

Burning wood in district heating plants has resulted in climate saving

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A conversion to wood biomass (wood chips and pellets) by Danish district heating plants has benefited the climate and is the more climate-friendly option compared to coal and natural gas. These are the findings of a new report from the University of Copenhagen's Department of Geosciences and Natural Resource Management.

The study is the first retrospective investigation by researchers of what a conversion to [wood biomass](#) has meant for greenhouse gas emissions at 10 Danish cogeneration plants—and thereby the climate impact of replacing either coal or natural gas in favor of [wood](#) biomass.

Among other things, researchers calculated the so-called carbon payback period for each plant, i.e. how long it takes for the conversion to wood biomass to elicit a positive climate effect.

"Our results demonstrate that the transition from coal to wood biomass has had a positive effect on CO₂ emissions after an average of six years. When it comes to the transition from natural gas, it has in most cases taken between 9 and 22 years, and in one case 37 years before CO₂ emissions were reduced," says Associate Professor Niclas Scott Bentsen of the Department of Geosciences and Natural Resource Management, who is one of the authors of the report.

Reduction in CO₂ emissions

The researchers also looked at the total CO₂ emissions from the three [energy sources](#) over a 30-year period, which is the life expectancy of a cogeneration plant.

Transitioning from coal to biomass resulted in a 15 to 71 percent reduction in CO₂ emissions, while the move away from natural gas resulted in emissions reductions between -4 and 19 percent.

The fact that, in one case, emissions were -4 percent after 30 years as a result of the conversion, is partly due to the fact that, in relation to [energy content](#), burning [natural gas](#) emits less CO₂ than burning wood, and that this particular plant had notable changes in its product portfolio.

"When such large fluctuations in the figures occur, it is because the

payback period and the amount of CO₂ emissions saved are significantly affected by the type of fuel, where it comes from and other alternative uses of the wood," says Associate Professor Niclas Scott Bentsen

Forestry residues are best for the climate

The 10 Danish cogeneration plants collected 32 percent of their wood biomass from Danish forests, while 41 percent was sourced from the Baltic states, seven percent from Russia and Belarus, and seven percent from the United States. The type of wood biomass used and the distance it needed to be transported factored into the carbon budget as well, according to Professor Bentsen.

"For the typical plant that was once coal-fired, but now using wood from around Denmark and only uses forestry residue that cannot be used for other products, the payback period was roughly one year. The 30-year saving was as much as 60%," explains Niclas Scott Bentsen.

Wood has an enormous potential to displace carbon heavy construction materials such as steel and concrete and is therefore an important aspect of the green transition.

"Our study demonstrates that the extent to which wood is used for construction or other forms of production, where the long lifespan of wood can bind CO₂, is even better for the climate than using it as fuel," says Niclas Scott Bentsen.

Additional facts

- The method used in the study includes an analysis of time series from individual [plants](#) that includes the pre- and post-conversion period from fossil energy sources to wood biomass. Among other

things, the analysis included specific knowledge of the type of fuel used, where the fuel came from and what alternative uses the wood might have had.

- Energy production is responsible for a large part of Danish greenhouse gas emissions. In 2018, more than 20 percent of [greenhouse gas emissions](#) were released as a result of heat and [electricity production](#) (9.4 out of 48 million tons of CO₂)
- Of Denmark's total energy consumption, 16 percent of energy is generated from the burning of wood biomass. By comparison, 7 percent of energy consumption comes from wind turbines.
- To reduce the carbon recovery period and atmospheric CO₂ emissions, utilities should focus on using residual biomass (tree branches and crowns from logging or residuals from the wood industry that have no other use), biomass from productive forests, as well as reducing long transport distances.

More information: [static-curis.ku.dk/portal/file ... tigation_Nov2020.pdf](#)

Provided by University of Copenhagen

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