Clean energy for EU islands

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The BES Islands' Grids: Past, Now, and Future

Parameter	Saba (SEC)	St. Eustatius (STUCO)	Bonaire (WEB)
Annual Electricity Demand	9.2 GWh	17.3 GWh	126 GWh (with rapidly increasing population)
Current Renewable Energy %	40%	55% (increased from 38% in 2024)	25%
Renewable Energy Sources	2 PV power plants + centralized battery storage;	Three hybrid plants, each including PV + BESS;	11 MW wind, 6 MW PV, 14 MW/14 MWh BESS, ~2 MW rooftop PV
Renewable Energy Targets	60% by 2025, 100% by 2030 (89.1% through planned hybrid plant already started while awaiting finance)	Decarbonisation scenarios being analysed (80%), a hybrid plant with wind, PV and storage recommended	Up to 80% (hybrid plan); detailed expansion in hybrid plan 2
Number of Electricity Users	1,380	1,950	13,000
Smart Meter Status	300 digital meters (not remotely monitored), 1,080 analog (Landis+Gyr)	75% digital, 25% analog (all manually read)	~170 smart meters (1.3%, mainly commercial); Landis+Gyr E350 meters
Smart Meter Plan	Planning techno-economic analysis; considering collaboration with STUCO for joint implementation	Planning implementation following Curaçao's example; further details in SES business case analysis	Full implementation 2025-2029; RF450 network being tested; Netinium platform for Meter Data Management

SES Study: BES Status Quo

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Dutch national government and an EU multiannual indicative programme (to be realised by the end of 2025)

Implementing of 0.5 MW wind, 6 MW PV and 15 MW Battery Storage System (BESS) for 89.1% share of RE!

