

Selection of Projects of Energy Community Interest (PECIIs)

Presentation REKK / DNV GL

**- Electricity -
Vienna 13.02.2018**

Agenda

1. Summary of country data received
2. Project eligibility for electricity projects
3. Project data verification and clarification
4. Finalization of Open Methodological questions
5. Introduction of the electricity market modelling reference

List of electricity projects

Project code	Project name	Project Promoters	Type of investment
EL_01a	Trans Balkan Corridor-OHL 400 kV Kragujevac – Kraljevo	Elektromreza Srbije	Construction of new transmission infrastructure; Voltage upgrade of existing transmission infrastructure
EL_01b	Trans Balkan Corridor- Double OHL 400 kV Obrenovac – Bajina Basta	Elektromreza Srbije	Construction of new transmission infrastructure; Voltage upgrade of existing transmission infrastructure
EL_01c	Trans Balkan Corridor- Double OHL 400 kV Bajina Basta (RS) – Visegrad (BA) – Pljevlja (ME)	Nezavisni operator sistema u BiH - NOSBiH/Elektroprenos BiH a.d.- JP Elektromreža Srbije	Construction of new transmission infrastructure
EL_01d	Trans Balkan Corridor- 400 kV section in Montenegro OHL Lastva – Pljevlja	Montenegrin Electric Transmission System CGES	Construction of new transmission infrastructure
EL_02	400 kV OHL Bitola (MK) - Elbasan (AL)	Macedonian Transmission System Operator Stock Company for Electricity Transmission and Energy System Management State Owned Skopje - OST	Construction of new transmission infrastructure
EL_03	400 kV OHL Banja Luka (BA) – Lika (HR)	Nezavisni operator sistema u BiH - NOSBiH/Elektroprenos BiH a.d. Banja Luka	Construction of new transmission infrastructure
EL_04	220 kV OHL TPP Tuzla (BA) – SS Gradačac (BA) – SS Đakovo (HR) to 400 kV	Nezavisni operator sistema u BiH - NOSBiH/Elektroprenos BiH a.d.	Construction of new transmission infrastructure; Voltage upgrade of existing transmission infrastructure

