

**Technical support to the Energy Community and its Secretariat to assess the candidate Projects of Energy Community Interest in electricity, smart gas grids, hydrogen, electrolysers, and carbon dioxide transport and storage, in line with the EU Regulation 2022/869**

**- Analysis Techniques' Guidance Document -**

TEN-E (PECI) Groups meeting – 3<sup>rd</sup> meeting of the “Electricity” Group

16 May 2024

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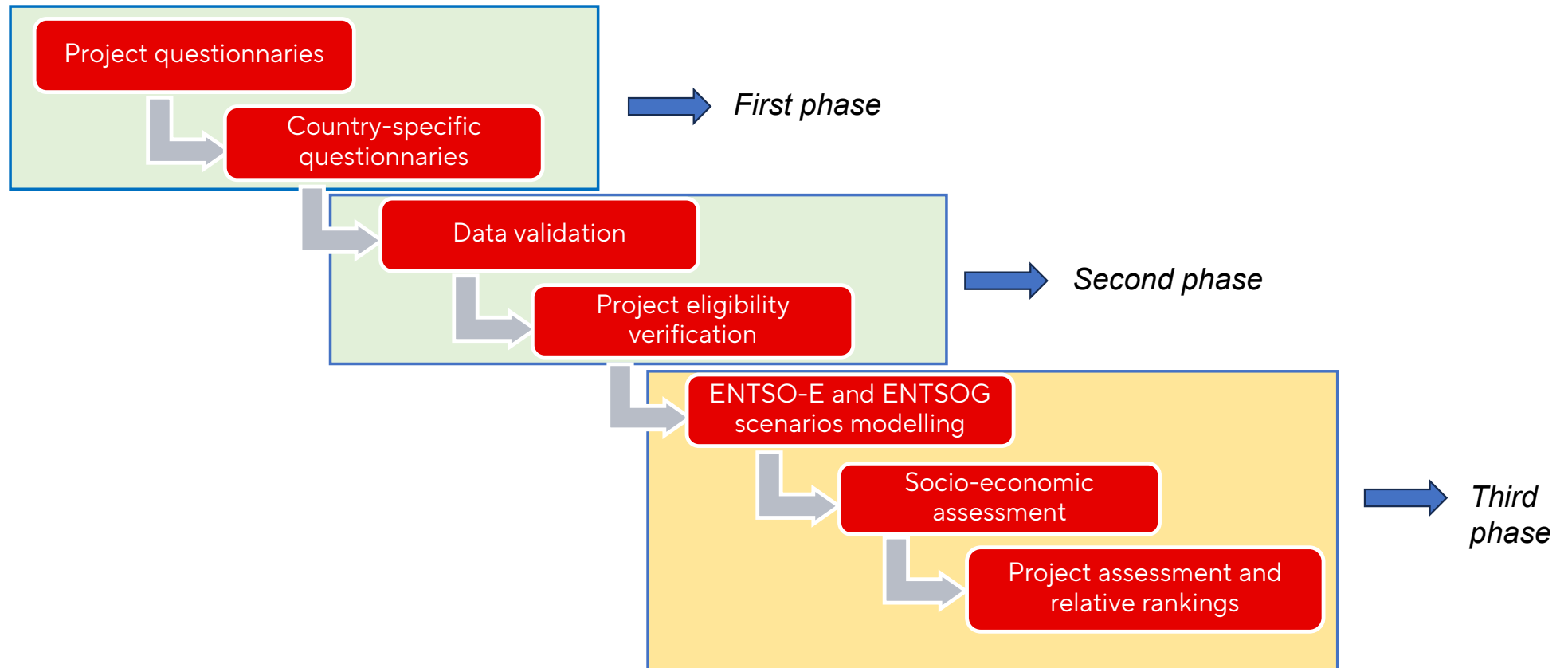
# — Analysis Techniques' Guidance Document

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# Main project activities

## Activities during the project implementation



# Work plan and deliverables

## 1. Inception Report

*Description of activities, work plan, approach, presentation of project-specific and country specific questionnaires*

## 2. Data Validation and Scenario Report

*Report on the collected project and country data, data validation process and compliance of the data with the proposed analysis, results of the project eligibility verification, description of defined scenarios*

## 3. Analysis Techniques' Guidance Document

*Final description of the data, scenarios, applied methodologies and techniques, sensitivities to be carried out, and structure of results and indicators*

## 4. Final Report

*Summary of the applied methodology, scenarios, data and assumptions and detailed presentation and interpretation of the results for each analysed project in all scenarios and sensitivities*

No	Activity	Beginning	End
1	Kick-off meeting	16/02/2024	16/02/2024
2	Inception Report preparation and submission ✓	16/02/2024	29/02/2024
3	1 <sup>st</sup> Groups' meetings	07/03/2024	07/03/2024
4	Data Collection	26/02/2024	08/04/2024
5	Data Validation and Scenario Report ✓	18/03/2024	15/04/2024
6	2 <sup>nd</sup> Groups' meetings	18/04/2024	19/04/2024
7	Data and Scenario Finalization	19/04/2024	03/05/2024
8	Analysis Techniques' Guidance Document ✓	19/04/2024	10/05/2024
9	3 <sup>rd</sup> Groups' meetings	15/05/2024	16/05/2024
10	Project Assessment	17/05/2024	14/06/2024
11	Assessment Results Consultation with the Secretariat	12/06/2024	17/06/2024
12	4 <sup>th</sup> Groups' meetings	19/06/2024	20/06/2024
13	Final Report preparation and submission	22/04/2024	28/06/2024

