

# Project Opportunity: Philippines

## PV-Hybrid Solutions for 24h Electricity Supply on Tagapul-an Island, Samar

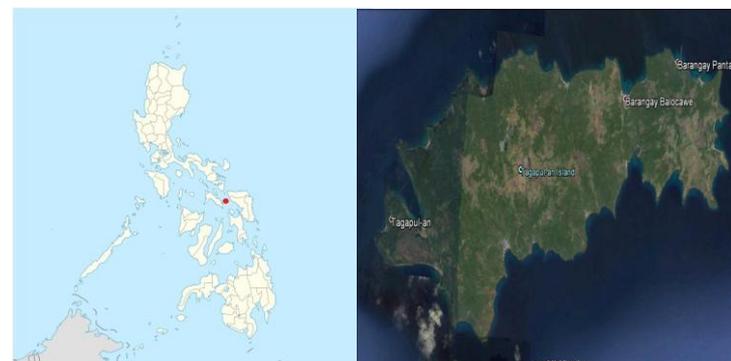
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This factsheet describes a specific project opportunity in hybridizing community diesel-grids in the Philippines and is intended to provide project developers with the most relevant information to access a suitability of the project for own development activities as well as fostering general knowledge on typical site conditions on smaller Philippian islands. Tagapul-an is an island municipality in Samar Province in the eastern Philippines. The island municipality has a population of 8,473 people in 1,643 households spread over 14 barangays (small community). The economic activities on the island are mainly fishing, copra production and retail stores. Electricity on the island is currently supplied by the Tagapul-an Diesel Power Plant operated by National Power Corporation Small Power Utilities Group (NPC SPUG) from 4pm until midnight. The distribution grid in Tagapul-an is operated by Samar Electric Cooperative (SAMELCO) 1. Continuous, 24 hour supply of electricity is needed to support the economic activities on the island. A PV-hybrid installation could bring a cost-effective solution.

### I. Project Opportunity

Tagapul-an Island is currently supplied with electricity from diesel generators from NPC SPUG for a limited capacity and operating time of 8 hours due to the high cost of fuel. The commercial activities and opportunities on the island are limited by the lack of consistent power supply. The availability of electricity could be extended by including a storage option or by incorporating renewable technologies such as solar, wind, or biomass to the existing diesel generators or as a separate system. These energy sources can either be embedded in the existing mini-grids or be used directly by a dedicated load, such as a cold storage facility or a water pumping system.



Location of Tagapul-an Island, Samar Province, Philippines

Source: Google Inc.: Google earth, August 2016 (C. N12.06672 E124.18319)

## 2. General Information

Tagapul-an Island is an island municipality of Samar province. The site can be reached from Metro Manila via an hour flight from Manila to Calabayog airport, a thirty minute drive to Calbayog City port, plus a three hour boat ride to the island. There are buses that travel from Metro Manila to Calbayog that take 17 to 19 hours with a ferry ride from Matnog to Allen.

The island municipality has a population of 8,473 in 1,643 households spread over 14 barangays with an average household size of 4.9. The annual population growth rate, -6.48%, is negative due to urban migration. The population density is 300 persons per km<sup>2</sup> with concentrations of settlements in the narrow coastal areas. Main economic activities on the island are fishing and selling copra. Regional average annual household income is P162,000; average annual household expenditure is P144,000.

The mode of transportation going to the island is via private pump boats that travel to and from Calabayog once a day. These boats also deliver goods and equipment. Smaller private boats can be hired to go to the mainland. Mobile cellular service is limited to Globe/Talk n Text; however, the signal is too weak for an internet connection. Radios receive local AM and FM stations. Commercial TV reception is weak while cable TV using a satellite dish is very popular on the island: subscriptions of PHP 100 per month are paid to retailers on the main land.

There is basic infrastructure on the island; each barangay has elementary schools, health centres, and barangay halls. Roads to connect coastal barangays are under construction requiring heavy equipment that carves out the slopes of the mountain. The water system, tapping water sources from the mountains, is also under construction. Concrete jetty ports were built in major barangays for easy access of goods and passengers to the boats.

