Selection of Projects of Energy Community Interest (PECIs)

Draft results – electricity infrastructure projects

Presentation REKK / DNV GL / MANU

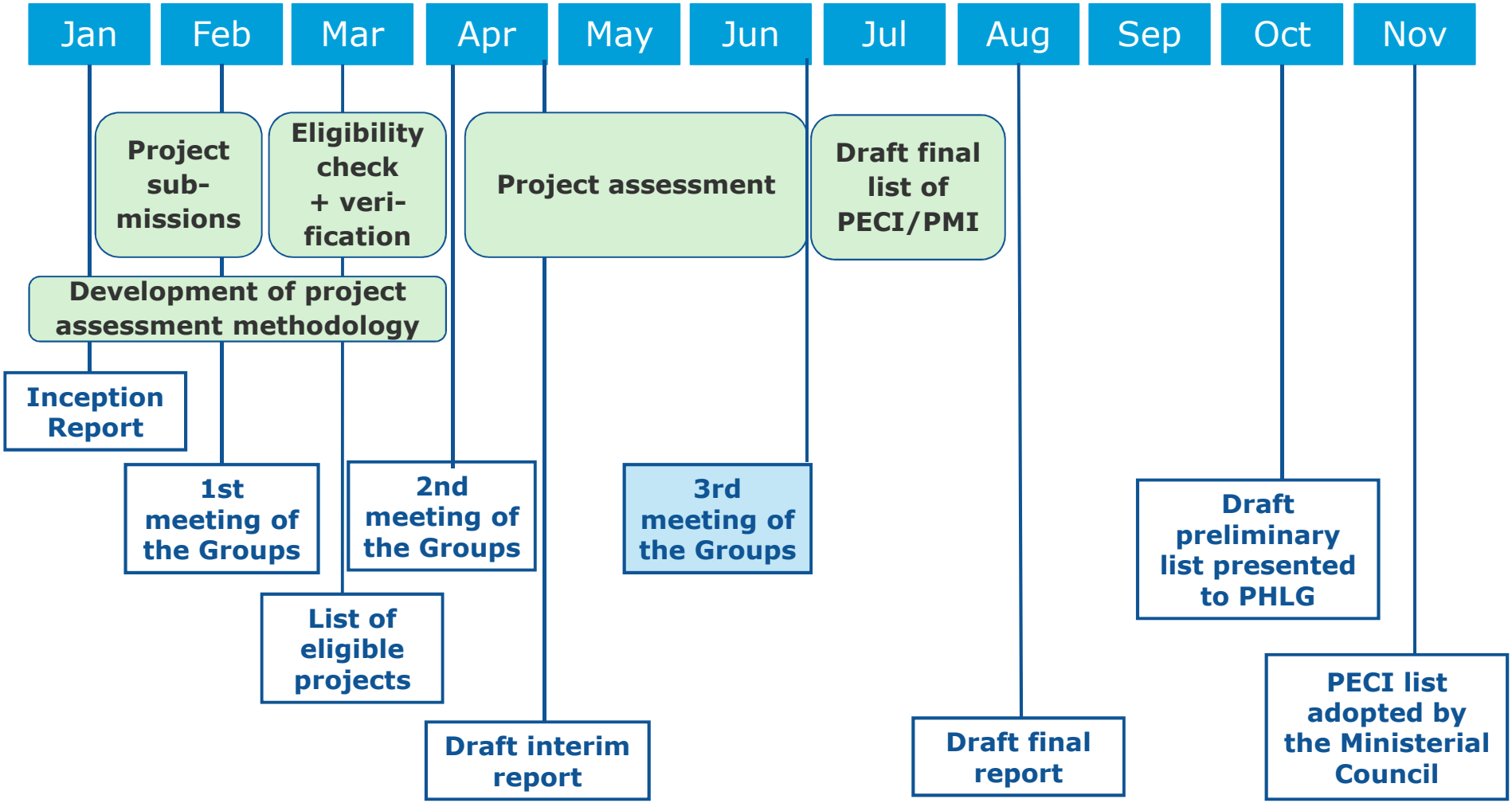
Vienna 29.06.2016

Agenda

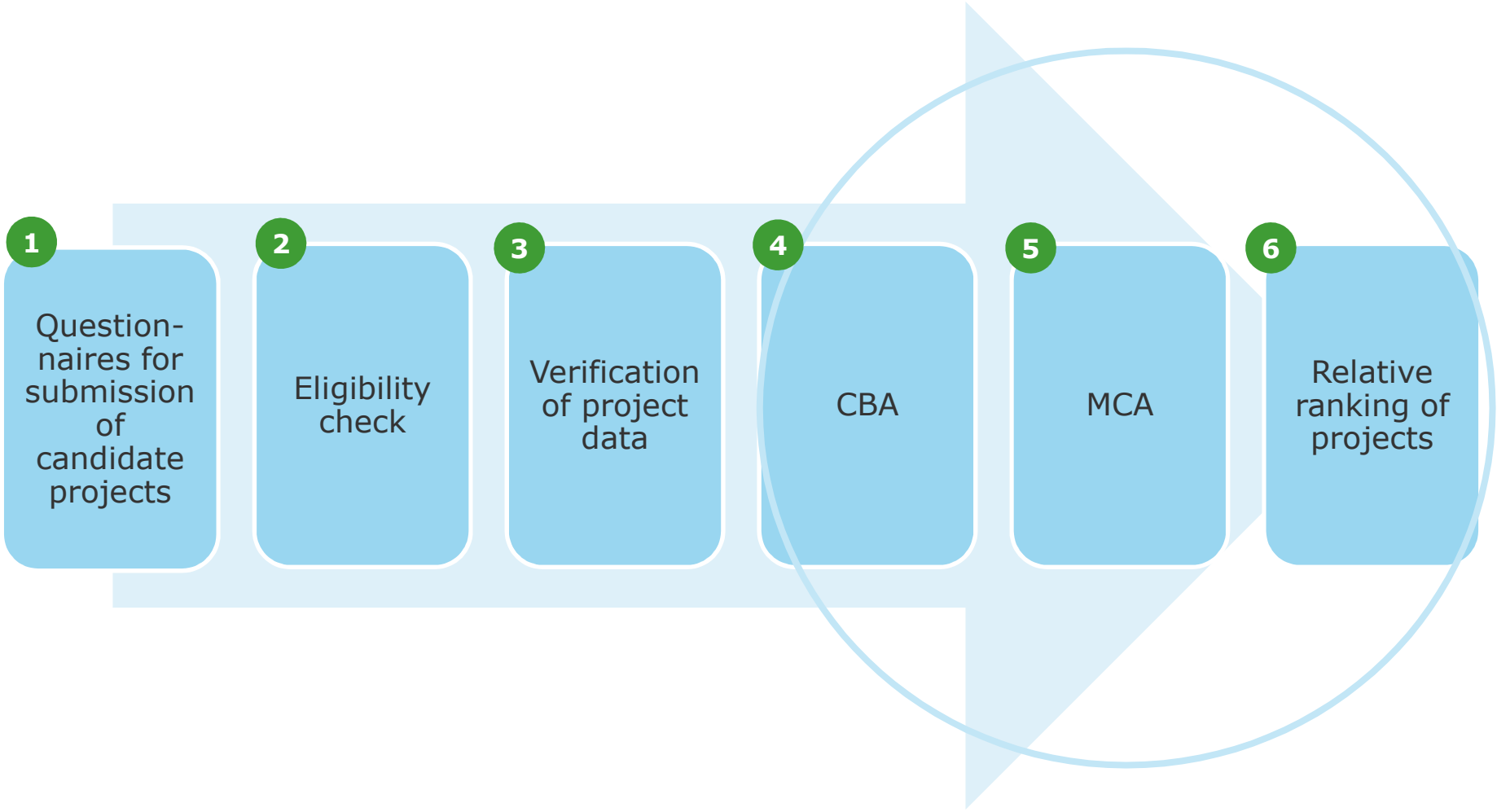
1. Overview on Assessment Methodology
2. Submitted Projects and Results of Project Verification
3. Electricity Market Modelling
   - Input data for modelling and assumptions
   - Reference case in 2016 and in 2030
4. Electricity Network Modelling
5. Multi-Criteria Assessment
   - Indicators and scoring
6. Assessment Results
   - Cost benefit results (NPV)
   - Multi criteria assessment (scores and relative ranking)
7. Sensitivity Analysis
8. Assessment Results for Individual Projects

Assessment Methodology

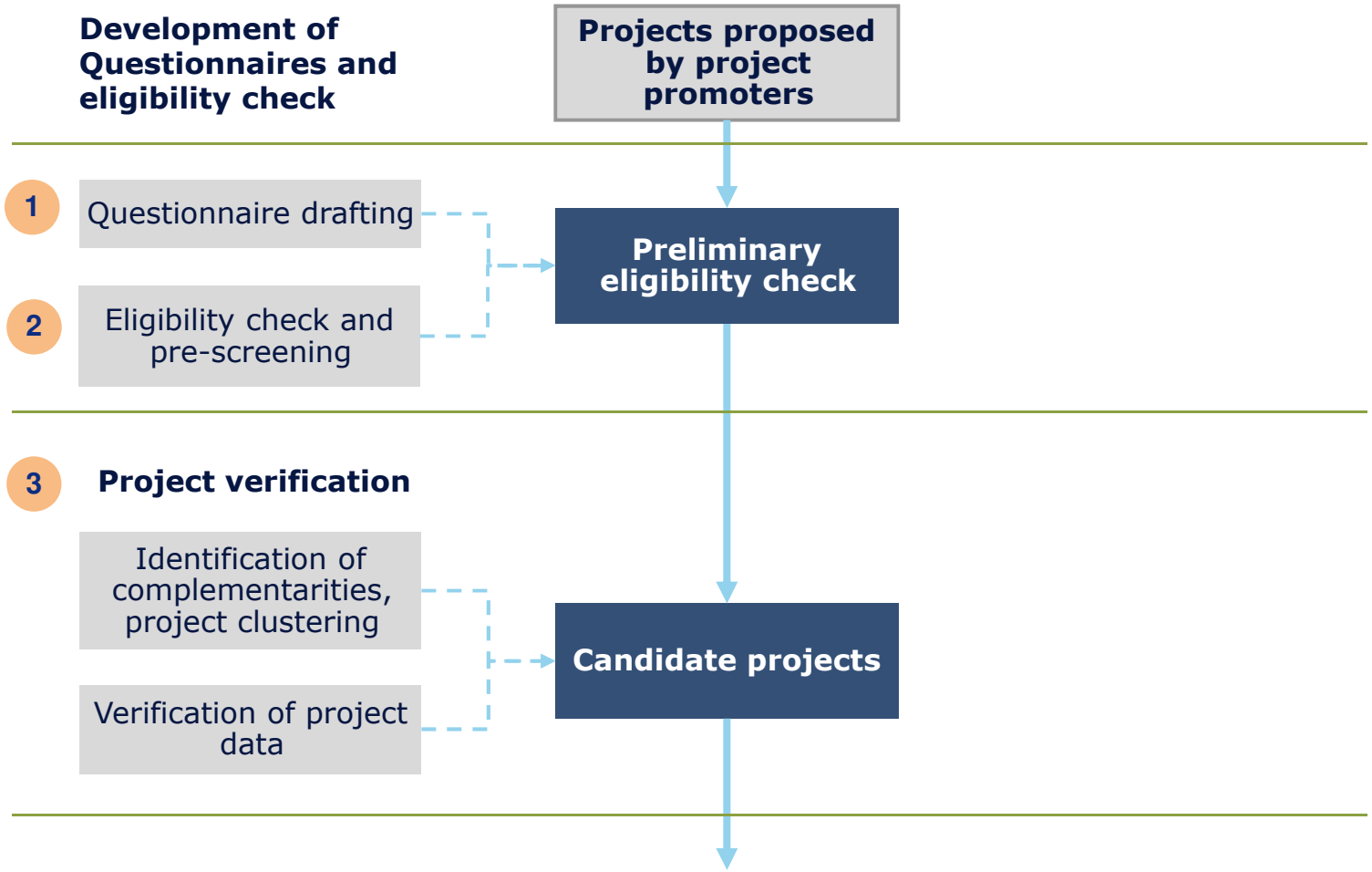
Project Timetable



Project Workflow



Overview of the Project Assessment Methodology



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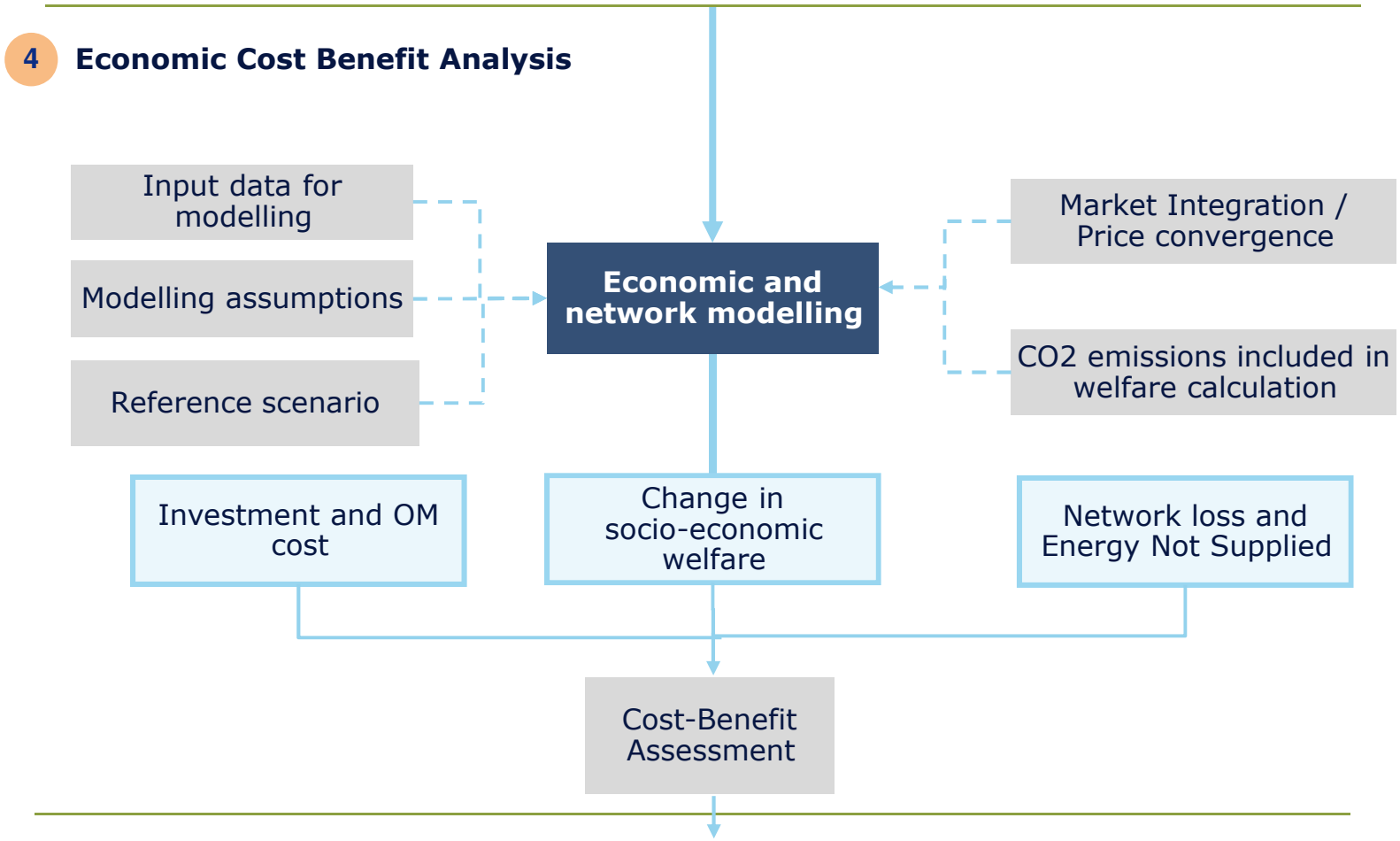

