Engineering, Procurement and Construction of 10 Solar PV rural microgrids in the Upper Suriname River

Mauricio Solano, Jorge Ortiz and Roger Sallent

tta Trama TecnoAmbiental

CONTEXT

- In Suriname there are over 135 rural villages with diesel genset based microgids providing limited supply of electricity (**free of charge 6 h/day**), and dozens of communities without access to electricity.

- Providing **24/7 hours electricity using renewable energy** sources is a priority for the National Government.

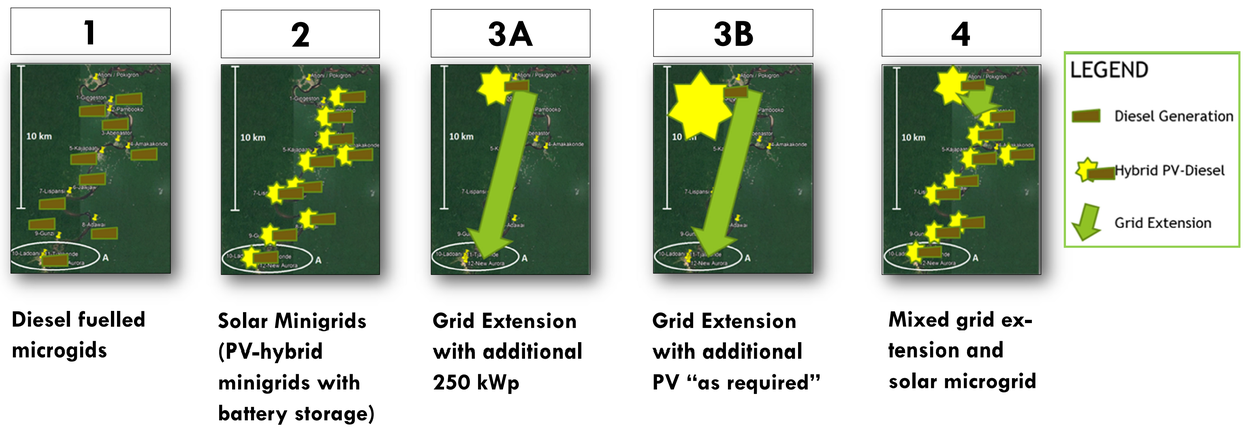
- In 2018, a solar power plant was commissioned to provide 24 h/day electricity in the communities of Pokigron and Atjoni with 500 kWp PV, with battery storage and diesel genset backup.

- More recently, the national electric utility, EBS with the technical assistance of TTA, has been progressing in the implementation of 10 new solar and battery storage microgrids in the Upper Suriname River, to **12 communities** with existing small diesel-based generation. It is estimated that a total of 4,200 inhabitants live in these communities.

INTRODUCTION

- In 2019, TTA presented at the Fort Collins Microgrid Symposium the initial steps of this program, where a study with a multi-criteria tool to support decision-making of alternatives in Suriname was shown. Since then, the project has progressed and is in now at the beginning of construction.

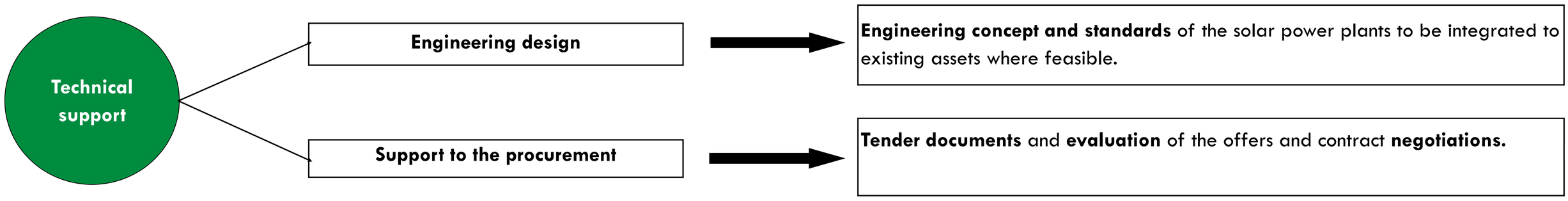
- In that study, five different scenarios were examined:



Scenario 2 - Solar Minigrids was the best-scoring with the highest in the Technical criteria and the lowest GHG from operation and was selected.

