

ARUBA

Investment partnerships to move towards a fully renewable energy system

Aruba is positioning itself as a Green Gateway for investment in renewable energy supply. Over the last decade, the island's utility has spearheaded investment in wind and other renewable power options that now account for nearly a fifth of electricity generation. The government has engaged the whole population in the Nos Aruba participative planning process to build a shared view of the future for the island, encompassing social, economic, and infrastructure elements with an overarching theme of sustainability and growth.

Island Profile

Aruba is a developed island in the south Caribbean with 100,000 inhabitants and a high standard of living. It has a flat terrain and semi-arid climate, outside the hurricane belt. Aruba became a colony of the Netherlands in 1636, when it was taken over from Spain, and is now one of four countries comprising the Kingdom of the Netherlands, with its own elected government and parliamentary democracy since 1986. Its economy was once dominated by oil refining owing to its proximity to Venezuela, but three quarters of gross domestic product is now earned through tourism and related services. Given the importance of electricity cost to the large resort hotels of Aruba, it is important to keep the current tariff low to maintain a competitive cost advantage.

Renewable Energy Profile

Aruba has excellent wind resources, from which it now obtains 18 percent of its electricity.

Electricity Access	100 percent
Installed Capacity in 2010	149 megawatts
Renewable Capacity in 2010	30 megawatts (wind, 20% of all capacity)
Electricity generation in 2012	876 gigawatt-hours
Renewable generation in 2010	105 gigawatt-hours (12% of all generation)
Electricity tariff (residential) in 2012	22 to 33 U.S. cents per kilowatt-hour

Additional projects are expected to increase the renewable capacity to 69 megawatts (29 percent share of total capacity) by 2016.

Electric Power Profile

Aruba's electricity is generated by utility company WEB (Water-en Energiebedrijf). WEB started out providing desalinated water for drinking and industrial use in the 1940s, assumed responsibility for electricity generation in the 1950s, and became an independent generation company in 1992. It operated 149 megawatts of capacity, including 30 megawatts of wind capacity, as of 2010. Another company, N.V. Elmar, is responsible for distribution of electricity to the island's 39,000 customers. Both companies are part of a holding company, Utilities Aruba, which is wholly owned by the government.

Political Priority to Enable Investment

The Government of Mike Eman came to power in 2009 with a “Green Gateway Aruba” vision of infrastructure investment to transform Aruba into a “knowledge-based, entrepreneurial and environmentally sustainable economy”. One pillar of the vision is replacing fossil fuels by investment in renewable energy which takes advantage of the island’s favorable wind and solar resources. Another pillar is increasing the capital for infrastructure by attracting international investors to own and operate the wind farms, as well as the projected solar farm and waste-to-energy project, through long term Purchased Power Agreements (PPAs) with WEB. In 2012, the Government of Aruba, the Carbon War Room and the New America Foundation filed a commitment with the United Nations to transition the island to ‘100 percent renewable’ power supply by 2020. WEB interprets this is a goal of zero heavy fuel oil, replaced half by generation from liquefied natural gas (LNG) and half by renewable generation (mainly wind, solar, and biogas).

Aruba has realised the importance of involving the community in a mind shift towards the sustainable use of electricity, which is something often missed in other islands. It has run a series of meetings called Bo Aruba and Bo Barrio to get people to discuss and decide on the future they want to live in. A key element of this is the question of sustainable energy. “To implement a green or renewable energy policy, we need to create momentum and awareness. It is not only the wind turbines and solar panels, but it is a way of thinking as well,” says Dr. Franklin Hoevertsz, Managing Director of Utilities, “With our forward thinking utility companies, WEB and Elmar, strategy advice from Harvard University, and the technical assistance of top Dutch advisors, such as TNO, Aruba is within reach of achieving 50 percent use of renewable energy in the near term.”

WEB’s strategic framework emphasizes demand-side as well as supply-side investment. This includes the installation of 1700 LED streetlights, incentives for efficient appliances, cars, windmills, and solar panels, and increased public awareness and education about sustainability. With TNO expertise, the utility is setting up a Smart Community of 20 new houses which will be the ‘living laboratory’ for a series of new technologies including smart metering, solar PV, energy efficient buildings, biogas from composting, small wind turbines, and electric cars. Their model is to introduce new technology for testing by residents, which promotes social adoption, and the experience gained helps develop new business models and policies.

Market Framework for Investment

The Ministry of Finance, Communications, Utilities, and Energy works closely with Utilities Aruba to ensure that government’s goals and policies are enacted by the management of Elmar and WEB whilst maintaining commercial viability. There is no specific legislated market framework for electricity, other than Commerce regulations. However the Government is pragmatic and aware that Elmar and WEB face significant challenges to continue to deliver low pricing whilst at the same time increasing its risk and investment requirements. These include changing their business model from fossil fuel generation, continually increasing efficiencies in their operation, and resolving grid stability issues to accommodate the intermittent renewable energy inputs of private sector investors. The

Government is supportive of the new technology approach taken by both WEB and Elmar, “We start small and try things”.

Along these lines, Elmar has established a Distributed Generation Interconnection Agreement and Policy to promote the use of solar photovoltaic systems by its customers. The cornerstone of the policy is a feed in tariff (FIT) for photovoltaic systems of up to 10 kilowatts on residential buildings and 100 kilowatts on non-residential buildings. A grid usage fee of 15 Aruban florins (US\$8.38) per kilowatt per month is charged to fund utility investments in grid stabilization equipment, though the first 3 kilowatts of capacity are exempted for residential systems. Residential customers then receive a credit equivalent to 85 percent of the “first bracket A tariff” for each surplus kilowatt-hour they generate from their systems (a credit of 0.332 florins or 18.5 U.S. cents per kWh in November 2013), while commercial customers receive a credit of 50 percent of the “B tariff” (a credit of 0.252 florins or 14.1 U.S. cents per kWh in November 2013). Some 200 kilowatts of photovoltaic power had been installed through this scheme by late 2013. The utility calculates a typical payback period of 5 to 7 years on the associated renewable investment.

The Government has also established an Aruba Free Zone with a number of financial incentives to attract investors into the country. It is hoped that the large investment anticipated into renewable energy projects will enable local companies to be set up to deliver the services required, as well as global companies to set up subsidiaries. Ultimately Aruba hopes to create a centre of excellence in renewable energy transformation which will attract the attention of, and do business with, islands around the world.

Technical Planning for Investment

In 2003 WEB faced an investment decision on how best to increase their generation capacity in order to accommodate forecast demand increases. This coincided with a rapid increase in the price paid for HFO (heavy fuel oil) which was the main fuel for generating electricity. They commissioned DNV KEMA Energy and Sustainability, an international energy consultancy, to carry out a long term planning study for electricity supply in Aruba. This *Energia Aruba 2025* study had a brief to establish the most cost efficient scenario, to reduce the dependency on fossil fuels, and to understand the relationship of water and electricity production to the island’s total demands. KEMA used a green field approach that assumed that existing boilers and turbines will no longer be in service in the future. The recommendations were for WEB to rapidly introduce renewable generation into their portfolio- with all of the technical consequences. This was supported by the intense pressure of rising costs of generation from fossil fuel cost: heavy fuel oil almost tripled in price from US\$36 per barrel in 2005 to US\$107 per barrel in 2012.

As noted by WEB’s Oslin Boekhout, KEMA’s research established that Aruba was well endowed with wind and solar resources. The trade winds provide a commercially viable wind resource on the northern coast, which is not populated and thus allows for easy development of wind farms. KEMA carried out a grid stability analysis and recommended the installation of modern reciprocating diesel engines to provide spinning reserve. In 2004-2005, the company invested in 44 MW of these diesel plants, which can be switched on and off quickly to enable the system to accommodate more intermittent wind and solar

generation. A joint venture of European companies was subsequently formed to develop Wind Park Vader Piet N.V. for US\$75 million with WEB to obtain the output through a power purchase agreement (PPA). The Wind Park entered service in 2009 and together with more efficient diesel engines has halved WEB's heavy oil consumption from 6,180 barrels per day in 2005 to 3,692 in 2012.

Building on this success, the government announced in 2010 that it wanted to plan for an additional 24 MW of wind power, 3.7 MW of solar power, 5 MW of waste-to-energy plants, and 6 MW of residential and commercial solar. Successful incorporation of the additional amounts of wind and solar power will require detailed technical studies to ensure that grid continues to operate reliably.

Aruba's approach is to have an open mind rather than a master plan about how to achieve its vision with a portfolio of renewable fuels generation. It is expected that LNG may well replace HFO and diesel as a lower carbon emissions and much cheaper fuel to supplement renewables. The emphasis is on all concerned to use the 100 percent renewable vision as an inspiration to continually explore options which optimise all the variables.

Both WEB and Elmar work with TNO and with the National Renewable Energy Laboratory (NREL) in the United States to research and model renewable option scenarios. Elmar has analysed the impact on Aruba's power systems of initiatives such as a 4 MW solar park, energy-efficient public housing with solar energy, highly-efficient LED street lights, and electric vehicles. Elmar's research shows that EV fuel costs are just one-sixth of those for a car that runs on petrol. Studies also show that customers could potentially have "free fuel" as each house could supply its own solar energy for its car via a 5 kW system over an area of 32 square metres of rooftop.

Capacity to Implement Investment

To help WEB and Elmar develop their knowledge and skills in renewable energy, the government has encouraged them to partner with the Dutch company, TNO, to transfer skills, research and knowledge between the Netherlands and Aruba. TNO is based in Rotterdam and is the third largest applied science not for profit organization in Europe. According to Jan Ebbing, head of TNO's Caribbean Branch Office, Aruba's extreme weather conditions call for wind turbines and solar panels that are resistant to wind, sun and salt spray so they do not malfunction, and TNO's expertise is valuable in this regard. The next step is for technology manufacturers to come to Aruba, to test their equipment. "Then they can sell it in this environment with a certificate to prove that their windmills are working here. We are using [Aruba] as a hub for Latin America to Europe and vice versa."

Transfer of knowledge and skills is paramount to Aruba's renewable energy ambitions. Just flying in expatriates to do the work is not sustainable. TNO has partnered with Arizona State University to establish a Green Faculty which began to offer courses in May 2012 to give local firms the knowledge required to install new solar equipment. In 2011 a memorandum of understanding was signed between The Government and TNO to develop the Aruba Sustainable Research Institute (ASRI) to test technologies for photovoltaics, wind, deep sea water cooling, and wave energy. The 'know how' transfer of these technologies will

commence through summer courses organized on Aruba for European students. Further ahead ASRI will contribute to Aruba's "Green Gateway" vision by functioning as a regional (Caribbean and Latin American) hub to promote economic and technological exchanges between Europe and our region. Among the first identified projects are the 'Solaroad' and the 'Rooftops Solar Project'. The Aruba Center of Excellence (COE) has also been set up to be the initial point of transfer of knowledge from ASRI to the Aruban community. Their aim is to create a high level of awareness about energy consumption and energy saving for households, government facilities as well as businesses.

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