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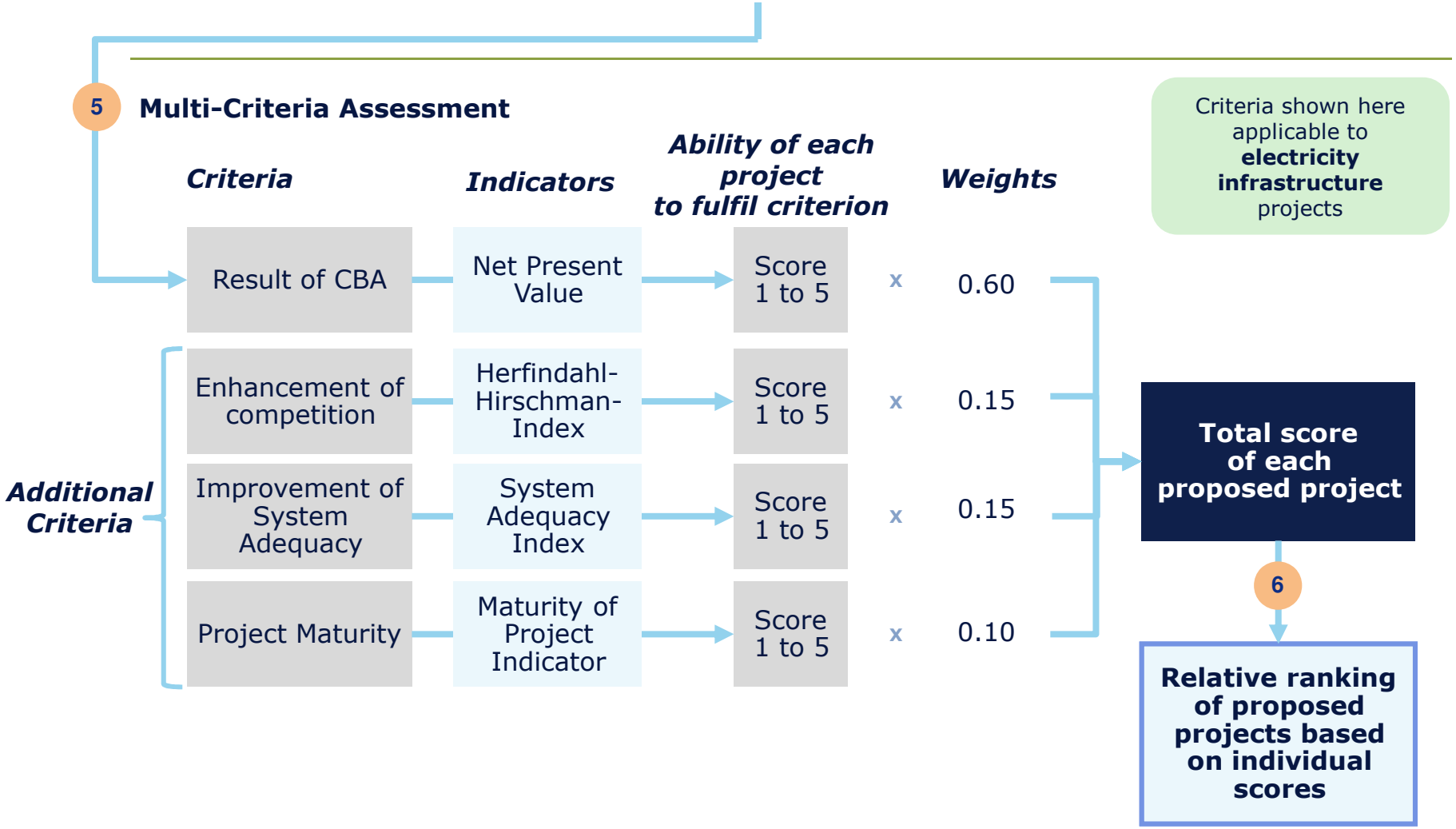


Cost-Benefit Analysis

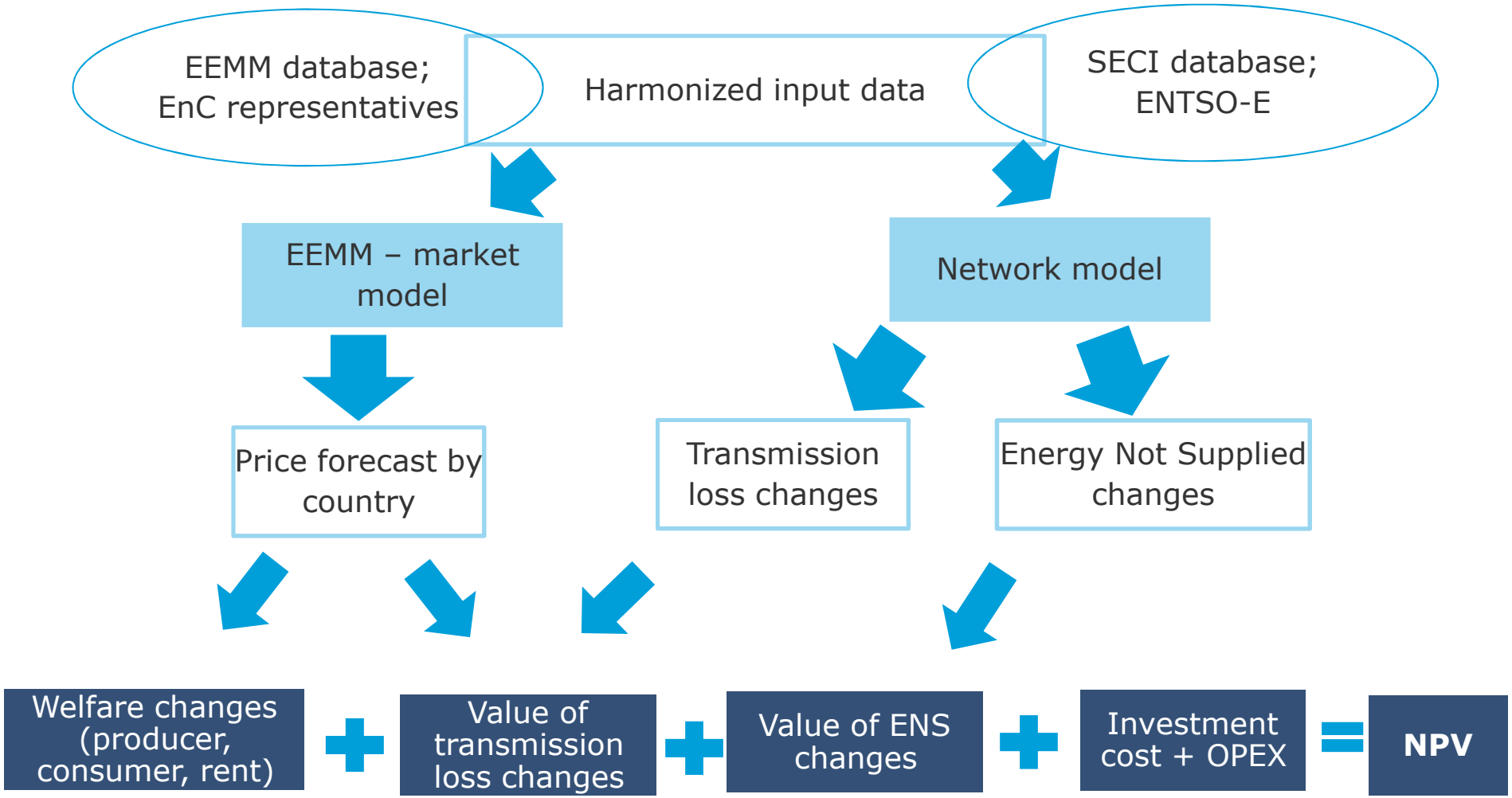
An investment project would be beneficial to the investigated stakeholder group if the cost-benefit analysis provides a positive net benefit (i.e. a positive NPV)

- Costs and benefits of a project are assessed in the economic analysis by the Net Present Value (NPV)
- Calculation of the Net Present Value (NPV) of economic costs and benefits includes
  - the monetary costs and benefits of the investor
  - the costs and benefits to other stakeholders and the society as a whole affected by an investment project
- (Economic) NPV is the difference between the discounted total social benefits and costs
- Economic assessment of a project is positive if the NPV is positive (NPV > 0)

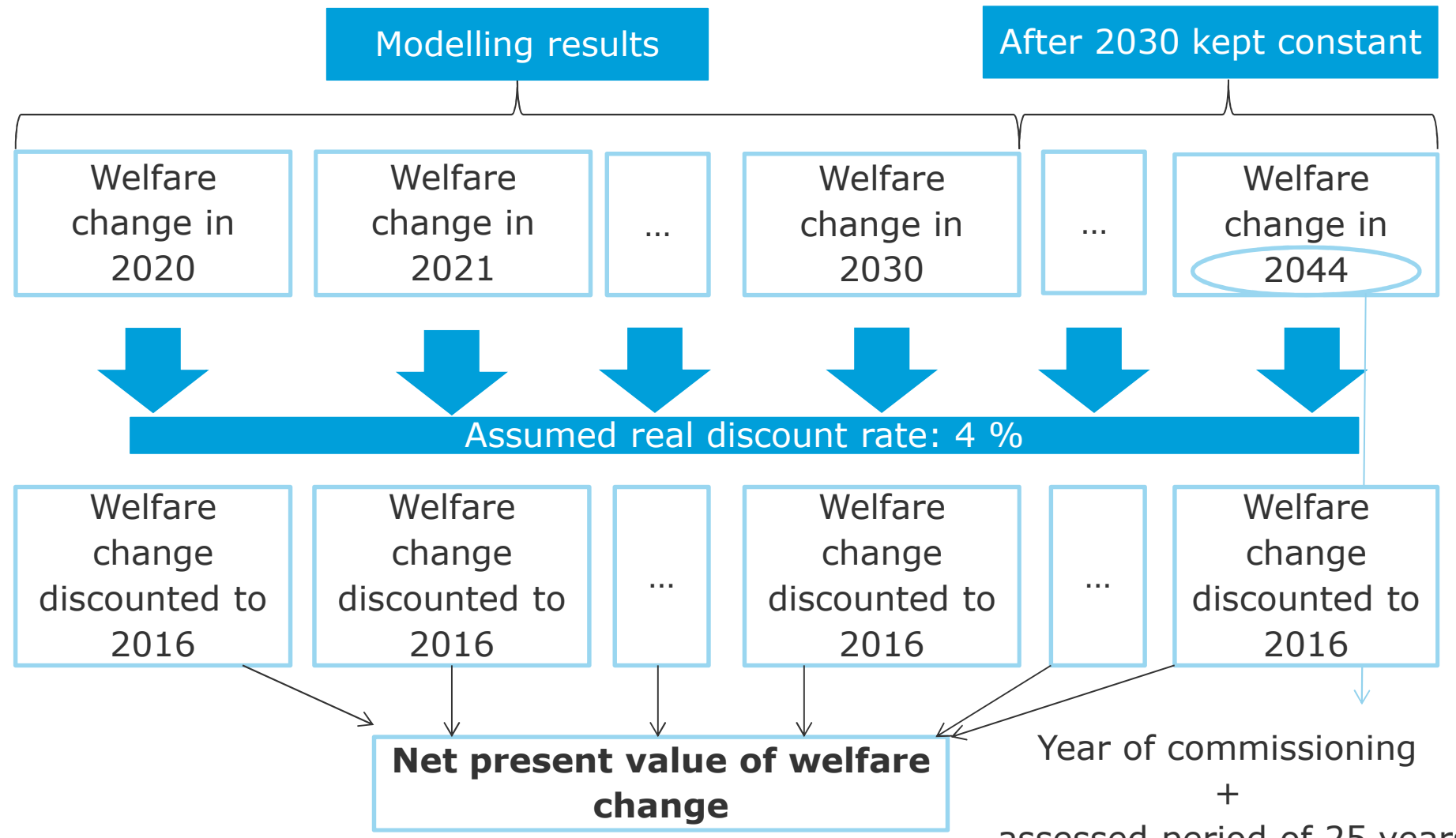
Agreed methodological issues

- Geographical coverage for the assessment: EnC CPs + neighbouring EU MSs
- PINT applied in the base CBA
- CO2: A carbon taxation regime after 2020 for the EnC region is assumed, so CO_2 impacts are endogenized in the economic modelling, it is included in the social-economic welfare
- Value of Loss Load (VOLL) in monetizing EENS (Expected Energy Not Supplied) calculated by using the GDP/Electricity consumption value as a proxy for VOLL, as it is region specific and based on more reliable data (e.g. on Eurostat data)
- Transmission losses monetized by modelled baseload electricity prices
- Sensitivity assessments:
  - Lower/higher electricity demand in the whole modelled region
  - Lowest/highest gas price based on EGMM model
  - Higher CO2 price
  - TOOT method
- Modell input data updated by received information from parties

Network and economic modelling in CBA



Calculating the Net Present Value of Social Welfare Changes



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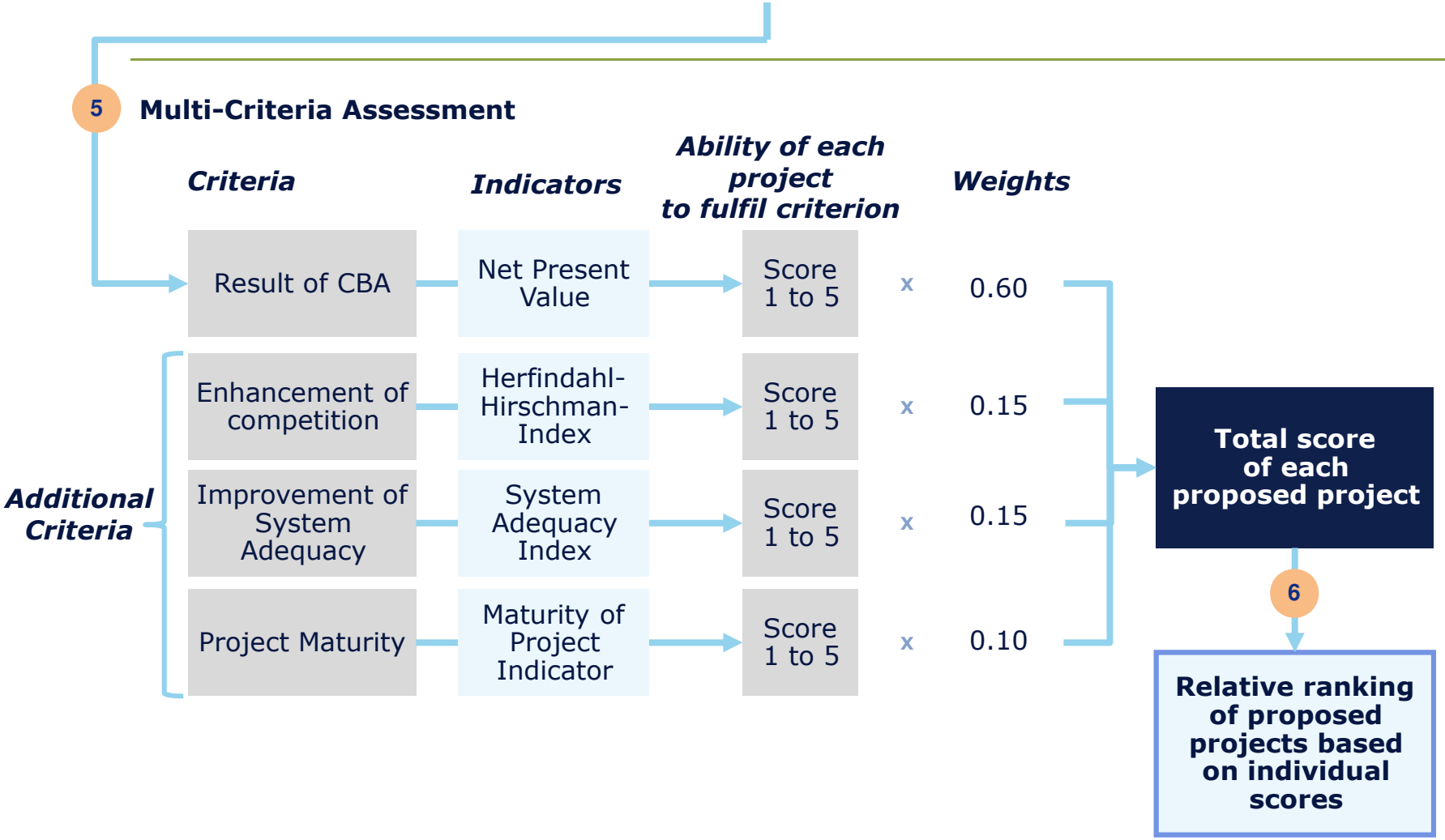


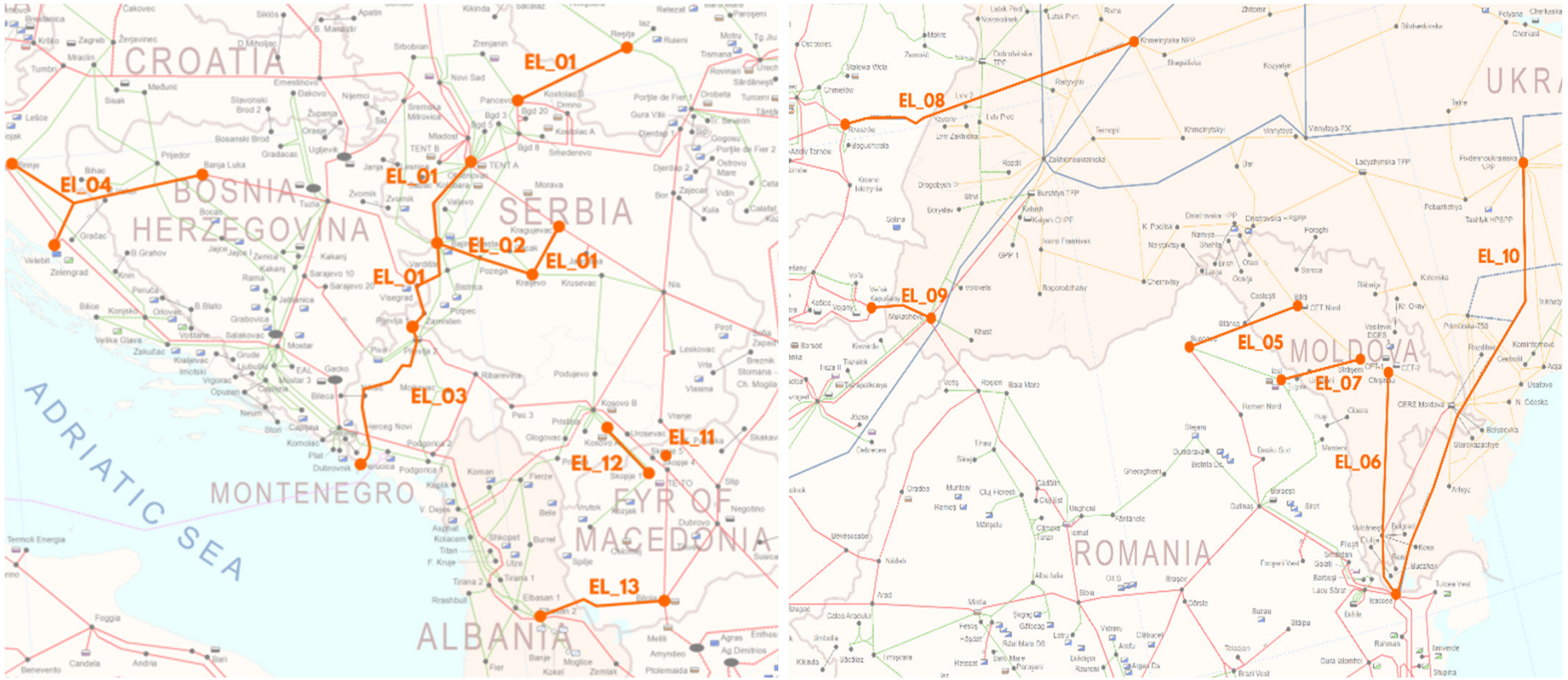
Verification of Projects

Projects submitted by categories

	Electricity trans-mission	Electricity storage	Gas trans-mission	Gas Storage	LNG	Smart Grid	Oil	Total
Submitted projects	13	0	16	0	1	3	1	34
Eligible projects	12	-	16	-	1	0	1	30
Submitted investment cost	Ca.1200 million €		Ca. 2350 million €				490 million €	Ca.4040 million €

- Out of the 13 submitted electricity transmission projects one electricity did not meet the criteria of the adopted Regulation
- Out of the 3 submitted smart grid projects none of them meet the criteria of the adopted Regulation
- Submitted investment CAPEX for all projects: **4000 million €**, **one third** goes to **electricity infrastructure** projects

Location of submitted electricity projects



Input summary of the analysed projects I.

