

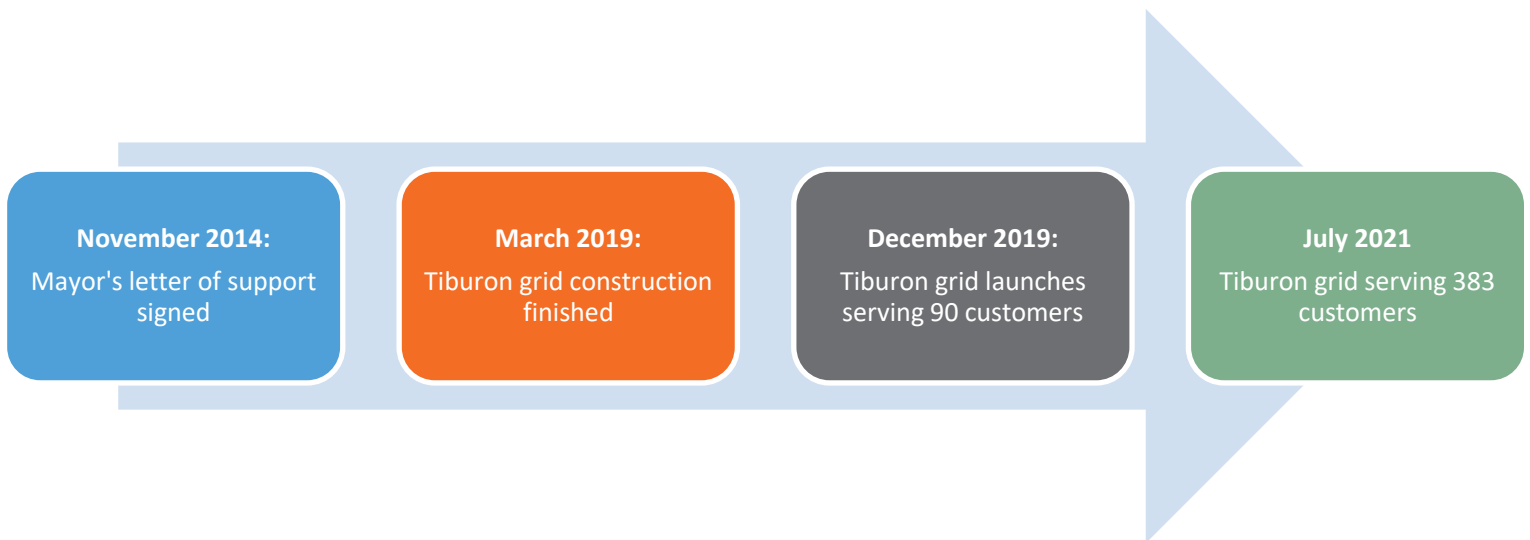


Tiburon Microgrid Fact Sheet

On December 21st, 2019 EarthSpark launched its second solar microgrid in Tiburon, a small fishing town in the southern peninsula. The Tiburon grid is a 95kW solar smart grid that offers a clean, 24-hour, and affordable electricity for homes and businesses. The grid has a backup diesel genset – the last genset EarthSpark will install as it transitions to 100% solar power for future grids. The launch of this microgrid was several years in the making and featured close collaboration with the community of Tiburon, local and national elected officials, the national regulatory authority ANARSE, the national electricity company Électricité d’Haïti, the Haitian engineering firm DigitalKap, and with international stakeholders including the US Agency for International Development and the World Bank to inform practical and policy next steps.

