# DEVELOPMENT OF RENEWABLE ENERGY MARKET IN JAMAICA

## A Regulatory Perspective

*Office of Utilities Regulation*
*Courtney Francis*
*2018 February*

# JAMAICA ENERGY SECTOR VISION

**Jamaica's National Vision**

"Jamaica, the place of choice to live, work, raise families and do business"

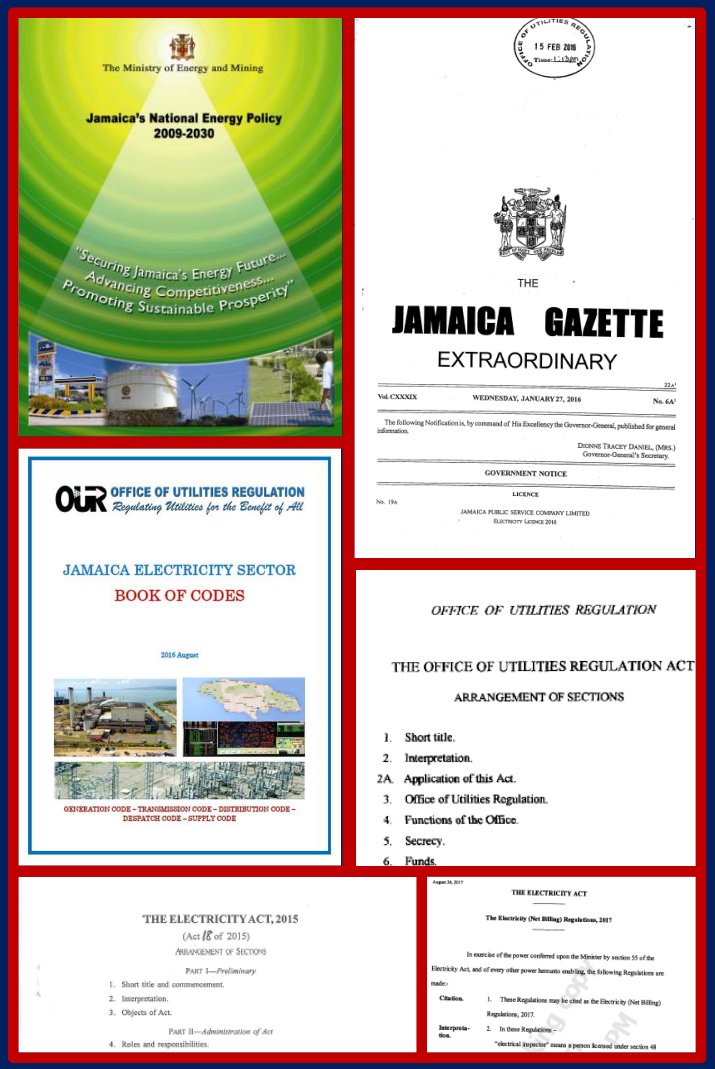
**Vision of Jamaica's Energy Sector**

"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

# LEGAL & REGULATORY FRAMEWORK

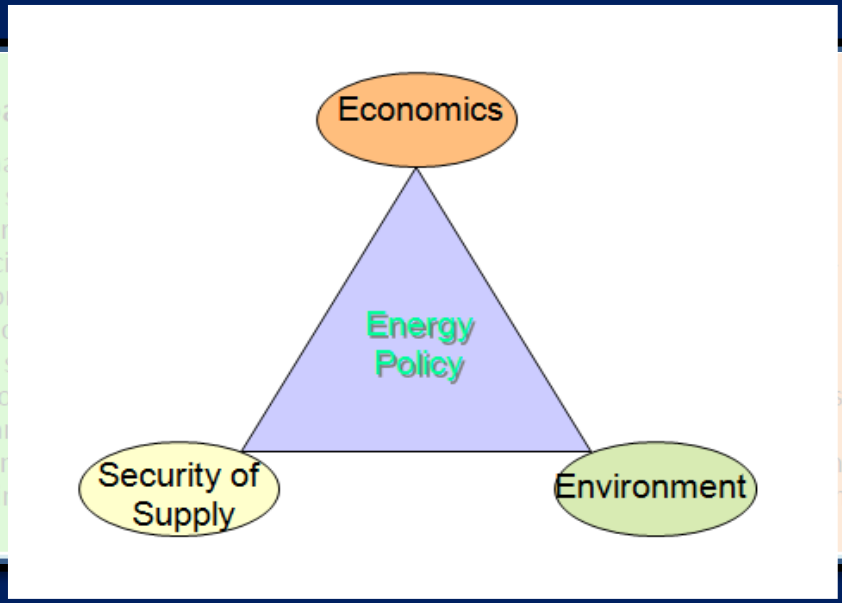
## Energy Policy RE Development Goals

### 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:

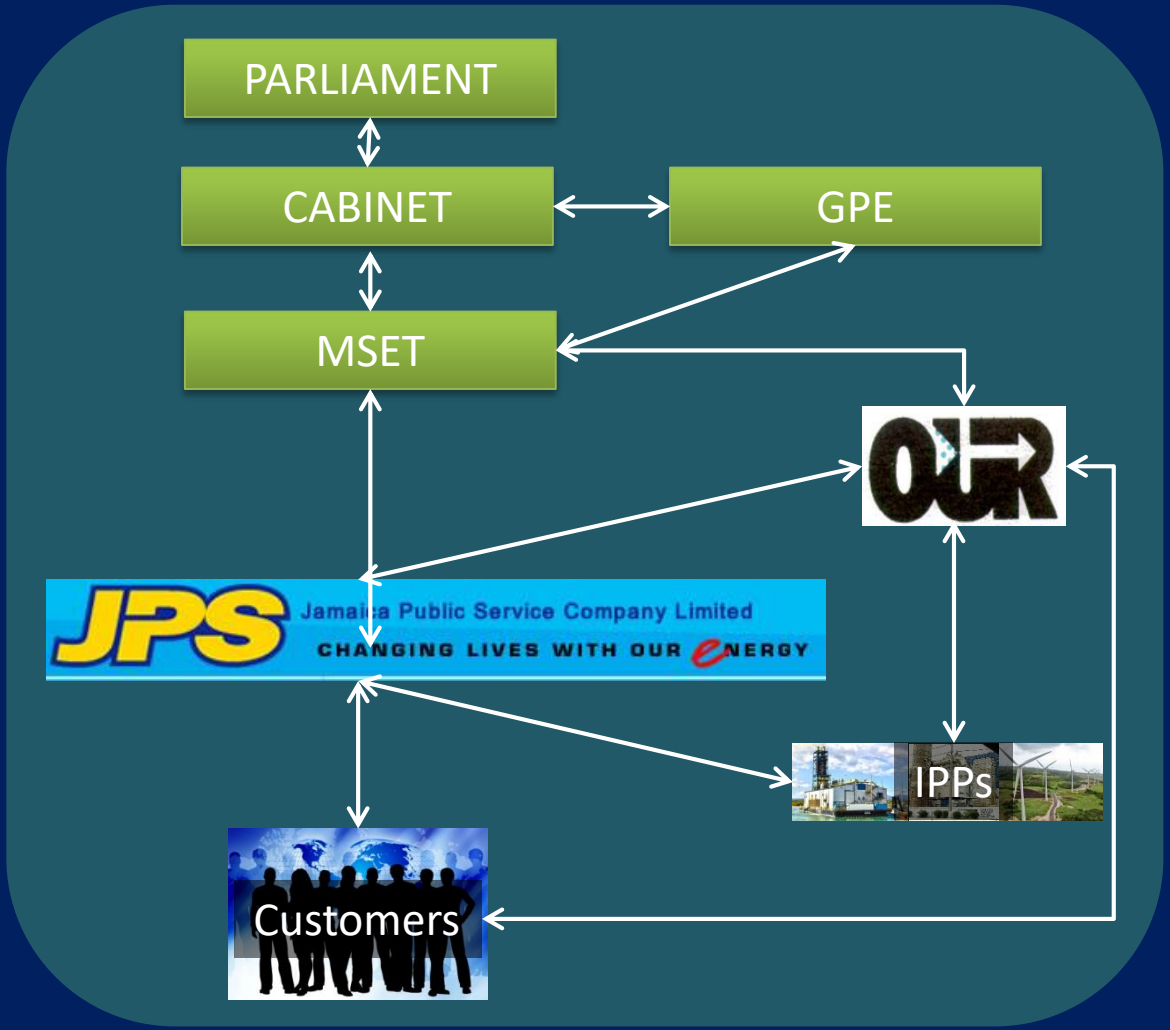
Jamaica's energy supply is secure and sufficient to support long-term economic and social development and environmental sustainability




- **Electricity Act, 2015**- promotes the use of renewable and other energy sources

