Selection of Projects of Energy Community Interest (PECIs)

1st Meeting of the Gas Group – Proposed Assessment Methodology

Presentation REKK / DNV GL

Vienna 12.12.2017

Agenda

1. Overview of general project assessment methodology

2. Cost-benefit analysis (CBA) and Gas market modelling (EGMM)

3. Multi-criteria assessment methodology

4. Country specific data and modelling assumptions
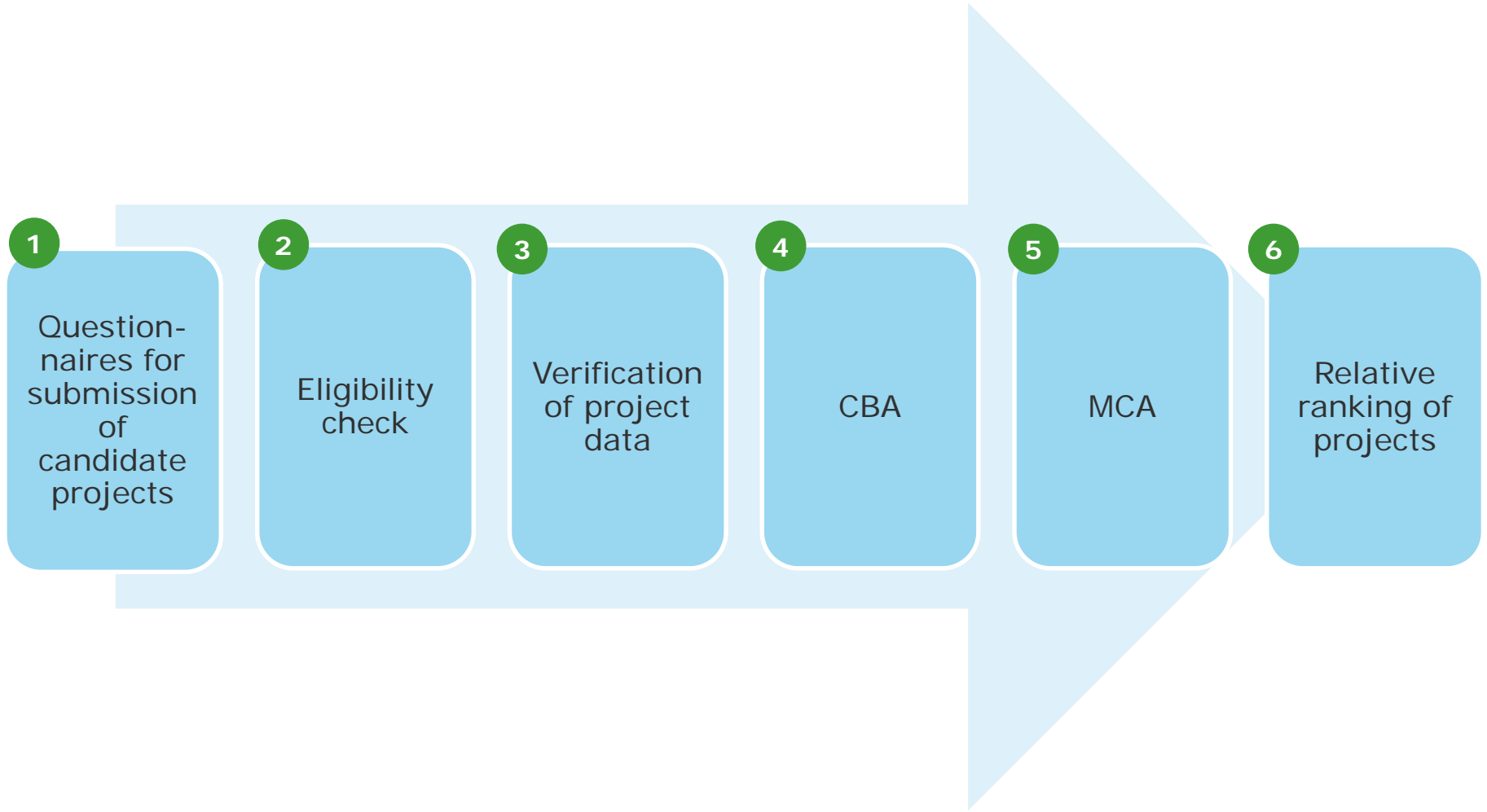
Project Objectives and Deliverables

