Camp Colley Goes Green

NSF-Funded GK-12 Project

Energy Lesson Plan

Week Breakdown

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

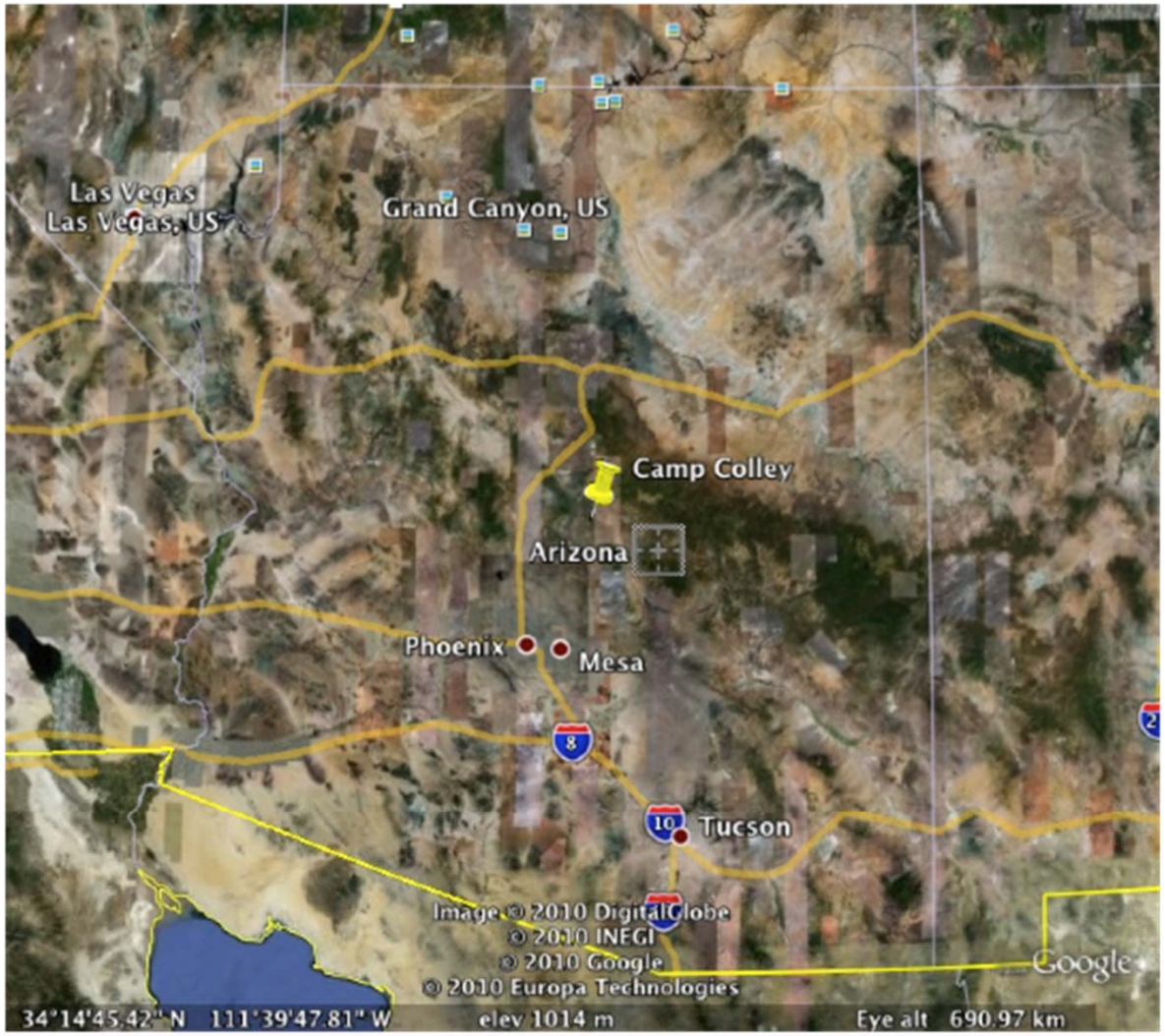
1. The Basics	2. Non-Renewable Energy Sources	3. Renewable Energy Sources	4. Let's Work Together	5. Presentations
•Introduce lesson and Camp Colley	•Where do fossil fuels come from?	•What are renewable energy sources?	•Energy portfolio creation	•Presentations and wrap-up

Camp Colley and Energy Basics
Day 1

Camp Colley

- 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


Las Vegas
Las Vegas, US
Grand Canyon, US
Camp Colley
Arizona
Phoenix
Mesa
8
10
Tucson
Image © 2010 DigitalGlobe
© 2010 INEGI
© 2010 Google
© 2010 Europa Technologies
Google
34°14'45.42" N 111°39'47.81" W
elev 1014 m
Eye alt 690.97 km

