

RENEWABLE ENERGY OVERVIEW

This section will cover some of the basics of renewable energy and what we may expect to find in our communities. Alternative energy is a term used for an energy source that is an alternative to using fossil fuels. Generally, it indicates energies that are non-traditional and have low environmental impact. According to some sources, the term *alternative* is used to contrast with fossil fuels.

In the case of APICDA communities, we are attempting to identify alternative energy opportunities in order to offset the use of diesel fuel.

Alternative energy sources that may have potential in one or more of the six communities are wind, solar, geothermal, wood, PV (photovoltaic's or solar), hydro, wave or tidal energy. Other sources could be nuclear, hydrogen or batteries.

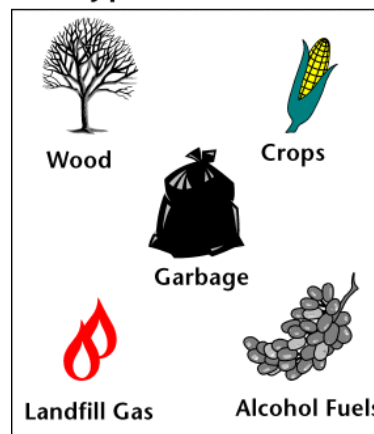
Biomass

Biomass refers to living and recently dead biological material that can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown for use as biofuel, but it also includes plant or animal matter used for production of fibers, chemicals or heat. Biomass may also include biodegradable wastes that can be burnt as fuel. It excludes organic material which has been transformed by geological processes into substances such as coal or petroleum. For instance, the combustion of wood for heat would be an example of biomass fuel. Of which, several of our communities have access.

Biofuels

Biofuel can be broadly defined as solid, liquid, or gas fuel derived from recently dead material. This distinguishes it from fossil fuels, which are derived from long dead biological material. Biofuel can be theoretically produced from any (biological) carbon source, though the most common by far is photosynthetic plants. Many different plants and plant-derived materials are used for biofuel manufacture. Biofuels are used globally, most commonly to power vehicles and cooking stoves.

Types of Biomass



Coal

Coal is a readily combustible black or brownish-black sedimentary rock normally occurring in rock strata in layers or veins called coal beds. The harder forms, such as anthracite coal, can be regarded as metamorphic rock because of later exposure to elevated temperature and pressure. It is composed primarily of carbon along with variable

quantities of other elements, chiefly sulfur, hydrogen, oxygen and nitrogen. Coal is touted as a cheap source of energy, and in fact in most places it is cheaper per kilowatt hour than other competing sources of energy, with the notable exception of hydropower in some locations. Alaska possesses roughly half the United State's total coal reserves, which translates to nearly 1/8 of the world's reserves. Even with current volatility in energy markets, local utilities, foreign markets, and outside investors are increasingly looking to develop Alaska's vast coal reserves. Alaska contains only one operating coal mine – the Usibelli Coal Mine in Healy - which currently supplies Fairbanks utilities, UAF and military bases, along with exports to South Korea and Chile. The Usibellis have a long and proud history in Alaska, which should not be confused with the Outside corporations now vying to exploit Alaska coal resources.

Geothermal Energy



Geothermal power (from the Greek words *geo*, meaning earth, and *thermal*, meaning heat) is energy generated by heat stored beneath the Earth's surface or the collection of absorbed heat derived from underground in the atmosphere and oceans. The largest group of geothermal power plants in the world is located in The Geysers, a geothermal field in California. As of 2007, geothermal power supplies less than 1% of the world's energy.

High and Moderate temperature geothermal resources can be used to generate electricity. Low temperature geothermal resources can be used for a wide range of direct uses, e.g. district and space heating, industrial processes, greenhouses, aquaculture and spas.

Geothermal energy offers a number of advantages over traditional fossil fuel based sources, primarily that the heat source requires no purchase of fuel.

Geothermal power plants work continuously, day and night, making them base load power plants. From an economic view, geothermal energy is extremely price competitive in some areas and reduces reliance on fossil fuels and their inherent price unpredictability. It also offers a degree of scalability: a large geothermal plant can power entire cities while smaller power plants can supply more remote sites such as rural villages

The United States of America is the country with the greatest geothermal energy production, some of the potential lies right in our communities backyards.

Hydrogen Power

A source of energy that converts hydrogen to electricity to provide heat, light, and power. Though hydrogen is readily available, the production of hydrogen power is expensive and not yet commercially viable.

Proponents of a world scale hydrogen economy suggest that hydrogen is an environmentally cleaner source of energy to end-users, particularly in transportation applications, without release of pollutants (such as particulate matter) or greenhouse gases at the point of end use. Analyses have concluded that "most of the hydrogen supply chain pathways would release significantly less carbon dioxide into the atmosphere than would gasoline used in hybrid electric vehicles" and that significant reductions in carbon dioxide emissions would be possible if carbon capture or carbon sequestration methods are utilized at the site of energy or hydrogen production.

Critics of a hydrogen economy argue that for many planned applications of hydrogen, direct distribution and use of energy in the form of electricity, or alternate means of storage such as chemical batteries, fuel plus fuel cells, or production of liquid synthetic fuels from CO₂ (see methanol economy), might accomplish many of the same net goals of a hydrogen economy, while requiring only a small fraction of the investment in new infrastructure. Hydrogen has been called the least efficient and most expensive possible replacement for gasoline (petrol). A comprehensive study of hydrogen in transportation applications has found that "there are major hurdles on the path to achieving the vision of the hydrogen economy; the path will not be simple or straightforward".

