

Smart Grid for Off-Grid Electrification in the Philippines

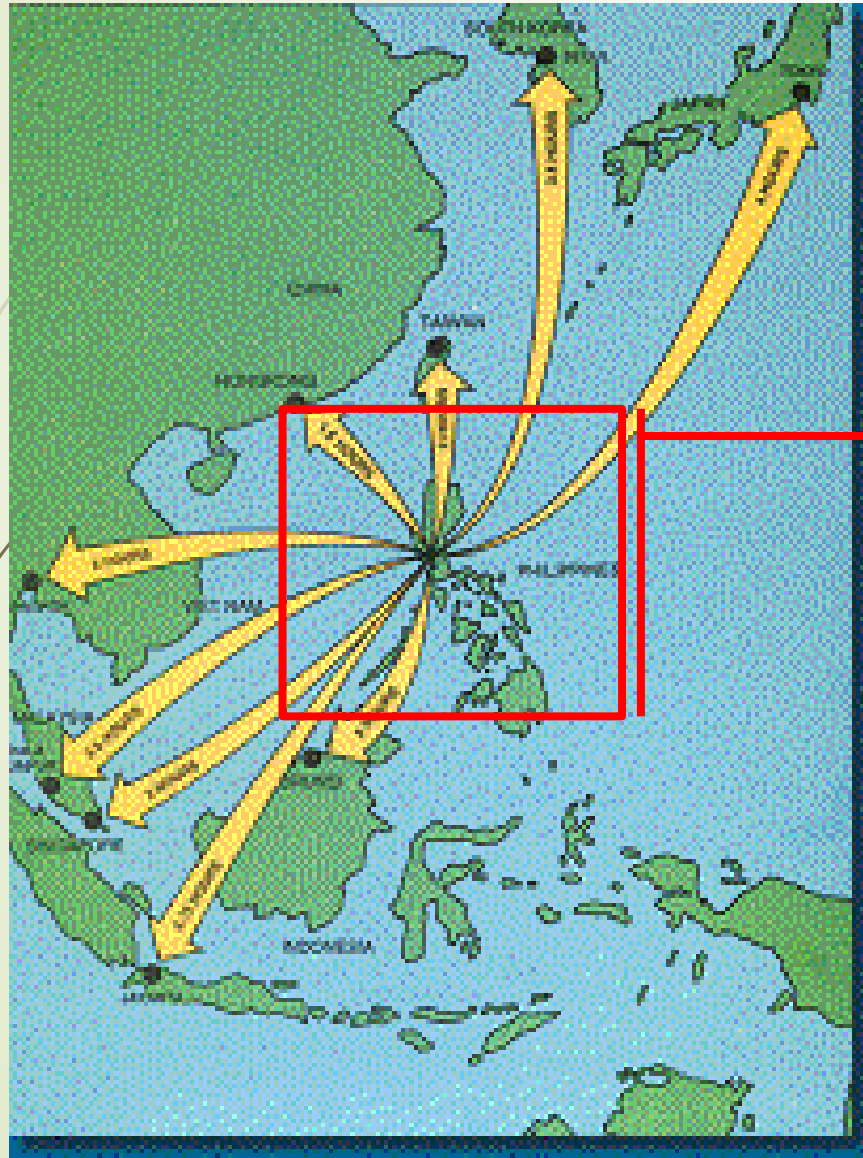
An Example and Opportunities

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Rural Electrification Expert

5th ASGC, December 4, 2019, Malaysia

The Philippines at a Glance



Land area: 300,000 sq. kms
Population: ~ 92 Million (2010)
Literacy rate: 93%
Climate: Tropical (23-32 ° C)
Language: Filipino
Government: Democratic

Religion: *Dominantly Roman Catholic*

Currency: *Peso*

With more than 7,100 islands, providing electricity services remains to be the biggest challenge to the Government ...



