DEVELOPMENT OF RENEWABLE ENERGY MARKET IN JAMAICA

A Regulatory Perspective

Office of Utilities Regulation
Courtney Francis
2018 February
“Jamaica, the place of choice to live, work, raise families and do business”

“A modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behavior on energy issues and an appropriate policy, regulatory and institutional framework”
PRESENTATION OUTLINE

- Legal and Regulatory Framework
- Overview of the Electricity Sector
- Rationale for RE Development
- RE Development Process
- Procurement of RE Generation
- OUR’s Present Role in the RE Generation Process
- RE Generation Integration Issues
- Measures to Manage RE Integration
- Long-term Strategies
LEGAL & REGULATORY FRAMEWORK

- The Electricity Act, 2015 (the “EA”)
- JPS Electricity Licence, 2001 (amended 2011 & 2016)
- The Office of Utilities Regulation Act (as amended)
- The Electricity Sector Codes [Generation, T&D, Despatch and Supply]
- National Energy Policy (NEP)
- Draft Electricity Regulations for Net Billing, Auxiliary Connections and Power Wheeling being developed by MSET
Goal 3: Jamaica realizes its energy resource potential through the development of renewable energy sources and enhances its international competitiveness, energy security whilst reducing its carbon footprint.

Goal 4: Jamaica’s energy supply is secure and sufficient to support long-term economic and social development and environmental sustainability.

Electricity Act, 2015: promotes the use of renewable and other energy sources.
The Office of Utilities Regulation (OUR) is a multi-sector regulatory agency established in 1995 by the Office of Utilities Regulation Act (as amended). Section 4 of the OUR Act provides for the office to:

1. Encourage competition in the provision of prescribed utility services
2. Protect the interests of consumers in relation to the supply of a prescribed utility service
3. Encourage the development and use of indigenous resources
OVERVIEW OF ELECTRICITY SECTOR

Governance Structure

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d) Promote and encourage the development of modern and efficient utility services

e) Enquire into the nature and extent of the prescribed utility service provided by a licensee or specified organization

The OUR has regulatory responsibility over:

- Telecommunications services
- Water and sewerage services
- The generation, transmission, distribution and supply of electricity
# Overview of Electricity Sector

## Responsibilities

<table>
<thead>
<tr>
<th>2001 - 2007</th>
<th>Since August 2015: Major Changes</th>
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<tbody>
<tr>
<td>- JPS responsible for System planning and generation procurement based on Licence and Regulatory Policy.</td>
<td>- MSET (Minister) – responsible for planning the System (IRP) and issue Electricity Licences</td>
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<tr>
<td>- OUR issue recommendations for Electricity Licences &amp; approve PPAs.</td>
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<tr>
<td>- Energy Ministry issue Electricity Licences.</td>
<td>- Manage Net Billing programme set the capacity limits</td>
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## After 2007

- OUR assume responsibility for generation planning and procurement (enshrined in JPS Licence in 2011). Make recommendations for Electricity Licences & approve PPAs.
- Energy Ministry issue Electricity Licences
- OUR – approve PPAs executed between IPPs and Single Buyer
  - Develop standard offer contract (SOC) for Net Billing arrangement
OVERVIEW OF ELECTRICITY SECTOR

Market Structure

- Single Buyer Model – vertically integrated electric utility with IPP participation
- JPS is currently the Single Buyer (SB)/System Operator (SO): *has exclusive right to transmit, distribute and supply electricity under Licence*
- Price Control Regime: *Previously Price Cap, now Revenue Cap*
- Revenue adjusted annually using PBRM
- Sector Regulator: OUR

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System Orientation & Performance Characteristics

- **Functional Generation Capacity**: ~ 941MW (JPS – 61%, IPPs – 39%)

- **RE Capacity (non-firm)**: ~ 144MW
  - JPS Hydro – 22 MW
  - JPS Wind – 3 MW
  - IPP Wind – 99 MW
  - IPP Solar – 20 MW
  - Net Billing – 5.8 MW

- **System Peak Demand (Gross)**: 666.7 MW (2017 September)

- **System Net Gen**: 4,361 GWh (2017)

- **Customer Base**: ~ 630,000 (2017)

- **7 Major generation locations across the Island**:
  - JPS (Conventional): Bogue, Rockfort, Old Harbour, Hunts Bay
  - IPP (Conventional): Old Harbour, Rockfort, West Kingston
  - IPP (RE): Wigton (Wind), Malvern (Wind), Content Village (Solar PV)

