Electricity - Costly for the Environment and for Us

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Electricity is a convenient intermediate form of energy that we use to run our businesses and our homes.

The primary sources of electrical energy are:

Coal generated about 50% of electricity in the United States in 2004, down slightly from 1994, according to the Department of Energy (DOE).[1] This is especially true in the mid-Atlantic area. Each kWh of electricity releases pollution in the form of CO_2 (the principal global-warming gas) as well as oxides of sulfur, nitrogen, and mercury.

Although there are vast reserves of coal in the United States, to lower the cost and danger of mining, the mining industry is turning from deep underground mining to strip mining and even mountaintop removal. These methods denude pristine landscapes, ruin streams and lakes with acid runoff and with the deposit of mine tailings, and destroy neighboring homes, farms, and businesses.

CO_2 is currently not regulated in the United States. There are proposals to permanently sequester this gas underground or beneath the oceans. However, sequestration is expensive and takes energy itself. It has only been used in small demonstration projects that inject CO_2 into nearly depleted oil fields to force out the remaining oil. A massive CO_2 escape could be deadly as a similar natural eruption from Lake Nyos in Cameroon in 1986 killed over 1700 people. A slow but cumulatively significant leak would defeat the very purpose of sequestration. Since the gas must be kept for thousands of years at high pressure, these dangers would be very difficult to prevent.

All of these pollutants except CO_2 are regulated, controlled, and mitigated to some extent by the use of higher (and more expensive) grades of coal and by costly scrubbers.

Oil fuels generators producing about 3% of the electrical energy; it does not have a prominent role except when many standby generators are fired up during outages.

Natural **Gas** generated about 18% of electrical energy in 2004 (up from 14% in 1994). Much of the new generating capacity uses gas, because low pollution levels, relatively low generating plant costs, short build times, and the opportunity to scale plant size to need. On the down side, North American gas supplies are depleting rapidly. Importing gas requires special ships, ports, and storage and revaporization facilities that have the ability to store liquefied gas at very low temperatures. Finding sites for these ports and facilities is difficult, given the widespread and possibly justified fear that these ports and storage facilities pose a severe hazard to their surrounding communities. The special handling required naturally raises costs considerably. Prices were well below $1 per gallon before 1978 have now reached $7 per mBTU. Prices spiked higher due to 2005 Gulf hurricanes Katrina and Rita before settling to back to about $7 per mBTU.

Nuclear energy was the fuel source for about 20% of the electrical energy for each year from 1994 to 2004. Although nuclear reactors do not produce greenhouse gases, fuel mining, refining, and manufacturing operations do. In addition, there are valid and widespread concerns about nuclear accidents, diversion of fuel for terrorist activities, and safe and permanent disposal of nuclear wastes.

Conventional **Hydroelectric** supplied about 7% of the energy for electricity in 2004. The percentage fluctuates year over year depending upon rainfall. The potential for more hydroelectric is limited by available sites and problems with existing dams. These include silting, loss of fish populations, and conflicts with other water needs.

DOE data lumps **Renewable** sources together. These include geothermal, wind, small-scale hydro and solar. These aggregate amounts are just over 2% for 1994 to 2004. These data mask growth in individual

[1] Energy Information Administration http://www.eia.doe.gov/cneaf/electricity/epa/epat1p1.html

sectors. For example, wind energy capacity grew from by 37% from 2000 to 2001.[2] Similarly, world solar energy capacity grew by about 20% per year from 1999 to 2002. Note that since wind and sun are variable, the net contribution of these energy sources will similarly vary and they still represent a very small portion of needed generating resources. Even alternative sources of electrical energy have built in concerns. Detractors allege that large wind detract from views and kill or injure birds and bats. For solar, there is concern with toxic elements used in their manufacture.

Note: Hydrogen is like electricity in that it is difficult to store and transport and it cannot be mined from nature. In this sense it, too, is an intermediate form of energy.

Electrical Loads

The other part of the energy equation (after taking into account transmission and other losses) are loads. A recent California End-Use Study[3] shows the following as principal load for all commercial usage:

Lighting (Int & Ext)	34.50%
HVAC	28.44%
Refrigeration	13.38%
Office Equipment	7.09%
Cooking	4.17%
Motors	4.17%
Miscellaneous	8.26%
All End Use	100.00%

The efficiency for each of the above uses can greatly improved. For example, typical T-12 fluorescent lamps with inefficient reflectors can benefit from more than 25% improvement by going to T-8 or T-5 with more efficient fixtures. Until recently, SEER efficiency ratings for air conditioning systems were below 10; now residential systems boast efficiencies of greater than 20.

[2] http://www.earth-policy.org/Indicators/indicator10.htm

[3] California Commercial End-Use Survey, March 2006, California Energy Commission, http://www.energy.ca.gov/ceus/index.html