BIOMASS ENERGY

ARIZONA PUBLIC SERVICE COMPANY

WHERE DOES BIOMASS COME FROM

Biomass is obtained from any plant, human or animal derived organic matter.

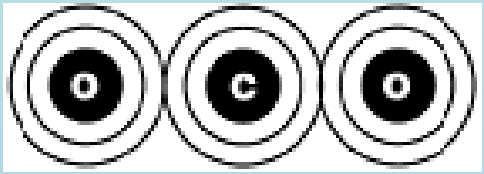
- ***Wood from trees, agricultural crops, wood factory waste, and the construction industry***
- ***Burnt wood from forest fires***
- ***Animals and animal droppings***

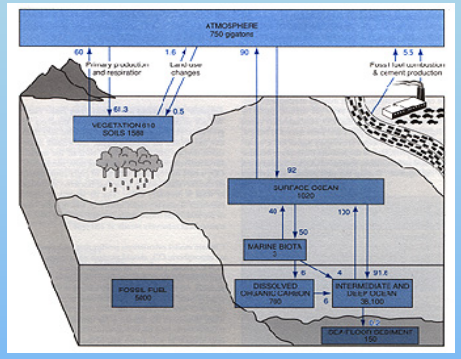
WHAT IS BIOMASS?

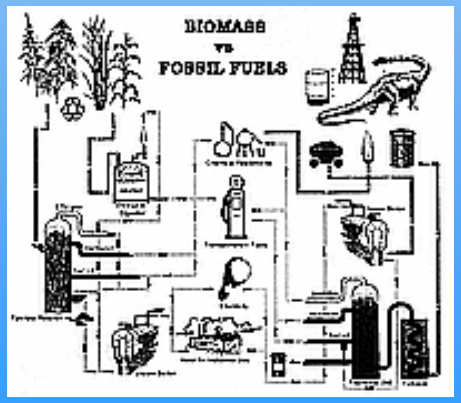
- ***All organic matter is known as biomass, and the energy released from biomass when it is eaten, burnt or converted into fuels is called biomass energy.***

- ***Biomass provides a clean, renewable energy source that could dramatically improve our environment, economy and energy security. Biomass energy generates far less air emissions than fossil fuels.***

- ***Unlike combustion of fossil fuels, which releases carbon dioxide captured by photosynthesis billions of years ago, carbon dioxide released by biomass is balanced by carbon dioxide captured in the recent growth of the biomass, so there is far less net impact on greenhouse gas levels.***





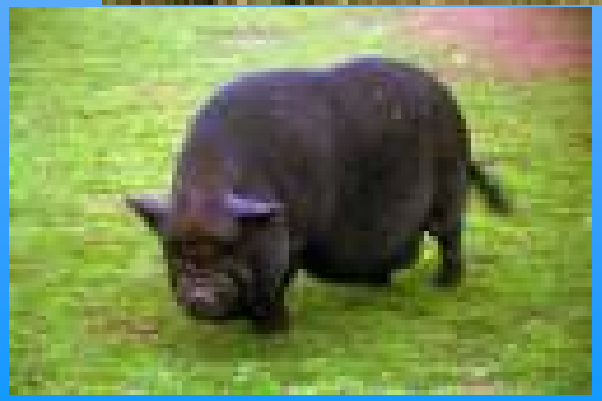


http://www.gcrio.org/CONSEQUENCES/vol4no1/figure1.html

HOW WAS BIOMASS USED IN THE PAST?

- ***Biomass was the first fuel mankind learned to use for energy. Burning wood for warmth and cooking and keeping wild animals away***
- ***Some of the earliest power plants in America were fueled by wood material***
- ***It was an abundant fuel in many parts of the country where logging took place***
- ***It burned much cleaner than coal and it was available before abundant oil and natural gas was discovered***
- ***Many cultures used animal dung to burn, and some are still doing this today***

http://hearth.com/what/historyfire.html



CONVERSION OF BIOMASS WASTE INTO USEABLE FUEL

- **Gasification**
  Exposing a solid fuel to high temperatures and limited oxygen produces biogas.

- **Pyrolysis**
  Heating the biomass can produce pyrolysis oil and phenol oil leaving charcoal.

- **Digestion**
  Bacteria, in an oxygen-starved environment can produce methane.

