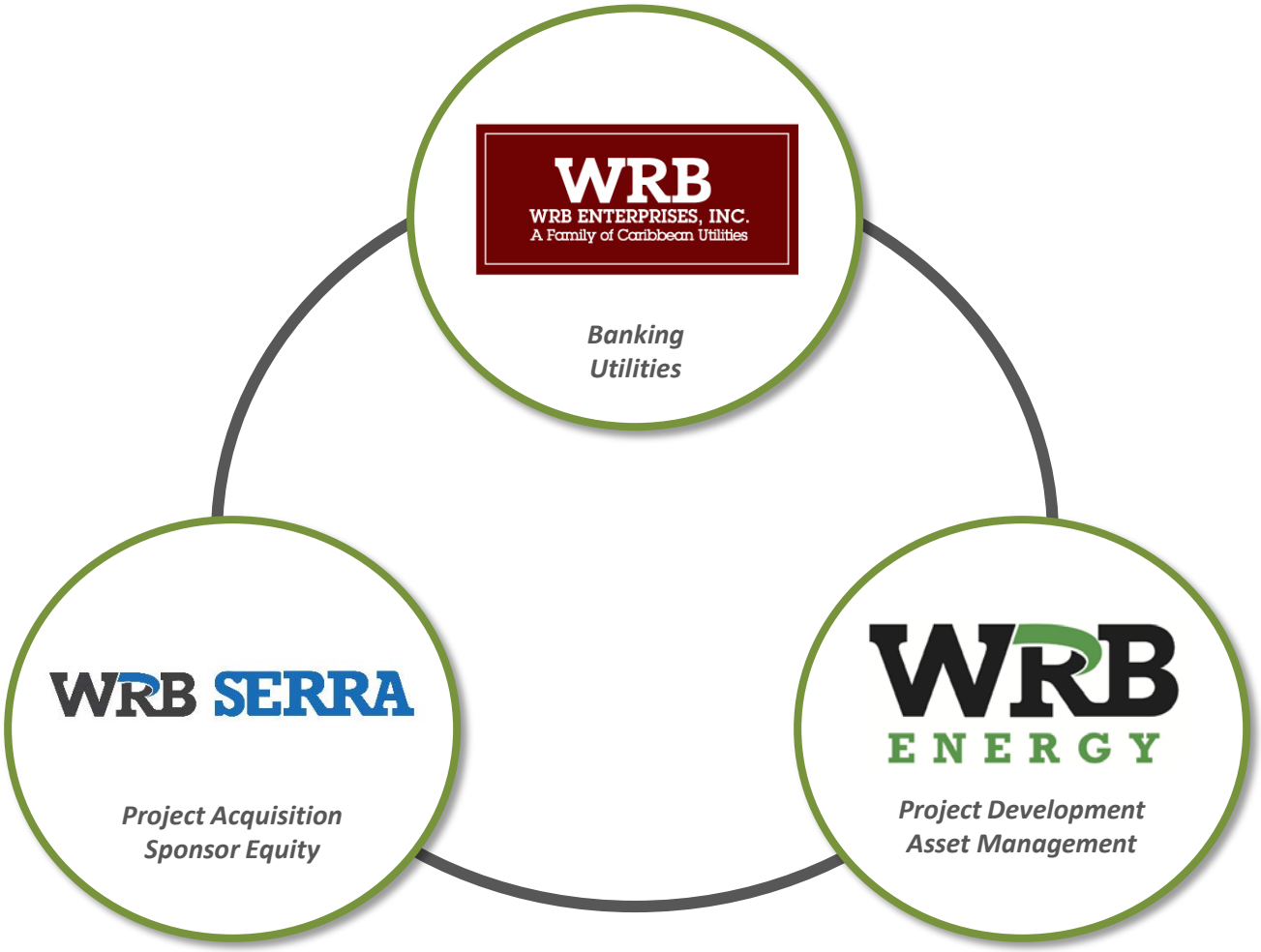
Impact of Low Oil Prices on Renewables: A Small Utility Perspective

Bermuda Energy Summit

Robert Blenker

June 29, 2016

Quick Overview of WRB



Where do Renewables Fit in the Caribbean?