Project code	Project name	Promoter	Origin	Destination	Capacity, MW		Commissioning date
					O->D	D->O	
EL_01	Transbalkan corridor - phase 1	JP Elektromreza Srbije	RO	RS	750	450	2018
			RS	ME	500	500	2018
			RS	BA	600	500	2023
EL_02	Transbalkan corridor - phase 2, 400 kV OHL Bajina Basta - Kraljevo 3	JP Elektromreza Srbije	RS	RS	0	0	2027
EL_03	Trans-Balkan Electricity Corridor, Grid Section in Montenegro	CGES	ME	RS	1000	1100	2020
EL_04	Interconnection between Banja Luka (BA) and Lika (HR) with Internal lines between Brinje, Lika, Velebit and Konjsko (HR) including substations	HOPS, EMS	BA	HR	504	504	2030
EL_05	Power Interconnection project between Balti (Moldova) and Suceava (Romania)	SE Moldelectrica	MD	RO	500	500	2025
EL_06	B2B station on OHL 400 kV Vulcanesti (MD) - Issacea (RO) and new OHL Vulcanesti (MD) - Chisinau (MD)	SE Moldelectrica	MD	RO	500	500	2022
EL_07	Power Interconnection project between Straseni (Moldova) and Iasi (Romania) with B2B in Straseni (MD)	SE Moldelectrica	MD	RO	500	500	2025

Input summary of the analysed projects II.

Project code	Project name	Promoter	Origin	Destination	Capacity, MW		Commissioning date
					O->D	D->O	
EL_08	Asynchronous Interconnection of ENTSO-E and Ukrainian electri List of submitted electricity projects (as of 26.02.2016.)city network via 750 kV Khmelnytska NPP (Ukraine) – Rzeszow (Poland) overhead line connection, with HVDC link construction	NPC Ukrenergo; The Ministry of Energy and Coal Industry of Ukraine	UA	PL	600	600	2020
EL_09	400 kV Mukacheve (Ukraine) – V.Kapusany (Slovakia) OHL rehabilitation	NPC Ukrenergo; The Ministry of Energy and Coal Industry of Ukraine	UA	SK	700	700	2020
EL_10	750 kV Pivdennoukrainska NPP (Ukraine) – Isaccea (Romania) OHL rehabilitation and modernisation, with 400 kV Primorska – Isaccea OHL construction.	UKRAINE - Ministry of Fuel and Energy	UA	RO	1000	1000	2025
EL_11	400/110 kV Substation Kumanovo	MEPSO	MK	-	-	-	2020
EL_12	400 kV interconnection Skopje 5 - New Kosovo	MEPSO	KO*	MK	200	200	2020
EL_13	400 kV Interconnection Bitola(MK)-Elbasan(AL)	MEPSO	MK	AL	1000	600	2019

Electricity Market Model

European Electricity Market Model – Functionality

- The map shows the geographical coverage of the model in the South East European region:
  - 25 European Union countries handled by model (whole Energy Community region is covered)
- EEMM:
  - Competitive market equilibrium prices by countries
  - Electricity flows and congestions on cross-border capacities
- The exogenous power prices are reflecting the changes in fuel prices.
- Non ENTSO-E part of Ukraine and Moldova are also covered
- The model calculates the marginal cost of more than 3500 power plant blocks and sets up the merit order country by country.
- Taking into consideration the merit order and exports/import, the model calculates equilibrium prices.
- Regional power flow is ensured by 90 interconnectors between countries.

Input Data Verification for EEMM Modelling – demand, and present capacity

GWh	2015	2020	2025	2030
AL	7 842	9 163	10 704	12 399
BA	12 606	13 000	14 000	15 000
KO*	5 570	6 318	9 216	10 484
ME	3 395	3 419	3 870	4 366
MD	5 861	6 567	7 357	8 243
MK	7 491	9 262	10 226	11 290
RS	37 735	36 648	38 600	40 845
UA_E	143 915	160 937	166 292	176 679
UA_W	4 429			

MW	Coal and lignite	Natural gas	Nuclear	Wind	HFO/LFO	Hydro	Other RES
AL	0	0	0	0	0	1 801	1
BA	1 765	0	0	0	0	2 162	0
KO*	1 171	0	0	1	0	53	0
ME	219	0	0	0	0	668	0
MD	1 000	1 727	0	1	0	64	3
MK	822	260	0	37	198	671	20
RS	4 075	417	0	10	0	3 018	13
UA_E	20 069	11 721	13 835	420	0	5 771	395
UA_W	2 334	217	0	7	0	38	19

Planned Fossil-Based and RES Generation Capacities

New fossil-based power generation capacities (in MW)									
	2016-2020			2021-2025			2026-2030		
	Coal and lignite	Natural gas	HFO/LFO	Coal and lignite	Natural gas	HFO/LFO	Coal and lignite	Natural gas	HFO/LFO
AL	0	200	0	0	160	0	0	0	0
BA	1100	390	0	300	0	0	0	0	0
KO*	0	0	0	500	0	0	500	0	0
ME	225	0	0	0	0	0	0	0	0
MD	0	0	0	0	0	0	0	0	0
MK	120	30	0	0	150	0	200	420	420
RS	0	478	0	700	0	0	350	0	0
UA_E	1300	550	0	1000	200	0	0	0	0
UA_W	0	0	0	0	0	0	0	0	0

New RES-E power generation capacities (in MW)												
	Hydro			PV			Wind			Other		
	2016-2020	2021-2025	2026-2030	2016-2020	2021-2025	2026-2030	2016-2020	2021-2025	2026-2030	2016-2020	2021-2025	2026-2030
AL	523	457	457	30	26	26	30	25	25	0	0	0
BA	285	65	0	10	0	0	232	0	0	0	0	0
KO*	212	0	0	10	0	0	149	0	0	10	0	0
ME	54	451	0	10	14	8	151	17	21	31	10	8
MD	0	0	0	0	0	0	149	124	124	8	8	8
MK	114	26	45	7	8	30	13	50	50	3	5	10
RS	458	100	780	5	90	100	500	0	100	144	69	72
UA_E	1 330	2 400	0	1 170	0	0	1 600	265	0	165	2 000	0
UA_W	0	0	0	0	0	0	0	0	0	0	0	0

Main Market Model Assumptions – Fuel Prices

Oil price

- Based on World Bank

Natural gas price

- Result of the EGMM Reference case

Coal price

- Hard coal price equal ARA price
- Coal price forecasts are based on Economist Intelligence Unit
- Lignite price = hard coal * 0.55

Year	ARA coal price, €/GJ
2016	1.52
2020	1.85
2025	1.85
2030	1.85

Nuclear

- Taken from literature, but irrelevant (never marginal)

HFO, LFO

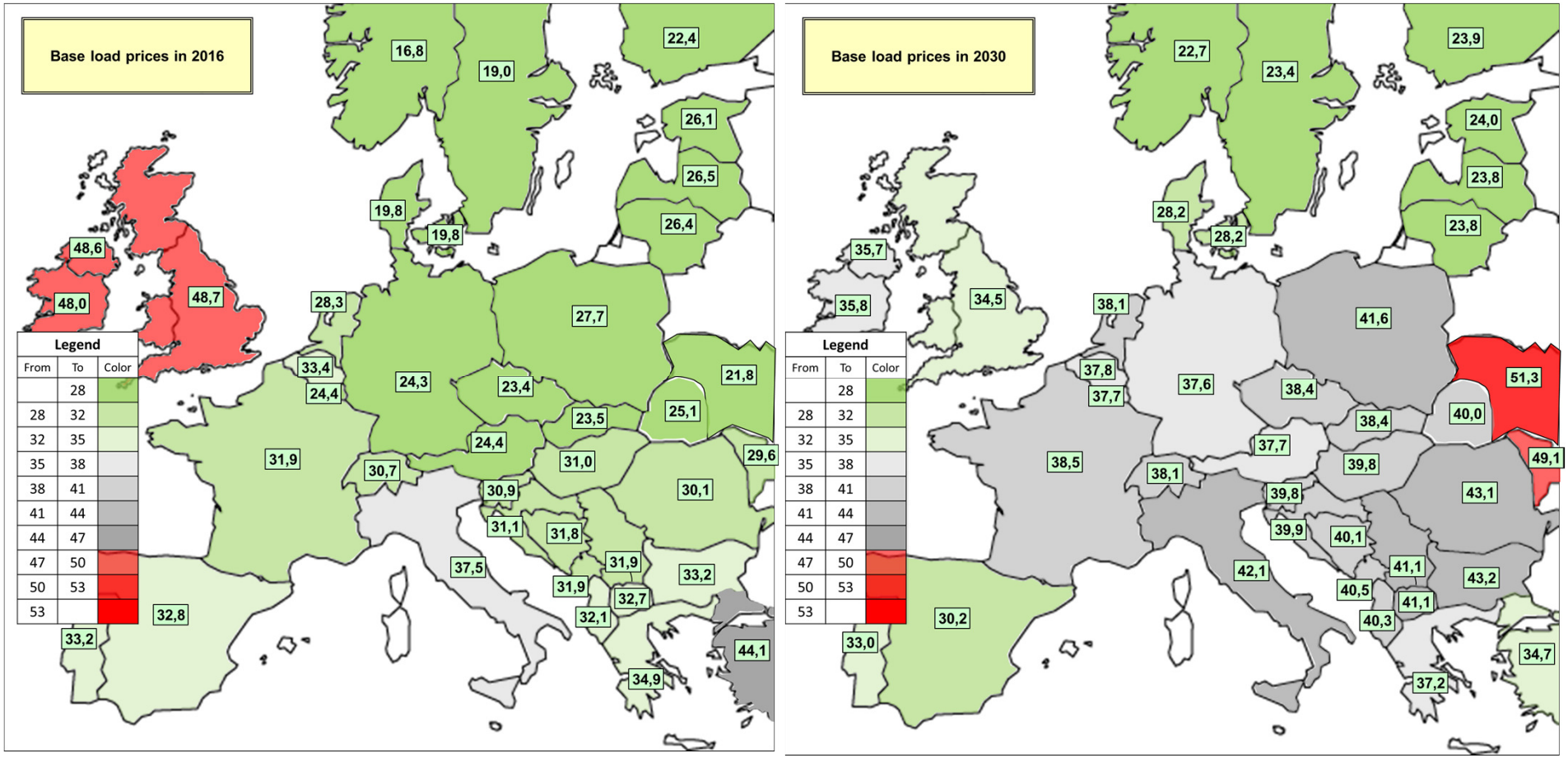
- Indexed to crude oil price

CO_2 price

- By 2030 CO2 price will increase to 22 €/t according to Impact Assessment of Climate and Energy Package in 2014
- EnC countries will join scheme in 2020

Year	CO2 price, €/t
2016	4.10
2020	9.21
2025	15.61
2030	22.00

Wholesale electricity prices in 2016 and in 2030, €/MWh



Electricity Network Model

Energy Community Electricity Transmission (EC-ET) model

- Countries covered in the EC-ET model:
  - Albania
  - Bosnia and Herzegovina
  - Bulgaria
  - Croatia
  - Greece
  - Kosovo*
  - Montenegro
  - Macedonia
  - Romania
  - Serbia
  - Slovenia
  - Turkey
  - Moldova

- Ukraine data was not available

Data issue

- Input data:
  - Generation capacity (electricity production)
  - Demand
  - Characteristics of the transmission network (voltage level: 110kV and up) except Montenegro and Slovenia (voltage level: 220kV and up)
  - Winter peak for 2020, 2025 and 2030 for all countries plus summer peak for Moldova (SECI and Moldova projects)

Network model characterisation

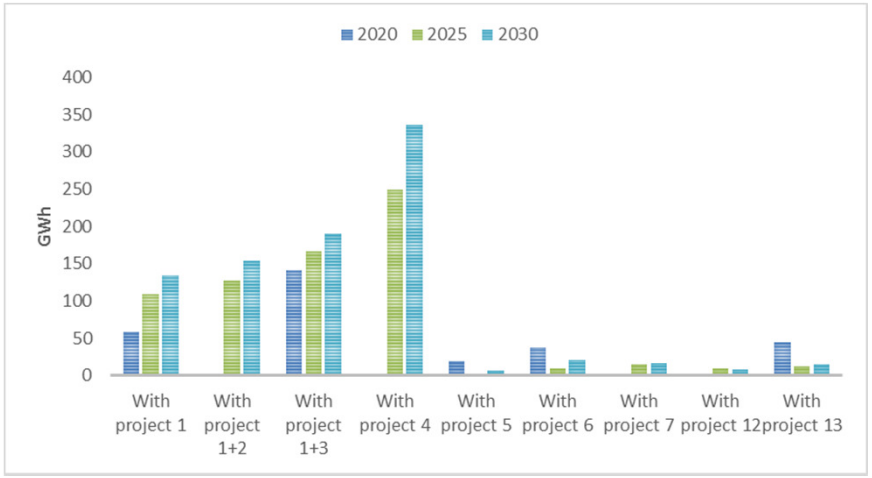
- Planning horizon:
  - 2020
  - 2025
  - 2030
  - Two methodology are applied:
    - Take Out One at the Time (TOOT)
    - Put In one at the Time (PINT)
  - The EC-TC model represents the actual network power flows
- Output:
  - Additionally, the following assessments are obtained:
    - Changes in net transfer capacity (NTC)
    - Changes in non served energy
    - Changes in transmission losses

Criteria – Reduction in Transmission Losses

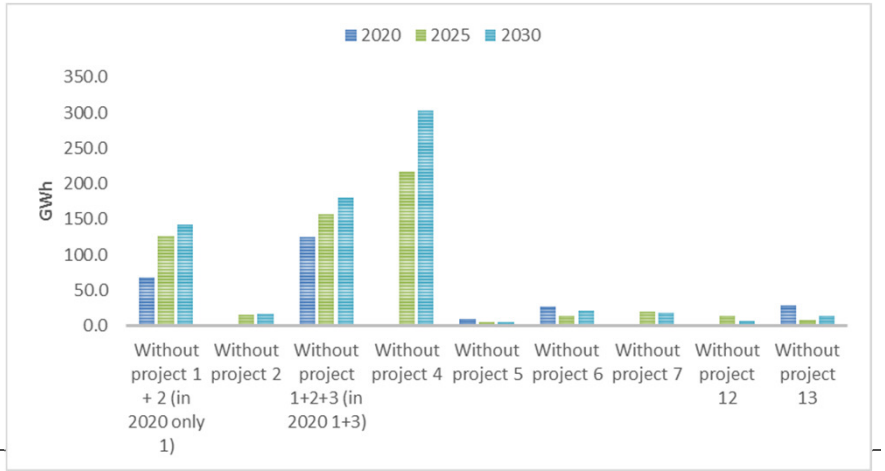
- AC – directly calculated (yearly)
- Without project 2020

