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RISK GOVERNANCE FOR POWER SYSTEMS: A SYSTEMATIC CLASSIFICATION OF EVALUATION PROCESSES FOR POLICY AND DESIGN DECISIONS UNDER UNCERTAINTY

Johannes Schöttler, Marius Tillmanns, Aaron Praktiknjo
RWTH Aachen University, Aachen, Germany

Extended Abstract

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Abstract Summary

Power system planning and the designing of corresponding risk policies are undergoing a paradigm shift due to the increasing importance of this critical infrastructure in electrified economies. Besides the extensively examined technically and economically optimal transition pathways towards sustainable energy systems, geopolitical interrelationships and conflicts are increasingly affecting regulatory objectives. The design of technical transformation processes is therefore significantly influenced by issues relating to raw material dependencies or resilient supply infrastructure.

Current power system evaluations as the foundation for planning processes mainly focus on generation and transportation adequacy assessments. Resilience analyses then are added by case studies reflecting threat scenarios like extreme weather or malicious attacks, primarily measured by Loss of Load Probability or Expected Energy not Served. Here, conceptual and methodological evaluation approaches have developed naturally from classical (probabilistic) reliability engineering. This led to several complex and powerful tools for security of supply analyses incorporating aleatory and epistemic uncertainties. Nevertheless, they are mostly unable to capture the whole range of additional system evaluation dimensions – for example operational security, robustness or stability – that are necessary for a comprehensive assessment of power systems.

This paper provides a systematic examination of the risk governance and policy processes for the design of power systems and their transformation. Through a system-theoretic abstraction of the central decision-under-uncertainty-problem, terminologies are harmonized and the qualitative risk formulation within the security of supply assessment contextualized. Hence, this approach offers a clearer classification of perspectives and evaluation dimensions that shape substantially decision and policy making. It shows that current power system assessments are inaccurate in the procedural localization of their approaches impeding direct implementation in regulatory measures. Therefore, our

approach yields a novel structured framework and a theoretical foundation supporting modelers and decision makers to qualitatively classify corresponding (non-)quantitative analyses in the assessment of power system design options.

Presenting Author Biography

ACADEMIC CAREER

Date	Position
Since 11/2023	**Research Associate & PhD Candidate** Rheinisch-Westfälische Technische Hochschule Aachen University E.ON Energy Research Center Institute for Future Energy Consumer Needs and Behavior Chair for Energy System Economics (Prof. Praktiknjo) Research focus: Energy System Analysis, Data Science, Security of Electricity Supply
10/2020 – 11/2023	**Master of Science Mathematics** University of Münster Specializations: Advanced Probability Theory, Financial Mathematics, Operator Algebras Thesis: Stochastic Models for Financial Time Series
10/2016 – 10/2020	**Bachelor of Science Mathematics** University of Münster Specializations: Probability Theory, Functional Analysis Minor: Business Administration Thesis: The Fast Times of the Brownian Motion