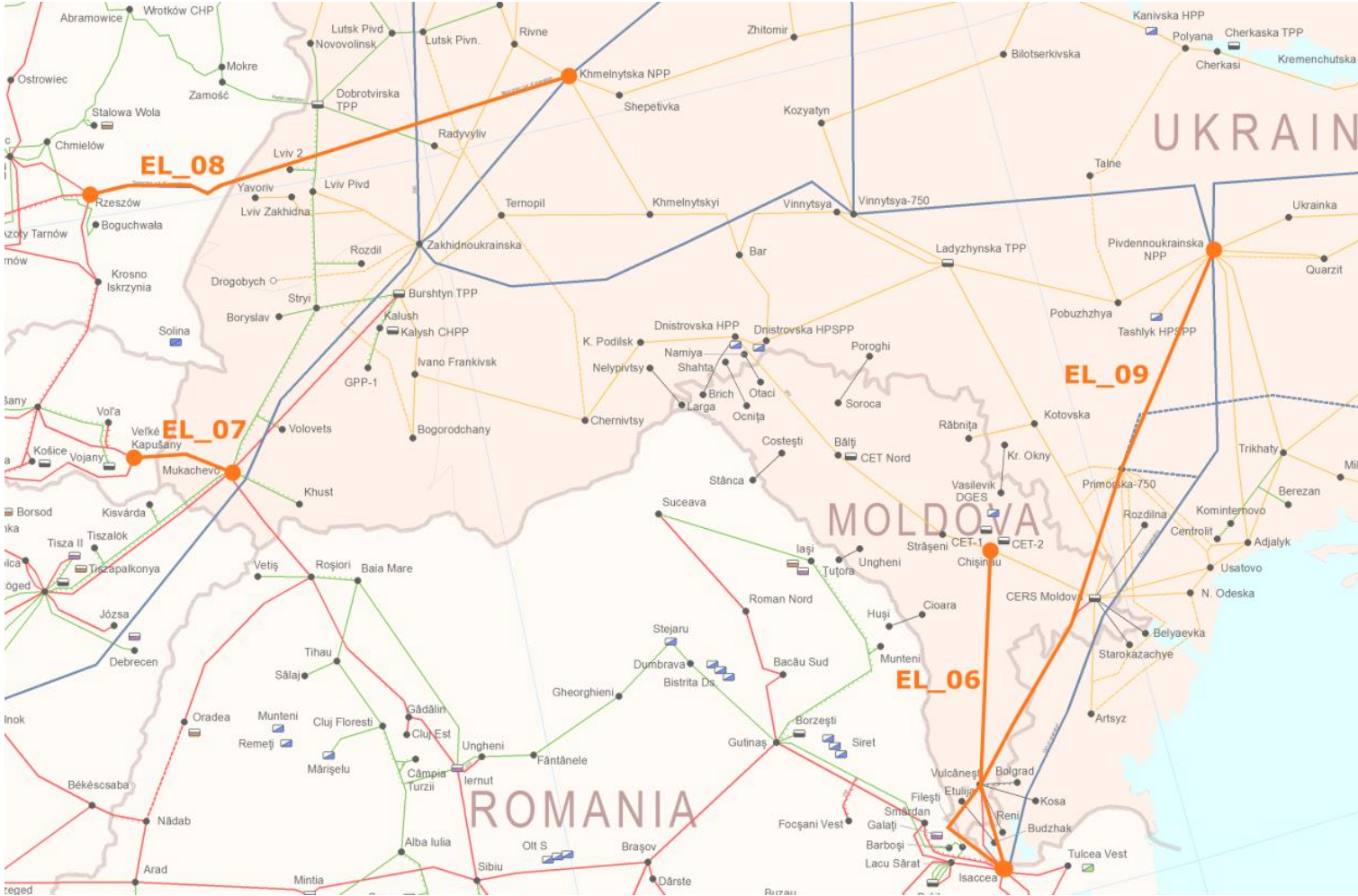
List of electricity projects

EL_05	220 kV OHL TPP Tuzla (BA) - SS Đakovo (HR) to 400 kV line	Nezavisni operator sistema u BiH - NOSBiH/Elektroprenos BiH a.d.	Construction of new transmission infrastructure; Voltage upgrade of existing transmission infrastructure
EL_06	400 kV OHL Vulcanesti (MD) - Issacea (RO)	State Enterprise Moldelectrica-CNTEE Transelectrica SA (Romania)	Construction of new transmission infrastructure; Current upgrade of existing transmission infrastructure; Extension of existing transmission infrastructure
EL_07	400 kV Mukacheve (Ukraine) – V.Kapusany (Slovakia) OHL rehabilitation	State Enterprise NPC Ukrenergo-Slovenská elektrizačná prenosová sústava, a.s. SEPS (Slovak Republic)	Current upgrade of existing transmission infrastructure
EL_08	750 kV Khmelnytska NPP (Ukraine) – Rzeszow (Poland) overhead line connection	Ministry of Energy and Coal Industry of Ukraine	Current upgrade of existing transmission infrastructure; Extension of existing transmission infrastructure
EL_09	750 kV Pivdennoukrainska NPP (Ukraine) – Isaccea (Romania) OHL rehabilitation and modernisation,	State Enterprise NPC Ukrenergo – C.N. Transelectrica S.A. (Romania)	Construction of new transmission infrastructure; Current upgrade of existing transmission infrastructure; Extension of existing transmission infrastructure; Replacement of existing transmission infrastructure
EL_10	Georgia - 3 synchronous zones,	JSC Georgian State Electrosystem	Construction of new transmission infrastructure; Voltage upgrade of existing transmission infrastructure
EL_11	Connecting Dajc/Velipoje wind power plant	ENERGIA RINNOVABILE SHKODER SH.P.K	Construction of new transmission infrastructure

