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Risk management in critical energy infrastructure

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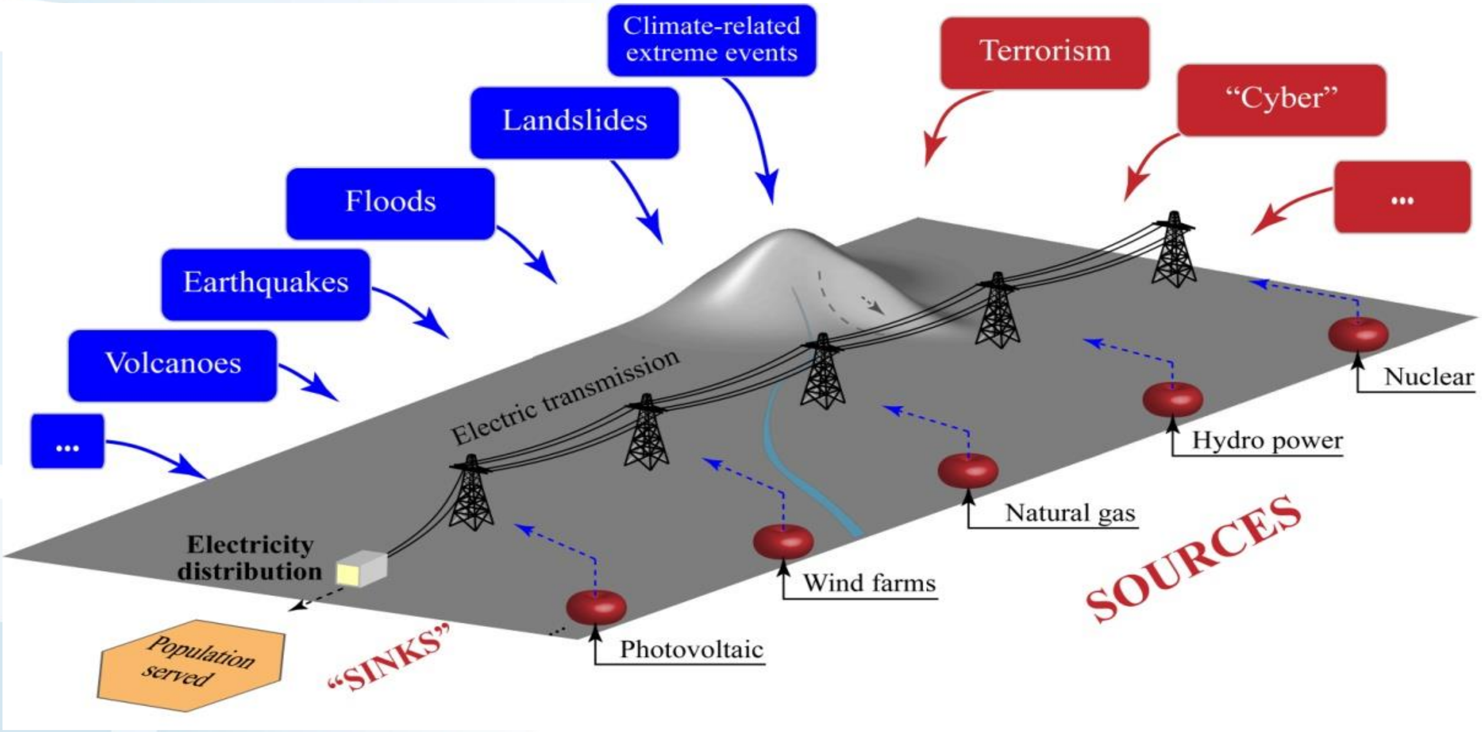
Need for a multi-risk approach