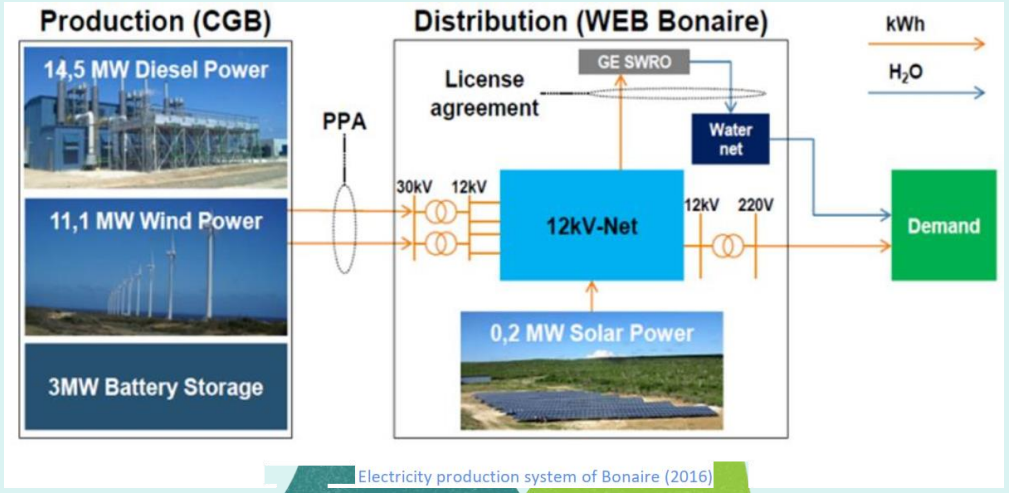
SES Study: BES Status Quo

Parameter	Saba	St. Eustatius	Bonaire
Street Lighting	391 LED (with unused option for smart photocell remote control)	550 LED (not remotely controlled); smart street lighting is planned but not prioritized	4,000 posts total; replacement with remotely controlled smart LED lighting began in 2023 (ongoing project)
Water Infrastructure	Managed by Public Entity of Saba	1,150 analog meters, 8 district digital meters; plan to reduce non-revenue water from 40% to 20% by end-2024	12,000 users, smart meter installation planned; 1,200 wastewater connections
Network Infrastructure	Digital meters read with handheld Itron device, readings uploaded to Itron system	Digital meters read with handheld device; 8 district water meters use Itron Temetra software with RF-based readout	Fiber optic network installed in 2010, RF450 network for smart meters, Netinium platform for meter data management
Additional Smart Grid Features	Energy Sector Strategy in 2019 and **renewable energy road map and action plan** in 2022: Centralised battery energy storage system; planning for smart grid implementation to integrate more renewables; Energy efficiency increase (lighting and solar thermal); geothermal energy analysis;	3 hybrid plants with PV + BESS; planning smart grid implementation for better monitoring and management Flexible demand option (desalination plant);	E-smart asset registration with AI, drone monitoring, power quality meters at substations, AI for early identification of failing components

SES Study: BES Status Quo

Governance and Key Actors

- National government: Ministry of Economic Affairs and National Office for the Caribbean Netherlands (Rijksdienst Caribisch Nederland)
- Regional government: Public Entity of Bonaire, Openbaar Lichaam Bonaire (OLB)
- Vertically integrated utility: Water- en Energiebedrijf (WEB) Bonaire owned by OLB
- NRA: Authority for Consumers and Markets (ACM):
  sets the maximum distribution tariffs that WEB Bonaire may charge for the distribution of electricity since January 1, 2023
- Electricity producer: ContourGlobal



Energy System Characteristics

- Isolated System: No interconnections with mainland or other islands
- Regulatory Framework: Electricity and Drinking Water Act BES
- Seasonal Demand:

1. Higher peaks during weekends and tourist seasons
2. Average load: 24.2 MW (Aug-Oct 2023) vs. 20 MW (rest of year)
3. Higher demand during low-wind periods (increased air-conditioning use)
4. Distribution losses decreased from 17% (2020) to 10% (2023): *mainly non-technical losses*
5. Distributed PV generation is not controllable, which complicates grid management

* Y. Sun paper, 2018

nergy System Characteristics

Generation Capacity

Total Installed Capacity: 34.5 MW

Current Renewable Share: 33% of electricity generation

30kV for production and 12kV for distribution

Generation Mix:

24 MW diesel thermal power plant

12 MW wind

5 MW solar

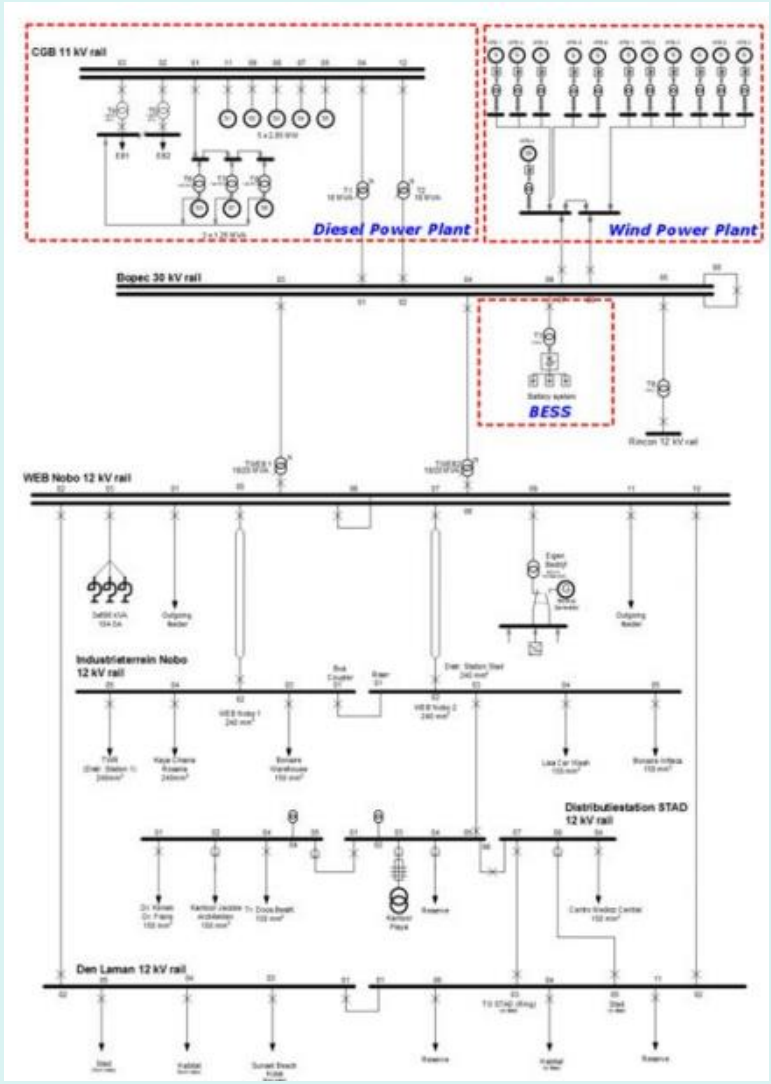
14 MW + 6 MW battery storage systems

System Operation:

Geospatial Energy Mapper system

PPA contract between WEB and CG for supply and ancillary services with the right of refusal and a 2-year ahead load prediction by WEB

60-70 % renewable is technically feasible but the investment is needed for new storage systems for flexibility



* Y. Sun paper, 2018

Energy System Characteristics

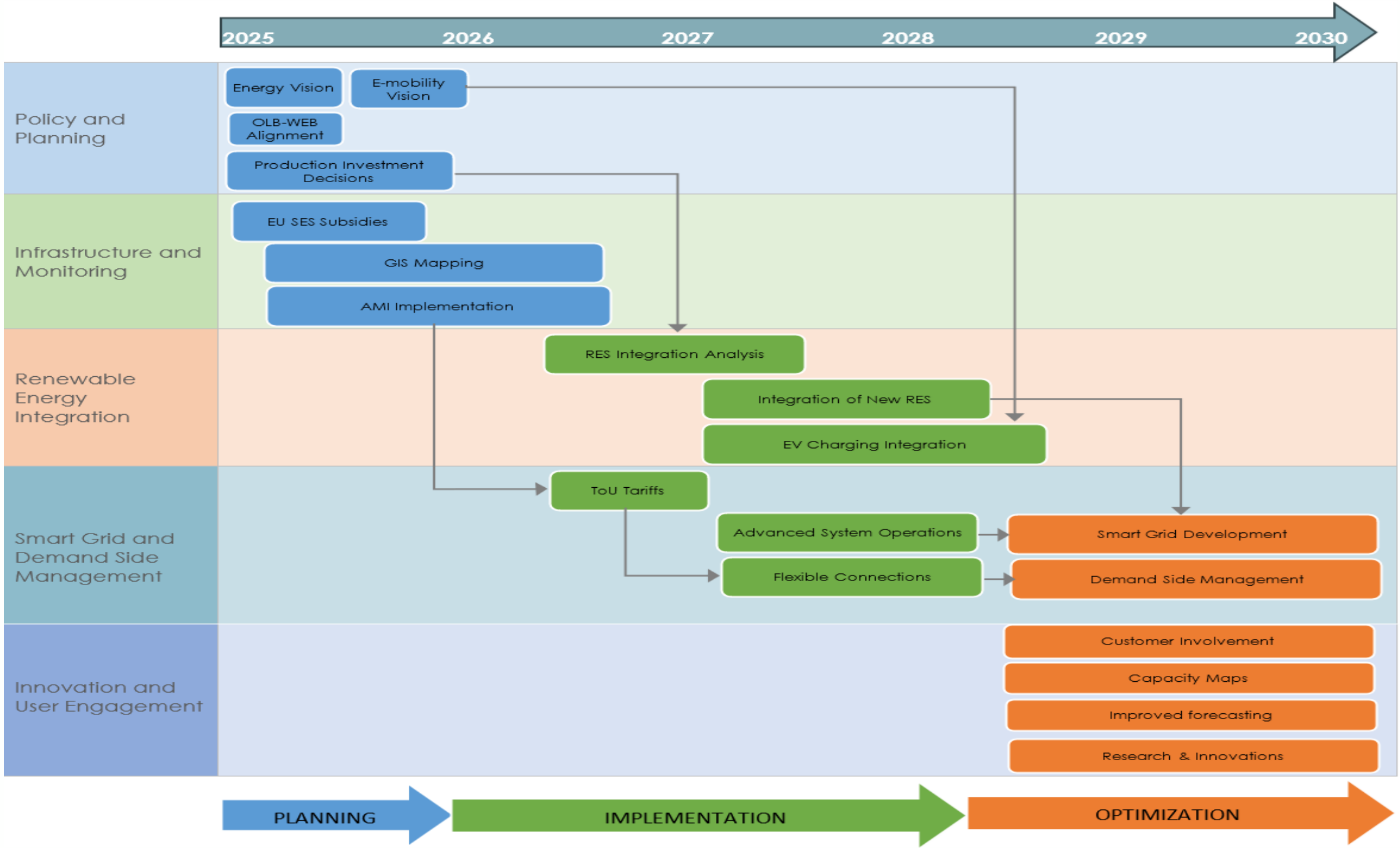
- **No formal procedure** in place for the connection of small, distributed generation facilities
- **Lacks specific legislation** for renewable connections, access to the grid for new generation is limited and kept under control by WEB Bonaire

Energy System Plans

- New producers must apply to the Dutch government (ACM)
- 70% share of renewable energy by 2025
- WEB + CG: expansion of the wind farm and development of a central solar park at Karpata
- a test installation of 792 solar panels (0.2 MW) at Barcadera

Key Challenges

- Grid services and regulatory framework not sufficiently transparent or up to date
- High costs of grid investments and dependence on private investors
- Dependence on imported fossil fuels and materials
- Need for storage or other grid flexibility options
- Lack of control of distributed PV generation
- Disturbances in the grid due to operation with integrated variable RES
- Power cuts from high demand and low flexibility of the grid


2025
2026
2027
2028
2029
2030
Policy and Planning
Energy Vision
E-mobility Vision
OLB-WEB Alignment
Production Investment Decisions
Infrastructure and Monitoring
EU SES Subsidies
GIS Mapping
AMI Implementation
Renewable Energy Integration
RES Integration Analysis
Integration of New RES
EV Charging Integration
Smart Grid and Demand Side Management
ToU Tariffs
Advanced System Operations
Smart Grid Development
Flexible Connections
Demand Side Management
Innovation and User Engagement
Customer Involvement
Capacity Maps
Improved forecasting
Research & Innovations
PLANNING
IMPLEMENTATION
OPTIMIZATION

Parameter	Saba	Bonaire	St. Eustatius
Key Short-term Actions (2025-2026)	• GIS of electricity meters• AMI implementation• Smart streetlighting• EV roll-out	• Development of Energy Vision• Alignment between OLB and WEB Bonaire• Investment decision for sustainable production• Obtaining EU subsidies• E-mobility Vision exploration• GIS mapping• AMI implementation	• Hybrid PV+BESS centralised power plant• Priority upgrades to distribution grid• Advanced metering infrastructure (AMI)
Key Medium-term Actions (2026-2028)	• Time-of-use tariff implementation• Integration of new hybrid power plant• Integration of EV charging infrastructure	• Time-of-use tariff implementation• RE-integration analysis• Integration of new RE• Integration of EV charging infrastructure• Flexible connection agreements• Automated systems implementation	• Smart meter roll-out• Time-of-use tariff implementation• Assessment and implementation of centralized storage• Integration of additional centralized RE• Integration of EV charging infrastructure
Key Long-term Actions (2028-2030)	• DSM of flexible assets• Active involvement of customers• Capacity map updates• Improved forecast and dispatch	• Development of Smart Grid• Demand side management of flexible assets• Active involvement of customers• Capacity map updates• Improved forecast and dispatch• R&I projects	• Demand side management of flexible assets• Active involvement of customers• Capacity map updates• Improved forecast and dispatch

BES Roadmap

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Thank you!

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