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

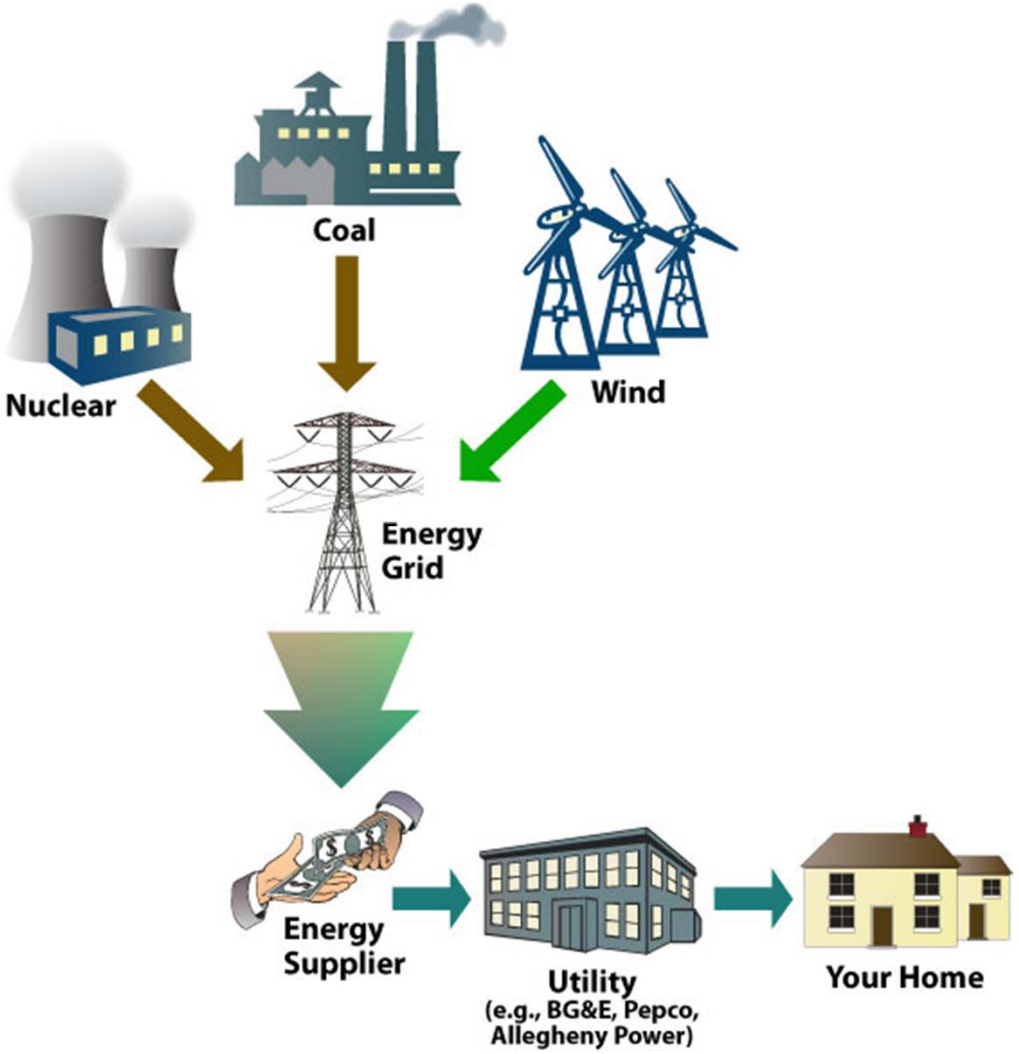
Handout

- Let's…
  - create our groups for the week
  - complete the handout
  - discuss the handout

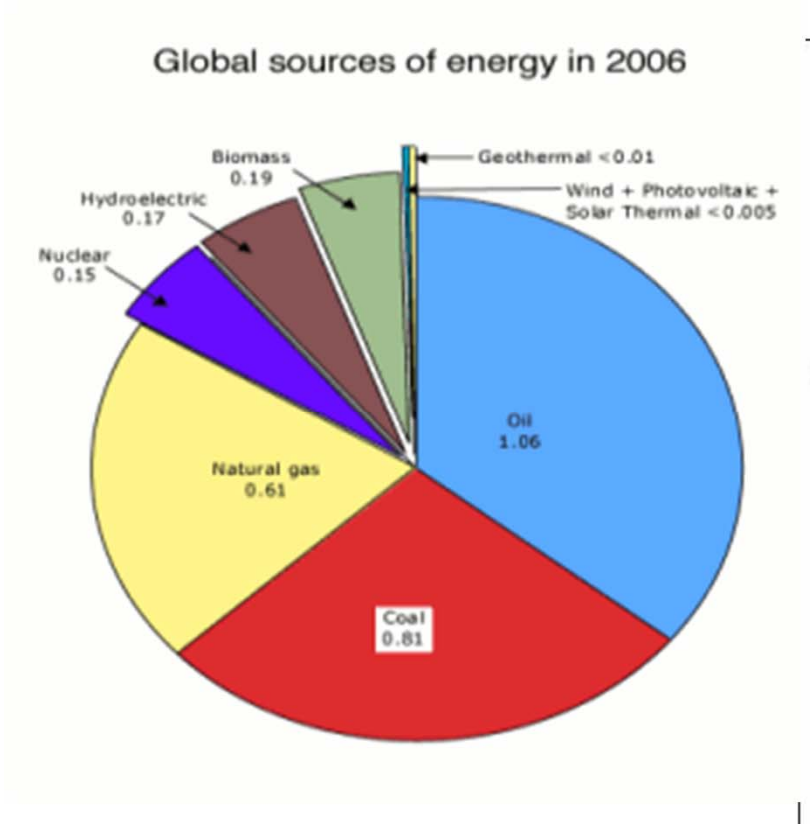
Definitions

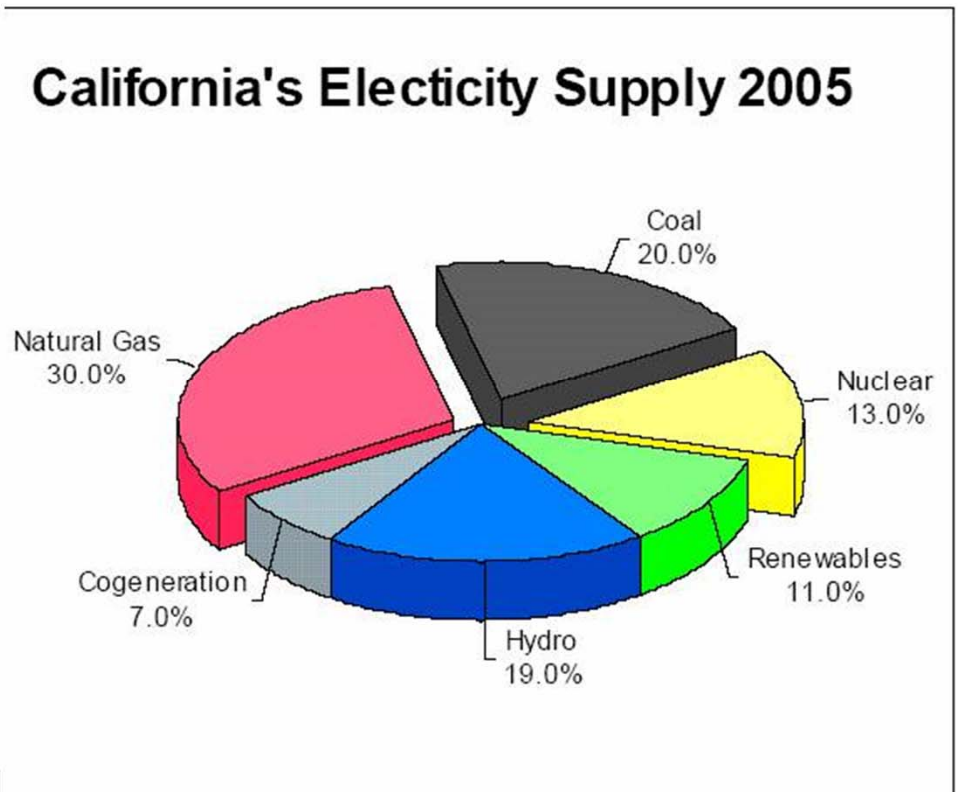
- **Non-renewable energy** - Energy resources that cannot be replaced once they are used or an energy resource that is not being replaced as fast as it is being used
  - Examples?
- **Renewable energy** - Used to describe energy resources that are being quickly replaced by nature so that they can be 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?

