

Life-cycle assessment of electricity generation options

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Abstract

Comparing options should be done with life-cycle assessment (LCA), looking at all the stages of an energy system (extraction, processing, transportation of fuels, building of power plants, combustion, ...). This method is essential to give an accurate picture of GHG emissions. One obvious example is fuel cells, which are often considered "emission-free". From a life-cycle perspective, this is not necessarily the case because fuel cells might be "fueled" by natural gas reforming, thereby creating large emissions at that stage.

For hydropower, LCA means that GHG emissions from reservoirs should be included in the assessment. However, some studies have exaggerated the importance of this issue, by focusing on exceptional cases. When looking at typical projects, GHG emissions from reservoirs are very small. Moreover, recent research has shown that all rivers and lakes are large emitters of GHGs. When these natural emissions are subtracted from measured emissions on reservoirs, "net" emissions from reservoirs are even smaller than currently reported in the scientific literature.

Another parameter of LCAs will also be presented: the "Energy Payback ratio". By estimating how much energy must be spent to sustain a generation option (notably in extracting resources), this parameter gives an indication if an option has long-term potential.

Overall, hydropower, nuclear and wind power have excellent performance in LCAs. If we consider the reliability and flexibility of operating these plants, hydropower can be shown to have the best performance.