- Firm Capacity: Biomass, geothermal, hydro
  - *Replace diesel/fuel generation (traditional thermal)*
  - *Have longer development cycles*
  - *Highly resource/jurisdiction dependent*
  - *Costs are still unclear (geothermal/hydro)*
- Intermittent Capacity: Wind, Solar, others
  - *Relatively faster to install – makes good headlines*
  - *Now are very competitively priced compared to fuel*
  - *Require spinning reserves, frequency and voltage support*
  - *Inject instability onto systems – a problem which may be solved*
  - *But, solving instability issues requires additional capital expenditure*
- Storage: Complicated and Evolving

However, presents opportunity for long-term price stabilization and reduction in export of hard currency once debt service is retired.

Caribbean Utility Summary

- You all know what the market looks like:

  Big: > 200 MWs

  Medium: < 200 MWs – 30 MWs

  Small: > 30 MWs

  Micro: Utila – 2 MWs, Petite Martinique – 150kW

Each has its own challenges and opportunities

No single solution fits all utilities!

RE on Large Systems vs. Small (relative)

Large Interconnected Market	Small, Non-interconnected (fuel)
Price for RE set by Gas, Coal, Nuclear	Price set by avoided cost of diesel/HFO
Already relatively low LRM pricing (compared to Caribbean)	Falling fuel price surcharge – also has impact on tax revenues
Fiscal/Regulatory Incentives (PTC, ITC, RPS)	Aspirational goals, no real fiscal incentives
Large scale projects driving economies of scale	Typically small scale projects
Relatively low development costs due to experience, regulatory regimes	Relatively high development costs due to in-experience, regulatory uncertainty, country risk, low volume of transactions
Moderate Impact of Energy Price on Economy	Significant Impact of Energy Price on Economy (Price Shock): Stabilized pricing, reduction in export of foreign currency, reduced price volatility – significant impact on GDP
Significant economic externalities: German Solar Experience	Few economic externalities: Jamaica – PV assembly, Trinidad – Silicon Reactor

Decision Criteria for Island Utilities

- Firming (and cost thereof)
- LCOE vs. Avoided Cost of Fuel (Currently at approximately US$0.08 – 0.09/kWh)
- Long-term forecasting: Fuel vs. Commodity pricing for RE
- Reliability and Energy security:
  - *Economic: Reduction in hard currency export*
  - *Physical: Distributed generation, storm recovery*
- Peril of being an early adopter. What would have happened if we had bought in six years ago at $5.20/w?!!
- Portfolio Diversification: How to diversify in a cost effective manner.
- Balancing fiduciary responsibility to Shareholders (returns) and customer (price)
  - *in many jurisdictions, all customers are shareholders via pension funds*
- How do we value non-monetary dividends that potentially translates into load growth e.g. ***Green-ada*** *Initiative*.
- Energy efficiency is also a confounding factor. Users becoming increasingly efficient.
- Gas (LNG/CNG) vs. RE (separate, parallel, equal?)

Caribbean Market Challenges

- Reconciling political/social expectations with project reality:
  - *Mismatch between expectations and reality (time/cost/capabilities).*
  - *Un-qualified non-performers offering unrealistic deliver times and prices: Cheap is not cheap. Fast is not fast.*
  - *Impacts on Pricing.*
  - *Goals are often "aspirational" with little to no regard for technical or economic impact/reality.*
- Insurance is a wildcard
- Risk Mitigation:
  - *Third-party Asset Manager?*
  - *O&M: Who and how long?*