SMART GRID IN THE PHILIPPINES

- ▶ There are primitive attempts at a smart grid in the 1990s for solar home systems where 2 to 3 houses are connected but with a central / main switch on a house.
- ▶ There were social problems that arise because if the owner of the house where the main switch is located, is angry with the neighbor, the owner can switch off power of the neighbor's house.
- ▶ This lead to social conflict, hence discontinued.
- ▶ In the 2000, Shell Renewables Philippines established a hybrid solar PV-gas genset-batter-biomass mini-grid in Bgy. Alaminos, town of Madalag, Aklan Province.
- ▶ It provided power to 132 households.
- ▶ Pre-Payment of electricity is multi-tiered. 20W of light for a week cost PhP56 while using a TV set adds another PhP15/week and so on.
- ▶ 100 percent collection efficiency
- ▶ Project was completed when the Aklan Electric Cooperative extended its grid in 2005 after the mini-grid was inaugurated in December 1999.
- ▶ Since then, there were a lot of mini-grid installed but no pre-payment scheme nor there were smart grids.

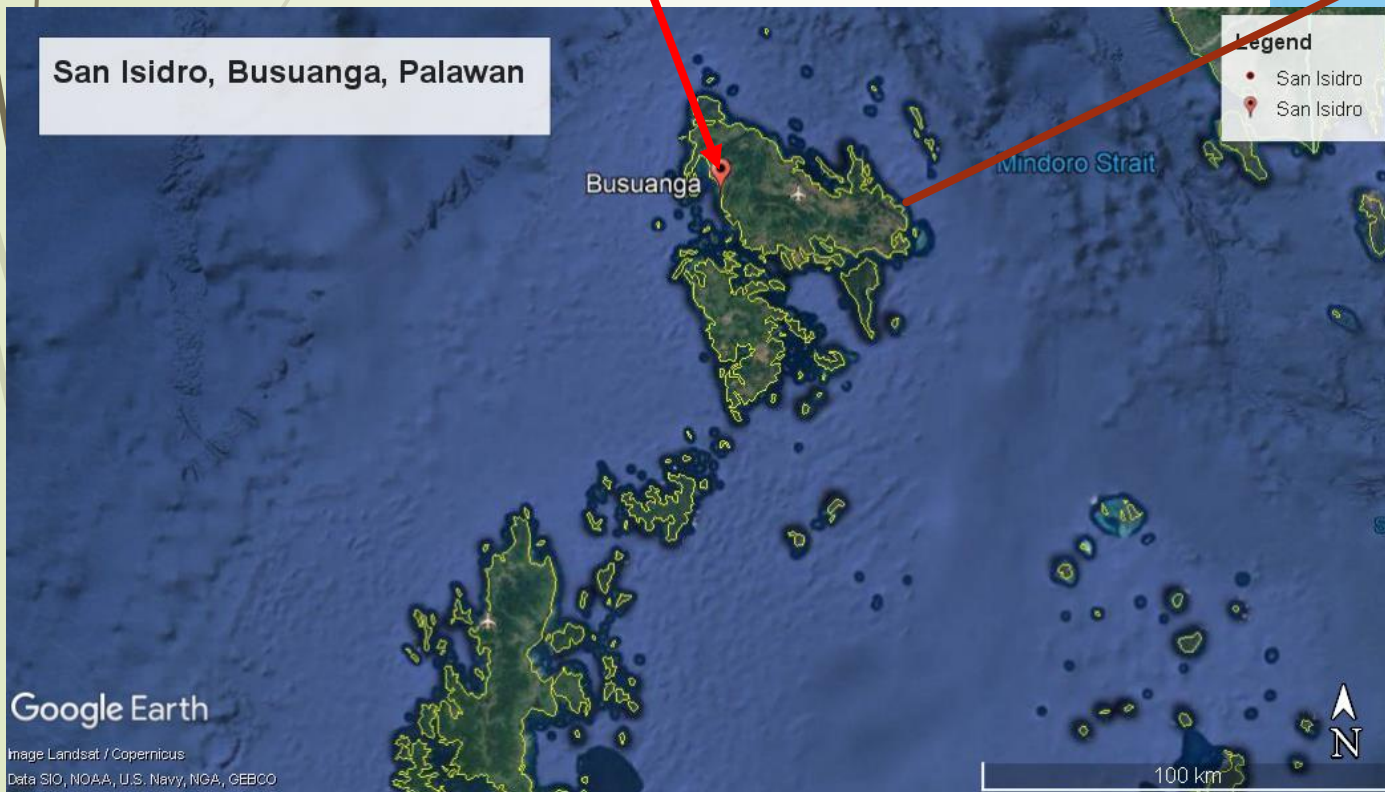


OKRA Smart Grid in Off-grid solar home systems in Bgy. San Isidro, Busuanga, Palawan

