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Electricity infrastructure resilience and mitigation measures to reduce natural and climate change risk

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Electricity infrastructure is critical to economic growth and social development. Interruptions in the energy power supply can have severe consequences, such as breakdowns of communication, transportation, utility systems and industrial production processes that threaten the stability and economy of entire regions. Electricity infrastructure faces a wide range of natural hazards that affect their operation that have either geophysical origin, like earthquakes, or are triggered by hydro-meteorological conditions. Regarding the second category, recent data suggest that climate change leads to sea level rise and to an increased number of extreme weather events that increase the likelihood of severe impacts on electricity infrastructure. Thus, it is urgent to assess the resilience of existing electricity infrastructure to provide valuable information for decision making on mitigation measures and climate proofing design to avoid severe energy blackouts. In this context, the present work focuses on an integrated methodology for resilience assessment in a multi-hazard environment. The methodology is applied to energy infrastructure case studies in Mediterranean regions that have been identified as vulnerable to climate change. First, potential hazards considering climate change are recorded and hazard scenarios are selected. The next step is to identify vulnerability indicators and quantify vulnerability in systemic level considering infrastructure specific data. To evaluate resilience, loss estimation in terms of energy supply losses and rehabilitation costs is conducted. After the resilience assessment, mitigation measures are proposed and the assessment methodology is applied for each measure scenario. The analysis results are compared and their impact on resilience is discussed. The studied methodology can be a useful tool in the hands of stakeholders to avoid energy supply interruptions from natural hazards. The conclusions derived highlight the importance of estimating the resilience of energy infrastructure to natural hazards, climate change's role and how mitigation strategies can be applied to reduce disaster risk.