

Renewable Energy Considerations (Part One)

Introduction

Earth's 2016 surface temperature was the warmest since modern recordkeeping began in 1880, according to independent analyses by NASA and the National Oceanic and Atmospheric Administration (NOAA)¹. This rise of earth's temperature is attributed to the increase of greenhouse gases in earth's atmosphere. When sunlight strikes the Earth's surface, some of it is reflected back towards space as infrared radiation (heat). Greenhouse gases absorb this infrared radiation and trap the heat in the atmosphere, resulting in increased temperatures.

Renewable energy can play an important role in reducing greenhouse gas emissions. When renewable energy sources are used, the use of fossil fuels is reduced. Unlike fossil fuels, non-biomass renewable sources of energy (hydropower, geothermal, wind, and solar) do not directly emit greenhouse gases. Furthermore, wind and solar energy sources are inexhaustible and are constantly replenished, according to the National Renewable Energy Laboratory (NREL)².

Fast Facts about Greenhouse Gases

Many greenhouse gases such as carbon dioxide, methane, water vapor, and nitrous oxide, occur naturally in the atmosphere while others are synthetic (man-made), including chlorofluorocarbons (CFCs)³, hydrofluorocarbons (HFCs) and Perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆). Some of these man-made gases are used as refrigerants in the air conditioning and refrigeration industry. In October of 2000, the U.S. Department of Energy published composition of greenhouse gases both natural and man-made (Figure 1).

Figure 1

(all concentrations expressed in parts per billion)	Pre-industrial baseline	Natural additions	Man-made additions	Total (ppb) Concentration	Percent of Total
Carbon Dioxide (CO ₂)	288,000	68,520	11,880 (2)	368,400	99.438%
Methane (CH ₄)	848	577	320	1,745	0.471%
Nitrous Oxide (N ₂ O)	285	12	15	312	0.084%
Misc. gases (CFC's, etc.)	25	0	2	27	0.007%
Total	289,158	69,109	12,217	370,484	100.00%

As shown above, CO₂ is the leading greenhouse gas component.

Renewable Energy Technologies and Facts

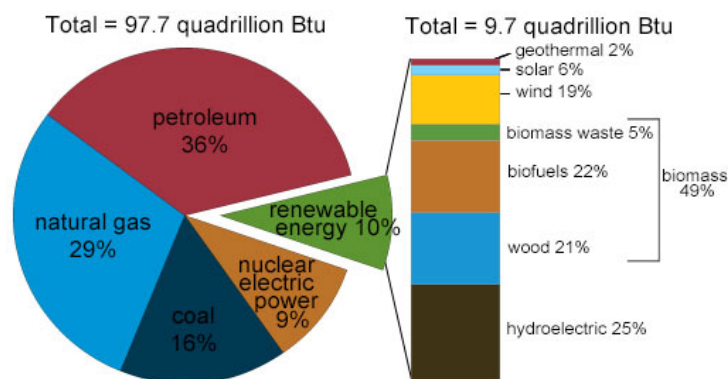
Renewable energy technologies have the potential to strengthen our nation's energy security, improve environmental quality, reduce greenhouse gases and contribute to a strong energy economy. There are six (6) commonly used renewable energy sources:

- **Biomass** is fuel that is developed from organic materials, a renewable and sustainable source of energy used to create electricity and other forms of power.
- **Geothermal** is a form of energy obtained from within the earth, originating in its core; also, energy produced by extracting the earth's internal heat.
- **Hydrogen** is a zero-emission fuel when burned with oxygen (if one considers water not as an emission) or used in a contained cell (allowing galvanic reaction) and capable of 'reversing' the reaction if needed.
- **Hydro Power** is energy derived from the movement of water.
- **Solar Power** is the conversion of energy from sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power.
- **Wind Power** converts the kinetic energy of wind into mechanical or electrical energy through turbines.

According to the US Energy Information Administration (EIA)⁴, these renewable energy technologies provided 11% of the total U.S. energy produced and 10% of the energy consumed in the U.S. in 2015 (Figure 2).

Figure 2

U.S. energy consumption by energy source, 2015



Note: Sum of components may not equal 100% because of independent rounding.

Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1 (April 2016), preliminary data



Renewable Energy Challenges

One of the most significant challenges is making renewable energy sources financially attractive and more widely adopted. For example, the amount of energy in a given amount of raw biomass tends to be significantly less than that contained in an equal amount of fossil energy, resulting in a higher cost of production. One promising process involves using chemical or thermal conversion to create biomass as energy-rich as fossil fuels, making it more economically competitive.

In addition, most renewable energy technologies are manufactured, and it is expected that increased use will result in economies of scale which will lower the cost of production.

Technological development of renewable sources will continue due to legislative efforts of both state and federal governments, including the Energy Independence and Security Act of 2007⁵. As energy demand use continues to grow in coming decades, renewable energy sources will play an increasingly important role in reducing greenhouse gas.

Part Two of this article will expand on each of the six (6) commonly used renewable energy sources and their benefits in reducing greenhouse gases.

Reference:

1. NASA, NOAA data show 2016 warmest year on record globally. <https://climate.nasa.gov/news/2537/nasa-noaa-data-show-2016-warmest-year-on-record-globally/>
2. Learning About Renewable Energy, NREL, <https://www.nrel.gov/workingwithus/learning.html>
3. Greenhouse Gases, NOAA, <https://www.ncdc.noaa.gov/monitoring-references/faq/greenhouse-gases.php?section=cfc>
4. Renewable Energy Explained, EIA, http://www.eia.gov/energyexplained/index.cfm?page=renewable_home
5. Energy Independence and Security Act of 2007, <https://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf>