Natural gas

Natural gas is a naturally occurring mixture of simple hydrocarbons and non hydrocarbons that exists as a gas at ordinary pressures and temperatures. The principal component of most natural gases is methane.

Higher molecular weight paraffinic hydrocarbons (C2-C7) are usually present in smaller amounts with the natural gas mixture, Most of these components are separated and recovered because of their added value when they are sold as separate products.

The non-hydrocarbon constituents in natural gas vary appreciably from one gas field to another. Some of these compounds are weak acids, such as hydrogen sulfide and carbon dioxide. Others are inert, such as nitrogen, helium and argon. Some natural gas reservoirs contain enough helium for commercial production

Natural gas containing the first two of these compounds, (H_2S) and (CO_2), is termed "sour" and the contaminants are referred to as "acid" gases. Natural gas that contains low enough concentrations of the acid gases to meet sales specifications is termed "sweet."

Water and acid gas components are removed to prevent freezing, corrosion, or other operating problems in transmission or utilization. Diluents that exist in significant quantities usually are removed to improve the combustion and/or heating properties of the gas.

Preparing Natural Gas for Transmission and Sale

For obtaining a sweet, dry natural gas. acid gases must be removed and water vapor reduced

GAS SWEETENING PROCESSES:

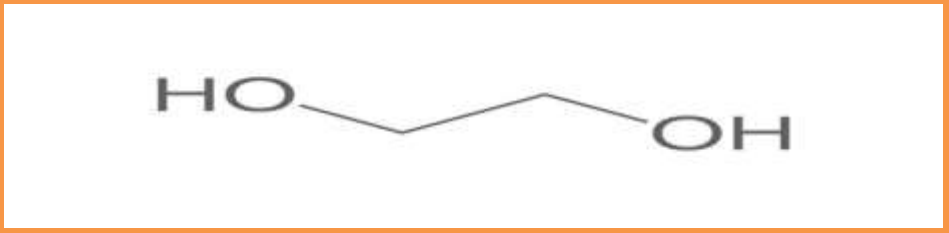
chemical absorption

Several chemical solvents are available for gas sweetening processes, almost all of them being based on alkanol amine products. They are all used under form of aqueous solutions.

Monoethanol amine (MEA) is a primary amine. It is the oldest solvent used in modern Gas Sweetening plants.

Water Removal:

Moisture must be removed from natural gas to reduce corrosion problems and to prevent hydrate formation. Hydrates are solid white compounds formed from a physical-chemical reaction between hydrocarbons and water under the high pressures and low temperatures used to transport natural gas via pipeline. Hydrates reduce pipeline efficiency.



To prevent hydrate formation, natural gas may be treated with glycols, which dissolve water efficiently.

Recognizing Natural Gas Leaks

- Recognizing gas leaks by smell:
  - In its natural state, natural gas is odorless. Odorant is added to give it a distinctive smell, similar to rotten eggs.

SMELL---GO---LET US KNOW!!

Additives: When the natural gas is intended for domestic use, tetrahydrothiophene (THT) is added so that the otherwise odorless natural gas can be detected in the event of a gas leak.

Coal

Coal is a natural combustible rock composed of an organic heterogeneous substance contaminated with variable amounts of inorganic compounds.