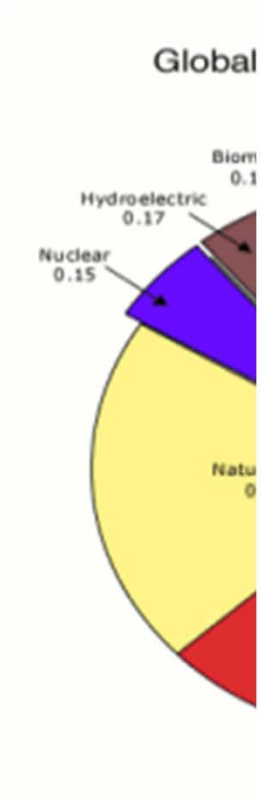


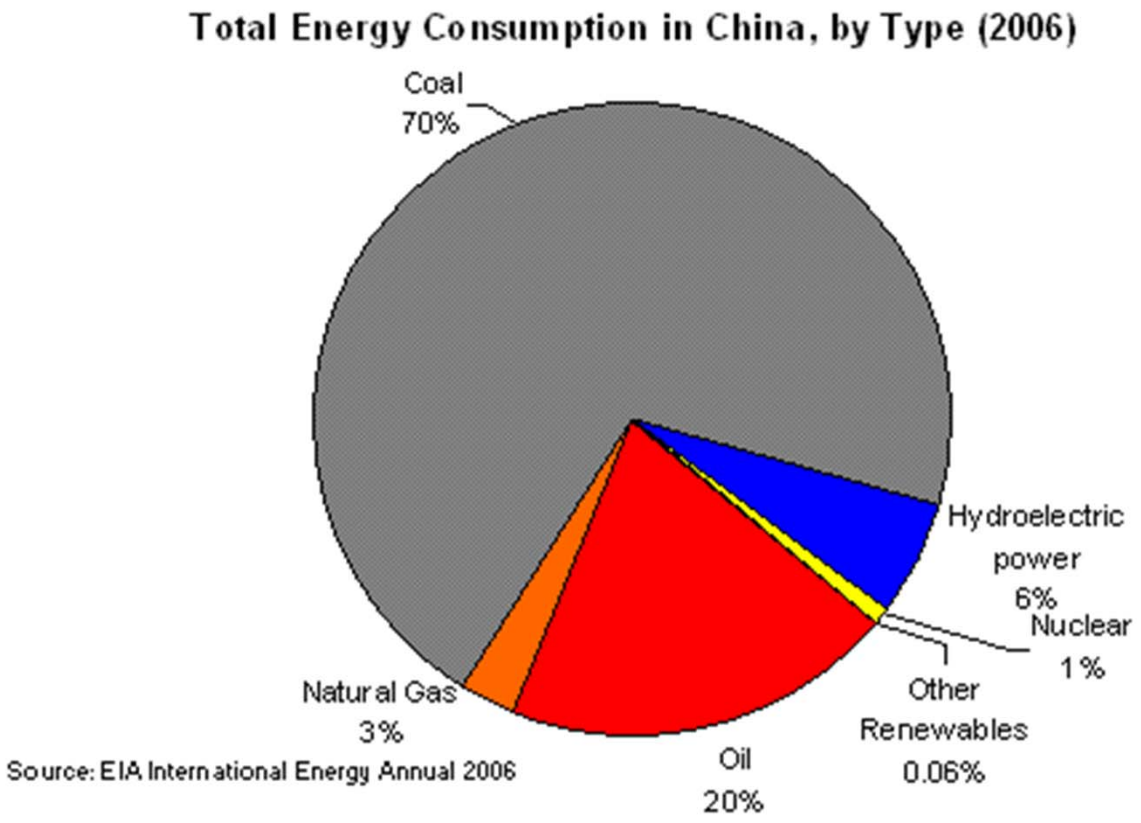
Energy Portfolio



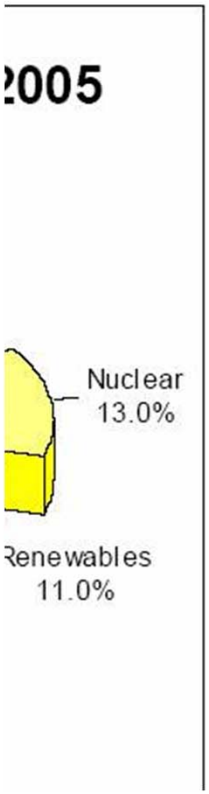


Energy Portfolio





Source: EIA International Energy Annual 2006



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

Pros	Cons
Cheap	Emissions are bad for the environment
Holds a lot of energy	Pollution
Easy to take from one location to another	Mining is dangerous for environment and humans
Easy to use in homes and businesses	They are non-renewable in our lifetime

