The Power of Math

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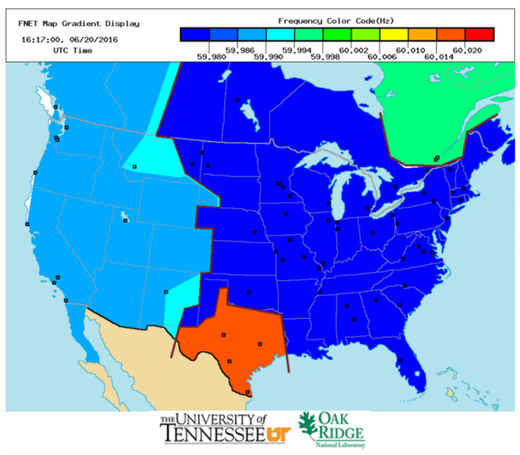
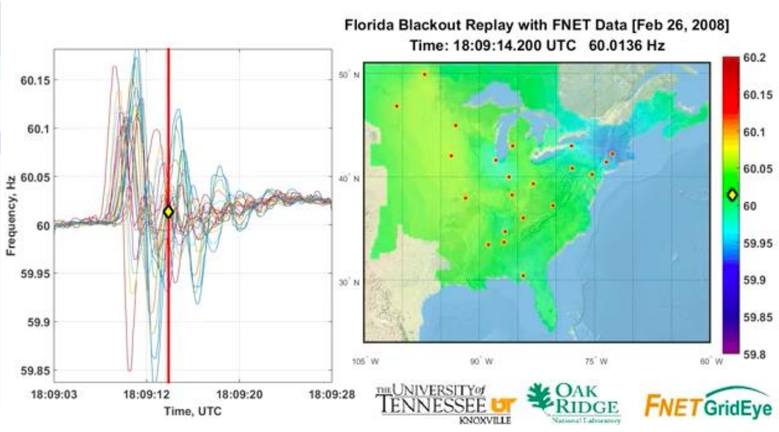
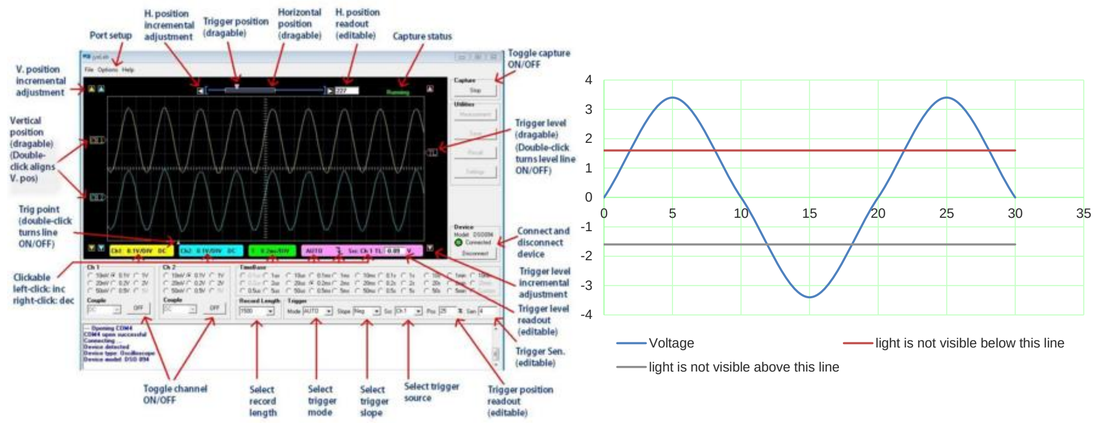
Project 1: Keep It Frequent!

Students will use their knowledge of how to recognize and construct sine functions to determine how frequency, amplitude, and DC offset will change what a lightbulb does. They will conduct an experiment that will show the effects on two different light bulbs. The class will use their discoveries to discuss how this experiment relates to the sine function. Then, using the oscilloscope, they will see the exact sine curve that the voltage makes. After the experiment, students will research how electrical engineers use trigonometry every day. They will analyze what contributions relate to changing the efficiency of the light bulb and how it could affect the Power grid. Students will then write a discussion board post detailing what they have learned about electricity, light bulbs, and the relevancy to trigonometry.