- ▶ MANILA, Philippines — Busuanga Island Electric Cooperative Inc. (BISELCO) has inaugurated the country's first off-grid smart solar network that can provide 24/7 power to 62 households in the Palawan town.
- ▶ Considered to be the first of its kind in the country, the project was done in partnership with the Association of Isolated Electric Cooperatives Inc. (AIEC), Island Light and Water Energy Development Corp. (ILAW), One Renewable Energy Enterprise Inc. (OREEI), OKRA, Infunde Development, and InfraCo Asia.
- ▶ The pilot project took five months to complete from documentation to the installation of solar panels and batteries, with a total investment of \$40,000 or P2 million.
- ▶ Read more at <https://www.philstar.com/business/2019/09/22/1953772/first-grid-smart-solar-network-launched-palawan#pZIJWx1QpY0UtwT.99>



The village of San Isidro in the town of Busuanga, Province of Palawan can be accessed by a motorized pump boat from Salvacion, also in Busuanga.





OKRA Smart Grid in Off-grid solar home systems in Bgy. San Isidro, Busuanga, Palawan

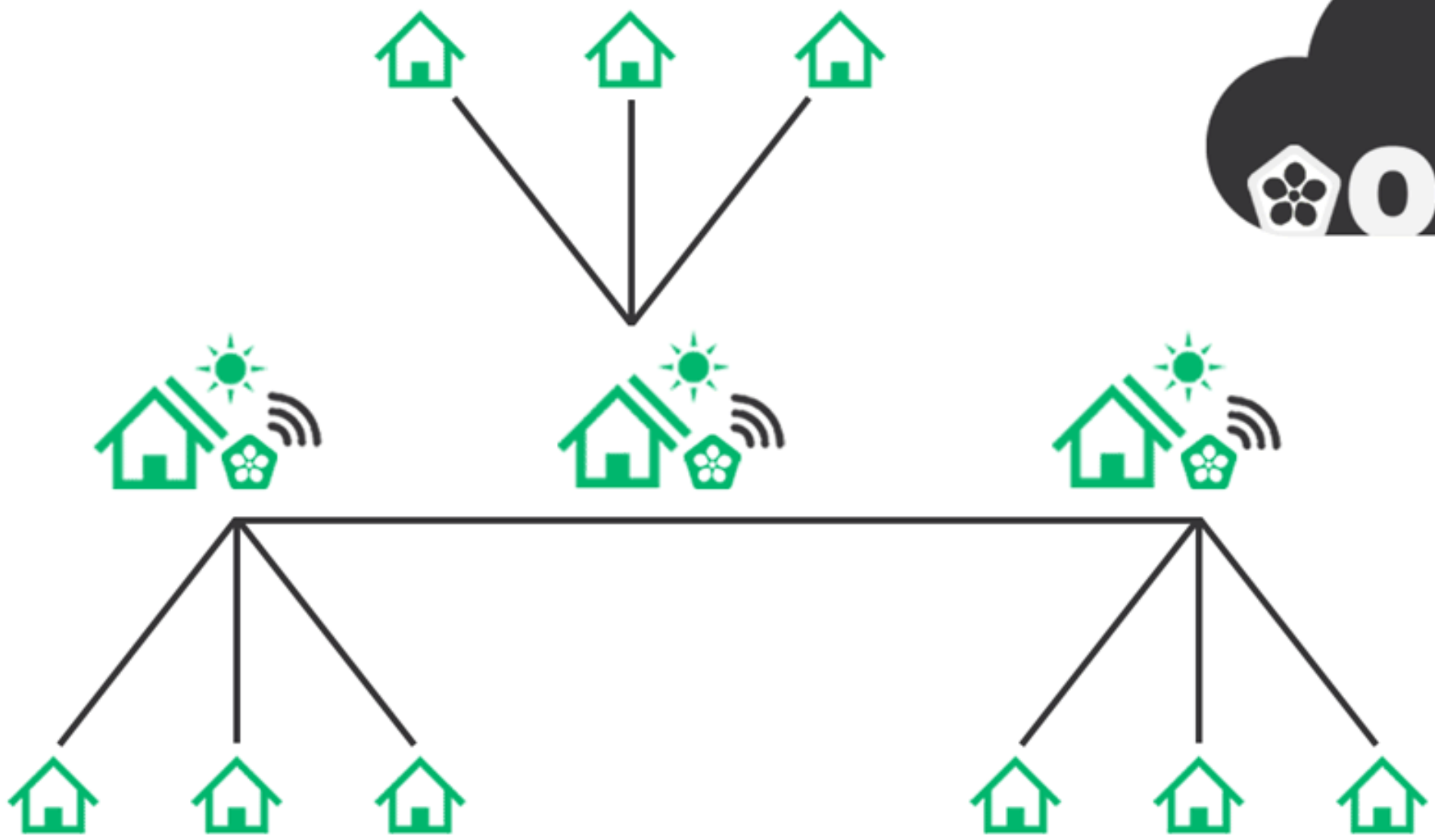
THE OKRA POD

Turning sunlight into productive power.

The Pod is the brainy building block of every Okra smart grid. It allows households to interconnect so that they can share energy to where it's needed when it's needed. This ensures each and every family has uninterrupted power for their essential needs – lighting, fans, mobile phone charging and TVs. Power distribution is automatically balanced which means families can also use freezers, cooking equipment, washing machines and water pumps, without fear of blackout.

The smart way to manage a smart grid.