For project EL_04 (BA-HR), ENTSO-E 2014 loss values were used, due to data inconsistency

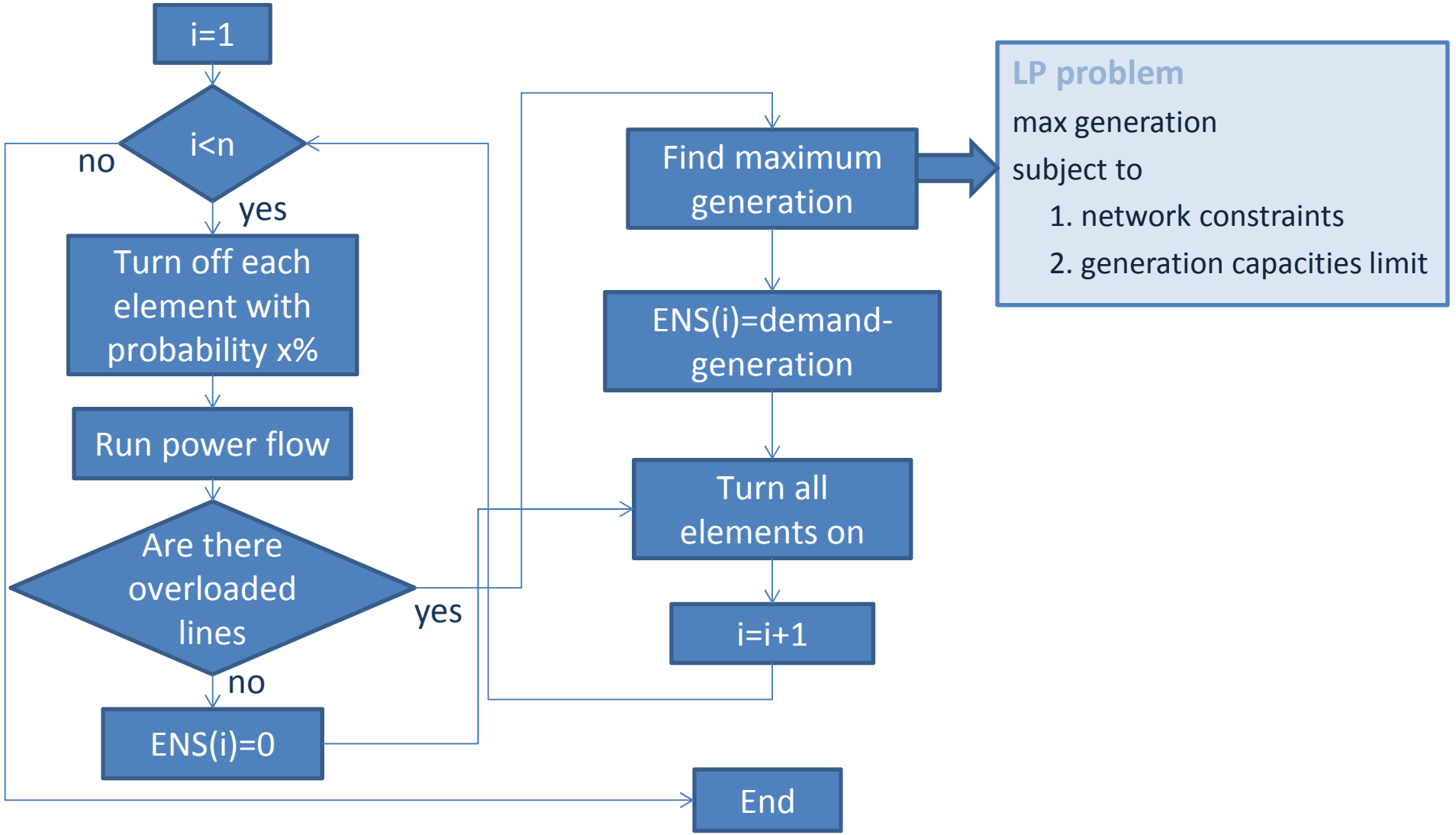
▪ *PINT*



▪ *TOOT*

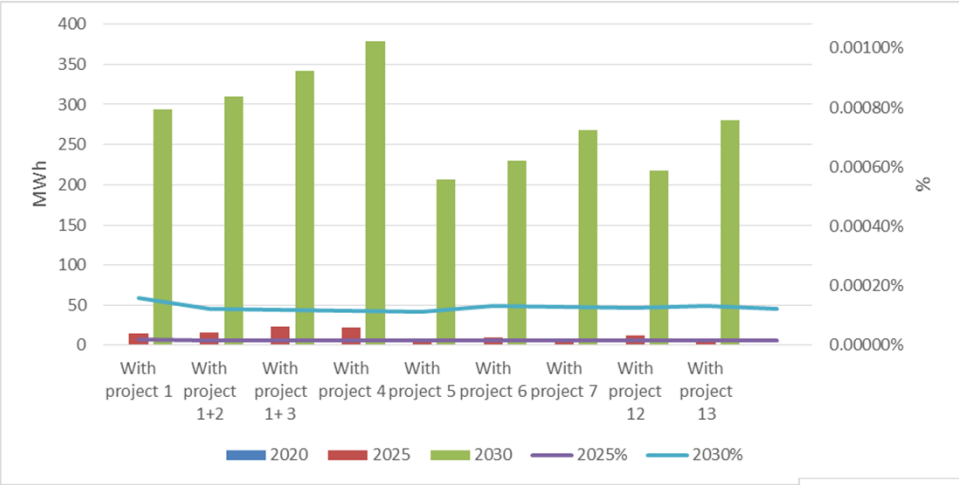


Criteria – Changes in Energy Not Served (ENS)



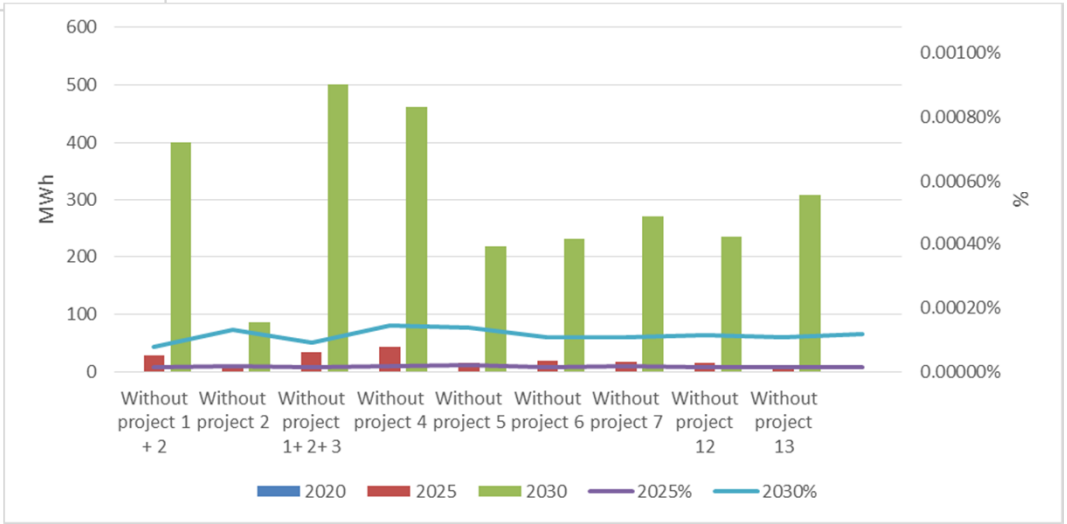
Criteria – Changes in Energy Not Supplied

▪*PINT*



% change depicted in figures show ENS compared to yearly consumption

▪*TOOT*



Criteria – Changes in Net Transfer Capacity (NTC)

- Calculation of NTC between two counties

  increase generation in country 1 (or in more courtiers)

  decrease generation in country 2

LP problem

max generation in country 1

subject to

1.Generation from the reference scenario = generation from increasing/decreasing (NTC) scenario

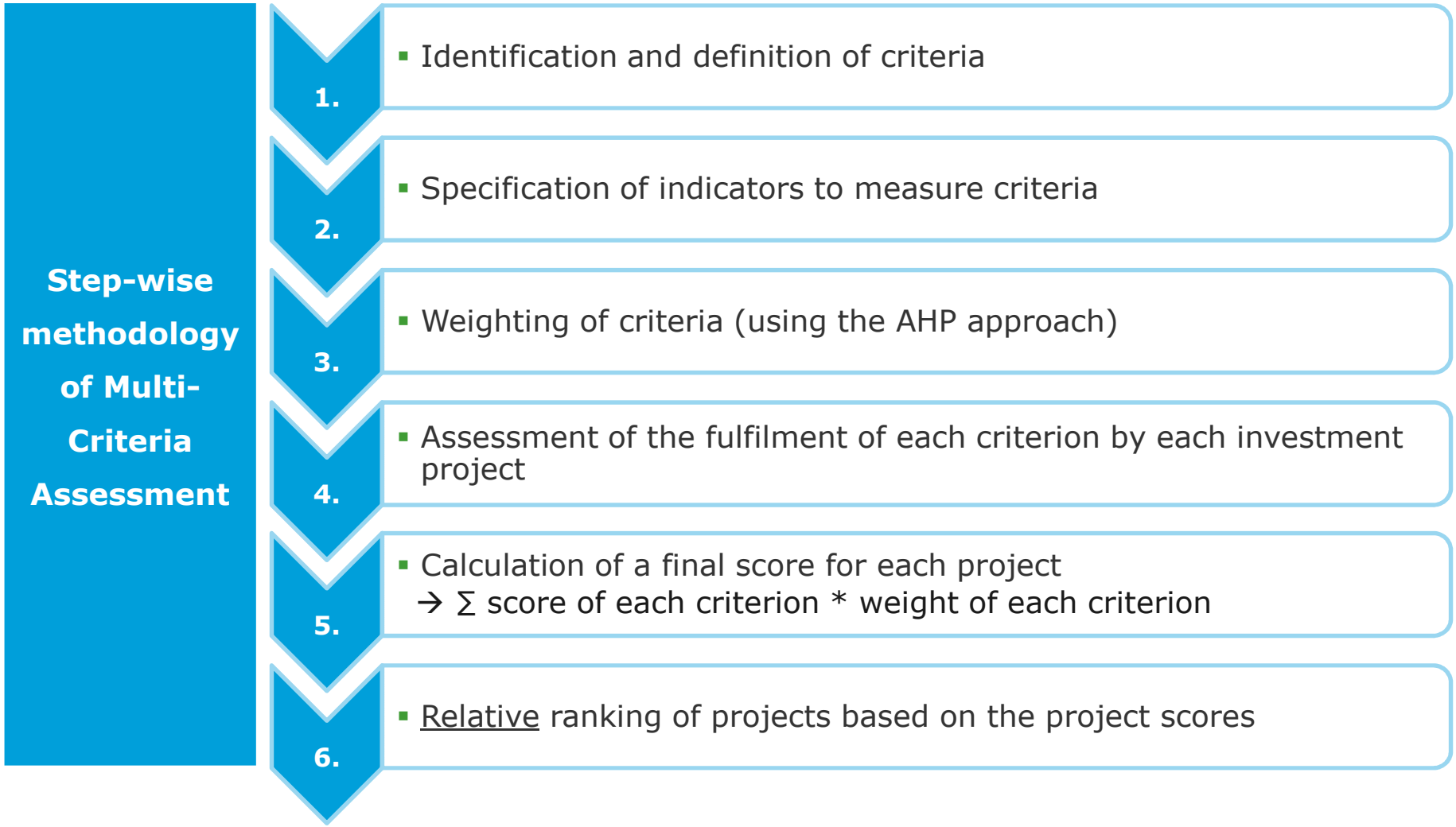
2. network constraints

3. generation capacities limit

N-1 criteria

Multi Criteria Assessment

Overview on Multi-Criteria Assessment Methodology



Project Assessment Criteria

1 Change in socio-economic welfare

- *Incremental welfare changes* resulting from individual investment projects are estimated as regards the project's impact on
  - **market integration / price convergence**
  - **improvement of security of supply**
  - **reduction of CO2 emissions**
- Calculation of the **economic net-present value (NPV)** discounting the incremental costs and benefits of each investment project back to their present values

2 System Adequacy

- The incremental *improvement of overall system reliability* is calculated as the change of the **system adequacy index (SAI)** with and without the individual project
- The higher the value of the index the higher the level of system reliability

$$SAI = \frac{(\text{generation} + \text{interconnection}) - \text{peak demand}}{\text{peak demand}}$$

Project Assessment Criteria

3

Enhancement of Competition

- *Incremental enhancement of competition* is calculated as change in the simplified **Herfindahl-Hirschman Index (HHI)** with and without the individual project
- The HHI is calculated by summing the squares of the individual market shares in electricity generation, accounting for interconnection capacities
  - market shares in **electricity generation** are based on ownership of generation capacities in the respective countries (assigning them to the majority shareholder)
  - "market shares" of for **electricity interconnection** are calculated, whereas each interconnector is counted as an additional market player

Project Assessment Criteria

4

Progress in Implemen-tation

- The **Progress in Implementation Index (MPI)** assesses the preliminary implementation potential of each individual project based on information provided in questionnaires:
  - Commissioning = 5 points (maximum score)
  - Construction = 4.63 points
  - Tendering = 4.27 points
  - Final Investment Decision (FID) = 3.90 points
  - Financing Secured = 3.54 points
  - Permitting = 3.18 points
  - Public consultation of Art. 9 = 2.81 points
  - Preliminary investment decision = 2.45 points
  - Market test = 2.09 points
  - Preliminary design studies = 1.72 points
  - Planning approval = 1.36 points
  - Consideration phase or no information provided = 1 point (minimum score)

Project Assessment Criteria

Calculation of Indicators

SAI, HHI

- Indices calculated
  - with and without the individual project
  - for the year of commissioning of the project
  - as aggregate of the impacts in the countries on each end of the interconnector

Scoring of Indicators

NPV, SAI, HHI

- Score of 1 and 5 assigned to projects with the smallest and largest change in the indicator respectively
- Scores of projects with changes in-between calculated by linear interpolation between min and max values of the change of the indicator
- Where changes of an individual indicator are significantly larger for one project than for all other projects this project has been treated as an outlier and the interpolation been conducted between all other projects
- Negative NPVs scored with 0

Assessment Results

Results of the reference scenario - PINT

Real 2016 values

Project code	Country	Welfare change, m€				Investment cost	OM cost	Transmission loss reduction,	ENS, m€	NPV, m€
		Consumer	Producer	Rent	Subtotal					
el_01+el_03	RO-RS-ME-BA	1 493	-1 005	-302	187	XXX	XXX	92	3	-32
el_02	RS	0	0	0	0	XXX	XXX	8	0	-28
el_04	BA-HR	4	-1	-2	0	XXX	XXX	30	4	-13
el_05	MD-RO	-143	329	-121	65	XXX	XXX	3	2	8
el_06	MD-RO	-143	329	-121	65	XXX	XXX	10	2	-54
el_07	MD-RO	-166	365	-128	71	XXX	XXX	7	3	-28
el_08	UA-PL	7 723	-7 287	731	1 167	XXX[1]	XXX	n.a.	n.a.	1 020
el_09	UA-SK	5 921	-5 749	628	799	XXX[1]	XXX	n.a.	n.a.	788
el_10	UA-RO	2 014	-2 782	1 165	397	XXX[1]	XXX	n.a.	n.a.	200
el_12	MK-KO*	16	30	-34	12	XXX[2]	XXX	3	1	12
el_13	MK-AL	-95	149	-39	15	XXX	XXX	10	2	-97
el_01	RO-RS-ME-BA	1 474	-991	-296	187	XXX	XXX	58	2	87
el_03	ME-RS	-78	129	-38	14	XXX	XXX	24	0	-114

[1]: In the Ukrainian projects back-to-back station cost might not be included

[2]: Investment cost of Kosovo* part of the project might not be included

PI
<0.9
>1.1
between 0.9-1.1

- EL_01 and EL_03 projects are interlinked agreed on the second Group Meeting, but also assessed individually -> EL_01 alone has a positive NPV
- EL_02 is a dependent project on EL_01
- PI=(welfare change+transmission loss reduction+ENS)/(-inv. cost-OM cost)