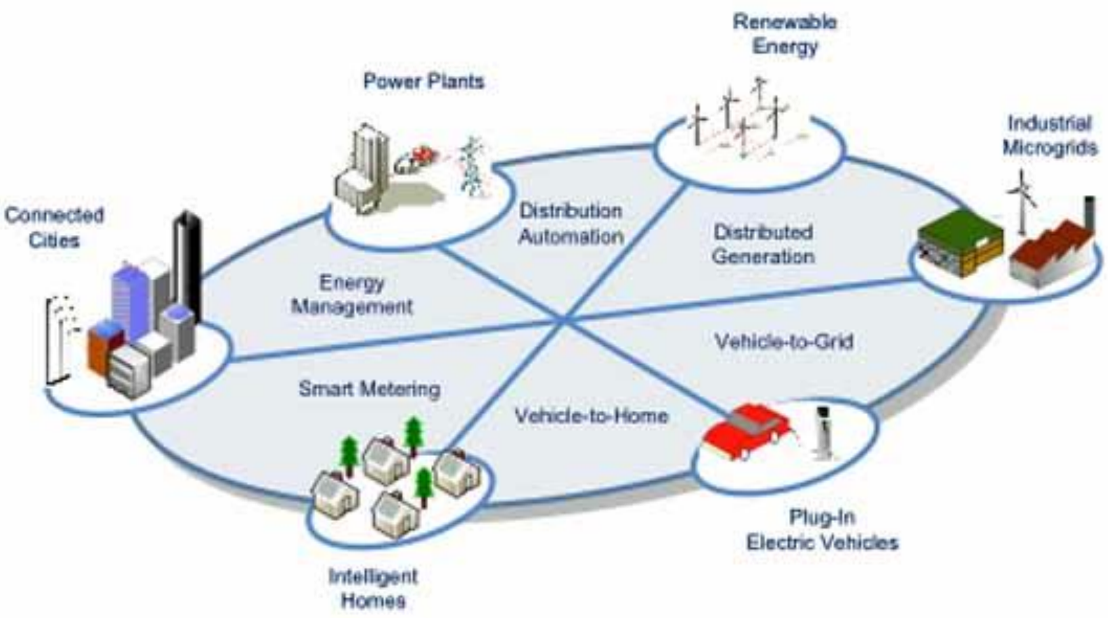
Source: Garcia, AMRA

Grids are already subject to impacts of natural hazards such as extreme weather events, earthquakes, cyclones, storms and heat waves

Impacts affect physical integrity of electricity transmission grids and decrease transmission capacity

New requirements on grid architecture and increased vulnerability

- Designed 50 years ago to satisfy needs with generating plants located near load areas
- Diversification of electricity supply located in different areas



Smart Grid building blocks

Grids at the border of their capacity to integrate growing volumes of renewable energy electricity

Several new km need to be constructed to secure market integration, security of supply and accommodate renewable energy expansion

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European electricity transmission system is grouped in 5 synchronous areas and is managed by 41 TSO from 34 countries

Source: ENTSO-E Memo 2012, values in GWh

Key figures (2012):

- 5 synchronous areas
- Network of 41 TSOs from 34 countries
- Serving 534 million citizens – 3'300 TWh consumption, 13% cross-border
- 305'000 km of transmission lines

Main goals:

- Security of supply, reliable operation
- Efficient and competitive market
- Optimal management and sound technical evolution of the system

Major Challenges for the European Transmission Network

Managed by network of 41 TSOs from 34 countries

Require massive transfer over long distances and peak smoothing strategies

Increased participation of active demand side

Multi-Risk Governance is needed

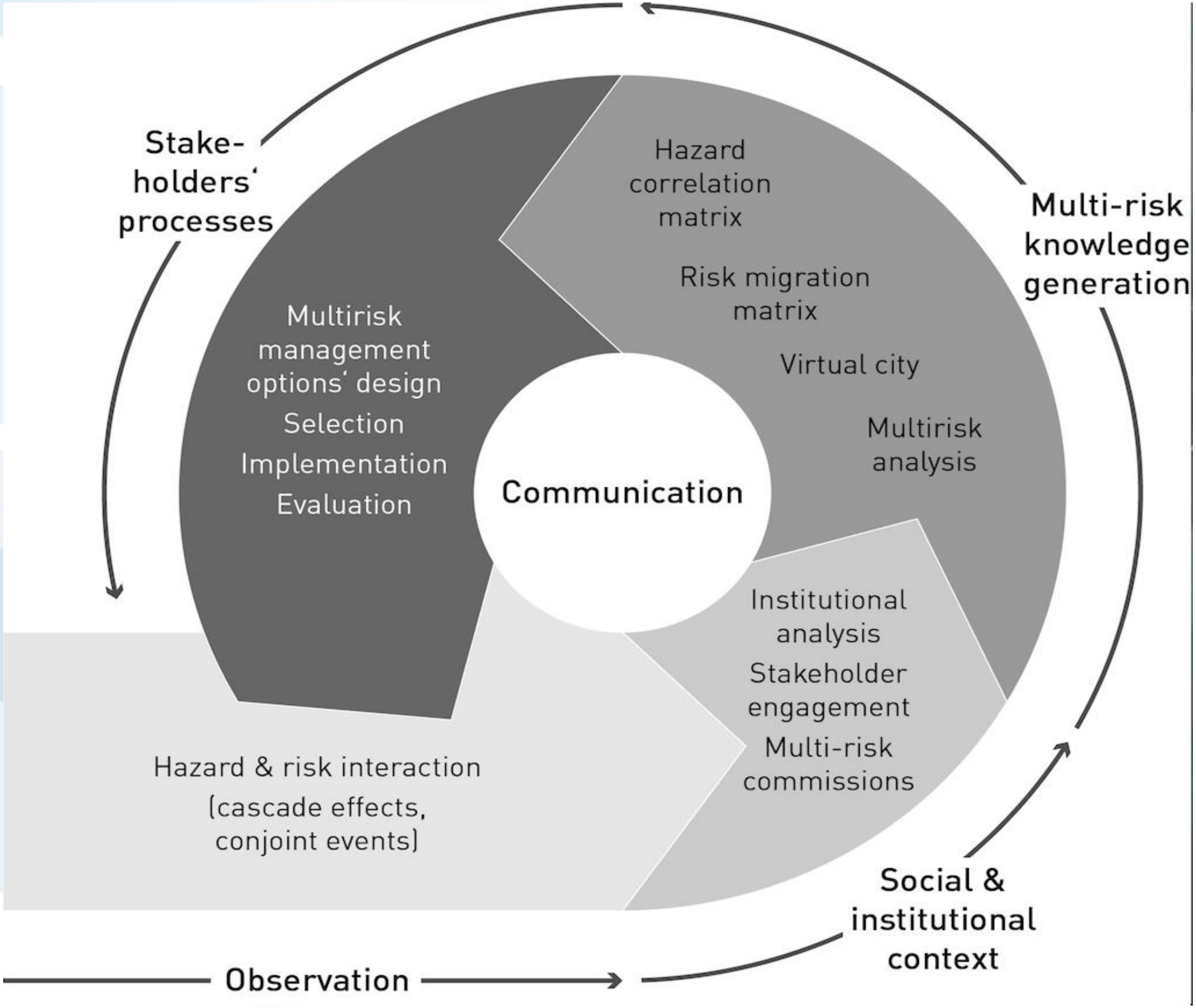
To address cascade tripping of multiple risks, voltage or frequency collapse, loss of synchronism

