Overview of mini and small hydropower in Southeast Asia

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1. INTRODUCTION

SHP has been applied in Southeast Asia (SEA) for three decades now. There is a number of existing SHP installations, both of mini and micro scale. However, comparing the current installed capacity to the potential capacity, SEA has yet to fully reap the benefits of SHP.

2. HYDRO RESOURCES IN SEA

Countries of mainland SEA have high hydropower potential for they are drained by five major river systems: the Irrawady, Salween, Chao Phraya, Mekong, and Red River. Except for Vietnam, countries of mainland SEA only have aggregate estimates of hydropower potential—potential undivided among the different scales of hydro technology. Thailand has an estimated theoretical potential of 1,770 TWh/year of hydropower. Cambodia's hydropower potential, although under evaluation, is estimated at 83,000 GWh/year. Laos has a theoretical hydroelectric potential of about 26,500 MW excluding mainstream Mekong. Of this, about 18,000 MW is technically exploitable, with 12,500 MW found in the major Mekong sub-basins and the remainder in minor Mekong or non-Mekong basins. Myanmar has a technically feasible hydropower potential of 37,000 MW, the largest in SEA. Meanwhile, Vietnam, which has more than 2,200 rivers with lengths of more than 10 km, has an estimated SHP potential between 1,500 and 2,000 MW—7% to 10% of the total economic hydropower potential.

Though separated by seas and not having common major river systems, the countries of insular SEA—Indonesia, Malaysia and Philippines—also have high potential for hydropower. Indonesia has a total hydropower potential of approximately 75 GW from 1,315 possible locations of different sizes and utilization schemes. Of this potential, around 50% could be exploited by large-scale hydro, and 493 MW by micro-hydro. To date, the country has installed a total of 21 MW of micro-hydro capacity, which represent only 4% of the total micro-hydro power potential. On the other hand, the Philippines, which has 421 principal rivers with watershed areas ranging from 40 to 25,000 sq km, has a minihydro potential of 1,286.776 MW, according to the Philippine Department of Energy estimates. So far, only 89.07 MW has been exploited. Malaysia's technically feasible potential of hydropower is around 123,000 GWh/year; however, small hydro potential is very low.

3. STATUS OF SHP IN SEA

Indonesia has a number of SHP installations and more are being planned. 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 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 around 25 MW.

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

In Thailand, the Department of Alternative Energy Development and Efficiency (DEDE), formerly known as the Department of Energy Development and Promotion (DEDP), and the Provincial Electricity Authority (PEA) are some of the institutions involved with mini and micro-hydro. The DEDP installed 23 mini hydropower plants with capacities ranging from 200 kW to 6 MW for a total of 128 MW. Aside from mini hydro, the DEDP has also built many village-level micro-hydro power plants. Meanwhile, the PEA operates three small hydro generation stations with a total capacity of 3.8 MW. It 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 hydropower 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 installations 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, while the second focuses on the Central Highland provinces that border Laos and Cambodia.

4. BARRIERS TO SHP

Some major issues hampering the commercialization of SHP in SEA include high investment cost, lack of knowledge in SHP development, lack of government policies, socio-economic concerns, environmental concerns.

The high initial capital cost of SHP schemes acts as a major impediment to SHP development in SEA where funding problems are most acute. The issue of distance between the hydro energy resource and the load centers, as in the case of Thailand and the Philippines, poses difficulties for SHP development. Project costing varies with the site, the size and the type of application. The specific investment cost per kW of SHP project also varies greatly from country to country, ragning from US$600/kW to US$4,000-6,000/kW. Further, the pre-investment work—site survey and feasibility study—is higher for SHP in percentage of the ultimate investment than large hydro. Usually, the cost of pre-investment work for SHP could be higher than the acceptable 10-15% of total investment, even if they are supported by government or foreign aid.

Attention has been paid to the training and technology transfer in some SEA countries during the last two decades, which enables them to master a great portion of work in SHP development. Although several countries have set up their own capabilities in SHP development, including pre-investment studies, engineering design, construction and operation, some other countries need to rely to a great extent on technical support from abroad. This fact, added to the costs of importing foreign expertise, materials and equipment, even if subsidized, has greatly impeded the faster development and more widespread introduction of SHP projects.

As these SHP are commonly produced for consumptive (i.e., residential) use, financial resources for the necessary O&M are frequently insufficient to warrant sustained operation. It is common that the existing SHP plants would be dismissed and replaced by the grid once the grid is extended to the area (e.g.,

Vietnam). Also, the economic feasibility of many SHP projects is not clear especially if and when compared with large-scale hydro and thermal power generation.

The socio-economic merits of electricity and of local resources exploitations are well established, but their quantification is still in infancy. In consequence, they do not usually enter into the evaluation of economic merits and projects, which could bring considerable advantages to the local population, and are in danger of being discarded by conventional economic analysis.

In some SEA countries, hydro developments are located in mountainous areas, commonly on land belonging to cultural minorities. In such cases the right of way to a project site, or the actual acquisition of ancestral lands may be problematic. Furthermore, there could be objections to water diversion if there are larger water users downstream for irrigation or drinking water supply.

In addition, there could be some environmental concerns although the environmental impact of run-of-river type developments is usually quite limited.

5. POLICY INSTRUMENTS SUPPORTING SHP

In SEA, there exist policies supporting the use of SHP. Though more policies still need to be developed, existing policies signify the interest of SEA in SHP. In Indonesia, the decree on Small Power Purchase Tariffs (SPPT) opens the energy generation market to private entrepreneurs and cooperatives. The decree aims to regulate the selling of privately produced electricity to PLN, with one of its priorities being the electricity production from non-conventional energy sources (NRES) such as wind, solar and mini-hydro. PLN, according to the small power project agreement (SPPA) and the SPPT, will purchase NRES-based electricity generated and fed into the PLN grid by private companies. All SPPAs are long-term agreements with PLN to safeguard the interest of the private investor.

Meanwhile, the Philippine Department of Energy's Renewable Energy Power Program (REPP) allocates US$30 million as a financial facility for private sector participation in NRE projects with capacities ranging from 200 kW to 25 MW. Project proponents are free to negotiate the financial terms with the conduit bank but the proposed interest rate, 12% for the funding source plus a 4-6% spread for the conduit, seems unattractive. To stimulate mini-hydro development, the Philippine government enacted Republic Act 7156, or the Mini-hydro Law. The law stipulates special incentives and privileges, such as tax and duty-free imports, lower sales tax, 10% VAT exemption, and seven-year income tax holiday.

To initiate private participation in power sector development and to promote the use of indigenous by-product energy sources and renewable energies for electricity generation, Thailand introduced the Small Power Producer (SPP) scheme in March 1992. At the end of 1996, there were 17 SPP contracts, three firm and 14 non-firm, with a total installed capacity of 910 MW; about 370 MW were sold to the national grid. The Thai government has embarked on a comprehensive Energy Conservation (ENCON) Program, adopting the Energy Conservation and Promotion Act of 1992. As one of its main objectives, the ENCON Program aims to promote the development and use of renewable energy sources, through Voluntary Programs. The program offers two types of financial support: support for the project implementing organization for the operational cost for management, administration incentives to individuals.

The energy master plan of Vietnam recommends the establishment of a Small Hydropower Development Authority (SHPDA). Since investments in the sector have been stagnant for years, the objective of the SHPDA would be to stimulate small hydro development by building local capacity to prepare a "bankable" pipeline of isolated and grid-connected small hydro projects that could lead to investments in this least cost remote power source on the order of US$20 million over a five-year period.

6. REFERENCES

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