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P3.226 How fusion power can contribute to a fully decarbonized European power mix after 2050.

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In the second half of this century, the European energy mix will be very likely completely decarbonized. Two main options are available to generate carbon free electricity: either to rely on renewable energy sources or to further differentiate the energy mix by including nuclear power.

In the former case a large storage capacity and/or back-up dispatchable generation are required to compensate for the intermittent electricity production from variable renewable sources. The size of the necessary storage system and back-up power plants can be reduced if a base-load carbon free power technology is available. Indeed, the affordability of a power mix mainly based on solar power (South Europe) is likely to increase if coupled with a large base-load generation with power swing that systematically reduces the day time power output. Conversely, in case of a power mix mainly based on wind power (North Europe), power swing is not necessary.

These options are studied with the COMESE code that assesses the hourly balance between load and generation through a simplified dispatch model and the system costs through a stochastic economic analysis.

We assume a complete phase out of fission power plants by 2080 in Europe, so that nuclear electricity is provided by fusion power plants only, operating in continuous or power- swing regimes. The probability distribution of the cost of electricity resulting from the stochastic economic analysis of each scenario gives key indications to make fusion a cost- effective ingredient of a future European decarbonized power mix.

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