Additional Considerations for Caribbean

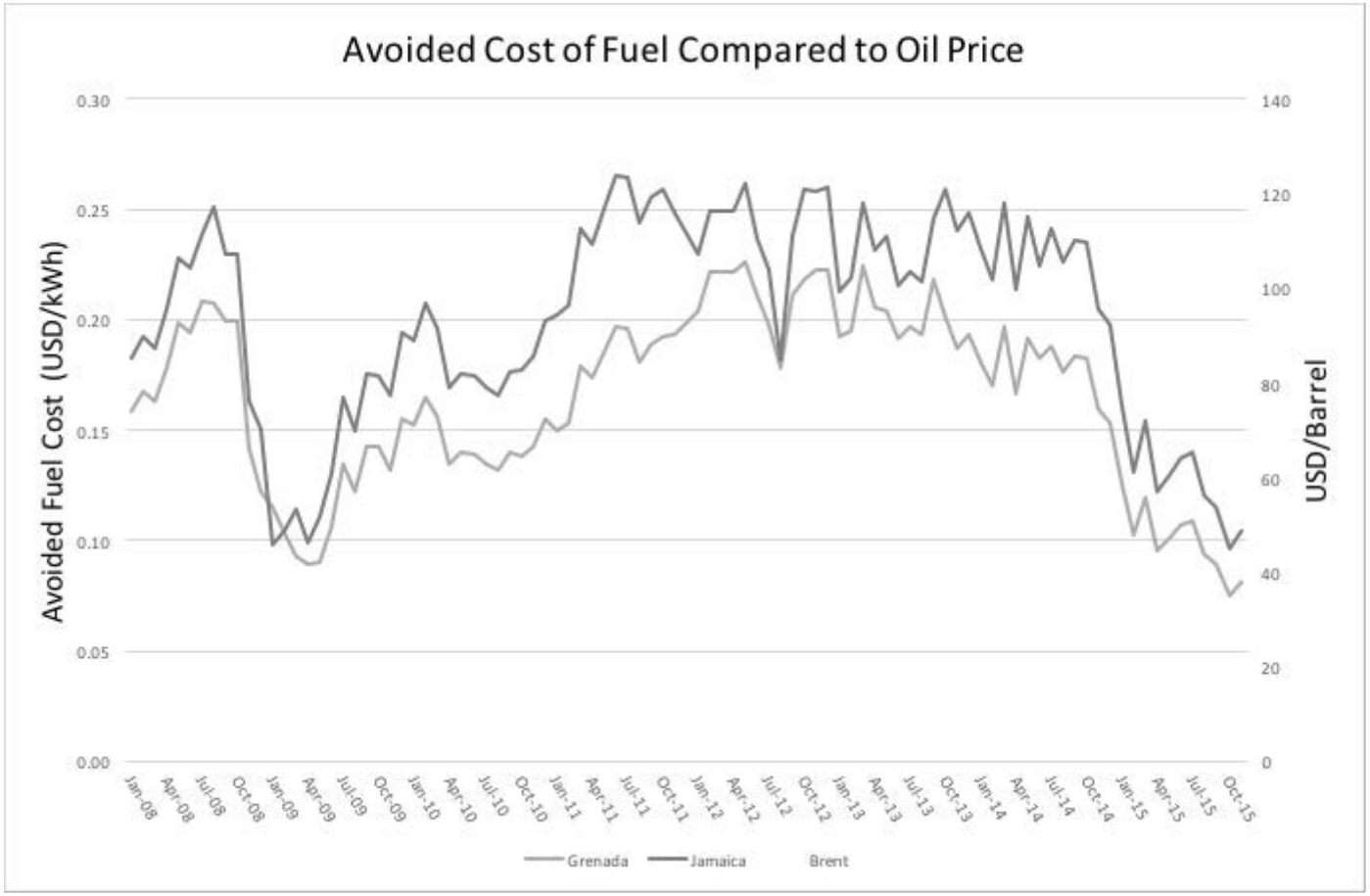
- Design for maximum wind loading: Hurricanes
- High-humidity conditions
- Theft/Vandalism/Site Security
  - *Unmanned, unprotected, isolated projects – probably not!*
- Redundant Communications
- Larger spare parts inventory
- Corrosivity: Seaside conditions

