

ZEP Policy Brief: CO₂ Capture Rates in the Context of EU Energy Systems Modelling

October 2019

Summary & Recommendations

- CO₂ capture rates of 95% or higher are possible on CCS-equipped power stations with limited increase to the Levelised Cost of Electricity (LCOE).
- Increasing CO₂ capture rate from 90% to 99% on coal and gas power stations could increase LCOE by as little as 7.4% and 6.2% respectively.
- CO₂ capture technologies are highly-upgradeable, meaning capture rate can be easily ramped-up over time in line with market conditions and an increasing CO₂ price.
- A 95% capture rate on gas power stations could increase LCOE by 1.6% compared with a 90% capture rate.
- An arbitrary 90% capture limit does not reflect the current status of CCS technology and is not an appropriate limit to use in energy systems models looking to achieve net zero emissions.
- EC models should include the option for rising capture rates and associated cost increases to show how capture rates in different climate and energy scenarios may increase over time as policy and economics evolve.
- Further studies should investigate high capture rates for other activities, including hydrogen production and energy-intensive industry processes. These are expected to result in similar cost reductions.

In the past, when CCS was discussed as the main option to decarbonise coal-fired power plants, a CO₂ capture rate of 90% was adopted as standard, regardless of the technology type, the location or fuel type. However, this standard value, adopted so ubiquitously, is actually an artificial limit.

The IEAGHG¹ has investigated the possibility and costs of achieving carbon capture rates higher than 90% for deployment of CCS in the power sector. The conclusion is that there were no technological barriers for increasing capture rates to 99% for all three main capture technologies, with minor financial and process efficiency penalties for post-combustion capture. Techno-economic studies were not performed for the pre-combustion and oxyfuel cases.

Table 1: Comparison of different post combustion capture rates for coal and natural gas fired power plants in percentage change compared to a 90% post combustion capture plant.

	Coal: Standard design		Coal: Optimised design	Natural Gas	
	95.0%	99.0%	99.7%	95.0%	99.0%
Capture Rate	95.0%	99.0%	99.7%	95.0%	99.0%
Net Power Output (MW)	-1.7%	-5.2%	-4.3%	-1.1%	-5.1%
LCOE (€/MWh)	+3.0%	+7.4%	+6.9%	+1.6%	+6.2%
CO ₂ avoided cost (€/t CO ₂)	+0.4%	+5.7%	+3.3%	-0.8%	+7.3%

¹ IEAGHG, 2019. "Towards zero emissions CCS from power stations using higher capture rates or biomass", 2019/02.