From Oil To Energy

Exploring the Transformation of Barbados' National Oil Company to a Leading Energy Company

Felicia Cox, Renewable Energy Department, BNOCL

Your Presenter – Felicia Cox

- S.B. (MIT 2002) – Electrical Sciences & Engineering
- M.Eng. (MIT 2006) – Electrical Engineering & Computer Science
- Past experience in electrical services design, education
- Renewable Energy Co-ordinator, Barbados National Oil Company
  - Photovoltaic system design
  - Energy policy & legislation
  - Equipment & educational standards
  - Project development and deployment

Focus

- History of fossil fuels in Barbados
- A World of RE
- Risk as a Business
- BN?CL: The Future

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Barbados' Fossil Fuel History: 1800's

Mid - 1800s	1848 - 1890	1870s - 1890	1873	1896 - 1915
• Scotland District: oil seeps & manjack	• Schomburk; Harrison & Brown: geological assessments	• Lloyd's Oil Co.: first exploration (East Coast)	• Barbados Gas Company Ltd. Formed.	• West India Petroleum Company: exploration (Scotland District)

Barbados' Fossil Fuel History: 1900 – 1950's

1910	1919 - 1940	1920 - 1937	Early 1940's	**1950 - 1955**
• Cunningham-Craig: geological assessments	• British Union Oil Company: exploration	• Menzies; Senn: geological assessments	• Barbados Gas Company: natural gas consumption	• Gulf Oil Caribbean: exploration

Barbados' Fossil Fuel History: 1950's - 1982

1950 - 1955	1950 - 1955	1979	1979	1982	1982
• Natural Gas Corporation: production, transmission, distribution	• General Crude: exploration (Woodbourne)	• Mobil Explorations: took over Gulf Oil Caribbean; exploration	• National Petroleum Corporation: established (statutory corporation)	• National Petrolum Corporation: took over functions of Natural Gas Corporation	• Barbados National Oil Company Limited: took over Mobile Explorations

Barbados' Fossil Fuel History: 1982 - 2010

- NPC
  - Network expansion
  - Promotion of natural gas air-conditioning and refrigeration
- BNOCL
  - Periodic exploration
  - Continued geological assessment
  - Gas compression facility
  - Amalgamation with Barbados National Terminal Company Limited

Milestone 2010: Renewable Energy and BNOCL

- 2010: Renewable Energy Department established at BNOCL.
- NPC activities:
  - Natural gas transmission, distribution, maintenance, expansion
  - Retail sales
  - Promotion of natural gas transportation, air-conditioning and refrigeration
- BNOCL activities:
  - Oil & gas exploration, maintenance
  - Oil & gas bulk sales, purchases
  - Terminalling
  - **Renewable Energy**

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2010 – 2016: BNOCL & NPC in evolution

- 2014: Pending sale of BNTCL & amalgamation of BNOCL/NPC announced
- 2015: LNG facility built

World of RE - Under the Umbrella

Renewable Energy & Energy Efficiency

Production

Management

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World of RE - Energy Production

Conversion & Storage

- Wind
- Solar
- Hydro
- Ocean
- Biomass
- Geothermal
- Hydrogen
- ESS

World of RE - Energy Production

Conversion & Storage

- Wind
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World of RE - Energy Production (Technically Feasible)

Conversion & Storage

- Wind
- Solar
- Ocean
- Biomass
- ESS

World of RE - Energy Production (Technically Feasible)

Conversion & Storage

- Wind
- Solar
  - PV
  - Thermal (DHW)
  - Thermal (power)
- Ocean
  - Kinetic marine
  - OTEC

World of RE - Energy Production (Technically Feasible)

