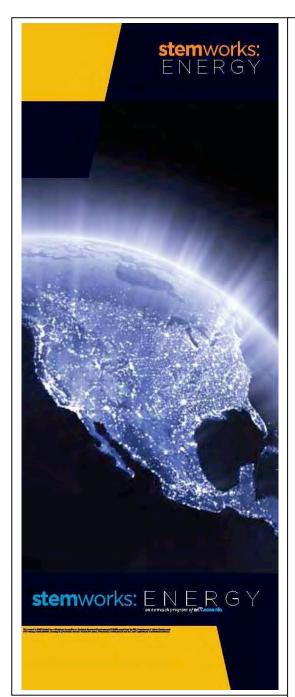
## STEMWorks\*: ENERGY

Hands On, Interactive Activities and Career Perspectives An outreach program of The Leonardo (www.theleonardo.org)



#### You? More?

www.350.org www.kilowattours.org and see back page

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### What IS Energy?

'Sources'?

Sun, Earth, Fusion, Fission Transformation—from one form to another--Loss/inefficiency

'Laws':

can't get something for nothing—Conservation – can't even break even—Entropy

Earth's Yin-Yang: Photosynthesis and Respiration

From Sun to Plants to Fuels

#### What IS Electricity?

Electrons, Charges, Balloons, and Hair; private lightning and magic wands

Magnets, electrons, induction

Dynamo/Generator (turning the Crank); welcome. 'slaves'!

Little generators (human power?) and really big ones!

Direct Electricity – Solar Cells Chemical Electricity: Batteries and Fuel Cells

#### **Energy use and costs**

Combustion/respiration and Photosynthesis CO2—vibrations, resonance, greenhouse - climate disruption

The Grand Balance—global teeter-totter: from 270 ppm to 400+ ppm!

Questar gas—how much and for what? Therms and Decatherms?

Rocky Mountain Power—how much and for what/watt? Kilowatt-hours?

How much are YOU worth?!

Transport--cars—gasoline--diesel

\$2 - \$5/ gallon—expensive?

Use/efficiency—YOUR 100-300 personal laborers (slaves?)

Coal, Oil Shale, Biofuels, Solar, Hydro, Wind, Nuclear

Hydrogen, Methane, Propane, Gasoline, Diesel, Coal, Shale—and CO2.

\*STEM = Science, Technology, Engineering, Mathematics

# STEMWorks: ENERGY Facts, Estimates, and Resources

(compiled by J Andrade; joe.andrade@utah.edu)

1 human ~ 100 watts work output ~ 1/10 horsepower

1 human working hard for 10 hours ~ 1 kw-hr—'worth' about 10 cents!

1 USA resident uses ~300 million BTUs/year ~ 100,000 kw-hours/year

1 USA resident 'employs' ~ 100—300 energy 'slaves'

(depending on how hard you work them)

1 lb coal ~1 kw-hr ~ 1.4 lbs CO2

average household in USA: 1000 kw-hr/month ~ 1000 lbs coal/month ~ 6 tons coal/year!

Gas energy about 1/5 that of electrical—in SLC.

One therm ~ 100, 000 BTU ~30 KW-hr; 1 million cubic feet ~ 10 therms Gasoline: 5.6 million BTU/barrel (a barrel is 42 gallons) = 1.33 therms/gal Therm ~30 kw-hrs ~ 100 cubic feet natural gas; Decatherm in 10 times that.

Questar \$6.81/DTH

Rocky Mtn Power: ~\$0.10/kw-hr

Installed capacity costs:--all about the same now!

Hydro: \$1-5/watt

Nuclear: \$2-4/watt Wind: \$2-3/watt Solar: \$2/watt Coal: \$1-3/watt

Coal installation costs will increase perhaps 50% with CO2 regulation! 1 acre land 14,000 gal oil/year via bioalgae (www.petroalgae.com)

Key links:

www.tinyurl.com/abigpicture www.utahcleanenergy.org

www.nef1.org

http://www.mines.edu/~rsnieder/Global Energy.ppt

www.youtube.com/watch?v=GHyagrizY9E

http://www.earthtoys.com/emagazine.php?issue number=06.08.01&article=slaves

www.350.org

www.kilowattours.org

http://www.unitconversion.org/unit\_converter/energy.html

www.dsireusa.org

www.energysmartschools.gov

www.ase.org/content/article/detail/4050

http://uprm.edu/aceer/pdfs/global\_energy.pdf

http://www.algarcia.org/Phys1SlidesSp07.html

http://www.eia.doe.gov/kids/energyfacts/sources/electricity.html#SecondarySource

http://co2.utah.edu/

www.nap.edu/catalog.php?record id=12204

http://dels.nas.edu/climatechange/basics.shtml

www.greenforall.org

http://www.ases.org/index.php?option=com\_content&view=article&id=699&Itemid=23

http://huntsman.usu.edu/cleantech/

Salt Lake Center for Science Education student energy videos:

Go to www.youtube.com and search: SLCSE Energy; then watch the 9 videos. Enjoy!