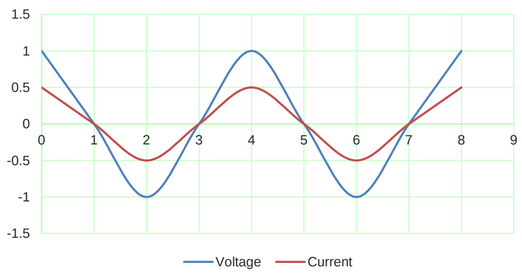




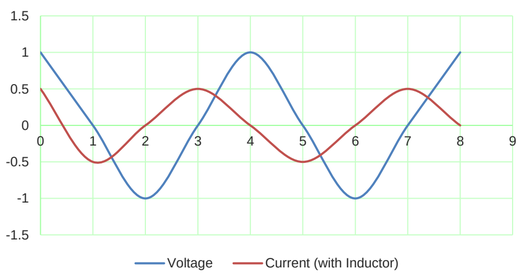
Project 2: Light Bulbs Are Curvy!

Students will have to read the activity sheet first and online articles to get an idea of what a power factor, watt, and the power grid is. Next, they will conduct an experiment of three different light bulbs to determine what their power factor is, the temperature, and the amount of watts used. They will have to determine which lightbulb is the most efficient for the power grid. Once the students have learned about the power factor, they should use their prior knowledge to graph a cosine function. There will be a discussion on how the graph will change. The relationship between the power factor and cosine graph should be discovered. The formula for the basic cosine graph and transformed cosine graphs should be discussed. The class will use their discoveries to discuss how this experiment would change in a real-world situation. After the experiment and discussion, students will research how electrical engineers determine what voltage they need to put on the Power grid and what could affect the power factor from not being close to one. Students will then write a discussion board post detailing what they have learned about the Power grid, the power factor, cosine equations, cosine graphs, and applications within real-world situations.

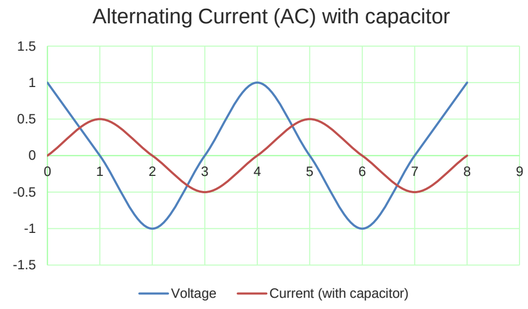
Alternating Current (AC) with a resistor



