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Flexibility of CCS Power Plants and Transport Systems

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Growing shares of renewable energy in the German power grid urge fossil fuelled power plants to reduce load or to shut down completely with increasing frequency and amplitude. Shut down, load changes and the following restart or ramp-up often have to be carried out as fast as possible.
To realize such fast transitions is already complicated and expensive for conventional power plants – if further measures for CO_2 reduction are applied, the task is even harder. Capture equipment and transport systems will add further process steps as well as additional masses of fluids and construction material. This will result in a change of time constants and a generally slower system reaction on changes in parameters like load, temperature and pressure in the power plant components and capture units. On the other hand there is only limited time to earn money by selling electricity - if there is a chance to sell more electricity in a short term, efficiencies should be as high as possible. Any capture unit that would reduce the efficiency causes economic conflicts. Therefore measures are analysed to offset the power generation from the capture process in time or to reduce the capture load temporarily.
The poster will present a case study for different CCS power plant configurations and load scenarios representing typical grid load from renewable energies. Approaches to balance the load and/or the CO_2 output of these power plants will be presented. These approaches comprise: bypassing of flue gas, intermediate storage of heat and/or fluids. Amounts of additional steam, electrical energy and other process fluids (e.g. scrubbing fluids like MEA) and size of auxiliary equipment will be shown .Finally, effects on the transport system (e.g. cooling down of CO_2 in the pipeline and changes in mass and volume flow) will be presented and discussed.