# Eligibility assessment overview

- **General eligibility criteria** set in the TEN-E Regulation
  - the project falls in at least one of the **energy infrastructure priority interconnection corridors** and areas set out in Annex I of the TEN-E Regulation;
  - the potential **overall benefits of the project outweigh its costs**, including in the longer term (will be calculated through the CBA);
  - the project meets any of the following criteria:
    - it involves **at least two Contracting Parties** by directly or indirectly, via interconnection with a third country, crossing the border of two or more Contracting Parties;
    - it is located on the territory **of one Contracting Party**, either inland or offshore, including islands, and has a significant **cross-border impact**.
- **Additional specific criteria within each energy infrastructure category analyzed and presented in the Report**

# Eligible projects for CBA and MCA

- Project eligibility verification resulted in **nine eligible projects** that will go into further analysis, i.e. CBA and MCA analyses
- All the projects refer to **electricity infrastructure**, eight to overhead lines and one to energy storage
- Among nine eligible projects, final confirmation regarding the **delta GTC values** due to a project still needs to be provided for two projects (E01 and E07)!

E01: Increasing the capacity of existing 220 kV interconnection between Bosnia and Herzegovina and Montenegro, 220 kV OHL Trebinje – Perućica (**delta GTC values still have to be verified**)

E02: New 400 kV interconnection between Bosnia and Herzegovina and Montenegro, 400 kV OHL Gacko – Brezna

E03: New 400 kV interconnection between Montenegro and Bosnia and Herzegovina, 400kV overhead line Brezna-Sarajevo with construction 400/220 kV substation Piva's mountain

E04: Trans Balkan Corridor: Double OHL 400 kV Bajina Basta (RS) – Visegrad (BA)/Pljevlja (ME) (BA section)

E05: Internal transmission line 400 kV Banja Luka 6 - Mostar 4

E06: Reconfiguration of 400 kV grid and new 400 kV interconnection Albania-Kosovo

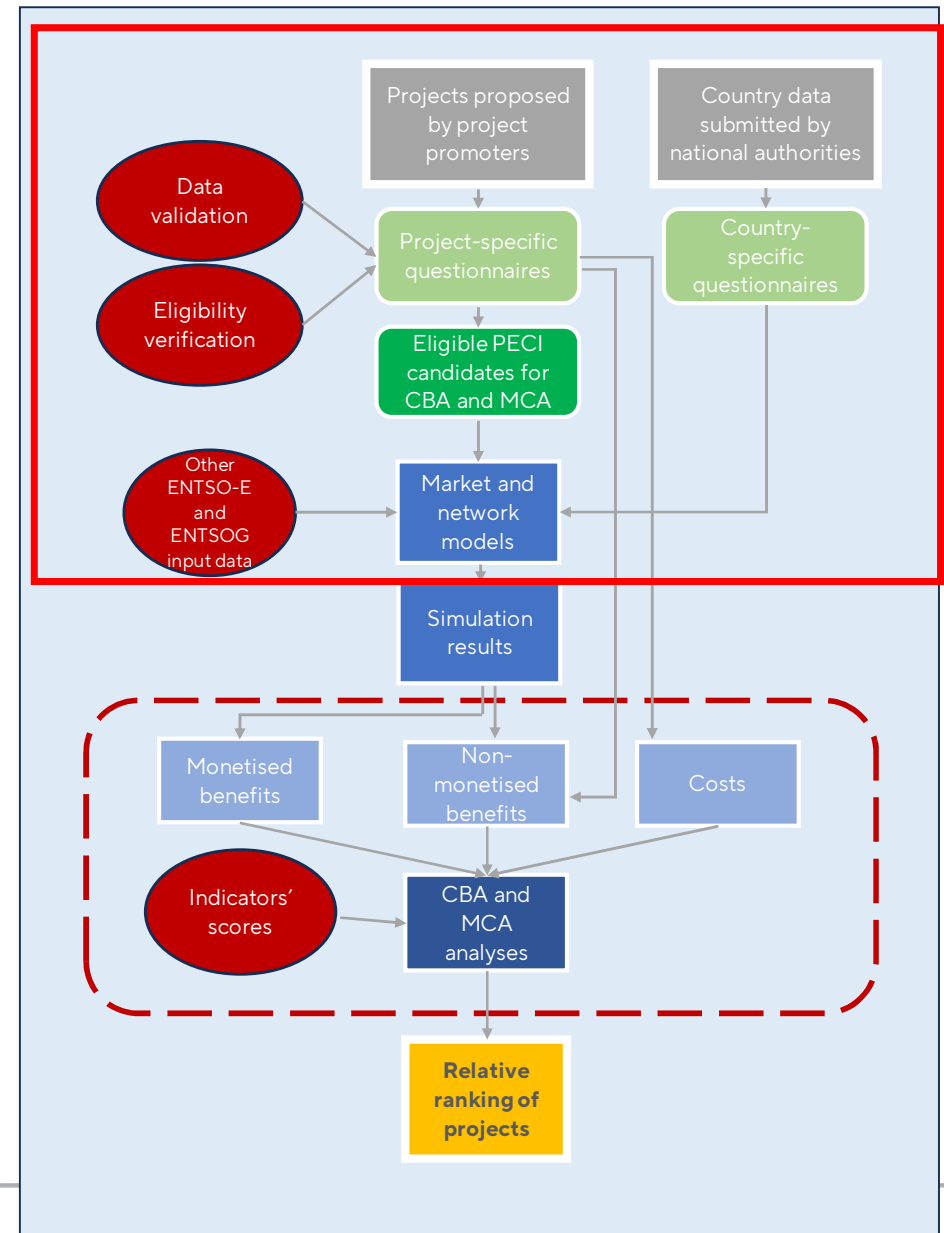
E07: Closing the 400 kV Albanian internal ring (**delta GTC values still have to be verified**)