- **Transmission Voltage**: 138kV and 69kV
- **Substations**: 44 both 138kV and 69kV
Overview of Electricity Sector

System Performance

Typical Daily Load Curve

2017 Net Gen by Fuel Type

- HFO 68%
- NG 19%
- Wind 7%
- Solar 1%
- Net Billing 0%
- ADO 2%
- Hyro 3%

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Rationale for RE Development

- Limited primary energy resources
- High dependence on imported fossil fuel
  - energy sector vulnerable to oil price volatility and disruption in energy supplies
- Energy Security
  - Need to transition to more diversified energy mix
  - Development of RE resources to increase energy security.
    - Reduce dependence on imported fuel oil
    - Reduce potential energy supplies issues
    - Reduce carbon footprint

Jamaica Energy Situation

- Net Generation by Source - prior to 2004
  - 2003 data
    - Total Net Gen: 3,696 GWh
    - Net Gen from Fuel Oil: 3,550 GWh
    - Net Gen from Hydro: 146 GWh

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Wigton Windfarm Limited (WWFL) established in 2000 by GOJ to develop windfarm project

Licence granted to supply 20.7 MW (23 x 0.9 MW WTGs) of generation capacity to system

20 year PPA executed with JPS in 2001

Energy Price – 5.05 US cents/kWh (all in)

Wind Generation Facility (Wigton I) commissioned in 2004
Average Annual Cap Factor: 30%, \textit{(initially projected at 35\%)}

\textbf{Early Financial Problems}

- Forecasting issues resulted in lower than expected annual net generation
- Financing issues affected cost coverage
- Reactive Power (Mvar) issues introduced additional operating costs

- WWFL requested PPA price review in 2010 (citing 2009 NEP provisions).

- OUR adjusted PPA price to “Avoided Cost” plus 15\% (premium) in 2010.
In 2006, OUR issue Regulatory Policy Document: “Guidelines for the Addition of Generating Capacity to the Public Electricity Supply System”

RE Generation classified in three categories:
- Large additions: plants of sizes greater than 15 MW
- Medium additions: plants greater than 100 KW but less than 15 MW
- Small additions: plants of 100 KW and less

RE generation greater than 15 MW would be subject to competitive tender

Simpler method for additions up to 15MW

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Renewable Energy Technologies (RETs)

- Classification applies to plants in which the source of primary energy is continually naturally regenerated. Such sources of primary energy include solar irradiation, wind, rivers and biological cycles.

- Generation Expansion Plan (GEP) should identify block of capacity for RE generation. (Utility-scale and Behind-the-Meter (BTM))

- RETs mainly compensated on a “Energy Only” basis due to resource intermittency.

- RE output should be priced at avoided cost plus premium (15%)
In 2008, OUR issued RFP for RE generation projects on a BOO basis:

- RFP issued to meet 2005 NEP RE target of:
  - 10% in 2010 and 15% in 2015

- RFP influenced by upward pressure on electricity prices due to rising oil prices

- Any proven RE technology with capacity of (1) MW or greater was permitted:
  - Biomass, Hydro, Solar and Wind, etc.

- Requirement for additional RE generation of:
  - 640,000 MWh per year (equivalent cap. ~ 73MW)
Outcome of 2008 RE Generation Tender

- Five (5) Proposals received
- Two (2) Projects awarded to JPS
  - JPS Maggotty Hydro Project - (COD – 2014 Feb)
  - JPS Munro Wind Project - (COD – 2010 Nov)
- Projects ring-fenced and treated as “JPS managed IPP assets” with separate cost recovery mechanism
- Energy priced at Avoided Cost + Premium

**JPS Maggotty Hydro**
- Capacity – 6.37 MW
- Production – 26 GWh/year
- Cap Factor – 45%
- Fuel Cost Savings – US$5.2M/year @2008 fuel price

**JPS Munro Wind Farm**
- Capacity – 3 MW
- Production – 10.5 GWh/year
- Cap Factor – 40%
- Fuel Cost Savings – US$2.2M/year @2008 fuel price
NEP revised 2009 - sets out policy objectives for 2009-2030
- RE Participation in 2009: 5% of Net Gen
- 2030 Target Revised to: 30% (but unofficial)
"Unsolicited Proposal" for Wigton II

Total Project Capacity: 18 MW Wind Power (9 X 2MW) WTGs

Proposed price: Avoided Cost plus premium

Capacity Factor: 30%

WWFL applied for 14 MW Licence – due to JPS Licence (2001) and Regulatory Policy capacity limit of 15 MW