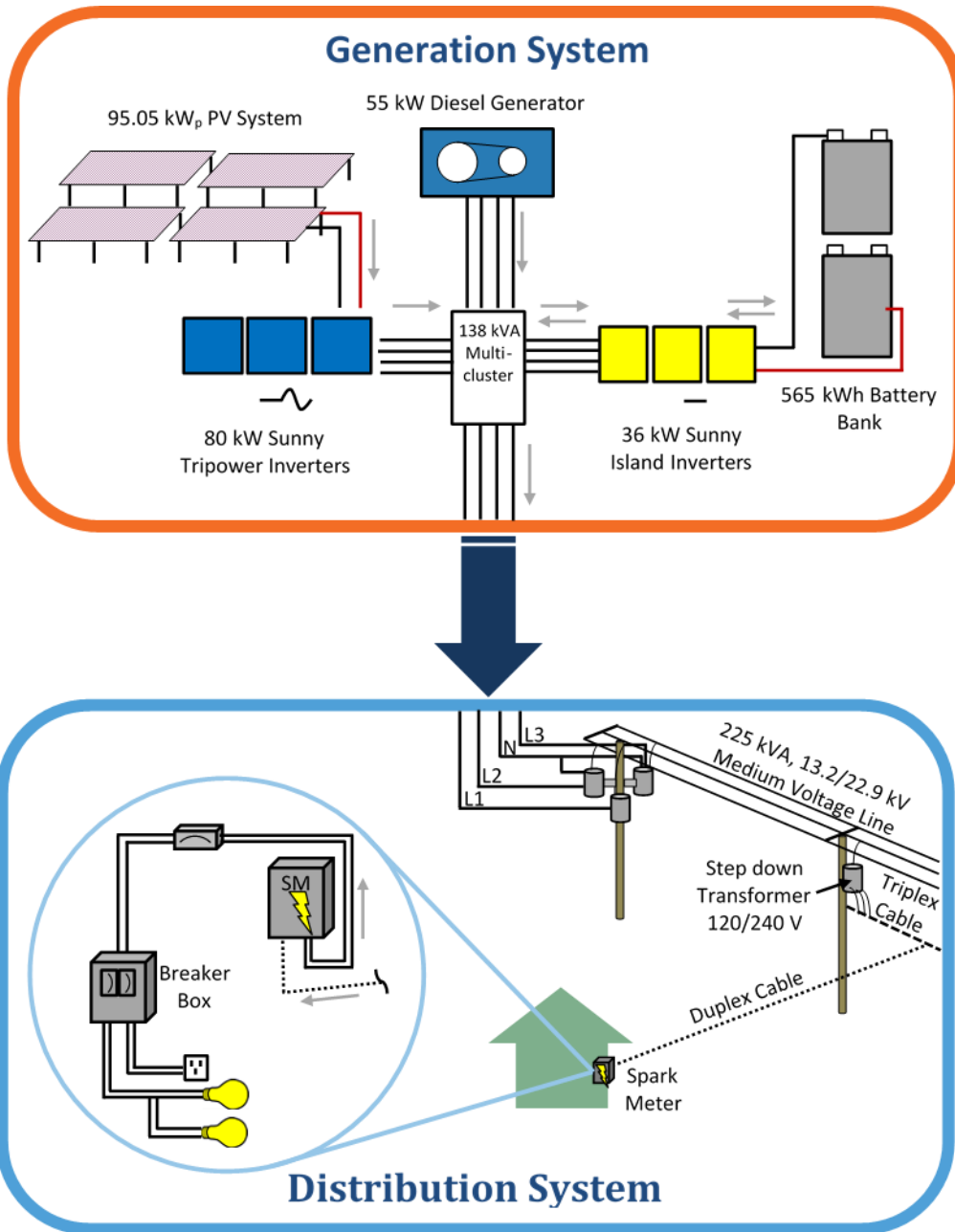
Despite significant challenges and hurdles along the way, the Tiburon microgrid was actually the first microgrid in Haiti to be launched under the Government of Haiti’s new energy regulatory framework and ANARSE. In addition to being a point of progress for clarification in the legal and regulatory environment for energy in Haiti, the Tiburon grid also represents a point of resilience in the face of natural disasters. Tiburon was hit hard in 2016 by Hurricane Matthew. Though EarthSpark had already secured funding and local support for the grid, the storm brought down pre-existing poles and wires. USAID and the Haitian government provided support to rebuild the distribution system and to complete the full construction of the grid.

By the end of the year, the microgrid had almost 90 connections (including streetlights). Even despite slowdowns because of the COVID-19 pandemic, that figure has jumped to over 380 connections by the end of Q2 2020. With almost 4,000 kWh of monthly consumption in April 2020, Tiburon customers have shown higher per capita consumption and higher per capita transactions across all tariff levels compared to the Les Anglais system, which is indicative of the higher proportion of Diaspora and higher income residents in Tiburon. Over the next few years, the microgrid is expected to serve over 500 households and businesses.



Generation/Distribution Overview

- **Nameplate Microgrid Capacity (Multicluster limit):** 138 kVA
- **Installed PV kW peak Generation Capacity:** 95.04 kWp
- **Effective solar capacity:** 80 kW (best case, at noon)
- **Installed Diesel Generator:** 55 kW (prime)
- **Peak demand:** surveyed at 50 kW (not taking into account battery charging)
- **Nominal solar daily power generation:** 485 kWh (peak)
- **Voltage of the medium-voltage distribution system:** 13.2/22.86 kV
- **Voltage of the low-voltage distribution system:** 120/240 V (split phase)
- **Kilometers of distribution line:** ~2.3 KM medium voltage, ~3.7 KM low voltage



PV system specs:

Component	Description
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Solar Panels	Canadian Solar 270 W polycrystalline
Open Circuit Voltage (Voc)	37.9 V
Rated Voltage (Vmpp)	30.8 V
Short Circuit Current (Isc)	9.32 A
Rated Current (Impp)	8.75 A
Field Wiring	Cu. only. 14 AWG min. insulated for 90°C min.
Total number of panels	352
Number of strings	16
Number of modules per string	22
String Voltage	677.6 Vmpp/833.8 Voc
String current (Isc)	9.32 A
Nominal system voltage	677.6 Vmpp/833.8 Voc
Nominal system current	140.0 A (Impp) / 149.12 A (Isc)
Panel area	1.6 m ² each.