Renewable Energy
Day 3

Renewable Energy

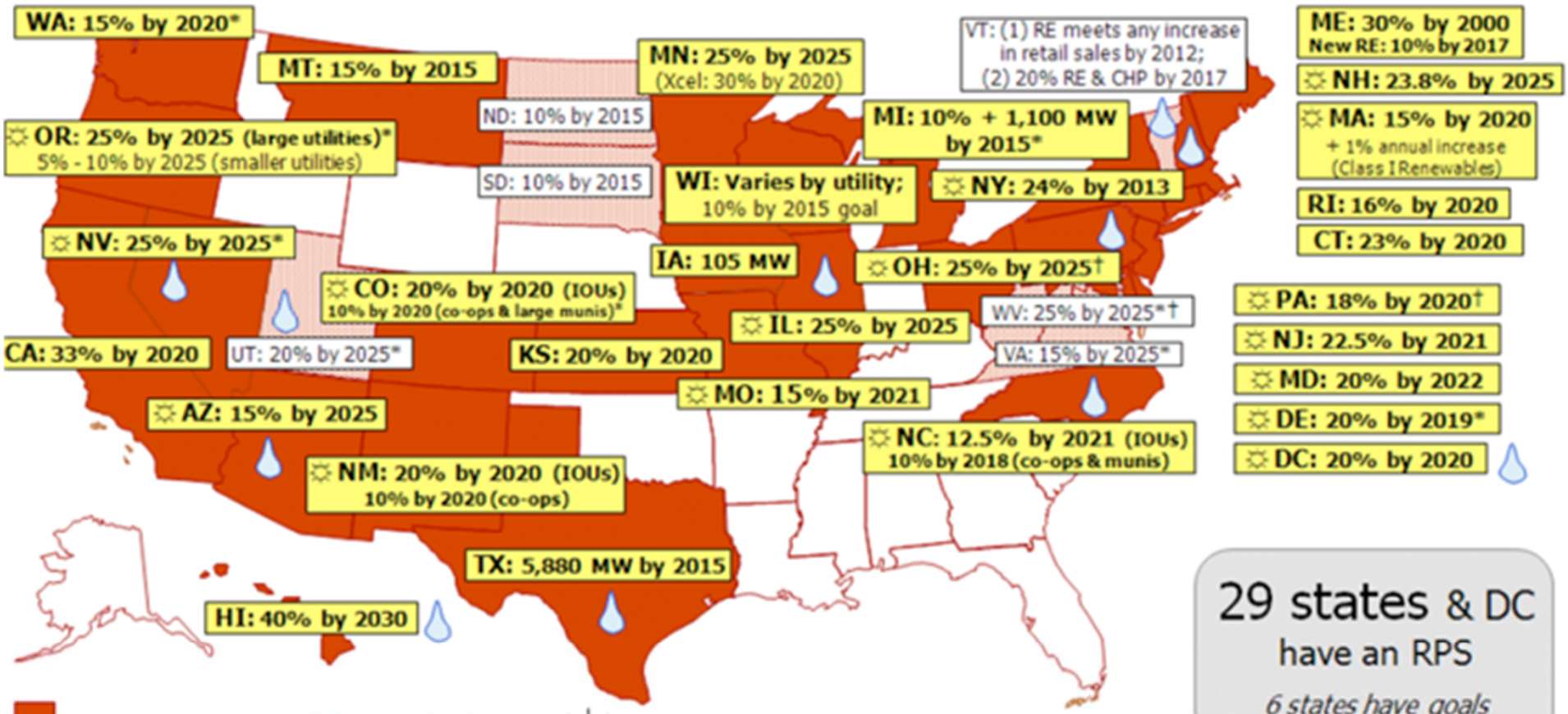
Used to describe energy resources that are replenished by natural processes on a sufficiently rapid time-scale so that they can be used by humans more or less indefinitely

Renewable Energy

NC State University
North Carolina Solar Center

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

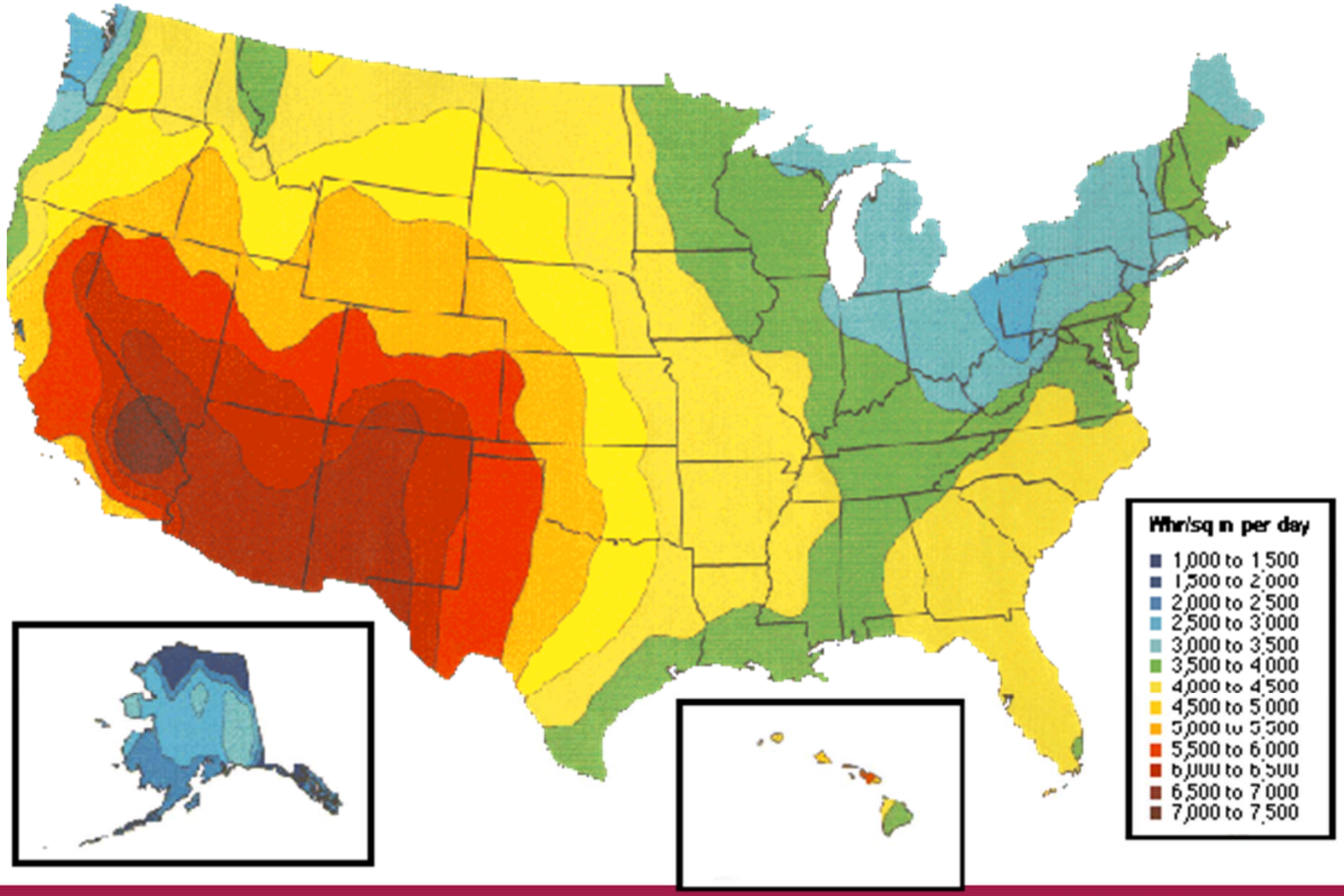
Minimum solar or customer-sited requirement