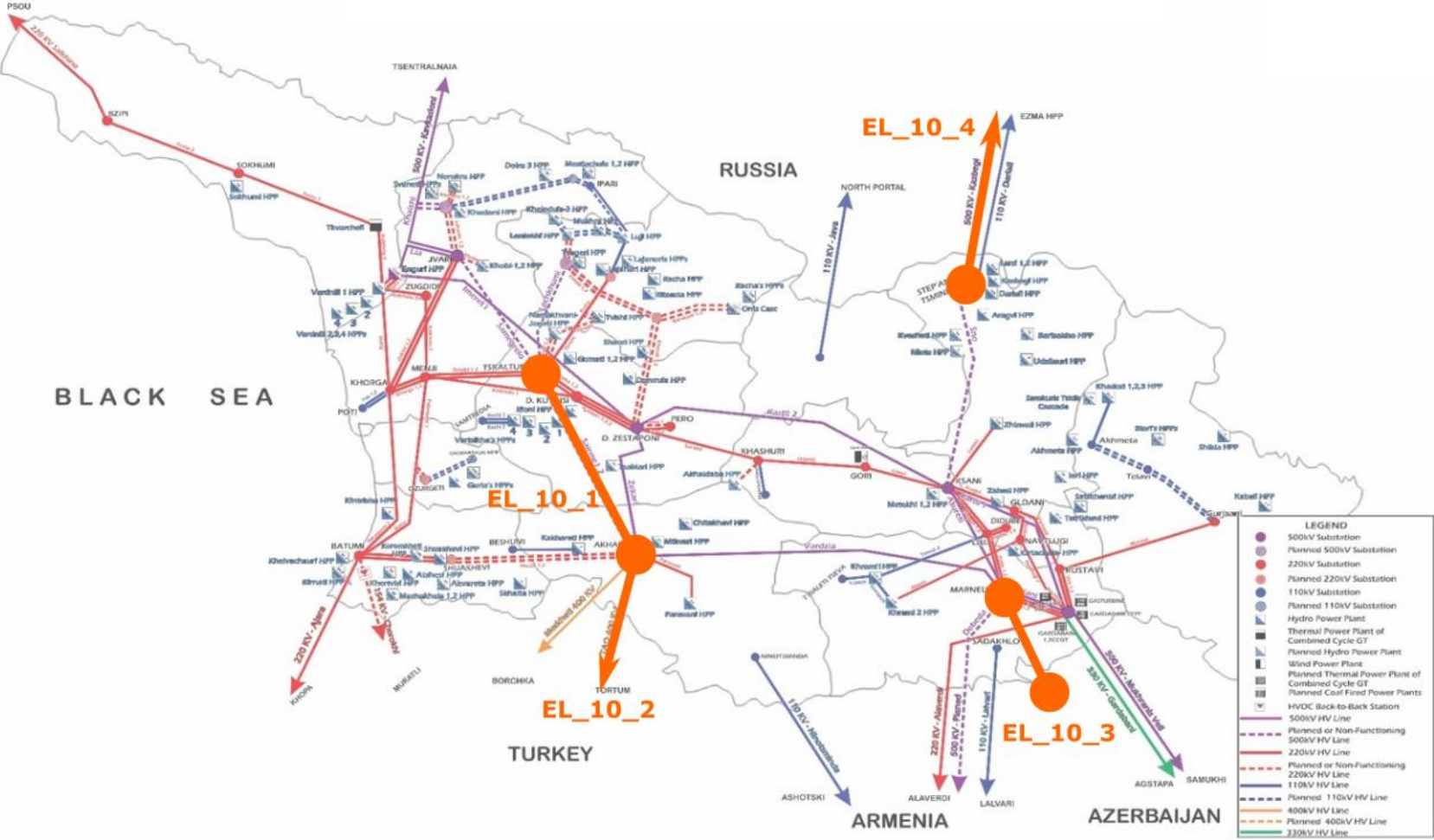
Electricity projects 1-5, 11



Electricity projects 6-9



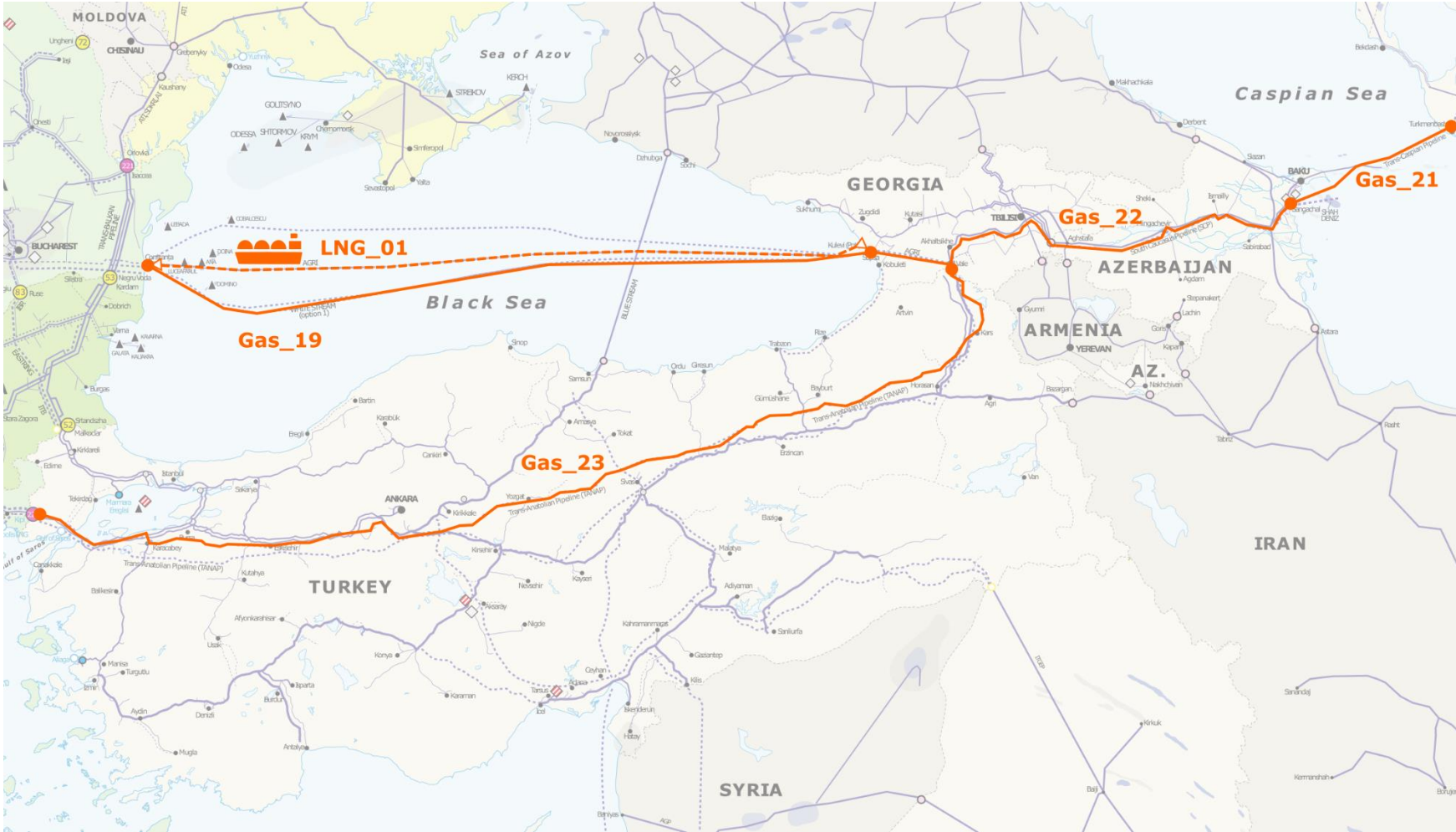
Electricity projects 10.1-10.4



Natural gas projects (Balcans and Eastern Europe)



Natural gas projects



Oil projects



Summary of submitted projects

	Elec- tricity transmi ssion	Elec- tricity storage	Gas trans- mission	Gas storage	LNG	Smart grid	Oil	Total
Submitted projects¹	11*	0	20	1	1	0	2	35
Submitted investment cost	*	*	*	*	*	*	*	*
Future investment need²	*	*	*	*	*	*	*	*

[1] Number of projects that will be evaluated as some projects were merged into one.