Hydropower

Hydropower or hydraulic power is power that is derived from the force or energy of moving water, which may be harnessed for useful purposes. Hydropower is manifested in the force of the water on the riverbed and banks of a river. It is particularly powerful when the river is in flood.

Damless hydro or Damless hydro-electric is a renewable technology based on capturing the kinetic energy of rivers, channels of chutes, spillways, irrigation systems, tides and oceans without the use of dams.

Since no dam is required, damless hydro may dramatically reduce the following:

- The safety risks (of having a dam)
- Environmental and ecological complications
 - Need for fish ladders
 - Silt accumulation in basin
- Regulatory issues
- The initial cost of dam engineering and construction
- Maintenance

Nuclear Power

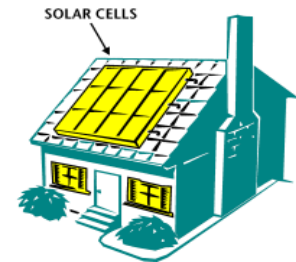


Nuclear power is any nuclear technology designed to extract usable energy from atomic nuclei via controlled nuclear reactions. The most common method today is through nuclear fission, though other methods include nuclear fusion and radioactive decay. All utility-scale reactors heat water to produce steam, which is then converted into mechanical work for the purpose of generating electricity or propulsion. Today, more than 15% of the world's electricity comes from nuclear power.

For instance, On December 14, 2004, the Galena City Council accepted a proposal from Toshiba to test their new Toshiba 4S (Super Safe, Small and Simple) “nuclear battery” reactor design, which would require only minimal staffing. If the reactor is successfully licensed, Toshiba will install it free of charge by 2012. It is expected to provide electricity for \$0.05–\$0.13/kWh, which factors in only operating costs. On paper, it has been determined that the reactor could run for 30 years without refueling.

Solar Energy

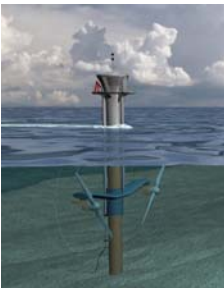
Solar energy is the utilization of the radiant energy from the Sun. Solar power is often used interchangeably with solar energy but refers more specifically to the conversion of sunlight into electricity, either by photovoltaic and concentrating solar thermal devices, or by one of several experimental technologies such as thermoelectric converters, solar chimneys and solar ponds.



Solar energy and shading are important considerations in building design. Thermal mass is used to conserve the heat that sunshine delivers to all buildings. Day lighting techniques optimize the use of light in buildings. Solar water heaters heat swimming pools and provide domestic hot water. Solar energy is the fastest growing form of energy production.

Solar distillation and disinfection techniques produce potable water for millions of people worldwide. Family-scale solar cookers and larger solar kitchens concentrate sunlight for cooking, drying and pasteurization. Clotheslines are a common application of solar energy. More sophisticated concentrating technologies magnify the rays of the sun for high-temperature material testing, metal smelting and industrial chemical production. A range of prototype solar vehicles provide ground, air and sea transportation.

Tidal Energy



Tidal power, sometimes called **tidal energy**, is a form of hydropower that converts the energy of tides into electricity or other useful forms of power.

Although not yet widely used, tidal power has potential for future electricity generation. Tides are more predictable than wind energy and

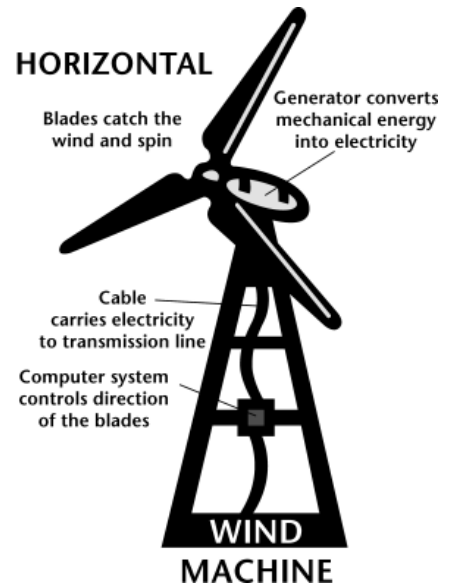
solar power.

Wind Energy

Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines. At the end of 2007, worldwide capacity of wind-powered generators was 94.1 gigawatts. Globally, wind power generation increased more than fivefold between 2000 and 2007.

Most wind power is generated in the form of electricity. Large scale wind farms are connected to electrical grids. Individual turbines can provide electricity to isolated locations. In windmills, wind energy is used directly as mechanical energy for pumping water or grinding grain.

Wind energy is plentiful, renewable, widely distributed, clean, and reduces greenhouse gas emissions when it displaces fossil-fuel-derived electricity. The intermittency of wind seldom creates problems when using wind power to supply a low proportion of total demand, but it presents extra costs when wind is to be used for a large fraction of demand. However these costs even for quite large percentage penetrations are considered to be modest.



Wave Energy

Wave power refers to the energy of ocean surface waves and the capture of that energy to do useful work — including electricity generation, desalination, and the pumping of water (into reservoirs). Wave power is a form of renewable energy. Though often co-mingled, wave power is distinct from the diurnal flux of tidal power and the steady gyre of ocean currents. Wave power generation is not currently a widely employed commercial technology.

