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Analyses of unavailabilities of power plants due to climate change - two methods of risk and adaptation assessments

M. Nogaj (1), B. Hoffmann (2), K. Fessart (1), M. Anderhalt (1), and S. Parey (1)
(1) EDF, Chatou, France (marta.nogaj@edf.fr), (2) EIFER, Karlsruhe, Germany

The majority of conventional power plants uses river water for cooling purposes. Increasing water and air temperatures due to climate change can significantly impact the power production of these power plants, due to legal thresholds for heat discharges or efficiency losses. These impacts are analysed through two different approaches: an "unavailability simulator", and a System Dynamics approach. The first one concerns a specific power unit in France (the Golfech generating plant) and associates a climate simulator with an impact simulator for the power plant regarding water resources (river flows and river water temperatures). Financial evaluations were performed to associate costs to different scenarios and to test several investment opportunities. In the second analysis, selected German thermal power plant units and their respective cooling systems are modelled taking into account legal thresholds for heat discharges to river waters together with regional climate data projections (SRES scenarios A1B, A2 and B1). Possible output and efficiency reductions in future periods are quantified for once-through and closed-circuit cooling systems for thermal power plants. Differences between cooling systems are analysed and scenario calculations are compared to the control period.

Those two approaches provide two different overviews of impacts and adaptation measures for climate-affected power generation: a macro-scale on Germany and a more detailed version on a french power unit. Consequently, the two approaches allow for the risk assessment of power output reduction during heat waves and provide a basis for risk management strategies such as necessary back-up capacity or investment into retrofit measures.