# OVERVIEW OF ELECTRICITY SECTOR

## Governance Structure




### Office of Utilities Regulation

- The 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:
  - a) Encourage competition in the provision of prescribed utility services
  - b) Protect the interests of consumers in relation to the supply of a prescribed utility service
  - c) Encourage the development and use of indigenous resources

# OVERVIEW OF ELECTRICITY SECTOR

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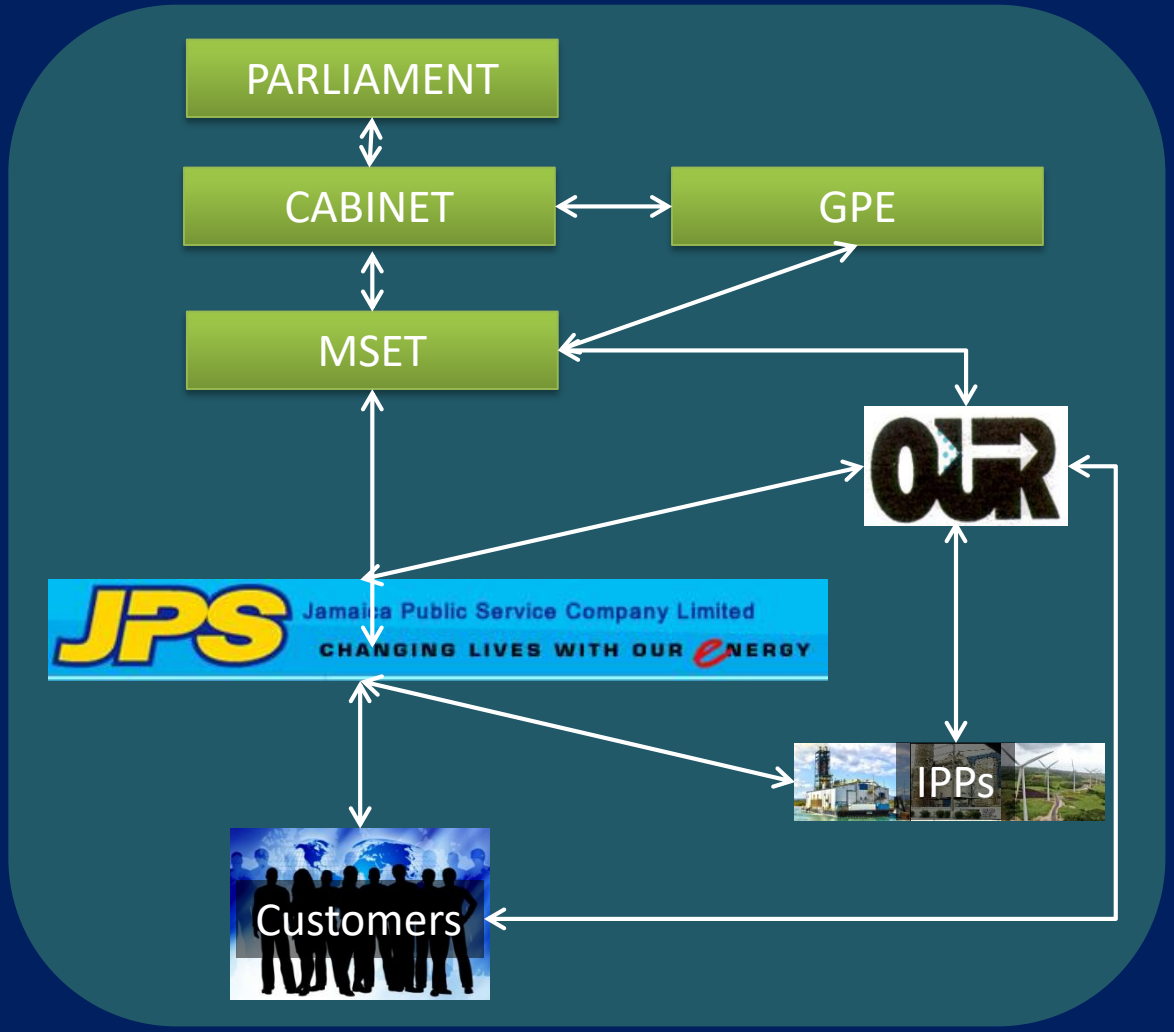



### Office of Utilities Regulation

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

### 2001 - 2007

- JPS responsible for System planning and generation procurement based on Licence and Regulatory Policy.
- OUR issue recommendations for Electricity Licences & approve PPAs.
- Energy Ministry issue Electricity Licences.