Overall Results – Scores & Ranking

Project ID		Project Name	Result of the CBA (NPV) 60%	Improvement of System Reliability (SRI) 15%	Enhancement of Competition (IRD) 15%	Project Maturity (MPI) 10%	Total Score	Rank
el_09	**UA-SK**	OHL rehabilitation Mukacheve (Ukraine) – V.Kapusany (Slovakia)	5,00	1,84	3,14	3,18	4,03	**1**
el_08	**UA-PL**	Interconnection of ENTSOE and Ukrainian network Khmelnytska NPP (Ukraine) – Rzeszow (Poland)	5,00	1,52	2,43	3,18	3,88	**2**
el_10	**UA-RO**	OHL modernisation and construction, Pivdennoukrainska NPP (Ukraine) – Isaccea (Romania) with Primorska – Isaccea OHL construction.	4,00	2,17	3,05	1,00	3,26	**3**
el_01+03	RO-RS-ME-BA	Transbalkan corridor phase 1 + Grid Section in Montenegro	0,00	5,00	5,00	1,73	1,67	**4**
el_12	MK-KO*	Interconnection Skopje 5 - New Kosovo	1,06	1,06	1,95	1,73	1,23	**5**
el_05	MD-RO	Interconnection between Balti (Moldova) and Suceava (Romania)	1,00	1,23	1,73	1,00	1,13	**6**
el_13	MK-AL	Interconnection Bitola(MK)Elbasan(AL)	0,00	1,93	2,54	1,73	0,83	**7**
el_06	MD-RO	B2B station on OHL 400 kV Vulcanesti (MD) Issacea (RO) and new OHL Vulcanesti (MD) Chisinau (MD)	0,00	1,23	1,73	1,36	0,57	**8**
el_07	MD-RO	Power Interconnection Straseni (Moldova) and Iasi (Romania) with B2B in Straseni (MD)	0,00	1,19	1,73	1,36	0,56	**9**
el_04	BA-HR	Interconnection between Banja Luka (BA) and Lika (HR)	0,00	1,00	1,45	1,73	0,53	**10**
el_02	RS	Transbalkan corridor phase 2, 400 kV OHL Bajina Basta Kraljevo 3	0,00	1,00	1,00	1,73	0,47	**11**

Negative NPVs

Overall Results – Scores & Ranking

Rank	Project ID	Project Name
1	el_09	OHL rehabilitation Mukacheve (Ukraine) – V.Kapusany (Slovakia)
2	el_08	Interconnection of ENTSOE and Ukrainian network Khmelnytska NPP (Ukraine) – Rzeszow (Poland)
3	el_10	OHL modernisation and construction, Pivdennoukrainska NPP (Ukraine) – Isaccea (Romania) with Primorska – Isaccea OHL construction.
4	el_01+03	Transbalkan corridor phase 1 + Grid Section in Montenegro
5	el_12	Interconnection Skopje 5 - New Kosovo
6	el_05	Interconnection between Balti (Moldova) and Suceava (Romania)
7	el_13	Interconnection Bitola(MK)Elbasan(AL)
8	el_06	B2B station on OHL 400 kV Vulcanesti (MD) Issacea (RO) and new OHL Vulcanesti (MD) Chisinau (MD)
9	el_07	Power Interconnection Straseni (Moldova) and Iasi (Romania) with B2B in Straseni (MD)
10	el_04	Interconnection between Banja Luka (BA) and Lika (HR)
11	el_02	Transbalkan corridor phase 2, 400 kV OHL Bajina Basta Kraljevo 3

Positive NPVs

Negative NPVs

Overall Results – Scores & Ranking (el_1 and el_3 separated)

Project ID	Contract. Party or EU MS involved	Project Name	Indicators (Scores) [Scale 1 (min) to 5 (max)]				Total Scores	Ranking
			Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)		
el_09	**UA-SK**	OHL rehabilitation Mukacheve (Ukraine) – V.Kapusany (Slovakia)	5,00	2,50	4,58	3,18	4,32	**1**
el_08	**UA-PL**	Interconnection of ENTSOE and Ukrainian network Khmelnytska NPP (Ukraine) – Rzeszow (Poland)	5,00	1,93	3,39	3,18	4,07	**2**
el_10	**UA-RO**	OHL modernisation and construction, Pivdennoukrainska NPP (Ukraine) – Isaccea (Romania) with Primorska – Isaccea OHL construction.	4,00	3,08	4,44	1,00	3,59	**3**
el_01	**RO-RS-ME-BA**	**Transbalkan corridor phase 1**	2,23	3,64	5,00	1,73	2,81	**4**
el_03	**ME-RS**	**Grid Section in Montenegro**	0,00	5,00	2,73	4,64	1,62	**5**
el_12	MK-KO*	Interconnection Skopje 5 New Kosovo	1,06	1,10	2,59	1,73	1,32	**6**
el_05	MD-RO	Interconnection between Balti (Moldova) and Suceava (Romania)	1,00	1,41	2,23	1,00	1,22	**7**
el_13	MK-AL	Interconnection Bitola(MK)Elbasan(AL)	0,00	2,66	3,59	1,73	1,08	**8**
el_06	MD-RO	B2B station on OHL 400 kV Vulcanesti (MD) Issacea (RO) and new OHL Vulcanesti (MD) Chisinau (MD)	0,00	1,41	2,23	1,36	0,66	**9**
el_07	MD-RO	Power Interconnection Straseni (Moldova) and Iasi (Romania) with B2B in Straseni (MD)	0,00	1,34	2,23	1,36	0,65	**10**
el_04	BA-HR	Interconnection between Banja Luka (BA) and Lika (HR)	0,00	1,00	1,75	1,73	0,56	**11**
el_02	RS	Transbalkan corridor phase 2, 400 kV OHL Bajina Basta Kraljevo 3	0,00	1,00	1,00	1,73	0,47	**12**

Negative NPVs

Sensitivity Analysis

Description of the assessed sensitivity cases

- Six sensitivity cases are analysed
- Demand and gas prices are symmetrical cases
  - For demand we have assumed +/- 0.5 % differences in the yearly demand growth rate
  - For gas prices we assume the minimum and the maximum gas prices of the sensitivity analyses in the gas market modelling
- In the reference scenario we assume that CO2 price increase to 22 €/T by 2030, while in the sensitivity analyses in growth to 40 €/t
- TOOT method is also assessed

Results of the sensitivity assessment, m€

NPV, m€		REF	CO2	High gas	Low gas	Low demand	High demand	TOOT
el_01+el_03	RO-RS-ME-BA	-32	302	-60	-43	-115	323	-36
el_02	RS	-28	-25	-28	-28	-28	-28	-29
el_04	BA-HR	-13	4	-10	-12	-17	-8	20
el_05	MD-RO	8	129	4	5	58	17	-58
el_06	MD-RO	-54	69	-58	-56	-5	-45	-119
el_07	MD-RO	-28	101	-32	-31	26	-19	-98
el_08	UA-PL	1020	1228	1067	986	856	1 945	370
el_09	UA-SK	788	924	782	742	577	1 428	283
el_10	UA-RO	200	298	254	184	222	195	-5
el_12	MK-KO*	12	54	10	9	25	4	0
el_13	MK-AL	-97	-32	-98	-99	-82	-108	-115
el_01	RO-RS-ME-BA	87	413	59	76	6	440	86
el_03	ME-RS	-114	-11	-113	-114	-104	-125	-137

Competing projects

Results of the sensitivity assessment II.

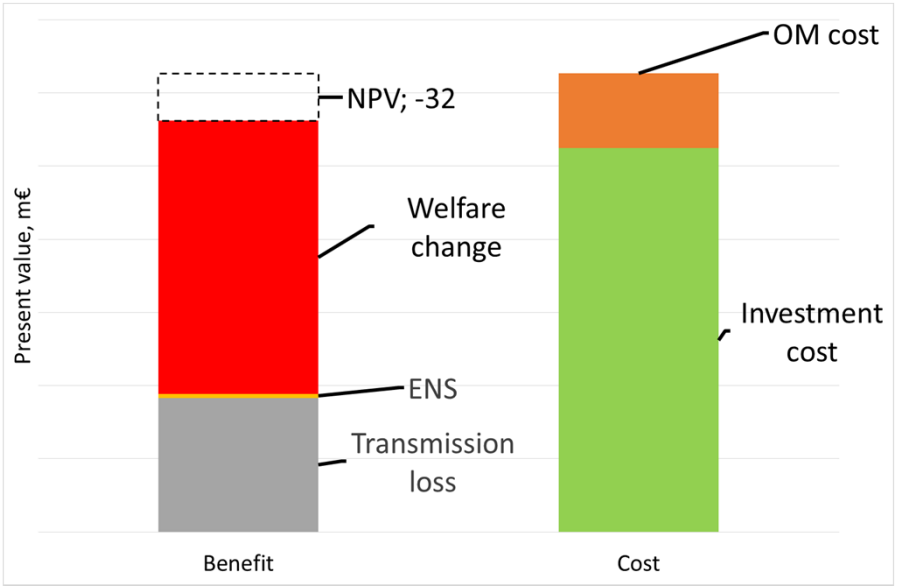
- Sensitivity assessment shows robust results
  - Only in a few cases there is a change in the sign of the NPV
- CO_2 price increase has the most significant impact on project NPV:
  - CO_2 price increases lead to higher wholesale electricity prices with higher differences in the countries, which in turn increases the utilization of the new lines
- Gas price and demand change has more limited effect compared to CO_2 and TOOT
- The TOOT assessment shows the expected results:
  - Competing projects (3 Moldovan and the 3 Ukrainian interconnector) see significantly reducing benefits in this case as project reduce each others effect
  - Two of the projects even become negative NPV
- **Three projects of Ukraine are competing projects, significantly reducing each-others benefits as shown by the TOOT assessment. Recommendation: only select the two positive NPV projects: UA-SK and UA-PL as Project of Mutual Interest (PMI), as the three projects together would already reduce overall welfare.**

Assessment Results for Individual Projects

Project El_01+EL_03 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
RO	RS	2018	750	750
RS	RO	2018	450	450
RS	ME	2023	500	500
ME	RS	2023	500	500
RS	BA	2023	600	600
BA	RS	2023	500	500
ME	RS	2020	1000	1000
RS	ME	2020	1100	1100

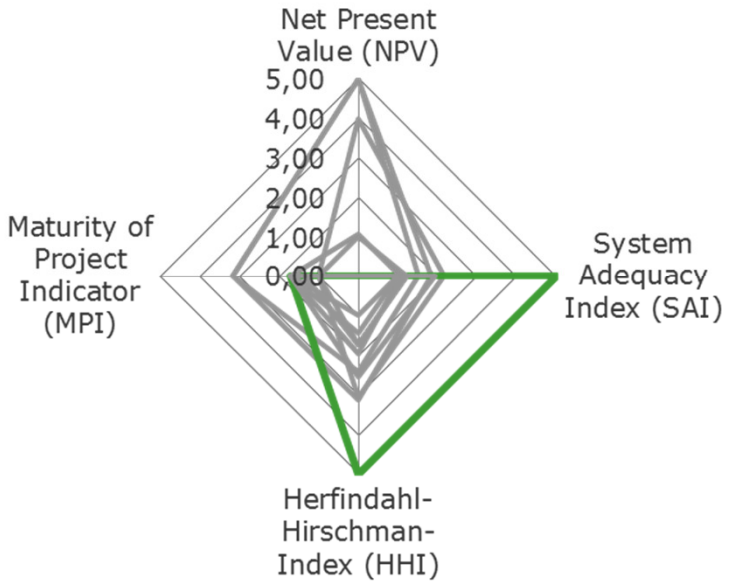
	Welfare change, m€				Transmission loss, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-37	39	-3	-1	3	2
BA	-94	124	-20	11	37	47
BG	257	-133	6	129	4	133
GR	-72	96	-37	-13	1	-11
HR	-5	11	9	15	17	32
HU	-6	13	-45	-39	0	-39
IT	63	-46	14	31	0	31
KO*	17	-7	-16	-6	1	-5
MD	140	-119	-1	20	0	20
ME	-15	24	-8	0	14	14
MK	20	-6	-12	2	0	2
PL	-3	2	2	1	0	1
RO	1 125	-949	-99	77	4	81
RS	94	-41	-89	-36	11	-26
SK	8	-11	4	2	0	2
UA	1	0	-6	-5	0	-5
Total	**1 493**	**-1 005**	**-302**	**187**	**92**	**278**



- Total NPV is negative for the merged project
- Profitability index: 0.9
- There is strong distributional effect: Serbia has negative impact: compensation mechanisms should be in place

Project El_01+EL_03 – MCA

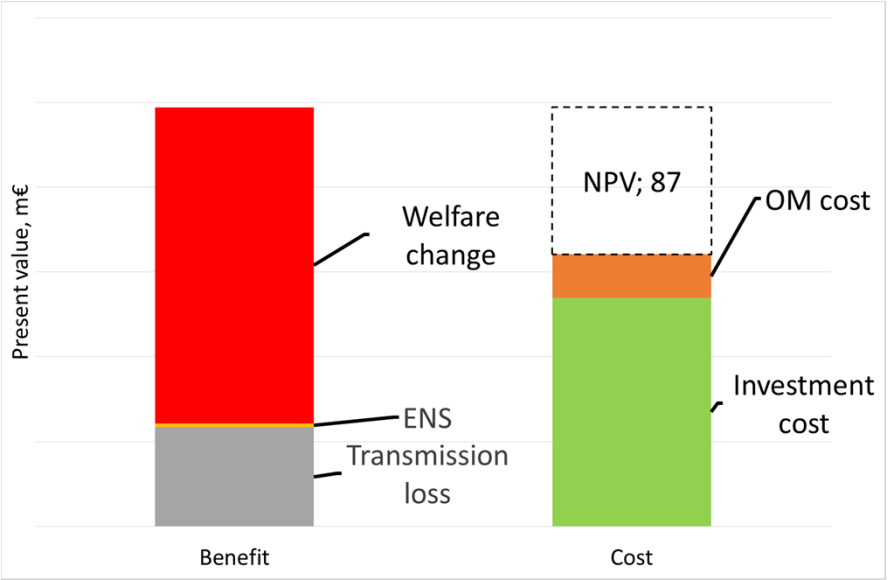
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	0,00	5,00	5,00	1,73	1,67	4
Value	-32	3,66	3182	Preliminary design studies		



Project El_01 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
RO	RS	2018	750	750
RS	RO	2018	450	450
RS	ME	2023	500	500
ME	RS	2023	500	500
RS	BA	2023	600	600
BA	RS	2023	500	500

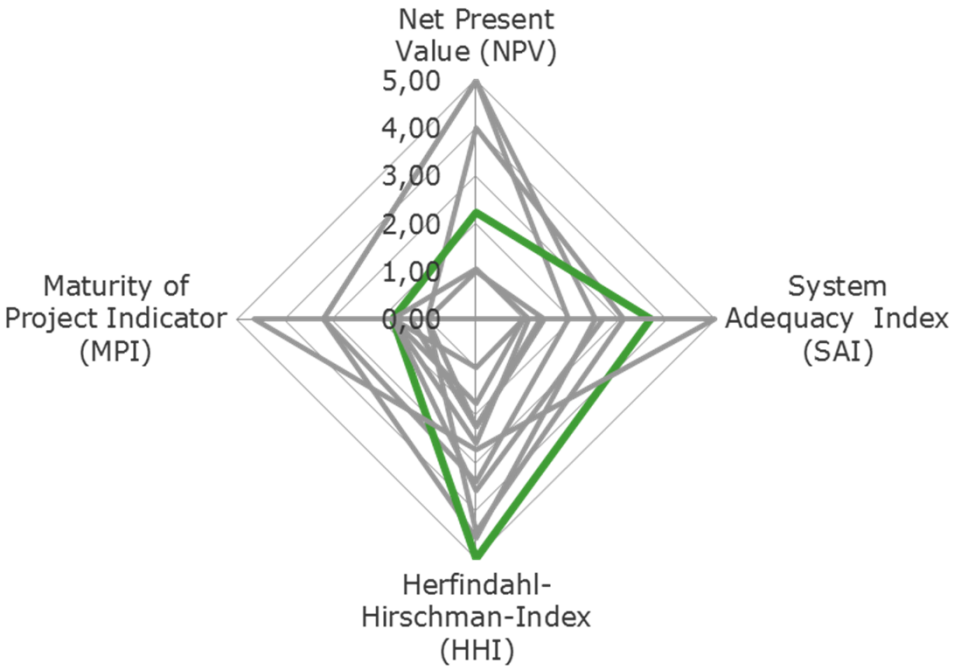
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-37	39	-3	-1	1	0
BA	-93	123	-19	11	23	34
BG	251	-129	6	128	3	132
GR	-74	98	-36	-12	1	-11
HR	-4	10	10	16	12	28
HU	-6	13	-44	-38	0	-38
IT	68	-51	13	30	0	30
KO*	15	-7	-15	-7	1	-6
MD	140	-119	-1	20	0	20
ME	-15	23	-8	0	1	1
MK	18	-5	-12	2	0	1
PL	-3	2	2	1	0	1
RO	1 116	-940	-99	77	4	81
RS	87	-37	-87	-37	13	-24
SK	8	-11	4	2	0	2
UA	1	0	-6	-5	0	-5
Total	**1 474**	**-991**	**-296**	**187**	**58**	**245**



- Three country interconnector alone has positive NPV
- PI index: 1.5
- But similarly as before: strong distributional effect (RS negative impact) call for compensation mechanisms