* Extra credit for solar or customer-sited renewables

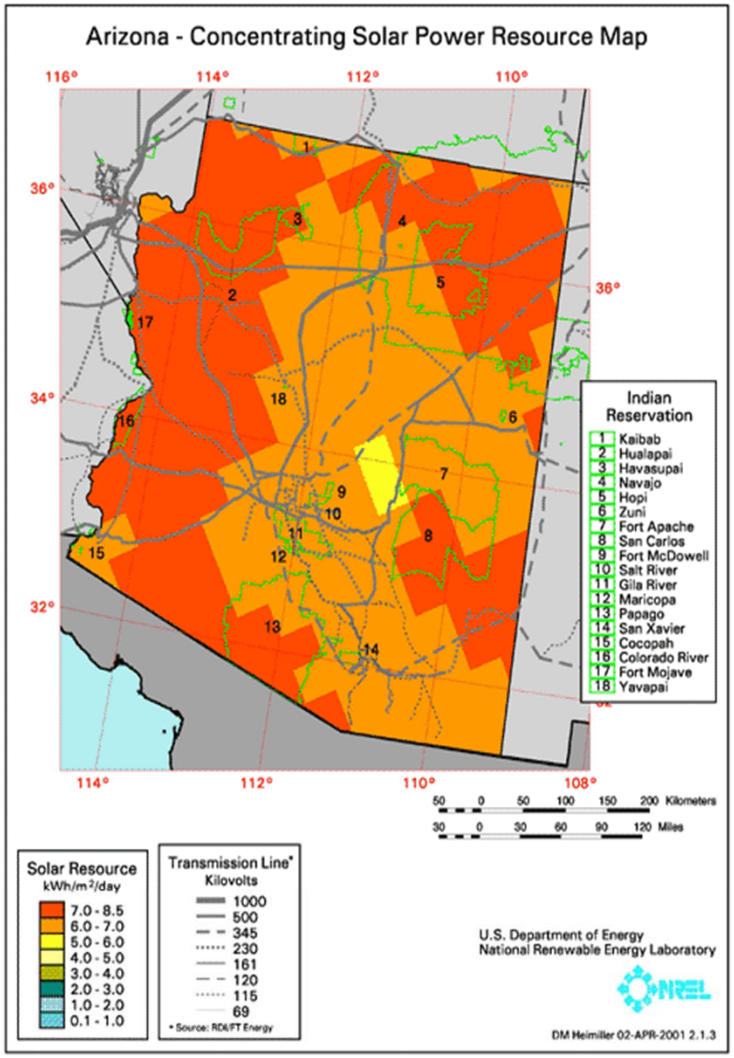
† Includes non-renewable alternative resources