E08: 330 kV OHL Balti (MD) - Dnestrovsk HPP-2 (UA)

E13: DTEK STORAGE 225 MW

# Project assessment approach

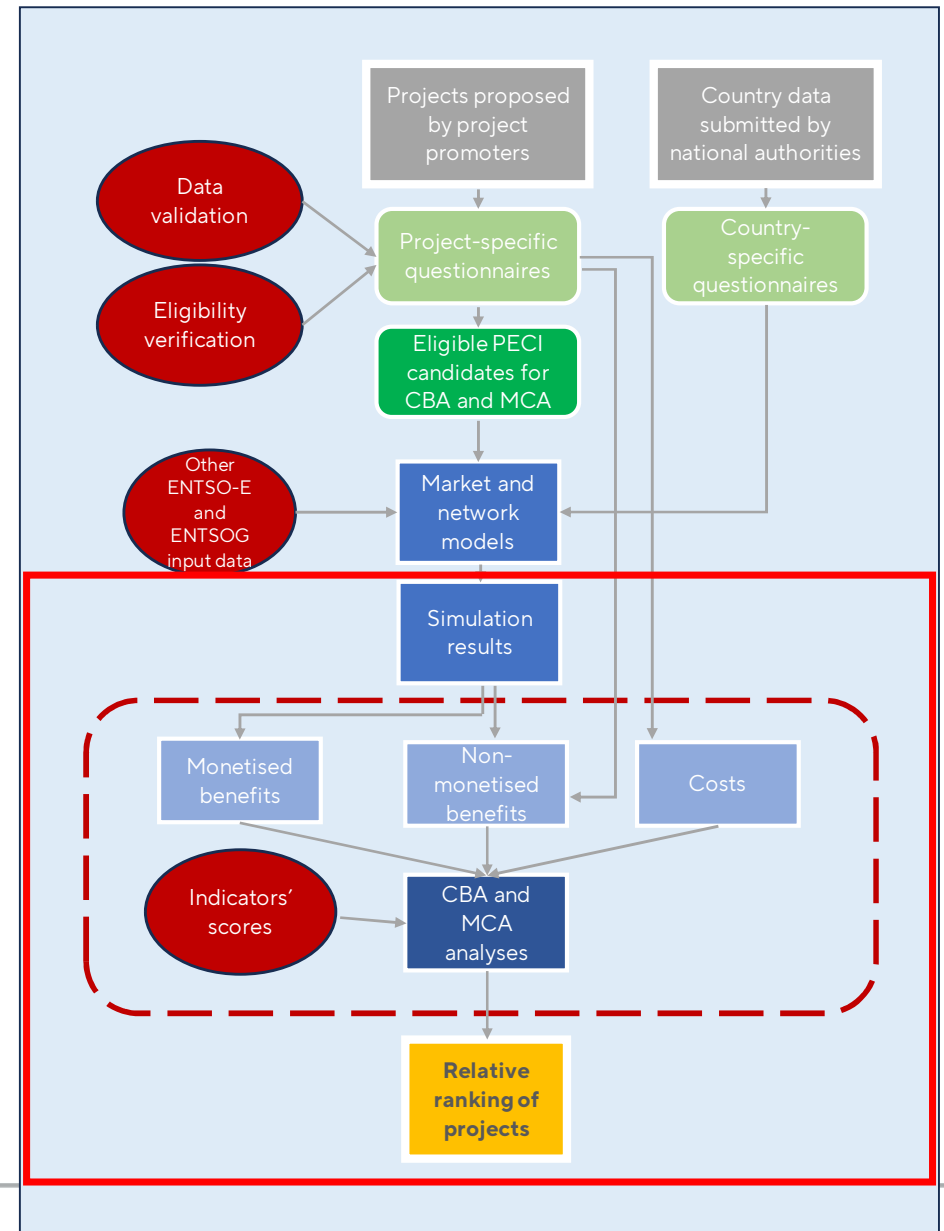
- **Data collection** – project-related data and country-specific data
- **Data validation** – Several iterations were made to clarify delivered data or to submit additional data by project promoters!
- **Projects' eligibility verification** – The final list of eligible projects for CBA and MCA according to the general and specific criteria assessment
- **Market and network models development**
  - Input data primarily based on the collected data regarding candidate projects and regarding country-specific data of the Contracting Parties
  - ENTSO-E and ENTSOG TYNDP 2022 data is used as other input data (e.g. fuel prices)





# Project assessment approach

- **Simulation results** – Will be used to determine monetised and non-monetised benefits for each project
- **CBA and MCA analyses** – Based on the **benefits** (determined by modelling and using delivered data by project promoters) and **costs** provided by project promoters
  - *The main objective is to determine if the potential overall benefits of the project outweigh its costs, (general eligibility criteria of the TEN-E Regulation)!*
- **Relative ranking of projects** – Indicators will be **scored** to enable comparison of individual project assessment results between projects in the same project category