CONSTRUCTION PHASE AND TECHNICAL ASSISTANCE

The objective is to provide Engineering, Procurement and Works supervision support to the public utility EBS in the construction of 10 solar microgrids. Phase I of the project included:



Phase II of the project is construction and includes the support to the **design and supervision** of the **construction** of the microgrids and to improve **capacity** of EBS in implementation of this technology and business model.

HYBRIDIZATION OF EXISTING DIESEL POWER PLANTS

- Comprehensive site visits were done to all communities. Detailed demand assessments were conducted to characterize the loads and profiles to proceed with an efficient and responsive design of the solution.
- One solar microgrid supplies one of each of 9 villages. Plus, 3 villages are clustered and supplied by a larger single microgrid where the existing diesel genset remains. For the other 9 sites generators will be dismantled, and replaced. Moreover, new distribution lines will be built by EBS in all communities.
- To achieve modularity of the plants of different capacities, **two types of Solar Basic Units (SBUs) were designed for the PV generator:** a **DC-coupled SBU**, consisting of a PV array, a DC combiner box, a PV battery charge controller and all protection devices; and an **AC-coupled SBU**, consisting of a PV array, a PV inverter and all necessary protection devices.

	GINGESTON	PAMBOOKO	AMAKAKONDE	ABENASTON	KAJAPAATI	JAWJAW	LESPAANSIE	ADAWAI	GUNSI	CLUSTER
PV GENERATOR										
Total PV capacity (kWp @STC)	42	≥ 84	≥ 75	≥ 159	≥ 285	≥ 218	≥ 84	≥ 25	≥ 193	≥ 554
DC-coupled PV capacity (kWp @STC)	≥ 42	≥ 84	≥ 75	≥ 47	≥ 84	≥ 65	≥ 84	≥ 25	≥ 58	n.a.
Number of DC-coupled SBUs	≥ 4	≥ 4	≥ 4	≥ 4	≥ 4	≥ 4	≥ 4	≥ 4	≥ 4	≥ 4, if applicable
Number of AC-coupled SBUs	0	0	0	≥ 4	≥ 4	≥ 4	0	0	≥ 4	≥ 4, if applicable
PV CHARGE CONTROLLERS										
Total rated output of all charge controllers (kW@48V)	≥ 32,3	≥ 64,6	≥ 57,7	≥ 36,2	≥ 64,6	≥ 50	≥ 64,6	≥ 19,2	≥ 44,6	
BATTERY										
Lead-acid	267	534	356	712			400	89	712	
Lithium ion					1024	921				2250
BATTERY INVERTER										
Total rated output (kVA, continuous @25°C)	≥ 20	≥ 40	≥ 40	≥ 80	≥ 120	≥ 120	≥ 40	≥ 15	≥ 40	≥ 290
DIESEL GENERATOR										
Rated output at prime power (kVA)	≥ 20	≥ 40	≥ 40	≥ 80	≥ 120	≥ 120	≥ 40	≥ 15	≥ 40	n.a.

- Also **two types of battery inverters were specified**. A **high-power battery inverter** (LV DC voltage) and a **lower-power battery inverter** (ELV DC voltage).
- **To meet the available budget, two possible battery technologies** were considered: **Li-ion** and deep cycle flooded **Lead-acid.** All electronic equipment (battery inverters, PV charge controllers) shall be compatible with both technologies, allowing a potential future upgrade from Lead-acid to Li-ion. Currently, the contract for construction has been awarded by EBS and detailed construction drawings are been produced. Commissioning is expected by first quarter of 2024.
- All power plants are designed to have a **Solar Fraction above 70 %** at the rated demand and the diesel genset is a complementary source of power.
- EBS will be tasked with the operation and maintenance of the mini grids, the universal national tariff will be applied to consumers, and running costs will be cross-subsidized through EBS country-wide operations.