Energy Conservation A Matter of National Security

"CLIMATE CHANGE IS THE SINGLE BIGGEST THREAT TO LIFE, SECURITY AND PROSPERITY ON EARTH" - UN Climate Change Executive Secretary Patricia Espinosa.

- In response, the UNFCCC Paris Agreement (COP 21), ratified by 175 states including the UK and European Union, requires all Parties to put forward their best efforts in order to strengthen the global response to the threat of climate change.
- We should expect nothing less from our public officials who should already be working hard to fast-track clean, affordable and secure renewable energy including energy efficiency and energy conservation.

WE KNOW THE CAUSE – increased CO2 from burning fossil fuel.



WE KNOW THE EFFECT – Climate Change





WHAT MAY NOT BE SO WELL KNOWN IS THAT SEA TEMPERATURES ARE ACCELERATING EVEN FASTER THAN AIR TEMPERATURE BECAUSE THE OCEANS ABSORB 93% OF ALL THE HEAT, WITH THE REST SPREAD BETWEEN DRY LAND AND THE AIR.



Source: "Improved Estimates of Ocean Heat Content from 1960 to 2015," Cheng et al, Science Advances, March 10, 2017

AS THE TEMPERATURE GOES UP, SO DOES THE RATE OF EVAPORATION.

- Last year Hurricane Harvey stalled just off the coast of Texas dumping 40" of rain on coastal communities, causing unprecedented flooding.
- Researchers at MIT have found the likelihood of a Hurricane Harvey event is now six times higher than just two decades ago.
- As if to prove the point, two weeks ago Hurricane Florence devastated North Carolina dumping over 30" of rain on the State.



Pre-Industrial Era cooling



LOWER NUMBER OF HURRICANES, HIGHER NUMBER OF MAJOR HURRICANES TRACKING FURTHER NORTH PUTTING BERMUDA ON THE FRONT LINE OF CLIMATE CHANGE.

- Researchers at the University of Durham studying the climate record captured in the chemistry of stalagmites from caves in the Caribbean and Bermuda show that the mean track of Cape Verde tropical cyclones shifted gradually northeastward from the western Caribbean toward the North American east coast over the last 450 years.
- Their results strongly suggest that future emission scenarios will result in more frequent tropical cyclone impacts on the financial and population centers of the northeastern United States (and therefore Bermuda as well).
- While multi-model ensemble studies predict that overall tropical cyclone frequency will decrease through the 21st Century, the frequency and intensity of the largest storms will increase.

IT'S NOT ALL BAD NEWS – the cost of renewable energy is falling faster than even the most avid enthusiasts predicted.



Source: Lazard

THE SAME IS TRUE FOR BATTERY STORAGE - Lithium-ion Battery Prices - Annual Decline



Source: Bloomberg New Energy Finance, GMO



From The Dark Side

"Without incentives, wind is going to be a \$0.02 or \$0.03 product early in the next decade. Battery storage will be \$0.01 on top of that. And when you look at coal and nuclear, today, operating costs are around \$0.03.

New wind and new solar, without incentives and combined with storage, are going to be cheaper than the operating cost of coal and nuclear in the next decade. That is going to totally transform this industry."

— James Robo, 06/22/2017

CEO of NextEra Energy

NextEra Energy is one of the three largest electric utilities in the US.

WAITING TO SEE IF 97% OF THE WORLD'S CLIMATE SCIENTISTS ARE WRONG ABOUT CLIMATE CHANGE IS THE DUMBEST EXPERIMENT IN HISTORY – Elon Musk

THINK GLOBALLY BUT, TO EFFECT CHANGE, ACT LOCALLY



- Locally, decarbonizing Bermuda is a matter of national security.
- Here's why:
- It will diversify our energy supply mix increasing security of supply by making our energy infrastructure more resilient to extreme weather events.
- More money will stay in the local economy which will improve the country's balance of payment, grow GDP and increase the tax base.
- It will improve our sovereign credit rating.
- Most important, it will improve our health.



Dr. the Honourable Kedrick D. Pickering, MHA Deputy Premier of BVI

• During his presentation at the Ocean Risk Summit held this year, Dr. Kedrick Pickering strongly advised diversification of our energy supply mix in response to the threat of climate change and extreme weather (especially in the wake of BVI's devastating impacts from Hurricanes Irma and Maria last year) - Personal communications from Dr. Anne F, Glasspool and Dr. Mark Guishard.



