in countries where household gas tariffs are fixed regardless of consumption (Bangladesh). Conversely, gas-based cogeneration is favored in Thailand where gas tariffs are set lower when used for cogeneration.

4 Finance: The Key Element for Realizing Technology Transfer

1 Roles of Finance in Technology Transfer

Adequate and appropriate provision of finance is the other key to successful technology transfer. In many countries and industries, lack of finance is deemed as the main barrier to technology transfer. In many developing countries in particular, equipment to conserve energy (e.g. by efficiency improvement or by renewable energy) are especially sensitive to financing, since the investment requirements are quite high for state-of-the art technologies, and generally the cost of equipment needs to be paid in foreign currency whereas the accrued benefits are often in local currency, thereby exposing the purchaser of equipment to currency risk. Furthermore, interest rates of commercial banks in many developing countries tend to be high (often in excess of 10% per year), which hinders adoption of new efficient technologies.

Type and scheme of climate finance is varied and depends on the objective, target of facility, fund size, number of actors, etc. under the program. Multilateral aid has a vital role to play in responding to global challenges such as climate change. The share of aid delivered by multilateral organizations has grown steadily, and is becoming increasingly complex as donors invest more in multilateral cooperation.

Many low-carbon technology transfer projects such as energy efficiency projects tend to be small in scale. Therefore, financing of such projects tend to be multi-layered. The sole responsibility of appraisal of disbursement requests, approval and disbursement of funds rests with the "Implementing Agency" such as a local bank. Implementing agencies manage the funds by multilateral development banks (MDBs) to support local-scale programs such as energy efficiency promoting programs. When customers are owners of factories / buildings, implementing agencies normally fund customers directly. On the other hand, when customers are households such as the case under the Solar Home System (SHS) programs, participating organizations selected by the implementing agencies (distributors of SHSs or microfinance agencies) will be the final channel to fund the customers. A schematic diagram of the multi-layered system of financing is shown in Figure 12. An example of such multi-layered financing (JICA's two-step loan in India) is shown in chapter 4.3.2.1.

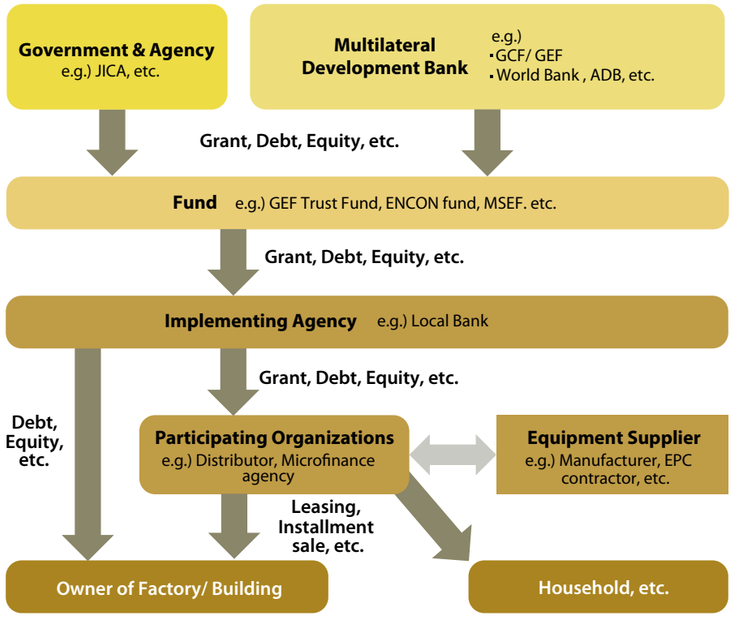


Figure 12 | Schematic diagram of multi-layered system of financing

Overview of international climate financing schemes currently available on a global scale is shown below.

Table 5 | Overview of global climate finance programs currently available

Name	Managing entity	Trustee	Implementing entities	Type of finance	Type of projects
GEF Trust Fund	GEF	World Bank	18 partners (UN organizations, development banks)	Grant	Adaptation, Mitigation
Least Developed Countries Fund (LDCF)	GEF	World Bank	Recipient countries	Grant	Adaptation
Special Climate Change Fund	GEF	World Bank	Recipient countries	Grant	Adaptation, Mitigation
Adaptation Fund	Adaptation Fund Board	World Bank	–	Grant	Adaptation
Clean Technology Fund (CTF)	CTF Committee	World Bank	ADB, other development banks	Complementing private finance	Mitigation
Strategic Climate Fund (SCF)	SCF Committee	World Bank	–	–	Adaptation, Mitigation
Green Bond	World Bank	–	–	Loan	Adaptation, Mitigation

2 Climate Finance in the Region

Financing schemes are not limited to internationally managed funds as shown in the previous page. Bilateral and local finance can also be conceived. However, availability of finance varies according to the development and maturity of the economy.

Table 6 | Overview of availability of financial sources

	Multilateral finance		Bilateral finance		Local finance		Microfinance
	Public	Private	Public	Private	Public	Private	
LDCs	All power generation, Energy efficiency	Large power, Energy efficiency	All power generation, Energy efficiency	Large power, Energy efficiency	All power generation, Energy efficiency	All power generation, Energy efficiency	Small-scale power generation
Non-LDCs	Large-scale power generation	None	Large-scale power generation	None	None	None	Small-scale power generation

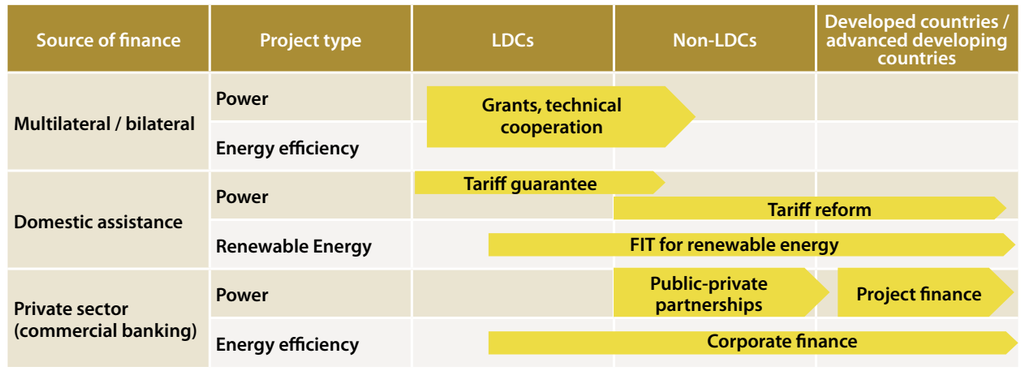


Figure 13 | Schematic diagram of stages of development and available financing

Financing for renewable energy has been increasing with introduction of feed-in tariff in many countries in the region. Overview of feed-in tariff regulation in the region is as shown below.

