EE 491 Week 7 Report - sddec18-03

Design of a More Reliable Power Grid for Puerto Rico

3/5/18 - 3/19/18
Faculty Advisor: Vikram Dalal

Team Members

Logan Lillis - *Communications and Reports Lead*
Ricardo Rodriguez-Menas - *Webmaster and Project Plan Lead*
Heiqal Zamri - *Test Engineer Lead*

Weekly Summary

On Monday, March 5th, we met in the TLA for our weekly meeting. Once again, we discussed logging hours and collected research in a functional and legible list for reports. After meeting with professor Dalal prior to the meeting, we also discussed creating the bi-weekly update slides to present at our meeting on 3/8/2018.

Past Week Accomplishments

- Work on Design Document (due end of week 8)
  - Section 1: Introduction - Ricardo
  - Section 2: Design Proposal and Analysis - Logan
  - Section 3: Testing - Heiqal
- Research for Professor Dalal:
  - Gas Turbines - Cal
  - Renewable Energy Implementation - Ricardo
  - Generation and Interconnectivity - Logan
- Begin looking into economics
- Start narrowing down energy storages
- Dig deeper into Natural Gas plant - Logan

Pending Issues

- Lack of research on costs associated with implementing and building
  - Will continue to look into
- Need to decide energy storage options

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours

Logan Lillis	• Research on proposed Natural Gas Deliquification Port
	  ○ Currently, import 55 billion cubic feet of LNG each year
	  ■ Main imports from Trinidad and Tobago
	  ■ Some industrial customers receive LNG from the US
	  ○ Floating Deliquification Port already proposed and approved by FERC in 2015
	  ■ Off coast of Peñulas, where current LNG imports come through.
	  ○ Originally planned a pipeline from south coast to north, but nixed due to environmental and load concerns
	  ■ North coast has 3 natural gas-fired generation plants. Currently use trucks to transport LNG
	  ○ PREPA reportedly has run feasibility reports on if a northern deliquification port is possible
	• Research on Economics
	  ○ Puerto Rico's utility rates: $0.24/kwH. Residential Rate:: $0.20/kwH, Industrial Rate: $0.18/kwH
	  ■ $0.10/kwH below regional average
	  ○ PREPA supplies power to all 78 of its municipalities, many government-owned enterprises, and some for-profit businesses
	  ■ Included things like disco ice rinks
	  ■ Economic model not been
		3	29

	discussed since 1958 ■ Citizens concerned repealing this plan would result in higher taxes ● Weekly Reports ● Meeting Minutes ● Formatting Slides https://www.eia.gov/state/analysis.php?sid=RQ www.nrel.gov/docs/fy15osti/62708.pdf. www.nytimes.com/2016/02/02/business/dealbook/puerto-rico-power-authoritys-debt-is-rooted-in-free-electricity.html.		
Ricardo Rodriguez-Menas	● Researched Interconnectivity ○ the Federal Policy Act of 2005. ○ In case we desire to implement simple “inverter-based systems” the new policies for the process are : ■ 25 kW for single-phase. ■ No more than 200 kW for three- phase systems ● Generators for these systems will be required to generate a capacity greater than 500 kW and less than 1MW ● These regulations are subject to changes every 180 days ● In the latest regulations the significant change was that an expedited plug-and-play interconnection process for systems with a generation capacity of 10kW or less installed in residences and businesses. ● PREPA has also established new regulations for interconnections using Wind and Solar generation https://www.nrel.gov/docs/fy14osti/57089.pdf ● Researched Energy Storage	2	25

	○ Previous Company supplying the island was ABB. ○ Now the majority of Energy Storage components is supplied by AES ○ AES is going to donate 6MW batteries to Island and suggest the installation of solar panels and microgrids in the Island is the answer ○ Other Companies working in Puerto Rico (Tesla, Sonnen and Tabushi America) ○ 300 million awarded in a contract to the Company Whitefish Energy. ● Energy Storage Applications ○ Capacity Firming ○ Load leveling ○ Spinning reserve ○ Peak shaving ○ Power quality ○ Frequency regulation		
Heiqal Zamri	● Research on Gas Turbines ○ Siemens ■ Three different types of gas turbines ● Heavy-duty: Cogenerate ● Industrial: Compact and rugged design ● Aeroderivative: Oil and Gas companies ■ Cost: Between 2-3 million dollars per turbine ■ Uses either simple cycle power generation or combined cycle power generation https://www.energy.siemens.com/ru/pool/hq/power-generation/gas-turbines/downloads/gas-turbines-siemens.pdf	2	20

	• Found and analyzed Performance Data from the US Department of Energy, Black and Veatch, and Siemens.
	• Researched global concentrations of different types of gas turbines
	  ○ Heavy duty, industrial, aeroderivative, etc.
	• Flywheels
	  ○ Energy storage
	  ○ Uses rotational energy
	  ○ Is used for backup and the rotor will keep rotating even when supplying energy
	  ■ It is a short term backup energy
	  ○ Active Power		

Plan for Upcoming Week

- ❖ Create Slides for Professor Dalal
  - ➢ Gas Turbines - Cal
  - ➢ Flywheels - Cal
  - ➢ Energy Storage and its applications - Ricardo
  - ➢ PREPA's interconnectivity - Ricardo
  - ➢ Natural Gas Deliquification Port - Logan
  - ➢ Economics and costs of oil imports - Logan
- ❖ E-mail slides to Professor Dalal for meeting - Ricardo
- ❖ Meet on Tuesday, 3/6 to work on group senior design reflection - codes of ethics.
- ❖ Begin thinking of a technical challenge for the lightning presentation after Spring Break.
- ❖ Begin looking into company connections between PREPA and USA
- ❖ Begin looking into cost comparisons between generating using natural gas and oil