Conversion & Storage

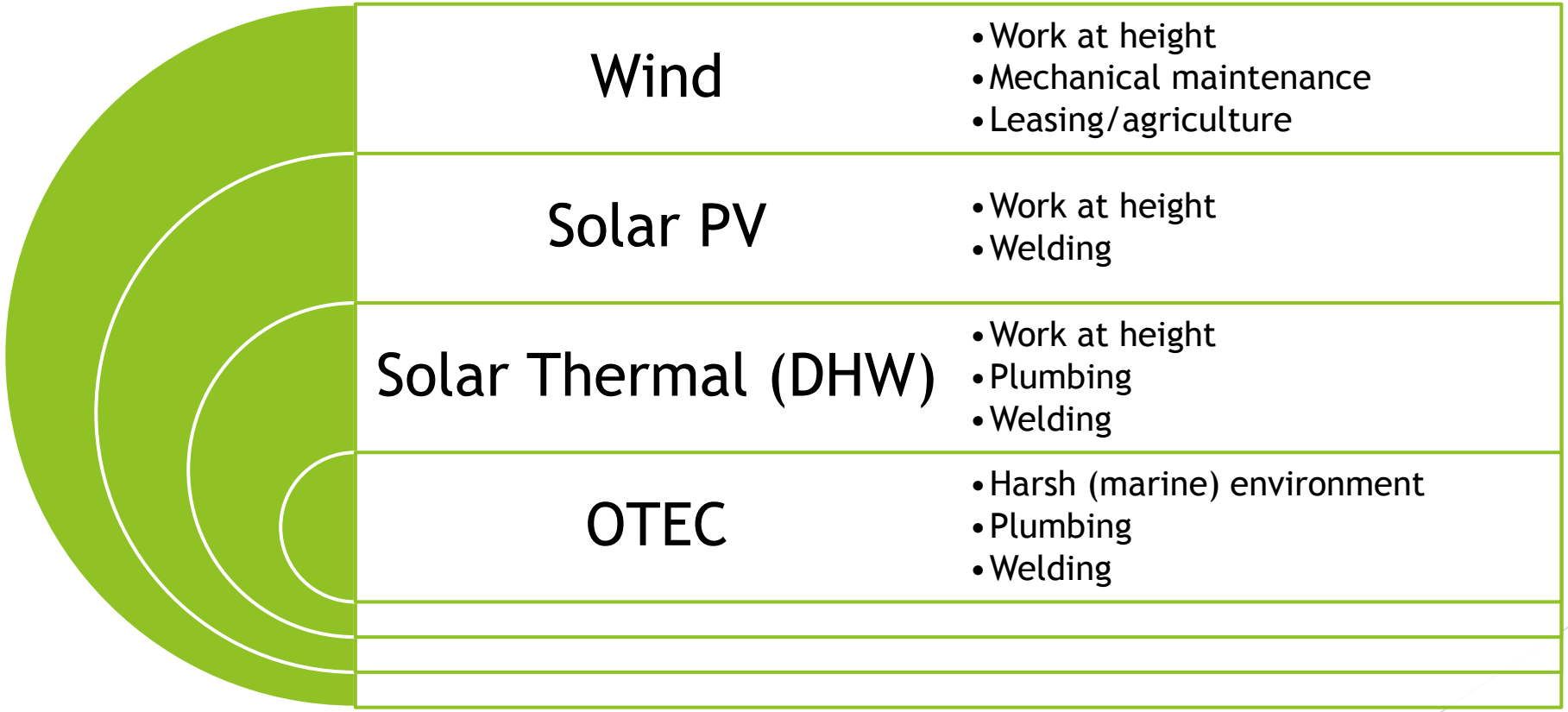
- Wind
- Solar
  - PV
  - Thermal (DHW)
  - Thermal (power)
- Ocean
  - Kinetic marine
  - OTEC

World of RE - Energy Production (Technically Feasible)

