

COGENERATION DEVELOPMENT IN ASEAN

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Cogeneration has made good progress in South-East Asia in the last 5-10 years. The most significant progress was due to the introduction of independent power producers (IPP) to the market, building new generating plants, including cogeneration, to supply heat and electricity to industry and supplement power to the national grid.

With the increasing economic growth in the region, the demand for electricity has also increased. In recent years, cogeneration has been the focus of attention and has started to attract the IPP for several reasons. These include: reducing governments' burden in power generation and distribution, and encouraging new entrants to build new plants; the cogeneration system can produce both the required thermal energy and electricity for the industry; and cogeneration is regarded as being environmentally friendly, reducing greenhouse gases.



POWER GENERATION, CONSUMPTION AND DEMAND

With an average economic growth of 4.8 percent in the region, power consumption has grown continuously. In 2001, ASEAN's total installed capacity reached around 98,000MW, with Thailand having the highest installed capacity of 25,337MW and Cambodia the lowest at 150MW.

The electricity consumption of Cambodia is very low as the country has one of the lowest power consumption ratios per population in the world. In Cambodia, the electricity produced is mostly generated using oil, which accounts for about 62 percent of total electricity production. The remaining 38 percent is from hydropower.

In Indonesia, the total installed capacity was 23,425MW in 2001, of which around 10 percent is owned by the private sector, the IPPs and SPPs. The electricity supply has also been growing rapidly at

an average rate of 10 percent in parallel to the growing needs of industry, urban households and the rural electricity programme. Before 1997, the growth of primary energy consumption was about 8 percent, which decreased to 7 percent after the economic crisis of 1997. The final energy consumption in 2001 was about 86TWh, with the biggest share of 39 percent by the industrial sector.

Malaysia has well defined national policies for power production and utilisation. The country has positive development, including major improvement in the legal framework for private power. The private sector contributes about 35 percent of the total electricity production. The demand for power is expected to grow by 7.8 percent annually up to 2005, with its firm Small Renewable Energy Power Programme (SREP) policies on promoting renewable energy resources.

Most of the electricity produced in the Philippines is from coal-fired plants, which account for about 51 percent of the total electricity produced. The country is also rich in geothermal energy, which accounts for about 20 percent of the power production.

Fossil fuels (fuel oils, natural gas and diesel) are the main source of power production in Singapore. Urban waste also contributes to the country's generating capacity. The total electricity generate was 34 million MWh, while the total demand was 43 million MWh. A shortfall was met by import of electricity.

Thailand has the highest total installed capacity (25,337MW) among the other ASEAN countries. In Thailand, the private sector contributes about 24 percent of the total electricity production.

In 2001, Vietnam's total electricity production reached 31 million MWh, of which hydropower accounted for a major portion of 58 percent. The remaining 42 percent of the country's electricity is produced from thermal power, gas fired power plants and diesel fired power plants.

AVAILABILITY OF FUEL RESOURCES

Oil has been a large energy source for many of the ASEAN countries, but with the decline in the oil field reserves, they have been examining new options to keep up with the increasing consumption rate.

Many countries in ASEAN are building energy generation plants fuelled by natural gas because this is one of the most abundantly found fuel resources. Besides, natural gas is an appropriate fuel for combustion in turbines and engines. It is also efficient, cheap and clean. As of 2001, Indonesia has proven and potential natural gas reserves of 91.9 trillion cubic feet and, exporting 28.5 million MT (38 percent of the world's total export), is the world's largest exporter of natural gas.

Malaysia and Thailand also have 75tcf and 11.8tcf of natural gas reserves respectively. The majority of the electricity production in these countries is from natural gas with the share of 65 percent and 63 percent respectively. Since 2000, Thailand has begun to import natural gas from Myanmar as the demand for the fuel is increasing.

Singapore is also expanding the commercial use of natural gas even though the country does not have any gas reserves. All

Countries	Installed capacity (MW)	Electricity production				Electricity consumption (mill. MWh)	Electricity demand (mill. MWh)
		Total (mill. MWh)	By source				
			Fossil %	Hydro %	Other %		
Cambodia	150	1	62	38	0	1	2
Indonesia	23,425	92	81	14	5	86	92
Malaysia	15,838	68	87	13	0	63	92
Philippines	15,132	47	68	12	20	48	51
Singapore	8,919	34	92	0*	8*	30	43
Thailand	25,337	100	82	5	13	80	110
Vietnam	8,750	31	35	58	7	26	29
Total	97,551	373	.	.	.	334	419

Figure for the year 2001

of their fuel comes from neighbouring Malaysia and Indonesia. Vietnam has around 554 billion cubic meters of proven natural gas but the country has not been able to use the fuel; hence, this source remains largely untouched. Vietnam expects to have large amounts of natural gas in the coming years.

In terms of coal, Vietnam has larger deposits of coal, around 3256 million tons. In Vietnam, electricity produced from the coal fired plant is around 10 percent. Besides, coal (peat) is also used to produce fertilisers due to its low heat content and high ash content.

In 2001, coal-fired power plants accounted for 51 percent of the total energy production in the Philippines. The country produced around 1.1 million short tons of coal in 1999 and the production continues to increase due to operation of several new mines.

Indonesia has a proven coal reserve of 11,484 million MT. Production continues to increase due to increase in domestic demand for the industrial sector and export. Indonesian coal export accounts for around 72 percent of the total coal production.

