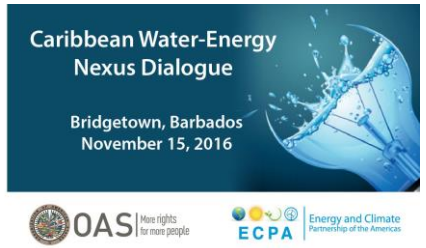
# Caribbean Water-Energy Nexus:

# Linkages between water and energy in the Caribbean

OCTOBER 15, 2016

HORACE ARCHER

DIVISION OF ENERGY AND TELECOMMUNICATIONS



# About the Division of Energy and Telecommunications

The Division is charged with the management of Barbados' energy sector and the development of Barbados' national energy policies and legislations. This encompasses the oil and gas sector, electricity sector and renewable energy sector.

The Division’s goal is to ensure that Barbados maintains a stable energy sector which supports sustainable economic and social development. Recognizing the strengths, weaknesses and opportunities which characterize the Barbadian economy, the Division of Energy revised the Electric Light and Power Act in 2013. This Act provides Independent Power Producers (IPPs) the opportunity to sell electricity from renewable energy sources to the Utility Company.

# Overview of Barbados' Water Supply

The island of Barbados is classified as water scarce and is ranked among the world's ten most water scarce countries. This classification is based on Barbados' resource per capita being less than three hundred and ninety cubic metres per person per year.

- Average annual rainfall is 1422 mm, ranging from an average of 1875 mm per year in the higher central area of the island to 1275 mm in the low lying coastal zone.

- The Barbados Water Authority (BWA) is the Statutory Body charged with supplying potable water for the island as well as monitoring and protecting water resources. The BWA pumps on average approximately 30 million gallons of water per day.

- This is supplemented by Ionics Freshwater Ltd which is a Brackish Water Reverse Osmosis (BWRO) Desalination Plant capable of supplying 30,000$m^3$/day. On average it supplies approximately six percent of the potable water supplied by the Barbados Water Authority.

# Overview of Barbados' Water Consumption

- Agricultural sector (68%, 23% from BWA)
- Domestic (22%), Commercial, Industrial
- Waste treatment plant
- Electricity Generation (Fossil Fuel Based)
- Oil and gas sector
- General Hospital
- The Rum Industry
- Biofuels production (Proposed ethanol and biogas)

# Water Consumed at the Power Plant

The average monthly water consumption of process water from Barbados Water Authority and Ionics. Closed loop system but there are losses due to evaporation.

- Steam Station - 3,846.2 m3
- Low Speed Diesel Station - 1,308.4 m3
- Low Speed Diesel "B" Station - 782.8 m3

Cooling water usage – Water pumped from wells on location

- Steam Station – 50,000 gallons/min
- Low Speed Diesel Station – 3,250 m3/hr
- Low Speed Diesel "B" Station - 650 m3/hr

# Water Consumed in the Agriculture Sector

Agriculture is the largest single consumer of water in Barbados and forms an important part of Barbados' economy. In 2011 the food import bill was in excess of US$300million and has remained around this level in subsequent years. Despite this local production of food has been declining in many instances due to limited access to affordable water and the high cost of energy.

# Water Consumed by BNOCL

The process of extracting fossil fuels requires large quantities of water during the drilling stage of production. Several 1000 of cubic metres of water per month are required for the drilling process and the drilling process can go on for several months.

# Biofuels Production

Cane Industry Restructuring Project (CIRP)

- As reported in the media the aim of the CIRP is the generation of 25 MW baseload electricity from 330,000 tones of cane and 150,000 tons of river tamarind. This electricity will be exported to the grid.

- The generation plant will feature water saving technology which uses air cooled condensers instead water cooled. Recycling water plus the harvesting of rain water for washing down of the facility.

- The feedstock (Sugar Cane and River Tamarind) does not require any irrigation and is in fact totally rain fed. The water extracted from the sugar cane when crushed can be used in the process.

# The Linkage Between Water and Energy

Water and Energy form part of an interconnected, interdependent chain. Energy is needed to pump water from underground aquifers; for desalination; and for water treatment. On the other side water is needed for the extraction and processing of fossil fuel and thermal power plant cooling systems.

# Water neutral Electricity generation

The widespread adoption of technologies such as solar and wind could significantly reduce the demand for water in the power generation sector. Unlike thermal power plants no additional cooling is required for these types of RE technologies.

Proposed Ocean Thermal Energy Conversion (OTEC) projects could potential generate electricity from the temperature differentials at different depths of water but could also produce desalinated water economically.

# BWA Losses

It is estimated that Non Revenue Water (NRW) in the BWA's network is between 44-49%. Reducing these losses could significantly improve BWA's cash flow and make more water available to households or other sectors of the economy. As the single largest user of electricity in Barbados the BWA intends to reduce its financial burden by implementing several energy saving technologies with an overall goal of 5% reduction in energy. This will be done by:

- Installation of Variable Frequency  Drives (VFDs) and high efficiency pumps

- Photovoltaic systems

- Geographic Information System (GIS) and Supervisory Control and Data Acquisition (SCADA)

# Energy Conservation measures in the Water Sector

Water Authority Plans to reduce Energy Consumption

- Goal of 5% reduction in energy
- Installation of Variable Frequency  Drives (VFDs) and high efficiency pumps
- Photovoltaic systems
- Geographic Information System (GIS) and Supervisory Control and Data Acquisition (SCADA)

# Future Scenarios for Water Consumption Patterns in Barbados

- Increased population and increased standard of living
- Larger Agriculture Sector
- Larger Tourism Sector

# Low Energy methods of water reclamation

- **Rain water harvesting**. Mandated by the Town and Country Planning Department for new constructions. Commonly used throughout Latin America and the Caribbean. Suitable for irrigation and in some regions used as potable water after purification.

- **Air conditioner condensate**. In tropical climates a typical 12,000 BTU air conditioning unit can produce more than 1 litre of water per hour and a high efficiency inverter air conditioning units can consume less than 1kW of electricity per hour per Ton of cooling. Recovery of water from A/C units is not widely used but has potential as a low cost source of greywater. Many air conditioned commercial office building in Barbados produces more condensate than it needs for toilet flushing.

“According to the Alliance for Water Efficiency (US), the amount of condensate water can range from 3 – 10 gallons/day per 1,000 square feet of airconditioned space.”

# Effect of Energy Prices on the Price of Water

The BWA's Rates are fixed to the consumer but in actuality the true cost of potable water from the BWA fluctuates significantly with the price of electricity.

- $2.48 per m3 (0-8 m3);

- $3.10 per m3 (9-20 m3);

- $4.66 per m3 (21-40 m3) and

- $7.78 per m3 (over 40 m3)

# Energy-Water-Food Conflicts

# THANK YOU

CONTACT DETAILS:

Horace Archer

Senior Technical Officer

Division of Energy and Telecommunications

Trinity Business Centre

Country Road, St. Michael, Barbados, W.I.

Tel: (246) 535-2553

Email: harcher@energy.gov.bb