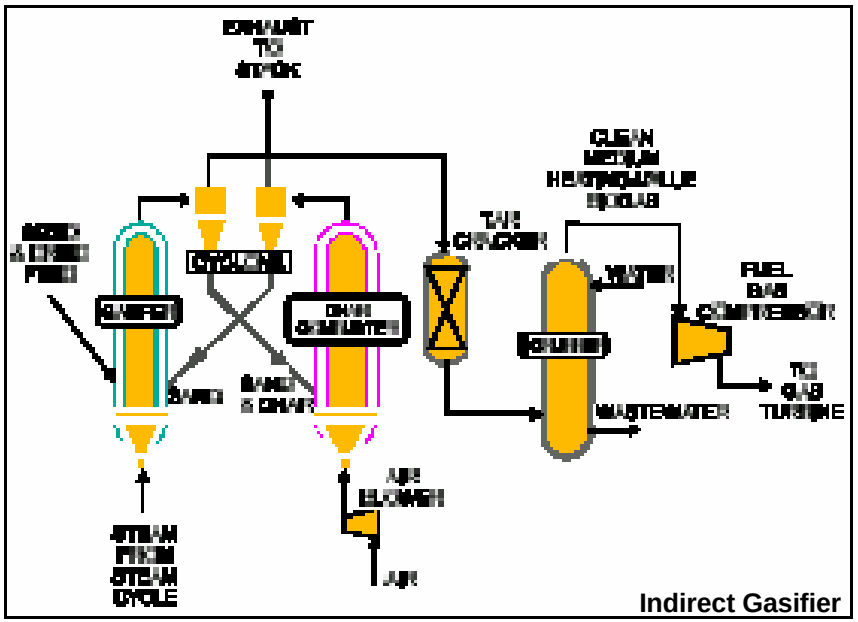
- **Fermentation**
  Bio-material that is used to manufacture Ethanol and Biodiesel by an anaerobic biological process in which sugars are converted to alcohol by the action of micro-organisms, usually yeast.

- **Solid Fuel Combustion**
  Direct combustion of solid matter.

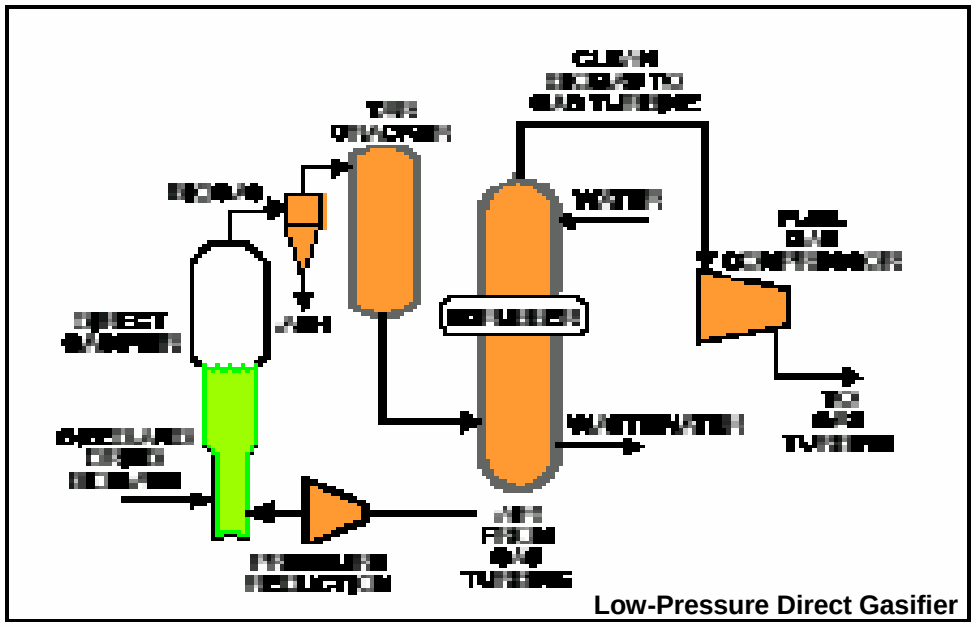
Biomass to Biogas

GASIFICATION

Biogas is produced by exposing biomass to high temperatures and limited oxygen.



Indirect Gasifier



Low-Pressure Direct Gasifier

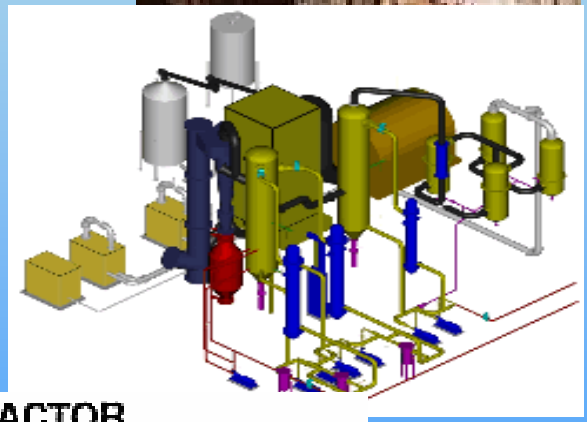
Biogas energy can serve as a feedstock for electricity generation or a building block for chemicals.

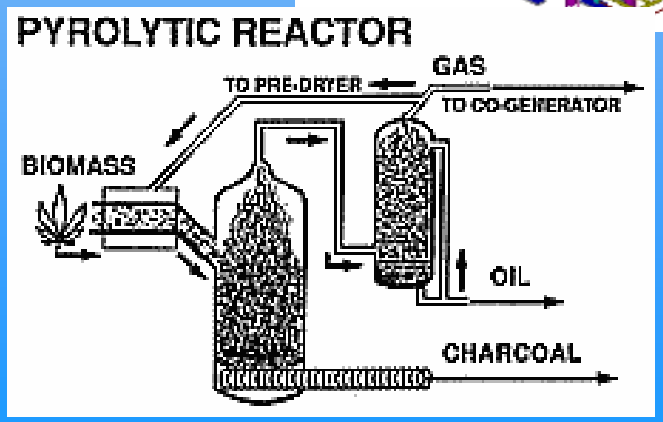
PYROLYSIS

- ***Heat is used to chemically convert biomass to bio-oil.***

- ***Pyrolysis Oil, is easier to store and transport than solid biomass material and can be burned like petroleum to generate electricity.***

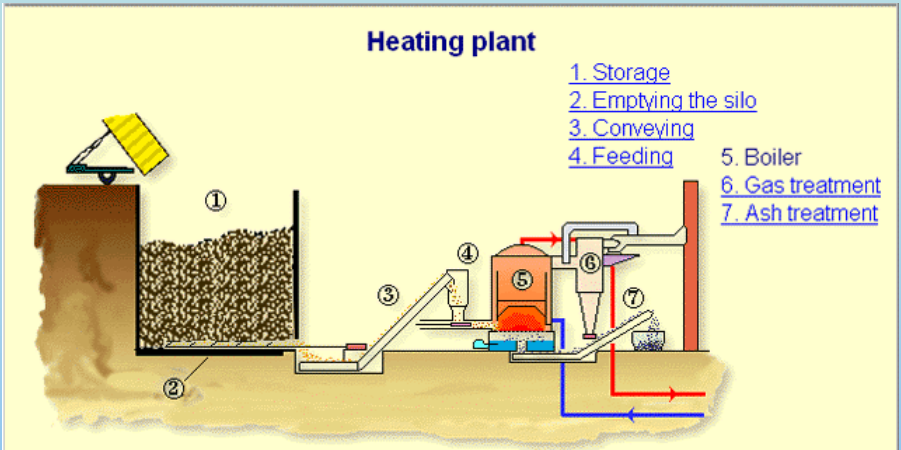
- ***Phenol Oil, a chemical used to make wood adhesives, molded plastics and foam insulation. Wood adhesives are used to glue together plywood and other composite wood products.***





DIGESTION

Decomposition of organic matter by anaerobic bacteria in an oxygen-starved environment.



Heating Plant, Lior International

Lemvig centralised biogas plant, Denmark, producing about 4 million m3/year of gas Agores Website

Dranco plant for anaerobic digestion of biowaste, Ghent, Belgium (supported under THERMIE) Agores Website

Anaerobic digesters compost (or "digest") organic waste in a machine that limits access to oxygen encouraging the generation of methane and carbon dioxide by microbes in the waste. This digester gas is then burned as fuel to make electricity.

FERMENTATION

- ***Unlike other renewable energy sources, biomass can be converted directly into liquid fuels— biofuels— for our transportation needs (cars, trucks, buses, airplanes, and trains).***

- ***The two most common types of biofuels are ethanol and biodiesel.***

- ***Ethanol is an alcohol, created by fermenting biomass high in carbohydrates. It is used as a fuel additive to cut down carbon monoxide and other emissions.***

- ***Biodiesel is made by combining alcohol with vegetable oil, animal fat or other recycled cooking grease and is also an additive to reduce emissions. When pure, biodiesel is a renewable alternative fuel for diesel engines.***

SOLID FUEL COMBUSTION

Direct combustion of solid matter where the biomass is fed into a furnace where it is burned. The heat is used to boil water and the energy in the steam is used to turn turbines and generators.

Eagar Biomass Plant, Springerville, Arizona
Photo by Photosmith

Wood

accumulated by Naomi F. Miller, University of Pennsylvania Museum March 2004

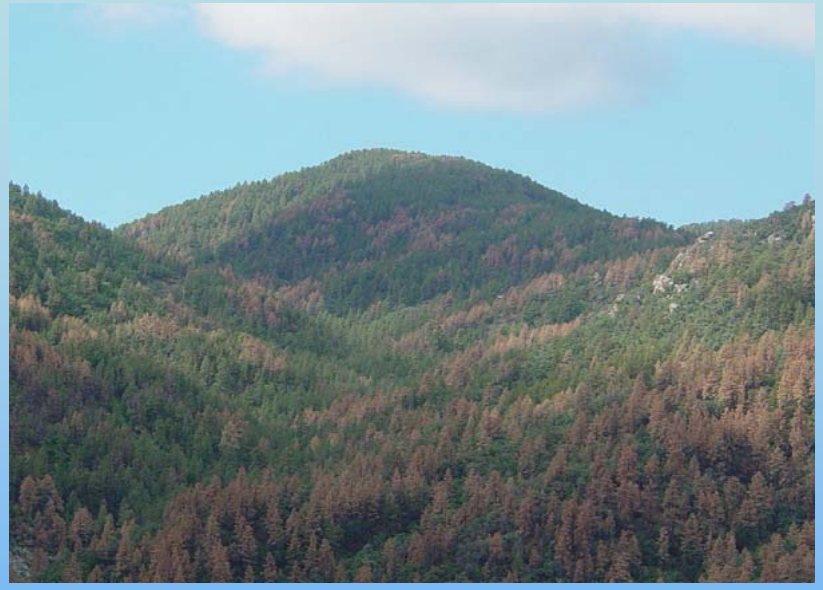
Animal Dung

From Wikipedia, the free encyclopedia

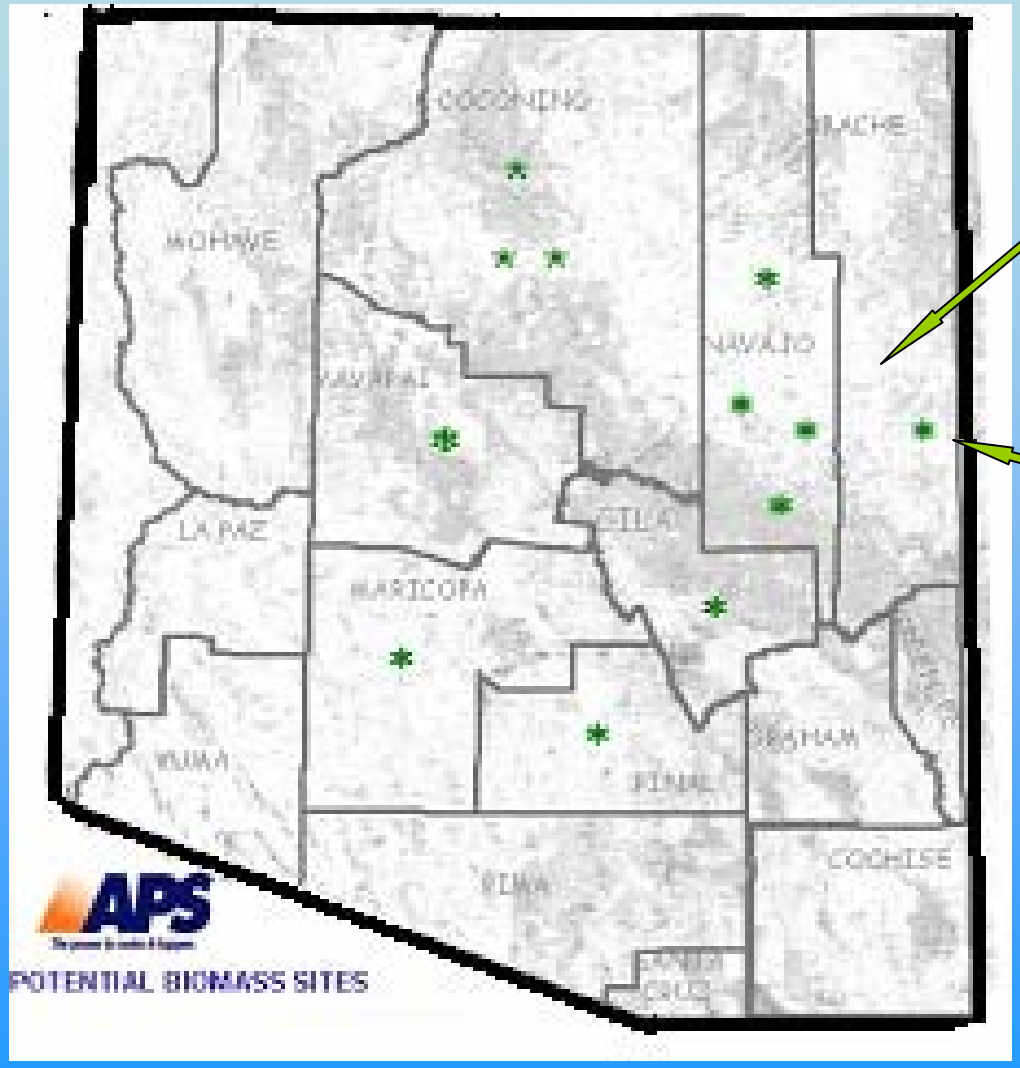
Peat is an accumulation of partially decayed vegetable matter. Peat forms in wetlands, bogs, moors, mires and fens

SOLID FUEL IN ARIZONA

- ***A major source of solid fuel is in Arizona's forests.***
- ***Arizona has over 14 million acres of forest and has the largest continuous Ponderosa forest totaling 7 million acres .***
- ***The drought and the bark beetle have devastated our forests and wild fires are one of the results.***
- ***Agencies have been formed such as the Healthy Forest Initiative and the Wildland Urban Interface (WUI) to clear the burnt wood and 9" and under diameter trees.***



POTENTIAL ELECTRICITY GENERATION LOCATIONS



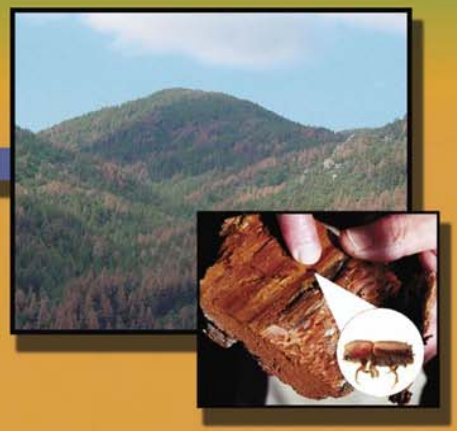
A 3 MW BIOMASS PLANT IS UNDER CONSTRUCTION IN SNOWFLAKE, ARIZONA – TO BE COMPLETED IN 2005

3 MW BIOMASS PLANT
EAGAR, ARIZONA

In Arizona, there may be up to 300 MW of electrical generation capacity.

APS

BIOMASS



Potentially, the waste material from long-term healthy forest initiatives can be used to support small diameter wood industries. The waste materials from those industries can be used to supply fuel to biomass power plants such as the APS/WRE power plant in Eagar.

There is also a considerable amount of biomass material, resulting from the recent catastrophic forest fires in Arizona and from the large-scale infestation of bark beetles, that needs to be removed from the forests.

Power plants such as the APS/WRE plant in Eagar can provide a means of disposing of this waste material while producing a useful commodity
- electricity.

APS

Additional Sources of Information

http://www.seps.sk/zp/fond/dieret/biomass.html

http://www.energyquest.ca.gov/how_it_works/fire.html

http://www.energyjustice.net/digesters/

http://www.eere.energy.gov

Contact Janet Crow, APS Outreach Coordinator at
(602) 250-4990 or janet.crow@aps.com