[2] Investment cost of projects already under construction is excluded.

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Main eligibility criteria for electricity projects

Article 4 of the Adapted regulation defines the criteria for projects of Energy Community interest as follows:

- a) the project falls in at least one of the energy **infrastructure categories and area** as described in Annex I of the Adapted regulation;
- b) the potential overall **benefits of the project**, assessed according to the respective specific criteria in paragraph 2, **outweigh its costs**, including in the longer term;
- c) the project meets any of the following criteria:
 - i. involves at least two Contracting Parties or a Contracting Party and a Member State by **directly crossing the border** of two or more Contracting Parties, or of one Contracting Party and one or more Member States
 - ii. is located on the territory of one Contracting Party and has a **significant cross-border impact** as set out in Annex III.1 of the Adapted regulation

Detailed eligibility criteria

- **Main infrastructure categories of electricity projects:**
 - a) high-voltage **overhead transmission lines**, if they have been designed for a voltage of 220 kV or more, and **underground and submarine transmission cables**, if they have been designed for a voltage of 150 kV or more;
 - b) **electricity storage facilities** used for storing electricity on a permanent or temporary basis in above-ground or underground infrastructure or geological sites, provided they are directly connected to high-voltage transmission lines designed for a voltage of 110 kV or more;
 - c) any equipment or installation **essential for the systems defined in (a) and (b) to operate safely**, securely and efficiently, including protection, monitoring and control systems at all voltage levels and substations
- Significant cross border impact is achieved if the new infrastructure contributes to an **at least 500 MW increase** in the cross-border transmission capacity compared to the situation when the project is not commissioned.
- Additionally the Adapted regulation states, that the projects should be part of the **latest ENTSO-E TYNDP list**, in the case of non ENTSO-E countries, the **national network development plans**.

Main steps of eligibility check

1. Check whether the project falls in the **electricity infrastructure categories** as defined by the regulation (high-voltage overhead transmission lines or underground and submarine transmission cables; electricity storage facilities; protection, monitoring and control systems)
2. Check whether the project is located in **two or more countries**. When located in one country, the cross border impact will be higher altogether than **500 MW**.
3. Check whether the project is part of the latest **ENTSO-E TYNDP** or of the **national network development plans**.
4. Assess whether the project is a candidate for a **PECI or a PMI label**

Final candidacy decision

- If the project is eligible, than it can become a candidate for **Project of Energy Community Interest (PECI) or Project of Mutual Interest (PMI)**
- Generally all eligible projects can be considered as candidate for PECI
- Additionally, based on the adapted regulation:
 - When the project directly crosses the border of one or more Contracting Parties and one or more Member States, in order to be considered to be a project of Energy Community interest, it shall be first granted a status of project of the common interest within the European Union.
 - Project that directly crosses the border of one or more Contracting Parties and one or more Member States which is not granted a status of project of the common interest within the European Union may be developed on voluntary basis as a project of Mutual Interest.

Eligibility of electricity projects

Project code	Infrastructure category	Crossing border of two CPs or MSs (or/and cross border impact)	TYNDP	Technical data verification	Cost verification	Candidate for (PECI/PMI/ not eligible)
EL_01	✓	✓	✓	✓	✓	PECI
EL_02	✓	✓	✓	?	✓	PECI
EL_03	✓	✓	✓	?	✓	PMI
EL_04	✓	✓	✓	?	✓	PMI
EL_05	✓	✓	✓	?	✓	PMI
EL_06	✓	✓	?	✓	✓	PMI
EL_07	✓	✓	?	✓	?	PMI
EL_08	✓	✓	?	✓	?	PMI
EL_09	✓	✓	✓	✓	✓	PMI
EL_10	✓	?	✓	?	✓	*
EL_11	x	-	-	-	-	NOT ELIGIBLE

*PROJECT NOT ELIGIBLE FOR PEGI/PMI, WILL BE ASSESSED AS PART OF EU4ENERGY PRI SELECTION PROCESS

Comments about the eligibility of electricity projects

- **Albanian wind farm interconnection project (EL_11) is not eligible**
 - The project is an 110 KV line which is smaller, than the minimum value stated in the adopted regulation
 - We suggest to the EnC Secretariat to consider the project to be assessed within the framework of the planned new project category of EnC, once it is finalized.
- **Georgian project (EL_10) is not eligible for PEGI/PMI, but will be assessed under the EU PRI selection process**
 - The projects have the sufficient level of cross border impact, but with countries that are neither part of the European Union, nor the Energy Community.
- **We found no evidence of the involvement of the following projects in the corresponding national development plans**
 - We were not able to locate the NDP of Moldova (EL_6)
 - The Ukrainian - Slovakian project (EL_7) is not part of the national development plan of Ukraine
 - The Polish- Ukrainian (EL_8) project is only briefly mentioned (not in the project list) in the development plan of Ukraine
 - Further information is needed by the project promoters

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Technical data verification methodology

- We validated the length and commission date of the projects based on secondary source datasets in the following hierarchical order:
 1. ENTSO-E TYNDP 2016
 2. National network development plan of the promoter country
 - If it is detailed enough to conduct the validation
 3. PECI 2016 submissions

- We validated the projects:
 - based on ENTSO-E TYNDP: Trans Balkan corridor (EL_1), Albanian-Macedonian (EL_2) and the Bosnian-Croatian (EL_03, EL_04, EL_05) lines
 - based on national development plan: The Georgian projects (EL_10)
 - based on earlier submission of PECI: All remaining projects (EL_06, EL_07, EL_08, EL_09)

Technical data verification summary

Project code	Submitted length	Secondary source length	Length match	Submitted commission date	Secondary source commission date	Commission date match
EL_01a	60 km	55 km	☑	2020	2019	✘
EL_01b	111 km	115 km	☑	2024	2021	✘
EL_01c	127 km	121 km	☑	2024	2022	✘
EL_01d	167 km	160 km	☑	2022	2022	☑
EL_02	97 km	151 km	✘	2020	2020	☑
EL_03	115 km	155 km	✘	2023	2030	✘
EL_04	65 km	46 km	✘	2030	2030	☑
EL_05	65 km	90 km	✘	2030	2030	☑
EL_06	158 km	158 km	☑	2022	2022	☑
EL_07	51 km	51 km	☑	2023	2020	✘
EL_08	398 km	394 km	☑	2022	2020	✘
EL_09	300+120 km	120 km	☑	2026	2025	✘
EL_10a	110 km	160 km	✘	2020-2023	2020	☑
EL_10b	35 km	30 km	☑	2020-2023	2020-2021	☑
EL_10c	19 km	19 km	☑	2020-2023	2018	✘
EL_10d	11 km	11 km	☑	2020-2023	2017-2021	☑

Validation of electricity projects, comments

- **Major discrepancies in length** between submitted and ENTSO-E TYNDP data, for the **Albanian-Macedonian (EL_2)**, and **all Bosnian-Croatian projects (EL_3, EL_4, EL_5)**
 - Clarification is required by the project promoters
- **Major discrepancies in length** between submitted data and Georgian national development plan, for the **Tskaltubo-Akhaltsikhe (EL_10a)** line
 - Clarification is required by the project promoters
- **Major discrepancies in commission date** between submitted and ENTSO-E TYNDP data, for the **Tuzla-Dakovo (EL_5)** project
 - Clarification is required by the project promoters
- We did not considered those cases a problem where the submitted commission date was later, than in the secondary source data, as those projects were delayed.

Cost verification methodology

- Based on ACER The Report on unit investment cost for Electricity 2016
 - For verification we checked whether the submitted project cost falls within the benchmarked interquartile range
- Indicators for unit investment costs for overhead lines (m€/km)

	Mean (m€/km)	Lower interquartile boundary (m€/km)	Upper interquartile boundary (m€/km)
380-400 kV, 2 circuit	1.06	0.58	1.41
380-400 kV, 1 circuit	0.60	0.30	0.77
220-225 kV, 2 circuit	0.41	0.36	0.46
220-225 kV, 1 circuit	0.29	0.16	0.30

- Indicators for Unit Investment Costs for transformer stations by ratings (m€/MVA)

Mean (m€/MVA)	Lower interquartile boundary (m€/MVA)	Upper interquartile boundary (m€/MVA)
0.0099	0.0069	0.0127

- The values presented in real 2016 Euros

Cost verification results

Project code	Project name	Reported cost (million €)	Estimated cost-average (million €)	Lower inter-quartile boundary (million €)	Higher inter-quartile value (million €)	Within estimated range
EL_01	Trans-Balkan Corridor	264	346	182	446	<input checked="" type="checkbox"/>
EL_02	400 kV OHL Bitola (MK) - Elbasan (AL)	49	61	32	78	<input checked="" type="checkbox"/>
EL_03	400 kV OHL Banja Luka (BA) – Lika (HR)	36	69	35	88	<input checked="" type="checkbox"/>
EL_04	220 kV OHL TPP Tuzla (BA) – SS Gradačac (BA) – SS Đakovo (HR) to 400 kV	26	53	28	68	LOWER
EL_05	220 kV OHL TPP Tuzla (BA) - SS Đakovo (HR) to 400 kV line	18	39	20	50	LOWER
EL_06	400 kV OHL Vulcanesti (MD) - Issacea (RO)	272	209	116	275	<input checked="" type="checkbox"/>
EL_07	400 kV Mukacheve (Ukraine) – V.Kapusany (Slovakia) OHL rehabilitation	11	31	15	39	LOWER
EL_08	750 kV Khmelnytska NPP (Ukraine) – Rzeszow (Poland) overhead line connection	4	238	120	305	SIGNIFICANTLY LOWER
EL_09	750 kV Pivdennoukrainska NPP (Ukraine) – Isaccea (Romania) OHL rehabilitation and modernisation,	231	417	227	547	<input checked="" type="checkbox"/>
EL_10	Georgia - 3 synchronous zones,	170	237	132	288	<input checked="" type="checkbox"/>

Comments on cost verification

- **The submitted cost data the Slovakian-Ukrainian project (EL_7) smaller than the lower interquartile boundary**
 - The submitted cost for the Slovakian-Ukrainian project is missing on the Slovakian side
 - We require the submission of the total cost
- **Related to Ukrainian-Polish (EL_8) project the submitted cost data is not even close to benchmarked data**
 - Further clarification is needed why the submitted cost is 4 million Euros
 - The cost for the Polish side is missing
 - We require the submission of the total cost
- **The submitted cost data for two of the Bosnian-Croatian projects (EL_4) and (EL_5) is smaller than the lower interquartile boundary**
 - The difference however is not high (within the absolute min-max range) so we considered these values realistic

