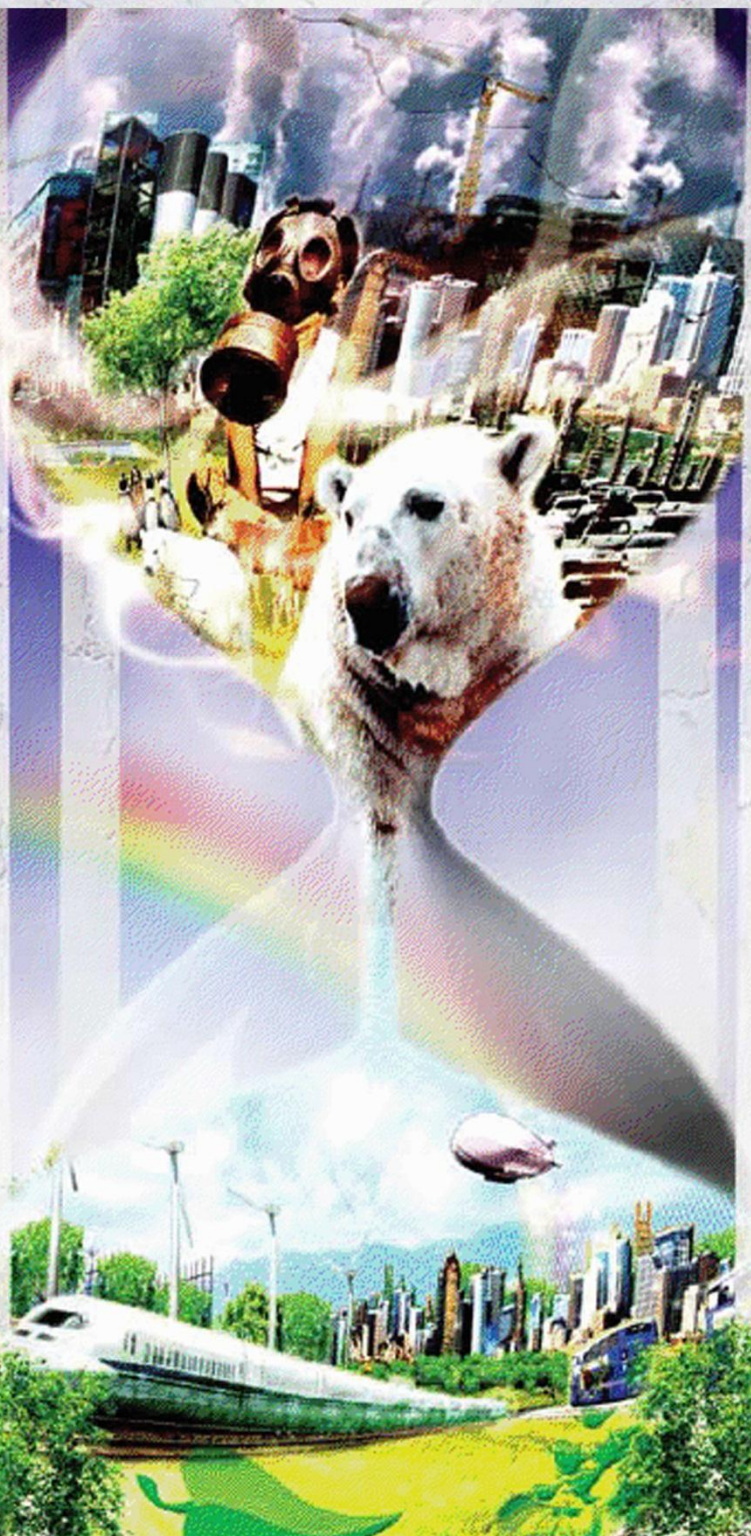
energy revolution



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The Fourth Revolution: Energy Revolution

What is Energy?

Energy "activity, operation" is an indirectly observed quantity. It is often understood as the ability a physical system has to do work on other physical systems. Since work is defined as force acting through a distance, energy is always equivalent to the ability to exert pulls or pushes against the basic forces of nature, along a path of a certain length.

The total energy contained in an object is identified with its mass and energy, cannot be created or destroyed. When matter is changed into energy (such as energy of motion, or into radiation), the mass of the system does not change through the transformation process. However, there may be mechanistic limits as to how much of the matter in an object may be changed into other types of energy and thus into work, on other systems. Energy, like mass, is a scalar physical quantity. In the International System of Units (SI), energy is measured in joules, but in many fields other units, such as kilowatt-hours and kilocalories, are customary. All of these units translate to units of work, which is always defined in terms of forces and the distances that the forces act through.

What is Energy Revolution?

Modern society dependence on low-cost Energy sources. It is need to propose organizational and technical innovations that could ensure effective, secure movement of people and goods in ways that minimize environmental impacts and make the best use of renewable sources of energy.

The Energy Revolution Has Begun

The start of the energy revolution is evidenced by continued high prices of energy and the successful introduction of hybrid cars by several manufacturers. The revolution is fueled by the tight supplies and resulting price volatility of petroleum products and natural gas. These tight supplies are going to continue over the next 20-30 years, accompanied by further increases in prices, until reliable alternative supplies of energy are found, especially for transportation vehicles. **This transition period, in which we have tight energy supplies, while we are continuing to develop vehicles that run on a new energy supply, as well as while we are developing alternate and improved energy sources for electrical generation defines the energy revolution.**

Although there are many alternative sources of energy that are under development, most of them are either suited to producing electricity or too early in their development to be available to help the transportation sector in the early years of the energy revolution. That leaves us with four alternatives based on demonstrated technologies:

- Increasing the standards for fuel efficiency.
- Accelerated use of existing vehicle technology - the diesel engine and hybrid vehicles.
- Increased use of and improvements in enhanced oil recovery.
- Increased use of unconventional oil.
- Accelerated use of renewable fuels, notably ethanol and biodiesel.