Table 7 | Feed-in tariff regulation of countries in the region

Country	India	Indonesia	Malaysia	Mongolia	Philippines	Sri Lanka	Thailand	Vietnam
Generation methods subjected to FIT	Bioenergy Minihydro Solar Waste	Bioenergy Geothermal Minihydro Solar	Bioenergy Minihydro Solar	Hydro Solar Wind	Bioenergy Minihydro Solar Wind	Bioenergy Minihydro Solar Waste Wind	Bioenergy Hydro Solar Wind	Bioenergy Waste Wind

However, financing for energy efficiency projects has trailed that for renewable energy. In the following chapters, innovative examples of climate financing schemes relevant for the private sector is shown.

3 Examples of Emerging Initiatives on Climate Finance

Recently, various initiatives on climate finance have been launched. Since energy efficiency projects tend to be small-scale projects conducted by small-scale project participants, finance poses a significant barrier in promoting energy efficient technology. Below are examples of initiatives on climate finance to promote low-carbon technologies.

Examples of Public Sector Finance: Energy Conservation Funds in Thailand

Thailand has initiated the innovative "Energy for Environment (E for E)" program. Under the program, the Energy Conservation Promotion fund (ENCON fund) was established, from levies on fossil fuel.

ESCO fund in Thailand

An ESCO (energy service companies) fund is established under the ENCON fund, under the sponsorship of Department of Alternative Energy Development and Efficiency (DEDE). The ESCO fund can function in a number of ways:

- ESCO projects are funded, up to 50 million baht (approx.1.2 million USD) per project. The ESCO fund can act as a minority shareholder, providing up to 50% of equity. The maximum investment period is 7 years.
- ESCO fund facilitates equipment leasing, entering into a purchase agreement with equipment suppliers and a leasing contract with ESCO project owners. The fund is paid back at 4% interest within a maximum of 5 years.
- ESCO fund guarantees loans from commercial banks, at a service charge of 1.75% of the guaranteed amount, for maximum of 5 years and 10 million bahts (approx.0.25 million USD).

Energy Efficiency Revolving fund

The Energy Efficiency Revolving Fund is also an instrument under the ENCON fund, providing a line of credit to local banks, which in turn provide loans on preferential terms to energy efficiency and renewable energy projects. 7,000 million bahts (approx.180 million USD) of credit was provided to private banks at 0.5% interest rate, which was combined with a comparable amount of banks' own credit to provide loans with a maximum interest rate at 4% and payback period of 7 years. 11 local banks participated, who were obliged to repay to the Energy Efficiency Revolving Fund within 10 years.

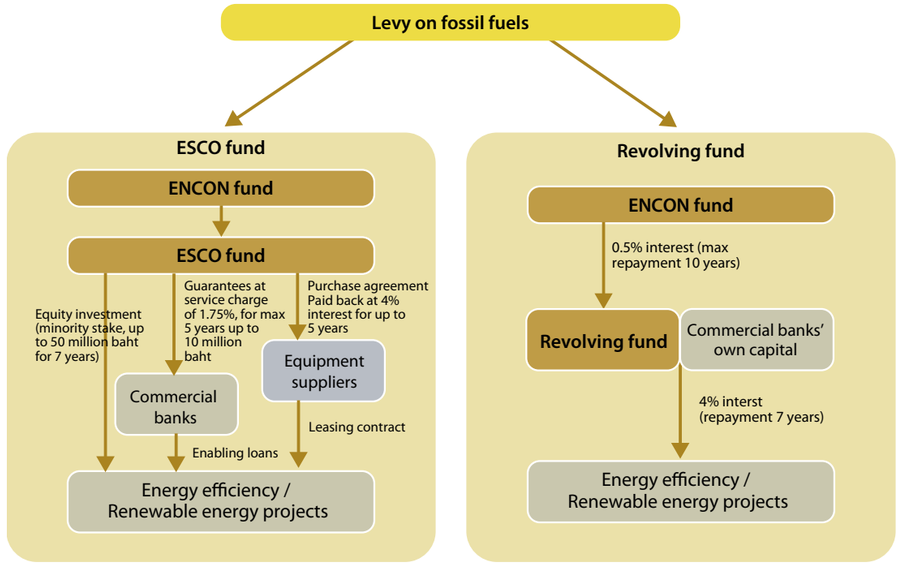
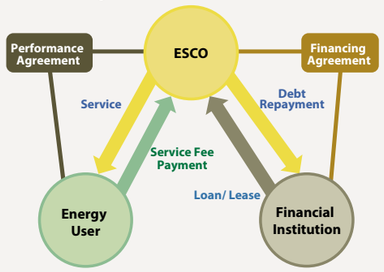


Figure 14 | Energy conservation (ENCON) fund schemes in Thailand

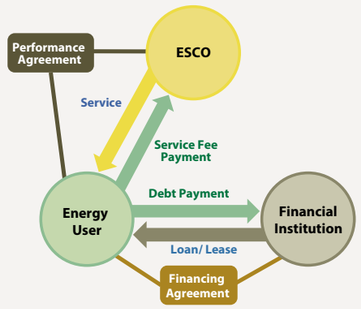
Energy service companies (ESCOs)

ESCOs implement projects to deliver energy-efficiency and use the stream of income from the cost saving to repay the cost of the project, including costs of the investment. Essentially the ESCOs will not receive their repayment unless the project delivers energy savings as expected. There are two different ESCO contracting models: "Guaranteed savings" and "Shared Service savings", as follows. In the guaranteed savings model, the energy user owns the facilities and arranges for the finance. In the shared savings model, they will be the task of ESCO. If a foreign company tries to implement ESCOs in emerging countries, it tends to prefer to start from guaranteed savings service scheme in order to reduce the risk of debt repayment. However, under the guaranteed service agreement, it will need to find a financial institution which can take the credit risk of the energy users. This kind of challenge is often faced by foreign companies attempting to venture into the ESCO business.

Shared Service Agreement



Guaranteed Service Agreement



(Source: Japan Association of Energy Service Companies)

Comparison of the risk-taking

	ESCO	Financial Institution	Energy User
Shared Service Agreement	Performance risk Debt repayment risk	Performance risk Credit risk for ESCO	-
Guaranteed Service Agreement	Performance risk	Credit risk for energy user	Debt repayment risk

Japan's Contribution to Emerging International Climate Finance Initiatives

JICA's activities: assisting MSMEs in India

Japan International Cooperation Agency (JICA) has been engaging in financing energy efficiency projects all over the world. One notable example of JICA's recent activities is financing investments in energy efficiency (EE) improvements of Micro, Small and Medium Enterprises (MSMEs) in India.

This is a "two-step loan" scheme where JICA extends concessional loans to Small Industries Development Bank of India (SIDBI), who then provide on-lending loans either directly or through local financial intermediaries to finance investments in EE improvements by MSMEs on preferential terms. JICA provides technical assistance (grants) for capacity development and facilitating the process.

Phases 1 and 2 of the program have extended more than 5,000 loans for MSMEs, resulting in an annual GHG reduction of about 550kt-CO_2 from reductions in electricity and heat consumption. Phase 3 of the program was signed in September, 2014.

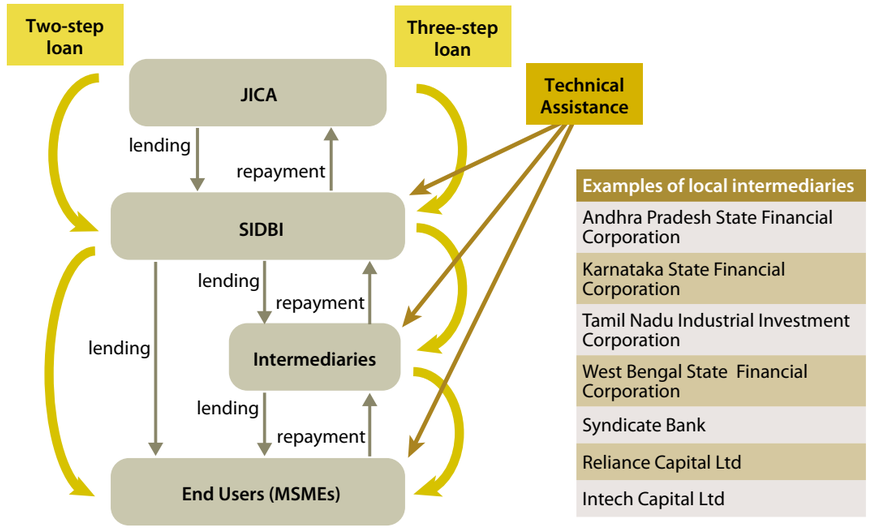


Figure 15 | Schematic diagram of MSME energy efficiency program by JICA
(Source: Japan International Cooperation Agency)

Cooperation of Public and Private Sector Finance: Example from Latin America

Recently, an innovative financing scheme for climate-friendly technology was initiated by MGM Innova Capital, a major player in the carbon market. The fund, MGM Sustainable Energy Fund (MSEF), provides equity or mezzanine financing to energy efficiency and renewable energy projects in Colombia, Mexico, Central America, and the Caribbean region. About 70% of the fund is to be directed to energy efficiency projects such as green appliances, commercial sectors such as hotels and hospitals (requiring both heat and power, these buildings provide opportunity for both energy efficient energy generation and consumption equipment), small and medium scale industries, as well as the municipal sector such as in street lighting. Renewable energies include proven technologies such as the expansion and rehabilitation of hydropower, as well as solar and wind generation. Expected projects include leasing of energy efficient / renewable energy equipment.

The uniqueness of the fund is that they have attracted a significant number of development banks which are public and quasi-public institutions. The total amount of the fund is expected to be USD 50 million, of which USD 10 million is financed by JICA. Through this fund, transfer of state-of-the-art energy efficient technologies and renewable energy technologies are anticipated.

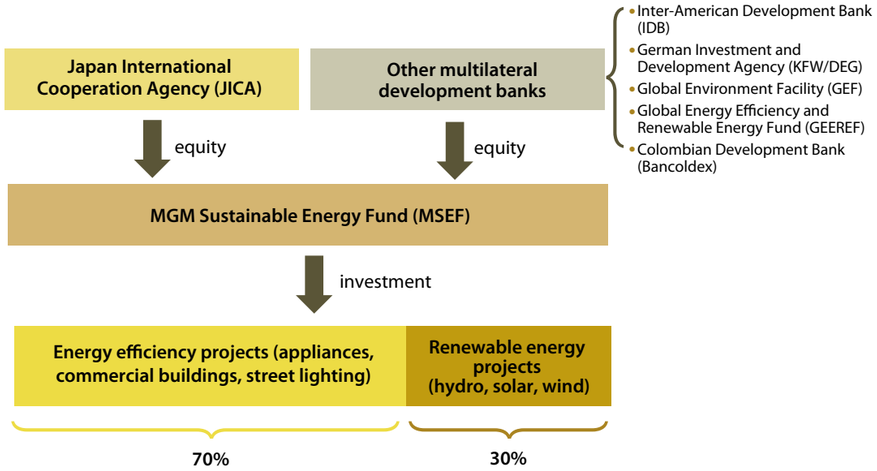


Figure 16 | Schematic diagram of MGM Sustainable Energy Fund

4 International Climate Finance: The Green Climate Fund

In 2009, COP15 took note of the Copenhagen Accord, which provided the direction for the Green Climate Fund[4]. Having been officially established in 2010, the initial capitalization has raised more than USD 10 billion. To date, 20 entities were accredited by the GCF and are eligible to access GCF funding (Table 7). The accreditation process involves evaluation of the entity's conformity with GCF's fiduciary standards (e.g. administrative and financial capabilities, transparency and accountability) and gender policy, as well as the ability to manage environmental and social risks.