Project El_01 - MCA

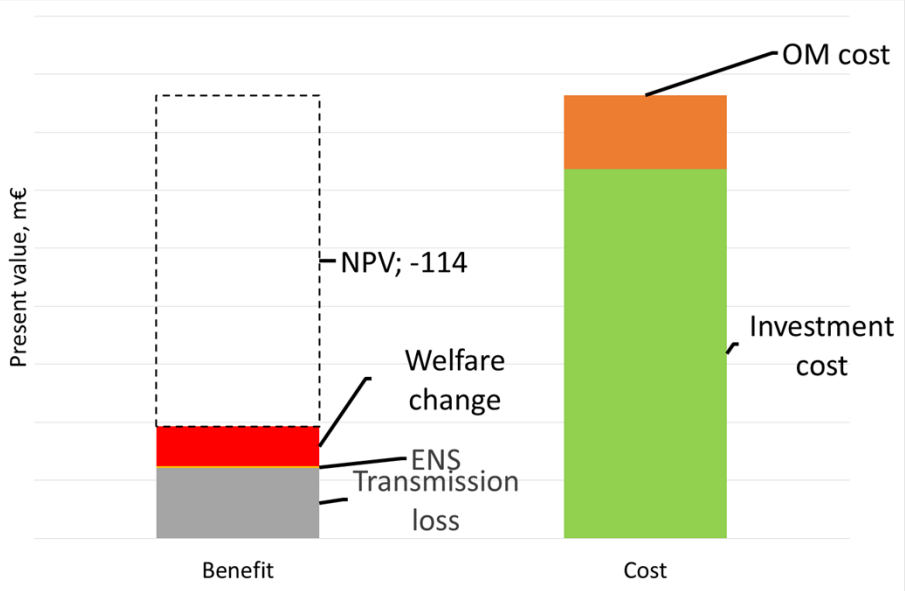
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	2,23	3,64	5,00	1,73	2,81	4
Value	87	1,46	2062	Preliminary design studies		



Project El_03 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
ME	RS	2020	1000	1000
RS	ME	2020	1100	1100

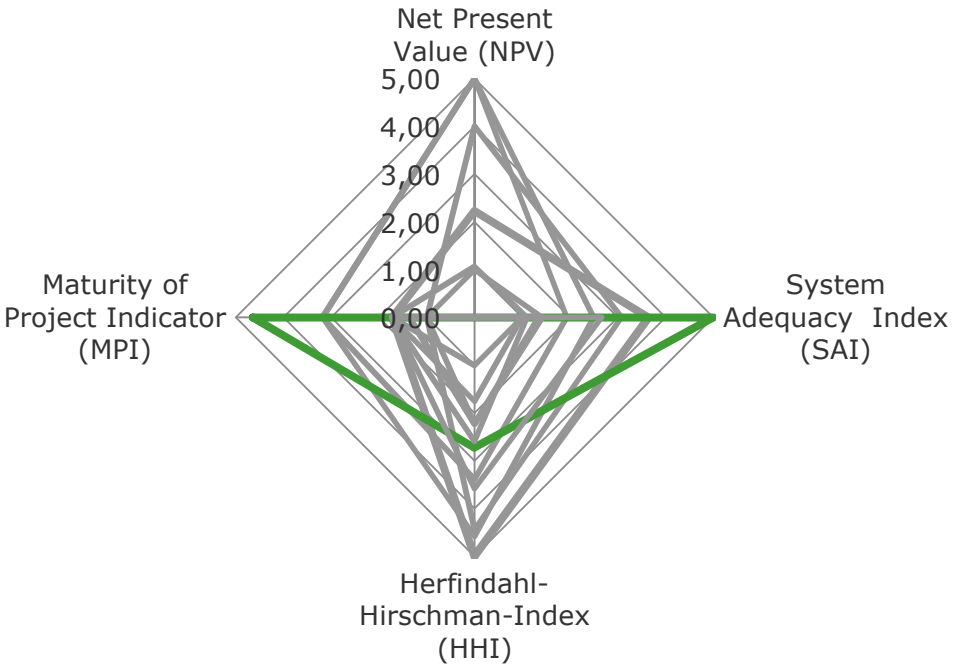
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-53	56	-1	2	2	3
BA	-32	24	-7	-15	9	-5
BG	9	-6	-5	-2	0	-1
GR	-20	24	-1	4	0	4
HR	-2	2	2	3	5	8
HU	0	1	-4	-3	0	-3
IT	-39	37	23	21	0	21
KO*	8	-4	-6	-1	1	-1
MD	0	0	0	0	0	0
ME	-21	34	-2	11	9	20
MK	12	-5	-3	5	0	5
PL	0	0	0	0	0	0
RO	11	-13	-2	-3	0	-3
RS	46	-22	-33	-8	-2	-10
SK	0	0	0	0	0	0
UA	0	0	0	0	0	0
Total	**-78**	**129**	**-38**	**14**	**24**	**38**



- A late commissioning project of 2030
- With highly negative NPV, monetised benefits far below investment/operation costs
- PI index: 0.25

Project El_03 - MCA

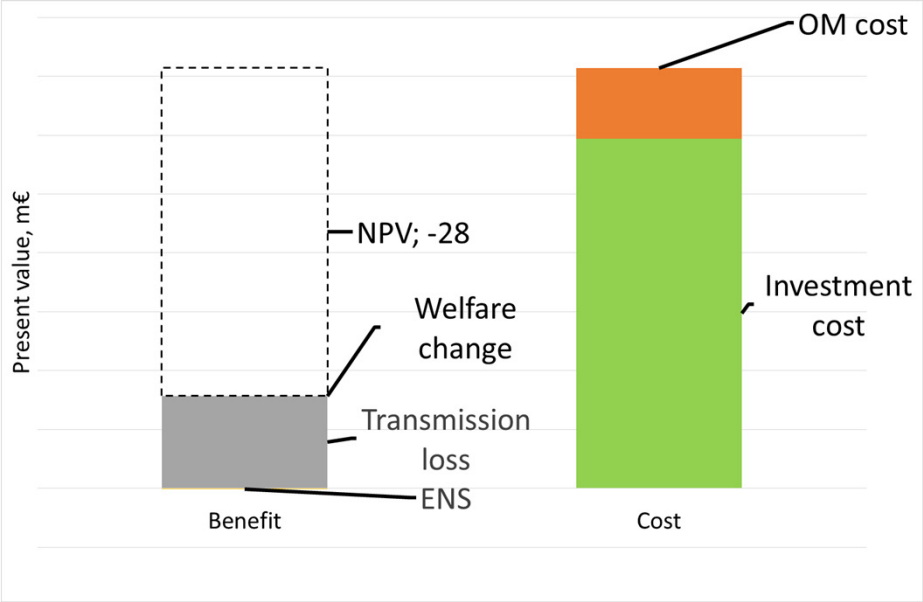
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	0,00	5,00	2,73	4,64	1,62	5
Value	-114	2,20	1120	Construction		



Project El_02 - CBA

- No NTC impact

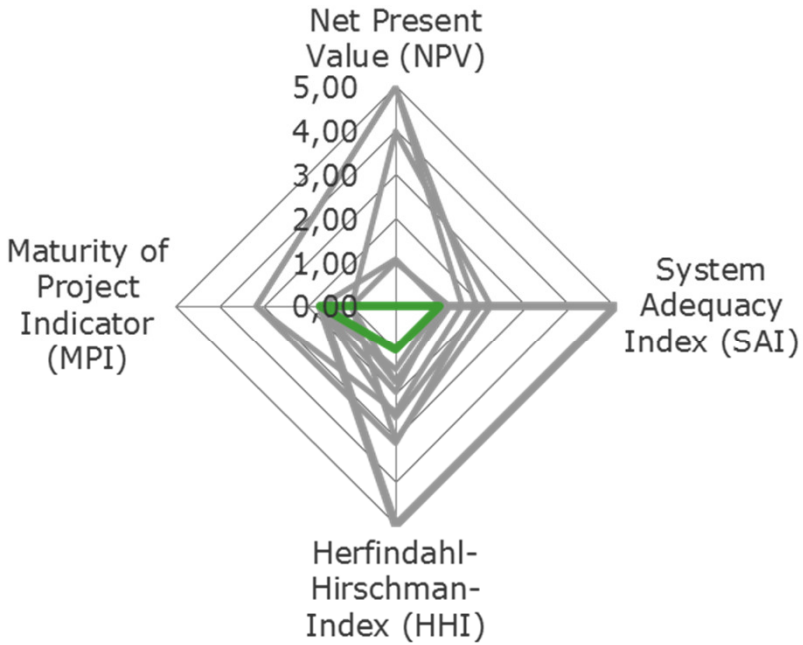
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	0	0	0	0	0	0
BA	0	0	0	0	0	0
BG	0	0	0	0	0	0
GR	0	0	0	0	0	0
HR	0	0	0	0	1	1
HU	0	0	0	0	0	0
IT	0	0	0	0	0	0
KO*	0	0	0	0	1	1
MD	0	0	0	0	0	0
ME	0	0	0	0	1	1
MK	0	0	0	0	0	0
PL	0	0	0	0	0	0
RO	0	0	0	0	0	0
RS	0	0	0	0	5	5
SK	0	0	0	0	0	0
UA	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**8**	**8**



- RS domestic project, with no quantified NTC impact
- As a result no quantified social welfare benefits
- Only benefit is on loss reduction at the moment
- PI index: 0.22

Project El_02 - MCA

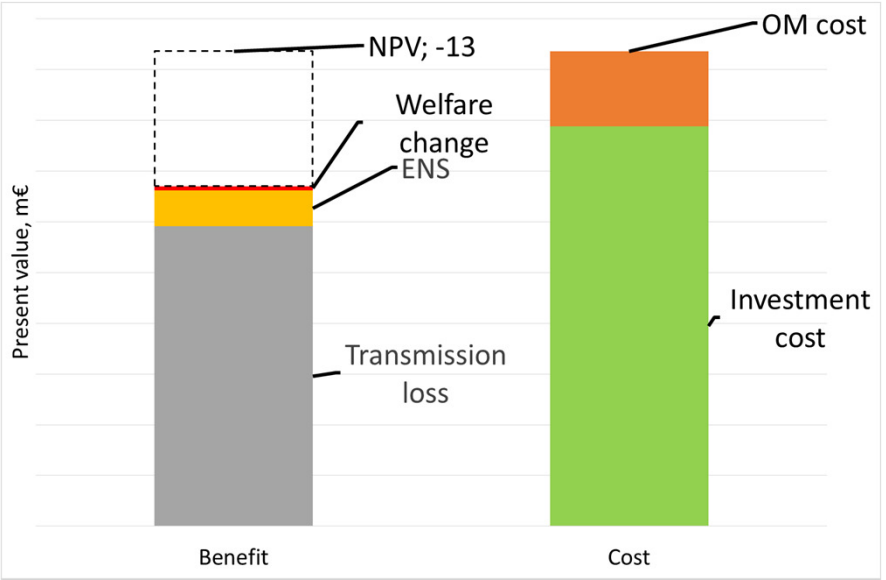
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	0,00	1,00	1,00	1,73	0,47	11
Value	-28	0,00	405	Preliminary design studies		



Project El_04 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
BA	HR	2030	504	504

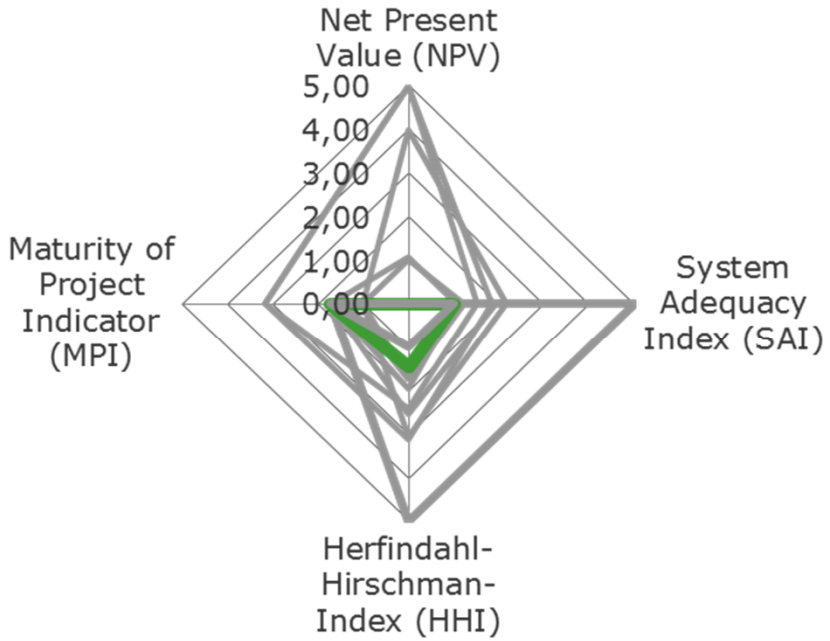
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	1	-1	2	2	0	2
BA	20	-15	-2	4	5	8
BG	0	0	0	0	0	0
GR	1	-1	0	0	0	0
HR	-8	6	-6	-8	24	17
HU	-16	19	1	4	0	4
IT	0	0	-5	-5	0	-5
KO*	0	0	1	1	0	1
MD	0	0	0	0	0	0
ME	5	-7	1	-2	0	-2
MK	0	0	0	0	0	0
PL	0	0	0	0	0	0
RO	1	0	-1	0	0	0
RS	1	-1	3	4	1	4
SK	0	0	3	3	0	3
UA	-2	0	1	-1	0	-1
Total	**4**	**-1**	**-2**	**0**	**30**	**30**



- A late commissioning project (2030) with negative NPV
- RISK: Most of the benefit is come from transmission loss reduction
- PI index: 0.72

Project El_04 - MCA

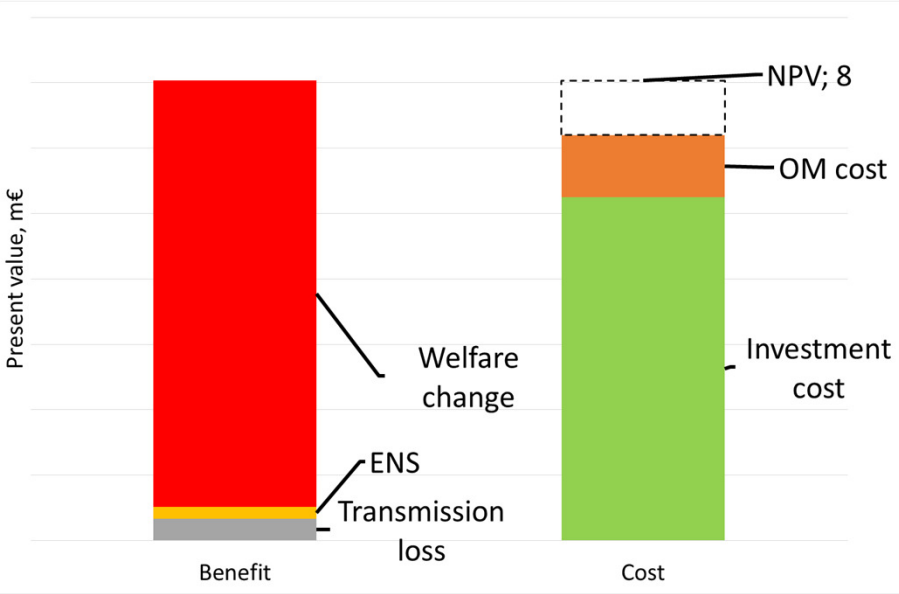
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	0,00	1,00	1,45	1,73	0,53	10
Value	- 13	0,34	716	Preliminary design studies		



Project El_05 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
MD	RO	2022	500	500

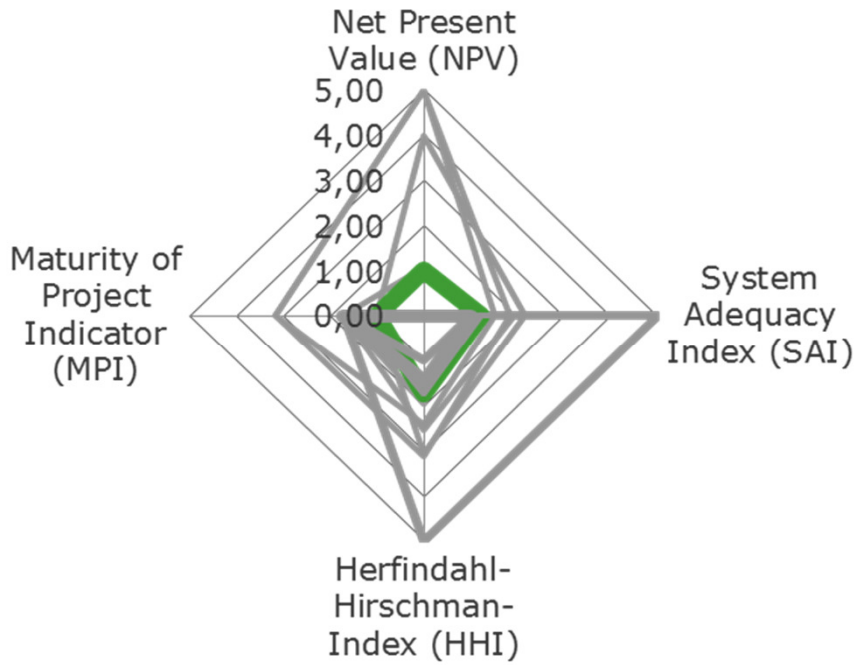
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-7	7	0	0	0	0
BA	-7	9	1	3	0	3
BG	-125	88	7	-29	1	-29
GR	-65	80	11	26	0	26
HR	-11	11	1	1	1	1
HU	-23	22	0	-1	0	-1
IT	-81	71	1	-9	0	-9
KO*	-6	4	-1	-3	0	-3
MD	437	-232	-66	138	-6	132
ME	-3	5	-1	1	0	1
MK	-9	5	-2	-7	0	-7
PL	0	0	-1	-1	0	-1
RO	-200	232	-69	-36	8	-28
RS	-35	22	-4	-18	0	-18
SK	-4	6	2	4	0	4
UA	-3	0	0	-2	0	-2
Total	**-143**	**329**	**-121**	**65**	**3**	**69**



