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Towards probabilistic risk-management in power system operations

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Abstract

The growing uncertainties brought about by renewable power generation, the ageing of the transmission system infrastructure and the extreme weather events associated with climate change are currently challenging the reliability and resilience of the pan-European electric power system. At the same time, technological innovations such as demand response, electricity storage and high performance computing create further opportunities to maintain the system functionality at a desirable level.

With this motivation, we developed a probabilistic risk-management framework to upgrade the (deterministic) N-1 based practice [GARPUR, 2016] Our framework relies on stochastic models of the exogenous uncertainties and combines technical and socio-economic indicators to express the complementary dimensions of risk in the operational context. Further, it serves to establish a consistent level of confidence on the system functionality against the spatio-temporally variable probabilities and consequences of exogenous threats while minimizing the socio-economic costs of doing so.

In this discussion, we shall focus on the application of this framework in the context of power system operation, wherein the challenge is to efficiently select preventive and/or corrective (post-contingency) control actions to mitigate the impact of possible contingency events [Karangelos, 2016]. We shall explain the rationale of the proposed framework as well as its capabilities beyond the N-1 practice. Further, we will discuss the additional data, modeling and computational requirements with respect to today's practice and identify the next steps for the its progressive practical implementation. To conclude, we will also briefly elaborate on the potential extension of the framework in the operational planning context.

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[1] 1: Impact of system resiliency on control center functions, 2: Dynamic system performance monitoring and control, 3: Next generation control centers/Generation and distribution control centers, 4: Data modeling/Big Data, 5: Vendors panel

GARPUR project (www.garpur-project.eu) is performed by collaborative efforts of 7 European TSOs, 12 R&D providers and 1 innovation management expert.

References

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