Alternating Current (AC) with an inductor

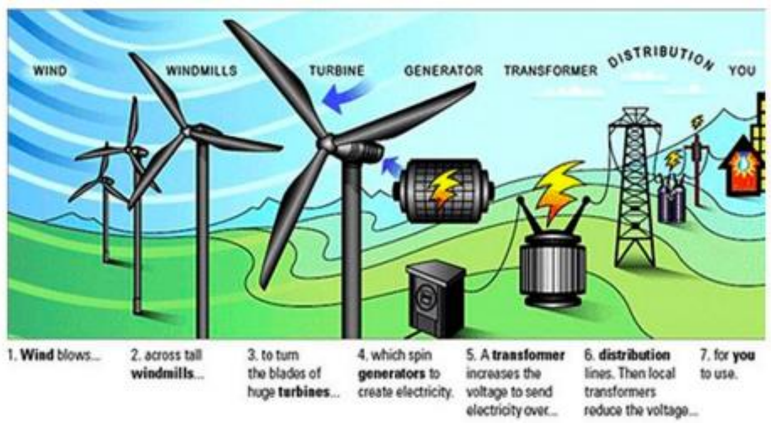


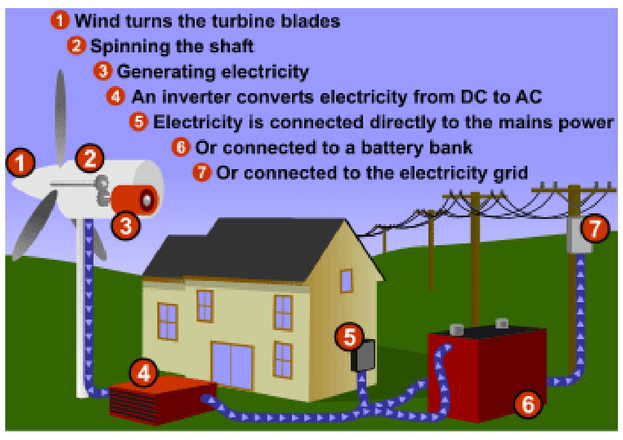
Alternating Current (AC) with capacitor



Project 3: Wind Turbine Power Calculations

Students will have to watch the videos and read online articles first to get an idea of what kinetic energy, Betz Limit, power coefficient, Wind Speed, Mass flow rate, Energy flow rate, tip speed, and rotational speed is. Next, they will have to make some calculations to fill out a chart for the tip speed, the power coefficient, the amount of power, and the amount of energy for each given time and wind speed. They will have to interpret a chart in order to determine the power coefficient. There will be a discussion on how a wind turbine converts kinetic energy into rotational kinetic energy into electrical energy that can be used on the power grid. The class will use their discoveries to discuss how this experiment would change depending on certain variables. After the experiment and discussion, students will research how electrical engineers predict how much energy will be produced by a wind turbine for the energy market and why that is important. Students will then write a discussion board post detailing what they have learned about the wind speeds, power, energy, wind turbines, and applications within real-world situations.





Wind Speed (M/S)	Time (Hours)	λ Value	C_p Value	Power (kW)	Energy (kWh)
1	531	X	X	X	X
3	1407	X	X	X	X
5	1831	X	X	X	X
7	1769	11.67	0.27	483,834	3,386,838
9	1386	9.08	0.4	1,523,442	13,710,981
11	913	7.43	0.42	2,920,558	32,126,138
13	524	6.28	0.37	4,246,883	55,209,477
15	249	5.45	0.32	5,642,379	84,635,685
17	105	4.80	0.24	6,160,224	104,723,808
19	39	4.30	0.18	6,450,179	122,553,412
21	12	3.89	0.12	5,806,008	121,926,168
23	3	3.55	0.08	5,085,246	116,960,665
25	1	X	X	X	X
27	0	X	X	X	X
Total	8,770	X	X	23,726,954	655,233,173

Resources:
Electric Energy Sources http://www.slideshare.net/mrmackenzie/ac-dc-electricity
Lighting Choices That Will Save You Money http://energy.gov/energysaver/lighting-choices-save-you-money
Understanding Power Factor and How it Affects Your Electric Bill https://www.progress-energy.com/assets/www/docs/business/power-factor-how-effects-bill.pdf
Energy Sources: http://energy.gov/science-innovation/energy-sources
Understanding Power Factor and How it Affects Your Electric Bill: https://www.progress-energy.com/assets/www/docs/business/power-factor-how-effects-bill.pdf
Peak-to-peak Voltage http://www.learningaboutelectronics.com/Articles/What-is-peak-to-peak-voltage.php
Frequency, Wavelength, and Amplitude: http://www.studyphysics.ca/newnotes/20/unit03_mechanicalwaves/chp141516_waves/lesson44.htm
Wind Power: http://www.slideshare.net/kkublbeck/wind-power-point-presentation
Power: https://en.wikipedia.org/wiki/Power_(physics)
Wind Turbine Calculations http://www.raeng.org.uk/publications/other/23-wind-turbine
How much Energy is Converted from the Wind by a Wind Turbine? http://www.weset.org/worksheets/ws-07.pdf
Wind Energy http://www.umanitoba.ca/outreach/crystal/Wind%20Energy.pdf