- Positive NPV project, but with asymmetric benefit distribution, for Romania benefits are negative (BG, RS also negatively impacted), but for Moldova high benefits could be observed
- PI index: 1.13

Project El_05 - MCA

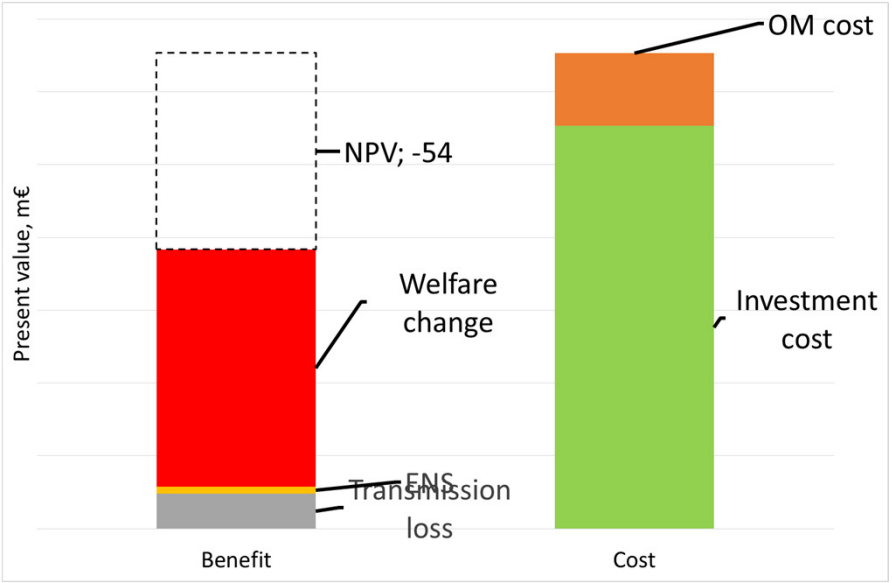
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	Total Score	**Ranking**
Score	1,00	1,23	1,73	1,00	1,13	6
Value	8	0,53	915	Consideration phase		



Project El_06 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
MD	RO	2025	500	500

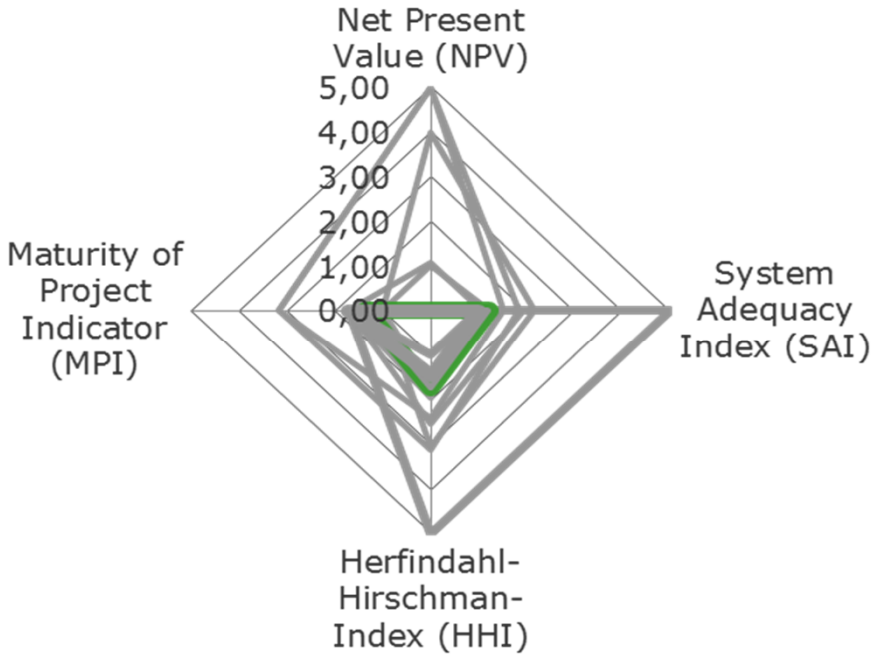
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-7	7	0	0	0	0
BA	-7	9	1	3	1	3
BG	-125	88	7	-29	0	-30
GR	-65	80	11	26	0	26
HR	-11	11	1	1	2	3
HU	-23	22	0	-1	0	-1
IT	-81	71	1	-9	0	-9
KO*	-6	4	-1	-3	0	-3
MD	437	-232	-66	138	7	145
ME	-3	5	-1	1	0	1
MK	-9	5	-2	-7	0	-7
PL	0	0	-1	-1	0	-1
RO	-200	232	-69	-36	0	-36
RS	-35	22	-4	-18	0	-18
SK	-4	6	2	4	0	4
UA	-3	0	0	-2	0	-2
Total	**-143**	**329**	**-121**	**65**	**10**	**75**



- Project with negative NPV, but high benefits for Moldova
- Many neighbours (BG, RO, RS) take some negative welfare impacts due to price increase
- PI Index: 0.59

Project El_06 - MCA

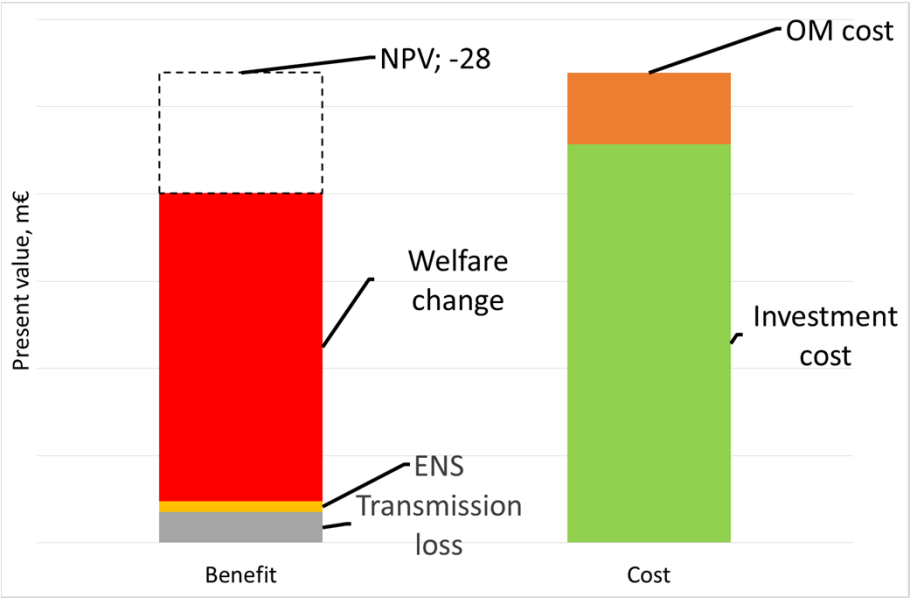
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	0,00	1,23	1,73	1,36	0,57	8
Value	-54	0,53	915	Planning approval		



Project El_07 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
MD	RO	2025	500	500

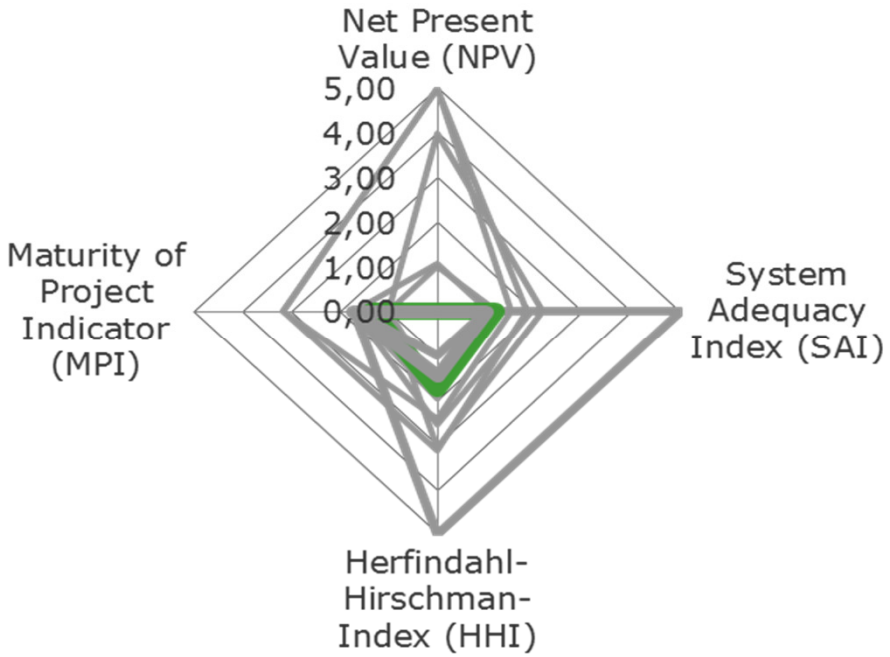
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-8	8	0	0	0	0
BA	-8	10	1	3	0	3
BG	-137	97	8	-32	1	-32
GR	-70	86	12	29	0	29
HR	-12	12	1	1	2	2
HU	-25	24	0	-1	0	-1
IT	-88	77	1	-10	0	-10
KO*	-7	4	-1	-3	0	-3
MD	466	-247	-70	148	-8	141
ME	-3	5	-1	1	0	1
MK	-10	5	-2	-7	0	-7
PL	0	0	-1	-1	0	-1
RO	-220	255	-73	-38	12	-26
RS	-38	23	-5	-20	0	-20
SK	-4	6	2	4	0	4
UA	-3	0	0	-3	0	-3
Total	**-166**	**365**	**-128**	**71**	**7**	**78**



- Negative NPV
- High increase in welfare of Moldova does not compensate for losses of others (BG, RO, RS)
- PI index: 0.74

Project El_07 - MCA

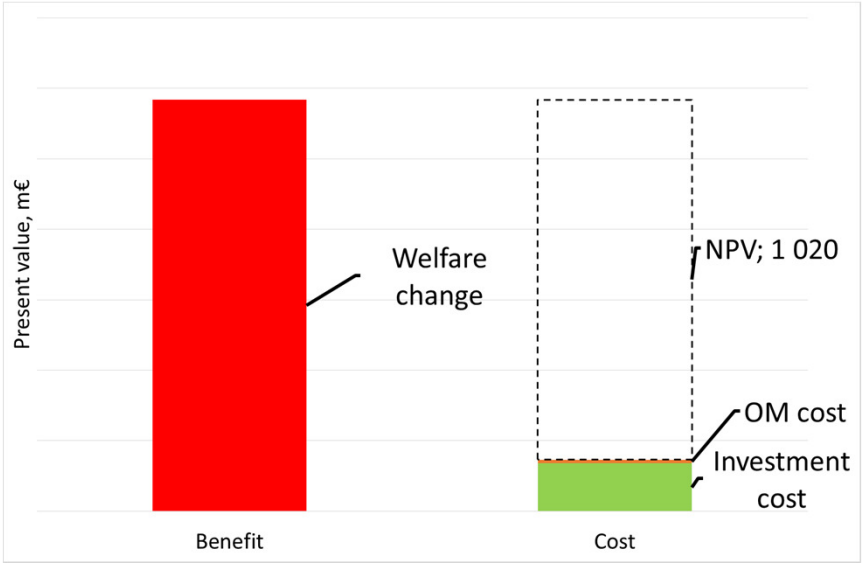
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	0,00	1,19	1,73	1,36	0,56	9
Value	-28	0,50	915	Planning approval		



Project El_08 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
UA_E	PL	2020	600	600

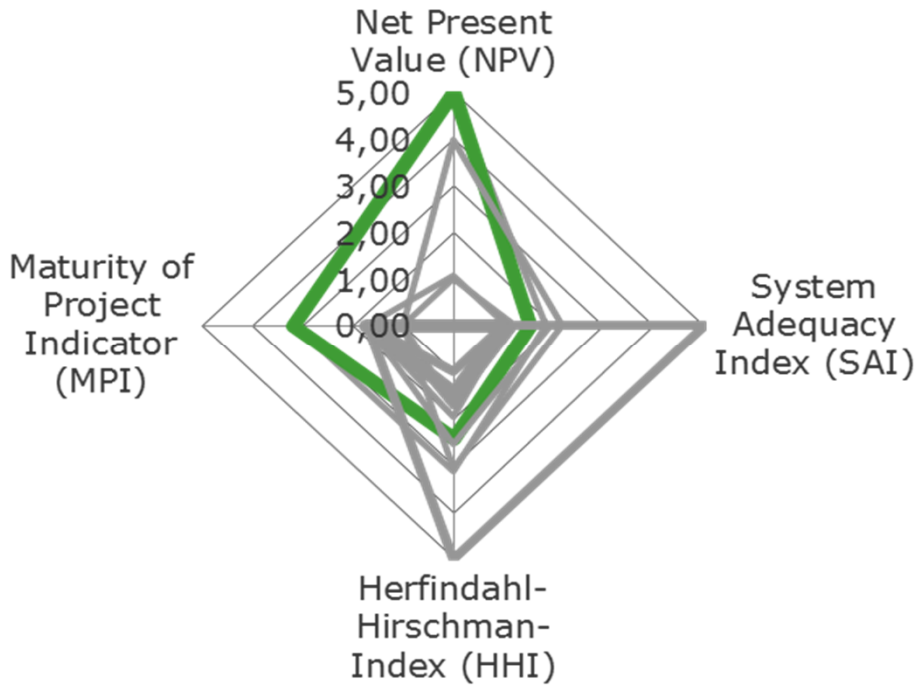
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	0	0	0	0	n.a.	0
BA	-2	2	-1	0	n.a.	0
BG	0	0	0	0	n.a.	0
GR	0	0	0	0	n.a.	0
HR	-3	3	0	0	n.a.	0
HU	-7	8	-3	-2	n.a.	-2
IT	0	0	-4	-4	n.a.	-4
KO*	0	0	0	0	n.a.	0
MD	0	0	0	0	n.a.	0
ME	0	0	0	0	n.a.	0
MK	0	0	0	0	n.a.	0
PL	-140	149	373	382	n.a.	382
RO	-1	1	0	0	n.a.	0
RS	0	0	-1	-1	n.a.	-1
SK	-14	20	-2	4	n.a.	4
UA	7 891	-7 471	369	789	n.a.	789
Total	**7 723**	**-7 287**	**731**	**1 167**	**n.a.**	**1 167**



- Highly positive NPV for the two countries (Poland, Ukraine)
- But minor impacts on other EnC countries
- Loss calculation is not included in figures
- PI index: 7.97

Project El_08 - MCA

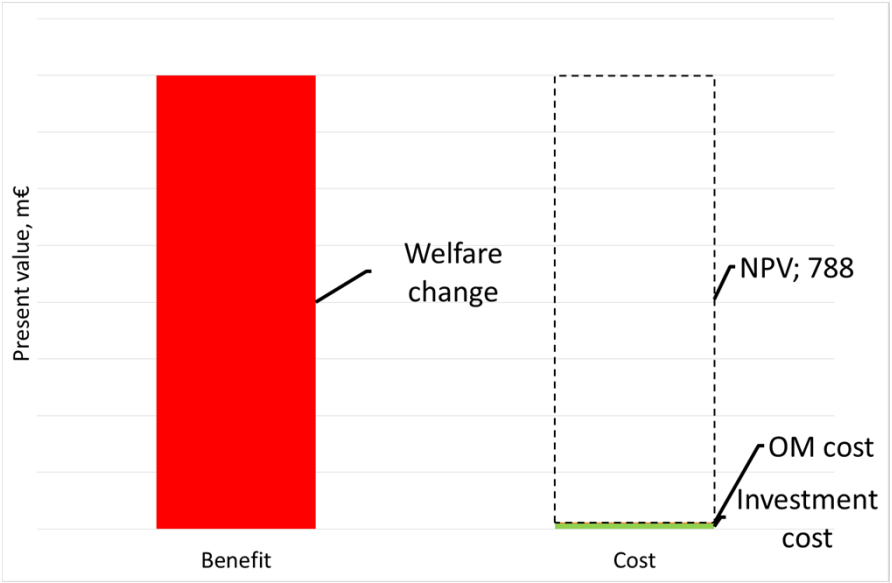
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	5,00	1,52	2,43	3,18	3,88	2
Value	1020	0,77	1395		Permitting	



Project El_09 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
UA_E	SK	2020	700	700

