
EE 491 Week 5 Report - sddec18-03

Design of a More Reliable Power Grid for Puerto Rico

2/19/18 - 2/26/18

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

We had our weekly meeting on Monday, February 19th. At this meeting, we delegated roles for our weekly lightning talk. Our discussion focused on the economic and technical goals of this project, reevaluating both our semester and year-long project timeline as well as what research we would need to have completed by when, and our plan of things we wanted to have in our proposal. We also had a discussion after the design thinking workshop, which opened up many new ideas for solutions of our project.

Past Week Accomplishments

- ❖ Solidified our main technical goals
 - Reliable and Cost-Effective to fix when natural disasters hit
 - NOT a renewable-centered plan. Natural Gas is still a very big option for the country, and our plan will have higher emphasis on integrating natural gas than integrating more renewable energy.
- ❖ Solidified our main economic goals
 - Restructure how PREPA costs electricity
 - Calculate the cost of installing the proposed technical solutions as well as a future payoff to weigh the initial cost to the eventual profits.
- ❖ Restructured our project timeline
 - Created more solidified research goals
 - Restructured our end deliverable to a deeply technical and economic proposal of a redesign of Puerto Rico's utility grid and market.
 - Hopefully able to present our findings to power conventions.
- ❖ Updated Team Website - Ricardo
 - Added biographies and images to team website
 - Added project plan to team website
- ❖ Individual Research

- Details in the Individual Contributions Section

Pending Issues

- ❖ Lack of information on current grid layout. Will continue to research.
- ❖ Lack of information on types of online grid simulation software.
 - Will not be necessary until fall semester, but will begin to research.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Logan Lillis	<ul style="list-style-type: none"> ● Found the types and locations of privately and publicly owned generation plants in puerto rico. Compiled the information into a map. <ul style="list-style-type: none"> ○ Publicly Owned: ○ PREPA (aka AEE): 7 Oil Generation Plants (4195 MW) ○ Privately Owned: ○ AES: 1 Solar, 1 Coal (478MW) ○ Gas Natural Fenosa: 1 Natural Gas (510 MW) ○ Sonnedix: 2 Solar(61MW) ○ Sovereign Bank(Gestamp Wind): 1 Wind (26MW) ○ Uriel Renewables and Coqui Power: 1 solar (27MW) ○ Pattern Energy: 1 Wind (75MW) ○ Windmar Renewable Energy: 1 Solar(4.5MW) ○ Other: ○ 21 Hydroelectric Plants (156 MW) ● Began researching transmission 	6	18

	<p>diagrams. http://energia.pr.gov/en/data-and-statistics/ seems to have the best diagrams so far.</p> <ul style="list-style-type: none"> ○ Data from PREPA website shows values for quantities of power technologies. (https://www.aeepr.com/INVESTORS/OperationalProfile.aspx) ● Further researched solar irradiance and wind irradiance. <ul style="list-style-type: none"> ○ Solar: Compared various maps. South coast looks best for solar, but promising areas on north shore. ○ Wind: Some discrepancies in maps. Some sites show only offshore wind, while others show promising wind values in the mountainous regions. ● Generated Weekly Reports ● Updated Meeting Minutes 		
<p>Ricardo Rodriguez-Menas</p>	<ul style="list-style-type: none"> ● Read through EIA documentation on rates and cost of electricity and consumption ● Found natural gas and several alternatives to implement Natural Gas as the main source of energy in the island ● Work with Teaching Assistant to work on website issues and documentation ● Research on energy storage and its applications ☐ The research I did on Energy storage I did it based on the Company's documentation that is the actual energy storage company supporting the island. I studied the applications of these energy storage components provided by the firm. Load leveling, peak shaving, frequency regulation and spinning reserve are among those. ☐ Also I researched about other prominent companies in the matter. So far ABB still the best quality option for us and Puerto Rico but in case we look for alternatives we have AES energy who partnered with Siemens one of the companies with power proposals in the island and that is also partnered with PREPA. 	<p>6</p>	<p>16</p>

	<p>But also a really good alternative could be Eos that builds low cost zinc air energy batteries with a projected life cycle of 10 000 full cycles that is equivalent to 30 years. Something that could be very benefactory for the economy of the island since the cost of these batteries that are extremely efficient is around \$1000 per Kilowatt.</p> <ul style="list-style-type: none"> ● Research on PREPA <ul style="list-style-type: none"> ○ Some tests on interconnections completed, test with a program similar to PSSE 		
Heiqal Zamri	<ul style="list-style-type: none"> ● Researched and read an article on how to implement renewable energy sources such as solar energy and wind energy as a power grid that is stored using energy storages. <ul style="list-style-type: none"> ○ Thermal Storage needed for solar energy to supply even at night which stores in water, molten salts and other fluids. <p>Research on energy storages and how they work</p> <ul style="list-style-type: none"> ○ Current US Capacity of Energy Storage: 23GW ○ Mostly pumped hydroelectric storage ○ Different storages for different functions such as the flywheel which stores energy in spinning mass and batteries ○ It is very expensive to implement (\$400/kW) <ul style="list-style-type: none"> ● Began research on Gas Turbines and the cost of one after meeting with Professor Dalal 	3	14

Plan for Upcoming Week

- ❖ Upload Documents to Website: Ricardo
 - Weekly Reports
- ❖ Complete Design Document
 - Section 1: Introduction - Ricardo

- Section 2: Design Proposal and Analysis - Logan
- Section 3: Testing - Heiqal
- ❖ Discussed logging study hours
 - Add specific examples
 - Share with Logan BEFORE the end of the next weekly report period
- ❖ Upon discussion with Dalal: Delegate specific research category roles
 - Gas Turbines
 - Energy Storage
 - Renewables
 - Generation
 - Interconnectivity
 - Economics