Table 8 | **List of entities accredited under the Green Climate Fund**
(Micro: 10 million USD or less, Small: Up to 50 million USD, Medium: up to 250 million USD, Large: above 250 million USD. Source: Green Climate Fund)

Name	Location	Scale
Acumen Fund, Inc.	USA	Micro
Africa Finance Corporation	Nigeria	Large
Agence Française de Developpement	France	Large
Asian Development Bank	Philippines	Large
Caribbean Community Climate Change Center	Belize	Small
Centre de Suivi Ecologique	Senegal	Micro
Conservation International Foundation	USA	Medium
Corporación Andina de Fomento	Venezuela	Large
Deutsche Bank Aktiengesellschaft	Germany	Large
Environmental Investment Fund	Namibia	Micro
European Bank for Reconstruction and Development	UK	Large
Inter-American Development Bank	USA	Large
International Bank for Reconstruction and Development and International Development Association	USA	Large
Kreditanstalt für Wiederaufbau (KfW)	Germany	Large
Ministry of Natural Resources	Rwanda	Small
National Bank for Agriculture and Rural Development	India	Large
Peruvian Trust Fund for National Parks and Protected Areas (Profonape)	Peru	Micro
Secretariat of the Pacific Regional Environment Programme	Samoa	Small
United Nations Development Programme	USA	Medium
United Nations Environment Programme	Kenya	Small

Financial terms and conditions of loans to the public sector are as follows:

Table 9 | **Financial terms and conditions of loans to the public sector** (Source: Green Climate Fund)

Concessionality	Maturity	Grace period	Interest	Service fee	Commitment fee
High	40 years	10 years	0.00%	0.25% / year	≦0.50% / year
Low	20 years	5 years	0.75%	0.50% / year	≦0.75% / year

4) http://www.greenclimate.fund/home

The Green Climate Fund approved the first 8 projects in November, 2015, as shown in Table 10.

Table 10 | **List of projects under first round of funding approved under the Green Climate Fund** (Source: Green Climate Fund)

	Name	Classification	Entity	Amount (MUSD)	Country	Type of finance	Submitted by:
1	Building the Resilience of Wetlands in the Province of Datem del Maranon in Peru	cross-sectoral	public	6.24	Peru	grant	Profonape
2	Scaling Up the Use of Modernized Climate Information and Early Warning Systems in Malawi	adaptation	public	12.295	Malawi	grant	UNDP
3	Increasing the Resilience of Ecosystems and Communities through the Restoration of the Productive Bases of Salinized Lands in Senegal	adaptation	public	7.61	Senegal	grant	Centre de Suivi Ecologique
4	Climate Resilient Infrastructure Mainstreaming in Bangladesh	adaptation	public	40	Bangladesh	grant	KfW Development Bank
5	KawiSafi Ventures Fund in Eastern Africa	cross-sectoral	private	20	Eastern Africa	investment	Acumen
				5		grant	
6	Energy Efficiency Green Bond in Latin America and the Caribbean	mitigation	private	20	Mexico	loan or guarantee	Inter-American Development Bank (IDB)
				2	Colombia, Dominican Republic, Jamaica	grant	
7	Supporting Vulnerable Communities in Maldives to Manage Climate Change-Induced Water Shortages	adaptation	public	23.64	Maldives	grant	UNDP
8	Urban Water Supply and Wastewater Management Project in Fiji	cross-sectoral	public	31.04	Fiji	grant	ADB
	Total			168			

Private sector entities also have access to the Green Climate Fund (subject to accreditation), with concessional conditions on loans, equity, and guarantees. In the case of loans, interest rate is determined on a case-by-case basis, based on the least concessional interest rate offered to the public sector (0.75%) adjusted by factors such as credit risk premium.

One of the projects (Energy Efficiency Green Bond in Latin America and the Caribbean) employs a complex scheme of loan and guarantee to help realize a portfolio of projects developed by ESCOs, by a special purpose vehicle (SPV) which finances these projects. Inter-American Development Bank (IDB) and GCF together provides senior loans and guarantees. This kind of financing scheme is yet to be developed in the South and Southeast Asian region. It is hoped that cooperation of technology and financial mechanisms enable sharing of knowledge gained through such programs.

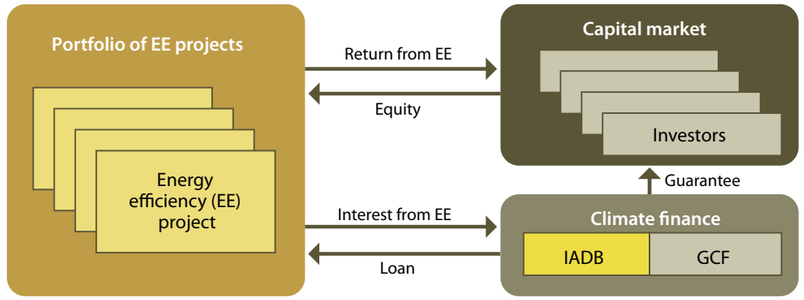


Figure 17 | **Schematic diagram of the program "Energy Efficiency Green Bond in Latin America and the Caribbean"**

5 Summary of Climate Finance

Financing of low-carbon technologies can take many forms, including grants, equity investment and loans. Financing can take on forms such as guarantees (providing investors with security). Financing can be made to the entities implementing the projects such as companies (e.g. corporate finance), or to projects themselves using special purpose vehicles (project finance). Development of leasing programs could help enable small and medium-sized enterprises adopt state-of-the-art technologies while relieving them of significant financial burden.

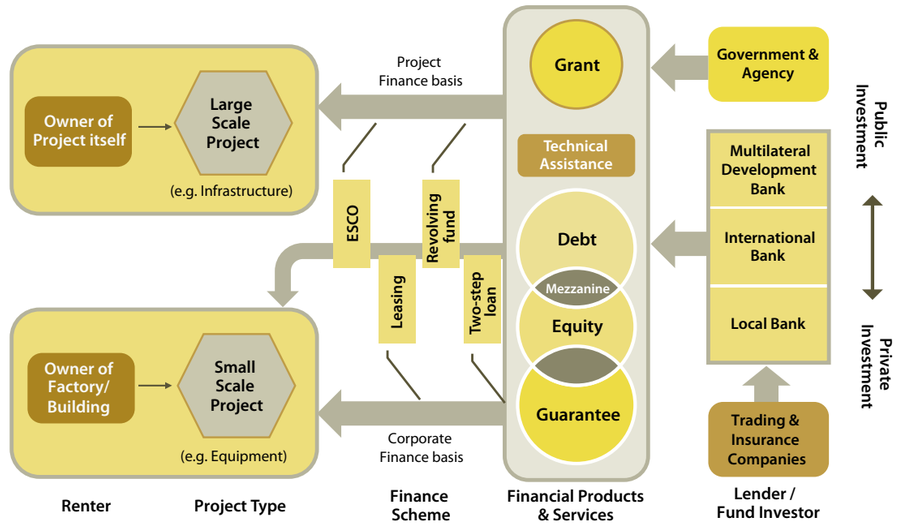


Figure 18 | **Various forms of climate finance**

5 Japan's Activities to Facilitate Technology Transfer

As a host nation of many state-of-the-art technologies, Japan has initiated numerous activities to facilitate transfer of low-carbon technologies. Examples are shown below.

