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Influence of extreme weather on electricity infrastructure and adaptation options – a GIS-based approach

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Energy infrastructure for generation and distribution of electricity can be included in the so-called critical infrastructures. As extreme weather events have an impact on the critical electricity infrastructure, the need for adaptation was soon identified in the context of a changing climate. Even though changing impacts are not yet registered, a change in frequency and intensity of extreme events might have more severe impacts on the reliability of electricity supply. Severe or extreme weather in this context includes meteorological as well as hydrological events, such as high or low ambient temperatures, heavy precipitation, hail and storms, as well as the combined events of thunderstorms, water temperatures and floods/low water events. Therefore, this presentation will first identify the most severe impacts of extreme weather events on thermal power plants, like oil-, gas- and coal-fired power plants in contrast to nuclear power plants, as well as on the renewable energies of run-of-river and wind power plants as well as photovoltaics. On the one hand, thermal power plants are mostly influenced by a shortfall in cooling water supply, on the other hand, floods can affect the power plant site in total and emergency measures need to be taken. Whereas renewable energies are mostly affected by the source for electricity production, e.g. runoff at run-of-river power plants and wind for wind power plants. Extreme precipitation, such as hail, can have a severe impact on all renewable electricity generation. The second part includes the identification and application of adaptation options, which have to be chosen according to the infrastructure affected and site-specific, since not every power plant has the same requirements towards retrofitting, adaptation and so-called "soft" measures. "Hard" measures include the construction of walls and dams, the spraying of agents on coal stockpiles and the application of heating wires along the rim of a wind blade. In contrast, "soft" measures consist of the application of rules, regulations and building codes as well as the prohibition of using flood plains for construction. The third part will give an overview on how these identifications and measures can be applied in a Geographical Information System (GIS), leading to precise maps of the areas and infrastructures affected. Therein, the cyclic procedure of planning, applying, checking and acting is described, so that a site-specific emergency planning in advance is possible. Moreover, maps with explanatory content can be used by power plant operators as well as power plant workers without further knowledge in mapping techniques by giving simple overviews of the site and unaffected areas nearby.