# Project assessment approach

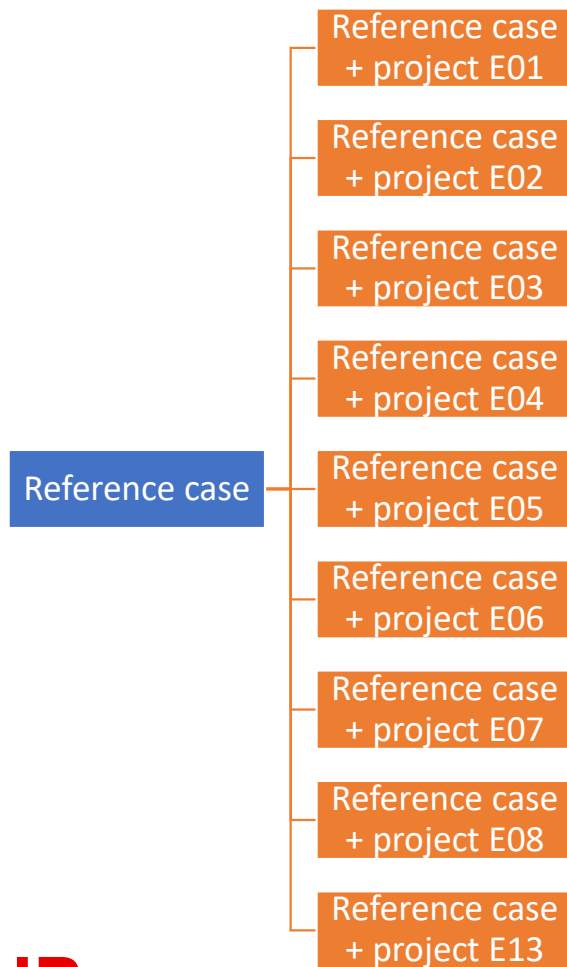
Develop a **reference case/scenario** (without any of the candidate projects), against which all projects will be assessed

- *Each project will be added to the reference scenario to determine its benefits (PINT modelling approach) until 2050*

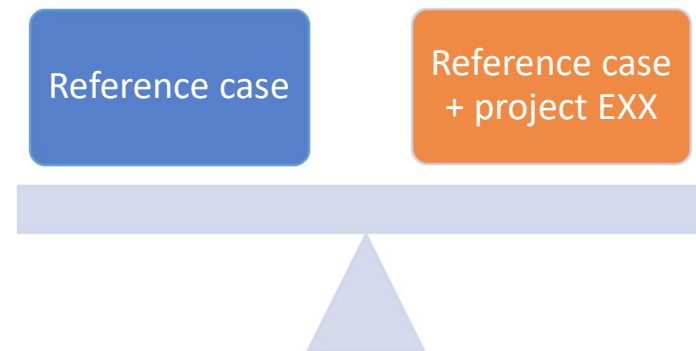
Compare individual project assessment results between projects in the same project category and propose **relative project rankings**

Determine socio-economic **monetary and non-monetary benefits** and costs for each project (project-specific CBA and MCA)

# Project assessment approach



- **Put IN one at the Time (PINT)** considers each new project on the given network structure one-by-one and evaluates the **results** with and without the examined network investment/project reinforcement
- Results are used to determine project **benefits** according to the relevant methodologies
- **Costs** are determined based on the submitted project data by project promoters
- Relevant indicators for each project are determined based on comparison with the reference case



# Project assessment approach

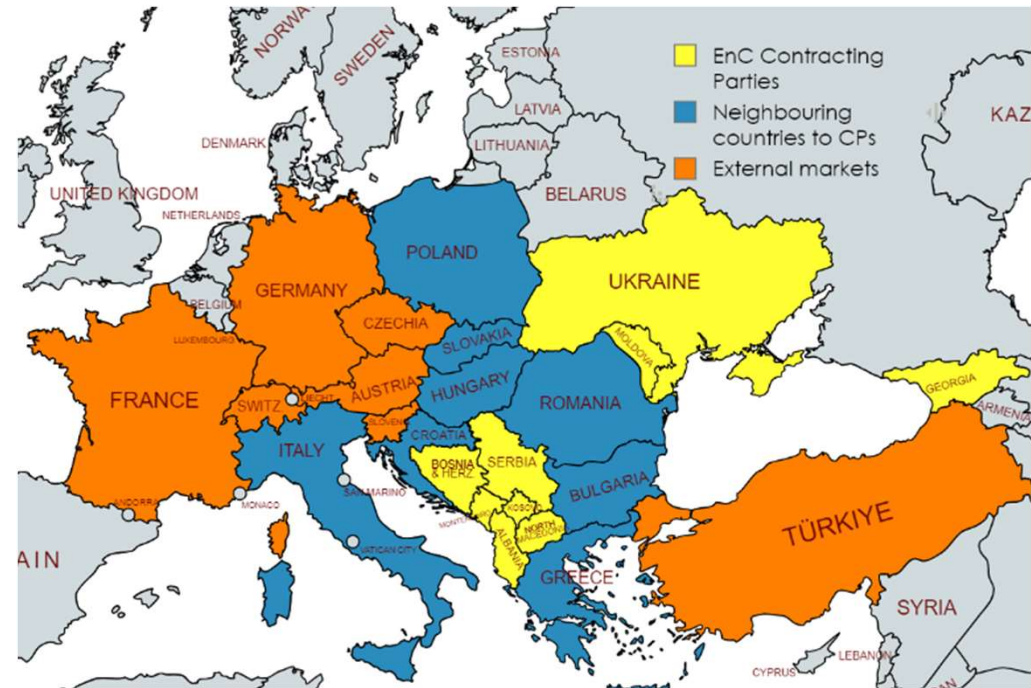
## Modelling phase of the project assessment

- **PLEXOS** – tool for project assessment
  - enables modelling and analyses of **both electricity and gas(es)/hydrogen markets**
  - The objective of the optimization function is to **minimize the total system cost** by taking into account various characteristics and constraints of the system and market
- **PSS/E** – additional tool for electricity network analyses
- Only **modelling of the electricity sector** will be considered in the modelling phase (in the eligibility verification process all the gas(es) candidate projects were declared as not eligible)



