EC-ASEAN COGEN PROGRAMME: IMPLEMENTING BIOMASS COGENERATION IN ASEAN

Chanfreau E., Deputy Programme Coordinator
Carlos R.M., Financial Advisor
Shakya S. K., Programme Associate
EC-ASEAN COGEN Programme Phase III (COGEN 3)
Asian Institute of Technology, Energy Building,
P.O. Box 4, Klong Luang, Pathumthani 12120 Thailand
Tel: +66 2 524 5399; Fax: +66 2 524 5396; Web site: http://www.cogen3.net
Email: eric.chanfreau@cogen3.net; romel.carlos@cogen3.net; sanjeebkumar.shakya@cogen3.net

ABSTRACT: The EC-ASEAN COGEN Programme Phase III (COGEN 3) is an economic cooperation between the European Commission (EC) and the Association of South East Asian Nations (ASEAN). COGEN 3 promotes proven, clean and efficient European cogeneration technology in ASEAN. The Programme including its previous phases spans over a period of more than 10 years and serves as a good model for international cooperation for consistent large-scale promotion and concrete implementation of bioenergy.

The ASEAN countries are endowed with biomass resources which, when processed in industries, generate large amounts of residues. Every year, more than 120 million tonnes of biomass residues are generated in the region which could be used to fuel high efficiency cogeneration with a capacity of about 10,000 MW. An increasing trend for biomass related industries is to use cogeneration to satisfy their energy demands and boost profitability.

More than 145 cogeneration projects in ASEAN, have been identified by COGEN 3. In 2003, 24 industrial projects were selected for demonstration purposes. These projects represent an aggregate capacity of more than 150 MW and involve EURO 200 million worth of Euro-ASEAN energy equipment. The paper presents the cogen3 approach to accelerate use of biomass cogeneration in industries in ASEAN.
Keywords:combined heat and power generation (CHP), de-centralised energy generation, bioenergy policies

1 INTRODUCTION

The importance of the energy sector in relations between the European Union and Asia has been emphasised since the eighties. In order to develop the use of cogeneration the EC-ASEAN Programme was started.

COGEN Phase I, which took place between 1991 and 1994, was essentially a technically focussed identification phase for what was to become COGEN Phase II.

COGEN Phase II (1995-1998) was a demonstration phase combining technical and business expertise. The purpose of COGEN Phase II was to demonstrate that proven European technologies are available to support biomass-based cogeneration in ASEAN countries, and so enhance the EU-ASEAN economic cooperation. COGEN II focused on 16 Full Scale Demonstration Projects promoting real reference projects using proven biomass-based technologies. COGEN Phase II directly increased EU-ASEAN economic co-operation by approximately 60 million Euro, contributed 354MWth/74MWe to the ASEAN energy supply and avoided 250 thousand tonnes of carbon equivalent/year of emissions. The Programme has increased ASEAN awareness of indigenous biomass resources (up to 6,000 MWe) and the availability of European technologies. The Programme also helped to increase European suppliers' competitiveness and the European image in the ASEAN market.

COGEN 3, a 3-year economic cooperation programme between the EC and ASEAN, is the third phase. The operation started in 2002, and will end in December 2004. The objective of COGEN 3 is to promote efficient biomass, gas and coal cogeneration, using European cogeneration equipment. The major activities in COGEN 3 are:

- Facilitation of development of cogeneration projects through contacts and assistance to equipment suppliers, cogeneration project developers, end-users and financiers;
- Information dissemination and promotion of clean and efficient cogeneration technologies;
- Technical and financial capacity building in seminars and conferences;
- Implementation of Full Scale Demonstration Projects (FSDPs) with contribution from the EC;
- Cogeneration policy guidance for ASEAN countries (seminars and study tours in Europe).

In ASEAN, the COGEN 3 Management Unit is based at the Asian Institute of Technology (AIT), Bangkok, Thailand. It is assisted by seven Country Coordinating teams managing COGEN 3 activities at national level in ASEAN. In Europe, COGEN 3 office is located at the Carl Bro International AB office in Malmoe, Sweden.

