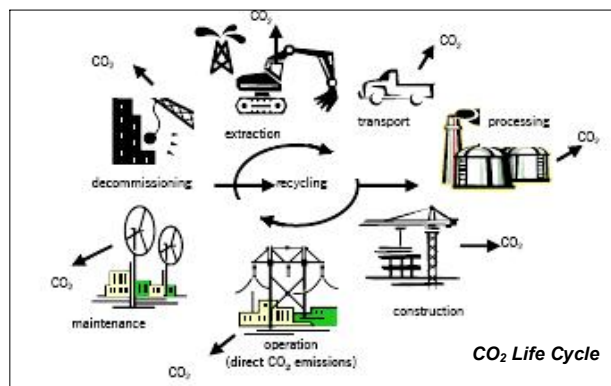


CARBON FOOTPRINT

Definition & Calculation:

Carbon Footprint: “The total amount of CO₂ and other greenhouse gases, emitted over the full cycle of a process or product. It is expressed as grams of CO₂ equivalent per kilowatt hour of generation (gCO₂eq/kWh)” - Parliamentary Office of Science and Technology¹

Calculating a Carbon Footprint: Carbon footprints are calculated using a method called Life Cycle Assessment (LCA), which analyzes the cumulative environmental impacts of a process or product through all stages of its life. It takes into account energy inputs and emission outputs throughout the whole production chain from exploration and extraction of raw materials to processing, transport, and final use.



Generation Comparisons:

(A least to greatest comparison of the carbon footprint for power plants)

- **Nuclear plants:** The carbon footprint of a nuclear plant such as Indian Point is less than that of an offshore windmill at approximately 5gCO₂eq/kWh. Nuclear facilities do not use combustion, therefore the actual operational CO₂ emissions account for less than 1% of the total output. Most emissions occur during mining, enrichment and fuel fabrication. Decommissioning has the next sizable contribution at 35% of the lifetime CO₂ emissions.
- **Wind power** has extremely low emissions. 98% of its total life cycle CO₂ emissions are created during construction of foundations and rotor blades. Offshore mills have a carbon footprint of 5.25gCO₂eq/kWh while onshore is 4.64gCO₂eq/kWh.
- **Hydroelectric** can be produced in two forms, storage and run-of-river schemes. Storage schemes have a higher footprint, approximately 10-30gCO₂eq/kWh while run-of-river schemes are typically less than 5gCO₂eq/kWh.
- **Marine technologies** (wave and tidal) technologies are still emerging and no formal life cycle analyses have been carried out, however based on examples the estimate is between 25-50gCO₂eq/kWh. This comes largely from the 665 tons of steel needed to create the wave converter device.
- **Photovoltaics (solar cells)** made of crystalline silicon which must be extracted from quartz at high temperatures is the most energy intensive phase of production and accounts for 60% of its total energy requirement. Life cycle CO₂ emissions also depend largely on the amount of sunlight in an area and can range from approximately 35gCO₂eq/kWh for solar cells in large amounts of sunlight, to 58gCO₂eq/kWh for cells that receive less sunlight.
- **Biomass** Can be from 25gCO₂eq/kWh to 93gCO₂eq/kWh based on the amount of organic matters burned.
- **Gas powered** electricity generation has a carbon footprint around half that of coal, around 500gCO₂eq/kWh.
- **Oil-fired** electricity generation has an average carbon footprint of 650gCO₂eq/kWh.
- **Coal burning** power plants have the largest carbon footprint of all electricity generation systems. Conventional coal combustion systems result in emissions greater than 1,000gCO₂eq/kWh. The newer gasification plants achieve emissions closer to 800gCO₂eq/kWh. This is still an emerging technology and is not widely available.

¹ October 2006, Number 268. Carbon footprint of electricity generation. POST (Parliamentary Office of Science and Technology). www.parliament.uk/post

POST is an office of both Houses of Parliament, charged with providing independent and balanced analysis of public policy issues that have a basis in science and technology

* Prepared by New York Affordable Reliable Electrify Alliance, February 25, 2008