



LEDS Global Partnership Case Study: Towards 100% sustainable energy on the Caribbean island of Saba

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“For centuries the Saba people’s livelihood has depended on the sustainable use of the forest and surrounding sea. For this reason, Saba is one of the most pristine islands in the Caribbean. To develop the energy sector, which only came into existence since the 1950s, in a 100% sustainable way, is a logical step in a century old tradition.”

– Mr Menno van der Velde, senior policy advisor, Government of Saba

Key messages

- The Caribbean islands of Saba, Bonaire and Sint Eustatius have been ‘public entities’ of the Netherlands since 10 October 2010. This is the general denomination for administrative divisions within the Dutch state including municipalities and provinces.
- Saba faces fundamental challenges in common with other Caribbean islands. These include an over-dependency on food and fuel imports, insecurity of energy supply, sustainable development, competitiveness, economic integration with neighbouring islands and environmental resilience.
- Current electricity supply depends entirely on one diesel power plant located close to sea level by the harbour. Fifty per cent of the cost of electricity is related to the volatile price of fossil fuels and lubricants. Consumers pay a subsidised rate 35% below the cost of production.
- The Government of Saba has made the decision to transform the island to 100% sustainable energy and eventually eliminate dependence on fossil-fuel-generated electricity. The island’s new energy policy is defined by the ‘Social development plan 2014–2020’ and is further detailed in ‘Saba’s energy sector strategy’. Intermediate targets are 20% renewable electricity by 2017 and 40% by 2020.
- Saba’s energy policy is the result of a robust process of technical studies, analysis, stakeholder consultation and consensus building. Equitable access to and quality of energy for all sectors of society, particularly the poor, is an overarching goal of the policy.
- The implementation of Saba’s energy policy has so far been successful. Two energy infrastructure projects are being implemented thanks to a private–public partnership (PPP) between the Dutch Government and the local Saba Electric Company NV (SEC).
- The first investment is related to security of supply. The current diesel power plant is being upgraded with modern and more efficient slow-turning engines and is being relocated to an area less vulnerable to flooding and other natural disasters. The second investment is

the construction of the first 1 MW photovoltaic (PV) solar system on the island. This first renewable energy system will be operating by the end of 2016 and will provide Saba with 20% of its energy needs.

- Between 2013 and 2015, the energy sector reform on the island received national (Dutch) conditional grants to reduce the risks of SEC losing money in its operations. In addition, technical guidance in the form of specialised analysis and studies have been provided by the Dutch Government to facilitate implementation of the energy policy to increase the share of renewable energy production on the island and reduce greenhouse gas emissions, while at the same time reducing the volatility and cost of electricity production.
- Infrastructure financing for a second renewable energy plant and for the modification of the transmission and distribution grid into an ‘intelligent’ system is being discussed with the European Development Fund (EDF).
- The successful ongoing implementation of Saba’s energy policy provides four important lessons to other Caribbean islands:
 - PPPs are a viable financing mechanism for the transition
 - low-risk off-the-shelf technology solutions are available, rather than taking the risk of using untested new technologies
 - ‘life-cycle analysis’ can be applied to support investment in equipment with fewer operational and maintenance complications, even though initial capital expenses may not be the cheapest
 - a business model should be chosen that guarantees continuity of supply for specific design scenarios that focus on the population.