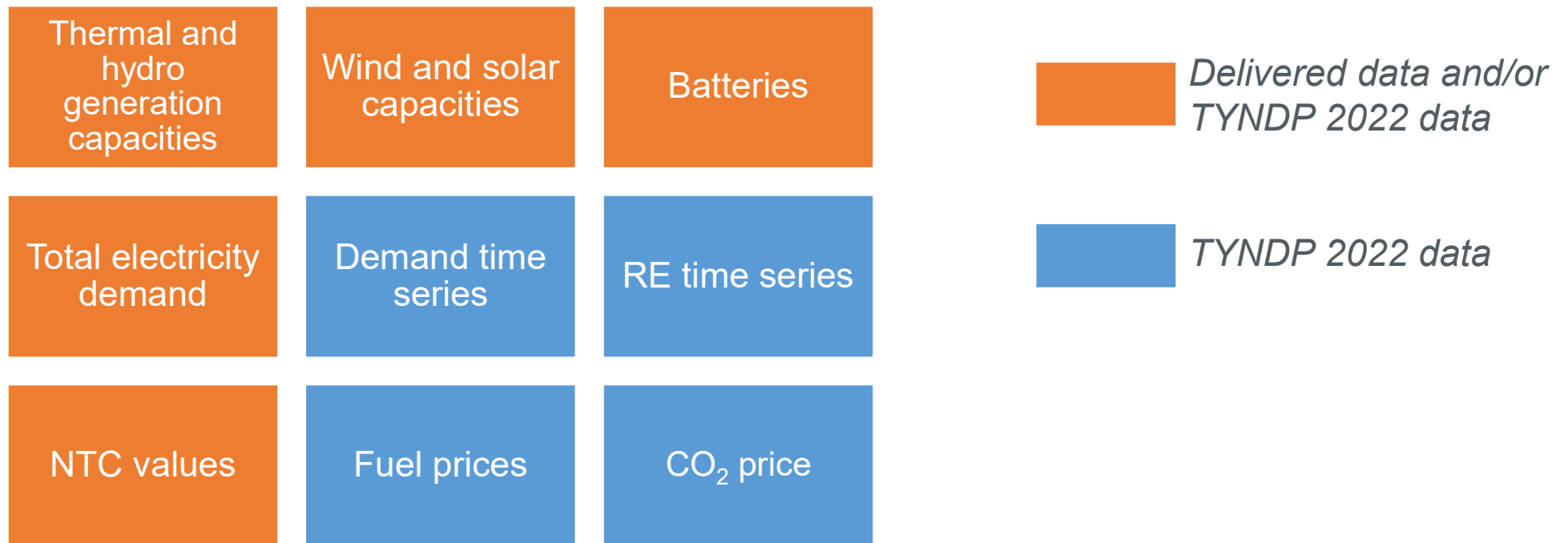
# Input data and modelling assumptions

- **Geographical scope:** Albania, Bosnia and Herzegovina, Georgia, Kosovo\*, Moldova, Montenegro, North Macedonia, Serbia and Ukraine
- **Time horizon:** 2030/2040/2050
- **TYNDP 2022 scenarios:** NT in 2030/2040 and DE in 2050
- **Climatic year:** 2009 as the most representative year in the TYNDP 2022
- **Hydrological conditions:** Average/Normal
- **Modelling tools:** PLEXOS Energy Modelling Software, PSS/E



# Input data and modelling assumptions

- Input data and assumptions for **reference scenario** (without projects) based on the delivered country-specific data and **ENTSO-E and ENTSOG TYNDP 2022** scenarios:



# Input data and modelling assumptions

- **Generation capacities**

- Data on generation capacities for CPs collected from relevant national authorities (based on the TYNDP 2022 scenarios)
- There are some differences between the collected data and the data based on the TYNDP 2022 scenarios
- Proposal by the Secretariat and the Consultant: **to use the data provided by relevant national authorities in market model development**
  - *The modifications of the provided input data are made where necessary **to assume carbon neutrality in 2050 (DE scenario) by decommissioning all coal-fired thermal power plants** without any exception, and by eventually assuming the application of carbon capture technology on gas-fired power plants or their usage of clean gases including hydrogen.*

# Input data and modelling assumptions

- **Generation capacities**

2030	Nuclear	Thermal-gas	Thermal-lignite/coal	Hydro	Wind	Solar	Batteries
AL	-	300	-	2623	300	700	-
BA	-	-	1418	2323.8	798	1514	50
GE	-	1598.2	22.3	4065	750	700	200
XK	-	-	904	100.7	677	550	170
MD	-	1720	47.2 <sup>1</sup>	64.5	442	470	10
ME	-	49 <sup>2</sup>	225	961.4	250	750	28
MK	-	760	31 <sup>3</sup>	938.1	443	580	-
RS	-	400.9	4427.8	3193.8	3844	235	-
UA	13 940	4772.3	15855	2572.9	580	7350	258

2040	Nuclear	Thermal-gas	Thermal-lignite/coal	Hydro	Wind	Solar	Batteries
AL	-	300	-	2633	700	1300	-
BA	-	-	1418	2480.3	1500	3000	381
GE	-	1598.2	22.3	5805	1700	1650	200
XK	-	-	904	100.7	1275	1340	170
MD	-	1720	47.2	64.5	960	750	10
ME	-	49	225	961.4	600	2400	28
MK	-	-	31	1480.5	723	998	-
RS	-	400.9	4427.8	3193.8	3246	950	-
UA	13 940	4772.3	15 855	2572.9	2580	11 120	258

2050	Nuclear	Thermal-gas	Thermal-lignite/coal	Hydro	Wind	Solar	Batteries
AL	-	300	-	2633	1650	1650	-
BA	-	-	-	2480.3	2500	5000	500
GE	-	1598.2	-	8350	2900	2600	200
XK	-	-	-	100.7	1873	1938	170
MD	-	1720	-	64.5	1120	880	10
ME	-	-	-	961.4	700	4300	28
MK	-	-	-	1480.5	605	11553	105
RS	-	300	-	3193.8	2968	725	-
UA	13 940	4772.3	-	2572.9	6750	21220	258



