SUNY MARITIME MICROGRID PROPOSAL

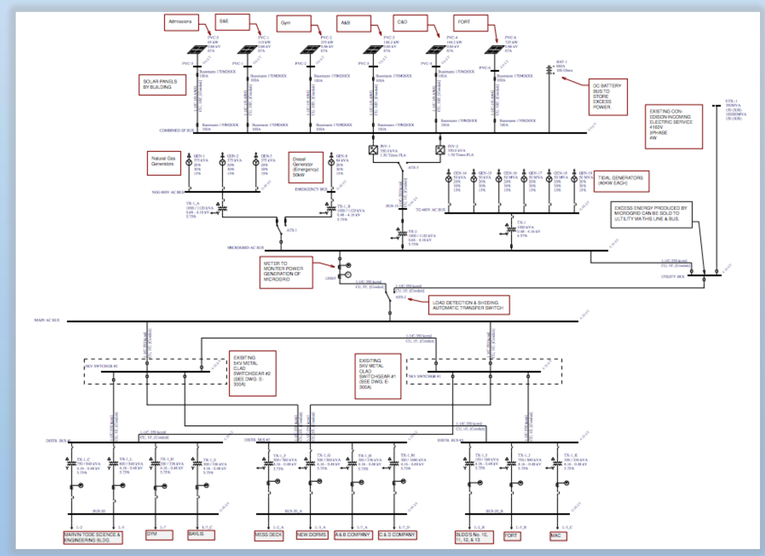
5 TEAMS – 1 Dedicated Professor & 23 Buildings
MISSION – Reduce kilowatt Load - Design a Sustainable Microgrid Based on Available Renewable Resources
- Lower Carbon Foot Print -

Using standard fluorescent bulbs our facility requires a capacity of 2.5 Megawatts

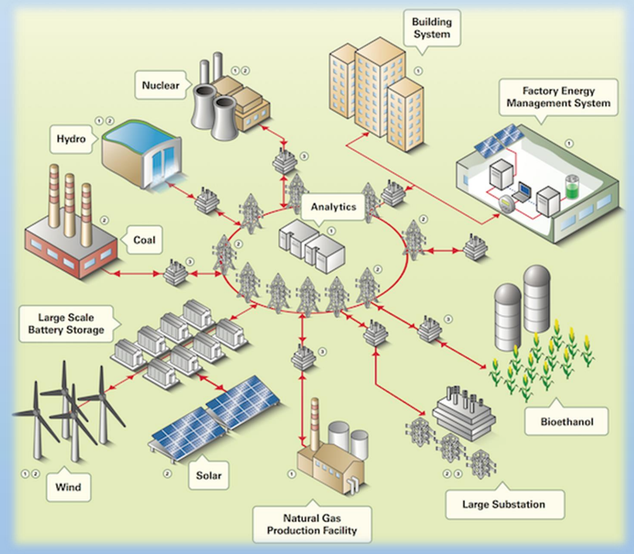
LED BULB REPLACEMENT	Kilowatt Reduction
Group 1	68.68 kW
Group 2	39.5 kW
Group 3	45.14 kW
Group 4	37.31 kW
Group 5	168 kW
TOTALS	358.63 kW

Regular Bulbs					
Floor	Hg Content(mg)	CO2 Emissions(kg)	kWh	Watts	Cost per day ($)
MAC	4760	8225933.431	321.404	2415	51.44
Baylis	21525	36929641.5	509.2	4775	81.47
TIV	1645	2180908.533	195.54	785	31.28
Mess Deck	3510	9468308.056	535.842	1366.5	85.74
TOTAL	**31440**	**56804791.51**	**1561.986**	**9341.5**	**249.93**
LEDS					
Floor	Hg Content(mg)	CO2 Emissions(kg)	kWh	Watts	Cost per day ($)
MAC	0	2711470.798	158.152	1281.5	25.29
Baylis	0	6281195.434	250.4584	2099.4	40.07
TIV	0	370940.8531	98.358	382.8	15.74
Mess Deck	0	1818598.342	242.3844	493.4	38.78
TOTAL	**0**	**11182205.43**	**749.3528**	**4257.1**	**119.88**

Maritime's Lighting Load characterization
LEDs Vs. Fluorescent Bulbs



ONE-LINE DIAGRAM OF PROPOSED MICROGRID

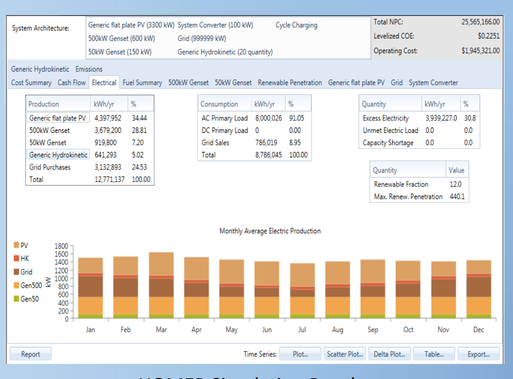


Simplified Overview of an Electrical Grid

The main grid isn't always reliable. It's susceptible to disasters, attacks, energy shortages, faults, and plain old errors. These events can affect thousands, even millions of people, in an instance and depending on what happened, it can take a long time to rectify.

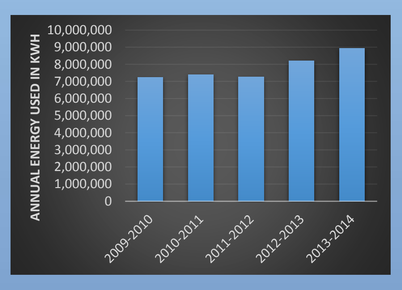
Microgrids offer some protection from this. If, rather than using or selling all the energy collected, a community stores it, they have a back-up during blackouts. This means when there could be no lights for miles around, a prepared community will have power to use and to distribute.

Microgrid Optimization, made easy with HOMER. Software allows you to model your microgrid to analyze and optimize before building.



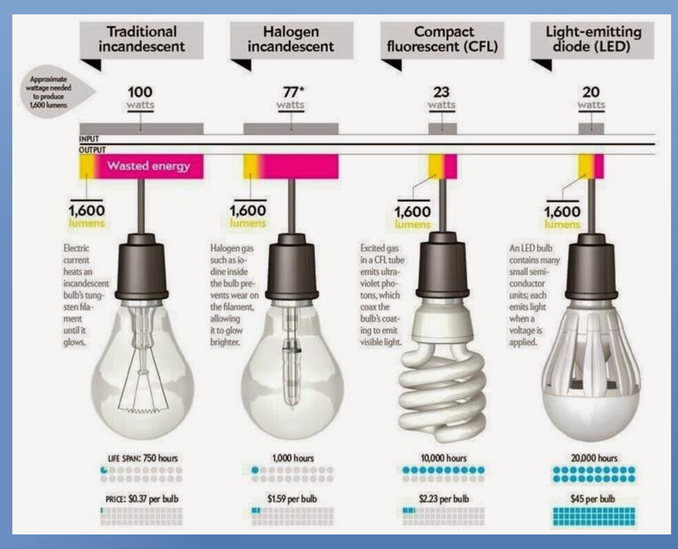
HOMER Simulation Results

358.63 kilo-Watts!
The LED bulb replacement reduced SUNY Maritimes' kilo-watt load by approximately 15%.

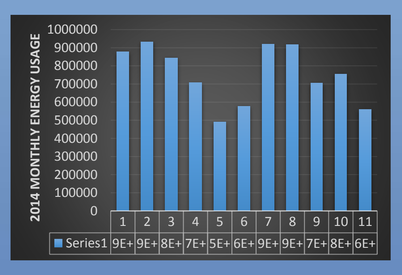


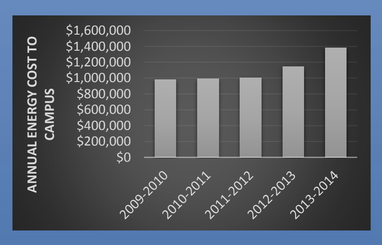
Electrical Load Simulation (One Year)

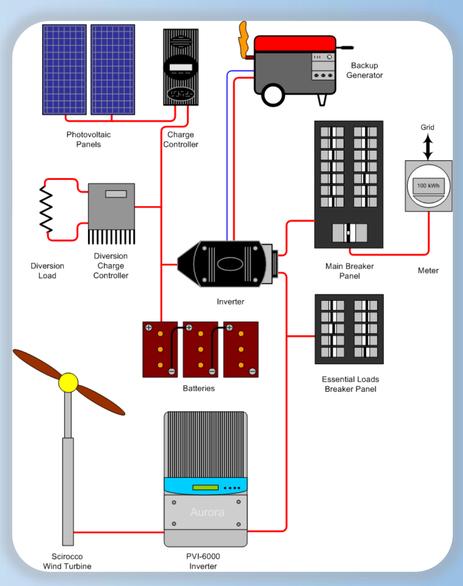
With 2.14 MW as the new approximate target capacity for SUNY Maritime, it was evident that our micro-grid power generators, transformers and switches would need to be reevaluated to better optimize our micro-grid proposal as well as making it better suited for the energy demands at SUNY Maritime. To do so our team used HOMER to run various scenarios.



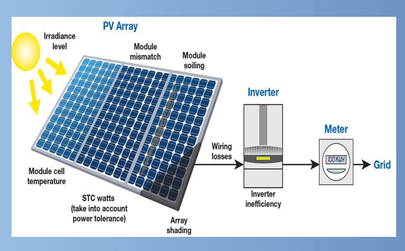
The US Department of Energy determines that the commercial sector uses on average 14% of its on-site energy for lighting. (U.S. Department of Energy, 2012) Compared to traditional incandescent light bulbs, LED light bulbs are much more efficient. When compared to a 60W traditional incandescent light bulbs, an equivalent 12W LED bulb saves up to 75% to 80% of the energy. Additionally, a traditional 60W light bulb can only last up to 1000 hours, while an equivalent 12W LED can last up to 25,000 hours, 25 times longer. (US Department of Energy, 2014) Thus making the lighting sector of our micro-grid a viable place to have real energy saving.



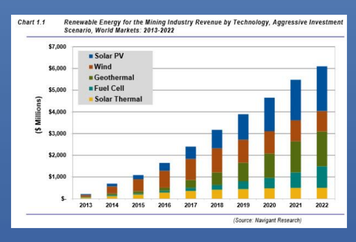




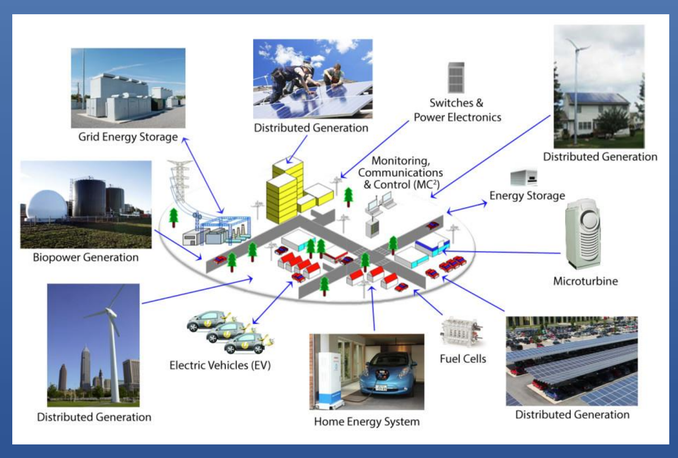
Simplified Microgrid One-line Diagram



Solar power is the conversion of sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power (CSP). Photovoltaics were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system. As the cost of solar electricity has fallen, the number of grid-connected solar PV systems has grown into the millions and utility-scale solar power stations with hundreds of megawatts are being built. Solar PV is rapidly becoming an inexpensive, low-carbon technology to harness renewable energy from the Sun.

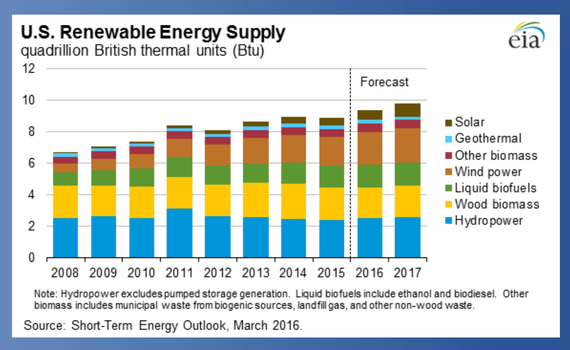


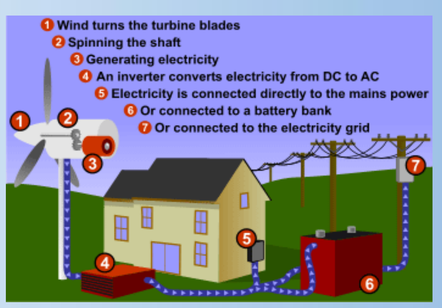
Every sector of the renewable energy business is seeing growth. As Photo Voltaic prices drop and energy prices rise, the choice is obvious.



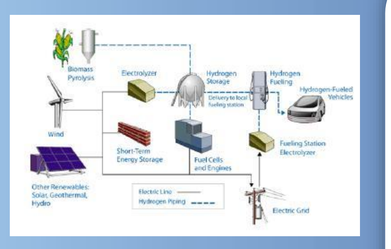
DER-Distributed Energy Resources

• Wind energy is a domestic, renewable source of energy that generates no pollution and has little environmental impact. Up to 95 percent of land used for wind farms can also be used for other profitable activities including ranching, farming and forestry.

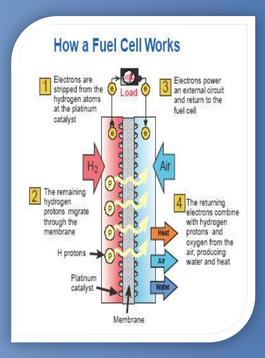


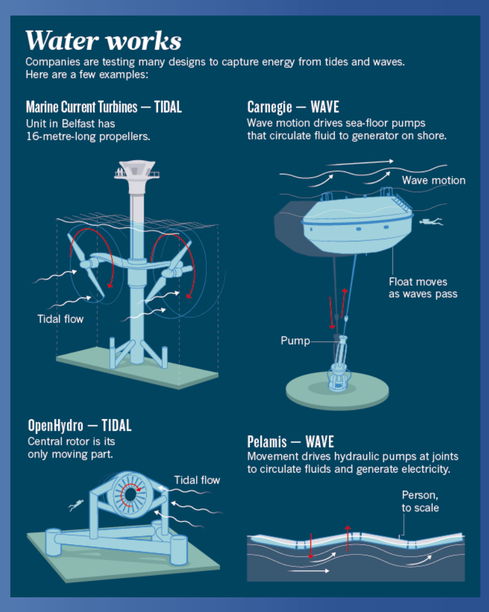


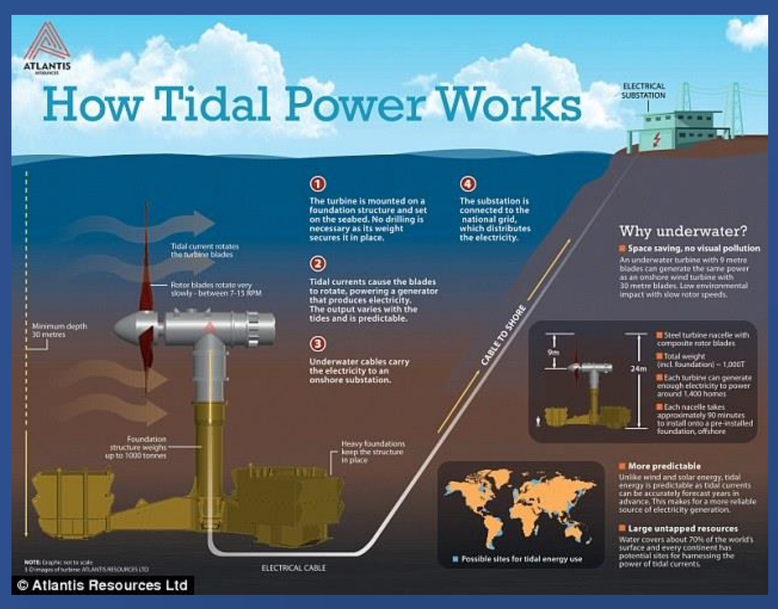
Energy Storage
Using Batteries

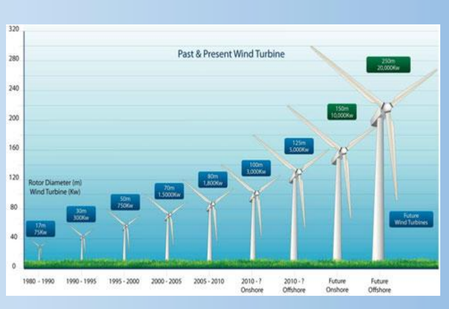


Energy Storage using
Hydrogen Fuel Cells









➢ Harmonious – Forming a pleasing or consistent whole
Technology integrated with the land makes for a better tomorrow

➢ A Sustainable future is easier, cheaper and more practical then once thought possible

The demand for renewable energies and their integration to the grid has become more important than ever before due to various reasons, including the increasing cost of electricity, depleting fossil fuels, an increasing population, etc. Thus the vision of a sustainable future requires easy and reliable integration of renewable distributed generators to the grid. With the ever increasing complexity of today's technology it is necessary to use the latest in interactive software to fully understand the dynamics of distributed generators when they are connected with the main grid. Simulink/MATLAB, SAM, HOMER, PowerSim, EasyPower, as well as hardware resources such as microcontrollers and sensors were used to design and simulate a micro-grid. Our presentation will include a load analysis, based on a 2.5 MW peak demand, a selection of five different scenarios of Distributed Energy Resources (DER) and a modified reduced generation through efficient LED lighting. Which will also be simulated with a small scale model of microcontrollers, electrical components and sensor modules. The goal of this presentation is to demonstrate the process and outcome of a micro-grid design based on clean, efficient and renewable energy.