### After 2007

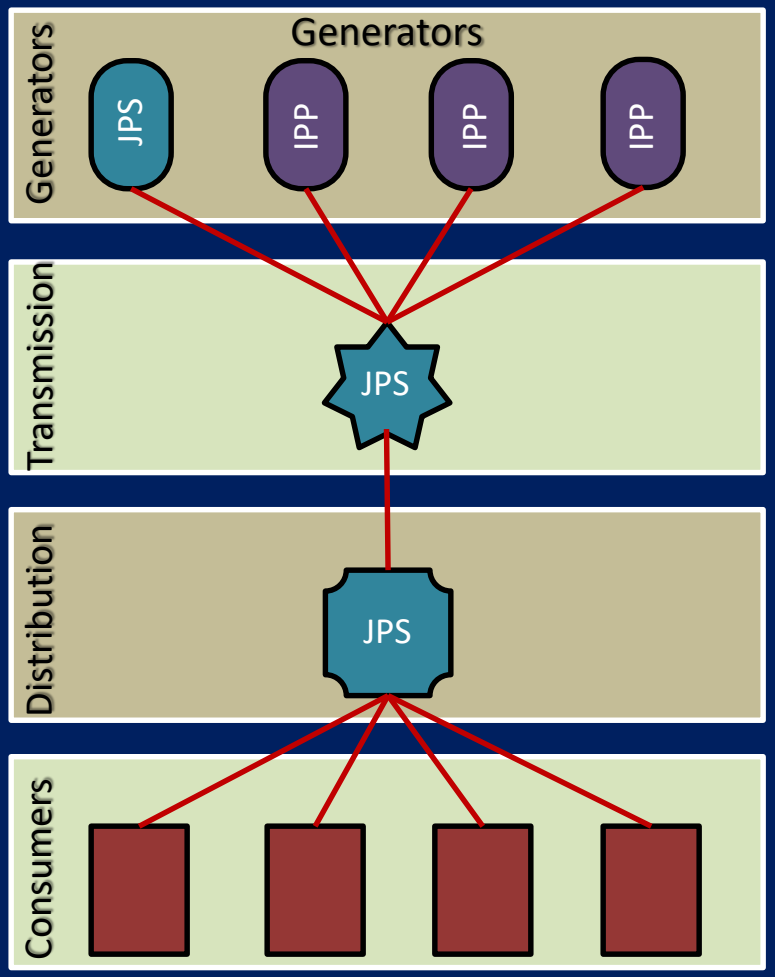
- OUR assume responsibility for generation planning and procurement (enshrined in JPS Licence in 2011). Make recommendations for Electricity Licences & approve PPAs.
- Energy Ministry issue Electricity Licences

### Since August 2015: Major Changes

- MSET (Minister) – responsible for planning the System (IRP) and issue Electricity Licences
  - Manage Net Billing programme set the capacity limits
- GPE - procure new generation capacity (conventional and RE)
- 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

# OVERVIEW OF ELECTRICITY SECTOR

## System Orientation & Performance Characteristics

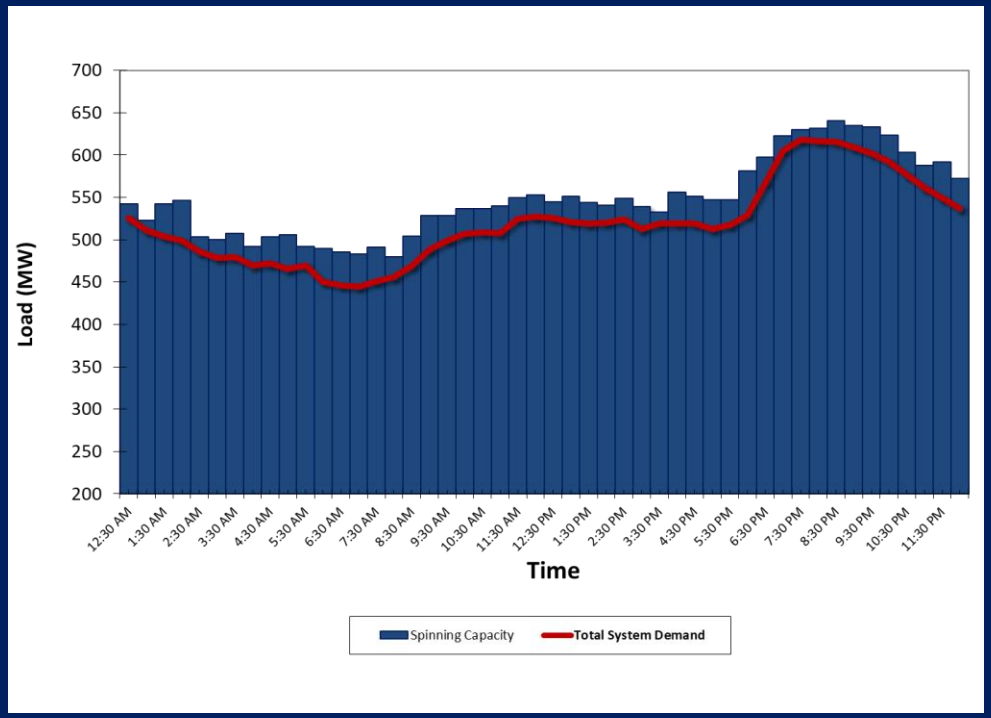
- 7 Major generation locations across the Island:
  - JPS (Conventional): Bogue, Rockfort, Old Harbour, Hunts Bay.
  - IPP (Conventional): Old Harbour, Rockfort, West Kingston
  - IPP (RE): Wigton (Wind), Malvern (Wind), Content Village (Solar PV)
- Transmission Voltage: 138kV and 69kV
- Substations: 44 both 138kV and 69kV

- 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)

