Terna's strategy to increase resilience of Italian Transimission Network

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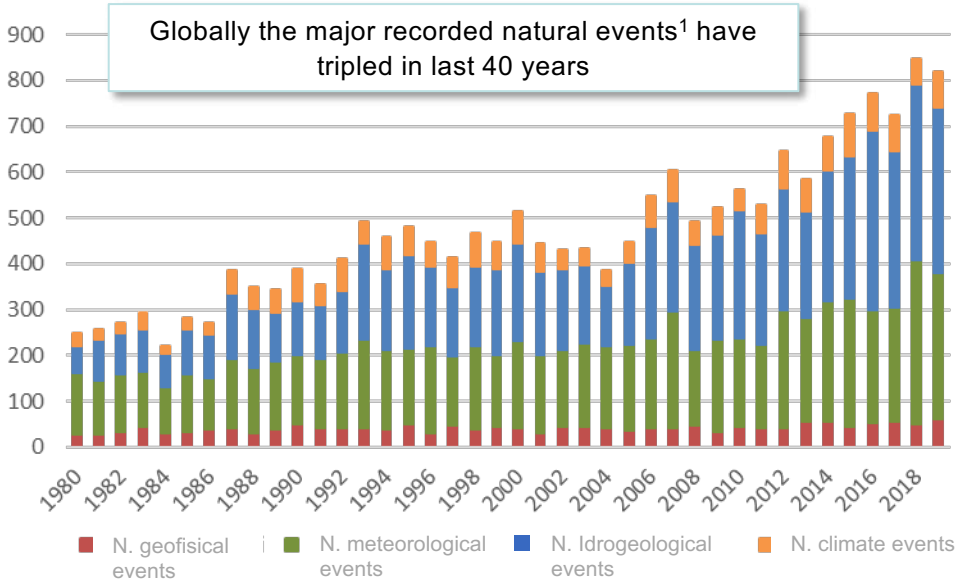
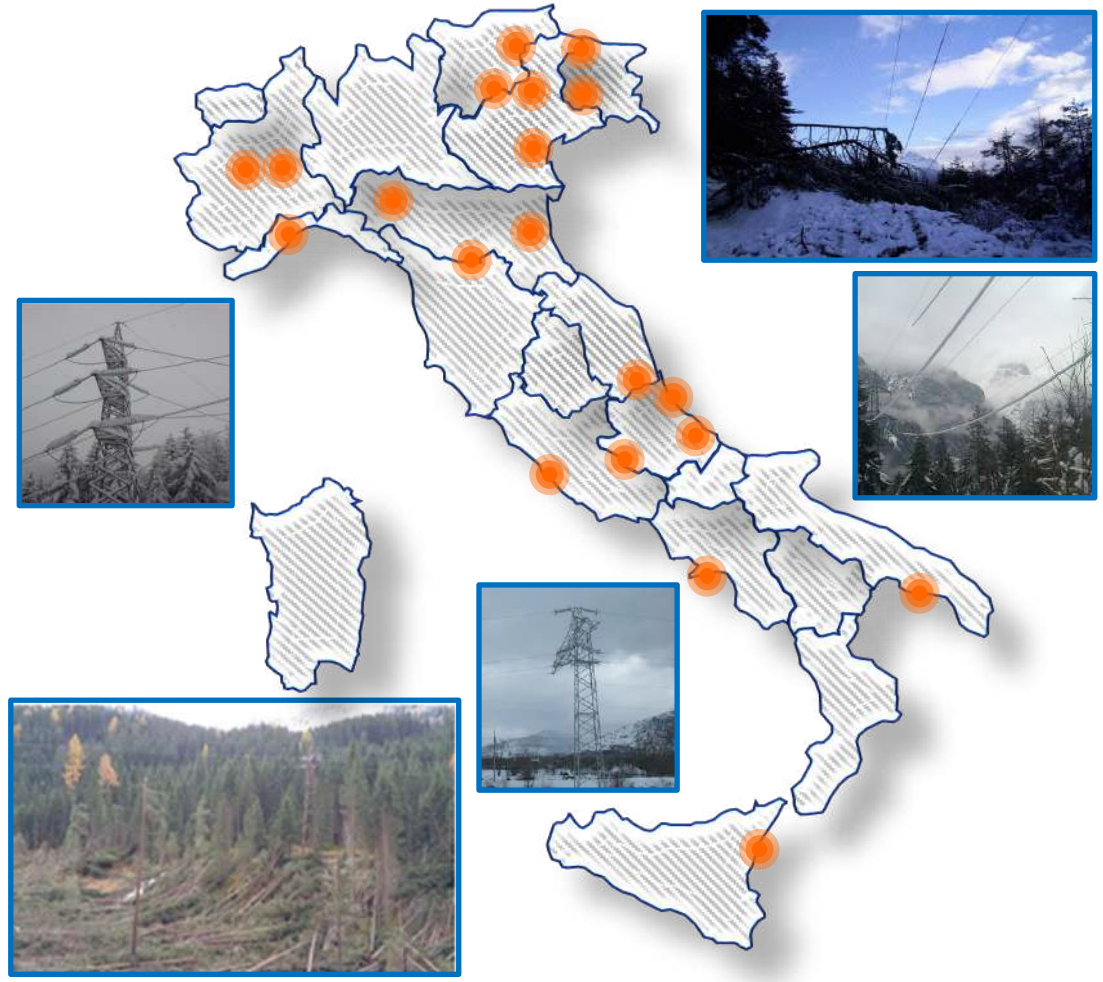
Evolution of climate risk



The **traditional frequentist methods** of **risk assessment** related to severe weather events, mainly based on **historical statistical information of outages**, might result in **losing adequacy and accuracy** because of the increase in severity and frequency of weather events due to **climate changes**