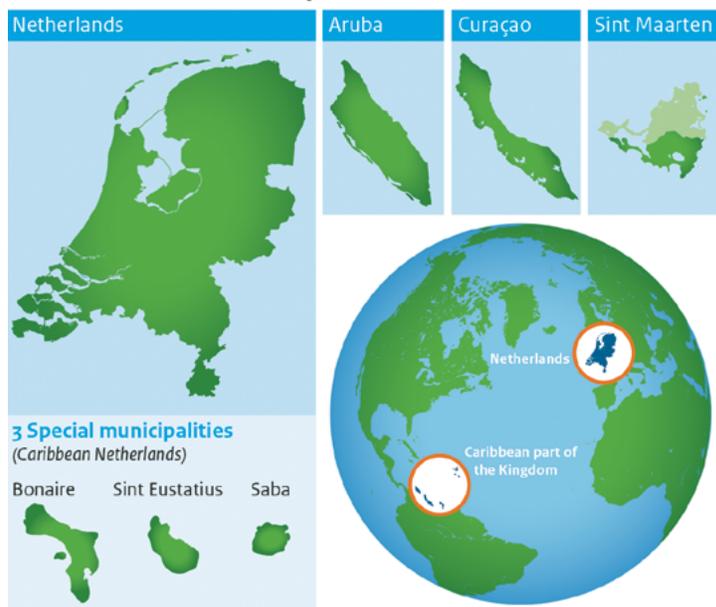
Background

With the dissolution of the Netherlands Antilles on 10 October 2010, the islands of Saba, Bonaire and Sint Eustatius became ‘public entities’ of the Netherlands. ‘Public entity’ is the general denomination for administrative divisions within the Dutch state. This means that the three islands are now officially part of the Dutch state and their citizens are Dutch citizens with all the rights of other Dutch citizens. The status of public entity is defined by the Dutch constitution; the municipalities and provinces of the Netherlands are also public entities. Under this status, the Public Entity Saba is part of the

Figure 1: Countries and special entities of the Kingdom of the Netherlands

Kingdom of the Netherlands

The **Kingdom of the Netherlands** comprises four countries: the Netherlands, Aruba, Curaçao and Sint Maarten.



Source: Kingdom of the Netherlands¹

Netherlands itself but preserves its autonomy with the exception of certain areas including defence, foreign affairs, immigration, health care, education, social affairs and labour – which are fully integrated with the policy framework of the Dutch State.²

The island's governor is the head of the public entity and is appointed by the King of the Netherlands. The Saba governor serves a 6-year term under the authority of the Dutch Minister of the Interior and Kingdom Relations. The governor is responsible for public order on the island and chairs the meetings of both the Island Council³ and the Executive Council.⁴

The Dutch Government remains responsible for specific areas such as justice, education, social security, central taxation, immigration and health. The responsibilities of the Government of Saba are primarily the local economy and infrastructure, similar to provincial and municipal governments in the Netherlands; ultimately, the state is responsible for a reliable and affordable energy service on Saba. The Dutch Government wants to see a fully sustainable energy supply by 2050 in all the country's territory. The Government of Saba has set the target of at least 16% of all energy to be generated from renewable sources by 2023 across the entire territory of the Netherlands. The Government of Saba has the autonomy to develop its own energy sector strategy and implementing policies.

The island of Saba covers 1,295 ha, it is about 4.5 km in diameter and is located 45 km south-west of Sint Maarten in the leeward region of the Caribbean. While it is home to approximately 2,000 permanent residents, the population swells with tourists – the island receives over 25,000 visitors each year. Saba has a rocky coast and the island consists of a dormant volcano, Mount Scenery (887 m), technically the highest point within the Kingdom of the Netherlands. Because of the local microclimate, a rare 'Elfin forest' with unique biodiversity is found on top of Mount Scenery. In 1987 the coastline and surrounding waters of Saba were declared a national marine park.

Saba can be accessed via its small airport and its seaport. These two access points are crucial for the local



Aerial view of Juancho E. Yrausquin airport. Saba's airport has the shortest commercial runway in the world at only 400 m. Source: Flickr/Killians_red



The Saba Bank – one of the largest underwater atolls in the world – covers an area of 2,000 km² and is located south-west of the island.

economy and need to operate with full reliability at all times. The small size of Saba and its difficult access make the island vulnerable to natural disasters.

Since 2011, the US Dollar (US\$) has been the official currency of Saba. The island's GDP in 2012 was US\$43 m, with a per capita gross domestic product (GDP) of US\$21,900. Like many other islands in the Caribbean, Saba's primary source of income is tourism. Other sources of income include agriculture, the Saba University School of Medicine, and artisanal and commercial

fishing. Reducing poverty is the key priority of the Government of Saba, reflected in the unemployment rate that decreased from 12% in 2004 to 4% in 2014. More than 40% of the working population is employed in government offices, health care and education; another 20% work in trade, transport, hotels and services.

Saba shares fundamental challenges with other Caribbean islands. These include putting its economy on a sustainable development path and the needs to increase competitiveness, reduce vulnerability to external shocks, increase environmental resilience, improve cooperation with neighbouring islands and, where possible, better integrate its economy into the regional and global economies.

Energy is also a familiar challenge across the Caribbean, and Saba faces considerable barriers to meet its energy needs sustainably, affordably and reliably. In particular, the difficulties include:

- **Security of supply.** There is a limited capacity for interconnection with the mainland and diversification of energy sources, which creates a serious energy security issue across the Caribbean islands. Saba's small demand makes interconnection unaffordable, and bulk gas shipping and gas or power interconnection with the nearest mainland are more expensive than importing oil.
- **Quality and reliability.** Operational constraints affect the quality and reliability of electricity. Isolated systems like Saba's electricity grid must constantly monitor demand and produce exactly the quantity of electricity required by end-users. This constrains economic development and impacts the quality of life on Saba.
- **High costs.** Expenditure on fuel imports for electricity generation is approximately 6.5% of Saba's total GDP. Spikes in fuel prices result in economic stress because Saba lacks any economy of scale to finance the volatility. Transportation, shipping and transaction costs add substantially to the costs of any infrastructure development on Saba.
- **Technical barriers.** Difficulties in overcoming barriers like adequate equipment maintenance in the harsh environment can hamper the deployment of renewable energy technologies.
- **Exposure to natural disasters.** The largest physical risks for any infrastructure on the island are extreme natural events such as hurricanes, big waves, extreme rainfall or combinations of natural disasters. All energy infrastructure built on the island must be able to resist Category 4 hurricanes.

Overview of Saba's electricity sector

The annual electricity demand on Saba is approximately 10 GWh, which is currently generated by one diesel power plant located at the seaport – entirely reliant on imported diesel fuel.⁵

The volatility of the cost of oil severely impacts Saba's trade balance, government budget and the incomes of energy consumers. Consumers pay a subsidised rate of US\$0.34–0.40 per kWh, artificially priced 35% below the cost of production – subsidised by the Government of Saba. According to an analysis commissioned by the Dutch Ministry of Economic Affairs,⁶ the actual cost of electricity generation can be as high as US\$0.51 per kWh. This roughly equates to an annual subsidy from the Dutch Government of US\$1.5 m or US\$750 per capita.

Fifty per cent of the electricity costs on Saba are related to fossil fuels and lubricants, the other 50% corresponds to operational costs, including maintenance, capital costs (depreciation, amortisation and interest), overheads and administration.

Saba is vulnerable to economic challenges from a combination of rising oil and food prices (mostly imported),



Saba's entire electric supply depends on a 4 MW diesel generator built near sea level.

creating a significant threat to the island. In order to mitigate this risk, Saba has committed to reduce its dependence on fossil-fuel-generated electricity.

Thus, Saba was faced with a decision on what sources of energy are economically viable, technically reliable, environmentally friendly, safe and reduce dependencies on external forces.

Increasing the share of renewable resources in Saba's energy mix will diminish dependence on fuel oil imports. It will also contribute to the diversification of supply options, reduce pollution, stimulate the local economy and employment, and reduce Saba's economic vulnerability to price volatility. The exploitation of renewable energy resources presents opportunities to enhance energy security on Saba.

Policy objectives and coherence

The energy policy for Saba was developed through a robust process of technical studies, analysis, stakeholder consultations and a participatory consensus-building process. These culminated in the 'Social development plan 2014–2020'⁷ and 'Saba's energy sector strategy'.⁸ The vision is to become a 100% sustainable energy island, ensuring that energy comes from local renewable energy sources, and is affordable and reliable.

While energy independence is the main priority of the official energy policy, the cross-cutting strategies focus on four main pillars: sustainability, affordability, energy independence and reliability of the system. In particular, equitable access to and quality of energy for all sectors of society, particularly the poor, is an overarching goal.

Specifically, the social development plan (SDP) states that energy independence is vital to the island's economic stability and quality of life. It also establishes energy efficiency as a key step in making energy more affordable. The SDP prioritises investments in sustainable energy, including generation with renewables, energy efficiency and continuing research into the feasibility of different forms of renewable energy.

The energy sector strategy then further defines the energy policy. The intermediate targets are 20% share of renewable energy in electricity production by 2017 and 40% by 2020. Further details of the strategy's action plan⁹ are presented below.

Overall, Saba's energy policy aims at achieving affordable and sustainable energy supply for everyone. It is coherent with policies on infrastructure, poverty reduction, quality of life and social welfare. It also contributes to the overall objectives of protection and sustainable use of Saba's natural resources, supporting sustainable and inclusive growth by:

- identifying the best renewable energy technology options for the island
- contributing to the diversification of the energy mix
- supporting energy efficiency through the development of 'intelligent' grids
- reducing greenhouse gas emissions from power generation
- protecting and making sustainable use of Saba's natural resources.

As for all municipalities and provinces of the Netherlands, Saba's energy policy is bound by the energy policy objectives of the Netherlands.¹⁰

Action plan

With the 2020 target of 40% renewables, the adopted energy sector strategy has proposed an energy transition action plan¹¹ for achieving its objectives. The actions put forward by the strategy are:

- **Action 1:** Secure electricity supply of the current 4 MW diesel power plant at a lower cost, with lower greenhouse gas emissions and in a safer location less exposed to risks from frequent natural disasters, such as hurricanes, flooding, big waves and extreme weather. This action is already in progress.
- **Action 2:** Increase the share of renewable energy production on Saba by constructing 2 MW of renewable energy infrastructure. A first solar PV of 1 MW is already out to tender.

- **Action 3:** Modify and adapt the current transmission and distribution grid, including the installation of energy storage, to reduce risks from the electricity supply of intermittent renewable energy sources (intelligent grid).
- **Action 4:** Further investigate what renewable energy sources can lead to an affordable, reliable and sustainable energy supply for the island.

The SEC is responsible for carrying out most of these actions defined by the official energy sector strategy.¹² SEC was founded on 1 January 2014 as the successor on Saba to the former Common Electricity Company of the Windward Islands, NV GEBE (in Dutch, Gemeenschappelijk Elektriciteitsbedrijf Bovenwindse Eilanden), the publicly held electric company serving Sint Maarten, Sint Eustatius and Saba. SEC is now a local public corporation, wholly owned by the Government of Saba. The agreement for the break-up of NV GEBE included transfer of all assets and personnel to the respective island governments free of all cost, debt, liens and attachments. With the unbundling of GEBE, there are both benefits and costs expected for the new SEC. For example, a reduction in direct costs may occur in general expenses and the purchase price of fuel. However, a standalone SEC faces cost increases in certain areas, such as auditing and legal fees.

The Government of Saba and the Dutch Ministry of Economic Affairs (MinEz) agreed that SEC must be able to operate on a profitable basis without increasing electricity prices. SEC is now the owner of all of the assets of the electricity system on Saba, including existing and future centralised power plants. As a new company, SEC is dealing with the challenges of building itself into a self-sufficient utility that has the technical and administrative capacities for managing and operating the electricity system. The main challenge is the system's small size.

With 2014 as the first year of operation for SEC, MinEz agreed to form a PPP to cover the losses due to the 35% artificial price subsidy. This PPP included support from MinEz to make SEC's operations financially and environmentally sustainable. As part of the agreement, MinEz is financing Action 1 and part of Action 2, with the construction of the first 1 MW of renewable energy infrastructure. These two investments are currently being implemented; the relocation and modernisation of the current power plant will be finished in 2015 and the 1 MW PV plant will be online in 2016.

The second stage of Action 2 is the construction of an additional 1 MW of renewable energy generation. This infrastructure will either be an additional PV system or a wind turbine. If more solar power infrastructure is built on the island, it could be expected that, on sunny days, the electricity for the island will be largely supplied by PV, and the diesel power plant would be used as secondary generation to balance loads. However, if wind power is not implemented, night-time generation may be an important energy asset required by the island. Again, the diesel power plant would act as a load balancer and serve as backup generation, increasing the island's resilience. (Saba has no central electricity generation redundancy.) In all scenarios, the upgrade of the distribution grid will need additional control and energy storage elements.



Groundworks for the relocation and modernisation of Saba's power plant thanks to the PPP between the Dutch Government and SEC

Financing for the second renewable energy infrastructure and for the modification of the distribution grid into an intelligent grid is being discussed with the EDF.

Budget and timeline

Overview: Saba energy sector strategy

- €1.6 m: First tranche of PPP financing from MinEz for Action 1: Relocation and upgrade of 4 MW diesel generator (installation of slow-turning engines). Contracts signed and relocation underway. Original budget was determined by a Ministry-commissioned study, but has proven to be insufficient on both civil works and on the price of the new diesel engines. The Government of Saba and the MinEz are analysing the cost overruns to correct it. Completion anticipated in 2015.
- €2.0 m: Second tranche of PPP financing for part of Action 2: Design, build and install 1 MW PV turnkey system (including all equipment, civil works, installation, testing and grid integration). Scheduled for completion by the end of 2016.
- Additional 1 MW renewable energy generation. Wind or PV.
- 2016–2019: Investments in upgrading the grid to an ‘intelligent’ grid, improved efficiency and energy storage capability. Finance being sought through EDF.

Contribution to sustainable and inclusive growth

The energy sector strategy of Saba¹³ and its action plan contribute to sustainable and inclusive growth through the following.

- Reducing greenhouse gas emissions from power generation on the island.
- Identifying best options for deployment of renewable energy on the island.
- Contributing to the diversification of the energy mix of Saba.
- Reducing the cost and volatility of electricity production, which will directly benefit the island’s finances and create the possibility of more investment in social welfare.
- Improving the reliability and redundancy of the system, which will have a direct impact on the productivity of commercial and industrial activities on the island.
- Creating business and employment opportunities in the renewable energy sector.
- Increasing the energy security of Saba by reducing its dependence on imported fuel oils.
- Establishing the foundations for the broader support to energy efficiency and actions related to demand-side management with the development of ‘intelligent’ grids.

Local ownership and integration with Dutch national policy

With respect to the energy sector, the Government of Saba works together with MinEZ. MinEZ is responsible for the energy security of Saba. MinEZ promotes sustainability through policies and by encouraging the implementation of sustainable energy projects.

The formulation of Saba’s energy policy has followed a conscious process of internal debate and consultation for creating ownership. Consultations were carried out with a two-phase consensus-building approach. First between the Government of Saba and relevant stakeholders on the island (Chamber of Commerce, SEC, business-sector parties and civil society associations), and later with the Dutch Government.

Saba’s energy policy has been supported throughout by the Dutch Government, first by agreeing jointly with the Saba Government on the policy objectives, and then by commissioning a series of studies to help understand the energy options and feasibilities at the local level. Saba has formulated an energy policy for achieving affordable and sustainable energy supply in an optimal way.

Saba’s energy policy is fully owned by the Government of Saba, SEC, and the most relevant business and civil society associations on Saba.

Replicability on other islands and lessons learned

The implementation of Saba's energy policy provides four important lessons that can assist other Caribbean islands in their transition towards sustainable energy supply.

- 1. Financing the transition:** Going from a fossil-fuel-based system to renewable energy sources is a capital intensive commitment, especially for islands. Their micro-scale economies and the difficulties they face in accessing long-term financing at good rates makes it very difficult to initiate a sustainable energy supply policy. PPPs like the one established between the Dutch Government and SEC are an excellent way to finance the energy transition at the local level.
- 2. Evaluation of technical options:** There is not much room to pilot new or advanced technical options on small islands like Saba. SEC has decided to go for tested, off-the-shelf solutions rather than for 'innovative' or 'promising' solutions. This decision is supported by the Government of Saba. Saba's small size and remoteness make obtaining any necessary technical support complicated and lengthy. If something goes wrong with the energy infrastructure, it may take days for a technical expert to reach the island. Obtaining spare parts is also a lengthy process as they must be shipped from Sint Maarten or from further away. The more innovative and new a technical option is, the longer it will take and more expensive it will be to solve problems during regular operation.
- 3. Implementing best practices:** In the initial evaluations, Saba equally considered wind and solar energy as best options for the island. Both are well known and available with off-the-shelf technologies. However, after a deeper assessment of the advantages and risks, the Government of Saba and SEC have decided to give priority to the construction of PV systems. Wind energy is unlikely to be adopted because of the risk of severe infrastructure damage when hurricanes hit the island. Wind energy would have similar chances compared to PV systems if technology breakthroughs to protect mills (e.g. retractable masts) became commercially cost-effective and available off the shelf worldwide. This is not yet the case.
- 4. Choosing a renewable energy business model:** A lengthy discussion over different business models for the supply of electricity took place on Saba over the past few years. While the choice of decentralised net-metering had some appealing features, it was concluded that, for the size of Saba, a more conventional business model offered more guarantees than a prosumers¹⁴ model. Because of the size of Saba's electricity system, SEC would quickly de-capitalise and not be able to operate, maintain or offer reliability to the system if only few customers decided to produce their energy and sell their surplus to the grid. Current legislation allows for self-production of electricity and for injecting surplus into the grid; however, no tariff has been established as remuneration for injecting surplus energy into the grid.

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2. www.government.nl/topics
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4. Executive body appointed by the Island Council.
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12. Ibid.
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14. Prosumers are businesses or households that both produce and consume electricity.

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