COGEN 3 has a large experience in cogeneration issues in ASEAN countries from facilitating the development of more than 70 cogeneration projects (using biomass, coal, biogas and natural gas, ranging from 0.5 to 100 MW) and organizing more than 25 events for awareness and capacity building.

2 ELECTRICITY GENERATION AND COGENERATION IN ASEAN

Electricity sectors in ASEAN show substantial variation in terms of fuel choice, power prices, market structure and ownership. Table 1 provides an overview of electricity generation and status of cogeneration in the ASEAN countries.

Table 1: Overview of electricity generation and cogeneration in ASEAN countries.

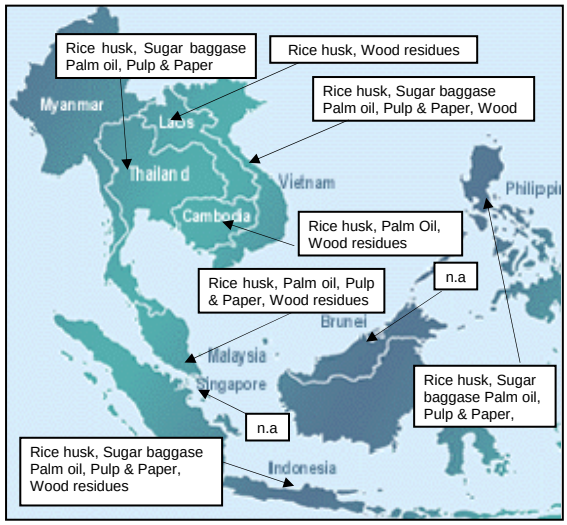
Country	Present electricity situation	Installed capacity (MW)	Forecast annual growth	Status of cogeneration
Cambodia	No national grid	160	~10%	None
Indonesia	Government : 56% Captive power: 40% IPP: 4%	23,425	NA	Industrial fossil fuel plants
Malaysia	Government : 85% Private: 15%	13,760	6-10%	Industrial fossil fuel plants Some large natural gas cooling plants Many biomass plants (rice husk & palm oil waste)
Philippines	Government : 55% Private: 45%	14,700	~10%	Industrial fossil fuel plants Old biomass plants (sugar bagasse)
Singapore	Power pool	8,140	NA	Fossil fuel plants in petrochemical sector Some biomass plants (wood waste)
Thailand	Government : 60% Private: 40%	24,500	~10%	Industrial fossil fuel plants New biomass plants (rice husk)
Vietnam	Government : 90% Private: 10%	3,296	~13%	Industrial fossil fuel plants

Note: "Private" power producers include all non-government producers, e.g. Independent Power Producers (IPP), Small Power Producers (SPP) etc.

The biomass fuel availability using bagasse, wood, rice husk and palm oil residues is elaborated below.

- There are over 150 sugar mills in the ASEAN producing huge amount of bagasse. Philippines, Thailand and Vietnam are the three main countries in ASEAN producing over 37 million tonnes of bagasse annually.
- The wood industry - including sawmills, plywood factories and furniture industries - converts about half of the raw wood into residue during the production process. In 1993, the sawn timber and plywood production in ASEAN were estimated at 16 million m^3 and 15 million m^3, respectively. Considering an average of 50% of residues production, this means that these two industries generated a total of about 31 million m^3 of wood residues.
- Rice husks produced as residues from the rice milling industry can be used as fuel. In a typical rice mill, electricity is required for milling and heat is needed for either mechanical paddy drying or for parboiling. It is estimated that over 100,000 rice mills are in operation in Indonesia, Philippines and Thailand, producing around 19 million tonnes of rice husk annually.
- The palm oil industry is one of the agro-industrial sectors producing the highest quantities of residues. As high as 70% of the fresh fruit bunches (FFB) are turned into wastes such as empty bunches, fibres and shells, while between 600 and 700 kg of liquid effluent is produced per tonne of FFB. As of 2003, there are around 600 palm oil mills in Malaysia, Indonesia and Thailand generating more than 27 million tonnes of residues.
- The Pulp and paper industry – Biomass being the fuel for the pulp and paper industry, is also a major energy resource for the industry. Black liquor and solid-biomass residues, generated in the processing, are used at the mill sites to fuel the cogeneration system providing steam and electricity for on site use.