Conversion & Storage

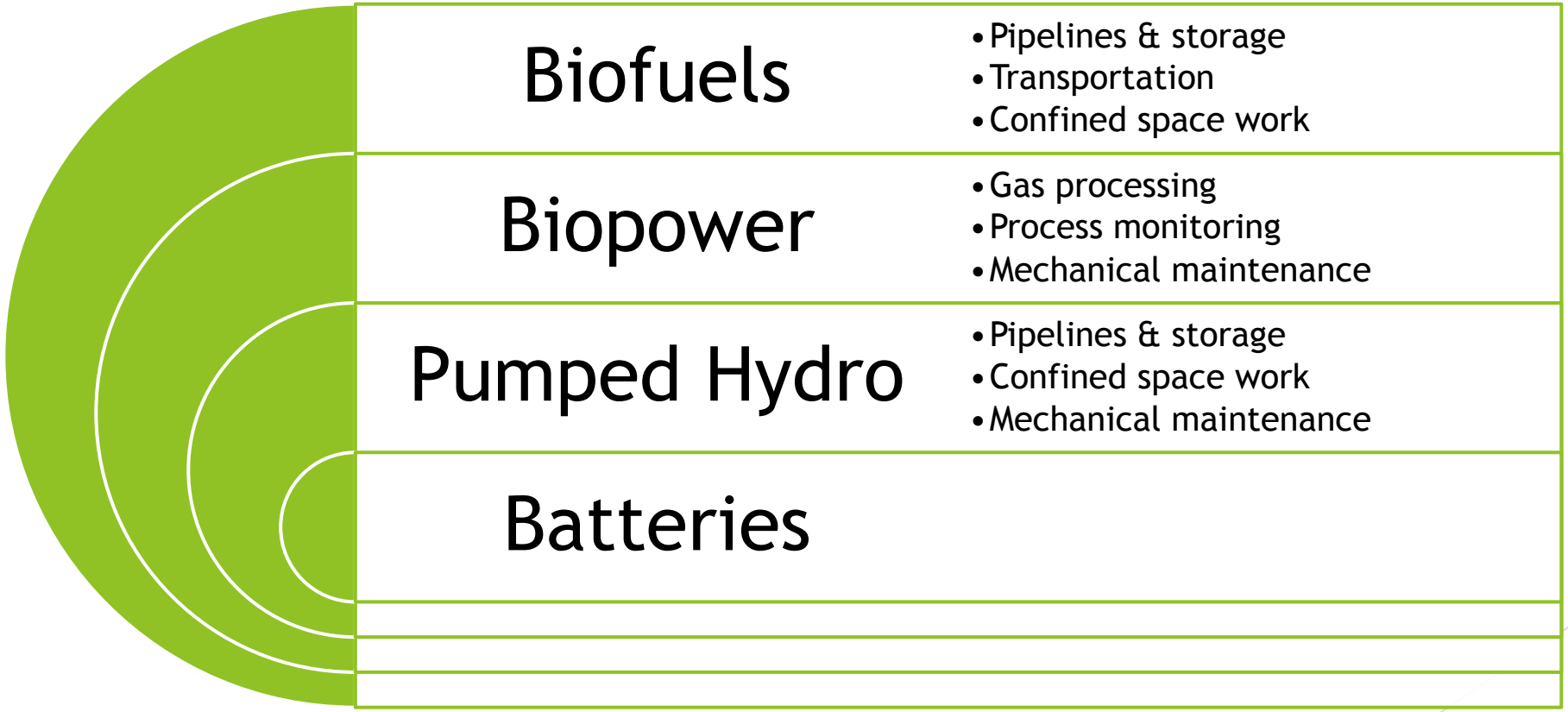
- Biomass
  - Biofuels
  - Biopower
- ESS
  - Pumped hydro
  - Batteries

World of RE - Energy Production (Technically Feasible)



Wind	• Work at height • Mechanical maintenance • Leasing/agriculture
Solar PV	• Work at height • Welding
Solar Thermal (DHW)	• Work at height • Plumbing • Welding
OTEC	• Harsh (marine) environment • Plumbing • Welding

World of RE - Energy Production (Technically Feasible)



World of RE - Energy Production (Financially Feasibile)

- Challenges
  - Site specificity
  - Access to data
  - Regulatory requirements
  - Cost of fossil fuel alternatives
  - Value assigned to renewable energy
  - Cost of financing
  - Size of project
  - Technology maturity
  - Market maturity

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Risk as a business

- Data collection and retention
- Analysis
- Approval Process
- Joint ventures
- Leases, royalties
- Offtake/supply contracts

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Risk - Solar

- Low technical risk
- Low implementation risk - residential/small commercial
- Moderate financial risk (FIT, CAPEX)
- Moderate market risk (competition) – residential/commercial
- Moderate to high implementation risk – large commercial/IPP
- Moderate to high regulatory risk (licensing) – large commercial/IPP
- Financial risk – profit sharing
- Financial risk - permitting

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Risk - SWAC

- Low to moderate technical risk
- Moderate to high market risk (offtake)
- Moderate to high financial risk (FIT, regulatory, permitting)
- Financial risk – market (district cooling/other use)
- Synergies – positive marketing

Risk - Biogas

- Low to moderate technical risk – technology, infrastructure
- Low market risk – existing market/off-taker(s), existing rates, “low” use
- Moderate financial risk (regulatory, permitting)
- Moderate to high operational risk – feedstock, feedstock variability
- Moderate operational risk – human resources
- Synergies – waste management, agriculture

BN?CL: The Future

- Risk assessment, management & mitigation
- Process management and monitoring
- Pipeline construction and maintenance
- Tank monitoring and maintenance
- Mechanical maintenance and repair
- Plumbing and welding
- Transportation

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Thank you!

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