4. Energy Transport

4.1 Construction of Energy Transport Infrastructure in Developing Countries

[Points]

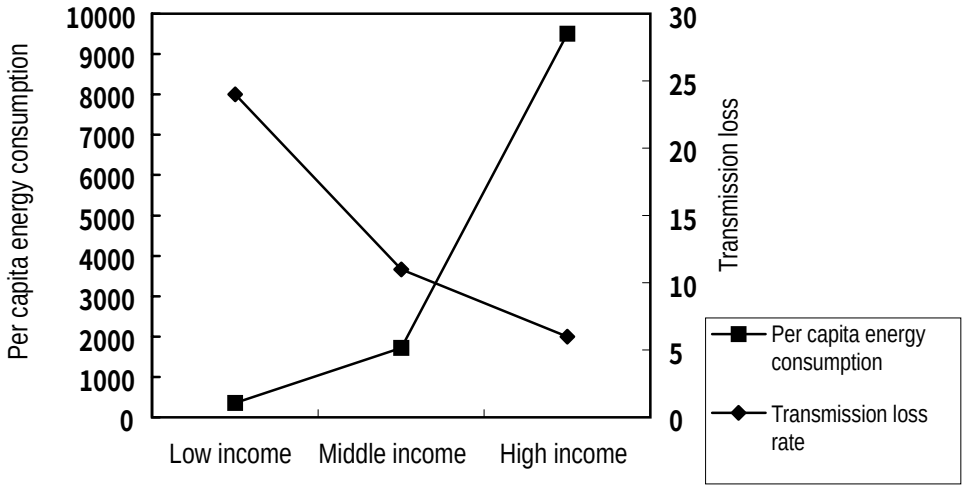
- Developing countries are short of adequate electricity and gas networks, with many communities in them relying on inefficient non-renewable biomass combustion, which has serious impacts on the environment (Table 4.1-1).
- Even when provided with such the networks, a greater loss in energy transportation appears in lower-income countries (see the case of electricity transmission in Figure 4.1-1).
- In order to encourage more efficient energy utilization, developing countries are advised to enhance energy accessibility through the development and reinforcement of energy transport infrastructures. World Energy Council (WEC) has placed "accessibility" as one of the top-priority issues.

[Related Data and Facts]

Table 4.1-1 World's access to energy

Region	Population without access to electricity (in millions)	Population relying on direct biomass combustion for heating (in millions)
China, Central Asia	18	706
Southeast Asia, Oceania	223	292
India	801	713
Middle East ・North Africa	28	8
Sub-Saharan Africa	509	575
Latin America	56	96
World's Total	**1,635**	**2,390**

Source: 30 Key Trends (IEA, 2005)



Source: World Development Indicator 2006 (World Bank)

Note: World Bank classifies countries into three categories, depending on the gross national income (GNI) per capita–low income (less than $825), middle-income ($826-$10,065), and high-income ($10.065 or more). .

Figure 4.1-1 Electricity supply situation in low-, middle-, and high-income countries (as of 2003)

4.2 Development of International Energy Transport Infrastructures

[Points]

- The worldwide development of oil and gas pipelines and power transmission networks is certain to contribute to the stable energy supply. Many countries are establishing and implementing construction projects for new pipelines and transmission networks (Table 4.2-1).
- However, when a project involves multiple regions with different operating systems, concerned parties face difficulty in dealing with the issues such as the allocation of construction costs and the determination of charge. In addition, as typically seen in the discontinuation of oil supply in former Soviet regions, including Ukraine and Belarus, there are increasing concerns over potential influence exerted by energy exporters.
- To ensure that the benefits of the transport networks are distributed in an equitable and peaceful manner, an international rule and a surveillance system should be built for the development processes from planning to construction and operation. Fore example, the Energy Charter Treaty, which was enacted for this purpose, presents a suitable model (Figure 4.2-1).
- As a solid fuel, coal involves difficulty in transport. To solve this problem, it is recommended to develop technologies for enhancing energy density per unit weight prior to transport, such as liquefaction, gasification, and reforming technologies, while promoting mine-mouth power generation. These technologies are part of clean coal technology.