Regional Examples: Lets Look at Numbers

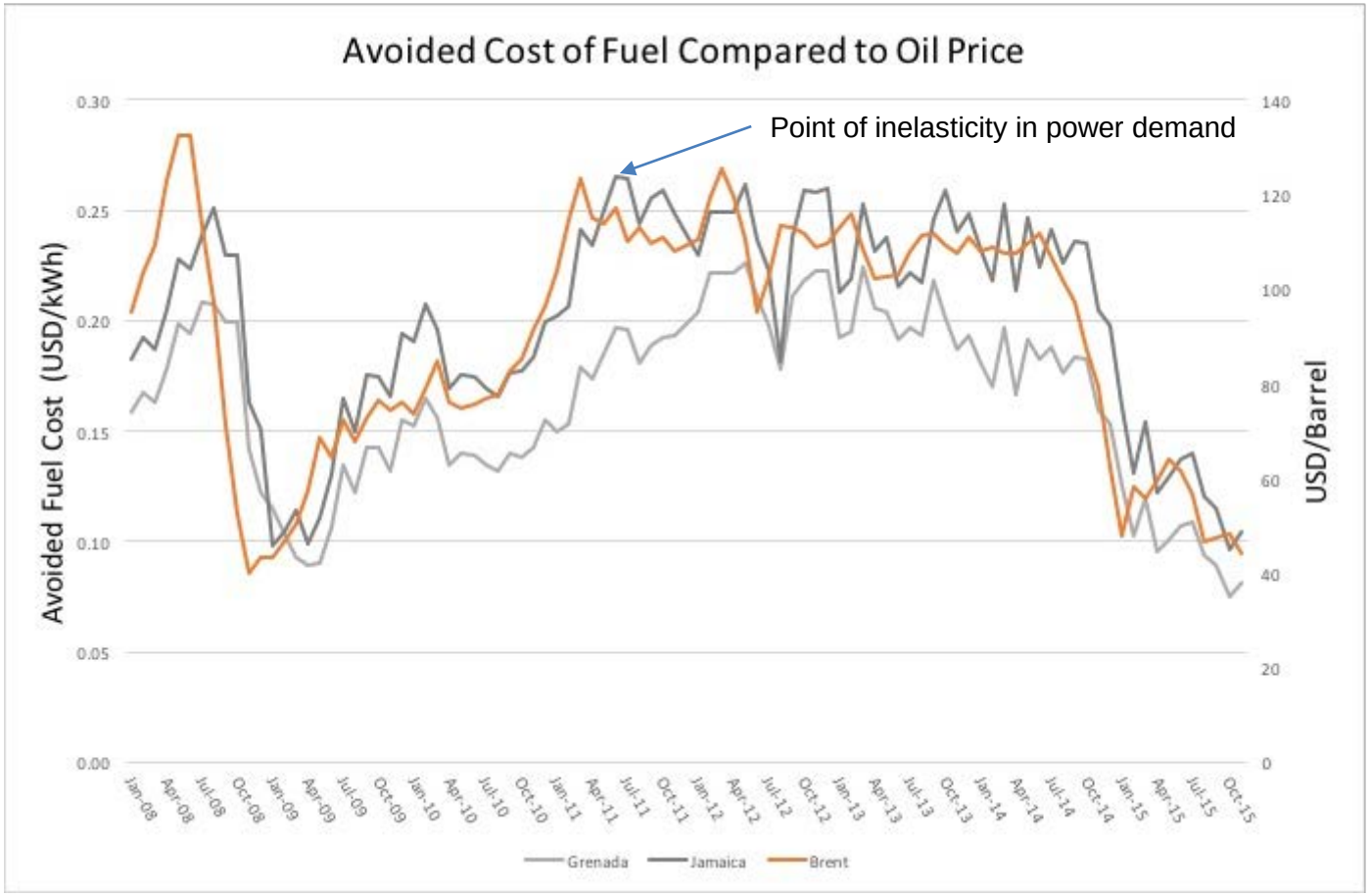
What have we seen in the last decade?