## 3. Energy Situation

The island electricity need is served by two diesel power plants, one with 163 kW and the other with 100 kW 263kW operated by NPC SPUG. SAMELCO I installed the distribution system and meters which are being used to conduct monthly meter reading, billing and collection. A lineman is assigned to maintain the line and household connections. Instead of installing mini-grids, LGU requested the extension of the lines from a single power plant to the 14 barangays on the island.

The generation charge was set by SAMELCO at PHP 7.5011 with a generation system charge of PHP 52.8468/kWh, FCA of PHP 3.0992/kWh, Forex of PHP0.4987/kWh and systems loss charge of PHP 1.0564/kWh. Including the distribution and other charges, the effective electricity rate is PHP 10.4959 in Tagapul-an . It should be noted that the values used by SAMELCO I and SPUG for the distribution charges slightly differ due to the nature of their operation as approved by ERC.

### Key Facts and Figures

Location	<b>Tagapul-an</b> , Samar Province, Eastern Visayas (Region VIII) Philippines
Population	<b>8,473</b> with 1,643 households (HH)
Land area	<b>28.70 km<sup>2</sup></b>
Economic activities	<b>Fishing</b> , copra, retail shops, services
Distribution utility coverage area	<b>Samar Electric Cooperative</b> (SAMELCO) 1
Existing power supply	<b>263 kW Diesel Genset with distribution line for 8 hours per day</b> , Operated by NPC-SPUG
Fuel cost	<b>PHP 36.25/litre</b> (€0.7/litre) retail price at gas station in Calabayog
Electricity tariff	<b>PHP 11.6804 /kWh</b> (€0.22/kWh) Subsidized rate
Solar radiation data	<b>4.81</b> (kWh/m <sup>2</sup> /year) National Renewable Energy Laboratory
Wind average speed (m/s)	<b>4.47m/s</b> (at hub height of 50m,Source: NREL1982-1993)
Biomass	<b>Coconut shells</b> ( 50% of the island is covered with coconut plantation, subject to inventory)

Source: Tagapul-anLocal Government Unit

## 4. PV-Hybrid Project Design Data

### Administration

Distribution utility	SAMELCO 1
Power generation entity	NPC SPUG
Cost of power generation	PHP 7.5542 ( Subsidized rate)
Electricity rate charged to customer (true cost & subsidized)	PHP 11.6804/kWh (SAMELCO 1)
Power plant upgrading plans	Request for extension of operating hours PHP 102,807.27 for 9,258 kWh
Average monthly energy sales	(SAMELCO 1 February 2016) Monthly meter reading, billing and collection by SAMELCO 1
Billing & collection system	collection by SAMELCO 1
Collection efficiency	80% to 90%