All OUR EGGS IN ONE BASKET

- BELCO's hub and spoke grid is fed by a central generation plant located on land averaging a foot above high tide in a new era of 30 to 40 inch hurricane rain events.
- If Hurricanes Florence or Leslie had hit us with 30 plus inches of rain, it would have put BELCO's central plant at significant flood risk.
- The new NPS (North Power Station) generators are going on 14' high pedestal and will be OK but existing generation assets are at risk – Highly placed BELCO source.

RENEWABLES ARE THE BEST WAY TO DIVERSIFY OUR ENERGY SUPPLY MIX

Mature renewable energy sources suitable for Bermuda fall into two categories:

Utility scale - ground mount solar installations over 500 KW, offshore wind and bio-mass

Distributed energy resources – rooftop solar, energy efficiency and energy conservation also known as behind the meter resources.

A new study by UK based environmental engineering company Etude, commissioned by Bermuda Engineering Ltd. shows the potential reduction in demand from energy efficiency and energy conservation is **30%**

Dispatch modeling shows that 80 MW of Solar and 60 MW of offshore wind can be incorporated in our energy mix, lowering prices and helping secure a reliable supply.

DECARBONIZING OUR ENERGY SUPPLY MEANS MORE MONEY STAYS IN THE LOCAL ECONOMY

Less money spent on expensive foreign fuel improves the country's balance of payment – *personal communication, Bob Steinhoff, former Vice Chairman of the Bermuda Monetary Authority*.

More money spent on local goods and services grows GDP which in turn increases the tax base replacing lost revenue from duty on fuel and increasing overall revenues - *personal communication*, *Robert Stubbs, economist.*

Improved credit rating means lower interest rates on the national debt. "What we want people to realize is: If you're exposed, we know that. We're going to ask questions about what you're doing to mitigate that exposure. That's taken into your credit ratings." - *Lenny Jones, managing director at Moody's. Source - Bloomberg News*

NOT ONLY IS BURNING FOSSIL FUELS IN BERMUDA CONTRIBUTING TO A GLOBAL CRISIS, IT IS VERY LIKELY COMPOUNDING PUBLIC HEALTH COSTS HERE AS WELL.

Independent studies from researchers at the US Environmental Protection Agency and, the Union of Concerned Scientists put the "public health added cost" of burning oil for the generation of electricity at between 8 and 19 cents/KWh.

The economic value of the health impacts in these studies was based on premature mortality, workdays lost, and other direct costs to the healthcare system resulting from emissions of fine particulate matter, NO_x, and SO₂.

The health impacts valuations presented in these studies come from national benefit per ton figures developed from a <u>Community Multi-scale Air Quality</u> (CMAQ) model, which is regularly used in EPA Clean Air Act rulemaking.



PEOPLE POWER

- To a large degree, our energy future is in the hands of Politicians, the Regulatory Authority and BELCO's top brass.
- But, there is one part of the energy sector everyone controls energy efficiency and energy conservation.
- We decide how efficiently we use energy and our decisions influence what our leaders do.
- By saving energy we not only save money, we help fasttrack clean, affordable and secure renewable energy making the economy stronger, Bermuda healthier and our energy infrastructure more resilient to the increasing threat of extreme weather events.

BELCO IRP Proposal

Energy Supply Mix - Natural Gas (Scenario 3)

Resource / Fuel Type	2018	2023	2028	2033	2037	Study Period Total
Fuel Oil	95.3%	0.0%	0.0%	0.0%	0.0%	17.6%
NG	0.0%	79.8%	79.5%	79.6%	79.2%	63.8%
LPG	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Renewables	4.4%	18.2%	17.5%	16.7%	16.2%	15.8%
EE / EV	0.3%	2.0%	3.0%	3.7%	4.7%	2.8%

4.7% reduction in demand

National Fuels Policy

Table 1: Targets for the Fuels Sector 2017-2035

Name	Unit	NFP scenario ¹	BAU scenario ²	Difference NFP - BAU
Energy use over period (2017–2035)	MMBtu ³	97,846,564	117,283,286	-17% (energy saved)
Cumulative energy use for electricity sub-sector	MMBtu	41,145,600	48,469,808	-15% (energy saved)
Cumulative energy use for transport sub-sector	MMBtu	53,758,830	65,714,910	-18% (energy saved)
Cumulative energy use for stationary use sub- sector	MMBtu	2,942,134	3,098,567	-5% (energy saved)

