Energy Notes

* Sources of heating & electricity have changed through time.
* Wood was the main source until the 1800s, coal, oil and natural gas followed.
* Today coal and natural gas used to heat homes and produce electricity.
* Transportation – Oil, Gas, Jet Fuel, Diesel
* Products – Plastic, Carpet, Vinyl, Asphalt etc
* Heating – Fuel Oil & Natural Gas
* Electricity/Power – Coal & Natural gas
* Coal is the main energy source for electricity in the USA. Wyoming and Utah are major coal and electricity producers
* ***Alternative Energy*** – alternatives to fossil fuels (ethanol, electric cars, wind, solar)
* ***Energy Independence*** – dependence on foreign (mid east in particular) sources of oil. Includes price and sustainability. Canadian tar sands example….
* Oil is a finite (non-renewable) resource
* Peak oil means the point when ½ the worlds oil produced – peak production
* When will the peak in production occur? Many/Author suggest 2015-2030 – gap in supply and demand – prices?
* Oil and gas is created by sedimentary processes and is produced from or pumped from wells drilled into sedimentary rocks.
* Oil and gas originate from bacteria and other organic matter accumulated in the oceans or lakes millions of years ago – algae
* Over long time periods organic material is buried and heated turns into oil.
* Oil originates from carbon rich marine or lacustrine source rocks
* Oil is generated in the subsurface by heat an pressure (goldilocks)
* Oil migrates to a reservoir rock and is trapped by rock above (clay/shale)
* Much of the oil and gas in Utah comes from the Uintah Basin. The Wasatch and Green River Formations (50 mya) produce much of the oil. Many wells are over 10,000 feet deep.
* Questar has a natural underground geological reservoir and trap that is used to store natural gas. Natural gas produced in other areas is stored in this reservoir. It is located east of Coalville, UT. When winter demand is high they produce gas from this storage reservoir.
* The US Gov’t has a huge geology
* Oil production is expensive and sometimes risky. Utah 13th
* It costs about $800,000 to drill and complete a 7000 foot deep producing oil well in Utah. Many companies..deeper=$
* A “wildcat” is an exploratory well high risk.
* The amount of oil higher at first and tapers off. Last 30 years.
* Oil produced depends on many factors. Ranges from a few barrels/day to hundreds of barrels/day. Barrel 45 gal
* Scenario 1 - 50 barrels/day x 365 days/year x $100/barrel = $1,825,000 year (well “pays out” in less than one year).
* Scenario 2 - 200 b/d x 365 d/y x $84/b = $3,650,000/year
* Oil companies do not own the land or oil and mineral rights. Grandpa/owner of land and mineral rights paid a **royalty** for the oil, gas, coal, minerals or sand and gravel on their land.
* **Royalties on Private Lands**
* Lease land the well is on
* 1/5th or 1/6th royalty or about 16.6 -20%
* Do not pay any costs “off the top” for royalties and no liabilities
* http://www.youtube.com/watch?v=p\_m-yxNgb-Y
* Crude oil costs about $84/barrel
* There are 42 gallons of crude/barrel
* $84/42 = $2 per gallon for crude oil
* Refinery, Transportation, Marketing and Retail costs 50 cents per gallon
* Taxes are 43 cents per gallon
* $2.00 + 0.50 +0.43 =2.93 gallon, are we overcharged…by retail???
* Utah ranks 8th in natural gas production in the USA
* Natural gas costs about $3 per 1000 cubic feet (MCF).
* Residential gas use about 110 MCF/year. A therm is 0.1 MCF, so use is about 1100 therms. Average cost is about $900 - $1000.
* **Most wells produce gas, oil and water**
* Geothermal - Hot rocks can produce hot water and steam from wells.
* The hot steam is used to produce power or heat homes.
* US has an installed and utilized power production capacity of 2,500 Megawatts-electric (MWe) from geothermal plants
* Alaska, California, Hawaii, Idaho, Nevada, and Utah.
* **a megawatt of capacity will produce electricity for 400 to 900 homes/yr**
* 2500 x 650 = 1.625 million homes – Utah has about 900K – possible source for all of UT, WYO, ID, NV, OR
* Methane Hydrate.. Large amounts of natural/methane gas trapped in “ice” occur in Alaska and on the sea floor. Methane produced by bacteria and the methane reacts with sea water to form the “ice” called methane hydrate.
* This resource could produce a large amount of clean energy, but it is very hard to mine.
* “Tar sands deposits are found all over the world, with the largest deposits located in [Venezuela](http://en.wikipedia.org/wiki/Venezuela) and [Alberta](http://en.wikipedia.org/wiki/Alberta), [Canada](http://en.wikipedia.org/wiki/Canada).
* 66% of the world's deposits of oil, with 34% (1.8 trillion barrels) in the Venezuelan [Orinoco tar sands](http://en.wikipedia.org/wiki/Orinoco_tar_sands) deposit, 32% (1.7 trillion barrels) in Canada's [Athabasca Tar Sands](http://en.wikipedia.org/wiki/Athabasca_Tar_Sands)
* Petroleum trapped in shale (oil shale) and in sand (tar sands-like asphalt).
* It is expensive to recover the petroleum from shale/clay. Recovery from the sands is more economical and less difficult.
* Oil shale has about the same energy value as a baked potato, so it may take more energy to squeeze the oil out of the huge “baked potato” than it is worth.
* The oil migrated to the surface instead of being trapped in the subsurface.
* Real costs far outweigh short term benefits
* Envronmental impacts - global warming, greenhouse gas emissions, disturbance of mined land, disposal of spent shale, use of water resources, and impacts on air and water quality.
* The development of a commercial oil shale industry in the United States would also have significant **social and economic impacts** on local communities. High cost of producing oil from oil shale (currently greater than $60 per barrel), and the lack of regulations to lease oil shale.
* Fracking - By fracturing the rock and use of horizontal drilling release the gas and oil
* Increase the permeability and allow the oil and gas to flow – use pressure
* Horizontal drilling, Use of Chemicals, Groundwater issue
* Coal in Utah - Supply for 100 years Using more renewables
* Production and use of petroleum products generates waste. Sources of this waste/pollution include:
* Releases from leaky underground gas tanks.
* Releases to the air and from spills of gas at petroleum refineries.
* Injection or disposal of drilling wastes
* Releases to the air from using the fuel/driving a car. Auto exhaust contains CO, CO2 and some hydrocarbons (unburned gas). Lead additives such as tetra ethyl lead were removed because the lead was having a large adverse effect on people and the environment. A chemical additive called MTBE is being phased out because it can be a health hazard.
* Wastes generated from petroleum production
* Acid rain from burning fossil fuels (less than pH 5.6)
* Fission is the controlled breaking apart of U atoms. Releases huge amounts of energy. U238, 235 and 234 – 235 is fissionable … E = MC2
* Released neutrons force the reaction. Control rods control the number of neutrons …atomic bomb uncontrolled release
* Source of clean energy
* Uranium source - 100+ yrs
* 100 power plants in 31 states, 20% of US electricity
* Waste is difficult to manage
* New Mexico
* Las Vegas
* Solar cells, also called photovoltaic cells, convert sunlight directly into electricity.
* PV gets its name from the process of converting light (photons) to electricity (voltage), which is called the*PV effect*.
* The PV effect was discovered in 1954, when scientists at Bell Telephone discovered that silicon (an element found in sand) created an electric charge when exposed to sunlight.
* <http://www.pbslearningmedia.org/resource/nvel.sci.tech.growapp/growing-appetites-limited-resources/> intro
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