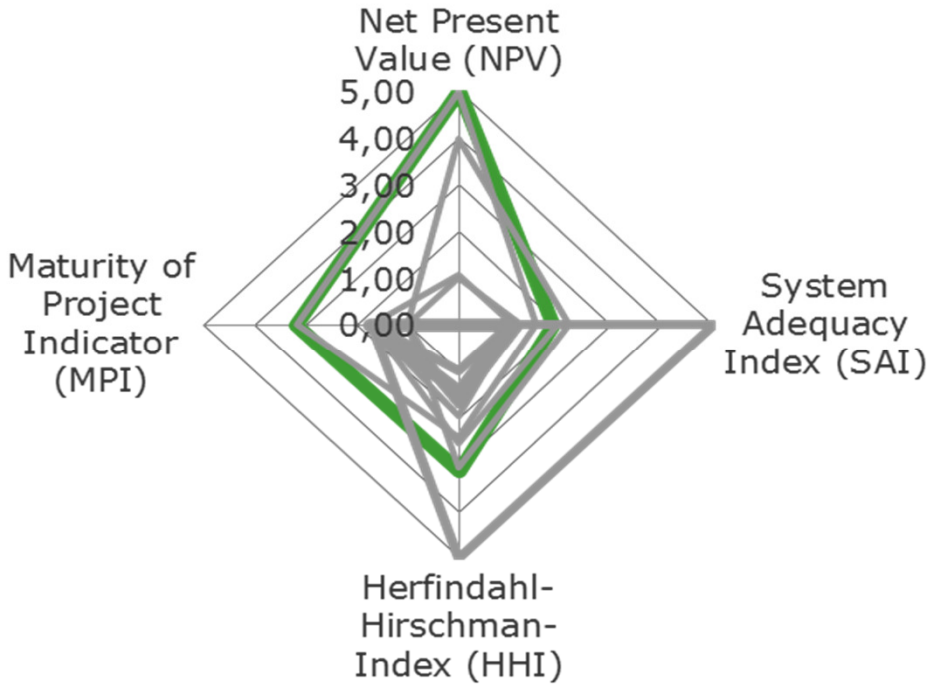
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	0	0	0	-1	n.a.	-1
BA	-6	10	-1	2	n.a.	2
BG	-11	9	0	-2	n.a.	-2
GR	-6	6	0	0	n.a.	0
HR	-11	14	-1	2	n.a.	2
HU	-30	32	5	7	n.a.	7
IT	10	-9	-6	-5	n.a.	-5
KO*	-1	1	-1	-1	n.a.	-1
MD	-1	1	0	0	n.a.	0
ME	0	0	0	0	n.a.	0
MK	-1	1	0	0	n.a.	0
PL	-76	73	9	6	n.a.	6
RO	-18	18	-2	-2	n.a.	-2
RS	-3	4	-4	-3	n.a.	-3
SK	9	-25	325	310	n.a.	310
UA	6 065	-5 882	304	487	n.a.	487
Total	**5 921**	**-5 749**	**628**	**799**	n.a.	**799**



- Highly positive NPV for the two countries (Slovakia, Ukraine)
- But minor impacts on other EnC countries
- Loss calculation is not included in figures
- PI index: 70.4

Project El_09 - MCA

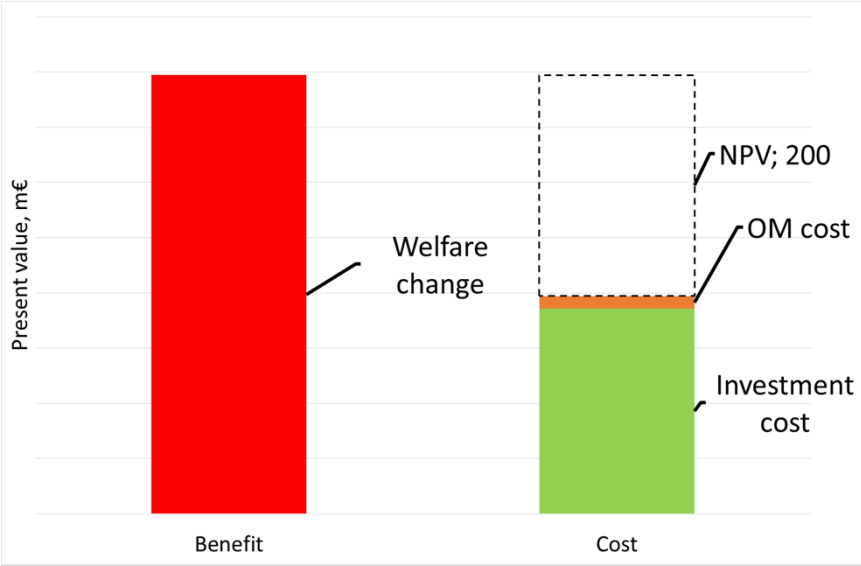
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	5,00	1,84	3,14	3,18	4,03	1
Value	788	1,04	1889		Permitting	



Project El_10 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
UA_E	RO	2025	1000	1000

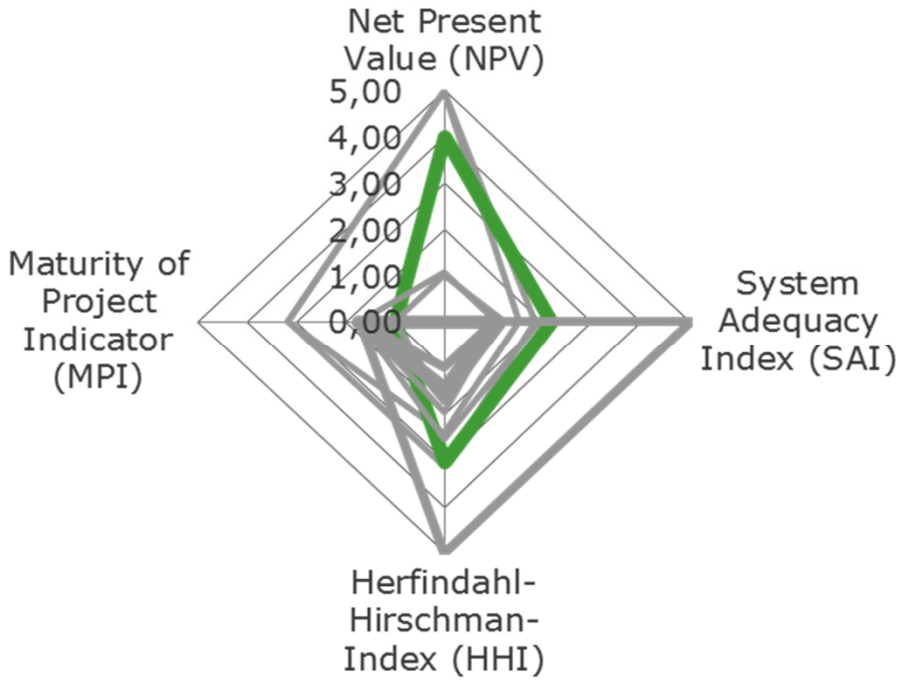
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-14	15	4	6	n.a.	6
BA	-4	8	6	10	n.a.	10
BG	-1 734	987	257	-490	n.a.	-490
GR	102	-129	216	189	n.a.	189
HR	-5	6	4	5	n.a.	5
HU	-11	9	68	67	n.a.	67
IT	30	-31	-7	-7	n.a.	-7
KO*	-16	12	16	11	n.a.	11
MD	-279	257	2	-20	n.a.	-20
ME	-5	8	-1	2	n.a.	2
MK	-24	15	21	12	n.a.	12
PL	0	0	0	0	n.a.	0
RO	-2 335	2 201	380	246	n.a.	246
RS	-92	67	89	64	n.a.	64
SK	-2	3	1	2	n.a.	2
UA	6 404	-6 212	110	302	n.a.	302
Total	**2 014**	**-2 782**	**1 165**	**397**	n.a.	**397**



- Highly positive NPV project with strong impacts on other EnC countries as well
- Loss calculation is not included in figures
- PI index: 2.0

Project El_10 - MCA

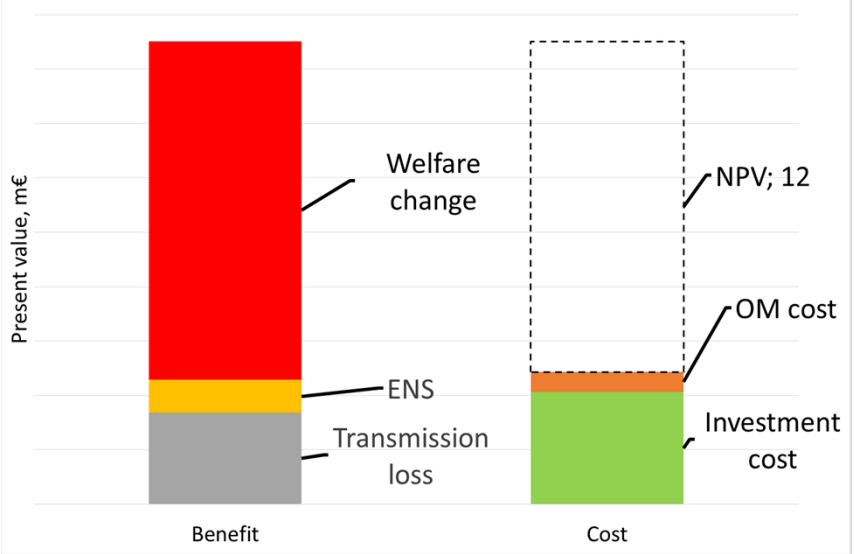
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	4,00	2,17	3,05	1,00	3,26	3
Value	200	1,31	1828	Consideration phase		



Project El_12 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
MK	KO*	2026	200	200

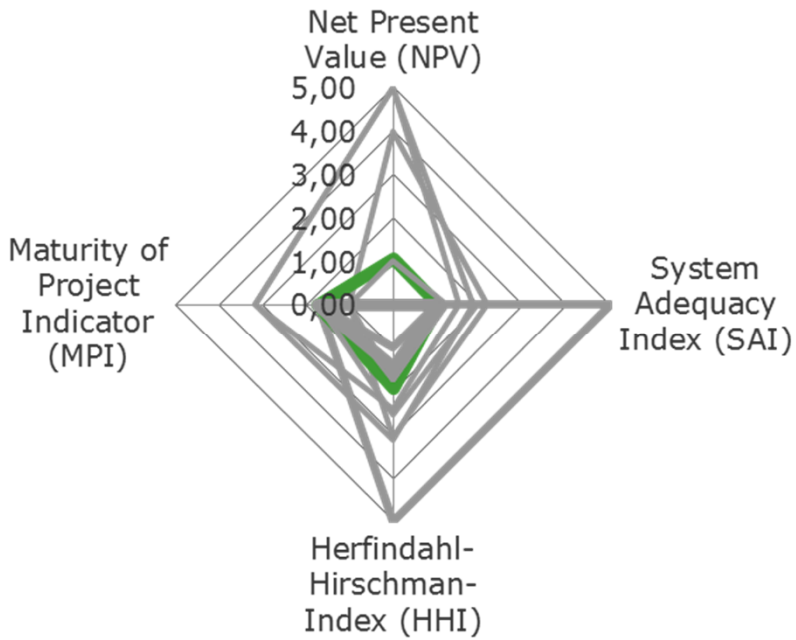
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-23	27	2	6	1	6
BA	-2	2	-3	-3	0	-4
BG	4	-2	-3	-2	2	0
GR	-15	19	-2	2	0	2
HR	0	0	-2	-2	1	-1
HU	1	-1	-3	-3	0	-3
IT	-13	12	3	2	0	2
KO*	7	-3	-3	1	1	2
MD	0	0	0	0	0	0
ME	-4	6	-5	-2	0	-3
MK	14	-6	1	9	0	9
PL	0	0	0	0	0	0
RO	5	-5	-2	-2	0	-2
RS	42	-20	-16	7	0	6
SK	0	0	0	0	0	0
UA	0	0	0	0	0	0
Total	**16**	**30**	**-34**	**12**	**3**	**16**



- Positive NPV project, gains spread over many EnC countries (AL,KO*, MK, RS)
- PI index: 3.5

Project El_12 - MCA

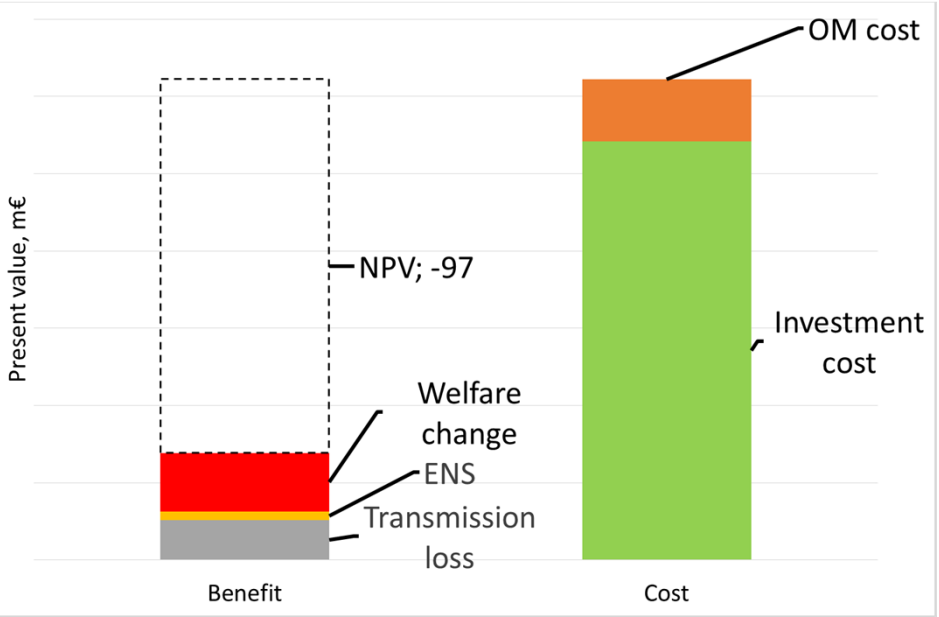
	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	1,06	1,06	1,95	1,73	1,23	5
Value	12	0,38	1063	Preliminary design studies		



Project El_13 - CBA

Origin	Destination	Year of commissioning	NTC: O->D (MW)	NTC: D->O (MW)
MK	AL	2019	1000	600

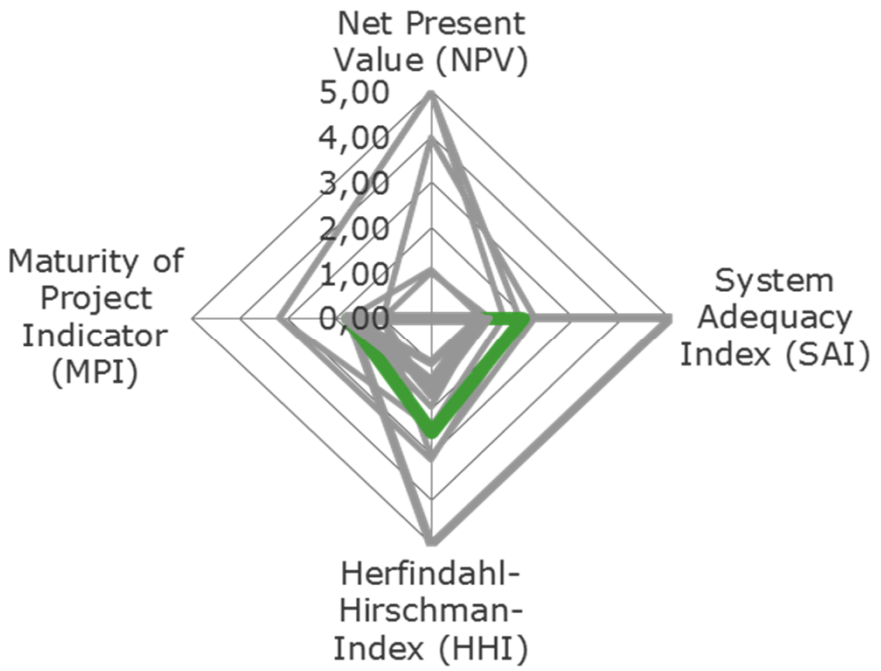
	Welfare change, m€				Transmission losses, m€	Total, m€
	Consumer	Producer	Rent	Total		
AL	-65	71	-1	4	0	5
BA	-28	21	-5	-12	1	-11
BG	9	-6	-5	-2	0	-2
GR	-31	39	-1	7	1	7
HR	0	1	3	3	3	6
HU	1	0	-3	-2	0	-2
IT	-33	32	17	16	0	16
KO*	7	-3	-5	-2	1	-1
MD	0	0	0	0	0	0
ME	-19	30	-3	8	0	8
MK	20	-10	-3	7	2	9
PL	0	0	0	0	0	0
RO	8	-8	-2	-3	0	-2
RS	37	-16	-29	-9	2	-6
SK	0	-1	0	0	0	0
UA	0	0	0	0	0	0
Total	**-95**	**149**	**-39**	**15**	**10**	**26**



- Negative NPV project, with significant impact on EnC countries
- PI index: 0.22

Project El_13 - MCA

	Net Present Value (NPV)	System Adequacy Index (SAI)	Herfindahl-Hirschman-Index (HHI)	Maturity of Project Indicator (MPI)	**Total Score**	**Ranking**
Score	0,00	1,93	2,54	1,73	0,83	7
Value	-97	1,11	1475	Preliminary design studies		



Thank you!

REKK
www.rekk.hu

Borbála Takácsné Tóth

Senior research associate

REKK
(REKK Kft.)
Po. Box 1803
1465 Budapest
Hungary

E-Mail: borbala.toth@rekk.hu
Phone: +36-1-482-7070

DNV GL
www.dnvgl.com

Dr. Daniel Grote

Senior Consultant Policy & Regulation

DNV GL Energy
(KEMA Consulting GmbH)
Kurt-Schumacher-Str. 8
53113 Bonn
Germany

E-Mail: Daniel.Grote@dnvgl.com
Phone: +49-228-4469049