- Commodity pricing
- Fuel pricing
- Awareness – Aspirations

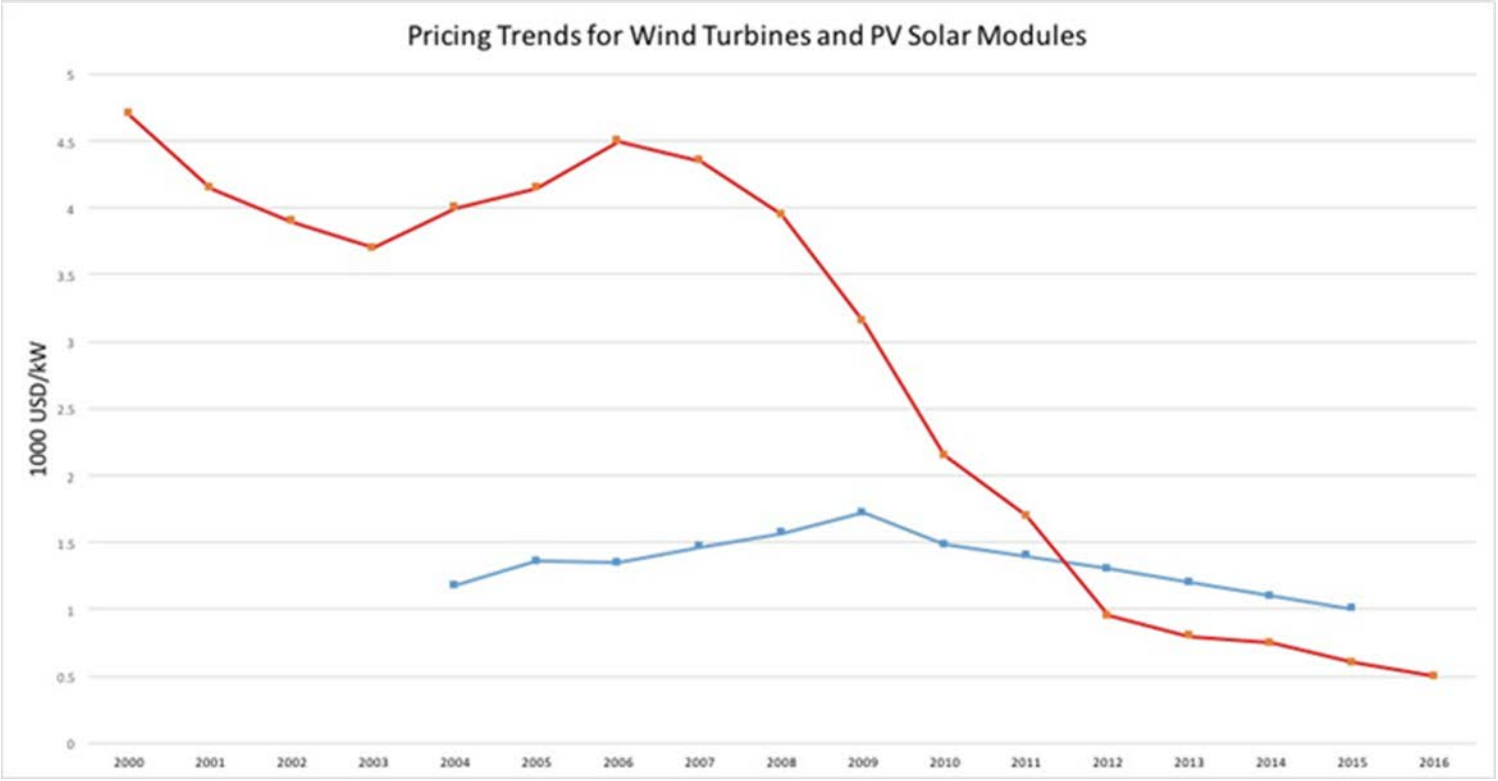
Avoided Cost of Fuel



Avoided Cost of Fuel



Trends in Equipment Pricing
Wind and PV Solar



We have seen a 25% drop in EPC pricing in the last 4 months

Trends in Equipment Pricing

FIGURE 2.5: GLOBAL TYPICAL INSTALLED COST, CAPACITY FACTOR AND LCOE RANGES WITH WEIGHTED AVERAGES FOR UTILITY-SCALE SOLAR PHOTOVOLTAIC AND ONSHORE WIND PROJECTS, 2010 AND 2014

Source: IRENA Renewable Cost Database.