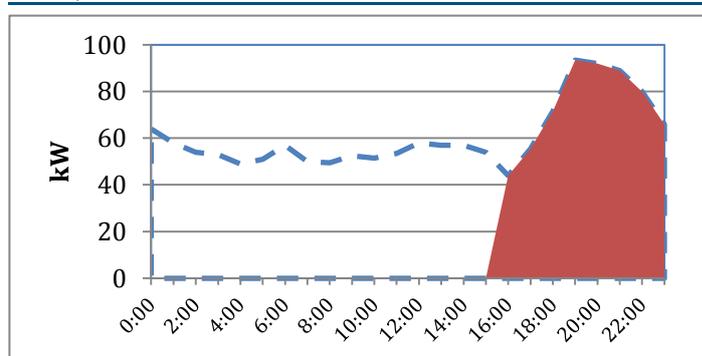
### Grid Information

Distribution system type	3 phase Wye
Single/3 phase, delta/star (wye)	
Distribution line (overhead, underground)	Overhead
Insulation (bare, insulated)	Bare
Type of pole (wooden, concrete, steel)	25 feet Steel pole
Sizes and number of transformers/substations	1
Network configuration (LV only, LV with MV)	MV
Distribution voltage level (Volts AC)	230
Nominal frequency (50/60Hz)	60
Meter type, brand, model	Intech Digital
Medium voltage level (kV)	13.2kV
MV line configuration (star, 4,5 wire, etc.)	4 wire Wye
Average power factor	0.89 lagging
Power supply service quality	-
Operating Hours per day	8 hours (4pm to 12mn)
Outages per year (hours/days), causes	Transformer overload, low fuel
Low voltage level (Volts AC)	-
Operating frequency range (Hz)	60Hz
Single Line Diagram of electrical distribution system	13.2kV Wye MV lines Secondary at 230VAC L-N Steel poles 50 meters apart

### Load/Demand

Types and number of customer, energy consumption households	452HH, 9,130kWh/month
Commercial	None

Industrial	None
Government building	6 connections, 1,181kWh/month
Water district	None
Streetlights	3 connection, 555 kWh/month
Others	None
Annual energy consumption kWh	128,136 kWh
Minimum load kWmin	30 kW
Maximum load kWmax	105 kW
Noon time load kW	50kW (during 2016 May elections)
Seasonal load variations	High demand during fiestas, holidays and special occasions
Electricity Demand Forecast	130 kW
Household Electrification Level (% of data)	year82%



Load Profile/Load Demand Curve

Source: NPC SPUG

### Diesel Genset Data

Power plant operator/administrator	NPC SPUG
Year plant operation started	163kW 03-Aug-1996 100kW 08-Feb-2009
Power plant data	-
Number of gensets	2
Genset capacities (installed)	100kW + 163kW
Genset capacities (dependable)	98kW + 160kW
Genset output voltage/wire configuration	220 Y/440 Delta
Genset operating time	4pm to 12mn
Fuel consumption (litres)	147
kWh generation	590kWh/day
Genset information/data sheet	-
Genset synchronization (manual/automatic)	Automatic
Genset control (manual/automatic)	Automatic
Fuel type	Diesel
Annual fuel consumption litres	53,655
Delivered cost of fuel	Contracted ( Retail rate PHP36.25/liter(€0.7/liter) in Calbayog
Fuel source/supplier	Contractor

## Hybrid Data

Renewable energy resources:

Solar radiation data (kWh/m <sup>2</sup> /day)	4.81
Solar data source	NREL
Wind data:	-
Wind average speed (m/s)	4.47
Hub height (m)	50
Period data taken	1982-1993
Wind density (kWh/m <sup>2</sup> )	127
Wind data source	NREL
Ambient temperature	26.45
Data source of temperature	PAGASA
Rainfall data / precipitation	924.19mm
Data source of precipitation	PAGASA
Availability of area for solar array	Available
Availability of area for power house	Available
Availability of area for battery bank	Available
Land ownership	Private

## 5. Hybrid Opportunity

There is growing energy demand which exceeds the current supply delivered by 8 operating hours of the diesel power plants in Tagapul-an Island. Extending the operating hours of the diesel plants will increase their fuel consumption and operating costs. There are renewable energy sources on the island such as solar, wind and biomass that can be utilized to supply the island with electricity for 24 hours. These technologies can be embedded in the existing mini-grid as a hybrid system creating a reliable and cost-competitive source of power with environmental benefits.



Tagapul-an Diesel Power Plant operating for 8 hours daily. SAMELCO I distribution line in Tagapul-an with kWh meters connecting residential loads.

## 6. Proposed Project Setup

The existing diesel power plant can be supplemented by other technologies which utilize solar, wind or biomass extending the availability of electricity as requested by the community in Tagapul-an. The investment for such a system could either come from stakeholders, such as the local government, the electric cooperative using a loan from the National Electrification Administration, or it could be financed by private investors and banks using a guarantee from the LGU-Guarantee Corporation or similar facilities. NPC SPUG can also invest into the hybrid system in order to reduce its fuel and subsidy requirement taken from the universal charge; however, this is subject to budget availability and government procurement regulation.

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