

Working Group Analysis of Costs and Benefits

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Climate resilience and adaptation framework in the CBA methodology

Motivations for a climate adaptation and resilience indicator

- ✓ Climate hazards are no longer extraordinary events and are getting more harmful for energy infrastructures, among others.
- ✓ In the context of electricity transmission system planning, it becomes essential to be forward-looking regarding infrastructures' exposure to climate hazards
- ✓ Climate adaptation results usually in higher investment cost (CAPEX) to make the asset resilient
- ✓ This could result in lower project net benefit as the benefit of being climate resilient is not being explicitly reflected in our current CBA methodologies
- ✓ There is a need to evaluate the climate adaptation benefit (project with adaption measures vs without measures) that can justify the higher investment cost



From: <https://geodesignbarriers.com/us/news/innovative-geodesign-barriers-shield-substation-from-flood-keeping-lights-on-for-thousands/>

Moreover Regulation (EU) 2022/869:

1. Tasks project promoters of PCI projects to report on an annual basis on their climate adaptation measures taken
2. Asks that ENTSO-E's CBA Methodology ensure that the climate adaptation measures taken for each project are assessed and reflect the cost of greenhouse gas emissions and that the assessment is robust and consistent with other Unions Policies in order to enable comparison with other solutions which do not require new infrastructures.

Climate adaptation measure definition

Definition agreed in the workshop of October 2023

“According to Regulation (EU) 2022/869, ‘climate adaptation means a process that ensures that resilience to the potential adverse impact of climate change of energy infrastructures is achieved through a climate vulnerability and risk assessment, including through adaptations measures.’

In the context of the energy transition, and specifically infrastructure planning, climate adaptation measures is any action (progressive or ultimate) taken in order to make infrastructure assets and the whole energy system less vulnerable to the intensity and prevalence of the direct and indirect climate change impacts, including both extreme weather events (high-impact low-probability events) and alteration of weather patterns. Common primary climate change impacts are changes in temperature, precipitation, sea level, wind speed, humidity and solar radiation. In terms of the CBA framework, climate adaptation measures are to be assessed as quantitative information.

Integrating climate adaptation measures in energy system planning aims at reducing the system vulnerability and enhancing its resilience to climate change, by better anticipating, mitigating, absorbing, accommodating and recovering from the effects of potentially hazardous events related to climate change. Therefore, resilience measures are all measures that help improving the security of supply, affordability and sustainability in the system. In terms of the CBA framework, climate resilience measures have to be given as quantitative indication .”

Current climate adaptation consideration in the Ten-Year Network Development Plan (TYNDP)

Excerpt from TYNDP 2024 implementation guidelines and 4th ENTSO-E CBA guideline:

- In the TNYDP project promoters will be asked to provide information about adaptations to an investment in order to cope with possible extreme weather conditions caused by climate changes as a percentage of CAPEX.
- Climate adaptation measures cost is not part of the NPV calculation.

Information about the part of the CAPEX used for investment climate adaptation measure:

Hazards	Explanation of adaptation	Climate adaptation cost (% of CAPEX)	Benefit
Ocean PH	foundation is protected against corrosion and structural failure		Corrosion resistance
Wild fire	forest management to reduce impact on OHL, stronger tower foundations, higher towers, protection of equipment against exposure to fire		prevention against inclination or collapse of equipment
Storms, including storm surge	extra-sturdy power lines that can withstand strong winds, designing the line to fail at controlled points		reduce the number of towers from toppling over
Flooding/Sea level rise	underwater drainage, extra-sturdy power lines that can withstand flooding, entire SS may need to be strategically elevated, flood barriers, pumping stations, flood storage reservoirs, flood monitoring devices		to avoid damage of HV equipment, operator can notify when flooding first occurs
Soil/costal erosion	retaining wall, maintaining the natural vegetation and taking up plantation near tower foundations, type of foundation structure that is used in ground improvement and stabilisation		prevent tower collapse
Ground instability/landslides/avalanches	modifying slopes geometry, using chemical agents to reinforce slope material, inspection system for remotely identify high-risk towers		prevent equipment damage
Ice jam	usage of materials and structures with low ice adhesion deicing properties		prevent equipment damage

Requirements for a new climate adaptation indicator in the context of a climate resilience and adaptation framework

- Should be a monetized indicator
- Should reflect any kind of assessed transmission asset type (overhead lines, substations, cables, converters, etc.)
- Although hazards are regional phenomena the methodology should measure impacts on regional and/or system-wide level
- Fit for purpose: any kind of monetized benefit (SEW, SoS, etc.) can be considered if an asset faces an outage due to a climate hazard

A simple NPV approach based on TYNDP market simulation results has been developed and will be presented later in the workshop.