15% reduction in demand



30% reduction in demand

THE DIFFERENCE

BY THE NUMBERS

Home energy use

- Lighting Switching incandescent to LED bulbs can save 10% on home use.
- **Cooling** Switching from old window units to a modern split system can save 19% on home use.
- Water heating Switching from electric water heaters to a modern water heat pump can save 12% on home use.
- **Refrigeration** A modern refrigerator can save 4% on home use.
- Appliances Turning appliances off when not in use can save 6% on home use.
- **Overall potential savings** can be up to 51% with no major infrastructure or building upgrades.

Domestic energy efficiency - Residential buildings consume 38% of electrical energy in Bermuda



Figure 5- Assumed historical breakdown of residential energy consumption based on end use

COMMERCIAL OFFICE ENERGY USE

- **Lighting** A combination of higher efficiency lighting and controls can reduce office use by 23%.
- **Cooling** Modern Variable Refrigerant Flow (VRF) systems can reduce total office use by 25%.
- **Building improvements** Insulating roofs and applying tinted window films significantly reduce solar heat gain and can reduce office use by an additional 5%.
- Case studies:
- Masters Lighting replacement; 26% savings.
- BHS Lighting replacement, window film, hot water efficiency; 33% savings.
- Cumberland House Lighting replacement, submetering, building management system (BMS) control; 40% savings.

• **Commercial office efficiency savings** - Office buildings make up a large proportion of commercial electricity sales.



ENERGY CONSERVATION PROJECT



- Bermuda College students will perform an ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Level I Preliminary Energy Audit geared toward the identification of areas of energy waste or inefficiency.
- ASHRAE Level 1 Walk-Through Analysis/Preliminary Audit
 - interviews with site operating personnel
 - review of facility utility bills and other operating data
 - a walk-through of the facility
 - energy use analysis report detailing
 - low-cost/no-cost measures
 - estimates of implementation costs
 - potential operating cost savings
 - and simple payback periods
 - and potential capital improvements for further study

Note: An ASHRAE Level 1 survey can result in energy savings of up to 1KWh per square foot.

SOMETHING WE CAN ALL TAKE HOME



• Heating and cooling

- 1. In summer, use fans and keep doors, windows, and shades closed during the day to reduce any unwanted heat from coming in.
- 2. In winter, open blinds and drapes to let the sun warm your space.
- 3. Use your ceiling fan instead of the thermostat to lower the temperature.
- 4. Adjust the thermostat in small degree changes. Your home won't heat or cool faster by cranking it up.
- 5. Install a programmable thermostat to automatically adjust the temperature to your schedule.

• Appliances and electronics

- 6. Wash your clothes in cold water. About 90% of the energy used by washing machines goes to heating the water.
- 7. Use your microwave instead of your stove when cooking to use two-thirds less energy.
- 8. Don't open the oven door while baking. Each time, the temperature can drop up to 13.8°C (25°F) and requires additional energy to bring it back up.
- 9. Turn off the oven 10-15 minutes before cooking time runs out. Your food will continue to cook without using the extra electricity.
- 10. Keep your refrigerator and freezer as full as possible to operate efficiently.
- 11. Use dishwashers and washers/dryers in off-peak hours to keep the house cooler.
- 12. Don't run bathroom or kitchen ventilation fans longer than necessary. They replace inside air with outside air.
- 13. Turn on your computer, monitor, printer, and fax machine only when needed.
- 14. Don't leave your mobile phone plugged in overnight, it only takes a couple of hours to charge.
- 15. Avoid placing objects that give off heat (for example, lamps or TVs) near a thermostat.

Lighting

- 16. Use desktop lamps with high-efficiency lightbulbs.
- 17. Open curtains and shades during the day to let in the natural light instead of using lighting.
- 18. Use a photocell or a timer on your outdoor lights for dusk-to-dawn only operation.
- 19. Turn off the lights when they're not in use and save up to 15% on your utility bill.

Home maintenance and improvements

- 20. Clean or replace all filters in your home once a month.
- 21. Seal cracks, gaps, leaks and add insulation to save up to 20% on heating and cooling costs.
- 22. Replace single-pane windows with more energy efficient ones, and/or add solar shades or tinting film.