<sup>1</sup> In Moldova thermal is not lignite/coal but other non-renewable thermal capacity  
<sup>2</sup> In Montenegro thermal is not natural gas but other renewable thermal capacity  
<sup>3</sup> In North Macedonia thermal is not natural gas but other renewable thermal capacity



# Input data and modelling assumptions

- **Electricity demand**

- Data on electricity demand for CPs collected from relevant national authorities (based on the TYNDP 2022 scenarios)
- There are some **differences between the collected data and the data based on the TYNDP 2022 scenarios**
- Proposal by the Secretariat and the Consultant:
  - to use the data provided by relevant national authorities
  - in cases where data were not provided, TYNDP 2022 data will be used

Country	2030	2040	2050
AL	8900	9400	12 116
BA	11 158	12 681	13 457
GE	19 111	23 907	29 071
XK	6802	7998	10 180
MD	7002	8417	9993
ME	4539	5534	6281
MK	8879	10 147	10 759
RS	36 498	37 240	37 218
UA	151 840	208 500	296 600

# Methodologies for project assessment

- **CBA Methodologies of the ENTSO-E and ENTSOG**

- ✓ **4<sup>th</sup> ENTSO-E Guideline for Cost-Benefit Analysis of Grid Development Projects, April 2023**

- ✓ *2<sup>nd</sup> ENTSOG Methodology for Cost-Benefit Analysis of Gas Infrastructure Projects, February 2019*

- Methodologies developed and published by **the European Commission**

- ✓ *Harmonised System Wide Cost-Benefit Analysis for Candidate Electrolyser Projects, May 2023*

- ✓ *Harmonised System Wide Cost-Benefit Analysis for Candidate Hydrogen Projects, May 2023*

- ✓ *Harmonised System Wide Cost-Benefit Analysis for Candidate Smart Gas Grid Projects, May 2023*

- ✓ *Harmonised System Wide Cost-Benefit Analysis for Candidate Smart Electricity Grid Projects, May 2023*

- ✓ *Harmonised System Wide Cost-Benefit Analysis for Candidate Cross-Border Carbon Dioxide Network Projects, May 2023*

- Methodology for assessing the hydrogen and electrolyser candidate PCI/PMI projects 2022-2023 exercise, June 2023

- **Methodology for assessing the electricity and offshore infrastructure candidate PCI and PMI 1<sup>st</sup> Union PCI-PMI list 2023, June 2023**

- Previous methodologies used for the selection of PECE/PMI projects in the Energy Community

# Methodologies for project assessment

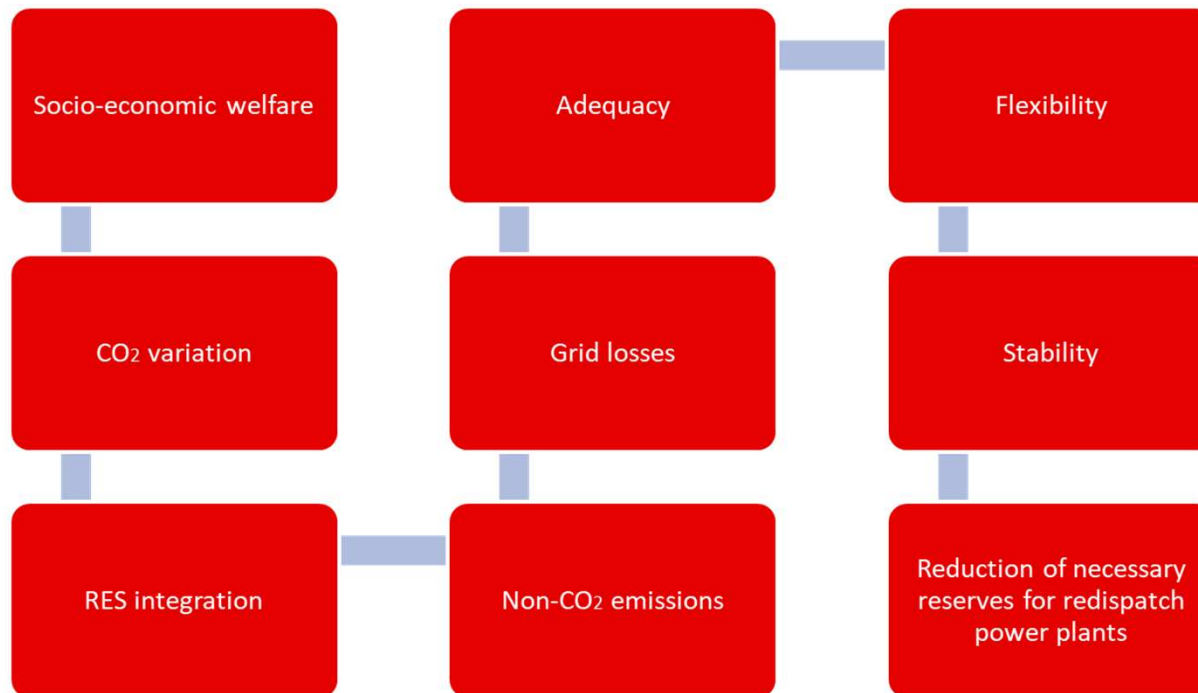
## Methodology for assessing the electricity and offshore infrastructure candidate PCI and PMI 1<sup>st</sup> Union PCI-PMI list 2023, June 2023

- The assessment methodology applies to **electricity transmission** and offshore projects as well as **energy storage facilities**
- The PEI candidate project shall contribute:
  - **significantly to sustainability** through the integration of renewable energy into the grid, the transmission or distribution of renewable generation to major consumption centers and storage sites, and to reducing energy curtailment, where applicable;and to **at least one** of the specific criteria:
  - **market integration**, including through lifting the isolation of at least one CPs and reducing energy infrastructure bottlenecks, competition, interoperability and system flexibility;
  - **security of supply**, including through interoperability, system flexibility, cybersecurity, appropriate connections and secure and reliable system operation.