Caution when using “Industry Statistics” applied to our Region
In the Caribbean: On the higher end of Installed Cost and LCOE

PPA Pricing: Regional Examples

- PPA examples from both sides of the Caribbean (and Pacific).
- Specifically NOT including US/Europe due to distortion caused by legislative and fiscal incentives (RPS, ITC, PTC)

PV Solar PPA Market Data			
MWs (ac)	Country	MWh Price	Year
20	Peru	223.0	2010
20	Peru	222.5	2010
20	Peru	215.0	2010
28	Honduras	139.2	2012
20	El Salvador	123.4	2013
14	El Salvador	123.4	2013
60	El Salvador	101.9	2013
20	Jamaica	188.2	2013
50	Uruguay	117.0	2013
50	Chile	85.0	2014
50	Chile	65.0	2015
20	Peru	64.0	2015

In 2016 Jamaica came in at US$84 and Mexico at US$54

Low Fuel Prices: Developer's Perspective

- Where does fuel go from here?
- Commodity (equipment prices) dropping – EPC down 20% in last 4 months
- But…..how much lower can they go? (Wind vs. PV)
- Land, development expenses, financing costs still the same
- Are we approaching the bottom of pricing?

Trends in the Region

Country	Trend
Grenada	Holding RE course
Jamaica	Holding RE course – Another 150 MWs soon
St. Lucia	Legislative initiative, RFP, IRP
Barbados	Moving forward with PV
Aruba	Still pushing for 100% renewable
Curacao	Holding course on RE
Nevis	Moving forward with geothermal
St. Vincent	Moving forward with Geothermal

IRPs: A conversation with the Nation –
where do we want to go and how do we get there?

What do Lower Fuel Prices Mean?

- Energy ministers and others around the region continue with commitment to generation diversification – take advantage of temporary price relief
- Flat-priced renewables PPAs represent a 20 year, fixed price hedge on fuel. What would that cost in the market?
- OPIC at Caribbean Energy Security Summit – “No decrease in requests for RE project funding”
- COP 21 and commitments: Results being telegraphed through markets
- David Pursell, Tudor Pickering Holt & Co. “Missing Barrels”

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Conclusions and Observations

PV at Grenlec

Thoughts

1. Non-fuel generation = Fixed 15 to 25 year Fuel price hedge
2. Utility vs. DG = Wealth Transfer from IOU to IPP
3. Who really wants to be their own utility?
4. Regulation is the new frontier! (no free lunch) It is complicated and we need to get it right in order to properly price ancillary services.
5. Reverse Robin Hood Effect: Those who can least afford it end up paying to support customer-owned solar.
6. Cannibalization of Grid = Cherry picking – Run the risk of losing the most important customers (see pt. 5)
7. Opportunities too small to attract competitive investment. If the generation becomes too small it won't attract competitive pricing/finance. Loss of economies of scale.

Conclusion: Continue with RE

- Grenlec is moving forward towards a diversified generation mix
- Looking towards a national discussion via an IRP process- Balancing Energy Security, Pricing Predictability, LCOE and Returns to Shareholders.
- Implement a Measured and Disciplined Plan - over the next 5 to 10 years to offset as much fuel as possible – capitalizing on falling prices and evolving technology.
  - *Carriacou wind/diesel hybrid*
  - *Petite Martinique – 100% renewable (PV + Storage)*
  - *Grenada DG – 1 MW PV (now)*
  - *Expanded Customer Owned Program (2 MW)*
  - *Grenada Ground Mount PV – 4 MW (RFP Q III)*
  - *Offshore wind/geothermal*

We keep advancing the RE program
at current fuel prices

PV Array on Petite Martinique, Grenada

Thank You

Robert Blenker

WRB Energy

1414 W. Swann Ave. | Tampa, FL | 33606

813.251.3737

rblenker@wrbenterprises.com

www.wrbenergy.com

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