COGENERATION DEVELOPMENT

In ASEAN, cogeneration vis-à-vis the total power sector is limited. In some countries, cogeneration has existed for a long time, particularly in sectors where residues are generated in the factory through the production process, such as in the sugar and palm oil industries. Other sectors that are most suitable for cogeneration include textile, pulp and paper, iron and steel, and the chemicals and ceramics industries.

In Malaysia, the government has been encouraging the use of renewable energy through its SREP. Malaysia has set a target of meeting 5 percent or 500-600MW of the country's power supply from renewable sources, especially biomass through SREP. Many of these projects could be most appropriately implemented using cogeneration technologies.

Cogeneration in Malaysia is not only limited to the palm oil sectors. Large commercial complexes like Kuala Lumpur International Airport (KLIA), Kuala Lumpur City Centre (KLCC) and Kuala Lumpur Sentral are examples of the cogeneration/trigeneration systems applied in commercial buildings using natural gas as fuel. In 2002, some 36 licenses had been issued from the Energy Commission under the Ministry of Energy, Communication and Multimedia for cogeneration projects in a number of different sectors using natural gas, coal and

biomass as fuel. Around 350 palm oil mills exist using cogeneration system in Malaysia.

Cogeneration in Thailand is not a new concept. It dates back to 1992 when the Electricity Generation Authority of Thailand (EGAT) announced it would buy back electricity from Small Power Producers (SPP), from cogeneration plants using commercial fuel, and from energy systems using renewable sources of fuel. The aim of this programme was to promote the use of renewable energy and promote efficiency of primary energy. SPP programme regulations on power purchase

require that cogeneration efficiency is more than 45 percent and produces at least 10 percent steam. The regulation requires the sale of power to EGAT for a maximum of 60MW (which can be increased to 90MW on a case-by-case basis). Through this programme, SPPs have a guaranteed power market, as EGAT guarantees to purchase not less than 80 percent of power per year, and they also have a direct sale to industrial estates near their power plants. Since the beginning of 1998, new contract SPP regulations have allowed EGAT to purchase power only from renewable sources.

The total installed cogeneration capacity in Thailand is about 1959MW, which is about 8 percent of total installed capacity. Of this, cogeneration from the agriculture industry is only around 700MW. The agriculture industry provides huge potential for biomass cogeneration, as the country, like other ASEAN countries, has a large surplus of biomass residues, in particular rice husk.

In Indonesia, there are about 25 existing cogeneration plants with a total capacity of about 1200MW. Power production from cogeneration is only about 5 percent of total power production in the country. Pulp and paper mills in Indonesia are the largest users of cogeneration, followed by chemical and textile industries. With the growth in the industrial sector, there has been a sharp rise in the captive power capacity, which contributes to almost 50 percent of the total power production due to the insufficient electricity supply by PLN, the national grid.

The industrial sector has the biggest share with 43 percent of the total power supplied by PLN. Industrial cogeneration so far in Indonesia is limited to only big industries. Due to the lack of proper policy on cogeneration, potential small industries in agricultural and commercial sectors are lagging far behind in Indonesia.

In Singapore, too, cogeneration is progressing with the development of the petrochemical and chemical industries. SembCorp, the first IPP natural gas cogeneration plant, has been installed to provide 815MW of electricity and 700 tonnes/h of steam to serve chemical and petrochemical plants.

Singapore has no cogeneration policy as such, but cogeneration plants in the country still comprise around 10 percent of the total installed capacity. The sharp decline in GDP by 2.4 percent in 2001 has led Singapore to form the Economic Review Commission (ERC) to review the situation of the country. One of the tasks of ERC is to review the regulations to encourage cogeneration as an efficient and cost effective power production

technology to maintain competitiveness in the international market and economy.

SUCCESS OF COGENERATION IN EUROPE

Among the most successful countries in terms of heat and power produced from cogeneration are Denmark, Finland and the Netherlands. 35-60 percent of the electricity is produced from cogeneration power plants in these countries. Cogeneration is used both in meeting district heating requirements and for industrial purposes. A major portion of the district heating is produced from cogeneration in Denmark and Finland.

Denmark has a history of cogeneration going back more than 80 years. Cogeneration development was intensified after the oil crisis in the early 1970s when Denmark was 90 percent dependent on foreign oil. The status of cogeneration today is a result of a number of important factors such as:

- Policy framework – comprehensive legal framework ensuring market conditions are successfully implemented
- Government priorities – economic incentives such as subsidies for electricity production
- Economic structure – gradual shift from a monopolistic electricity system to a more competitive electricity market

The successful development of cogeneration in these countries could be used as a model from which governments in South-East Asia could learn. This will help the relevant authorities to avoid

certain mistakes and to focus their efforts on solutions that have been demonstrated to work.

CONCLUSION

The fuel source is a critical element in the development of a cogeneration project. Cogeneration is regarded as being environmentally friendly because of its high efficiency when compared with conventional power plants. There are however many factors hindering the growth of cogeneration in the region. One of the most important factors is the lack of policy framework and incentives to support cogeneration. Lack of awareness, proper infrastructure and accessibility to financing are the main hindrances in the development of cogeneration.

However, more and more countries in ASEAN are now changing from the heavily oil dependent power sector to the abundance of environmentally friendly fuels for cogeneration, in particular biomass, natural gas and clean coal. Considering the benefits of cogeneration and the lessons learned from other countries where cogeneration has been successfully implemented, the use and accessibility of cogeneration is likely to increase further in the next few years. ■

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