TECHNOLOGY STATE OF THE ART IN SEA

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1. INTRODUCTION

Generally, renewable energy technologies suitable for green independent power producers are already available in SEA in the form of demonstration projects and small-scale installations. This paper tries to present the current status of these technologies in SEA by giving information on existing and planned installations.

2. BIOMASS

2.1 Palm Oil

In SEA, numerous palm oil plants in Indonesia, Malaysia, and Thailand use their waste to generate combined heat and power. Malaysia has an estimated total installed capacity of 200 MW. Usual configurations consist of boilers with rated capacities of 25 to 30 tons per hour and turbines no larger than 1 to 1.15 MW; the turbine is usually in a backpressure setup because the first priority is generating heat for sterilization. Thailand produces palm oil in large quantities in 30 palm oil mills having an average milling capacity of over 10 tons of fresh fruit bunches per hour. Cogeneration of heat and power for internal consumption reaches an average power of 530 kW per mill.

2.2 Baggasse

Currently, SEA has over 150 sugar mills producing over 26 million tons of baggase annually. Most sugar mills utilize baggase to generate heat and power to answer in-house needs; however, existing facilities have very old and inefficient equipments. Indonesia has 56 sugar mills mostly equipped with old steam generation facilities, which can be upgraded to high efficiency, high-pressure systems to produce more excess energy for export. The Philippines has 39 sugar mills, located mostly in Negros and each having an average daily capacity of 4,600 tons of sugarcane. A study by the Philippine Sugar Millers Association showed that improvements in existing cogeneration systems -- having an average thermal efficiency of only 62.5 % -- can bring about 100 MW of exported power to the grid. In 1995, power from 17.6 mega tons of bagasse accounted for 4.3 % of the total energy supply of Thailand. Thailand has over 50 sugar mills with a total capacity of 0.4 mega tons per day and installed generating capacities of electrical and mechanical power from bagasse at 580 MW and 270 MW respectively. In Vietnam, around 40 sugar mills use combined heat and power from baggasse.

2.3 Rice Husk

SEA has a very big potential for energy from rice husk as proven by the fact that in Indonesia, Philippines, and Thailand alone, over 100,000 rice mills produces around 19 million tons of rice husks annually.

Rice husk cogeneration suffers from an image problem in Malaysia due to mixed and disappointing results in past projects. Renewed interest is expected as successful projects come about like the rice husk

based cogeneration system installed in Pendang Kedah Darul Aman, which uses a steam boiler, 6.5 tons per hour, 30 bar, saturated, connected to a 450 kW back pressure turbine and heat exchanger.

Plans to use rice husk for large-scale power production exist in the Philippines. The largest is a 40 MW grid-connected plant developed by Cypress Energy. Scheduled for construction in Bulacan, the plant will use rice husk from a radius of 80 km. Other plans include that of the Philippine National Oil Company Energy Research Development Center (PNOC-ERDC), which has already completed detailed feasibility studies for the installation of two communal rice husk fueled plants in Cabanatuan and Aurora, Isabela, each with a capacity of 2 MW.

Rice mills in Thailand of more than 20 tons per day capacity generate energy from rice husk by direct combustion in fixed bed, flat grate or inclined-step grate furnaces -- generally inefficient, causes pollution, unsuitable for electricity production. An exception is the Chia Meng Co. Mill in Chakkaraj Nakorn Ratchasima: the ASEAN-EC COGEN Program established a 2.5 MW demonstration plant using a more efficient technology. Aside from rice mills, two small power producers (SPP) use energy from rice husk. One SPP uses a combination of rice husk and wood waste to generate up to 47 MW of electricity; while the other SPP generates up to 6 MW of electricity using only rice husk.

2.4 Wood

Some of the planned and existing projects in SEA utilizing energy from wood wastes are the following. In Indonesia, the ASEAN-EC COGEN program initiated the wood wastes cogeneration plants at T Siak Raya Timber in Pekanbaru, Sumatra (5.5 MW) and at PT. Kurnia Musi Plywood Industry in Palembang (35 tons per hour at 35 bar and 380 degrees celsius steam boiler). In the Philippines, the Paper Industries Corporation operates a total utilization policy: forest and saw mill wastes are burned with black liquor for cogeneration of process heat and electricity. In Thailand, the Electricity Generating Public Company Limited (EGCO) is developing a 22 MW power plant fueled by rubber wood-chips.

With regards to the use of specially cultivated trees, the Philippines had bad experiences with dendrothermal. Of the 16 dendrothermal plants, purchased by the National Electrification Authority (NEA), only 2 reached operation. Problems with the cultivation of dedicated tree crops and political instability have been cited as reasons for their failure.

2.5 Biogas

There are an estimated 300 operational biogas units of varying capacity, both industrial and household scale, in the Philippines. Biogas is used for process heat, power generation and lighting. An example of pig wastes utilization is the system of Maya Farms, a large hog farm and meat processing plant, which pioneered the use of biogas technologies for large-scale applications. Until recently, the farm met all of its power needs from its biogas plant, based on Indian, Chinese and European technologies.