Generator specs:

Component	Description
Make	Cummins
Model	C60D6E
Power Rating	55 kW
Serial number	C60D6E

Manufacturing Order Number	GD0DI-1796210	
Declared rating	ESP	PRP
Rated Power (KVA)	75.0	68.8
Rated Power (KW)	60.0	55.0
Rated Current (A)	196.8	180.6
Rated Voltage (V)	220	220
Rated Frequency (Hz)	60	60
Rated Power Factor	0.8	0.8

Battery bank specs:

Component	Description					
Make	Sonnenschein A600 Solar					
Model	A602/3270					
Type	VRLA tubular plate gel batteries					
Material	Acrylonitrile butadiene styrene (ABS)					
Voltage	2 V					
Terminal type	F-M8					
Dimensions (mm)	Length: 214	Width: 489		Height: 816		
Weight (kg)	198					
Capacity Amp-Hours (AH)	1-Hr rate	3-Hr rate	5-Hr rate	10-Hr rate	100-Hr rate	120-Hr rate
	1309	1935	2228	2532	3184	3266

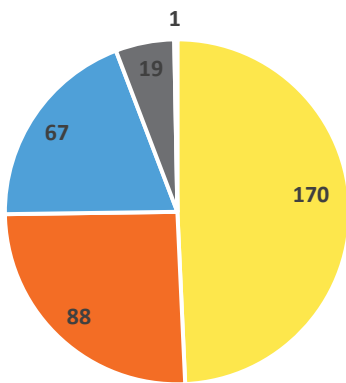
Energy at 100-Hr rate	5.890 KWh per battery (565.5 kWh total, 291.5 kWh usable)
Number of batteries	96
Number of strings/number of batteries per string	4/24
Voltage per string	44.4V (48V)

Customers and Grid Operations

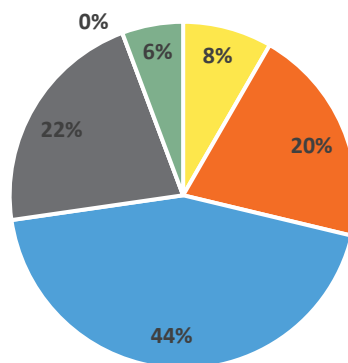
Grid Operations are currently managed by EarthSpark’s spin-off Enèji Pwòp, SA. The Tiburon microgrid is also under the ANARSE regulator, so tariffs are set through that process. Overview customer and operations metrics (Jan 2021) are presented below.

- **Number of connections:** 345 households and businesses
- **Number of streetlights:** 46
- **Average total energy consumption from all users:** 115-225 kWh/day
- **Average Service Availability (Grid up-time):** 80%
- **Average Monthly Sales:** ~130,000 htg Pre-pay

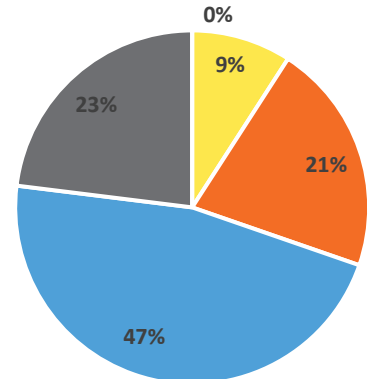
Total Customers by Type



Proportion of Consumption by Type



Proportion of Pre-Pay Revenue



■ LIMYE ■ TV ■ FREEZER
■ GWO BAGAY ■ TELCO

■ LIMYE ■ TV ■ FREEZER
■ GWO BAGAY ■ TELCO ■ STREETLIGHT

■ LIMYE ■ TV ■ FREEZER ■ GWO BAGAY ■ TELCO

*Load figures exclude electric cooking and consumption from Eneji Pwop operations so that the load and revenue figures align. There are additional sub-categories for customers (i.e. Limye plus, TV plus) which allow for some greater flexibility within tariff tiers, but they have been grouped here for clarity.

Class (Power Limit)	Rate (HTG/kWh) ¹	Number of connections	% of Total Consumption	Average monthly consumption per connection (in kWh)	Average number of transactions (Average monthly expenditure)
Lighting (30W)	35 – 44	170	8%	1.6	1 (63 htg/month)
TV (120W -360W)	35 – 44	88	20%	7.6	2.8 (356 htg/month)
Freezer (360-600W)	35 – 44	67	44%	21.5	4.0 (975 htg/month)
Gwo Bagay (600-1000)	35-44	19	22%	37.2	5.8 (1680 htg/month)
Telco (No Limit)	Variable ²	1	0% ³	0	1 (0)
Streetlights (20W)	44	46	6%	5.8	N/A

¹ Tariffs are set by the energy regulator ANARSE. Range represents day to night tariffs. Daytime tariffs are lower and run from 8AM – 6PM. Nighttime tariffs are higher and run from 8AM – 6PM.

² Telco customers pay monthly or quarterly bills based on negotiated contracts. Currently Digicel pays quarterly at \$0.58/kWh.

³ Telco customer is interconnected, but currently not consuming from the grid.