

Recap: developing a framework to guide the new indicator

Benedict Englisch (ENTSO-E)

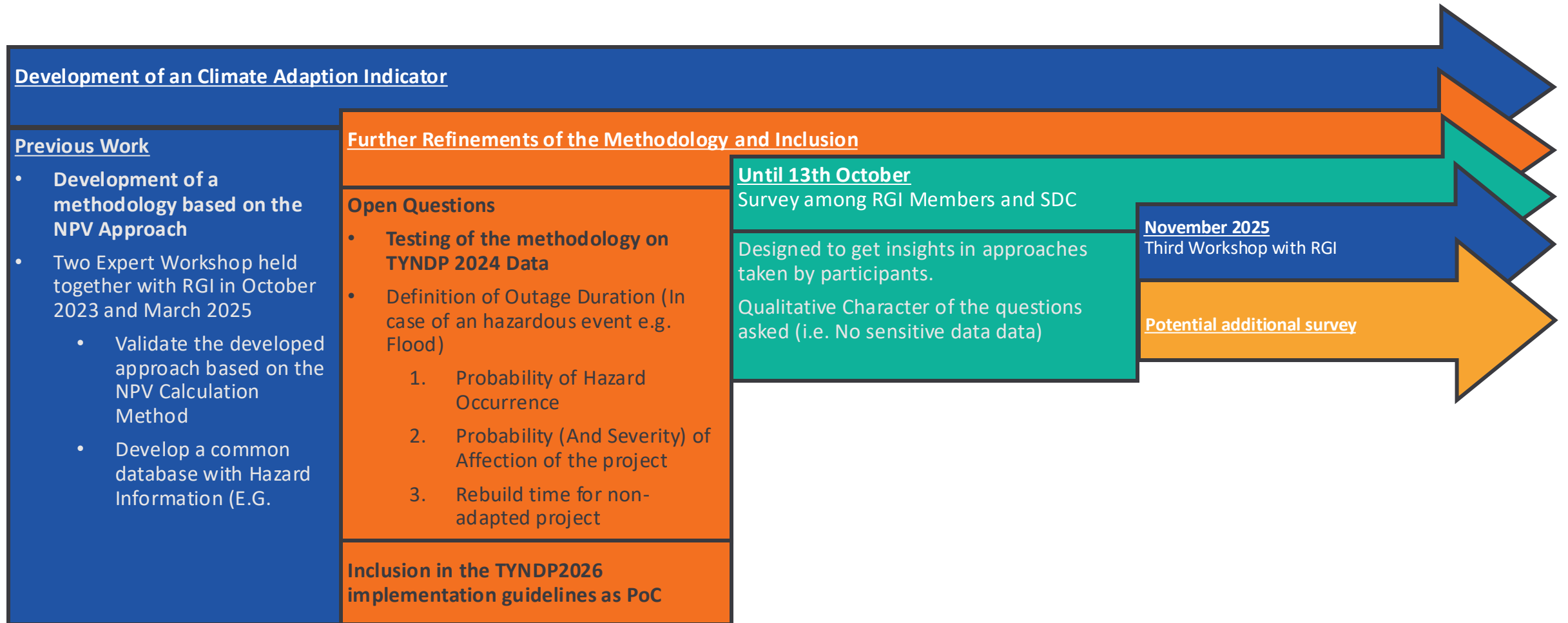
Why do we need a climate adaptation and resilience indicator?

- ✓ 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/>

Climate adaptation in TYNDP: from development to application



Climate Adaptation Indicator based on the Net Present Value (NPV)

NPV project with adaption	NPV for non-adapted project (with outage)
$NPV_{adapted} = \sum_{t=t_0}^T \frac{Benefit_t - Cost_t^A}{(1+r)^t}$	$NPV(N)_{non-adaptation} = \sum_{t=t_0}^T \frac{Benefit_t \cdot (1 - d_t) - Cost_t^B - Cost_t^R \cdot f_t}{(1+r)^t}$ $NPV_{Non-adaptation} = \frac{1}{T} * [NPV(1) + NPV(2) + \dots + NPV(T)]$
Cost^A: Cost Adapted (CAPEX + OPEX) r: Discount rate T: Maximum year of NPV approach (25 years)	d: Duration of outage (between 0 and 1) Cost^B: Cost: Non-adapted (CAPEX + OPEX) Cost^R: Rebuild Cost (CAPEX required to restore damaged infrastructure) r: Discount rate = 4 % N: Year of hazard occurrence T: Maximum year of NPV approach (25 years) f_t: model factor to include the rebuild costs into the formula ($f_t = 1$ for $t=N$ and $f_t = 0$ else)

Benefits of Climate adaptation

$$Benefit_{Adaptation} = NPV_{Adapted} - NPV_{Non-adaptation}$$