# Methodologies for project assessment

## 4<sup>th</sup> ENTSO-E Guideline for Cost-Benefit Analysis of Grid Development Projects, April 2023

- defines nine categories of possible benefits for overhead transmission lines



*Some project benefits can be quantified and monetised, while others can only be qualitatively described.*

# Methodologies for project assessment

## Costs and benefits for electricity storage and overhead lines based on the relevant methodologies

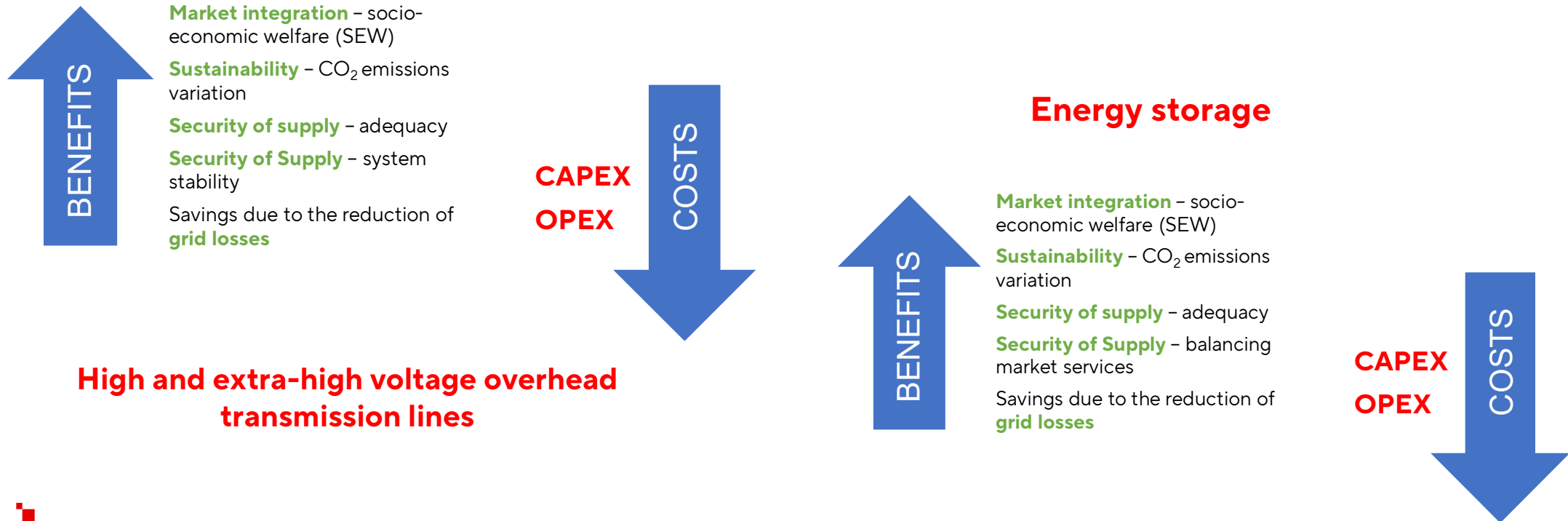
- Through the use of synchronized market and network models, the following indicators will be monetised:
  - **Socio – economic welfare (SEW)** – assessed through the contribution of the project in increasing transmission capacity(ies) over the borders of the EnC CPs (excluding the EU Member States), making an increase in commercial exchanges possible so that electricity markets can trade power in a more economically efficient manner. The monetisation of SEW is done in EUR/yr. For this indicator, generation cost method will be used to monetize the increase in SEW, by determining a difference between the total generation costs in the power systems of EnC countries with and without the project.
  - **Security of supply (SoS)** – this indicator is calculated in case there is an occurrence of unserved energy in the modelling results and is then monetised by multiplying that unserved energy with the value of lost load (VoLL).
  - **Grid losses** – shall be assessed through the cost of compensating for thermal losses in the power system due to the project. For the grid losses calculation, both market and network models will be used – in the network model the amount of losses (GWh) will be calculated and then multiplied by marginal prices acquired from the market model in order to fully monetize this benefit.

# Methodologies for project assessment

- To determine whether each project complies with the specific **TEN-E Regulation criteria**, specific indicators identified below will be presented for each project:
  - **Market integration:** increase in Annual Socio-Economic Welfare (**B1  $\Delta$ SEW** indicator, M €/year)
  - **Sustainability:** additional societal benefit due to CO<sub>2</sub> variation (**B2  $\Delta$ CO2 indicator**, tonnes/year)
  - **Security of supply:** improvement in system adequacy (**B6  $\Delta$ SoS**, M €/year), and
    - **B8** System Stability (Transient, Voltage and Frequency Stability) for OHLs
    - **B7** Balancing services for energy storages
  - **Grid losses:** (**B5  $\Delta$ Losses** indicator, M €/year)

# Methodologies for project assessment

Costs and benefits for electricity storage and overhead lines based on the relevant methodologies



# Structure of results

## Project assessment indicators

- Positive impact of the proposed project will be analysed within the **benefits defined by the relevant methodologies**
- The benefits, i.e. indicators that will be calculated in the project assessment process refer to **monetised, and non-monetised**
- **CBA and MCA analyses will address** both monetised and non-monetised indicators

