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Decommissioning is a significant part of nuclear power's GHG impact

The greenhouse gas (GHG) emissions produced during the decommissioning phase of nuclear power plants may have been underestimated in previous assessments, new research suggests. The study estimated that the decommissioning process for a German plant resulted in 1 651 265 tonnes of CO_2 (or equivalent) emissions, or 0.825 tonnes of CO_2 equivalent per tonne of waste. While the researchers acknowledge that impact is highly dependent on the unique characteristics of each decommissioning project, these results raise questions as to whether this phase has been accurately assessed in earlier research.

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Nuclear power is controversial. On the one hand, it can provide a low-carbon source of energy. On the other, it produces large amounts of highly toxic waste and fears over its safety have increased since the Fukushima accident in 2011. Such concerns have led the German government to phase out nuclear power entirely by 2022, and a growing number of plants are being decommissioned worldwide.

The decommissioning process is long and complex, but there has been little research into its environmental impacts. For this study, researchers performed a life cycle assessment (LCA) of the decommissioning of a German nuclear power plant which began operating in 1973 and was shut down in 1990.

The decommissioning, which commenced in 1995 and has not yet ended, involves immediate dismantling of some components and containment of others, to allow them to decay naturally. This LCA included all aspects of decommissioning: component dismantling and building demolition; radioactivity measurements; decontamination of radioactive components; interim and final storage of low- and intermediate-level nuclear waste; recycling of conventional waste (which reduces impact); site management (including running administrative buildings and hazardous substances warehouses, among others); and, finally, transportation.

The environmental impacts were calculated according to the CML 2001 Impact Assessment Method, and this study focused on impacts in terms of GHG emissions. The researchers did not include disposal of spent fuel rods, as they considered this to be part of the operational phase of the plant's life.

The entire decommissioning process would amount to 1 651 265 t CO_2 eq (tonnes of CO_2 equivalent: other GHGs were measured in terms of the amount of CO_2 that would have the equivalent global warming impact). This is larger than estimates from other LCA studies.

However, the researchers point out that they assessed the impacts of decommissioning a single, real-life plant and this formed the 'functional unit' for the analysis. Other studies have used electricity output as the functional unit (e.g. emissions per kilowatt hour produced during the life of the plant), which entails making assumptions about the plant's lifespan. Many studies assume a 40-year lifespan, but this may vary widely; in this case the average lifespan of all reactor pressure vessels was only 14 years.

There is only one other study which has assessed decommissioning in this way, based on a power plant in the UK. For this site, decommissioning produced 241 000 t CO_2 eq. Although this is much lower, the site was smaller, with less waste. The impacts per tonne of waste were actually calculated to be lower for the German plant (0.825 t CO_2 eq) than the UK plant (1.18 t CO_2 eq). This may have been partly because recycling was not considered in a reference scenario in the UK study.

Although more studies are needed, the authors conclude that these results highlight the contribution of decommissioning to nuclear power's GHG impacts and raise the possibility that it has not been accurately assessed in previous research.