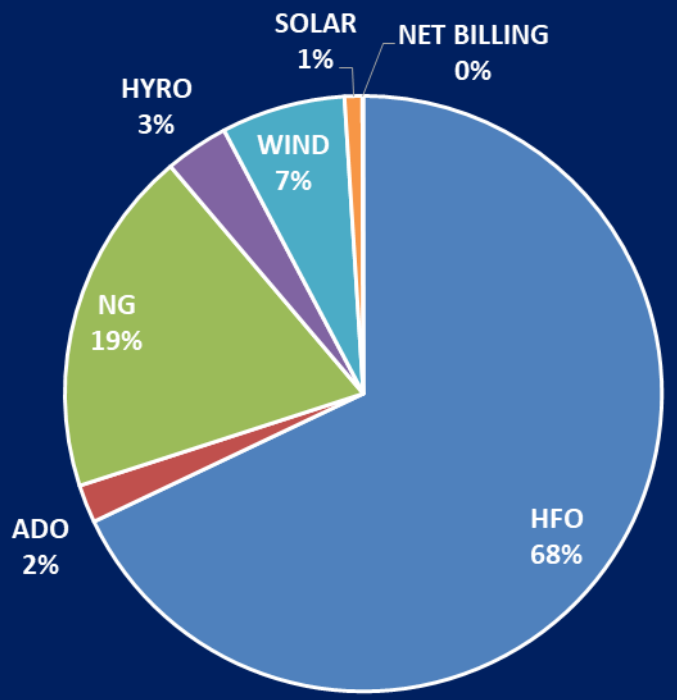
# OVERVIEW OF ELECTRICITY SECTOR

## System Performance

### Typical Daily Load Curve

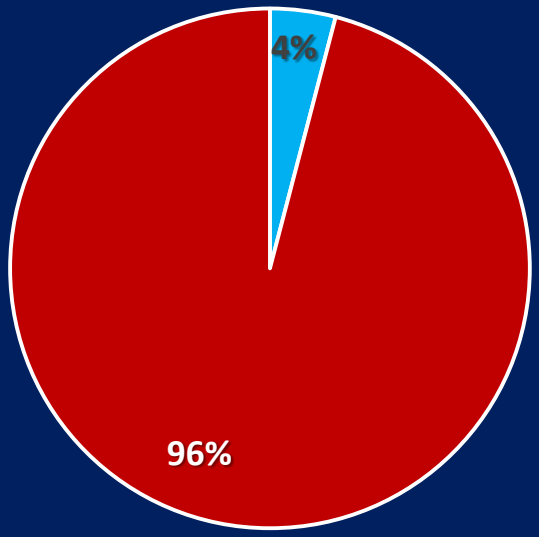



### 2017 Net Gen by Fuel Type



# RATIONALE FOR RE DEVELOPMENT

## 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

## Why the push towards RE?

***Jamaica Energy Situation***

- 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

# RE DEVELOPMENT STRATEGY

## Transition Point: Development of Wigton Wind Farm

- 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

# RE DEVELOPMENT STRATEGY

## Transition Point: Development of Wigton Wind Farm

- Average Annual Cap Factor: 30%, (*initially projected at 35%*)

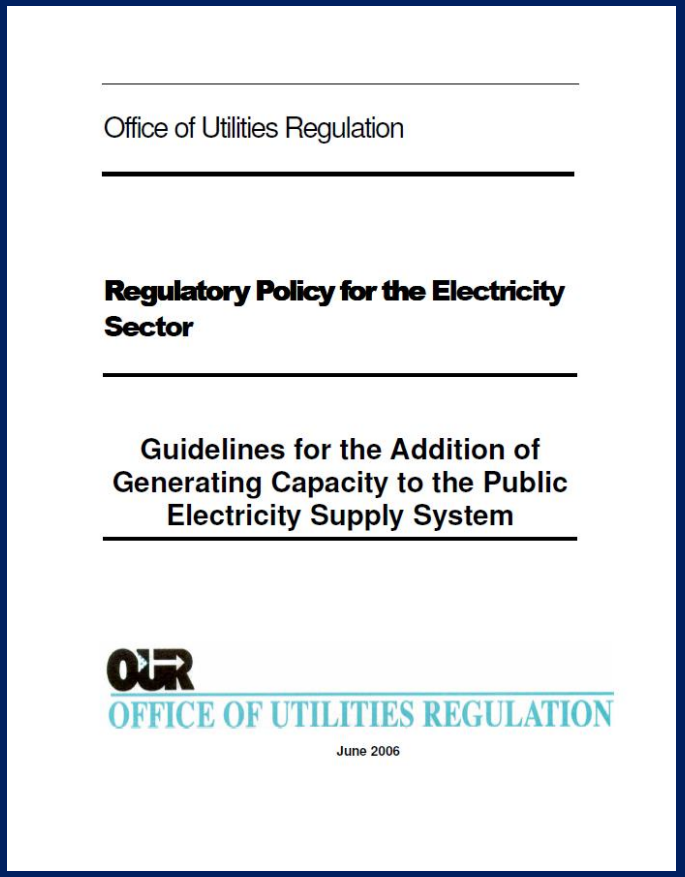
**Early Financial Problems**

- 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.

# RE POLICY DEVELOPMENT

## Development of Regulatory Policy for Addition of Generation


Office of Utilities Regulation

**Regulatory Policy for the Electricity Sector**

Guidelines for the Addition of Generating Capacity to the Public Electricity Supply System

OUR
OFFICE OF UTILITIES REGULATION
June 2006

- 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

# RE POLICY DEVELOPMENT

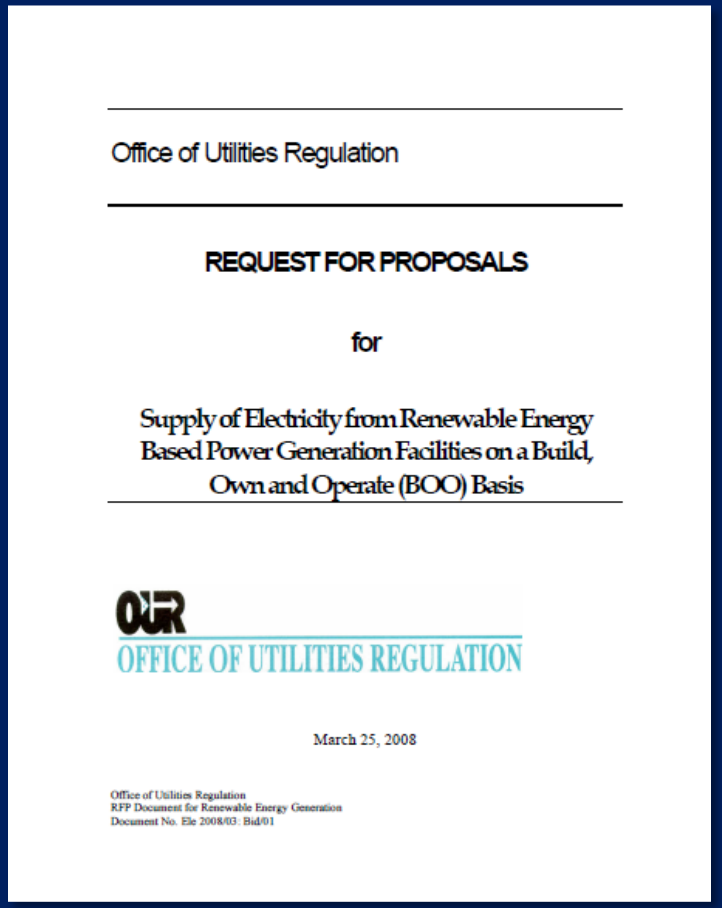
## Renewable Energy Technologies (RETs)