1 Supporting Innovation and Renovation: Subsidy Program for innovation of low Carbon Technologies for Developing Countries

The Ministry of the Environment, Japan has launched a subsidy program to support technology renovation efforts to help enable Japanese technology providers better suit the situations and needs in emerging markets.

Background, Objectives

- Excellent low carbon technology is in high demand in developing countries and is essential to strengthening global climate change countermeasures.
- However such technology may not be appropriate to be introduced in the market of developing countries due to the difference of environmental regulations and systems, culutural pracices and restriction of energy resources.
- The program aims to fundamentally improve technologies in order to meet the requirement of developing countries, and realize low carbon society, promote international expansion of technology, as well as reduce CO_2 emission.
- The innovation process in the program will lead to technology development in Japan and to dissemination of its technologies in other regions.

Summary of subsidy program

This program provides subsidies to private organizations for fundamental improvement of low carbon technologies in order to meet various requirements of the developing countries, such as environmental regulations and system, cultural practices and restriction of energy resources.

Expected impact

- Scale-up utilization of the Joint Crediting Mechanisms (JCM)
- Diffuse appropriate low carbon technology in developing countries
- Strengthen global competitiveness of execellent low carbon technologies

Subsidy Scheme

Target: Private organization (Percentage of subsidy is 1/2～2/3 of whole project budget)
Implementation period: Maximum 3 years

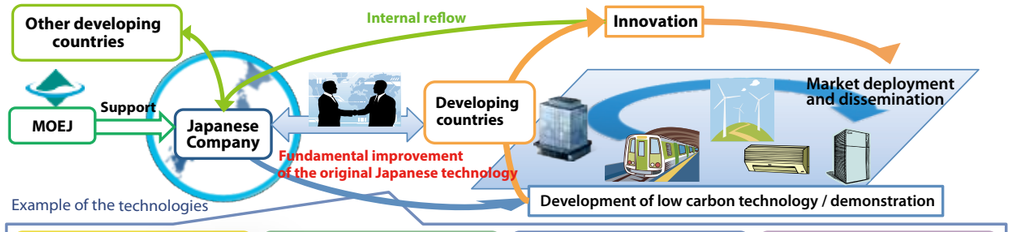


Figure 19 Schematic diagram of subsidy program for innovation of low carbon technologies for developing countries
(Source: Ministry of the Environment, Japan)

Projects approved to date under the program are as follows.

Table 11 Projects approved under the subsidy program for innovation of low carbon technologies
(Source: Ministry of the Environment, Japan)

Year	Project	Company	Country
2014	High efficiency motors and inverters	Hitachi Industrial Equipment Systems Co. Ltd.	Thailand, Indonesia, Cambodia, Vietnam
2014	Electric three-wheel taxi	Prozza Corporation	Laos
2014	Micro-scale photovoltaic for non-electrified regions	PEAR Carbon Offset Initiative Ltd.	Bangladesh
2014	Use of geographic information systems (GIS) in locating leaks in waterworks	Geocraft Co. Ltd.	Cambodia
2014	Optimal control of multiple centrifugal chillers in district cooling plants	Mitsubishi Heavy Industries Ltd.	Malaysia
2014	Low-cost LED lighting for commercial use that meets developing country needs	Axiohelix Co. Ltd.	Vietnam
2014	Electric motorcycle for taxis	Milai Corporation	Cambodia
2015	Micro hydropower for mobile phone stations	Sinfonia Technologies Co. Ltd.	Indonesia
2015	Reverse osmosis membrane seawater desalination system	Toyobo Engineering Co. Ltd.	Thailand
2015	Ethanol production from cellulose biomass	Nippon Steel & Sumikin Engineering Co. Ltd.	Philippines
2015	Improved charging and control of photovoltaic generation for off-grid areas	Digital Grid Solutions Co. Ltd.	Kenya, Tanzania

Example of innovation program in action 1

Micro-scale photovoltaic for non-electrified regions(Bangladesh)

The project proponent, PEAR Carbon Offset Initiative Ltd., aims to provide mini-solar home systems (mini-SHS) which have 10 or 20 Wp PV panel with a Li-Ion battery, equipped with LED lighting and 12VDC and USB outputs. Such a device provides electricity to supply basic lighting and communication needs (charging of mobile phones), enabling studying for children and cash generation activities for adults. This project contributes to GHG emission reductions through substitution of kerosene lamps with photovoltaic generators.

Figure 20
Example of project under "Subsidy program for innovation of low carbon technologies for developing countries": Micro-scale photovoltaic technology for non-electrified regions by PEAR Carbon Offset Initiative, Ltd.
(Source: Ministry of the Environment, Japan)

Example of innovation program in action 2

Improved charging and control of photovoltaic generation for off-grid area (Kenya and Tanzania)

The project aims to develop an innovative scheme where battery charging services using small-scale photovoltaic power are installed in local shops (kiosks) to sell electricity to meet basic needs such as lighting and communication, using a smart-phone application renovated to tailor local needs. This project contributes to GHG reduction through substitution of small-scale diesel gensets by photovoltaic generators.

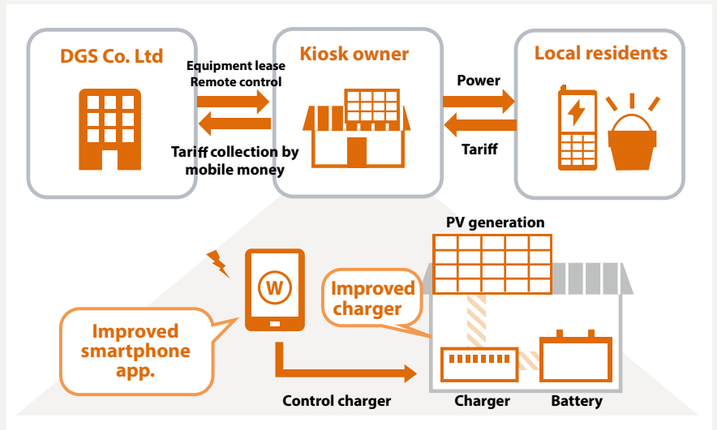


Figure 21 **Example of project under "Subsidy program for innovation of low carbon technologies for developing countries": Improved charging and control of photovoltaic generation for off-grid areas by Digital Grid Co. Ltd.**
(Source: Ministry of the Environment, Japan)

2 Joint Crediting Mechanism (JCM): Initiative to Support Diffusion of leading Low Carbon Technologies

State of the Joint Crediting Mechanism (JCM)

The Joint Crediting Mechanism (JCM) is another initiative by Japan to facilitate diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, contributing to sustainable development of developing countries. JCM aims to contribute to the ultimate objective of the UNFCCC by facilitating global actions for GHG emission reductions or removals. JCM agreements are concluded on a bilateral basis, and 2015 saw a steady development of JCM, having reached agreements with 4 countries (Saudi Arabia, Chile, Myanmar and Thailand), bringing the total number of countries to 16.

