Solar panels: Looking at the periodic table of elements, where are the 'metals'? Where are the non-metals? (i.e., if I gave you a table and asked about an element, could you know the difference based on position). What are semiconductors and where are they located on the table? What properties do metals usually have? What about semiconductors? What is the basic idea of 'doping' semiconductors? How are the two 'active' layers of the photovoltaic panel different, atomically from each other? Given a cross section of a photovoltaic panel, could you describe the function of each layer?

Coal fired power plants: How does the burning of coal result in the production of electricity? Could you draw a simplified drawing of the major components?

Gas turbines: How does a gas turbine operate? Why are gas turbines (which spin) inherently more efficient that any kind of 'piston driven' engine?

Electrical energy terms: How does a joule compare to a Watt compare to a Kilowatt-hour?

Puerto Rico energy: What fraction of Puerto Rico's energy supply comes from burning coal? Why does this leave the nation at extreme risk? What fraction of the electrical 'grid' came down during the hurricane? What percentage of solar panels were damaged in that same storm? How does the concept of the 'smart grid' compare to the traditional model of large centralized power plants? Why are computers necessary in this new model of energy distribution? What was the main 'roadblock' to Puerto Rico rebuilding their energy grid into an 'all solar' system?

Turning Farm-waste into power: What were the main advantages to 'the dairy farm' and the nearby communities in the PBS news clip about turning farm-waste into energy? How much power was produced? How many homes were powered by this system in addition to the farm? What are the environmental benefits of this model?

Efficiency defined: What is the fundamental definition of efficiency? How does that fundamental definition of efficiency differ from other, more generic definitions of efficiency? (examples being how we measure the efficiency of cars and our in-class stove projects).

Vortex formation. What is a vortex in a fluid? What are fluids? How are fluids different from liquids? Or are they 'the same'?

The chemistry of combustion. What does "complete" combustion of Hydrocarbons (and carbohydrates) look like? How can you tell if the combustion process is 'complete'? What are examples of hydrocarbons? Why are they called that? What are examples of carbohydrates? Why are they called that?

Math section: The heat equation. Know how to use it. Given a data set from a student 'hot bolt into cold water lab', be able to determine: the heat gained by the water, the specific heat capacity of the metal piece. Efficiency of stove lab: Given a student data set: be able to determine the efficiency of the system. From the Up and Down lab: Be able to determine 'the work done' to climb a hill and the 'power output' given the time. Percent error. Given a student derived answer and 'the right' answer, be able to

determine the percent error of the students work. Standard Deviation. Given a collection of data points, be able to determine the 'standard deviation'.

Nikoli Tesla. Who was he and why is his work important? When did he live? What examples of modern day electrical system trace their roots back to Tesla? Fundamentally, how does an electric generator work? Why does the electrical current come in 'alternating format'? What is AC current? What is DC current? Why did Tesla argue that AC was superior to DC with regard to transmitting power over distances (as we do today). How did Thomas Edison try to convince the public that his, Direct Current model was safer than the AC model proposed by Tesla? How did Edison propose to 'boost' the voltage along long lengths of powerlines? Why were observers so startled about Tesla's radio controlled boat demonstration? Why were neighbors in Tesla's community so frightened of his work?

Late additions: Heat transfer.

How does convection differ from conduction differ from radiative heat transfer. Given a sample scenario of heat transfer, can you describe how to improve it? Or why it may not be working as well as planned?