- 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%)

# RE GENERATION PROCUREMENT

## OUR's First Competitive RE Generation Tender

- 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)



Office of Utilities Regulation

REQUEST FOR PROPOSALS

for

Supply of Electricity from Renewable Energy Based Power Generation Facilities on a Build, Own and Operate (BOO) Basis

OUR

OFFICE OF UTILITIES REGULATION

March 25, 2008

Office of Utilities Regulation
RFP Document for Renewable Energy Generation
Document No. Ele 2008/03: Bid/01

# RE GENERATION PROCUREMENT

## 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

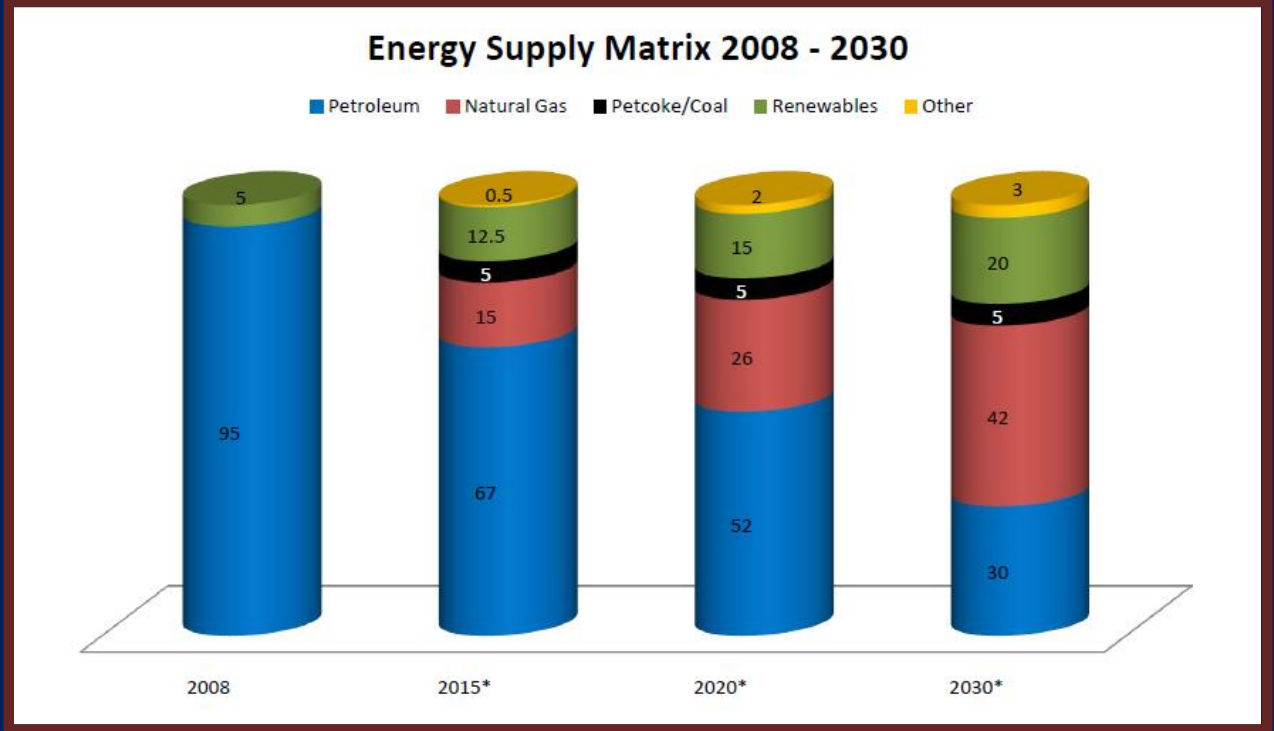
### JPS Munro Wind Farm

- Capacity – 3 MW
- Production – 10.5 GWh/year
- Cap Factor – 40%
- Fuel Cost Savings – US$2.2M/year @2008 fuel price

# ENERGY POLICY UPDATE

| 2009 National Energy Policy | | |
|---|---|---|
| TARGETS FOR RE PENETRATION IN JAMAICA (% of Net Gen) | | |
| 2012 | 2015 | 2030 |
| 11% | 12.5% | 20% |

- 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)



# RE GENERATION PROCUREMENT

## WWFL Capacity Expansion (2009-2010)

- "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

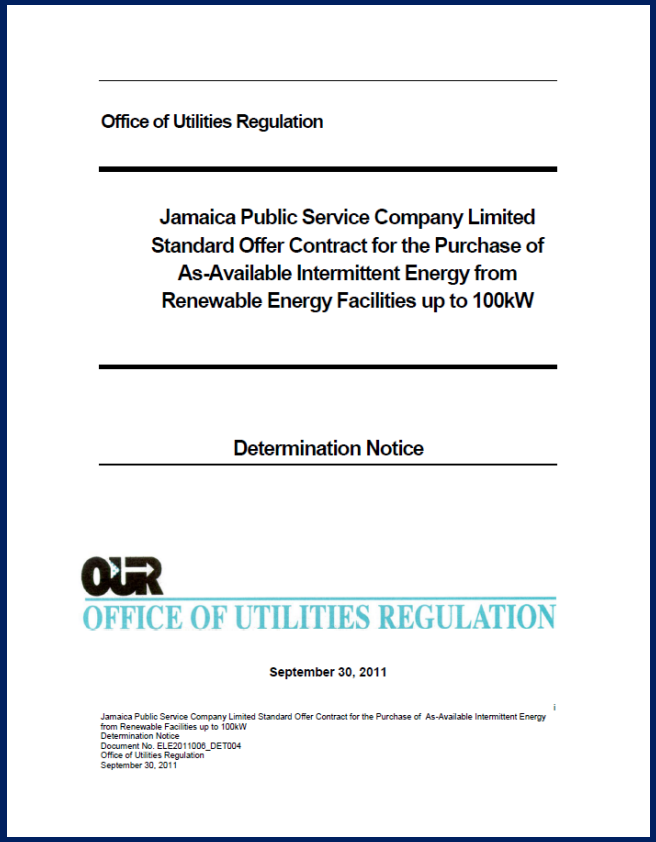


4. For capacity additions of under 15 MW the Office may, after consultation with the Licensee, approve a simpler procurement methodology, on a case by case basis. Notwithstanding the foregoing, for capacity additions of up to 25MW which are generated from Renewable Sources, the Office, may approve a 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.

# CUSTOMER-BASED (BTM) RE GENERATION

## 2012 Net Billing Programme

- 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



Office of Utilities Regulation

Jamaica Public Service Company Limited
Standard Offer Contract for the Purchase of
As-Available Intermittent Energy from
Renewable Energy Facilities up to 100kW

Determination Notice

OFFICE OF UTILITIES REGULATION

September 30, 2011

Jamaica Public Service Company Limited Standard Offer Contract for the Purchase of As-Available Intermittent Energy from Renewable Facilities up to 100kW
Determination Notice
Document No. ELE2011006_DET004
Office of Utilities Regulation
September 30, 2011

- **Big debate over net-billing vs net-metering.**
- **OUR adopted net-billing based on cost allocation principles.**

# CUSTOMER-BASED (BTM) RE GENERATION

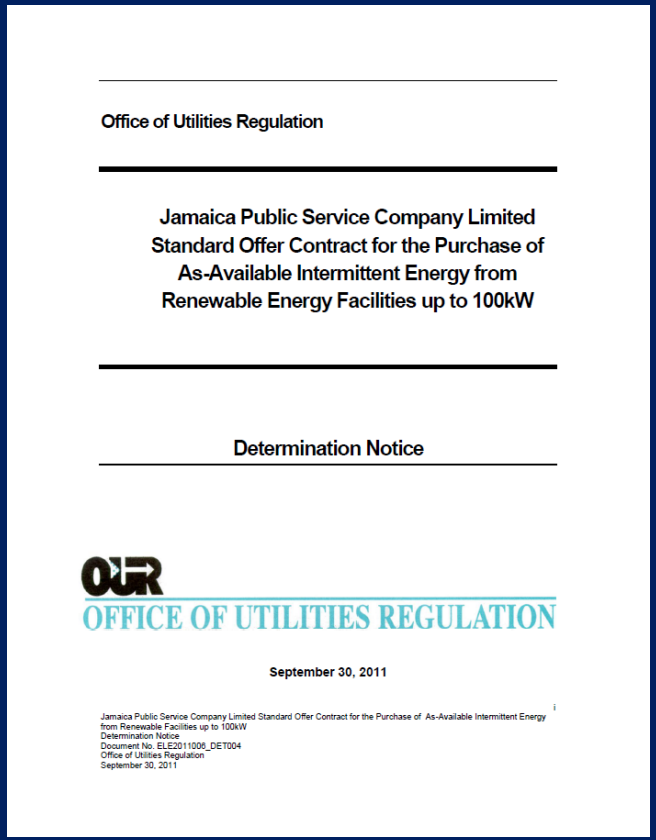
## 2012 Net Billing Programme

- 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

| Description | KW |
|---|---|
| Target 2% of System Peak | 12,000 |
| Application Received | 14,789 |
| Commissioned | 5,223 |

New MSET Administered Program 2017

| Licence Issued | | Commissioned | |
|---|---|---|---|
| Qty | KW (Inverters) | Qty | KW |
| | | | |
| 55 | 1120.35 | 27 | 560.38 |



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# 2012 RE GENERATION PROCUREMENT

## OUR 115 MW RE Generation Tender

**2015 RE Target – 12.5% of Net Generation**

- 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 | | | |
|---|---|---|---|
| Firm Capacity (37MW Tendered) | | Energy Only (78MW Tendered) | |
| RET | No. of Proposals | RET | No. of Proposals |
| Biomass Conversion | 1 | Wind | 3 |
| | | Solar PV | 26 |
| | | Solar Cogeneration | 1 |

- 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**

# 2015 RE GENERATION PROCUREMENT

## OUR 37MW RE Generation Tender

### 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.

| 37 MW RFP (Net) - Proposals Received based on RET | | | |
|---|---|---|---|
| Firm Capacity | | Energy Only | |
| RET | No. of Proposals | RET | No. of Proposals |
| Biomass | 1 | Wind | 5 |
| | | Solar PV | 11 |
| | | Hydro | 1 |
| | | Waste to Energy | 1 |

- 19 Proposals Received
- One (1) Solar PV project selected for Electricity Licence and PPA with the JPS

# 2015 RE GENERATION PROCUREMENT

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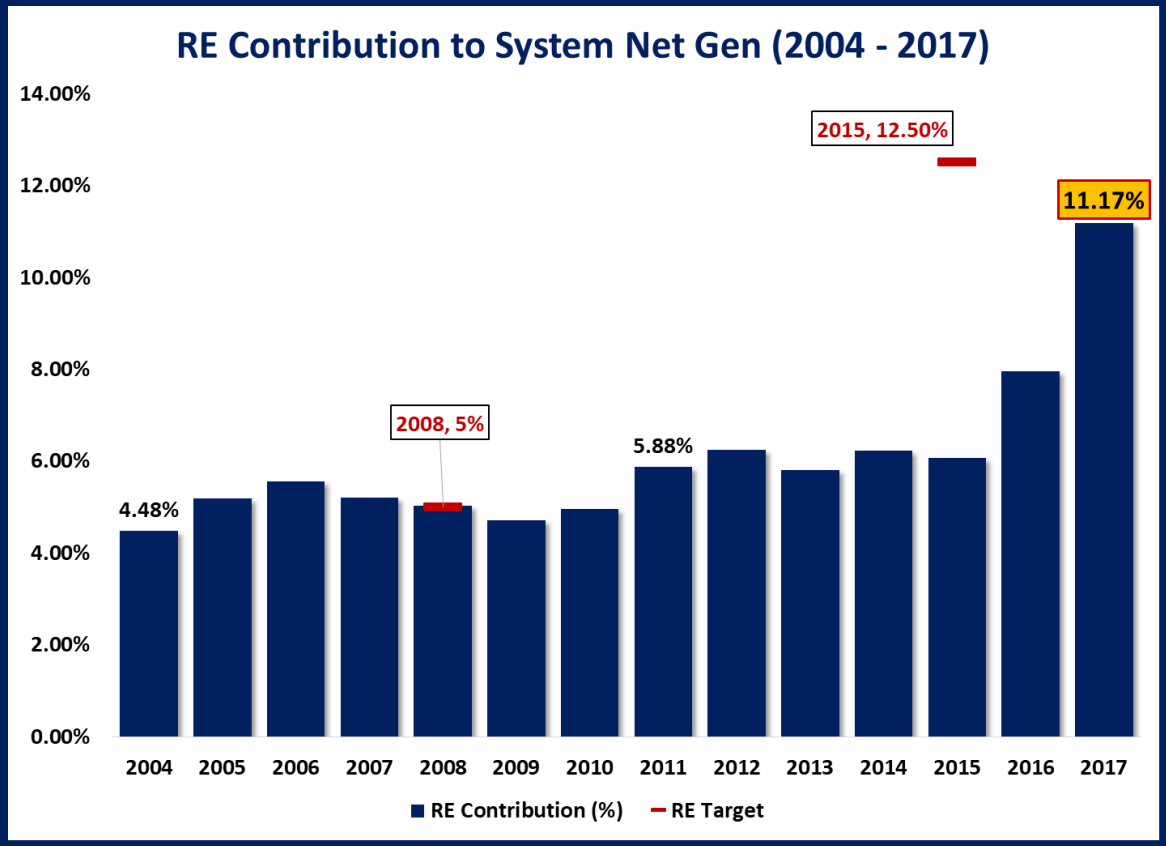
| | | Hydro | 1 |
| | | Waste to Energy | 1 |