Fig. 1: Overview of biomass fuels available in ASEAN



Some indicators for the cogeneration potential in ASEAN are:

2.1 Growth in electricity consumption and lack of electric capacity:

As the ASEAN economies are growing, the electricity requirements are rising and new electric capacity is needed. Although the national electricity systems still report an overcapacity since the economic crisis in 1997, the surplus is decreasing and some areas are experiencing shortage of electricity and black outs. This applies especially for rural areas with weak or no connection to the national grids.

2.2 Many suitable applications:

The biomass related industries, rice, sugar, palm oil and wood are increasingly turning to cogeneration using their residues as fuel. The energy plants fill many purposes. Heat is widely used for processes in factories. The lack of capacity and reliability in the electric grid make cogeneration attractive for factories in remote locations. The use of the residues as fuel reduces the need for waste disposal and the ash produced can in some cases be an additional source of income.

2.3 Electricity production is based on fossil fuels:

Many countries have realised the big potential in biomass power generation and cogeneration to replace electricity generation based on fossil fuel. Biomass waste

products are widely available, and can be a cheap source of fuel.

2.4 Electricity liberalisation and deregulation:

Some of the ASEAN countries have started liberalising the electricity markets. This gives cogeneration plants the opportunity to sell excess electricity to the grid, thus enhancing the financial viability of the plants.

2.5 Increased awareness of cogeneration*:*

In all ASEAN countries, but mainly in Thailand and Malaysia, the general awareness of the benefits of cogeneration has grown among end-users, project developers and government policy makers. This is due to cogeneration plants being implemented successfully, cogeneration awareness programmes, and a general increase in awareness about energy efficiency.

2.6 Barriers to Cogeneration:

Development of the cogeneration potential in ASEAN countries faces barriers, similar to barriers seen in many European countries and the United States:

- Policies to enhance cogeneration are "hidden" in policies for renewable energy, power development, etc, and spread over many government agencies;
- Lack of political will to make appropriate legal framework and set targets for cogeneration;
- Lack of incentives to support clean and efficient cogeneration;
- Inadequate competition in electricity markets, difficulties to secure grid access on fair terms, and inadequate price recognition of environmental and grid benefits for small power producers
- Lack of financing sources for cogeneration (and energy efficiency in general);
- Lack of awareness of cogeneration among end-users, project developers, financing institutions, and policy makers. No independent organisations promoting cogeneration.

2.7 Cogeneration policies:

None of the ASEAN countries has initiated cogeneration roadmaps or directives similar to the United States and the European Union, and there are no policies specifically made to enhance cogeneration development today. Biomass cogeneration is however supported indirectly through biomass power and energy efficiency policy, legislation and support programmes, which are often scattered between different government agencies. Some of the programmes directly and indirectly affecting cogeneration are:

- *Indonesia:* Programme for 1 MW renewable energy power plants;
- *Malaysia:* Small Renewable Energy Power (SREP) programme supporting biomass cogeneration (tariff contract for 21 years and tax allowance);
- *Thailand:* Power Purchase Programs from Small Power Producers (SPP, 1992-1997 and 2001) programme, Subsidy for Renewable Energy SPPs and Very Small Renewable Energy Power Producer (VSREPP, < 1MW, currently the only programme in ASEAN open for new plants),
- *Singapore*: No biomass or cogeneration policies;
- *Philippines:* In process of finalising renewable energy legislation;
- *Vietnam and Cambodia*: Developing renewable energy programmes.