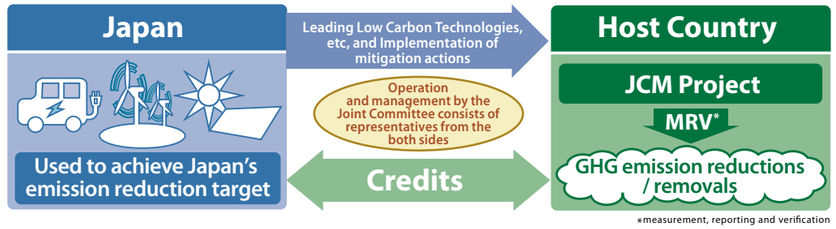


Figure 22 **Schematic diagram of JCM**
(Source: New Mechanisms Information Platform[5])

Table 12 **Status of countries which have engaged in bilateral agreement with Japan on JCM**
(as of March 25, 2016) (Source: JCM website[6])

	JCM Agreement	JCM Rules and Guidelines	Joint Committee Convened	Third Party Entities	JCM Methodologies approved	JCM Projects registered
Mongolia	○	○	3	12	2	2
Bangladesh	○	○	2	0	0	0
Ethiopia	○	○	2	7	0	0
Kenya	○	○	2	7	1	0
Maldives	○	○	2	6	1	0
Vietnam	○	○	4	8	5	2
Laos	○	○	0	4	0	0
Indonesia	○	○	5	10	10	5
Costa Rica	○	○	1	0	0	0
Palau	○	○	3	6	1	1
Cambodia	○	○	1	3	0	0
Mexico	○	○	1	6	0	0
Saudi Arabia	○	TBC	0	0	0	0
Chile	○	TBC	0	0	0	0
Myanmar	○	TBC	0	0	0	0
Thailand	○	TBC	1	0	0	0

5) http://mmechanisms.org/e/initiatives/jcm.html
6) http://www.jcm.go.jp

Projects registered to date are as follows:

Table 13 | Projects registered under the Joint Crediting Mechanism (JCM)
(as of March 25, 2016) (Source: JCM website)

Name of project	Host country	Date of registration	Project participant	Expected annual emission reduction (t-CO_2)
Energy Saving for Air-Conditioning and Process Cooling by Introducing High-efficiency Centrifugal Chiller	Indonesia	31 Oct 2014	PT. Primatexco Indonesia, Nippon Koei Co. Ltd. (Focal Point), Ebara Refrigeration Equipment & Systems Co. Ltd.	114
Project of Introducing High Efficiency Refrigerator to a Food Industry Cold Storage in Indonesia	Indonesia	29 Mar 2015	PT. Adib Global Food Supplies, PT., Mayekawa Indonesia, Mayekawa Mfg. Co. Ltd.	120
Project of Introducing High Efficiency Refrigerator to a Frozen Food Processing Plant in Indonesia	Indonesia	29 Mar 2015	PT. Adib Global Food Supplies, PT., Mayekawa Indonesia, Mayekawa Mfg. Co. Ltd.	21
Energy Saving for Air-Conditioning at Textile Factory by Introducing High-efficiency Centrifugal Chiller in Karawang West Java	Indonesia	24 Mar 2016	Nippon Koei Co. Ltd. (Focal Point), Ebara Refrigeration Equipment & Systems Co. Ltd.	176
Energy Saving for Air-Conditioning at Textile Factory by Introducing High-efficiency Centrifugal Chiller in Batang, Central Java (Phase 2)	Indonesia	24 Mar 2016	Nippon Koei Co. Ltd. (Focal Point), Ebara Refrigeration Equipment & Systems Co. Ltd.	145
Small scale solar power plants for commercial facilities in island states	Palau	21 Apr 2015	Western Caroline Trading Company, Surangel and Sons Company, Pacific Consultants Co. Ltd. (PCKK), InterAct Inc.	227
Installation of high-efficiency Heat Only Boilers in 118th School of Ulaanbaatar City Project	Mongolia	30 Jun 2015	Anu-Service Co. Ltd., Suuri-Keikaku Co. Ltd.	92
Centralization of heat supply system by installation of high-efficiency Heat Only Boilers in Bornuur soum Project	Mongolia	30 Jun 2015	Anu-Service Co. Ltd., Suuri-Keikaku Co. Ltd.	206
Eco-Driving by Utilizing Digital Tachograph System	Vietnam	04 Aug 2015	Nippon Express (Vietnam) Co. Ltd. Nippon Express Co. Ltd.	296
Promotion of green hospitals by improving efficiency / environment in national hospitals in Vietnam	Vietnam	30 Nov 2015	Energy Conservation Center Ho Chi Minh City (ECC), Mitsubishi Electric Corporation, Mitsubishi Corporation, Mitsubishi UFJ Morgan Stanley Securities Co. Ltd.	515

Japan Fund for Joint Crediting Mechanism (JFJCM)

In June 2014, the Government of Japan and the Asian Development Bank (ADB) have launched Japan Fund for the Joint Crediting Mechanism (JFJCM), which provides grants and technical assistance to projects that are financed or administered by ADB, or non-ADB projects which install state-of-the-art low carbon technology in developing countries which have entered in. The fund totals JPY 3.6 billion (approx. USD30 million).
A schematic diagram of JFJCM is shown below.