[Related Data and Facts]

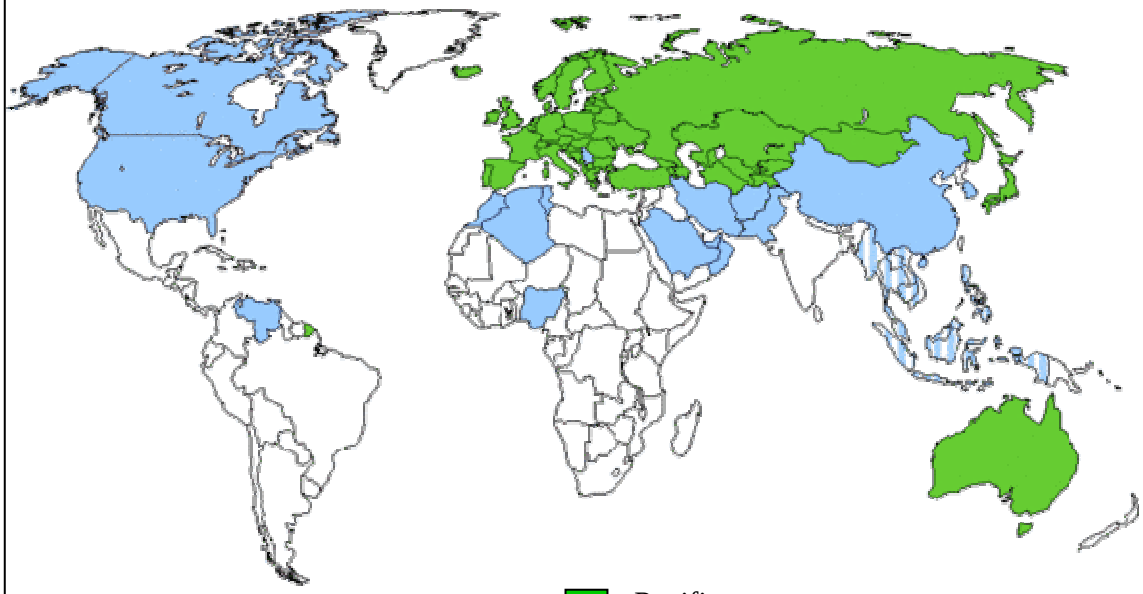
Table 4.2-1 Major International petroleum and gas pipeline projects

Project		Description	Length
Oil	Adria Reversal Project	Construction of an oil pipeline from Central Europe to an Adriatic coast on Croatia	600
	Druzhba Expnasion	Reinforcement of an oil pipeline in Central Asia, mainly in Belarus and Ukraine	3000
	Baltic Pipeline	Construction of an oil pipeline from Russia to a Baltic coast	N/A
	Taishet-Nakhodka	Construction of an oil pipeline to a Russian coast (Chinese route or Japanese route)	3000
	SOUTH SUMATRA TO WEST JAVA PHASE II GAS PIPELINE PROJECT	Construction of a gas pipeline between Sumatra and Java	N/A
Gas	Turkmenistan-Afghanistan Pakistan Natural Gas Pipeline (Phase II)	Feasibility study on the construction of gas pipelines Turkmenistan to Afghan and Pakistani regions	N/A
	Gas Pipeline Development	Feasibility study on the construction of an undersea gas pipeline between Papua New Guinea and Australia	N/A
	3A-West African Gas Pipeline (IDA S/UP)	Construction of a gas pipeline in West Africa (Ghana, Togo, and Benin)	N/A
	Yamai-Europe II	Construction of a gas pipeline from Russia to Europe via Belarus and Poland	N/A
	Blue Stream	Construction of a gas pipeline from Russia to a Turkish coast via Black Sea	1000
	North Trans-Gas Pipeline	A plan to connect gas pipelines (half of them undersea pipelines) Russia to Finland to Britain	1700

Source: Compiled based on materials from World Bank, Asian Development Bank, and U.S. EIA

＜ Outline of the Energy Charter Treaty＞

- The Energy Charter Treaty was put into effect in 1998, currently with 51 member countries and regions, including Japan and EU. Russia has signed the treaty but has not ratified it yet, while China has participated as an observer without signing it.
- The charter aims to reform energy markets and promote international energy trading. It mandates members to eliminate all domestic and overseas barriers to energy transport with respect to oil, gas, coal, and electricity.
- In the event of an international dispute, independent mediators are appointed to settle it. Mediators are permitted to set temporary passage rates or other charges.
- The recent formulation of international energy transport projects is directing keener attention to the Energy Charter Treaty.
- Concerned parties are expecting Russia to ratify the treaty and expand cooperation with its neighboring countries under the treaty.



(ASEAN (the blue stripe) is an observer as the organization.)

Source: Oil and Natural Gas Review, March 2006, http://www.encharter.org/index.php?id=61

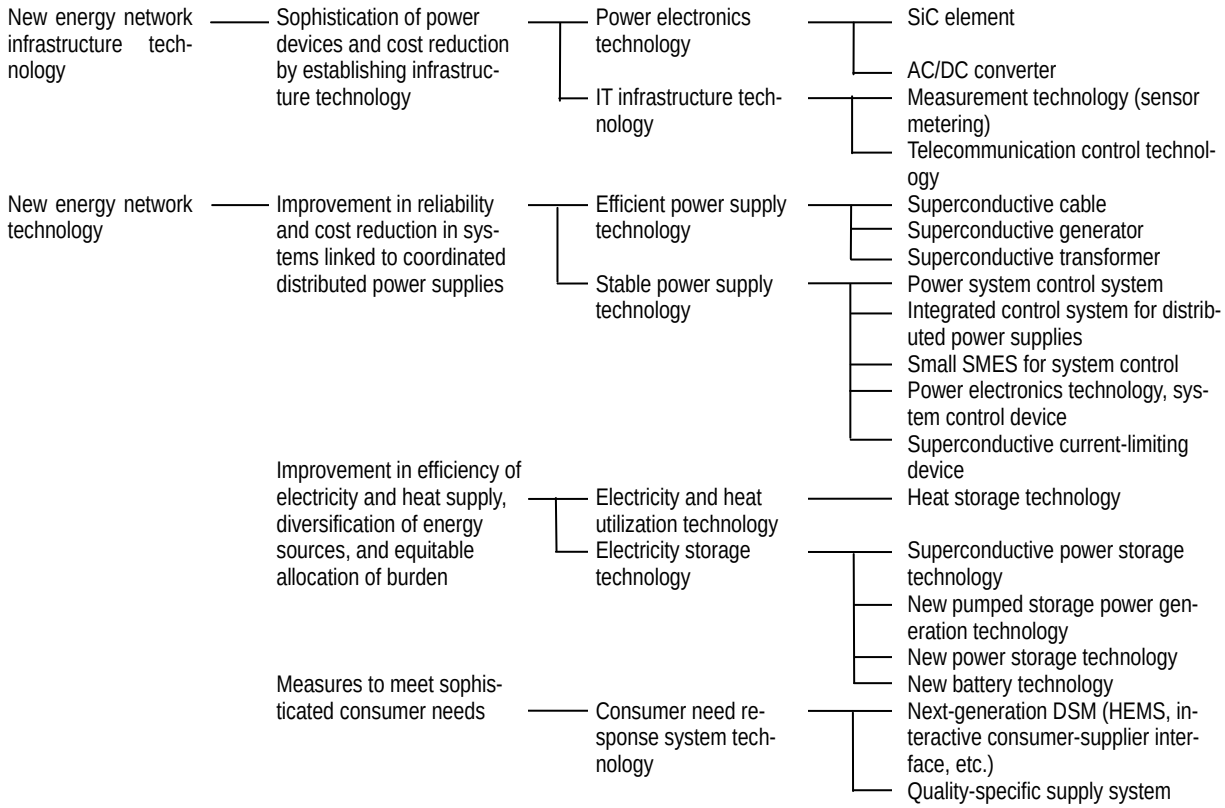
Figure 4.2-1 Energy Charter Treaty member countries

4.3 Development of Energy Transport Technology

[Points]

- Various technologies of the energy transport and storage has been developed (Figure 4.3-1). Each country is desired to endeavor to develop and integrate technologies suitable for its own circumstance, by considering a comprehensive perspective of the energy system.
- Efforts may be focused, for example, on power system control technology and distributed power supply control system so as to ensure compatibility between renewable energy and large concentrated power supply systems to optimize total efficiency.
- These technologies are thought to be more effective if introduced into developing countries that are newly introducing the energy infrastructures.

[Related Data and Facts]



Source: Complies based on materials from "Study Group Report on New Energy Network Systems" (The Institute of Applied Energy)

Figure 4.3-1 Innovative technology systems for energy transport and storage