Summary of all relevant technical data of the projects

Project code	Total cost (M€)	Commission date	NTC A-B 2020 (MW)	NTC A-B 2025 (MW)	NTC A-B 2030 (MW)	NTC B-A 2020 (MW)	NTC B-A 2025 (MW)	NTC B-A 2030 (MW)
EL_01 (Montenegro-Serbia)	264	2024	1550/ 1400*	1550/ 1400*	1550/ 1400*	1200/ 1250*	1200/ 1250*	1200/ 1250*
EL_01 (Montenegro-Italy)			1000	1000	1000	1000	1000	1000
EL_01 (Serbia-Bosnia)			0	700/ 200*	700/ 200*	0	300/ 100*	300/ 100*
EL_02 (Macedonia-Albania)	49	2020	1000	1000	1000	600	600	600
EL_03 (Bosnia-Croatia)	36	2023	650	650	500	950	950	200
EL_04 (Bosnia-Croatia)	26	2030	0	0	350	0	0	250
EL_05 (Bosnia-Croatia)	18	2030	0	0	350	0	0	250
EL_06 (Moldova-Romania)	272	2022	0	600	600	0	500	500
EL_07 (Ukraine-Slovakia)	31	2023	300	1000	1000	300	1000	1000
EL_08 (Ukraine-Poland)	238	2022	235	835	835	0	600	600
EL_09 (Ukraine-Romania)	231	2026	0	0	1000	0	0	1000
EL_10 (Georgia-Turkey)	170	2023	700	1400	1400	700	1400	1400
EL_10 (Georgia-Russia)			570	1600	1600	570	1600	1600
EL_10 (Georgia-Armenia)			350	700	700	350	700	700

Additional comments related to technical data

- For NTC values in the modelling, we will use the submitted data by project promoters

- For the Ukrainian-Slovakian (EL_7) and the Ukrainian-Polish (EL_8) investment plan we highlighted the benchmarked cost data based on ACER, as the submission of projected costs were not complete

- For the Bosnian-Croatian projects (EL_3, EL_4, EL_5) we used the NTC values of the relevant clusters from the ENTSO-E TYNDP 2016, as no data was submitted by the project promoters.
 - Additional data submission is required by the project promoters

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Finalization of open methodological question

Question #1

- **Additional modelling the Georgian transmission line projects**
 - The project (EL_10) in reality consist of three separate interconnection projects
 - ❖ We suggest to asses these interconnectors separately as there is no real connection between them on top of that all of them is located in Georgia.
 - It is not possible to model Russia with the EGMM, as data on Russia is not available
 - Additionally, the interconnector has a low utilization rate, so the extension seems less supported on economic ground
 - ❖ We suggest to model only the Georgian-Turkish and the Georgian-Armenian transmission lines

Finalization of open methodological question

Question #2

■ **CO₂ pricing:**

- We apply the assumption of CO₂ pricing from 2030 on. From this year on, not only EU member countries will apply carbon values in their electricity system, but also EnC Community member states.
- The carbon value is 33 Euro/tCO₂ in 2030, increasing to 88 Euro/tCo₂ by 2050 according to the latest European Energy forecasts.
- No complementary social cost of carbon calculation will be carried out
- Georgia – CO₂ pricing?

Finalization of open methodological question

Question #3

■ **Geographical area of benefit calculations:**

- We calculate project costs and benefits for the EnC countries, and the direct neighbours (directly connected by infrastructure): Italy, Croatia, Hungary, Romania, Bulgaria, Greece, Poland, Slovakia
- In case of Georgia, this calculation will be limited to the two connected countries, Georgia and Turkey and Georgia and Armenia in the additional modeling

Question #4

■ **NPV vs. Benefit/cost ratio:**

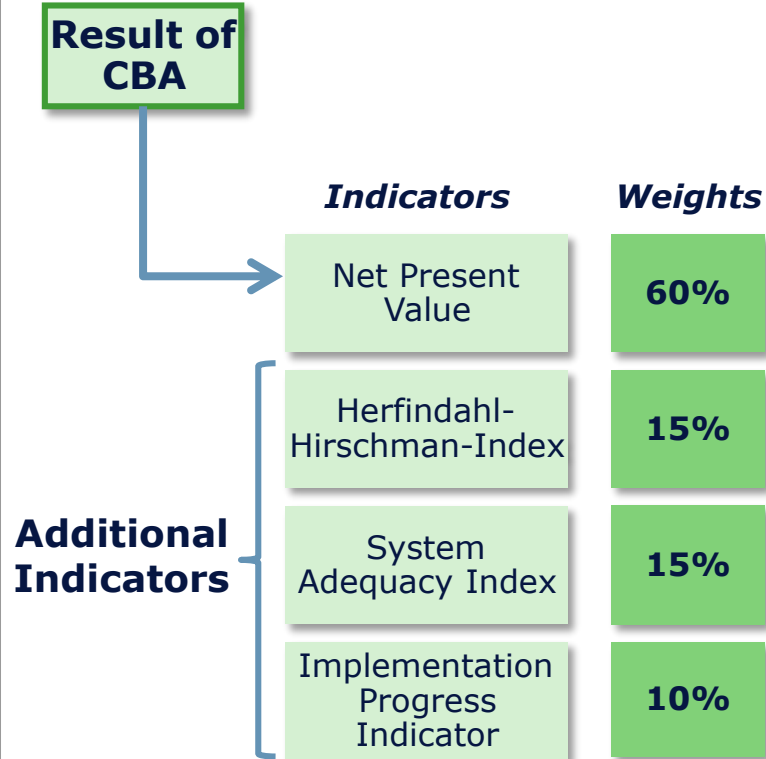
- We will calculate both NPV and B/C ratios for the projects, but we will use the B/C ratio in the PINT (Put-in-one-at-time) case for ranking the projects.
- Both information will be available for the project promoters for their own project.