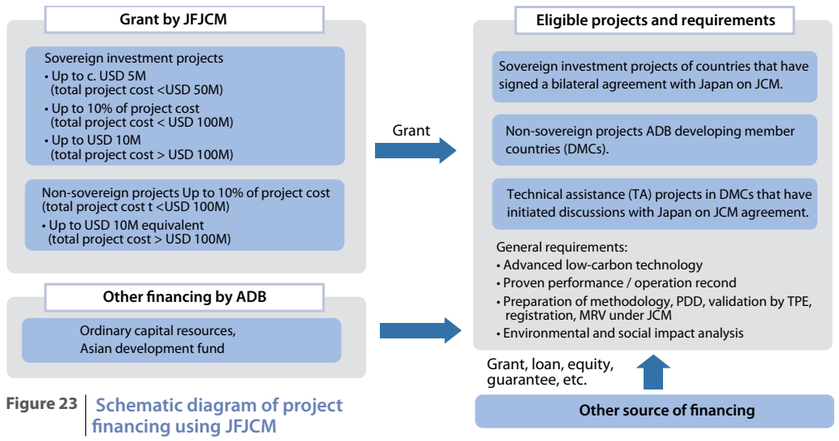


Figure 23 | Schematic diagram of project financing using JFJCM

3 Supporting Mutual Understanding

Starting in 2015, the Ministry of the Environment, Japan initiated a program to facilitate technology transfer activities in the South and Southeast Asian region, organizing a series of workshops and industry missions in two regions and fostered dialogues between technology needs side and seeds side. Elements of renovation identified are as shown in Table 18.
Three landmark events (industry missions to Vietnam and Indonesia, and a workshop in Thailand) held are also shown in following pages.

Technology Transfer Mission in Vietnam

The first technology transfer mission under the program was conducted in Vietnam (Ho Chi Minh City, and Da Nang City).


Workshop jointly organized with Energy Conservation Center, Ho Chi Minh City


Workshop jointly organized with Investment Promotion Center, Da Nang City

Figure 24 | Support program to facilitate technology transfer: Activities in Vietnam (Ho Chi Minh City and Da Nang City)

Schedule of the mission was as follows:

Table 14 | Participating companies of technology transfer mission in Vietnam

Day	Event
Nov.16	• Meeting with Energy Conservation Center, Ho Chi Minh City. • Meeting with a leading hotel franchise in Ho Chi Minh City (air conditioning, home appliances), in cooperation with Energy Conservation Center, Ho Chi Minh City.
Nov.17	• Meeting with a leading food company in Ho Chi Minh City (refrigeration technology). • Workshop with hotel industry and engineering companies in Ho Chi Minh City.
Nov.18	• Workshop with Da Nang City Investment Promotion Committee.
Nov.19	• Field survey of urban development project in Da Nang City.

Participating companies and topics included the following:

Table 15 | Overview of technology transfer mission in Vietnam (In alphabetical order)

Company	Technology
Asahi Glass Co. Ltd.	Low emissivity glass in buildings
Daikin Industries Ltd.	High efficiency air conditioners
Mayekawa Manufacturing (Mycom)	High efficiency industrial refrigeration
Milai Corporation	Electric motorcycles
Next Energy & Resources Co. Ltd.	Photovoltaic generators
Panasonic Corporation	Appliances, energy solutions
Sanicon Co. Ltd.	Wastewater treatment

Extensive discussions were held with various industries, including hotels and commercial buildings, as well as food industry and urban development. These industries have considerable demands for efficient technologies on various areas of energy efficiency and renewable energy, where the Japanese companies involved in the mission have developed cutting-edge technologies. As a result of the industry mission, discussions have been initiated on transfer of low-carbon technologies on various areas, including introduction of high efficiency equipments in food industry, hotel / service apartment franchises, waste collection industries, and shopping malls.

It was also pointed out that capital expenditure was the largest barrier; bilateral program such as JCM is proposed as a way forward, but an it was also discussed that environment to enable financial schemes such as leasing or payment in installment is desirable.

Technology Transfer Mission in Indonesia

Workshop jointly organized with APINDO, the employers' association of Indonesia

The workshop has attracted many participants from various sectors of local business community

Figure 25 | Support program to facilitate technology transfer: activities in Indonesia

Schedule of the mission was as follows:

Table 16 | Overview of technology transfer mission in Indonesia

Day	Event
Jan. 26 a.m.	• Business matching workshop held in association with APINDO at JS Luwansa Hotel and Convention Center, Jakarta
Jan. 26 p.m.	• Individual business matching among participating companies

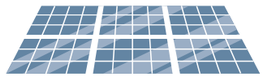
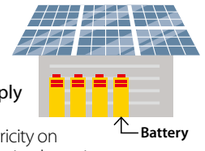
Participating companies and topics include the following:

Table 17 | Participating companies of technology transfer mission in Vietnam (In alphabetical order)

Company	Technology
Iwasaki Electric Co. Ltd.	LED
PT Mayekawa Indonesia	Industrial refrigerators
PT Panasonic Manufacturing Indonesia	LED, Refrigerant, Power Monitoring System, Off-grid Solar Power Supply System, etc.
PT Takasago Thermal Engineering	ESCO service
Toyo Standard Asia Pte Ltd(Singapore)	Power saving device for air conditioner and refrigerator

Extensive discussions were held with participants from various industries with a particular emphasis on the industrial (manufacturing) sector. Indonesian participants were very keen on practical knowledge on how to tap financial support from Japanese government for adopting the energy saving equipment, which is a testimony to their interests on cutting-edge technologies of Japanese companies.

Table 18 | Examples of renovation elements found through the mission

Existing technology	Renovated technology	Renovation element found through the industry missions
<Air conditioners and refrigerators> • 90% of electricity consumption used by compressor	<Power saving device for air conditioners and refrigerators> • Control compressor by observing running situation of compressor as not to stop compressor with dangerous timing which might be damaged	In South and Southeast Asian regions, there is large potential for energy saving in air conditioners & refrigerator applications.
 <Solar Panels> • Supply electricity only during the daytime	 <Power supply containers> • Supply electricity on demand by using batteries	In rural areas, especially isolated grid areas, there are only diesel generators which operate only during night time because fuel expenses are high.
 <LED> • Glare from electric light	 <LED> • Reducing glare	Lighting for gymnasiums need to consider glare issues because this can interfere with activities.
 <LED> • Fixed Color • Fixed brightness	 <LED> • Changing light color according to weather condition • Changing light brightness according to traffic conditions	Power saving could be achieved by providing appropriate light according to the ambient environment.

In South and Southeast Asian regions, there is a large potential for energy efficiency investment. However, there is a significant challenge of financing. In general, owners of factories or buildings obtain a loan to pay for installation of energy efficiency technology if they do not have their own financing. However, with high interest rates in emerging countries such as Indonesia or Vietnam, factory/building owners tend not to invest in energy-efficiency technologies which do not directly result in increased production.