IREC
INTERSTATE RENEWABLE ENERGY COUNCIL

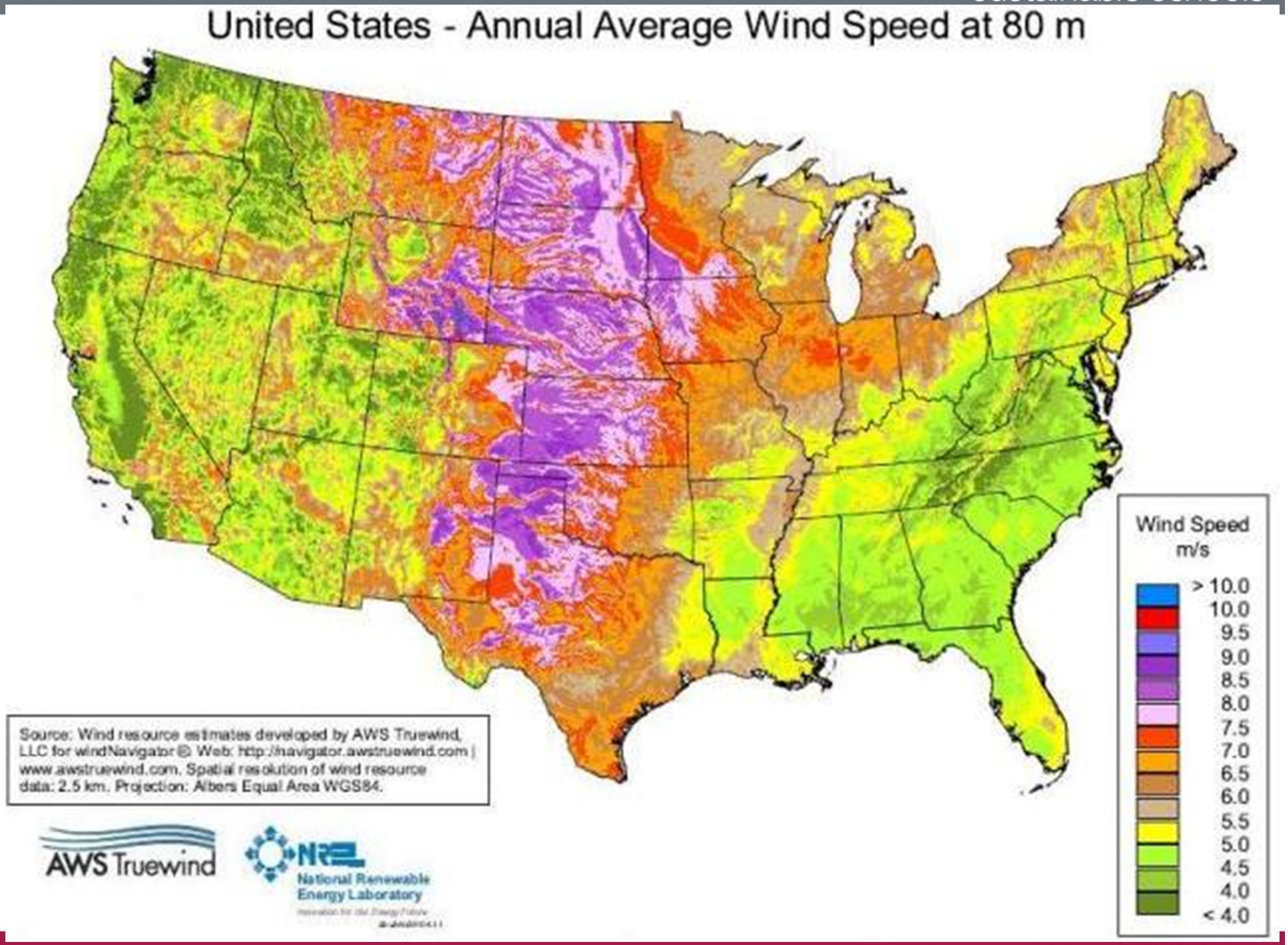
US Solar Potential



AZ Solar Potential



United States - Annual Average Wind Speed at 80 m

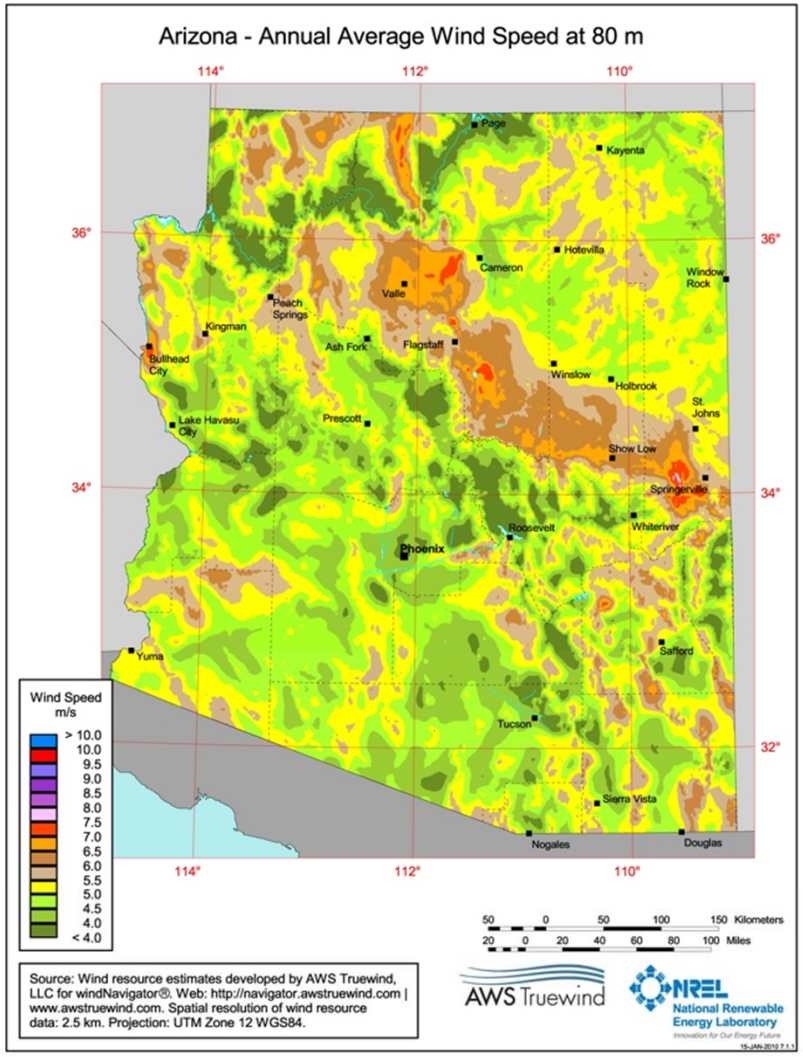


Source: Wind resource estimates developed by AWS Truewind, LLC for windNavigator®. Web: http://navigator.awstruewind.com | www.awstruewind.com. Spatial resolution of wind resource data: 2.5 km. Projection: Albers Equal Area WGS84.