Hybrid vehicles are the first step in reducing gasoline consumption. Greater use of diesel powered vehicles, which can reduce fuel consumption by 30% compared to conventional gasoline engines, would also substantially reduce fuel consumption.

Renewable energy

Renewable energy is energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished). About 16% of global final energy consumption comes from renewables, with 10% coming from traditional biomass, which is mainly used forheating, and 3.4% from hydroelectricity. New renewables (small hydro, modern biomass, wind, solar, geothermal, and biofuels) accounted for another 2.8% and are growing very rapidly. The share of renewables in electricity generation is around 19%, with 16% of global electricity coming from hydroelectricity and 3% from new renewables.

Wind power is growing at the rate of 30% annually, with a worldwide installed capacity of 198 gigawatts (GW) in 2010, and is widely used in Europe,Asia, and the United States. At the end of 2010, cumulative global photovoltaic (PV) installations surpassed 40 GW and PV power stations are popular in Germany and Spain. Solar thermal power stations operate in the USA and Spain, and the largest of these is the 354 megawatt (MW) SEGSpower plant in the Mojave Desert. The world's largest geothermal power installation is The Geysers in California, with a rated capacity of 750 MW. Brazilhas one of the largest renewable energy programs in the world, involving production of ethanol fuel from sugar cane, and ethanol now provides 18% of the country's automotive fuel.[11] Ethanol fuel is also widely available in the USA.

Mainstream forms of renewable energy

- **Biofuel**

Biofuel is a type of fuel whose energy is derived from biological carbon fixation. Biofuels include fuels derived from biomass conversion, as well as solid biomass, liquid fuels and various biogases.

- **Biomass**

Biomass, as a renewable energy source, is biological material from living, or recently living organisms. As an energy source, biomass can either be used directly, or converted into other energy products such as biofuel.

- **Geothermal**

Geothermal energy is thermal energy generated and stored in the Earth. Thermal energy is energy that determines the temperature of matter. Earth's geothermal energy originates from the original formation of the planet, from radioactive decay of minerals and from volcanic activity.

- **Hydroelectricity**

Hydroelectricity is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water. It is the most widely used form of renewable energy.

- **Solar energy**

Solar energy, radiant light and heat from the sun, has been harnessed by humans since ancient times using a range of ever-evolving technologies. Solar radiation, along with secondary solar-powered resources such as wind and wave power, hydroelectricity and biomass, account for most of the available renewable energy on earth.

- **Tidal power**

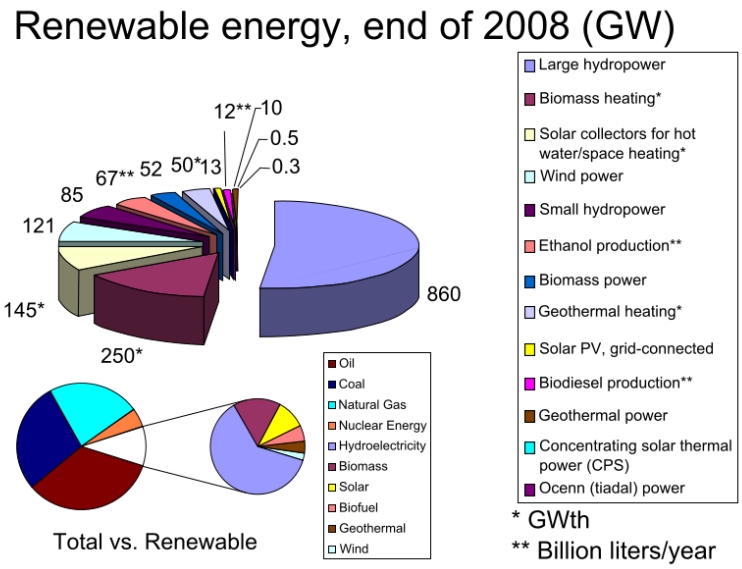
Tidal power, also called tidal energy, is a form of hydropower that converts the energy of tides into useful forms of power - mainly electricity.

- **Wave power**

Wave power is the transport of energy by ocean surface waves, and the capture of that energy to do useful work — for example, electricity generation, water desalination, or the pumping of water (into reservoirs).

- **Wind power**

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity, windmills for mechanical power, windpumps for water pumping or drainage, or sails to propel ships.



Summary

Biofuels. Ethanol, biodiesel Fischer-Tropsch diesel and pyrolysis oils are emerging as very important technologies. They are especially important since they are renewable - their source is vegetation that can continue to be grown independent of whether we have fossil fuels or not.

One long term solution to propelling our vehicles is to use an alternative form of propulsion that does not use liquid fuels, such as hydrogen powered fuel cells. This is the only alternative that has come to the forefront and it appears that the automotive industry has accepted this technology as being the most likely to succeed.

Depending on scheduled breakthroughs in technology to meet a deadline is one of the greatest risks that can be taken. I have learned this lesson well in my career in R & D and it is inappropriate to take such risks to solve a problem of this magnitude.

In summary I quote from Hirsch, p60, as his final conclusion regarding resolving the problems of the transportation sector "The world has never confronted a problem like this, and the failure to act on a timely basis could have debilitating impacts on the world economy."

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