- 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 TREND

## 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

# RE GENERATION INTEGRATION

## OUR's Present Role in RE Generation Process

- 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

# RE GENERATION INTEGRATION ISSUES

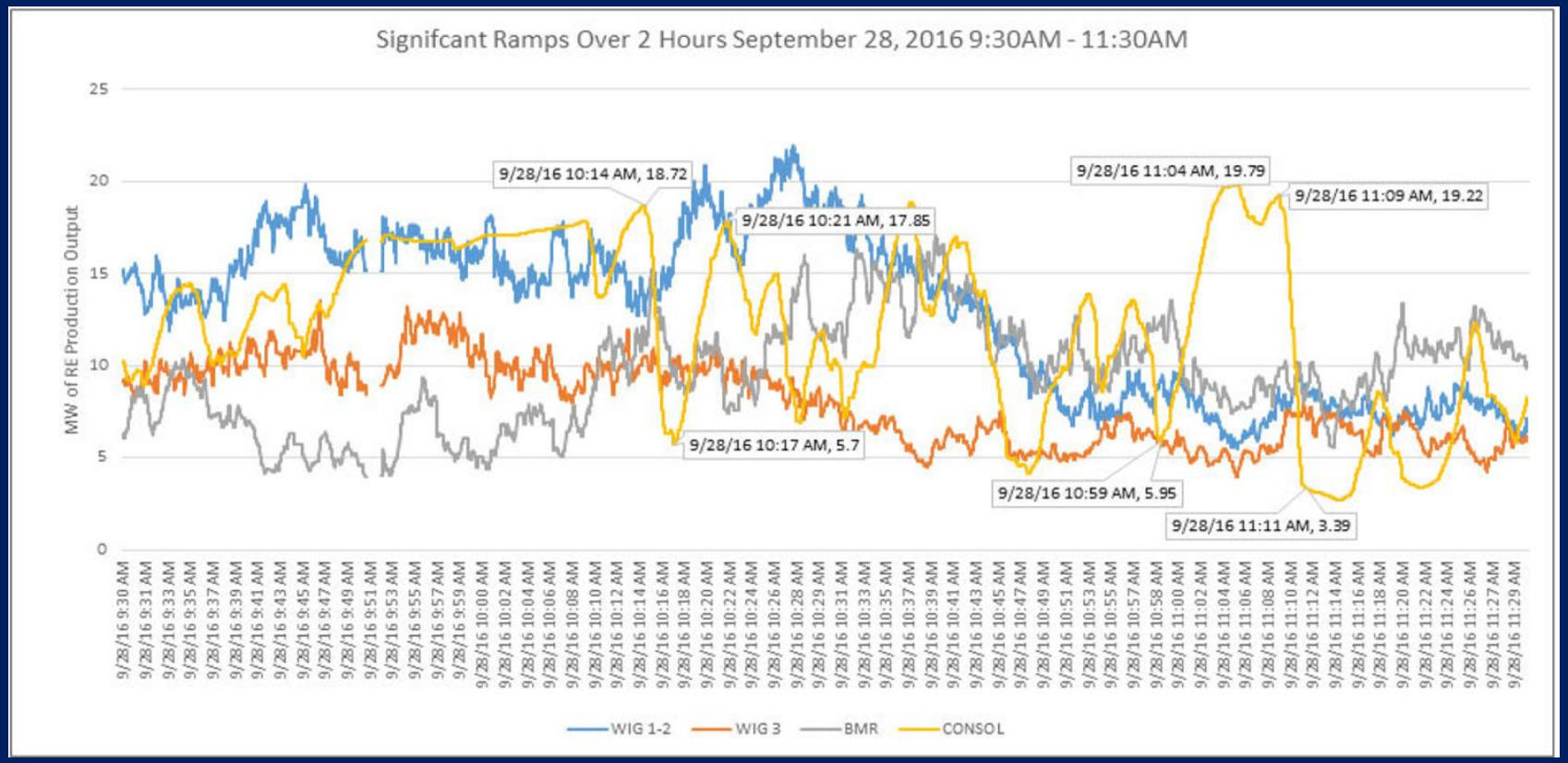
## Problems Encountered by JPS

**The promise of deriving a high share of generation from RES comes with integration challenges**

- 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

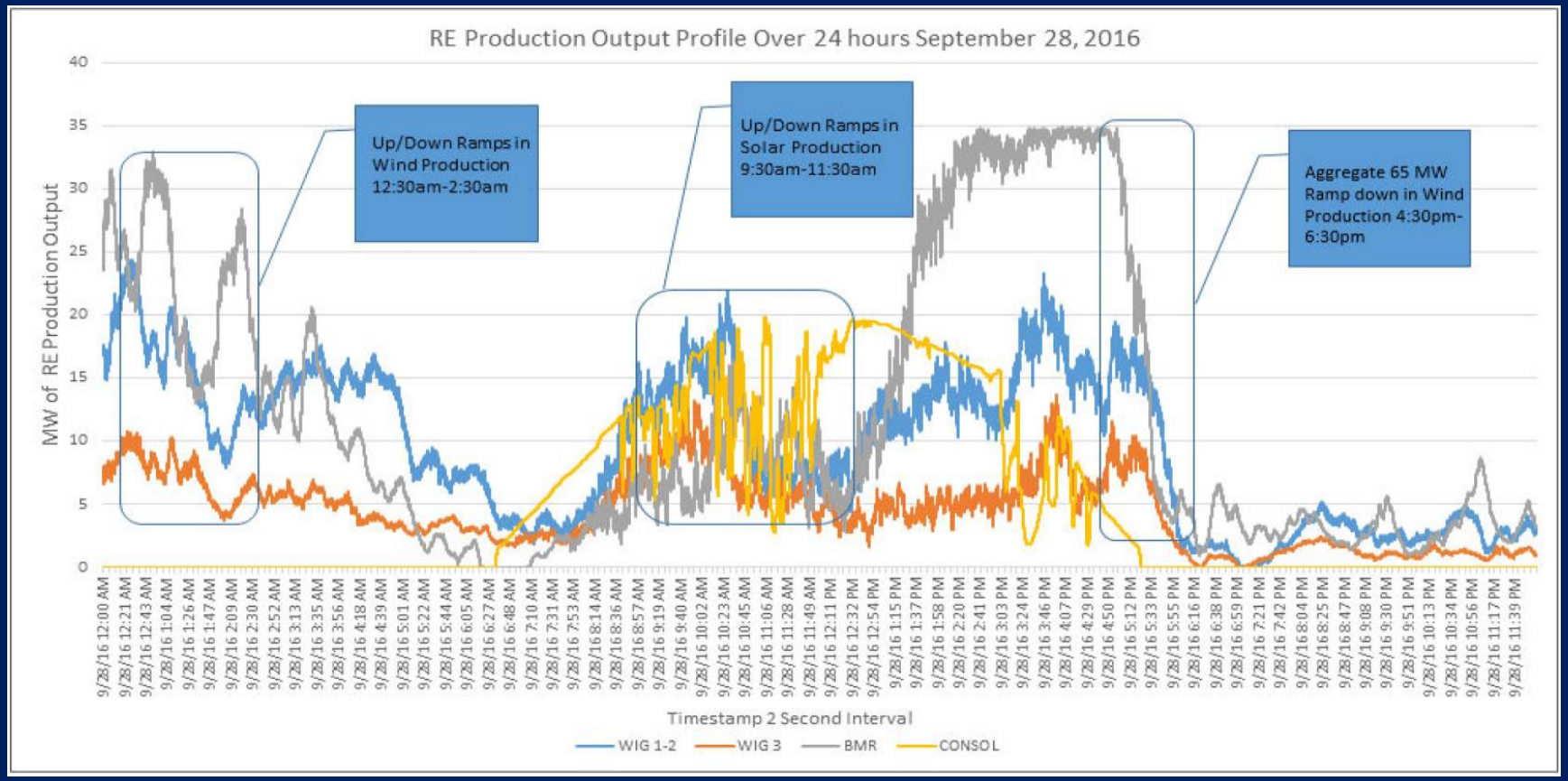
## RE Intermittency on JPS System in 2016




- 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

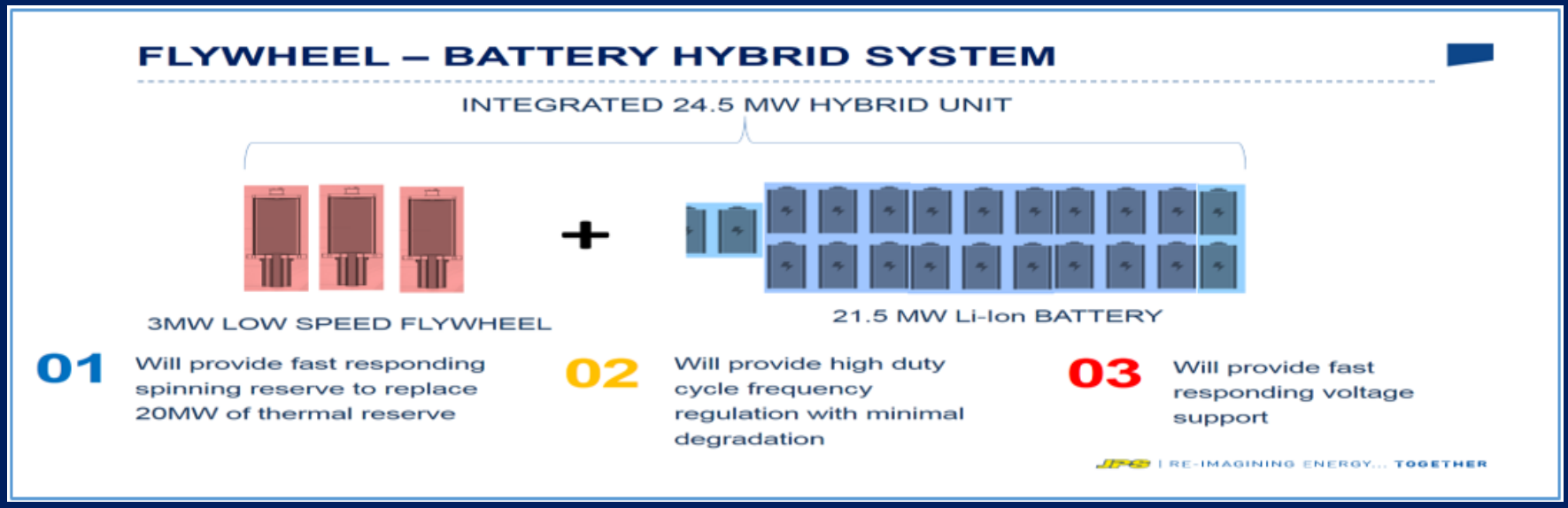



- Automatic and/or Manual Load Shedding
- Ramp up Online Generating Units
- Start up Gas Turbine (GT) Units

# 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.

# SUMMARY

- 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?