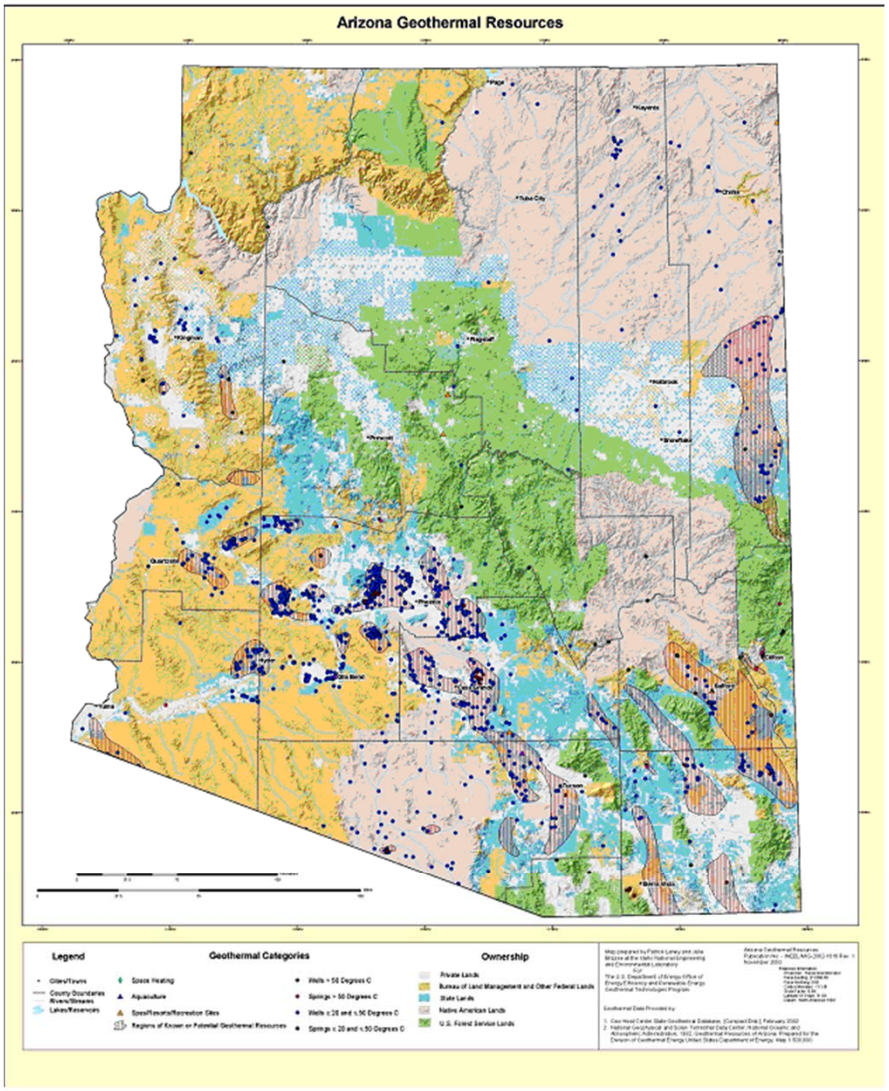
AWS Truewind

NREL National Renewable Energy Laboratory

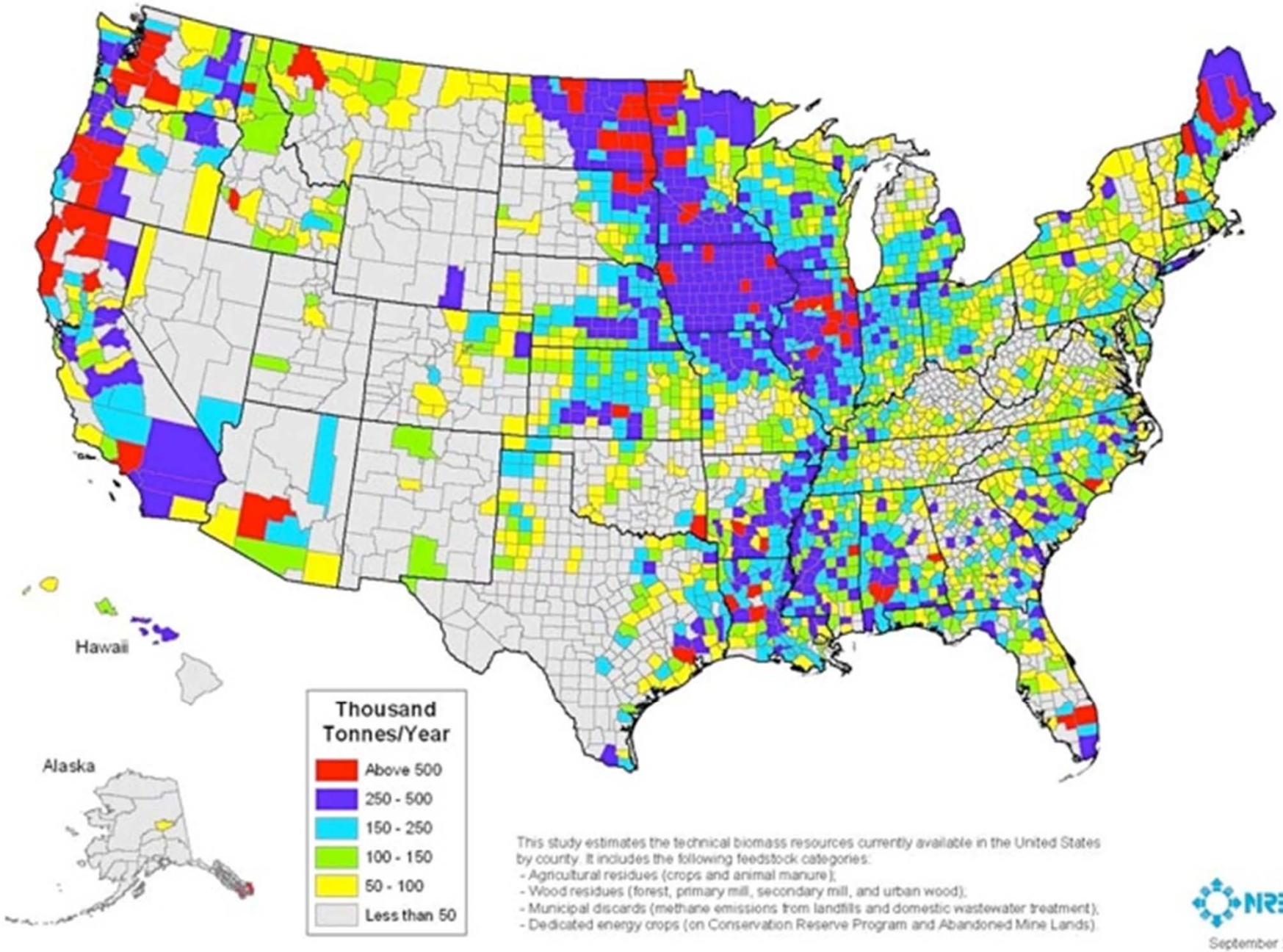
AZ Wind Potential



AZ Geothermal Potential



Biomass Resources Available in the United States



This study estimates the technical biomass resources currently available in the United States by county. It includes the following feedstock categories:
- Agricultural residues (crops and animal manure);
- Wood residues (forest, primary mill, secondary mill, and urban wood);
- Municipal discards (methane emissions from landfills and domestic wastewater treatment);
- Dedicated energy crops (on Conservation Reserve Program and Abandoned Mine Lands).

NREL

September 2005

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.

Wind Power

Power Analysis

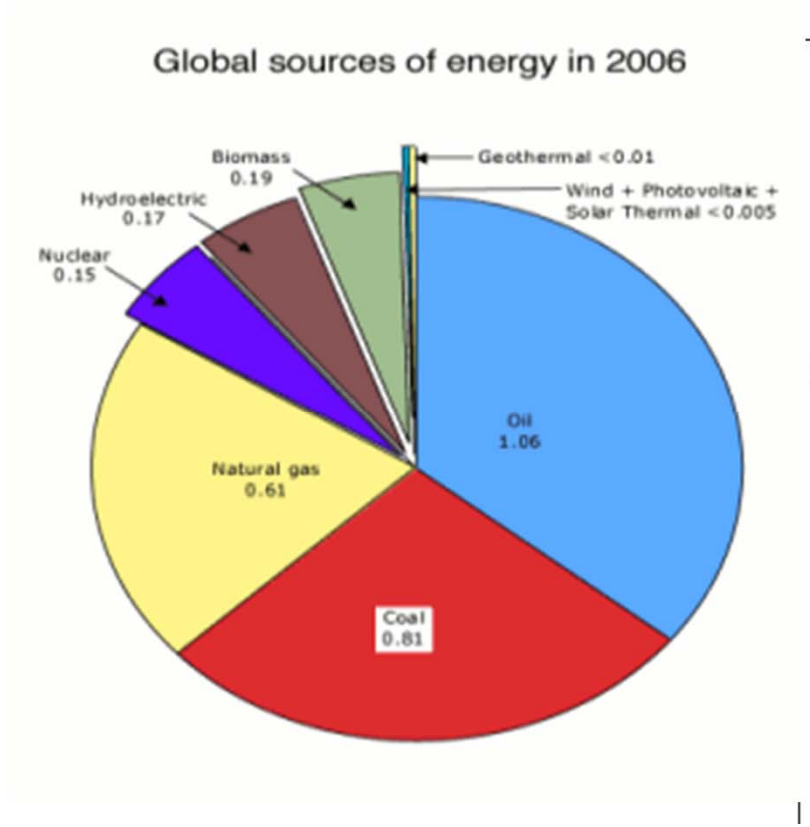
- Get into pairs - Each group will complete the worksheet
- The amount of power produced by a wind generator increases as the wind speed increases.
  - The independent variable = wind speed
  - The dependent variable = power
- Determine values of k by plugging in the given values for wind speed and power. 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.

