Evaluating Renewable and Alternative Energy Resources

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About 84% of the commercial energy consumed in the world comes from nonrenewable energy resources (78% from fossil fuels and 6% from nuclear power). Nonrenewable fossil fuels include crude oil, coal, and natural gas. These nonrenewable energy resources are considered exhaustible because they are extracted and used at a much faster rate than they were formed. The United States is the world's largest user of commercial energy. The average American citizen consumes as much energy in a day as a person in the poorest countries consumes in a year. (Miller)

Because these nonrenewable energy resources are soon to run out, not to mention the dangers they pose, we are forced to find cleaner and renewable, alternative energy resources. However, they too, have advantages and disadvantages.

The six main types of renewable energy are solar, flowing water, wind, biomass, geothermal, and hydrogen. We can get renewable solar energy directly from the sun or indirectly from moving water, wind, and biomass. We can get geothermal energy from the earth's interior and use renewable energy to produce hydrogen fuel from water. (Miller)

Direct solar energy can be used to heat buildings and water in two ways; passive solar heating or active solar heating. Passive solar heating is accomplished by facing the sun and storing its heat in the structure. Active solar heating is accomplished by mounting special

collectors, usually on the roof. Heat-absorbing fluids, such as water or antifreeze, are pumped through the collectors while absorbing the sun's energy. Solar energy can also be used to generate high-temperature heat and electricity with large arrays of collectors placed in sunny deserts. This can produce high-temperature heat to spin turbines and produce electricity. Another way of utilizing solar energy is by using rooftops and windows as power plants to produce electricity with photovoltaic (PV) cells. Commonly called solar cells, PV cells can be incorporated into roofing materials or windows. (Miller)

By trapping the flowing water from rivers and streams in reservoirs located behind dams, the water can be released as needed to spin turbines and produce energy. This is called hydropower, which is an indirect form of renewable solar energy. There are three methods used to produce such electricity which include large-scale hydropower, small-scale hydropower, and pumped-storage hydropower. Wind power is also an indirect form of solar energy that can be captured by wind turbines and converted to electricity. Since, 1990, wind power has been by far the world's fastest growing source of energy, with its use increasing almost sevenfold between 1995 and 2004. (Miller)

Biomass is plant and animal wastes that can be burned to provide heat or electricity. It can also be converted into gaseous or liquid biofuels. Most biomass is burned directly for heating, cooking, and industrial processes of indirectly to drive turbines and produce electricity. Geothermal energy is produced by tapping the earth's internal heat. Examples include volcanic rock, geysers, and hot springs. Geothermal heat pumps are used to tap into the heat between underground and surface temperatures and they use a system of pipes and ducts to heat or cool a building. (Miller)

The following chart is a compilation of the advantages and disadvantages of the six main types of alternative, renewable energy resources. Please note that there are three ways of using solar energy listed. Based on this research, I believe that we will see more use of solar and wind power in the next 5-10 years.

ADVANTAGES	DISADVANTAGES
PASSIVE OR ACTIVE SOLAR HEATING	
Energy is free.	Need access to the sun 60% of the time.
Net energy is moderate (active) to high (passive).	Blockage of sun access by other structures.
Quick installation.	Need heat storage system.
No CO_2 emissions.	High cost (active).
Very low air and water pollution.	Active system needs maintenance and repair.
Very low land disturbance (built into roof or window).	Active collectors are unattractive.
Moderate cost (passive).	
HIGH-TEMPERATURE HEAT and ELECTRICITY (Solar)	
Moderate net energy.	Low efficiency.
Moderate environmental impact.	High costs.
No CO_2 emissions.	Needs backup or storage system.
Fast construction (1-2 years).	Need access to the sun most of the time.
Costs reduced with natural gas turbine backup.	High land use.
	May disturb desert areas.
SOLAR CELLS	
Fairly high net energy.	Need access to sun.
Work on cloudy days.	Low efficiency.
Quick installation.	Need electricity storage system or backup.
Easily expanded or moved.	High land use (solar-cell power plants) could disrupt desert areas.
No CO_2 emissions.	High costs (but should be competitive in 5-15 years).
Low environmental impact.	DC current must be converted to AC.
Last 20-40 years.	
Low land use (if on roof or built into walls or windows).	
Reduces dependence on fossil fuels.	
LARGE-SCALE HYDROPOWER	
Moderate to high net energy.	High construction costs.
High efficiency (80%).	High environmental impact from flooding land to form a reservoir.
Large untapped potential.	High CO_2 emissions from biomass decay in shallow tropical reservoirs.
Low-cost electricity.	Floods natural areas behind dam.
Long life span.	Converts land habitat to lake habitat.
No CO_2 emissions during operation in	Danger of collapse.

temperate areas.	
May provide flood control below dam.	Uproots people.
Provides water for year-round irrigation of cropland.	Decreases fish harvest below dam.
Reservoir is useful for fishing and recreation.	Decreases flow of natural fertilizer (silt) to land below dam.
WIND POWER	
Moderate to high net energy.	Steady winds needed.
High efficiency.	Backup systems are needed when winds are low.
Moderate capital cost.	High land use for wind farm.
Low electricity cost (and falling).	Visual pollution.
Very low environmental impact.	Noise when located near populated areas.
No CO_2 emissions.	May interfere in flights of migratory birds and kill birds of prey.
Quick construction.	
Easily expanded.	
Can be located at sea.	
Land below turbines can be used to grow crops or graze livestock.	
SOLID BIOMASS	
Large potential supply in some areas.	Nonrenewable if harvested unsustainably.
Moderate costs.	Moderate to high environmental impact.
No net CO_2 increase if harvested and burned sustainably.	CO_2 emissions if harvested and burned unsustainably.
Plantation can be located on semiarid land not needed for crops.	Low photosynthetic efficiency.
Plantation can help restore degraded lands.	Soil erosion, water pollution, and loss of wildlife habitat.
Can make us of agricultural, timber, and urban wastes.	Plantations could compete with cropland.
	Often burned in inefficient and polluting open fires and stoves.
GEOTHERMAL ENERGY	
Very high efficiency.	Scarcity of suitable sites.
Moderate net energy at accessible sites.	Depleted if used too rapidly.
Lower CO_2 emissions than fossil fuels.	CO_2 emissions.
Low costs at favorable sites.	Moderate to high local air pollution.
Low land use.	Noise and odor (H_2S).
Low land disturbance.	Cost too high except at the most concentrated and accessible sources.
Moderate environmental impact.	

(Miller)

Works Cited

1. Miller, G. Tyler. Living in the Environment. 14th ed. USA: Jack Carey, 2005.