Implementation of N-1 principle (elements in operation must be capable to accommodate the change of electricity flow)

Governance concern: TSO is only responsible for operation of own networks but networks are interconnected within European electricity market

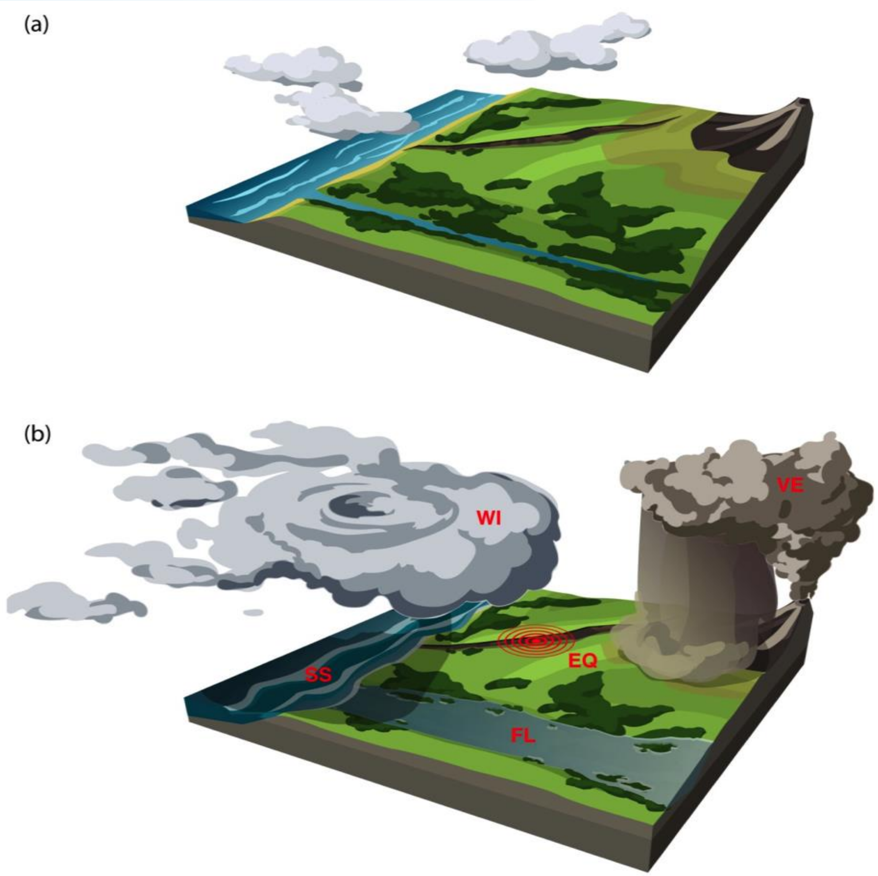
Recommendation: regional coordination is necessary to assess risks, to ensure efficiency of operational decisions and remedial actions