Sensitivity assessment

- **Sensitivity assessment will be carried out for the following variables:**
 - Fuel price: 50% increase/decrease by 2050 on gas prices will be checked.
 - CO₂ price: half of the assumed price of the reference will be used in this sensitivity scenario
 - Demand estimations: +/-0.5% change/year will be assumed for the demand projections

Overview on Multi-Criteria Assessment Methodology

Multi-Criteria Assessment



Proposed weights have been used in previous assessment and reflect the following arguments:

- CBA covers 3 key benefits: market integration (price convergence), security of supply, reduction of CO₂ emissions and network losses
- Net benefit of a single infrastructure project considering benefits *and* costs is only assessed within CBA, additional indicators consider only additional benefits (not cost)
- Benefits are quantified and monetised within CBA (based on market modelling), additional indicators in MCA evaluated qualitatively
- Impact on competition only indirectly covered in CBA (price convergence), market model assumes perfect competition → HHI standard indicator for competition
- CBA incorporates only some aspects of security of supply → SAI proxy to account for system adequacy and ability of system to withstand extreme conditions
- IPI to account for uncertainty of projects in consideration phase and to favour projects with clear implementation plan / preparatory activities already started
- Proposed weights provide good balance of above reasoning

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Gross electricity demand

Gross electricity demand, GWh	2015	2020	2025	2030	2035	2040	2045	2050	Average yearly growth rate	Source
AL	6 876	7 410	8 350	9 350	10 324	11 342	12 462	13 691	2.0%	OST - Forecast of Electricity Demand
BA	11 733	13 986	15 393	16 923	18 149	19 689	20 666	21 576	1.8%	SEERMAP - 2017
GE	10 871	12 950	15 010	17 040	19 585	21 810	24 039	26 266	2.6%	TYNDP - 2018-2028
KO*	5 570	5 955	6 330	6 764	7 215	7 696	8 210	8 757	1.3%	ERO Report 2015 ,Energy balance 2017-2026, after 2026 annual electricity demand is estimated by Energy Department
ME	3 461	4 105	4 634	5 214	5 416	5 711	5 997	6 248	1.7%	Energy Balance for 2017 and Energy Development Strategy of Montenegro by 2030
MD	4 050	4 278	4 518	4 772	5 040	5 323	5 622	5 938	1.1%	-
MK	8 170	7 658	8 164	8 544	9 017	9 649	10 193	10 474	0.7%	SEERMAP - 2017
RS	33 841	36 249	37 746	39 271	40 730	42 131	44 280	46 538	0.9%	EMS Forecast of electricity demand
UA_E	143 915	157 628	161 608	165 689	169 872	174 162	178 560	183 069	0.7%	PECI 2016
UA_W	4 429	4 453	4 565	4 680	4 799	4 920	5 044	5 171	0.4%	PECI 2016

Net installed capacity, MW

		AL							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
Natural gas	- Existing	0	0	0	0	0	0	0	0
	- New	0	100	300	400	400	700	700	700
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		1920	2 212	2 336	2 870	3 000	3 150	3 310	3 360
Wind		0	0	80	150	180	200	784	1 066
Solar		0	0	50	80	85	120	249	585
Other RES		5	5	5	8	8	10	16	19
Total		1 925	2 317	2 771	3 508	3 673	4 180	5 058	5 730

		BA							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	1 970	1 660	1 460	1 350	1 130	530	300	300
	- New	0	1 400	1 700	1 700	1 700	1 700	1 700	1 700
Natural gas	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		2 155	2 179	2 221	2 263	2 364	2 738	3 060	3 297
Wind		0	41	41	31	113	338	900	1 988
Solar		9	44	44	44	58	93	189	370
Other RES		0	1	1	2	3	6	9	12
Total		4 134	5 325	5 467	5 390	5 368	5 404	6 157	7 667

		GE							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	13	13	13	13	13	13	13	13
	- New	0	300	300	300	300	300	300	300
Natural gas	- Existing	680	410	110	110	110	110	110	110
	- New	230	480	480	730	730	730	730	730
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		2 807	3 113	6 416	6 416	6 416	6 416	6 416	6 416
Wind		0	21	21	21	21	21	21	21
Solar		0	0	0	0	0	0	0	0
Other RES		0	0	0	0	0	0	0	0
Total		3 730	4 337	7 340	7 590	7 590	7 590	7 590	7 590