## Electricity transmission project benefit indicators

### Monetised

Change in SEW

Grid losses

Adequacy

### Non-monetised

CO<sub>2</sub> variation

Project maturity

SoS-System stability

## Energy storage project benefit indicators

### Monetised

Change in SEW

Grid losses

Adequacy

### Non-monetised

CO<sub>2</sub> variation

Project maturity

SoS-Balancing services



# Structure of results

## B/C ratio

- The **Benefit/Cost (B/C) ratio** – the present value of all monetised benefits divided by the present value of all project costs (CAPEX and OPEX)
- **Discount rate of 4%** will be used
- If the B/C ratio is lower than one, then the project **does not comply with the general eligibility criterion** set out by the TEN-E Regulation
- For projects with B/C ratio higher than one, **points will be allocated to enable project ranking** under the same infrastructure category
- **Maximum points** that a project can receive is **20**

Range of B/C ratio value	Points
1	10
1-2	11
2-3	12
3-4	13
4-5	14
5-6	15
6-7	16
7-8	17
8-9	18
9-10	19
>10	20

# Structure of results

## CO<sub>2</sub> variation

- **CO<sub>2</sub> emissions variation** (tonnes CO<sub>2</sub>/year) – a change in the total CO<sub>2</sub> emissions between the reference scenario and the scenario with the project
- Monetised value of CO<sub>2</sub> emissions is already contained in the calculation of the change in SEW; to avoid double counting, variation in CO<sub>2</sub> emissions will be verified separately as a non-monetised indicator
- Points will be assigned to each project based on the calculated amount of CO<sub>2</sub> emissions
- A maximum of **3 points** can be assigned based on the defined ranges

Range of CO <sub>2</sub> emissions decrease (tonnes/year)	Points
1-49,999	0.1-1
50,000-100,000	1-2
>100,000	3

# Structure of results

## SoS - System stability

- **System stability** – non-monetized indicator which shows quantitatively how much the project supports the voltage stability, transient stability and frequency stability
  - ✓ '0' - no change: the technology/project has no (or just marginal) impact on the respective indicator,
  - ✓ '+' - small to moderate improvement: the technology/project has only a small impact on the respective indicator,
  - ✓ '++' - significant improvement: the technology/project has a large impact on the respective indicator
- Data regarding this indicator requested **in the project questionnaire**
- According to the *4<sup>th</sup> ENTSO-E Guideline for Cost-Benefit Analysis of Grid Development Projects*, a project can attain a maximum of 5 '+'
- For small to moderate impact on system's stability ('+'), a **0.4 points** will be assigned, and for significant impact ('++'), **0.8 points** will be assigned
- A project that has a maximum impact of 5 '+' can be assigned with maximum of **2 points (5\*0.4)**

# Structure of results

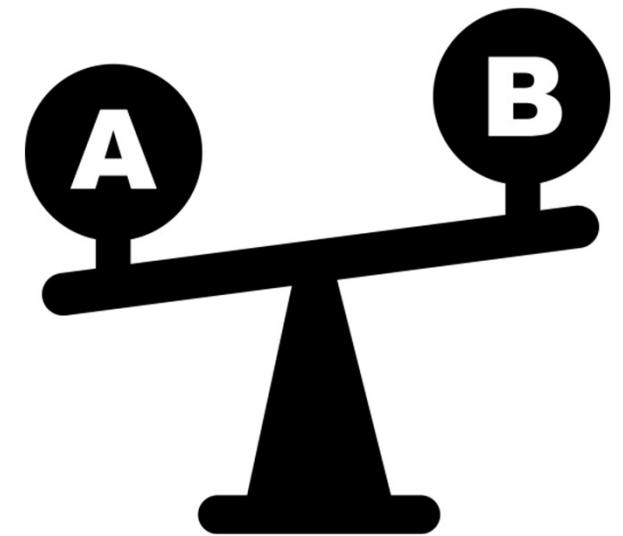
## Project maturity

- **Project maturity** – will be determined based on the data about status/completion of project development phases delivered by the project promoters through project questionnaires
- For the completion of each project development phase a score of **0.5 point** is assigned
- A maximum of **5 points** can be received for completion of all project phases before the construction

Project development phase	Possible points for phase completion
Prefeasibility study	0.5
Technical feasibility study	0.5
Economic feasibility study (CBA)	0.5
Environmental impact assessment	0.5
Detailed design study	0.5
Resolved financing	0.5
Obtained approvals/permits	0.5
Approval by regulatory authority	0.5
Final investment decision	0.5
Tendering procedure	0.5

# Relative rankings of projects

- Based on the results of quantitative and qualitative analysis, individual project assessment will be made for each of the eligible project categories
- Each of the criteria evaluated in a specific project category (monetised and non-monetised) will have a certain number of points in the total possible score
- Based on the calculated total scores of each individual project a **relative ranking of all eligible projects** will be provided as the final output of the assessment



# Relative rankings of projects

- Based on the calculated total scores of each individual project a **relative ranking of all eligible projects** will be provided as the final output of the assessment
- The candidate project will be ranked if it proves **that its overall benefits outweigh its costs**
- For electricity transmission overhead lines and energy storage projects **a maximum of 30 points** can be assigned based on the indicator scoring
- The projects (OHLs) will be ranked from top to bottom in line with the total score, e.g. from 30 points to 1 point

Indicator	Maximum points
B/C ratio	20
Variation in CO <sub>2</sub> emissions	3
SoS - System stability (OHL) or Balancing services (Storage)	2
Project maturity	5
<b>TOTAL</b>	<b>30</b>

# Thank you for your attention



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