Harvest is the all-in-one tool that helps Okra grid owners run operations and maintenance from afar. It manages mobile payments, inventory and live alerts. It provides a realtime visualization of all that happens within Okra grids – from generation to battery charge, to consumption.



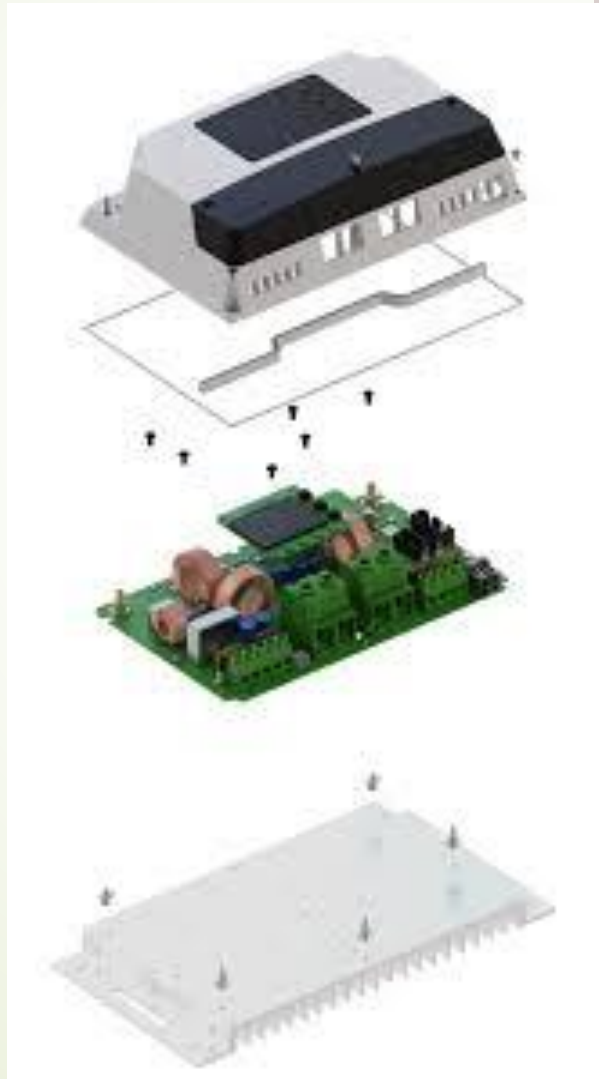
OKRA Smart Grid

- Clusters of house connected.
- Excess energy from the solar module is stored in a lead-acid battery and supplies energy to connected loads when needed.
- More efficient in storing electricity and dispensing it through a microgrid controller



OKRA Microcontroller

1. GSM Antennae
2. GSM SIM Card, Open Line
3. Load Inputs, e.g. LED lights, Refrigerator, freezer
4. Battery Input





QUOTES From Afnan Hannan, OKRA CEO

- ▶ Afnan: We want to power the distribution channel that's most adept, that has low cost, speaks the local language and has local tentacles to get it done. This means working with the local license holder. We need to make sure they are incentivized to do the work.
- ▶ We create a private investment vehicle with investors, debt, and some of the local utility's money. The SPV pays for all the capex, financing of productive appliances. It pays the local utility to find the sites, install the hardware and operate the microgrid. Households pay for energy on an ongoing basis, which pays the investors back digitally through a smart contract. The software cuts access when the households don't pay, and similarly it penalizes utilities if they don't complete the maintenance.
- ▶ So far, this business model is working well. Households are paying their bills and utilities are completing the maintenance. Going from 120 households to 8,000 in the next phase will be the real test, with less hands-on support from us.
- ▶ <https://www.cleantech.com/bringing-scale-to-energy-access-okra-solar-makes-the-new-50-to-watch-list/>