		KO*							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	1 478	1 478	678	678	678	678	0	0
	- New	0	0	500	500	500	500	1 100	1 100
Natural gas	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	200	300	300	300
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		49	130	220	240	240	254	311	359
Wind		1	70	130	150	180	200	240	814
Solar		0	10	30	38	56	104	238	504
Other RES		0	0	0	1	3	5	10	17
Total		1 528	1 592	1 304	1 353	1 628	1 222	2 199	3 094

		ME							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	219	225	0	0	0	0	0	0
	- New	0	0	225	225	225	225	225	225
Natural gas	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		668	729	1 281	1 281	1 281	1 281	1 281	1 281
Wind		0	151	168	190	190	190	190	190
Solar		3	8	20	32	32	32	32	32
Other RES		0	10	10	49	49	49	49	49
Total		890	1 123	1 704	1 777	1 777	1 777	1 777	1 777

		MD							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
Natural gas	- Existing	380	393	393	393	393	393	393	393
	- New	0	13	13	13	13	13	13	13
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		16	17	18	18	18	18	18	18
Wind		1	100	115	130	150	170	185	200
Solar		1	40	50	60	70	80	90	100
Other RES		3	20	25	30	35	40	45	50
Total		401	583	614	644	679	714	744	774

Net installed capacity

		MK							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	800	675	450	0	0	0	0	0
	- New	0	130	130	330	330	330	330	330
Natural gas	- Existing	294	294	294	294	0	0	0	0
	- New	0	0	280	280	774	774	774	774
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		210	210	210	0	0	0	0	0
Hydro		673	673	673	673	809	1054	1353	1600
Wind		37	40	40	16	14	59	256	721
Solar		20	35	35	39	65	143	323	577
Other RES		7	11	12	13	12	14	27	47
Total		2 041	2 068	2 123	1 645	2 004	2 375	3 063	4 049

		UA_W							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	2 335	1 945	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
Natural gas	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	300	300	300	300	400
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		38	38	38	38	38	38	38	38
Wind		7	7	7	7	7	7	7	7
Solar		19	19	19	19	19	19	19	19
Other RES		0	0	0	0	0	0	0	0
Total		2 399	2 009	64	364	364	364	364	464

		RS							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	4 417	4 373	4 073	4 073	4 073	3 343	3 343	3 343
	- New	0	0	350	707	707	707	707	707
Natural gas	- Existing	403	0	0	0	0	0	0	0
	- New	0	140	478	478	478	478	478	478
Nuclear	- Existing	0	0	0	0	0	0	0	0
	- New	0	0	0	0	0	0	0	0
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		3 070	3 098	3 118	3 387	3 387	4 067	4 067	4 067
Wind		11	500	500	600	600	600	600	600
Solar		3	10	100	200	200	200	200	200
Other RES		11	144	213	285	285	285	285	285
Total		7 915	8 265	8 832	9 730	9 730	9 680	9 680	9 680

		UA_E							
Net installed capacity, MW		2015	2020	2025	2030	2035	2040	2045	2050
Coal, lignite	- Existing	19 568	16 316	11 051	4 227	2 467	625	0	0
	- New	0	0	0	0	0	0	0	0
Natural gas	- Existing	3 650	3 350	3 350	2 513	2 513	1 676	839	0
	- New	0	0	2 400	3 200	5 600	9 600	13 600	16 800
Nuclear	- Existing	13 835	13 835	13 835	13 835	13 835	13 415	9 000	2 000
	- New	0	0	2 000	2 000	2 000	2 000	2 000	2 000
HFO/LFO		0	0	0	0	0	0	0	0
Hydro		5 771	5 771	5 771	5 771	5 771	5 771	5 771	5 771
Wind		507	2 020	4 085	6 150	8 215	10 280	12 345	14 410
Solar		395	1 495	1 995	2 495	2 995	3 495	3 995	4 495
Other RES		2	179	419	659	899	1 139	1 379	1 619
Total		43 728	42 966	44 906	40 850	44 295	48 001	48 929	47 095

- In 6 countries data were modified (AL; GE; KO*; ME; MD; RS)

Cross-border capacities in the Region

Present capacities

Origin and destination country		NTC values, MW	
Country A	Country B	From country A to country B	From country B to country A
BA	HR	699	652
BA	ME	459	467
BA	RS	566	462
BG	GR	500	341
BG	MK	202	100
BG	RO	300	300
BG	RS	263	156
HR	HU	1 000	1 200
HR	RS	607	478
HR	SI	1 466	1 466
HU	RO	700	700
HU	RS	700	777
HU	SK	1 000	1 300
HU	UA_W	450	581
MK	GR	261	350
MK	RS	150	315
ME	KO*	300	300
RS	ME	260	235
RS	RO	506/800	511/700
SK	UA_W	400	400
RO	UA_W	100	550
ME	AL	400	400
AL	GR	240	248
RO	MD	0	0
KO*	RS	350	300
UA_E	UA_W	0	0
KO*	MK	150	291
KO*	AL	208	219
AR	GE	140	140
AZ	GE	950	950
GE	TR	850	850
GE	RU	650	650
MD	UA_E	825	725
UA_E	RU	1175	125
UA_E	BY	350	0



Data received from RS and RO are different

Future capacities in the REF

New cross-border capacities, NTC, MW					
From	To	Year of commissioning	O → D	D → O	TYNDP code
ME	IT	2019	500	500	28
RS	RO	2020	600	600	144
AL	KO*	2016	500	500	147a

Thank you!

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