Introduction to Alternative & Renewable Sources of Energy

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Alternative and Renewable Sources of Energy
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AAS – Beirut, 25-26 November, 2010

No doubts that fossil fuel has contributed to the fast development of the world in building the infrastructure necessary for economical and social development from the energy derived. Man was able to harness land and seas to the benefit of mankind.

But with CO$_2$ emission and greenhouse effect and IPCC reports of climate change, it became a must to provide clean energy sources by introducing technology in utilizing fossil fuel and looking into alternate sources of energy.

Alternative sources of energy could be divided into the following categories:

1. **Chemical**: Oxidation-reduction of organics or **photo-physical**: absorbing sunlight to generate heat or electricity.

2. **Nuclear**: releases energy by splitting heavy nuclei or by fusing light nuclei.

3. **Thermo-mechanical**: wind, water, geological steam or hot water. (Geothermal)

Currently, most world supply of energy comes from fossil fuel and nuclear sources so we have to address CO$_2$ sequestration and keeping our nuclear energy option open. In the mean time to look for efficient economically feasible and friendly – use alternate sustainable clean energy sources, to substitute the depleted, fossil fuel supplies.

Solar is abundant, but current technology is still behind low in conversion efficiency and high cost. Advances in science is needed in new materials films, made cheaply, containing nanostructure conducting polymers. containing nano-particles with wide range of electronic wide gaps, so much of the solar spectrum can be captured by the solar cell-ideal solar collector.

Fuel cells-oxidation of CO$_2$ and H$_2$ needed an anode, cathode and electrolytes as batteries hydrogen is attractive as fuel oxidation product is water, the problem how to store it, carbon nanotubes may the challenging scientific answer.

Now, the research challenge is how to converge physics, chemistry, biology and engineering research at nanoscale. Many of the molecular
components that nature makes fuels are at the nanoscale including enzymes, photosynthetic units, and molecular engines.

However, we have to remember that alternate energy is sustainable and non depletable: Sun, wind, flowing water are available for free. Renewable energy could be utilized as backup or stored or sold back to the grid system, resulting in less electric bills, so hydride system is the most appropriate in many parts of the world.

1. CH₃CH₂OH biofuel is a renewable source of energy, produced from biomass, sugar cane, corn, and cellulose or veg. oil. It supplement or replace fossil fuel. Ethanol¹ and biodiesel² most common. Brazil is no. 1 in the world using EtOH from sugar cane.

2. Biodiesel produced from vegetable oil or fats using trans esterification. Compete for food security: Palm oil, rape seed, sunflower, soy bean.

3. Algae fuel: 30 times more energy per acre than land crops such as soybean. This 3rd generation of biofuel.
   - Agitation in vertical cellophanes out under the sun.
   - United States dept. of energy estimate of Algae fuel replaced all petroleum fuel in the states, it would require only 15,000 square miles, roughly the size of Maryland and or less 1/7 the land devoted to corn. Algae as chlorella unlgares easy to grow, but algae oil is hard to extract. Some algae produce ethanol naturally without killing the algae.

   World leaders in biofuel development are Brazil, USA, France, Sweden, and Germany.
   There are social problems: Food us fuel competition for land-space.
   - Effect of moderating oil prices.
   - Poverty and Food crises.
   - Carbon emissions levels.
   - Deforestation and soil levels.

   In addition to advancing alternative energy technology, research is needed to manage fossil fuel resources, better.

¹ output of the fermentation process of starch to gucose, then to ETOH, enzymes by microorganisms less commonly bational and propanol.
² Biobatanol used directly as biogasoline into the engine.
These difficult scientific and technological problems in energy involve not only interdisciplinary science, but also, science policy.

Energy policy will differ among nations according to socio economical, environmental and financial factors; but many of the issues require international cooperation. All nations share the atmosphere of our planet and all benefit from reduced emission. Healthy global economy benefits producers and consumers of energy. It is important in basic research. As energy plays a vital role in society, it is important that policy, science, technology. Work together, global energy security problems cannot be solved if the 3 components work in isolation. Policy determines what is acceptable, science shows what may be possibly and technology demonstrates what is practicable.