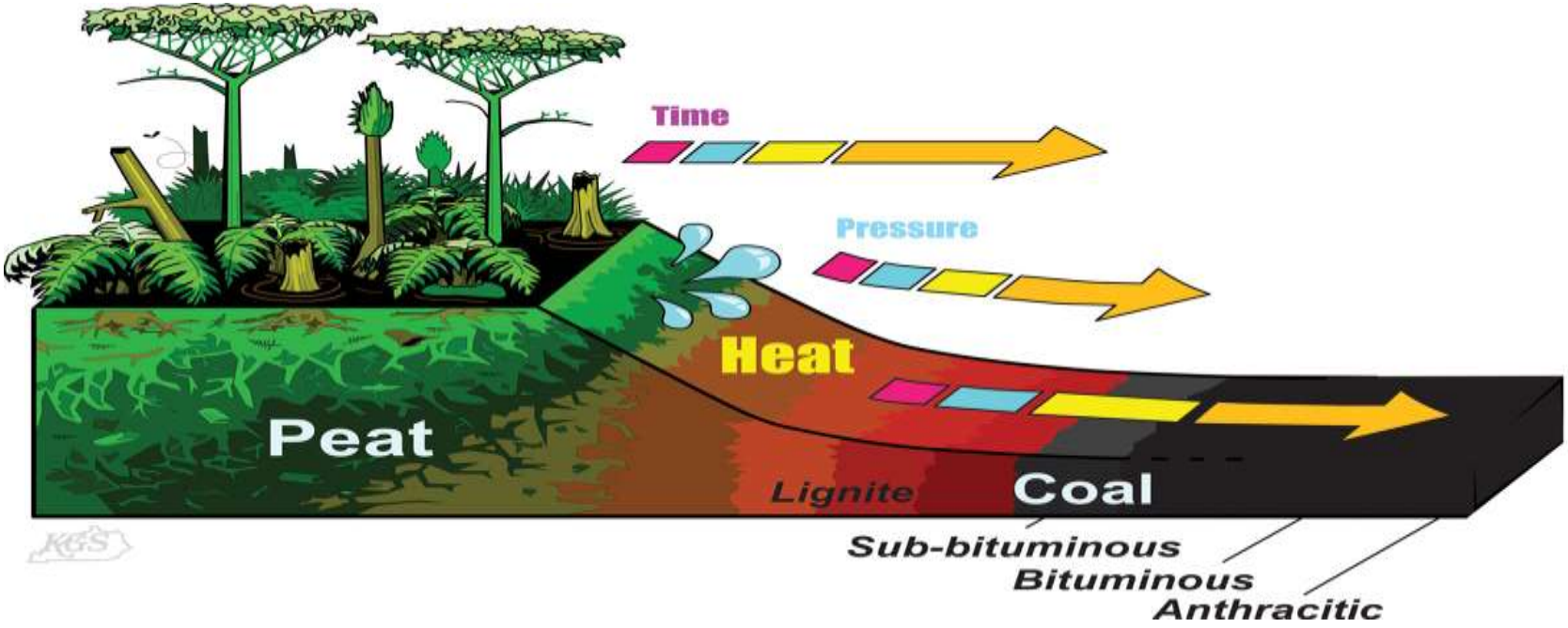
Most coal reserves are concentrated in North America, Europe, and China.

Coals are classified by rank.

Rank is a measure of the degree of coalification or maturation of the coal. The lowest rank coal is lignite, followed in order by sub-bituminous coal, bituminous coal, anthracite and graphite. Coal rank is correlated to the maturity, or age, of the coal. As a coal matures, the ratio of hydrogen to carbon atoms decreases. For example, peat, which is considered a young coal, has a low fixed carbon content and a low heating value.

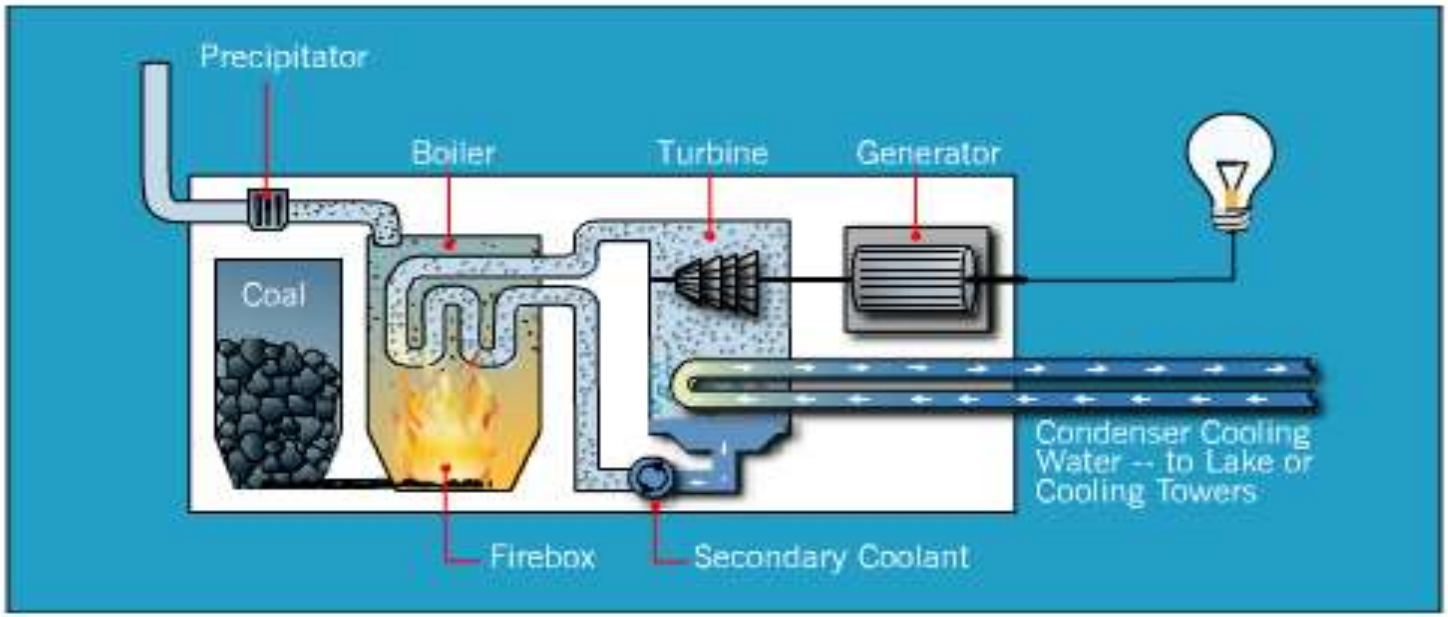
peat → lignite → sub-bituminous → bituminous → anthracite

increasing coal maturity



Types of coal

- Lignite
- Sub-bituminous coal
- Bituminous coal
- Anthracite
- Graph



Coal is a major source of energy in the production of electrical power using steam generation. In addition, gasification and liquefaction produce gaseous and liquid fuels that can be easily transported

Nuclear energy

We obtain nuclear energy from two types of reactions: fission, and fusion. Fission is the splitting of one large nucleus into two smaller nuclei; fusion is the joining of two small nuclei into one large nucleus. In both reactions, significant amounts of energy can be released. Nuclear energy in the past and present energy mix has been provided by nuclear fission reactions. the heat power generated by uranium in a nuclear reaction is of the order of a million times greater than that of the equal mass of coal. Nuclear reactors generate 17% of the world's electricity and 5% of total energy. The benefits of nuclear energy are: no air pollution, no greenhouse effect, and a reduction in dependence on foreign oil. The potential problems are: U.S. reactors are getting old and there is no currently available site for permanent nuclear waste disposal. The potential site is located below Yucca Mountain, Nevada.

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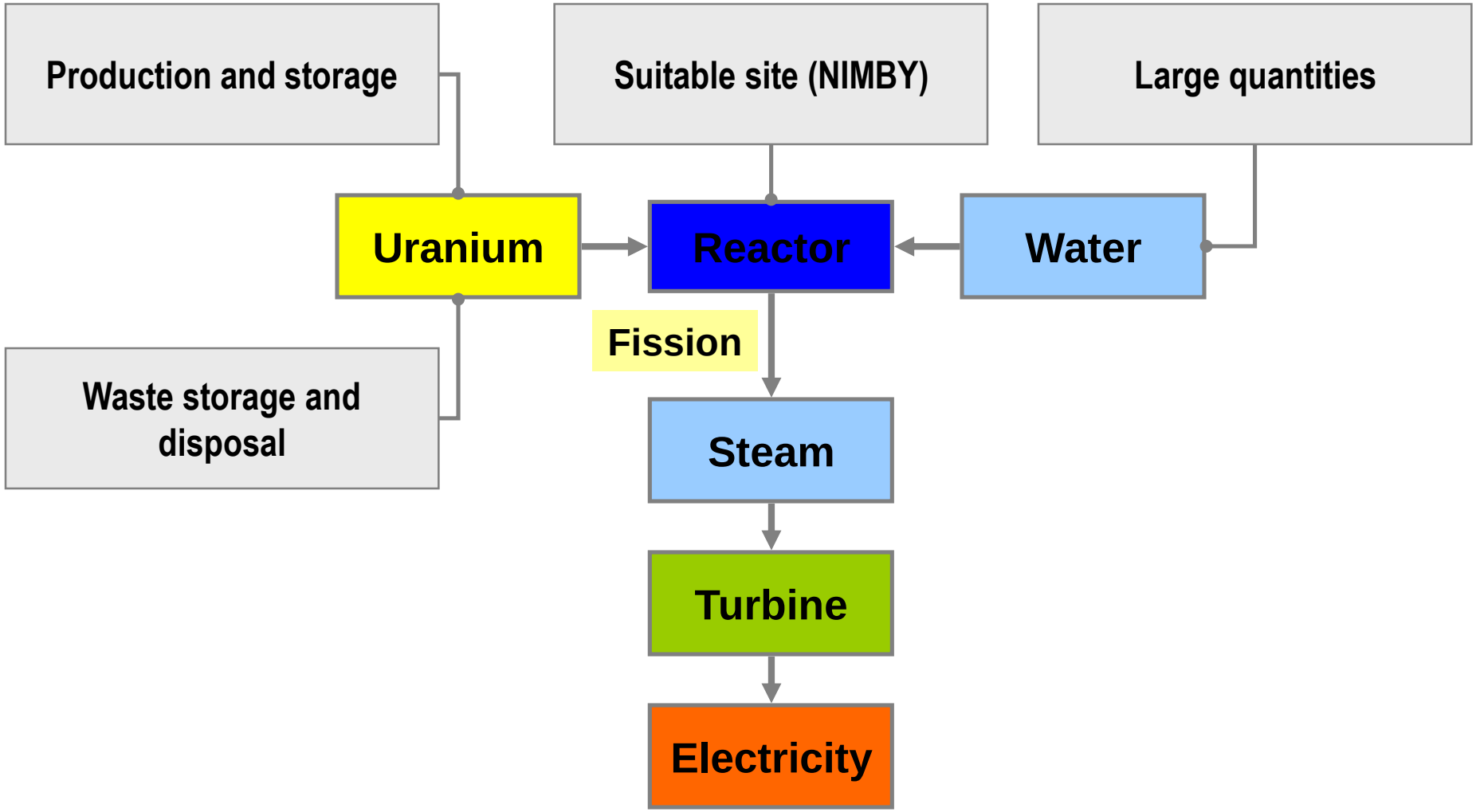
Nuclear Power

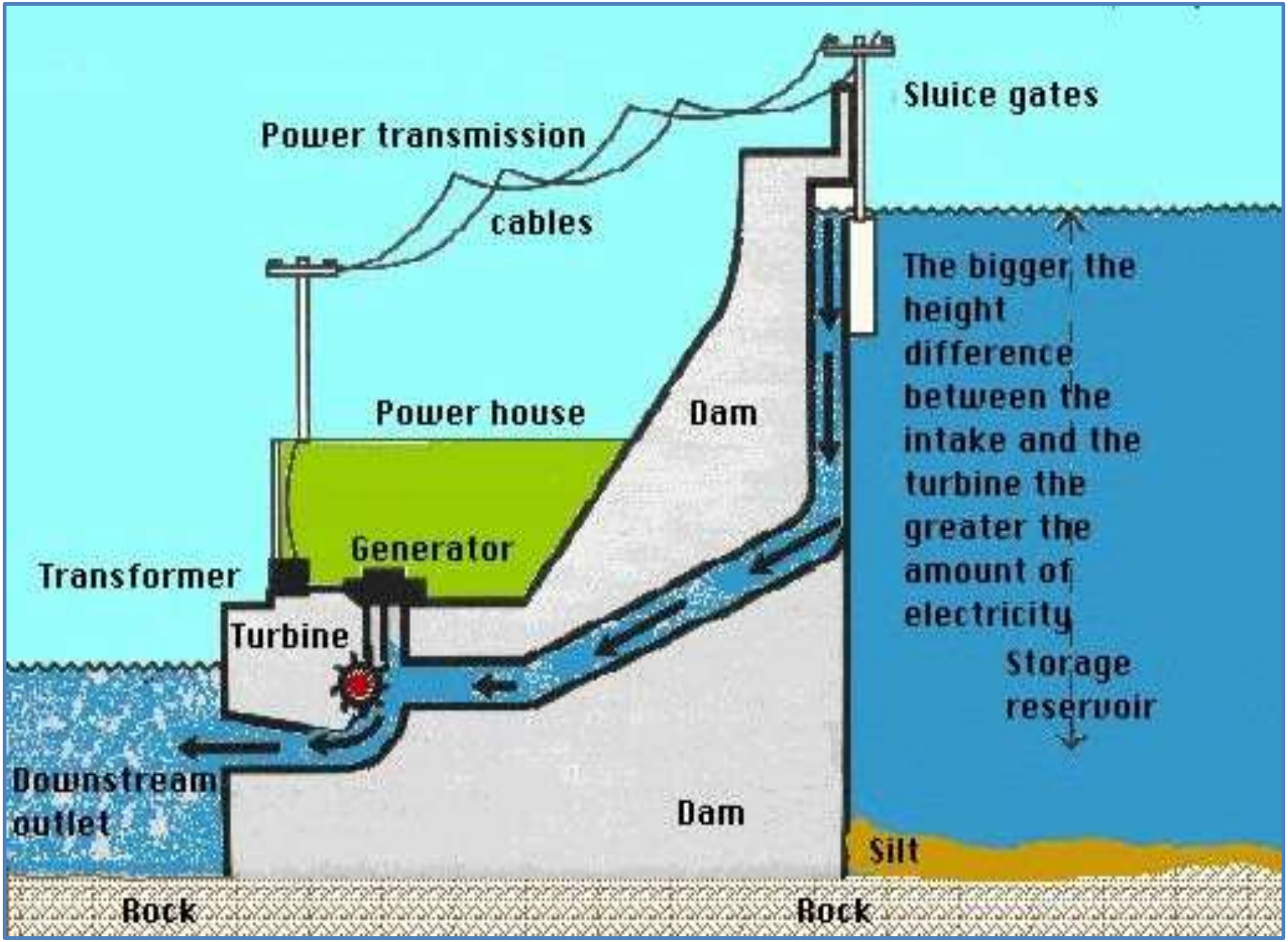



Nuclear Fission
fission product
incident neutron
release of energy
fissionable nucleus
chain reaction
incident neutron
splitting of nucleus
fission product

Renewable Energy Systems

Hydropower

Energy is generated when water dropping from higher to lower elevations is used to drive turbines that rotate generators to produce electricity.


Sluice gates
Power transmission
cables
The bigger the height difference between the intake and the turbine the greater the amount of electricity
Power house
Dam
Generator
Transformer
Turbine
Storage reservoir
Downstream outlet
Dam
Silt
Rock
Rock

Geothermal power

its most dramatic form uses heat from sources of underground steam or hot water (hydrothermal resources) to generate steam used to drive turbines and thus generate electricity.

Wind Energy

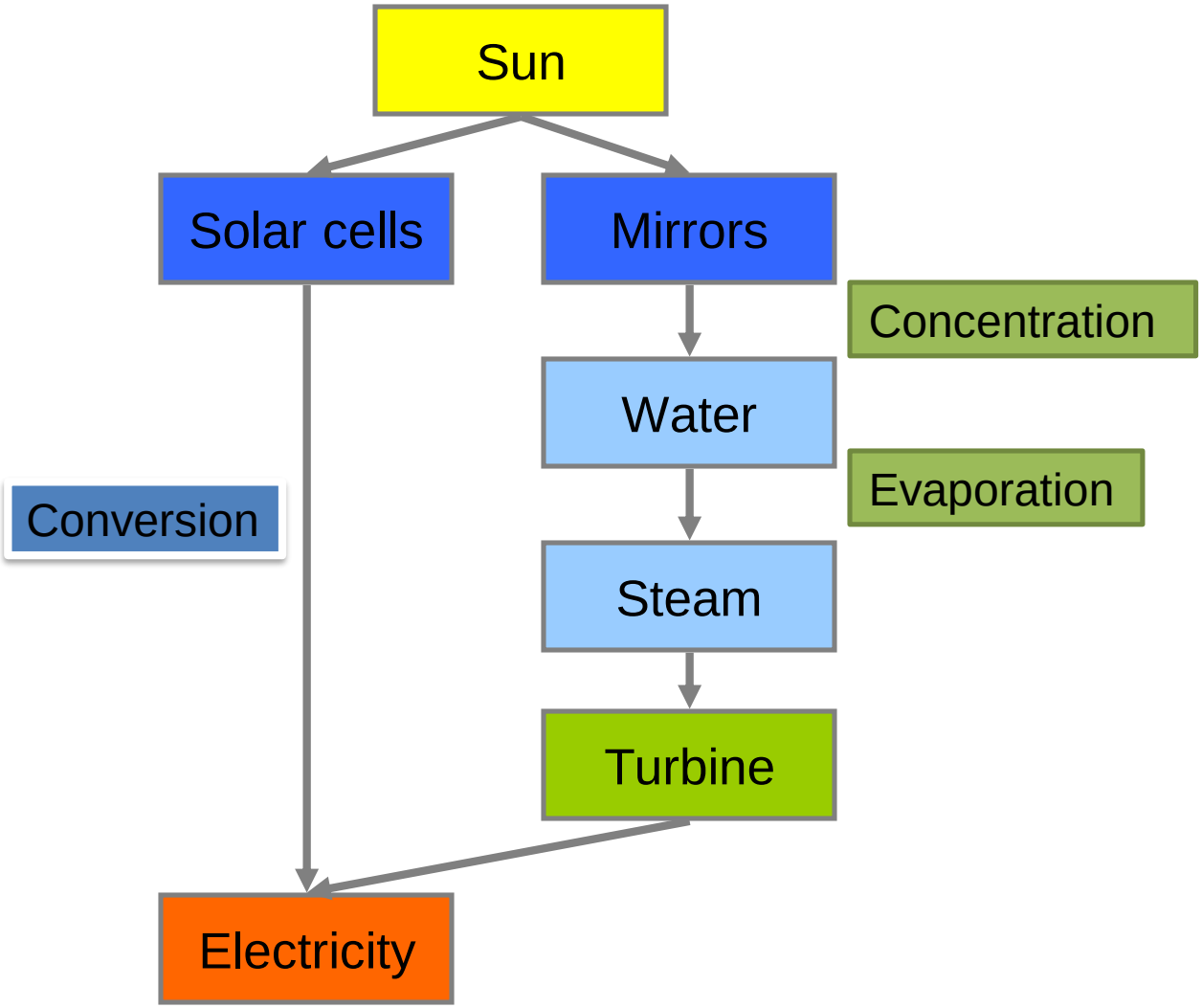
The kinetic energy of wind and flowing water are indirect forms of solar energy and are therefore considered renewable.

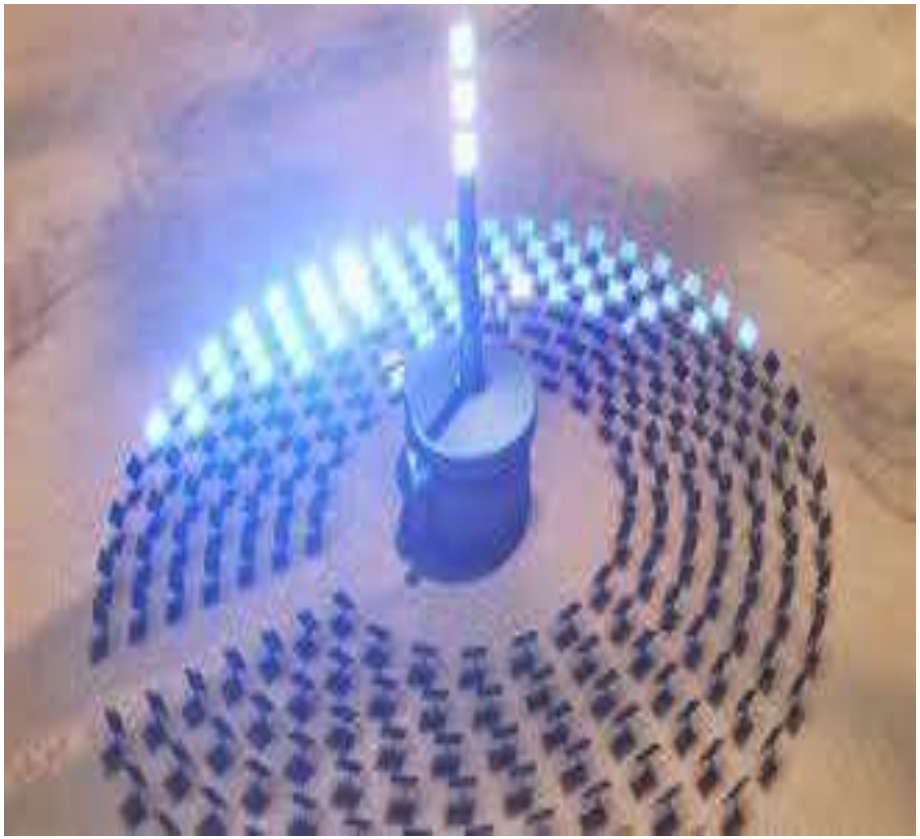
Since wind energy is time and location dependent.

Waves And Tides

The motion of the wave can be converted to mechanical energy and used to drive an electricity generator. The water can flow through the gate four times per day because the tide rises and falls twice a day..

Solar Energy





Biomass

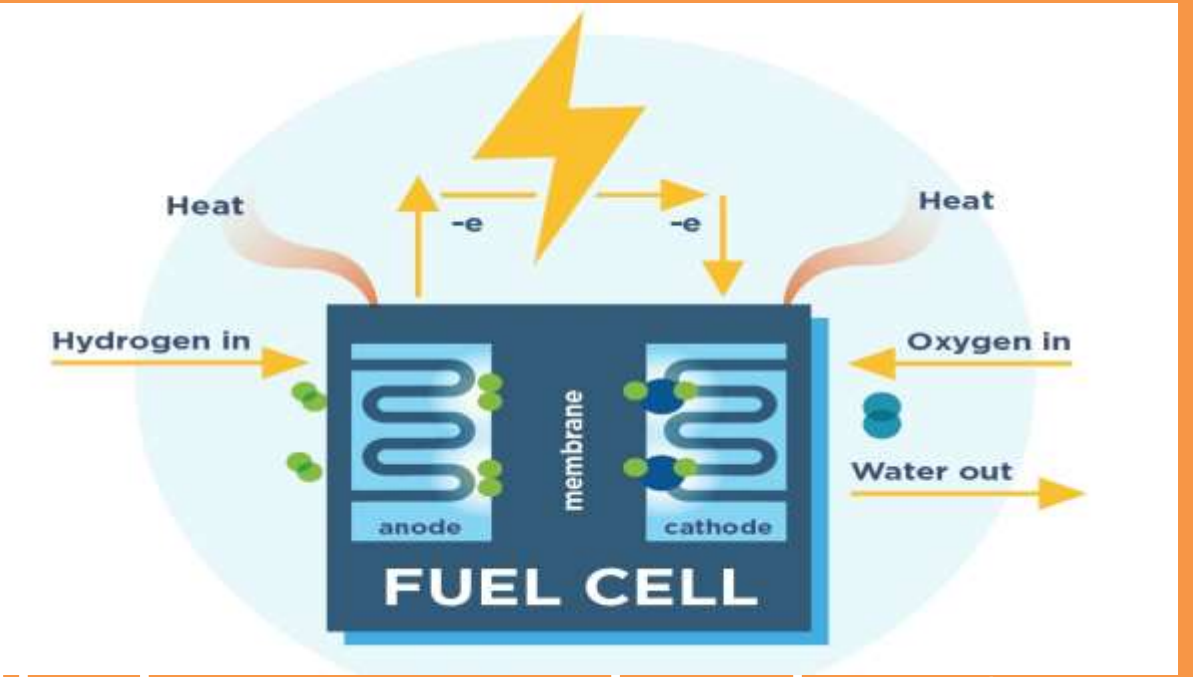
Biomass refers to wood and other plant or animal matter that can be burned directly or can be converted into fuels. Biomass gasification converts solid biomass to flammable gas.

Methanol, or wood alcohol, is a volatile fuel that has been used in race cars for years. Another alcohol, clean burning ethanol, can be blended with gasoline to form a blended fuel (gasohol) and used in conventional automobile engines.

HYDROGEN AND FUEL CELLS

- Hydrogen is considered a carrier of energy because it can be transported in the liquid or gaseous state by pipeline or in cylinders. Once produced and distributed, hydrogen can be used as a fuel for a modified internal combustion engine or as the fuel in a fuel cell. Fuel cells are electrochemical devices that directly convert hydrogen, or hydrogen-rich fuels, into electricity using a chemical rather than a combustion process.

Fuel cells produce clean energy in the form of electricity and heat from hydrogen.



Fuel cells do not need recharging or replacing and can produce electricity as long as they are supplied with hydrogen and oxygen.

Methods Of Energy Storage

There are five different methods for energy and fuel storage

1-Chemical Energy Storage

. Chemical fuels in common use are processed coal, gasoline, diesel fuel, natural gas, shale gas, biogas, liquefied petroleum gas (LPG), propane, butane, ethanol, biodiesel, and hydrogen. All of these chemicals are readily converted to mechanical energy and then to electrical energy using heat engines that are used for electrical power generation.

2-Electrochemical Energy Storage

Batteries:

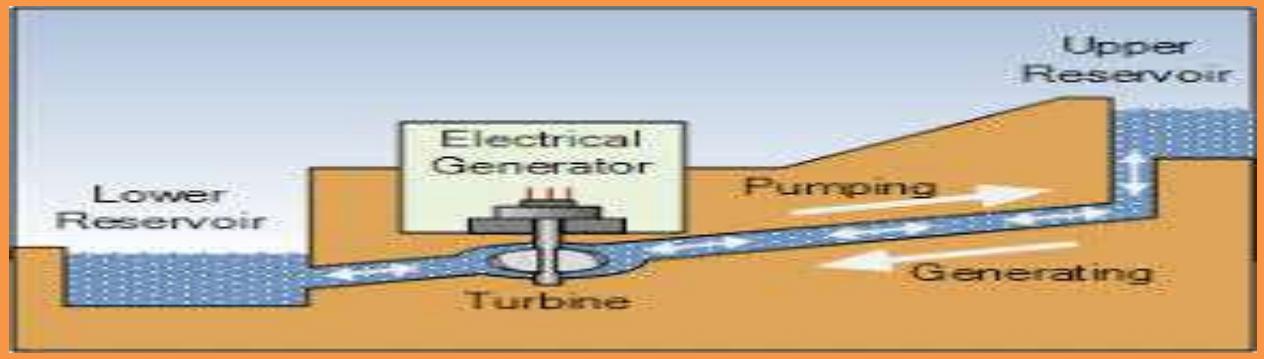
A battery is a device that transforms chemical energy into electric energy.

Fuel Cells:

A fuel cell uses stored chemical energy to generate power.

3-Mechanical Energy Storage

compressed air , flywheel , and pumped-storage hydroelectricity



4-Electrical Energy Storage

Capacitor

5-Thermal Energy Storage

Power plants are usually integrated into district heating systems At present, storage of compressed gas underground is the primary technology used to store natural gas.