Week Breakdown

- Camp Colley and Energy Basics
- Non-renewable Energy
- Renewable Energy
- Energy Portfolio
- Presentations

1. The Basics
   - Introduce lesson and Camp Colley

2. Non-Renewable Energy Sources
   - Where do fossil fuels come from?

3. Renewable Energy Sources
   - What are renewable energy sources?

4. Let’s Work Together
   - Energy portfolio creation

5. Presentations
   - Presentations and wrap-up
Camp Colley and Energy Basics
Day 1
Has anyone ever been to Camp Colley?

Outdoor adventure camp nestled in a pine forest on the Mogollon Rim - 50 miles north of Payson at 6,700 feet

Phoenix Parks and Recreation Department
- Structured, supervised recreation opportunities in a unique forest setting

30-acre (~23 football fields) site surrounded by national forest
Camp Colley
Call to Action

- The city council has gathered the 20 smartest campers (you!)
- They want you to decide how the Camp is going to be off-grid (i.e. no fossil fuels)
Energy

- What do you think of when you hear the word ‘energy?’
- Energy is used to provide heat, power or do work for human use
- Note – everything is either capable of providing energy or has energy – has been transformed to something else and/or is unusable
- Energy is the foundation for everything we do
  - How do you think energy relates to food, water, and transportation?
- Energy source - the resources for producing heat, electricity, and fuel for cars
Handout

• Let’s…
  • create our groups for the week
  • complete the handout
  • discuss the handout
Definitions

* **Non-renewable energy** - Energy resources that cannot be replaced once they are used or an energy resource that is not being replaced as fast as it is being used
  * Examples?

* **Renewable energy** - Used to describe energy resources that are being quickly replaced by nature so that they can be used by humans more or less forever
  * Examples?

* **Energy Portfolio** - The diversity of energy resources being used by a particular place
  * Why is it important that we use more than one type of energy source?
How does it get to my home?

Diagram showing the flow of energy from coal, nuclear, and wind power plants through the energy grid to an energy supplier, then to a utility, and finally to a home.
Energy Portfolio

Global sources of energy in 2006:
- Oil: 1.06
- Natural gas: 0.61
- Coal: 0.81
- Nuclear: 0.15
- Hydroelectric: 0.17
- Wind + Photovoltaic + Solar Thermal: <0.005
- Geothermal: <0.01
- Biomass: 0.19

California's Electricity Supply 2005:
- Natural Gas: 30.0%
- Coal: 20.0%
- Hydro: 19.0%
- Renewables: 11.0%
- Nuclear: 13.0%
- Cogeneration: 7.0%
Energy Portfolio

Total Energy Consumption in China, by Type (2006)

- Coal: 70%
- Natural Gas: 3%
- Oil: 20%
- Other Renewables: 0.06%
- Hydroelectric power: 6%
- Nuclear: 1%

Source: EIA International Energy Annual 2006

2005
- Nuclear: 13.0%
- Renewables: 11.0%
Non-renewable Energy
Day 2
How are fossil fuels made?

Non-renewable energy –
Energy resources that cannot be replaced once they are used or energy resources that are not being replaced as fast as they are being used

Making Fossil Fuels
Toil for Oil Activity

• Today we are going to “drill” for oil, a non-renewable resource, and we will model the extraction of oil reserves over 3 years
• What happened to the oil production as the number of oil drillers increased with each year? What might this simulate?
• With each year, was it easier or harder to extract the oil?
• What are some policies, laws, manufacturing practices, or other types of legislation that could be implemented to reduce dependency on non-renewable energy sources? (i.e. What are some changes that the government could force people to make?)
# Non-renewable Energy

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheap</td>
<td>Emissions are bad for the environment</td>
</tr>
<tr>
<td>Holds a lot of energy</td>
<td>Pollution</td>
</tr>
<tr>
<td>Easy to take from one location to another</td>
<td>Mining is dangerous for environment and humans</td>
</tr>
<tr>
<td>Easy to use in homes and businesses</td>
<td>They are non-renewable in our lifetime</td>
</tr>
</tbody>
</table>
Renewable Energy
Day 3
Renewable Energy

Used to describe energy resources that are replenished by natural processes on a sufficiently rapid time-scale so that they can be used by humans more or less indefinitely.
Renewable Portfolio Standards

www.dsireusa.org / November 2009

29 states & DC have an RPS
6 states have goals

State renewable portfolio standard
State renewable portfolio goal
Solar water heating eligible
Minimum solar or customer-sited requirement
Extra credit for solar or customer-sited renewables
Includes non-renewable alternative resources

WA: 15% by 2020*
MT: 15% by 2015
OR: 25% by 2025 (large utilities)*
5% - 10% by 2025 (smaller utilities)
NV: 25% by 2025*
CA: 33% by 2020
UT: 20% by 2025*
AZ: 15% by 2025
NM: 20% by 2020 (IOUs)
10% by 2020 (co-ops)
TX: 5,880 MW by 2015
HI: 40% by 2030

MT: 15% by 2015
MN: 25% by 2025 (Xcel: 30% by 2020)
SD: 10% by 2015
WI: Varies by utility; 10% by 2015 goal
MI: 10% + 1,100 MW by 2015*
OH: 25% by 2025†
IL: 25% by 2025
IA: 105 MW
KS: 20% by 2020
MO: 15% by 2021
NC: 12.5% by 2021 (IOUs)
10% by 2018 (co-ops & munis)

VT: (1) RE meets any increase in retail sales by 2012;
(2) 20% RE & CHP by 2017
NH: 23.8% by 2025
MA: 15% by 2020 + 1% annual increase (Class I Renewables)
RI: 16% by 2020
CT: 23% by 2020
PA: 18% by 2020†
NJ: 22.5% by 2021
MD: 20% by 2022
DE: 20% by 2019*
DC: 20% by 2020
AZ Wind Potential

AZ Geothermal Potential
Wind Power

• In Arizona, we tend to focus on the potential of using solar energy to create electricity.
• In the US, wind power has a lot of potential.
Power Analysis

• Get into pairs - Each group will complete the worksheet
• The amount of power produced by a wind generator increases as the wind speed increases.
  – The independent variable = wind speed
  – The dependent variable = power
• Determine values of k by plugging in the given values for wind speed and power. This will yield four slightly different values for each blade; it is up to you to decide how to find one value of k that best represents the relationship, for each blade.
• Use this value to find the power supplied at a wind speed of 25 mph.
# Renewable Energy

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<td>No emissions or mining</td>
<td>More expensive than fossil fuels</td>
</tr>
<tr>
<td>We are not running out</td>
<td>Site specific</td>
</tr>
<tr>
<td>Available within our country</td>
<td>May harm the natural environment</td>
</tr>
<tr>
<td>The energy can be stored</td>
<td>Dependent on the weather</td>
</tr>
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Creating Energy Portfolios
Day 4
Energy Portfolio

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Source: EIA International Energy Annual 2006
Team Work

• Split up into your groups
• Create an energy portfolio for Camp Colley using only renewable energy sources
• Decide the percentages of the different energy sources and create a pie chart
• On the side of your paper, provide a short description of where this energy would come from
• Try to be realistic - recall the energy source maps from yesterday and how it is better to have diversity
• Pick one representative who will present your energy portfolio to the class tomorrow
Presentations
Day 5
Camp Colley’s Actual Energy Portfolio

- Totally off the grid
- Use:
  - Solar energy
  - Propane
  - Well water and a constructed wetlands system for waste water disposal