elab energy hunt

Solar thermal panel:

1. find the solar thermal panel demo downstairs at the elab, and take a photo of it for this lab.
2. where is the harvested energy in this panel stored if it were installed in your green home?
3. measure the area of the panel in meters (l x w):
4. if the max solar radiation at the elab is 1500 Watts/m2, how much power in Watts could this panel collect?
5. If it does so for an effective 5 hours per day, how many kWh is this? (multiply kW by hours)
6. if electricity costs $0.40/kWh how much money does this produce each day?
7. If the panel, pump and tank cost $2000, how many days would it take to pay off the system? (this is called ROI, or return on investment)
8. If it lasts for 40 years, subtract the payoff time from 40
9. what is the total cost of ownership for the panel?
10. look up extreme solar thermal where the fluid is not water, even melted salt-where are these and how do they work?

PV panel

1. find a PV panel around the elab, take a photo
2. where does the energy this panel harvests get stored?
3. assume that the panel you found can harvest 200W of solar power for 5 hours per day, how many kWh is this?
4. using the numbers above, how many $ does this produce each day?
5. If the panel cost $400 (1 dollar per Watt), how long is the ROI?
6. If the panel lasts for 20 years, what is the TCO?
7. When the elab was built, we installed 26 kW of PV on the roof when it cost $11/Watt. How much did the system cost?
8. how much would it cost today?
9. in your green home, how will you use PV?
10. research how much PV is installed in large arrays on our island,

where they are and what percentage of our island energy comes from these arrays.

Wind

1. find the wind turbines around the elab (there are several) and take a photo
2. there are two types: leading blade and following blade, which did you find?
3. If a small wind turbine like the one above the garden can produce 400W for 10 hours per day, how many kWh is this?
4. how much money can it make you each day?
5. If it costs $500, what is the ROI?
6. If it lasts for 8 years, what is the TCO?
7. why are wind turbines good or bad for your green home?
8. there is a myth that wind turbines kill more birds than cats (actually is it 1/10000), what other reasons do folks not like wind?
9. offshore wind is much more constant and far from view, why is this a good alternative in the UK specifically?
10. Europe has many large wind turbines, look up the max capacity for one of these monsters, including the size
11. research the major wind turbine installations on our island- where are they and why?
12. how much of our island energy comes from these?
13. when the wind is not strong in Waimea, you may notice the power plant across the road near the dump going full blast-why?

Hydro

1. research where on our island are hydroelectric systems installed, and include a diagram.
2. how big are they?
3. look up how much energy our island uses each day
4. what percentage is this?
5. look up “run of the river” hydro-how is it different from a dam?
6. how would you use hydro in your green home?
7. why has New Zealand banned hydro on the west side of the south island?

8. why is electricity so cheap in Norway and the Columbia gorge?
9. Facebook has servers on the Columbia river-is this just about hydro power?

Geothermal

1. where on this island is there a large geothermal plant? Include a photo or diagram of the plant.
2. is it a closed or open cycle plant? what is the difference?
3. what is the circulating fluid?
4. your choice of location for your green home may be influenced by access to geothermal-where on the planet are the best locations for this geologically?
5. in the 1970's there were protests about geothermal on this island-what was this about, and what has changed?
6. how is the attitude about geothermal in Hawaii different from the attitude among the Maori in NZ?
7. Sonoma county in northern California has large geothermal plants-how is the geology there important?
8. look up how much power the Puna Geothermal system is allowed to contribute the Big Island grid
9. who controls this, and why do they limit it?

——non-renewable energy———

Thermal power plants-Hawaii

1. across from the elab (south) is a Hawaii Electric power plant, what sort of fuel does this use?
2. what sort of thermal plant are these?
3. how many plants like this are on our island?
4. what percentage of our island energy comes from these plants?
5. are there any coal fired plants on our island now or in the past?
6. how much oil is imported every week for these plants?
7. how does it get here?
8. if there was a tsunami that impacted the ports, how many days of electricity would we have on our island?
9. what is the biggest client for HELCO?
10. in your green home, what sort of non-renewable energy might you need and why?

Thermal power plants-global

1. what is common about coal or oil fired and nuclear power plants?
2. how are these different from gas turbine plants?
3. fracking is a controversial means of getting natural gas-what are the concerns?
4. how has fracking impacted the price and availability of natural gas in our country?
5. how has this changed the nature of power plants?
6. thinking of #2 above, why would fracking enable more integration of renewable energy into our grid?

Smart grids

1. what is a smart grid?
2. how does it integrate renewable, non-renewable energy and energy storage?
3. why is it critical to understand energy uses in place and time?
4. how is this monitored?
5. what country or countries are leading in smart grids?

Storage

1. where is our water stored?
2. where is our hot water stored?
3. where is our electrical energy stored?
4. if the hot water tank in your home hold 240l of hot water that was warmed from 20°C to 40°C (hot water) this is about 5.5 kWh. If this tank costs $400 what is the cost per kWh to store hot water?
5. if the cost to store electrical energy in a lithium battery is $8000 for 10 kWh, what is the price per kWh to store electrical energy?
6. what is the advantage and disadvantage of each?
7. if you moved into an older home in Hawaii, which would you install first: PV or solar thermal?
8. why is energy storage such a big deal in a smart grid?

Transportation:

1. how man kWh are stored in a typical gasoline car if the tank is 15 gallons?
2. how many kWh are stored in the battery of an EV of your choice?
3. which of these (gas or EV) would have longer range in a straight freeway scenario?
4. which would have greater range in a city scenario-why?
5. when a gas gar slows down where does the energy of motion (kinetic energy) go?
6. how is this different in a hybrid or electric car?
7. why is the miles per gallon for a hybrid car higher in the city than the highway?
8. if you lived in a state our country where charging stations were common, would you buy a gas or EV?
9. what if you lived on this island? gas, hybrid or EV?
10. in the near future, EV driving ranges will get to exceed gas car (full tank) range-how would this impact your choice?
11. how many minutes does it take to fill the typical gas car tank?
12. how many minutes does it take to charge an EV of your choice?
13. how is this changing?
14. some say that an EV can be green or not-so-green depending on where the electricity comes from-explain
15. why would an EV in Norway or near the Columbia river in Oregon be greener than one in NYC?
16. the next generation of EVs will enable you to plug into your house to power everything on one battery-how will this change your green home design?
17. why will it be necessary for utilities then to have an energy trade agreement with you (charge at work, while your home PV puts energy into the grid)?
18. how will autonomous EV cars change this?
19. how will they change the infrastructure of cities?
20. have you ever taken an Uber or Lyft? what was it like?
21. have you ever been in a robotaxi? what was it like?