Solar PV market in the Philippines

- ▶ There is around 900MWp of installed capacity, majority of which are solar farms because of the Feed-In-Tariff incentives provided by the government, PhP9.6/kWh for the first 50MWp and PhP8.69/kWh for the next 520MWp)
- ▶ Solar rooftop installations are booming with shopping malls taking the lead..g. ShoeMart, Robinsons Malls, Gaisano and commercial establishment as second, e.g. Wilcon Builders, Car Showrooms.
- ▶ Solar rooftop installation for houses is slowly growing but not rapidly, due to lack of financing.
- ▶ Solar module market is currently dominated by Chinese manufacturers with Tier I rating, Jinko, Trina, Canadian Solar, Seraphim, etc.
- ▶ Inverters are dominated by SMA followed by Huawei and Sungrow with other Chinese inverter manufacturers.
- ▶ Mounting rails supply is from China, Schletter and others
- ▶ There is plan from MERALCO, the biggest distribution utility in the Philippines for a 2000MW expansion in 2020, 1000MWp will be sourced from solar.

Other Solar PV market in the Philippines

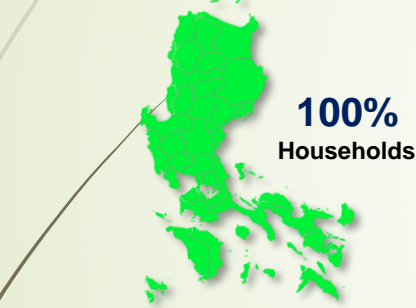
- Qualified Third Party where private developers can be the generator, distribution company and collection center for waived and unviable areas for rural electrification.
- In a QTP, the developer has a Full Cost Rate of generating power. It in turn can sell the electricity to the households and other customers at a Subsidized rate. For example if the the QTP developer generates electricity at PhP25/kwh and sell its at PhP12/kWh, the PhP13/kWh will be paid by the National Power Corporation from the Universal Charge for Missionary Electrification (UCME).
- Note that the Energy Regulatory Commission has to approved the rates.
- There are more than 245 unviable areas in the list. The lowest hanging fruit is the island of Camiguin with a potential capacity of 5MW, There are other sites ranging from 100kW to 30MW.
- The power system can be a hybrid solar-wind-diesel-BESS-biomass, which ever is an available resource and more applicable.

Status of Household Electrification as of June 2019



22.60 Million Households
have electricity out of
22.98 Million Households in
the country

LUZON



VISAYAS



MINDANAO



Distribution Utilities (in Millions HH)	HH Population	Served HH	HH Electrification Level (%)
Luzon	13.31	14.06	100.00%
Visayas	4.40	4.23	96.00%
Mindanao	5.27	4.31	81.87%
Philippines	22.98	22.60	98.33%

Note:

- Potential HHs is based on Philippine Statistics Authority - 2015 Population Census
- Served June Update from Non-Ecs (AEC, CELCOR, CEPALCO, CLPC, DLPC, FBPC (BELS), ILPI, MMPC, OEDC, PECO, SFELAPCO, VECO)
- Served June 2019 Update from ECs based on NEA Report

2.8 million Households without electricity access in Philippines in 2018

<https://medium.com/climatescope/2q-2019-off-grid-and-mini-grid-market-outlook-aabe027e9e9>



Challenges to Rural Electrification

Rural Electrification

- Geographical Location
- Right of Way (RoW) Provision
- Peace and Order Situation
- Rehabilitation and Upgrading of Distribution Lines
- Absorptive capacity of Ecs
- ..and more!

Household (HH) Electrification

- Geographical Location
- Financial Capability of HH for Service Connection
- Targeting of HH Beneficiaries
- Service Connection Requirements (Fees and Charges)
- ...and more!

Socio-economic

Financial

Technical

Socio-political



THANK YOU

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