In Thailand, a substantial effort has been developed through the Thai-German Biogas Program whose major sector is commercial pig farms. Local biogas generation technologies are already available for the anaerobic treatment of animal wastes, which can result in the production of 30 – 40 % of a farms electricity requirement.

3. SMALL HYDROPOWER

In Indonesia, there exist a number of SHP installations and there are more installations on their way. The micro-hydro project of the Government of Indonesia (GOI) and the GTZ developed standardized hydro and electricity schemes with nominal capacities of 10-100 kW and installed 28 micro-hydro power plants between 1992-1999. Plans to continue the project will focus on implementing standardized technologies

for off-grid decentralized village hydro schemes with nominal capacities of less than 100 kW and replacing diesel by installing on-grid schemes with nominal capacities greater than 25 kW. The PLN (electric utility of Indonesia), under the East Indonesia Renewable Energy Development (EIRED) Program, identified SHP plants at 15 sites in Sulawesi, Papua Barat (former Irian Jaya), and Flores with a total capacity of approximately 25 MW.

Currently, the Philippines has 68 micro-hydro systems, generating an aggregate capacity of 233 kW and benefiting about 6,000 households. With regards to mini hydro, the Philippines has 51 existing mini-hydropower facilities with a total installed capacity of 82.07 MW. These mini-hydro plants contribute around 200 gigawatt-hours or 0.34 million barrels of fuel oil equivalent (BFOE) every year. The total installed capacityof mini-hydro will increase to 89.07 MW as a 7 MW plant in Bukidnon nears completion. By the year 2009, aggregate mini-hydropower capacity will reach 151.29 MW with the development of additional 12 mini-hydropower sites.

In Thailand, the Department of Energy Development and Promotion (DEDP) and the Provincial Electkicity Authority (PEA) are some of the institutions involved with mini and micro-hydro. The DEDP installed 23 mini hydro power plants with capacities ranging from 200 kW to 6 MW and totaling a capacity of 128 MW. Aside from mini hydro, the DEDP have also been constructing many village-level micro-hydro power plants. PEA of Thailand is also involved with small hydro. PEA operates 3 small hydro generation stations with a total capacity of 3.8 MW and plans to implement five more small hydro generation stations to increase the total capacity of its small hydro to 18 MW.

Among the countries of SEA, Vietnam is the most active in hydro technology. In 1998, around 500 small hydro power plants were constructed with a total capacity of 75 MW. Aside from having many installations, Vietnam also manufactures mini and micro-hydro components. Locally manufactured components include various types of turbines –- Francis, Kaplan, Pelton, Crossflow, and Propeller type –- and associated equipment for installatons of up to 2.1 MW. Two mini-hydro installations programs are currently on-going. The first program concentrates on the China - Vietnam border region; the second program, on the Central Highland provinces that border Laos and Cambodia.

4.0 WIND POWER

Currently, wind installations are limited to small-scale systems. Indonesia has around 27 wind generators, with capacities varying from 0.1 kW to 15 kW; two of the 27 wind generators are part of hybrid pilot projects. The Electricity Generating Authority of Thailand (EGAT) procured 6 small horizontal axis wind turbine generators for experimentation at Promthep station in Phuket Island. The 6 wind turbine generators has the following characteristics:

a) 0.7 kW, 12 VDC, 3 fixed blade, direct coupling wind turbine generator (WTG)
b) 1.0 kW, 240 VAC/48 VDC, 2 variable pitch angle blade, permanent magnet WTG
c) 2.0 kW, 48 VDC, 3 variable pitch angle blade, shunt generator WTG
d) Two 10 kW, 240 VDC, 3 special pitching blade, battery charging permanent magnet WTG
e) 18.5 kW, 2 variable pitch angle blade, induction generator grid-connected WTG.

In the Philippines, the National Power Corporation established a 10 kW stand-alone system with an inverter, a 700 Ah battery bank and a 220 VAC small distribution for 23 households. Another wind installation in the Philippines is a 25 kW stand-alone system located in Picnic Grove in Tagaytay, 50 km south of Manila. The Philippine Telegraph and Telecommunications Corporation also operates a wind turbine -- 3 kW stand-alone system located in Bantay, Ilocos Sur which powers a relay station. Most common design of existing wind systems in the Philippines are 3 bladed upwind, active yawing with a 380 VAC induction machine. Vietnam has around ten thousand 200 W battery charging wind turbines installed for household use.

With regards to large-scale wind power plants, there are two wind power plants that are about to be constructed in the Philippines. The Philippine National Oil Corporation (PNOC) is developing a wind

farm in the villages of Saoit and Pagali in nearby Burgos town of Ilocos. The project consists of building a 40 MW capacity wind farm facility and laying down 42 km of transmission line in northern Luzon. Early next year, the Metro Manila based Northwind Power Development Corporation will start setting up a wind power plant at the windswept town of Bangui, Ilocos Norte. The wind farm will begin its commercial operation by 2004. The Bangui Bay wind farm will use 30 units, 60 meter high Vestas wind turbines, arranged in a single row stretching on about a 3 km shoreline facing the South China Sea.

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