14MW Licence granted

Project (18 MW) commissioned - 2010 December
RE GENERATION PROCUREMENT

WWFL Capacity Expansion (2009-2010)

- WWFL requested second Licence for extra 4MW for same facility without physical separation
- 4 MW licence not recommended due to inconsistency with legal capacity limit of 15MW. Extra 4 MW would have violated JPS Licence conditions.
- JPS Licence amended in 2011 to accommodate Wigton II (18MW). Capacity Limit increased from 15MW to 25MW

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**THE JAMAICA GAZETTE EXTRAORDINARY**

[AUGUST 19, 2011]

4. For capacity additions of under 15 MW the Office may, after consultation with the Licensee, approve a simpler procurement methodology, on a case by case basis. Notwithstanding the foregoing, for capacity additions of up to 25MW which are generated from Renewable Sources, the Office, may approve a simpler procurement methodology provided that the capacity from Renewable Sources shall not exceed twenty percent (20%) of net energy to the System and provided further that in the exercise of its functions herein the Office shall take account of system stability and the overall price to be paid by customers of the Licensee for a Supply of electricity.
The Net-Billing programme permits Customers/Self-generators with small RE generation facilities (up to 100kW) to export excess electrical energy to the System.

Standard Offer Contract (SOC) governs the commercial arrangement with JPS for sale of excess energy.

- 2 Year Pilot Project commenced 2012 May
- Capacity capped at 2% of System peak demand ~ 12MW
- Up to 10kW - Residential customers
- Up to 100kW - Commercial customers
- Retail rate for electricity imported from System

Big debate over net-billing vs net-metering.
OUR adopted net-billing based on cost allocation principles.
CUSTOMER-BASED (BTM) RE GENERATION

2012 Net Billing Programme

- NEO exported to system priced at short run marginal cost of generation + 15% (premium)
- OUR developed SOC document
- Application for interconnection required
- Electricity Licence required to supply power
- Pilot programme eventually ended in 2015
- Programme administered by MSET since 2017

<table>
<thead>
<tr>
<th>Description</th>
<th>KW</th>
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<tr>
<td>Target 2% of System Peak</td>
<td>12,000</td>
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<tr>
<td>Application Received</td>
<td>14,789</td>
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<tr>
<td>Commissioned</td>
<td>5,223</td>
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New MSET Administered Program 2017

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<th>Licence Issued</th>
<th>Commissioned</th>
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<tr>
<td>Qty</td>
<td>KW (Inverters)</td>
</tr>
<tr>
<td>55</td>
<td>1120.35</td>
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In 2012, OUR issued RFP for RE generation projects to supply ~417 GWh (115 MW), on a BOO basis, to meet 2015 target. Influenced by rising oil prices.

### Proposals that Responded to RFP

<table>
<thead>
<tr>
<th>Firm Capacity (37MW Tendered)</th>
<th>Energy Only (78MW Tendered)</th>
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<tbody>
<tr>
<td>RET</td>
<td>RET</td>
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<tr>
<td>No. of Proposals</td>
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<tr>
<td>Biomass Conversion</td>
<td>Wind</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Wind</td>
<td>Solar PV</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
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<tr>
<td>Solar Cogeneration</td>
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31 Proposals received

Three (3) Projects selected for Electricity Licence and PPA with JPS:

- Wigton III: 24MW Wind Power, CF – 30%, COD - 2016
- BMR: 34MW Wind Power (negotiated to 36.3MW), CF – 34%, COD - 2016
- Content Solar (WRB): 20MW Solar PV, CF – 24.95%, COD-2016

No Firm Capacity proposals selected

RE Capacity Procured

80.3 MW
In 2015, OUR was requested by Cabinet to complete the procurement of 37 MW (Net) of RE generation outstanding from the 2012 RFP (115 MW) process.

### 37 MW RFP (Net) - Proposals Received based on RET

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<tr>
<td></td>
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<td>RET</td>
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<tr>
<td>Biomass</td>
<td>Wind</td>
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<td></td>
<td>Solar PV</td>
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<tr>
<td></td>
<td>Hydro</td>
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<td></td>
<td>Waste to Energy</td>
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- 19 Proposals Received
- One (1) Solar PV project selected for Electricity Licence and PPA with the JPS
2015 RE Target – Additional RE Procurement

In 2015, OUR was requested by Cabinet to complete the procurement of 37 MW (Net) of RE generation outstanding from the 2012 RFP (115 MW) process.

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Eight Rivers Energy Company (EREC): 33.1MW (negotiated to 37MW), CF – 25.69%, Paradise Park, Westmoreland

- Scheduled Commissioning – 2018 December: project on schedule
- Significant reduction in capital cost and energy price
- Energy Price: **8.5 US cents/kWh** (compared to 18.80 US cents/per kWh prior)
RE Generation Contribution Since 2004

- RE Generation capacity added since 2004: 128 MW
- EREC 37MW Solar PV project Scheduled for commercial operation 2018 December
- 2015 RE Target projected to be achieved by 2020
Verify that IPPs receive Electricity Licences to supply electrical output to the System.

Review and approve PPAs executed between IPPs and SB:
- Determine mechanisms for payments and indexation
- Evaluate cost impact of RE projects/PPAs

Ensure compliance with the Electricity Sector Codes, including interconnection requirements

Assess risks associated with PPAs and ensure they are appropriately allocated

Address PPAs and SOCs related disputes between SB and IPPs/self generators
Since the addition of 80.3MW of VRE (wind & Solar) in 2016, JPS reported stability issues caused by significant variability in RE generation.

Response limitation of existing generating units constrains them from ramping fast enough to counter rapid variations in VRE output.

Sub-optimal generation dispatch operations

Adverse effect on Heat Rate and increased production cost

Part-load operation of generating units, increasing emissions and reducing operating life of equipment

Impacts System reliability, security, stability and power quality

Power management and power quality issues at the distribution level due to distributed RE resources.
RE GENERATION INTEGRATION ISSUES

RE Intermittency on JPS System in 2016

- Unpredictable and steep RE ramps
- CSL ramping at 7.9 MW/Min
- JPS units ramping capability: 1 MW/Min – 5 MW/Min
RE GENERATION INTEGRATION ISSUES

System Operator Immediate Response to RE Intermittency

- Automatic and/or Manual Load Shedding
- Ramp up Online Generating Units
- Start up Gas Turbine (GT) Units

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MEASURES TO MANAGE RE INTEGRATION

JPS Grid-Scale Energy Storage Project

As part of a comprehensive grid infrastructure modernization programme to bolster system security, reliability and resilience, JPS identified energy storage (ES) to address the RE integration issues.

- HESS Configuration: 24.5 MW grid-scale hybrid energy storage system
- 21.5MW/16.6MWh of Li-ion battery storage, and 3MW of low-speed flywheels
- ES Project approved by the OUR, 2018 February
- HESS to be commissioned into operation by 2018 December
MEASURES TO MANAGE RE INTEGRATION

Broad Measures to be Considered

- A comprehensive approach to System planning to address RE integration issues: planning and integration studies with focus on System reliability, stability, security and power quality.

- Ensure that the regulatory framework, RE procurement strategies and market design support measures to address the variability of RES and RE generation integration requirements.

- Implement systems to better manage the power system as the proportion of VRE increases, maintain grid performance and minimize costs: consider use of advanced forecasting systems, automated control systems (AGC) and smart grid technologies.
MEASURES TO MANAGE RE INTEGRATION

Broad Measures to be Considered

- Encourage investments in firm and flexible capacity and incorporate Energy Storage.

- Greater coordination between Policy-maker, System Planner, System Operator and Sector Regulator.

- Policy, planning and regulatory interventions should seek to minimize overall System costs in meeting RE targets.
MEASURES TO MANAGE RE INTEGRATION

Other Strategies

Long-term planning for RE integration:

- Evaluation of siting of RE projects using criteria for optimal integration: proximity to the transmission system could be more crucial than quality of RES at a particular project site.

- Establishing RE targets and growth rates, taking into consideration complementary generation investments, and T&D reinforcement.

- A balanced mix of RES: geographical dispersion and diversification of VRE tend to reduce aggregate variability.

- Increasing the flexibility of the System to ensure economic dispatch at high levels of VRE: configuration of committed conventional generation projects may not provide the support required.

- Evaluation of the merits of incorporating non-conventional frequency regulation assets in the system.

- Incorporation of weather tracking and anticipation of nature imposed changes in RE generation facilities.
In Jamaica, we would say Renewable Energy is “Up and Running”. But **Caution**!

- Public Policy prescriptions for RE development should be properly assessed to avoid undue burden on rate payers.

RE penetration targets should be consistent with configuration and capability of physical infrastructure to avoid operational issues.

Aspirational targets should be aligned to tangible projects, to achieve outcomes.

There is no need to re-invent the wheel.
Questions?