FUTURE ENERGY TRENDS

DISTRIBUTED GENERATION

Distributed generation or "micro-power" systems refer to the use of small localized power production systems to generate electrical power for a specific on-site application. The United States currently relies on large centralized power stations that relay electrical power over long distances to millions of end users. New technologies such as solar cells, microturbines, fuel cells and wind generators are now available that can reliably generate power at levels as low as one kilowatt. Most commercial applications require no more than 1-10 kilowatts and "micro-power" systems offer better scale of application than large centralized power systems. Continued technological advances in micro-power systems are likely to accelerate the trend of downsizing power generating systems.

HYDROGEN

Hydrogen is the most abundant element in the universe. The heat from combustion of hydrogen is two to three times greater than other fuels and the byproduct of burning hydrogen is simply water. Hydrogen can be produced from petroleum products, natural gas or

CHARACTERISTICS OF DISTRIBUTED GENERATION:

- Micro-power systems are modular allowing units to be added or removed to match the energy demand.
- The systems can offer a high quality constant voltage which is critical for the now prolific computer based business systems.
- Micro-power systems can be less susceptible to interruptions in supply that can sometimes arise from centralized power systems (California brownouts, 2001).
- These systems promote a more diverse, renewable energy based mix that can readily take advantage of resources specific to a region such as wind power with one or two wind turbine towers used to meet a local business' or schools' needs.
- Micro-power systems facilitate co-generation energy strategies where "waste" heat from the electrical power production system (such as a gas micro-turbine) is used to provide space heating needs, heat water or to provide heat for a manufacturing processes. Such co-generation strategies can result in significant energy savings and help conserve resources by producing only the amount of power required directly at its point of application.
- The trend towards distributed generation also reduces the need to expand or upgrade current power distribution lines and can be configured to meet local needs more precisely.
- Fuel cells and micro-turbine systems can be highly technical, are often computer controlled and make home maintenance impractical.
- Electrical power is still often least expensive when purchased from a large utility power plant.
- Environmental emissions from multiple small on-site power systems can present regulatory challenges.

can be generated using an electric current to "split" water. Hydrogen can be used in most applications where natural gas is used and the same infrastructure could be adapted to carry hydrogen. Hydrogen can be used to generate electrical power using fuel cell technology to provide residential and commercial electrical needs. Hydrogen driven fuel cells can also be used in motor vehicles replacing fossil fuels for transportation needs. Almost every automobile manufacturer currently has a fuel cell research program and several models are predicted to be available soon.

Hydrogen is predicted to be the fuel of the future. A sustainable energy cycle could be implemented using hydrogen produced from renewable energy sources. In the future hydrogen fuel could be distributed across the United States. A similar distribution system was developed for gasoline and natural gas in the 1930's and much of this system could be adapted to deliver hydrogen. Hydrogen is an ideal candidate to replace fossil fuels promising to be a clean burning, convenient source of power.

FUEL CELLS

A fuel cell is an electro-chemical device that converts chemical energy of fuels such as hydrogen, methane, gasoline, methanol or propane to electrical energy. Fuel cells are designed to extract electrons from the fuel source and provide a continuous electrical current. Essentially a fuel cell is a battery that is constantly refueled. Because no combustion takes place, fuel cells do not produce the pollution associated with a traditional power systems and are significantly more efficient. Fuel cells can be sized for any given application from a handheld radio to a system large enough to provide on-site electrical power for a homeowner or business. Fuel cells often run on gases such as hydrogen or methane or they can be designed to strip hydrogen from more complex fuel sources such as methanol or gasoline.

HYBRID ELECTRIC VEHICLES

Unlike electric cars that run on batteries, hybrid electric vehicles (HEVs) do not need to be plugged in for a recharge. The cars batteries are recharged using inertia and the force generated during braking. A small traditional gasoline engine is used during higher speeds and the battery driven electric motor is used at lower speeds (usually below 25 mph). As a result these cars get their best gas mileage in city driving where drivers brake more and speeds are lower. The Toyota hybrid (four passenger Prius) gets an average of 50 miles per gallon and the Honda hybrid (two passenger Insight) gets an average of 65 miles per gallon. Many other car companies are developing similar technologies. Ford Motor Company have indicated an intent to release hybrid versions of their sport utility vehicle (SUV) Escape, and Chrysler will begin making hybrid versions of the Dodge Durango.