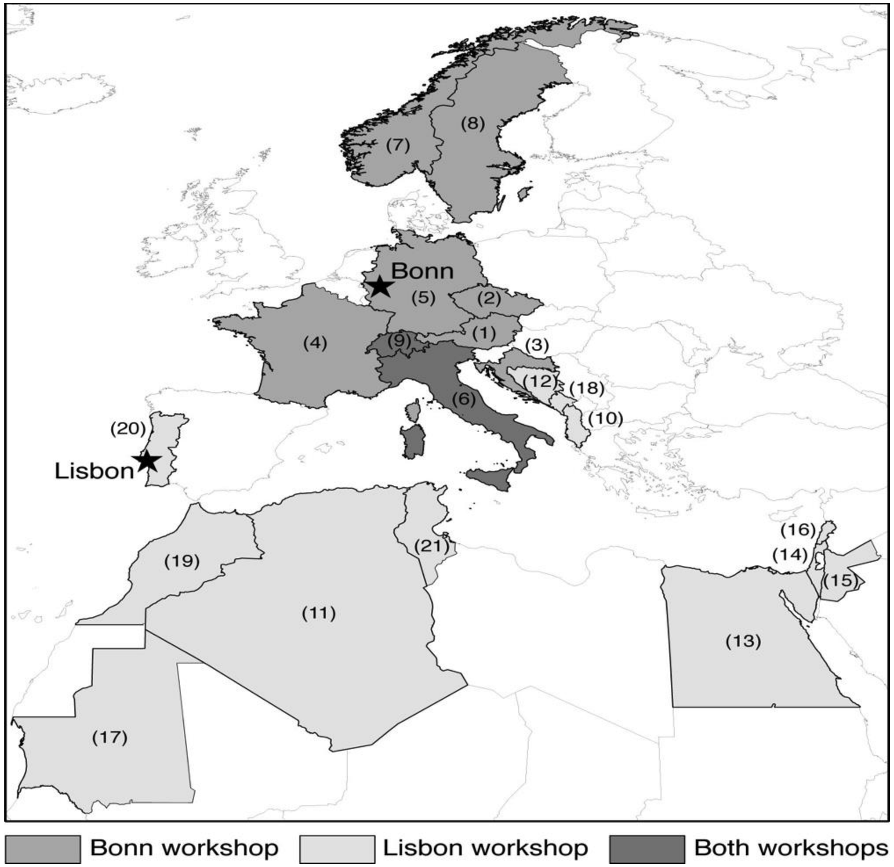
Multi-risk governance framework



Source: Scolobig, A., Komendantova, N., Mignan, A. *Geoscience*

Participatory modeling: stakeholders process with national civil protection authorities



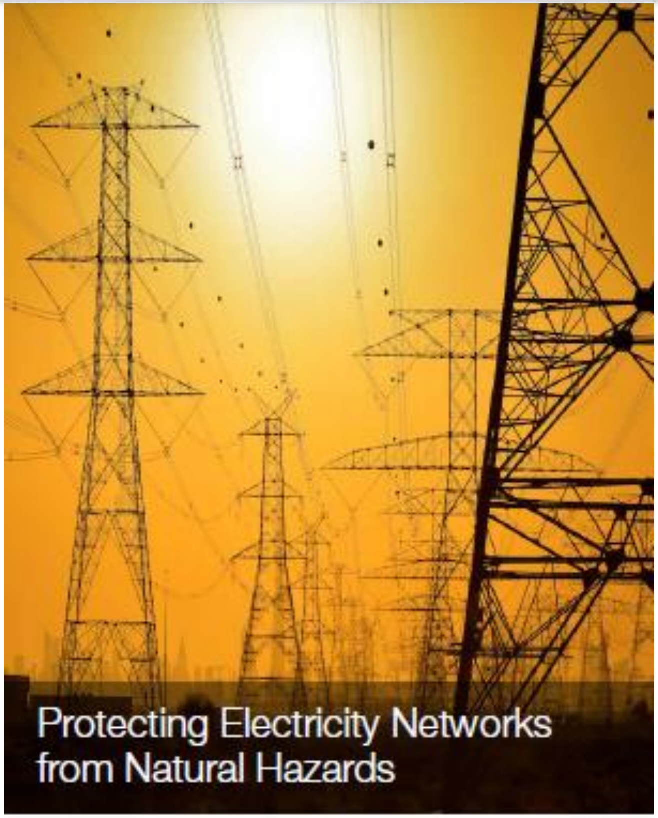


Source: Komendantova, Scolobig, Mignan, Mrziglocky et al., (2016) International Journal of Disaster Resilience in the Built Environment

The Handbook compiles effective risk management concepts, tools and case studies to guide practitioners in the field

Increasing number of blackouts caused by natural hazards / extreme weather conditions

A practitioner's guide for energy professionals to increase the resilience of electricity networks



OSCE Organization for Security and Co-operation in Europe