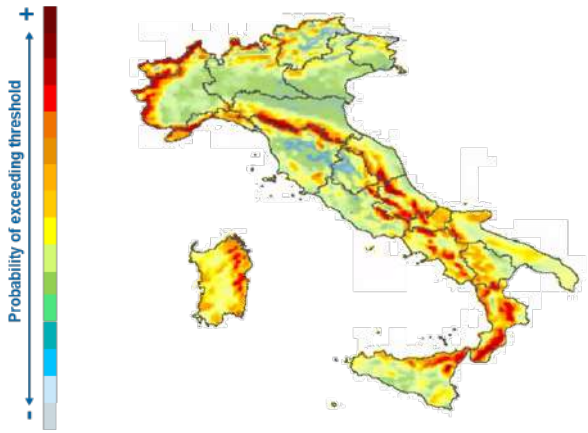
In the latest years in Italy it has been observed a significant increase in terms of frequency of occurrence of catastrophic meteorological events

1. https://natcatservice.munichre.com

The Resilience Methodology

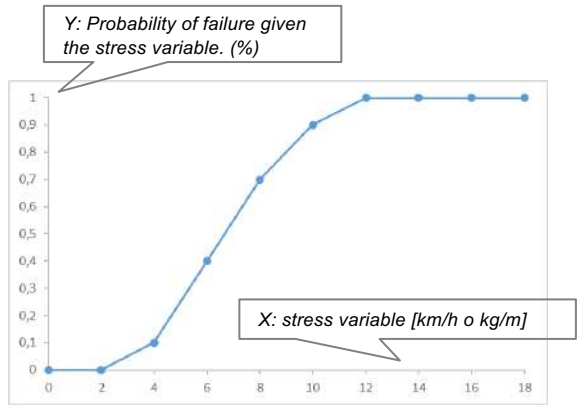
Terna with RSE* defined a new methodology to assess the resilience of the Italian Transmission Grid **based on 3 key-pillars**

Prospective climate hazard



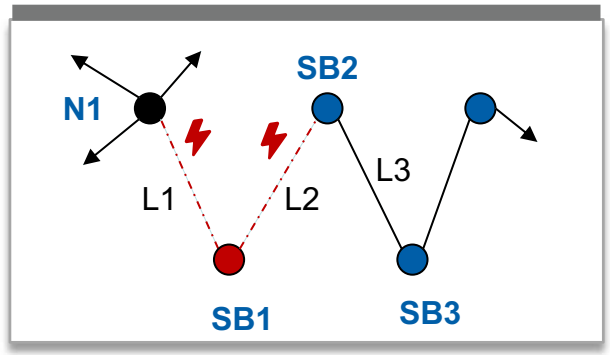
Prospective climatological models used to determine the **probability of occurrence** of severe **weather events**

Assets vulnerability



Vulnerability assessment *(failure probability),* obtained adopting an **engineering approach** based on **technical standards**

Contingencies analysis



A **contingency analysis approach** quantifying **substations' outage Return Periods (RP)** and **EENS,** simulating **weather-induced multiple contingencies** (N-k)

Terna received **positive opinion, issued** by **Italian Regulatory Authority** with deliberation 9/2022/R/eel, and it has applied to **identify** the critical **areas** due to **wet snow** and **strong wind**

** Ricerca sul Sistema Energetico – RSE S.p.A*

Terna Resilience Plan

CONTENT

The Resilience Plan represents a transversal plan that **includes all the initiatives that Terna will launch in the next five years**. **Thanks to the application of the Resilience Methodology** and the evidence obtained, **Terna has identified different types of interventions**

MEASURES TYPE

> *Preventive*

> *Restoring*

> *Mitigating*

> *Monitoring*

The 3rd edition of Resilience Plan will be updated in May 2023

Preventive measures

Intervention for resilience

The infrastructural solution as preventive measure

Different solutions are foreseen:

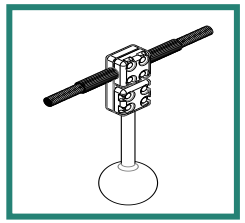
- **overhead lines rebuilding:** improve the mechanical characteristics to better resist against extreme conditions;
- **overhead lines conversion into underground cables:** immunization of the grid
- **new lines building:** Increase the grid redundancy trought meshing of the transmission grid

Rappresented only the principal intervention identified for snow sleves and wind gusts.

Mitigation, restoring and monitoring - the main measures

MITIGATION

Anti-tortional devices avoid the rotation that increasing the conductor torsional stiffness



New "Icephobic" paint use of new conductors with hydrophobic paint reduce the risk of wet-ice sleeve formation

Interphase spacer devices: avoid the contact between phases

RESTORING

New emergency plan
fast recovery devices, such as mobile generators, the operation (power supply) in loading islands

Advanced operational equipment

- reinforcing the vehicle fleet
- reinforcing satellite phone

- Expanded use of helicopters for inspections, workers transportation

MONITORING

Remote monitoring
New technologies such as satellite or Wireless Sensor Network.

Monitoring tools

Forecast and alert systems able to foresee severe conditions in grid operations and to suggest possible real-time solutions

Terna commitment for grid resilience

Increase the resilience of Italian Transmission network, **analyzing additonal network area having the scope to increase basket of intervention** identified with Resilience Methodology.

Extend the Methodology in order to **include/model further extreme metheorological phenomena**

Focus on research in order to **identify innovative technical solutions** able to increase the reselience of transmission network

Continue collaboration with research center and universities finalized to the extension and evolution of probalistic model about complex natural phenonena


Terna
Driving Energy