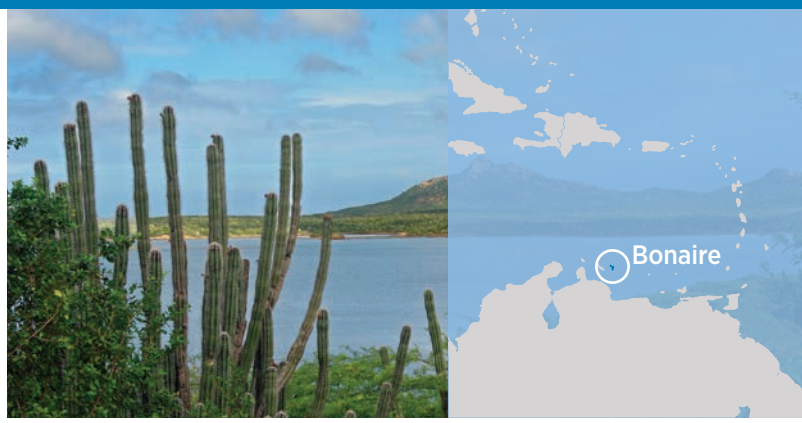
ENERGY TRANSITION INITIATIVE
Islands

Energy Snapshot
Bonaire

This profile provides a snapshot of the energy landscape of Bonaire, a special municipality of the Kingdom of the Netherlands located off the coast of Venezuela. Bonaire's utility rates are approximately $0.35 per kilowatt-hour (kWh), above the Caribbean regional average of $0.33/kWh. Bonaire is a leader in the use of wind power in the Caribbean with approximately one-third of its energy coming from wind. The remaining two-thirds of its electricity is generated from petroleum-based fuels. However, its plans to replace these fuels with biodiesel have the potential to insulate it from the global oil price fluctuations that directly impact the cost of electricity.



Population[1]	17,400
Total Area[2]	288 sq. km
Gross Domestic Product (GDP)[3]	$372 million U.S. dollars (USD)
Share of GDP Spent on Fuel and Imports	Electricity – Unknown Total –2.6%[4]
GDP Per Capita	$21,400 USD
Urban Population Share	Unknown

Government and Utility Overview

Government Authority	**Ministry:** Ministry of Economic Affairs (Netherlands)	
	Key Figure: Minister Henk Kamp	
Designated Institution for Renewable Energy	Ministry of Infrastructure and the Environment (Netherlands)	
Regulator	Authority for Consumers and Markets (Netherlands)	
Utility	**Name:** Water-En Energiebedrijf Bonaire N.V.	Government-Owned

Electricity Sector Data

The utility company for Bonaire is Water-En Energiebedrijf Bonaire N.V. (WEB), which supplies both water and electricity to the island. WEB is a government-owned entity and is strictly a distribution utility, owning no generation of its own. The island's generation assets are owned by ContourGlobal, an independent power producer (IPP) that also operates generation assets on the Caribbean islands of Guadeloupe and St. Martin.[5] Other power producers are allowed but must obtain a permit from the Authority for Consumers and Markets (ACM) and guarantee a continuous power supply.[6]

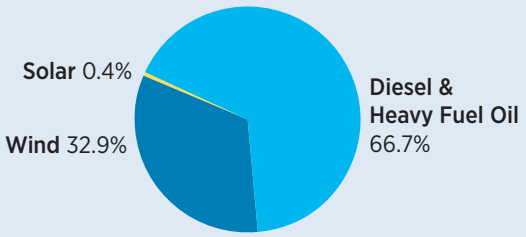
The Ministry for Economic Affairs has sought to improve the governance and performance of WEB through new regulations imposed in early 2014.[7] This move was prompted by

Electricity Sector Overview

Total Installed Capacity[8]	25 megawatts (MW)	
Peak Demand	12 MW	
Total Generation	75 gigawatt-hours	
Renewable Share[11]	33%	
Transmission & Distribution Losses[12]	13.5%	
Electrification Rate	Unknown	
Average Electricity Tariffs (USD/kWh)[13]	**Residential**	$0.35
	Commercial	$0.35
	Industrial	$0.33

Energy Consumption by Sector
Unknown

Energy Generation Mix [9]



Existing Policy and Regulatory Framework

Renewable Energy	
Feed-in Tariff[11]	■
Net Metering/Billing	
Interconnection Standards[6]	●
Renewables Portfolio Standard/Quota	
Tax Credits	
Tax Reduction/Exemption	
Public Loans/Grants	
Green Public Procurement	
Energy Efficiency	
Energy Efficiency Standards	
Tax Credits	
Tax Reduction/Exemption	
Public Demonstration	
Restrictions on Incandescent Bulbs	
Appliance Labeling Standards	
Targets	
Renewable Energy	
Energy Efficiency	

● In Place ■ In Development

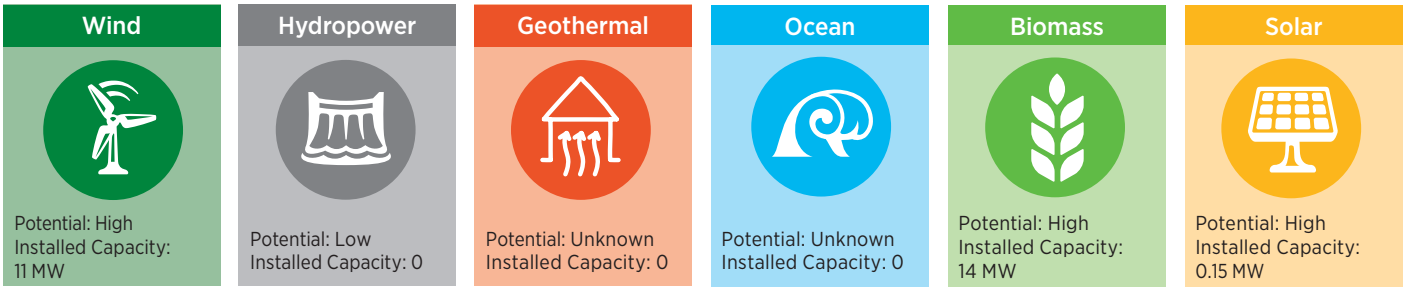
an audit by Dutch government officials, which revealed that WEB was struggling financially and that local and national regulators needed more effective tools to ensure the reliability, affordability, and sustainability of electricity supply to Bonaire.

Clean Energy Policy Environment

As a special municipality of the Kingdom of the Netherlands, Bonaire is largely regulated by ministries of the Netherlands' national government. In recent years, the Ministry of Economic Affairs in the Netherlands has been active in reforming the regulation of the electricity sector in Bonaire, both in terms of utility regulation and expanding generator access.[13]

One of the main regulatory developments has been the establishment of a framework for distributed generation, allowing customers to interconnect their own generation systems to the grid.[6] Unlike IPPs and other "official" generators of electricity, which require a permit from ACM, customer-sited distributed generation can interconnect if it meets a standard set of requirements.[6] The excess generation from these generators will be paid a to-be-determined fixed price under a feed-in tariff arrangement. These policies are targeted to enter effect on July 1, 2015.[11]

Renewable Energy Status and Potential[9,14]



In addition, there has been local interest in developing centralized "solar gardens," a community-based model that would allow those without the means to install their own rooftop system to own and benefit from centralized solar generation.[9]

Energy Efficiency and Renewable Energy Projects

After a fire destroyed the island's sole generating station in 2004, Bonaire developed a plan to serve the island with 100% renewable energy from a single hybrid generating system. The first component of the hybrid system is an 11-MW wind farm, which consists of 12 Enercon E-44 turbines with a capacity of 900 kW each.[14] This model of turbine was chosen because Bonaire judged that it did not have the construction and maintenance resources to support larger, megawatt-scale turbines.

The second element of the generation system is a 14-MW thermal generation station, featuring five 2.8-MW MAN diesel engines that can run on heavy fuel oil, light fuel oil, or biodiesel.[14] These engines will provide baseload power but also have quick ramping speeds to compensate for changes in wind energy output. Project plans call for the eventual production of biodiesel from algae in Bonaire's shallow seaside ponds, which have traditionally been used for the production of salt from seawater.[15] This biodiesel would in turn be used in the diesel engines, enabling a 100% renewable electricity sector. To date, the diesel engines have run on petroleum-based fuels, as research and development for the large-scale production of biodiesel on the island is expected to take significant time and effort.[14]

The last component of the upgraded generation system is a 3-MW energy storage system, built by Saft using their nickel-cadmium battery technology.[16] The battery is anticipated to smooth power fluctuations from the wind energy system and provide a buffer to allow the diesel generators to ramp up as wind output declines. Once a biodiesel supply has been established for the diesel engines, those generators are expected to supply 55% to 60% of the island's energy need, with the wind farm making up the remainder.[14]

Apart from the hybrid wind-diesel-storage system, a pilot solar project was commissioned in March 2015 to study the effects of solar generation on Bonaire's electrical system and determine the feasibility of future "solar gardens" or distributed solar generation.[17]

Opportunities for Clean Energy Transformation

By choosing to recover from disaster with a resilient, renewable electricity supply, Bonaire has set an example in clean energy for the region and the world. Integrating wind power, energy storage, and eventually biofuels makes it an energy leader in far greater proportion than its system size would suggest. If it maintains its focus on energy policies and programs, including energy efficiency opportunities, Bonaire will achieve its energy goals and cement its leadership along the way.

Energy Transition Initiative

This energy snapshot was prepared to support the Energy Transition Initiative, which leverages the experiences of islands, states, and cities that have established a long-term vision for energy transformation and are successfully implementing energy efficiency and renewable energy projects to achieve established clean energy goals.

Through the initiative, the U.S. Department of Energy and its partners provide government entities and other stakeholders with a proven framework, objective guidance, and technical tools and resources for transitioning to a clean energy system/economy that relies on local resources to substantially reduce reliance on fossil fuels.

[1] http://www.cbs.nl/en-GB/menu/themas/bevolking/publicaties/artikelen/archief/2013/2013-3917-wm.htm.

[2] http://www.unesco.org/csi/pub/papers/demayer.htm.

[3] http://www.cbs.nl/nl-NL/menu/themas/macro-economie/publicaties/artikelen/archief/2014/2014-bbp-bonaire-2e-raming-2012.htm.

[4] http://www.cbs.nl/nl-NL/menu/themas/internationale-handel/publicaties/artikelen/archief/2014/2014-bonaire-import-export-2013-art.htm.

[5] http://www.contourglobal.com/press/1176.

[6] http://www.amigoe.com/english/175394-new-legislation-enables-private-persons-to-generate-power.

[7] http://curacaochronicle.com/region/new-dutch-energy-law-in-the-works-for-bonaire-saba-and-sint-eustatius/.

[8] All information in this table is from Power Engineering International, unless otherwise noted; http://www.powerengineeringint.com/articles/print/volume-18/issue-5/features/bonaire-island-of-green-dreams.html.

[9] http://www.saba-news.com/solar-power-pilot-project-bonaire/.

[10] http://blog.rmi.org/blog_2015_01_07_a_caribbean_island_says_goodbye_to_diesel_fuel.

[11] http://docs.liigl.nl/officielebekendmakingen.nl/kst/2014/20141127/kst-415064.pdf.

[12] http://webbonaire.com/en/residential/rates-and-conditions.

[13] http://curacaochronicle.com/region/solar-pilot-project-at-barcadera-bonaire/.

[14] http://www.powerengineeringint.com/articles/print/volume-18/issue-5/features/bonaire-island-of-green-dreams.html.

[15] http://energyblog.nationalgeographic.com/2012/10/01/on-the-island-of-bonaire-views-of-a-potentially-rich-renewable-energy-resource/.

[16] http://www.saftbatteries.com/press/press-releases/saft-energy-storage-system-support-caribbean-island-bonaire-power-grid-switch.

[17] http://www.bonaireinsider.com/index.php/bonaireinsider/category/Government/.

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