Decentralized Renewable Energy Applications in the Philippines

by
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Figure 3 SBCS in Sara, Iloilo

The SBCS in Malalison Island

In August 30, 1996 a 300 Wp SBCS was installed in Malalison Island in central Philippines [4] as shown in figure 4. There were only 9 battery users at that time with only one TV set in the whole island. The number of battery users grew to 20 within four months of the SBCS operation.

Figure 4 SBCS in Malalison Island, Antique

Two years later, the site was inspected to repair the faulty ampere-hour meter. Utilization of the station has dropped because two diesel generators are now operating in the island. Of the 110 households, 50 were connected to the genset with a monthly fee of $ 3.75 . There are now 8 TV sets in the community with two video houses. A store runs another generator and operates a refrigerator producing cold water. The improvement of livelihood in this fishing village was mainly due to the increase in their catch as a result of a successful resource management program.

As this was anticipated, people in Malalison chose to use diesel gensets because there are no solar home systems available for them to rent. Fuel is accessible for the genset operator and for fishing boats. The genset operator claims to have a total monthly collection of $ 125.00 with 50 consumers against an operating and maintenance cost of $ 75.00. Operation of the genset becomes viable with more than 20 consumers paying $ 3.75 per month.

The SBCS in Malalison still serve battery users in the island that are not connected to the genset. Their houses are far from the main street and the cost of connection is expensive.

National Power Corporation SBCS Projects

Two pilot solar photovoltaic electrification projects were launched by the National Power Corporation (NPC) in Mindanao last 1997 [5]. The projects consist of 26 SBCS rated at 300 Wp and 5 rated at 150 Wp. The projects has an estimated 570 household beneficiaries. NPC provided PHP 4.5M for the purchase of the charging stations and the DC electrical systems for the households.

The projects serve as a good investment for NPC since this is an earning venture and not a complete dole-out. The local cooperative will manage the project to repay back the investment at a very low interest rate. Revenues generated from the project will be used to purchase additional SBCS equipment for other unelectrified communities.

SBCS for the Underground River

Two hours ride from the center Puerto Princesa , Palawan is an underground river. This underground river in Sabang is a favorite tourist destination. Adventurous visitors take a boat with a professional tour guide for $ 6.25 per person to see the spectacular view of stalactites and stalagmites with a pitch black background. Before, the tour guides use open flame lamps but pose as a health hazard to tourist and the soot accumulates on the ceiling of the caves. Now, they are using battery powered lamps that is more convenient and safer to use. Outside the cave are solar battery chargers mounted on the sand to recharge the batteries used in the cave shown in figure 5.

Applications like this will remain as is because of the nature in the use of PV. In fishing villages where batteries are used for lights when fishing at night, SBCS are acceptable and in no way be converted to solar home systems. Running a diesel genset solely for battery charging were tried in several locations but operation was short lived.

Figure 5 SBCS for the Underground River, Puerto Princesa

Lessons learned

In clustered communities, operation of diesel gensets becomes viable with the higher energy demand of several households and cheaper distribution cost. Comparing the cost of connecting to a genset against using batteries in Malalison, the genset monthly fee is $ 3.75 while the battery charging fee only costs $ 2.00 if done four times per month. What matters most is the cost of battery replacement every two years or less. Another is the inconvenience of battery handling. An automotive starting battery with 70 AH capacity costs $ 80.00. If the typical service life is only two years, the additional monthly expense for using batteries is $ 3.33 for a total of $ 5.33 monthly. This makes gensets more attractive and practical in clustered communities with regular access to fuel.

For communities with scattered households, battery users increase their frequency of recharging with their increasing demand. This makes battery charging more difficult and not practical anymore. Battery users then move up to solar home systems. If the community has no access to loans for SHS, their next option is to use a diesel genset.

Successful application of SBCS are those in areas where batteries are used for mobile applications such as lights for boats. This proved to be more practical and competitive against running a diesel or gasoline genset just for the purpose of charging batteries.

Rural Photovoltaic Electrification

The Rural Photovoltaic Electrification (RPE) is a project jointly undertaken by the National Electrification Administration (NEA) and the German Agency for Technical Cooperation (GTZ) under the Philippine-German Special Energy Program (SEP) [8].

The financial scheme involves the solar generator composed of a solar module, mounting frame, controller and house wiring amounting to $ 480 financed over 10 years at 12% interest. This results to a monthly amortization of $ 6.88 with an additional 10% for operation and maintenance. The household buys the balance of system composed of the battery and loads for a DC system.

The program is implemented through the Electric Cooperatives (EC) who take care of installation, operation, monitoring and fee collection of these decentralized systems. SEP provided 50% of the system cost as an incentive to the EC. Households are not subsidized and the full amount is charged as a commercial project to recover the investment and loan interest. Areas where grid extension is not considered, a rent to own scheme is offered with $10.50 monthly payment for 36 months with16% interest.

Initially, SEP selected 10 ECs with good financial and operational performance. From 1992 until the end of 1995, there were 975 households energized and requests for additional 1918 installations were received.

Status of RPE

There are now of 30 ECs involved in RPE. There are 11 ECs in Luzon area, another 12 in the Visayas and 7 in Mindanao. There were 2,220 systems installed under the RPE program [2] with a total capacity of 144,479 Wp serving 2,484 households as of June 30, 1998. The installation is made up of 2,154 SHS and 66 SBCS. The SBCS installed has a total capacity of 4,994 Wp.

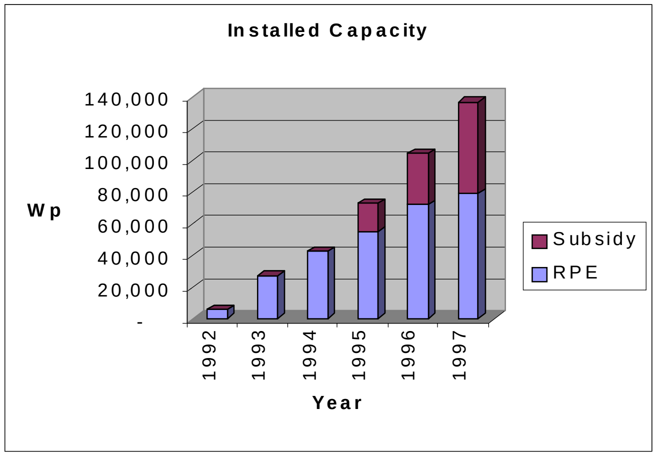

Figure 6 Installed Capacity of RPE project

NEA released $ 182,218.88 to 11 participating Ecs. An amount of $ 28,046.15 was repaid immediately by four cooperatives for full payment of their loan. A total outstanding loan of $ 135,103.19 still have to be collected with an average collection efficiency of 147.9%. Although the payment term is ten years, households opted for the 3 years rent-to-own scheme. This is why collection was high with shorter loan repayment periods.

There are still 4,800 communities to be energized using solar energy from calendar years 2000 to 2010. With a grant of DM 400,000 from the Federal Republic of Germany through GTZ plus NEA's counterpart, a funding requirement of $ 90 Million is still needed.

There were 23,876 communities electrified by 120 electric cooperatives using grid electricity with a total potential of 35,362 communities for 100% electrification [7]. The Philippine Department of Energy estimates that to reach the 80% electrification goal in the Philippines will cost $1,500 Million. The same goal can be attained with SHS for $ 72 Million [3]. With lower material requirement, the RPE method needs extended management with higher input of local labor.

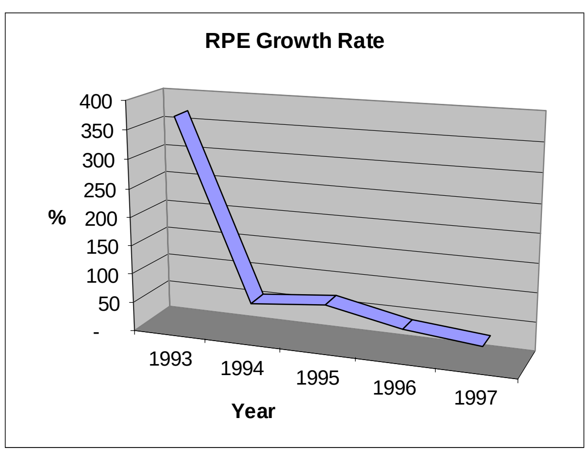

Figure 7 RPE Growth Rate

Subsidy

As it was intended, the RPE was designed to fully commercialize photovoltaic electrification without subsidy. As indicated in figure 6, subsidy was introduced in 1995 and by 1998 grew to 31% of the total project share (figure 7). As the project growth declined after the boom in 1993 shown in figure 8, subsidy has become a significant factor in the continuation of the program.