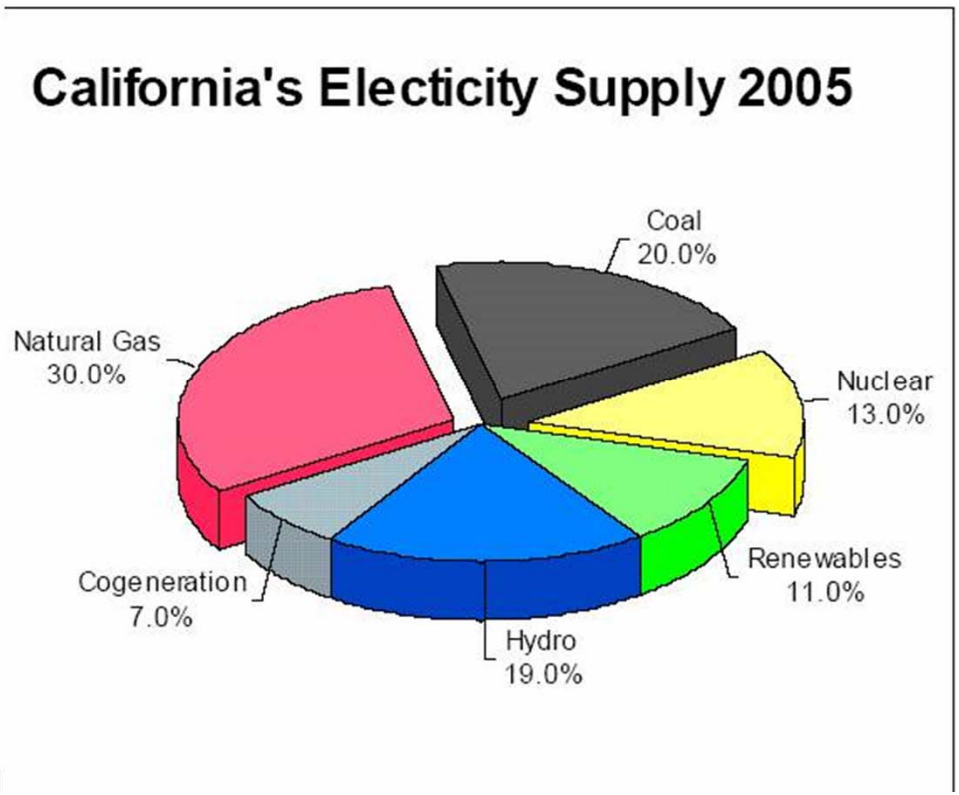
Renewable Energy

Pros	Cons
No emissions or mining	More expensive than fossil fuels
We are not running out	Site specific
Available within our country	May harm the natural environment
The energy can be stored	Dependent on the weather

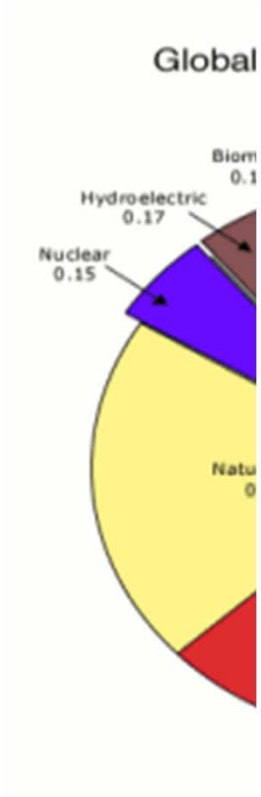
Creating Energy Portfolios
Day 4

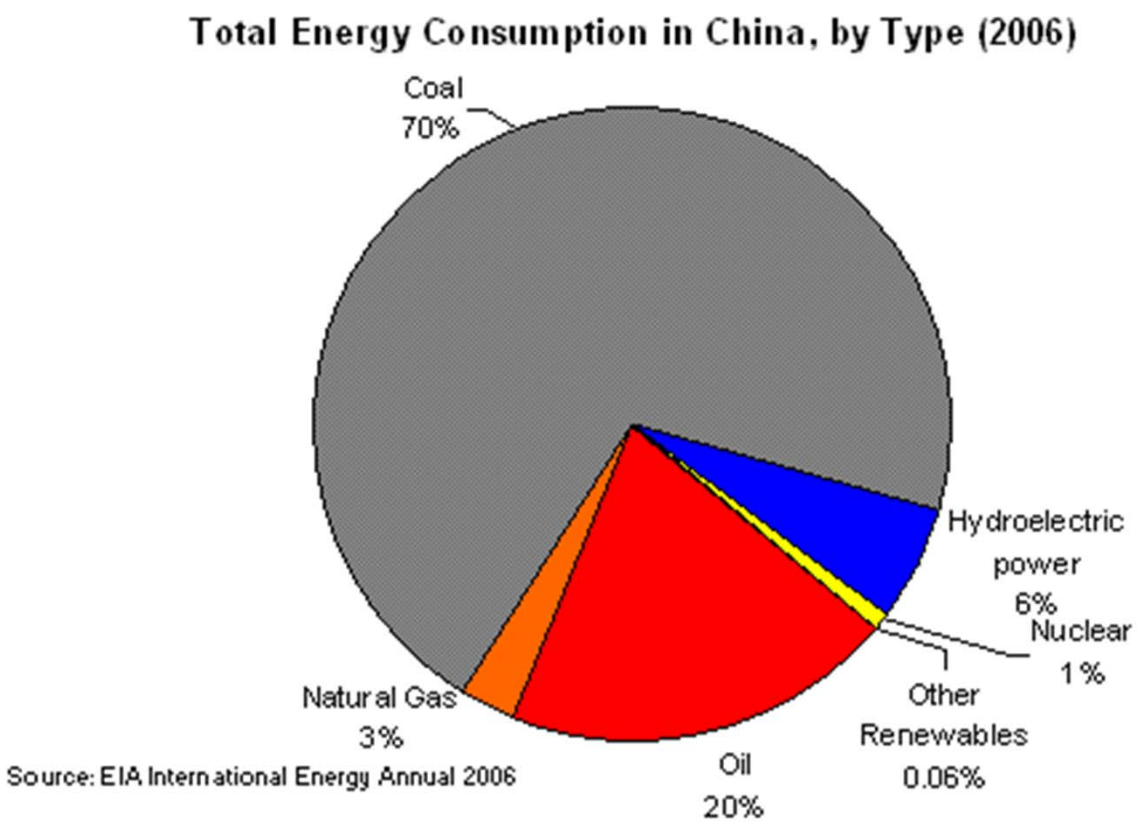
Energy Portfolio

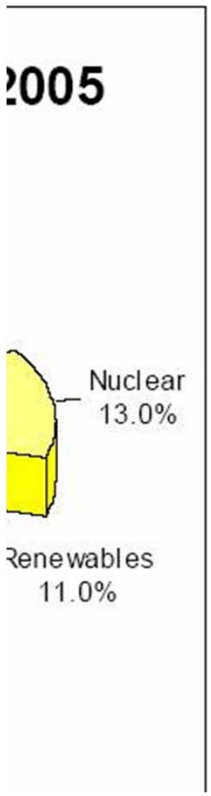




Energy Portfolio







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