The Second Bangkok Regional Workshop on Low Carbon Technology Transfer and Diffusion (Bangkok, February 23-24, 2016)

Overview of the workshop

The Second Bangkok Regional Workshop on Low Carbon Technology Transfer and Diffusion was held in Bangkok, Thailand on February 23-24, 2016. The workshop was opened by remarks from Mr. Soichiro Seki, Vice Minister of the Ministry of the Environment, Japan, Dr. Somchai Chatratana, Deputy Secretary General National Science Technology and Innovation Policy Office, Ministry of Science and Technology, Thailand (STI), and Prof. Worsak Kanok-Nukulchai, President of Asian Institute of Technology.

Table 19 | Overview of the Second Bangkok Regional Workshop

Organization	• Hosted and organized by Ministry of the Environment, Japan • Co-hosted by National Science Technology and Innovation Policy Office (STI), Ministry of Science and Technology, Kingdom of Thailand • Co-organized by: Asian Institute of Technology, Thailand and Mitsubishi Research Institute, Japan (secretariat)
Date and Venue	23-24, February, 2016, at Novotel Bangkok on Siam Square, Bangkok, Thailand
Participants	Approximately 50 participants from Thailand and the South / Southeast Asia and Japan, including the following:

National Designated Entities (NDEs) of CTCN	Indonesia, Mongolia, Philippines, Sri Lanka, Thailand, Vietnam
Nationally Designated Agencies (NDAs) of the Green Climate Fund	Bangladesh, Indonesia, Mongolia
Organizers	Japan, Thailand (STI, OENP, TGO, etc.)
International and national organizations	UNEP, Energy Conservation Center, Ho Chi Minh City
Financial institutions and organizations	Asian Development Bank, JICA, CTI-PFAN
Private sector	Asahi Glass, Full Advantage, Hitachi Zosen, JCCIB Thailand, Panasonic, PWC India, Siam Cement
Academia	Asian Institute of Technology

Agenda

Day 1 (February, 23)	Day 2 (February, 24)
Opening remarks and Keynote address Session 1: Sharing knowledge and experience on technology transfer from examples on the ground Session 2: Role of national and international policy instruments	Session 3: Role of the financial sector

Figure 26 | Scenes from the Second Bangkok Regional Workshop

Summary of discussions

At the keynote address, a representative from the National Science Technology and Innovation Policy Office, Ministry of Science and Technology, Thailand (STI) highlighted the importance of the linkage of finance ministries, the Green Climate Fund (GCF), Climate Technology Centre and Network (CTCN), and its nationally designated entities (NDEs), in order to effectively guide and finance low carbon projects towards implementation. Summary of discussions in the three sessions are as follows:

Session 1: Sharing knowledge and experience on technology transfer from examples on the ground

This session focused on the private sector involved in climate-friendly projects. Elements suggested as key characteristics of a successful technology transfer are: will on the side of the project participants (equipment suppliers and purchasers), continued effort to reduce costs, and national commitment on greenhouse gas (GHG) reduction. Views on the importance of finance were more varied, though the importance of finance was not disputed. The prevailing view was that a strong partnership between local and foreign partners is often the deciding factor in technology transfer. Such partnership and trust is forged by the willingness of the project participants as well as the effectiveness of task-sharing between local and foreign partners, partially necessitated by efforts to minimize costs and maximize competitiveness. Further more, a strong national commitment on GHG reduction gives rise to various enabling policies (e.g. feed-in tariff, tax incentives, voluntary and mandatory standards) which facilitate introduction of low carbon technologies.

Session 2: Role of national and international policy instruments: what are keys to successful policies that can facilitate transfer of low carbon technologies?

This session focused on policymakers such as National Designated Entities (NDEs) from various countries in the region. Some of the NDE speakers also have the function of National Designated Authorities (NDA) of the GCF. Speakers exchanged each country's activities on formulating and submitting requests to CTCN, as well as other technology transfer activities such as the Joint Crediting Mechanism (JCM). A diversity of approaches was highlighted, with some countries formulating requests on policies (such as energy conservation laws), whereas other countries are in the process of establishing a screening process to call on the private sector. New requests are being planned in Mongolia and Sri Lanka. It was highlighted from a member of CTCN Consortium that, of the approximately 90 requests for technical assistance to the CTCN submitted to date, about 85-90% were formulated by the public sector and / or academia, and the remainder from the private sector. In view of this, CTCN is making efforts to reach out to the private sector. It was suggested that a private sector-oriented request submission necessitates a robust procedure to screen candidate requests. It was suggested from one of the participants that, following the Paris Agreement, role of CTCN will be strengthened with respect to R&D, domestic capacity building, and linkage with Financial Mechanism. Against this backdrop, several speakers mentioned their countries' intention to formulate or revise Technology Needs Assessment (TNAs) and Technology Action Plans (TAPs).

Session 3: Role of the financial sector: how public and private financial institutions can help enhance transfer of low carbon technologies?

In this session, activities of various financial and finance-related organizations were introduced. A speaker from Asian Development Bank introduced its activities-Climate Technology Financial Centre, Asian Climate Partnership, and Energy Savings Insurance. The Asian Climate Partnership is a venture capital investing in proven climate-friendly technologies with a high expected return. Representative from CTI-PFAN underscored the difficulties of investors ranging from deciding upon the activity (sale of equipment, royalty, license, maintenance contract, JV/profit sharing) to project evaluation (maturity / obsolescence of technology, location, collateral, material, adaptability).

Such difficulties investors face are especially pronounced in energy efficiency retrofit projects such as ESCOs, which in general tend to be small-scale and therefore are conducted by small-scale operators, often lacking in credit. One of the speakers cited the example of Indian micro, small, medium-scale enterprises (MSMEs) demonstration, where efficiency tends to decline with size of enterprise. This creates a situation where the more desirable the project is from the viewpoint of energy efficiency improvement, the less desirable it gets from the viewpoint of investors. "Two-step" loans by JICA, loaned initially to Small Industries Development Bank of India (SIDBI) and then to MSMEs, are an attempt to alleviate such dilemma, since such schemes lower the cost of interest to the project participants, which can be significant.

The experience of working with various bilateral and multilateral climate finance institutions were discussed. One country cited difficulties in obtaining accreditation under the GCF. For energy efficiency / renewable energy projects generating financial benefits, loans were preferred to grants. It was therefore found to be easier to access GCF through an entity already accredited. Improvement in direct access to the Fund was desired. The general agreement was that bilateral financing schemes such as JCM tend to operate under simpler rules (though the high quality of projects financed by multilateral institutions was also highlighted).

Photo: Alamy/Aflo

This report is prepared for the Ministry of the Environment of Japan by Mitsubishi Research Institute Inc.

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