

DEVELOPMENT OF A METHODOLOGY TO CREATE STANDARDIZED, QUALITY TESTED, AND UPDATABLE LCI DATASETS BY WAY OF THE GERMAN ELECTRICITY MIX

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ABSTRACT

Energy processes are of central meaning for LCA, as nearly all production as well as service processes require energy inputs. Since the energy sector is subject to changes which tend to become stronger in the future, it is necessary to update LCI data for energy processes in a transparent and efficient way. Furthermore, various LCI data available for a certain product or process often show differences in emissions and materials use. Therefore, the LCI should be based on data agreed on by the

stakeholders and reviewed according to a quality standard. With respect to the German electricity generation mix, the authors developed a methodology to create a standardized, quality tested, and updatable LCI. To model the most relevant power plants' emissions, reviewed and half-yearly updated data from the German National System of Emissions Inventories originally developed for the UN FCCC reporting process are used. As regards the more difficult data situation for the upstream fuel

DIRECT EMISSIONS

- using original data from the German National System of Emission Inventories originally developed for the UN FCCC reporting process (9 air emissions, reviewed, half-yearly updated)
- combining the emission data with primary energy demand data of power plants delivered by the German Working Group on Energy Balances (AGEB) to calculate the efficiencies (yearly updated)
- using additional data from the power industry to calculate the power plant's parasitics

Fossil fired power plants

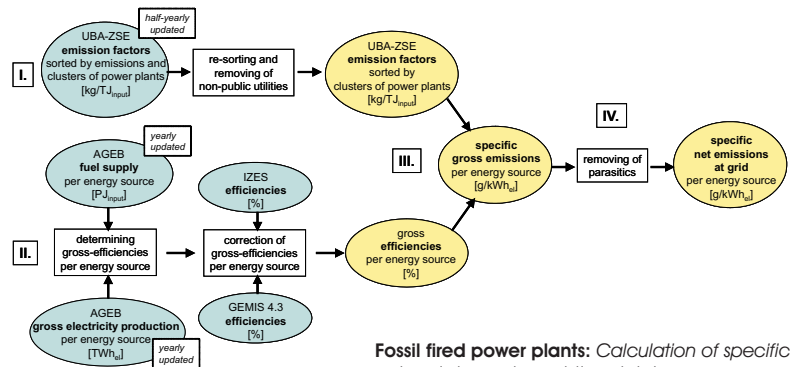
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Nuclear power plants

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Renewables

- data of high quality available in Germany
- currently not included in the LCI data because of methodological inconsistencies
- using National Renewables Energy Statistics (yearly updated)
- regarding emission data for biomass based electricity production (no emissions for wind, photovoltaics, and water)



Fossil fired power plants: Calculation of specific net emissions using existing databases

Basic LCI dataset "Electricity mix Germany"

- net, at low voltage grid
- based on quality tested and yearly updatable data
- currently without up-stream processes and

Material	Input		Output	
	kJ/kWh _{el}	kg/kWh _{el}	Emissions (air)	kg/kWh _{el}
lignite	2,831	3.11383E-01	ammonia (NH ₃)	5.72596E-06
coal	2,374	7.91864E-02	carbon dioxide (CO ₂)	6.16463E-01
natural gas	1,012	3.18944E-02	carbon monoxide (CO)	2.26614E-04
mineral oil	167	3.91043E-03	nitrous oxides (N ₂ O)	2.16451E-05
uranium	3,320	8.33792E-07	methane (CH ₄)	1.04718E-05
			NM VOC	1.89233E-05
			sulfure dioxide (SO ₂)	3.16384E-04
			particles	1.87111E-05
			nitrogen oxide (NO _x)	6.39896E-04

INVOLVED STAKEHOLDERS

The study was commissioned by the German Network on Life Cycle Inventory Data. It was done by a consortium of the leading stakeholders in energy related LCA in Germany managed by DLR's systems analysis group and supported by the Federal Statistical Office and GreenDelta (review) - a necessary condition to reach an overall standard in data



UPSTREAM PROCESSES

- the data quality of upstream processes (coal, lignite, natural gas, mineral oil, and uranium) was checked
- substantial improvement of data quality and data availability is necessary to create standardized and updatable datasets (especially for energy demand and air pollutants of coal, lignite, and natural gas processes)

MANUFACTURE OF POWER PLANTS

- will be included as soon as standard processes are harmonized within the other network's working groups (metals, building materials, traffic, ...)