3 COGEN 3: PROGRAMMES AND SERVICES

To consistently promote the wider use of cogeneration COGEN 3 provides services covering all significant aspects of cogeneration. The services are grouped into three categories: General Services, Support to Cogeneration Projects and Full Scale Demonstration Projects.

3.1 General services

The target groups for these services are project developers and industrial end-users of cogeneration, financing institutions and policy makers. COGEN 3 provides services in the form of:

Information

- Reports about ASEAN cogeneration market in energy intensive industrial sectors
- Directories covering European technologies and equipment suppliers
- Links to European and ASEAN companies and organisations relevant to cogeneration
- Reports about technology, market and investment climate
- Financing sources for cogeneration projects

Analytical Tools for preparation, assessment and implementation of cogeneration projects

- Cogeneration Project Development Guide describing all steps of development of a cogeneration project
- Software tools for technical, financial and environmental calculation of cogeneration projects
- Templates with guidance and examples for feasibility studies

Capacity building focused on cogeneration

- seminars
- workshops
- training programmes
- study tours

3.2 Support to cogeneration projects

The target groups for these services are mainly project developers and cogeneration end-users. COGEN 3 will support cogeneration projects in the different phases of development:

- Identification of business opportunities
- Identification of European technologies and suppliers
- Business facilitation
- Technical advice to potential investors
- Assistance in feasibility studies
- Assistance in drawing up contracts
- Follow up of contractual obligations
- Preparation and supervision of training and monitoring

3.3 Full Scale Demonstration Projects

As a part of the COGEN 3 Programme, cogeneration projects can be selected to be Full Scale Demonstration Projects (FSDP). A FSDP is the implementation of proven technology on a full scale basis in order to demonstrate its technical reliability,

economic viability, and environmental friendliness. It is a showcase in ASEAN aiming to convince other potential end-users to select the appropriate technology in order to replicate successes.

Projects that have FSDP status will be able to get the full range of support from COGEN 3 which will ensure the smooth implementation of the project. Once the projects are implemented, support activities such as assistance in the training of operators and monitoring of the plants will be conducted. The support will include:

- Advice and assistance
- Financial support
- Advice on implementation
- Training of operators and monitoring of the plant

Between 1991 and 1998, COGEN selected and implemented a series of FSDPs using biomass as a fuel. Sixteen full scale demonstration projects have been selected in the wood, rice, palm oil and rubber sectors in Malaysia, Thailand and Indonesia.

During the current phase of COGEN, 24 projects were selected to be FSDPs. All projects selected will use biomass fuels such as palm oil wastes, bagasse, wood wastes, rice husk, biogas and bio-oil. Some of the highlights of the projects are presented below:

- Capacity: 0.3 – 41 MW (Total: 174 MW)
- Total Amount of EC support: 6.8 mill. EURO
- Total Investment: 209 million EURO
- 17 projects (Cambodia – 1; Indonesia – 2; Malaysia – 7; Singapore – 2; Thailand – 4) are expected to be implemented by end of 2004

4 CONCLUSIONS

There is a huge potential for biomass fuelled cogeneration in the ASEAN Countries. Some of the ASEAN countries have implemented policies that promote cogeneration and which to some extent have exploited this huge potential. However, a lot remains still to be done to remove the obstacles for a wider use of biomass in energy production. The main obstacle is a lack of awareness of benefits of cogeneration among the industry, policymakers and financiers. The EC-ASEAN Cogen Programme is designed to address these issues. The target groups of the programme are the end-users developing cogeneration projects, the equipment suppliers, financing institutions and policy makers. The experience and knowledge is disseminated targeting these groups in the form of concrete advice, seminars and training workshops. A grant mechanism has been introduced to promote certain projects selected for demonstration purposes. The EC-ASEAN Cogen programme serves as a good model for international multilateral cooperation for consistent large-scale promotion and concrete implementation of bio-energy fuelled cogeneration.

5 REFERENCES

All information in this paper originates from reports made available by the EC-ASEAN COGEN Programme. Reports and information can be freely downloaded from the Cogen 3 website: http: //www.cogen3.net