

STEMWorks*: ENERGY

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



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

You? More?

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

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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!