BUSINESS PROSPECTS IN SOUTH-EAST ASIA FOR EUROPEAN COGENERATION EQUIPMENT USING BIOMASS AS FUELS

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THE POWER SITUATION IN SOUTH-EAST ASIA[1]

South-east Asian nations have a population of approximately 480 million and an installed capacity of about 96 000 MWe to be compared with EU 25 having 450 million inhabitants and approx. 600 000 MWe of installed capacity. Annual generation amounts to 367 TWh. Fossil fuels represent about 82%, hydro 14%, wind & geothermal and bio 2% each. Some countries are heavily dependent on imported (fossil) fuels. The estimated annual demand growth in SE Asia ranges from 6 to 13%.

STATUS OF COGENERATION[2]

In most countries there are some industrial fossil fuel plants as well as old biomass plants. In Malaysia and Thailand there are a smaller number of newer biomass plants. Plant standard differ widely between and within industrial sectors. However, the dominant feature is old to very old plants (20 to 50 years) with a big need for replacement.

BIOMASS RESOURCES IN SE ASIA

In SE Asia wood represents only 5-25%[3] of the biomass volume. The agricultural sector is by far the dominating provider, especially of fast growing annual plants. The most important are rice husk/straw, sugar bagasse, palm oil solid waste and wood waste. The total volume of these wastes is estimated to enable production of about 15% of the total electricity consumption and at the same time four times as much

[1] In this article the following countries are encompassed, viz. Cambodia, Indonesia, Malaysia, The Philippines, Singapore, Thailand and Vietnam.
[2] Cogeneration or CHP (combined heat and power) is defined as simultaneous generation of electricity and heat. In Europe the heat is used for district heating systems as well as in industrial processes. In SE Asia only industrial process heat is of relevance.
[3] In The Philippines it is about 55%.

process heat (corresponding to total investments of maybe € 10 billion). Use of industrial bio CHP would imply a hypothetical reduction in use of fossil fuels by approx. 300 TWh/year and a subsequent reduction in CO_2 emissions by something like over 110 million tones.[4]

POTENTIAL BENEFITS FROM BIO COGENERATION

The large amount of biomass residues represents a great potential for saving of fossil fuels and reduction of CO_2 emissions. Bio residues not used constitute a waste problem and degradation will generate methane gas, which is about 20 times more aggressive than CO_2. Purchase of electricity from the grid would be eliminated and security of supply enhanced. Efficiency would increase compared to separate electricity and heat production[5]. Heat offers an opportunity to improve the product quality, especially in the rice industry.

SUCCESS FACTORS

A number of prerequisites must be at hand for the benefits to materialise. This is not quite so yet. **Awareness** of the cogeneration concept is not widely known in all countries. Energy operation is not the core business of potential users. There is a lack of successful demonstration projects. The **markets for biomass** vary as regards both regularity of supply and price stability. Together these circumstances also negatively affect the willingness of external financiers to provide funds needed to undertake the investments. Several countries lack a **regulatory framework** that promotes the expansion of cogeneration.

The quality of biomass as fuel is not homogeneous. Some properties impose challenging **technical problems**. Rice husk has low char reactivity. A common denominator for most fuels is a high content of alkali. The heat value is rather low (due to high moisture and/or high ash) and the ash properties are problematic (low ash fusion) which cause combustion-related problems such as slagging, fouling and corrosion. These circumstances provide European industry with a competitive advantage due to its experience burning demanding fuels at high boiler efficiencies based on efficient cycles with advanced live steam data. An upgrading of steam data

[4] Note that the calculation is hypothetical requiring a penetration level of 100% which of course is impossible in the real world.

[5] Applicable technologies are primarily (i) steam boiler + back pressure turbogenerator, (ii) steam boiler + extraction condensing turbogenerator and (iii) gas turbine/engine with heat recovery steam generator.

to 60 bar, 480 ^{o}C feeding extraction condensing turbines combined with entirely new core power plants based on single high pressure boilers operated at representative combustion conditions will result in overall efficiencies of about 25 %. The power-to-heat ratio will be in the order of 0,3-0,33. The major advantages of European equipment are related to high overall efficiency, high availability, reliability and durability, environmental friendliness (low emissions), high automation level and low service demand.

European equipment is handicapped by a relatively high **purchase price**. Increasing the content of locally produced/assembled components could lower it. Furthermore focus should be put on the annual cost over the useful life of the equipment rather than the purchase price. “Extras” such as training and financing support could be added. A systems approach - providing solutions rather than parts/components – might prove successful as will a good after sales service on location.

A BRIGHTER FUTURE?

In all, the winds seem to blow more favourably for biomass cogeneration. As an example, under the EC[6]-ASEAN[7] Cogeneration Programme (COGEN 3) 24 full scale demonstration projects with European equipment in seven countries[8] have been approved for support. Fuels represented are palm oil waste, rice husk, bagasse, wood waste, biogas and bio oil. The total investment is nearly € 209 million and total capacity 174.5 MW (with individual projects ranging from 0.3 to 41 MW). Furthermore, COGEN 3 has identified another 100+ cogeneration projects, currently under assessment.

LIST OF REFERENCES

This article is based on the work of the EC-ASEAN Cogeneration Programme (COGEN 3), an economic cooperation programme between the EC and ASEAN during January 2002 and December 2004. COGEN 3 promotes the use in ASEAN of proven, clean and efficient European cogeneration technology and equipment with biomass, coal and gas as fuels. It is funded by the EC and coordinated by Carl Bro International AB and the Asian Institute of Technology. It has offices in Sweden, Thailand, Cambodia, Indonesia, Laos, Malaysia, The Philippines, Singapore and Vietnam.

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[6] European Commission.

[7] Association of South East Asian Nations, viz. Burma, Brunei, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand and Vietnam.

[8] Cambodia, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam.