

WATER IN DIFFERENT ENERGY TYPES

Renewable Energy

Hydropower

- Hydropower produced 89% of the world's renewable electricity in 2006, and 16.6% of total electricity generation worldwide. Two-thirds of worldwide economic potential remains unexploited – this resource is concentrated in the developing world
- 25% of dams worldwide are used for hydro power and only 10% have hydropower as their main use. Most of them are used for flood control or irrigation, or for multiple purposes
- Hydropower uses and releases water instantaneously or with a delay but do not consume water. Their main loss stems from evaporation when air temperatures are high;
- Energy output from hydropower is dependent on sustainable upstream water use as well as hydrological patterns, and is therefore susceptible to climate change impacts;
- Hydropower reservoirs store both water and energy and are becoming increasingly important for the management of climate change.

Solar, wind and ocean energy

- Solar thermal power plant water consumption is about 1 m³ of water per 103 kWh (electric) or 277m³ of water per 1,000 G.J.
- Wind energy and photovoltaic cells that produce electricity directly from sunlight are considered to have negligible water use;
- Wave energy is still a largely untapped source of renewable energy, which, like hydro-power, uses water but does not consume it.

Crude Oil

- As easy oil is used up, pumping oil from reservoirs is now associated with more water production per amount of oil produced than ever before (due to aging reservoirs and increased oil recovery operations). The volume of water produced worldwide from the oil and gas industry is still increasing at a rate of about 10% per year. Water to oil ratios ranged from <1 to up to 40 depending on maturity of the field with the lowest ratios generally observed in the Middle East.
- Between 2 and 8 m³ of water per 1,000 G.J. have historically been required to extract oil, including water for drilling, flooding and treating. However, when thermal steam injection or enhanced oil recovery is included in the process, this number can increase, on average, to 1,058 m³ per 1,000 G.J.

Oil Refining and Gas Processing

- Consumptive water use for processing and cooling in traditional refining facilities in industrialized countries ranges from 25 to 65 m³ per 1,000 G.J.
- For about 800 million gallons of petroleum products refined daily in the US, 1 to 2 billion gallons of water are consumed per day;

Biomass for Conversion to Bio-fuels

- An illustrative range of average water footprints for biomass production is 24 m³/GJ (24,000 m³ per 1,000 GJ) in the Netherlands to 143 m³/GJ (143,000 m³ per 1,000 GJ) in Zimbabwe
- Large differences in crop water requirements exist among countries due to different climates. Also, the amount of water used does not reflect water sources and whether the crop is rain-fed or irrigated;
- Water is not only required for biomass production, but also for its conversion to biofuels.

Coal

- More electricity is generated from coal than from any other fuel – 39% of world generation in 2002

- Open pit coal mining requires 2 m³ of water per 1,000 GJ of energy in the coal, while underground mining operations require 3-20 m³ of water per 1,000 GJ

Nuclear

Power generation

There are two types of cooling systems for nuclear power plants:

- open-loop water cooling, where water is withdrawn from a river, lake or the sea, and then returned to it after cooling. The average amount of water consumed is approximately zero and the water required and then returned is approx. 160 m³/MWh (equivalent to 44,444 m³ per 1000 GJ).
- closed- loop water cooling, where water flows into a closed circuit and part of it is evaporated through a cooling tower into the atmosphere. The average amount of water consumed (through evaporation) is approx. 2 m³/MWh (555 m³ per 1000 GJ) and the water required and then returned is approx. 6 m³/MWh (equivalent to 1, 666 m³ per 1000 GJ).

Source:

<http://www.iwawaterwiki.org/xwiki/bin/view/Articles/WaterEnergyandClimate>