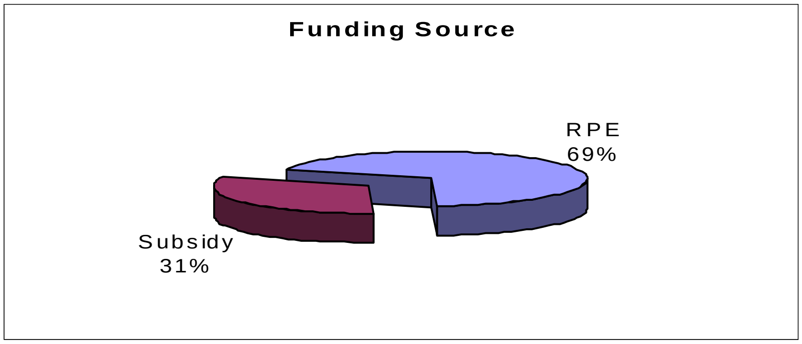

Figure 8 Subsidy share on RPE projects

Subsidies do not necessarily mean dole-outs for rural households but another funding source provided by the local government. Monthly dues are still collected from SHS users to maintain the systems, making the project sustainable. The local governments find the RPE project beneficial to their constituents. This has been integrated in their rural development plan to offer basic services to the communities. With subsidies, ECs are less burdened from loan repayments and interests.

Photovoltaics in Batanes

Batanes is the north most province of the Philippines composed of three groups of islands; Batan, Sabtang and Itbayat. Livelihood is mainly agriculture and fishing. Diesel power plants owned and operated by NPC provide electricity for 3 to 12 hours per day [9]. The current cost of power production in Batanes is $ 0.439/kWh while the selling rate to the EC is $ 0.063/kWh. While cost reduction is being explored by NPC-Strategic Power Utility Group (SPUG) with NREL using wind-diesel hybrid retrofits, Congressman Florencio Abad of Batanes had been implementing PV projects through the Batanes Development Foundation, Inc. (BDFI) with systems supplied and installed by Solar Electric Co., Inc.

From 1995 to 1998, a total capacity of 13,671 Wp of solar PV and 1,100 watts of small wind turbine generator has been installed [10]. These systems include solar power for homes, municipal buildings, hospitals, health centers, district hospitals, freezers, telecommunication and wind-solar hybrid potable water pumping systems. A typical system is shown in figure 9. PV systems were installed as back-up power for grid connected communities and as main power source for off grid installations.

Figure 9 PV installation in Batanes

This is a special case where the population of communities are small, access to fuel is very difficult. Batanes lies on the typhoon belt and ships delivering goods from Manila only comes less than ten times a year. Small planes land in the capital, Basco; twice a week but cancel their flight unpredictably during bad weather. Decentralized systems are practical in this situation because of big distances between load centers with very low consumption. When there is a major technical trouble and spare parts are not readily available, decentralized systems has the advantage of operating independently from other systems.

SPUG's projection of an average annual growth rate of 9.3% reaching a 56.6% growth in 5 years [9] to justify additional generating capacity seemed to be too high. The isolation of the island from the main land keeps its energy demand from growing fast. However, PV systems are modular and can be upgraded according to the growth of energy demand. Because of the proportion of the Countrywide Development Fund (CDF) of Congressman Abad to the small population of Batanes, many had benefited much from the solar electrification project. As the initial investment is subsidized, the users' responsibility and counter part is the operation, maintenance of the systems.

Conclusions and Recommendations

PV installations in the Philippines are shown in a map in figure 10.

Factors affecting the use of renewables for electrification

1. Density of households in the area

   In areas where transmission line requirement is long and the demand is low, the cost of transmission may not be justifiable. The next thing to consider is the density of the village.

The denser the village, the lower the cost and viability of centralized systems such as gensets, centralized PV or hybrid systems

2. Access to fuel

   Operation diesel gensets greatly depended on the availability of fuel in a particular location. Fishing villages usually have access to fuel not only for electric power generation but also for their fishing boats. Access to fuel is more difficult in mountain villages specially during rainy season. This is where renewables becomes more competitive.

3. Payment capacity of households

   The type of energy systems in villages also depends on the income level of the community. Poor villages tend to use kerosene and dry cell batteries even if the equivalent energy cost is high because the investment required is low. Energy needs of middle income villages using car batteries can be met with SBCS. Even high income families with gensets still use solar home systems for continuous availability of power. When the initial investment is subsidized, the capacity of the household to maintain the systems should be considered.

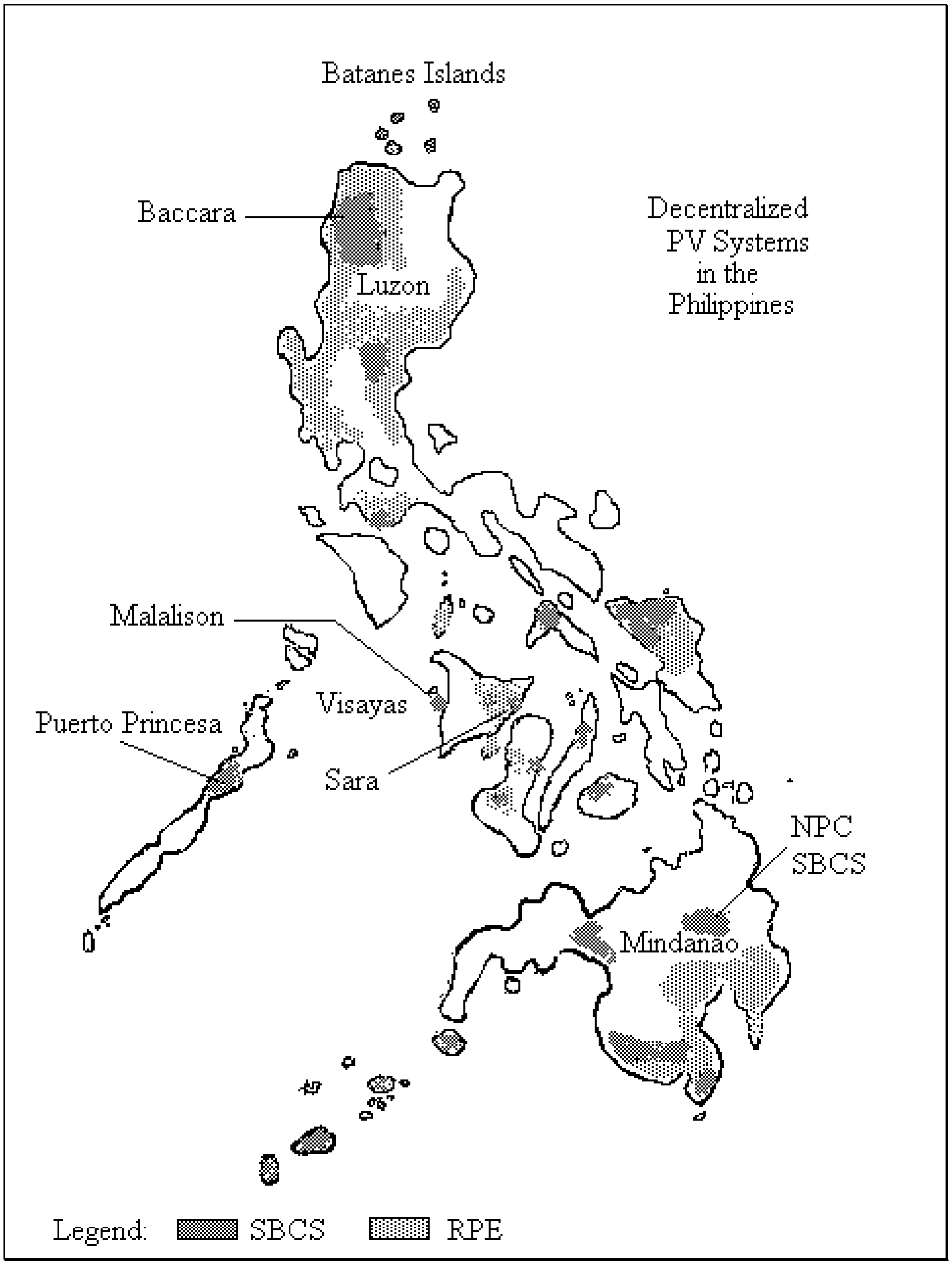

Figure 10 Location of PV installations

4. Access to financing

Renewable energy systems, particularly PV; is characterized with high initial investment and low operating cost. Diesel on the other hand has a moderate initial investment, operating and maintenance costs. Appropriate financing package should be adapted to the community to match their payment capacity. In the Philippines, loans for renewable are available to electric and people's cooperatives through NEA and development banks. This have been very helpful and effective in the dissemination and use of PV systems. Subsidies are needed initiate a project but should be gradually phased out for full commercial operation and sustainability.

5. Specific Applications

   In applications where the load is small and the value of the service is high, photovoltaic systems are best suited. With such small electrical load that can be met by a car battery, PV battery charging is viable and could be the only practical way of replenishing the charge of the battery as in the situations of the underground river in Sabang, Puerto Princesa.

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Exchange rate: 1997 $1 = PHP 25
1998 $1 = PHP 40 DM 1 = $ 1.54

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