- **Objectives**
  - To assess the candidate projects for electricity, gas and oil infrastructure, as well as for smart grids, in order to be able to identify those which bring the larges benefits for the EnC
  - To develop the electricity and gas market models for the Energy Community Contracting Parties needs and use these in the assessment of PECI AND PMI candidates;
  - To develop a multi criteria assessment methodology, using also the ENTSOE and ENTSOG methodology for cost benefit analysis where applicable;
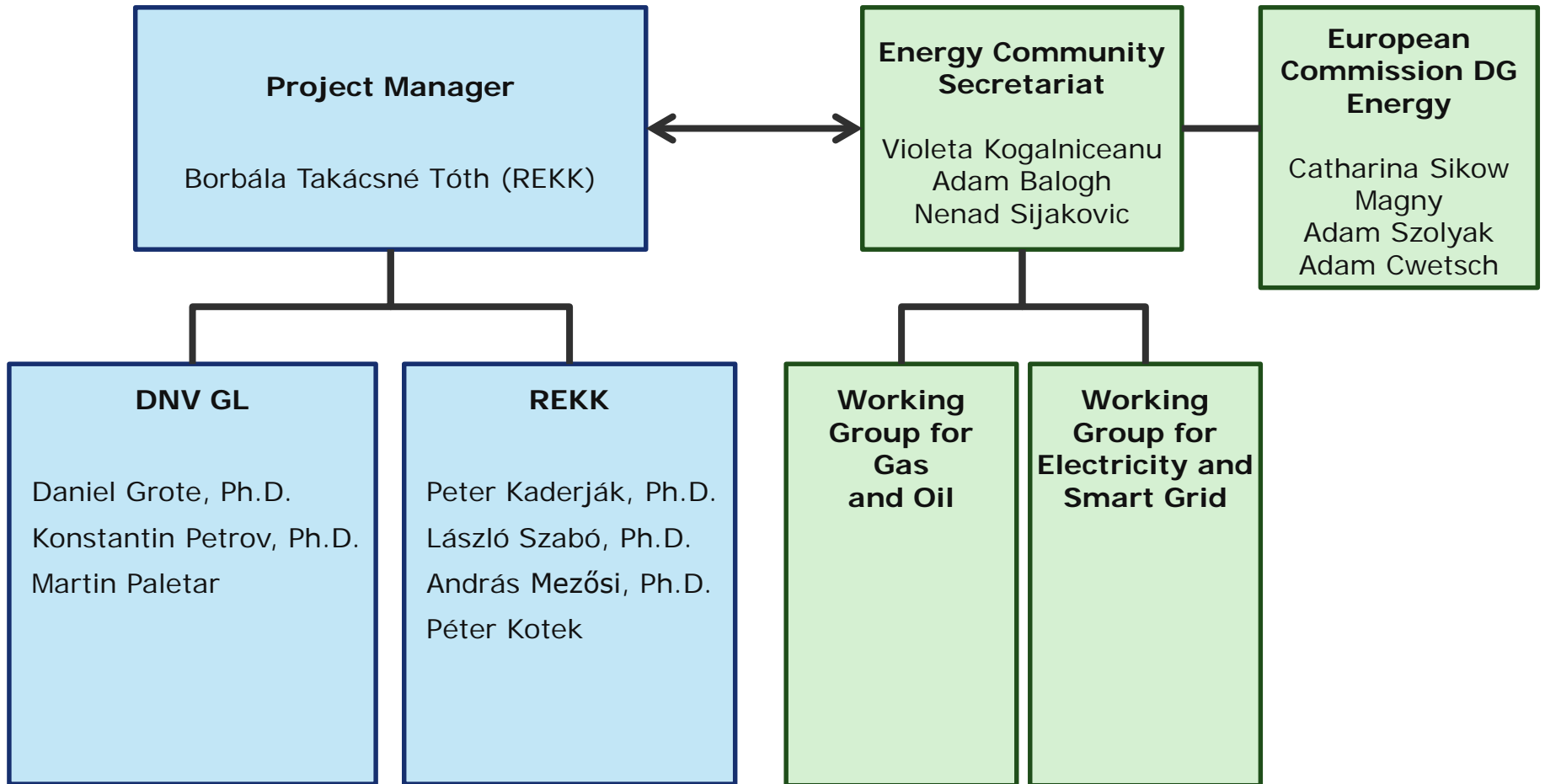
- **Deliverables**
  - Interim report (by 02. January 2018) containing:
    - the list of submitted projects, the result of the eligibility checks and data verification process, the description of the CBA methodology, indicators and weights used for the multi-criteria assessment
  - Draft final report (by 07. May 2018) containing:
    - description of the CBA methodology, indicators and weights used for the multi-criteria assessment, results of the CBA and multi-criteria assessment
  - Final report (by 11.07.2018), which incorporates the contents of the draft final report and reflects to the comments and feedback received by EnC Secretariat and project promoters.
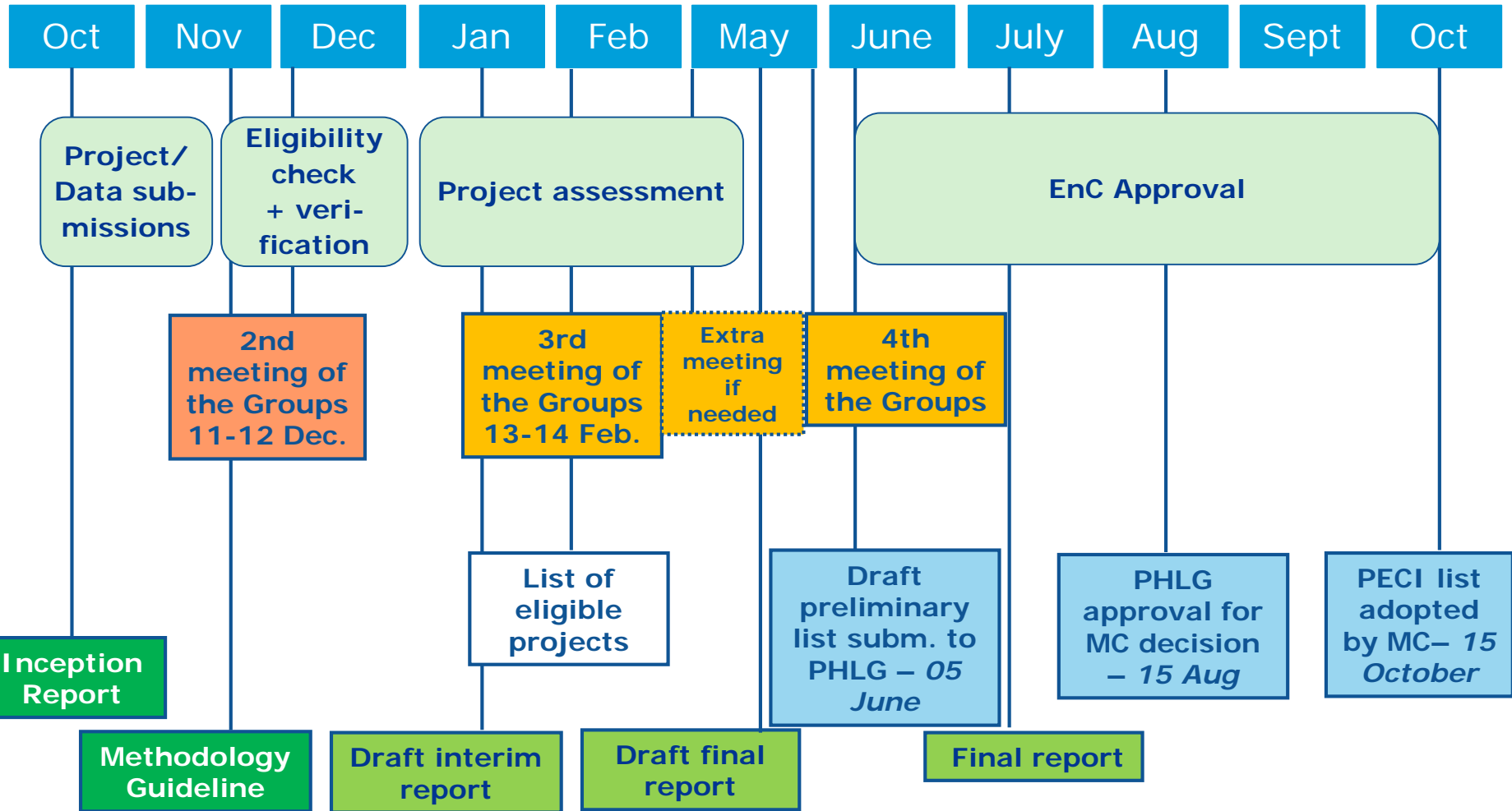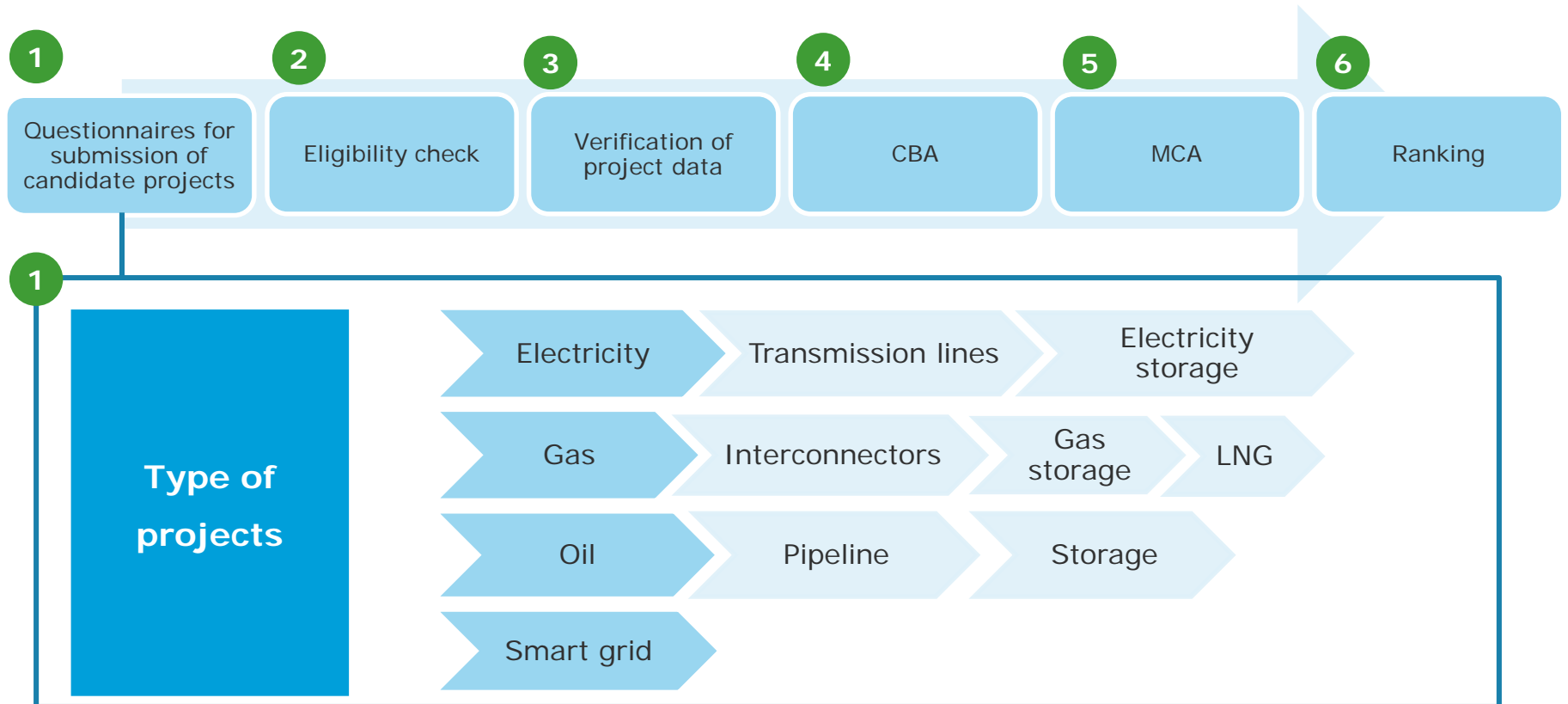
Project Workflow

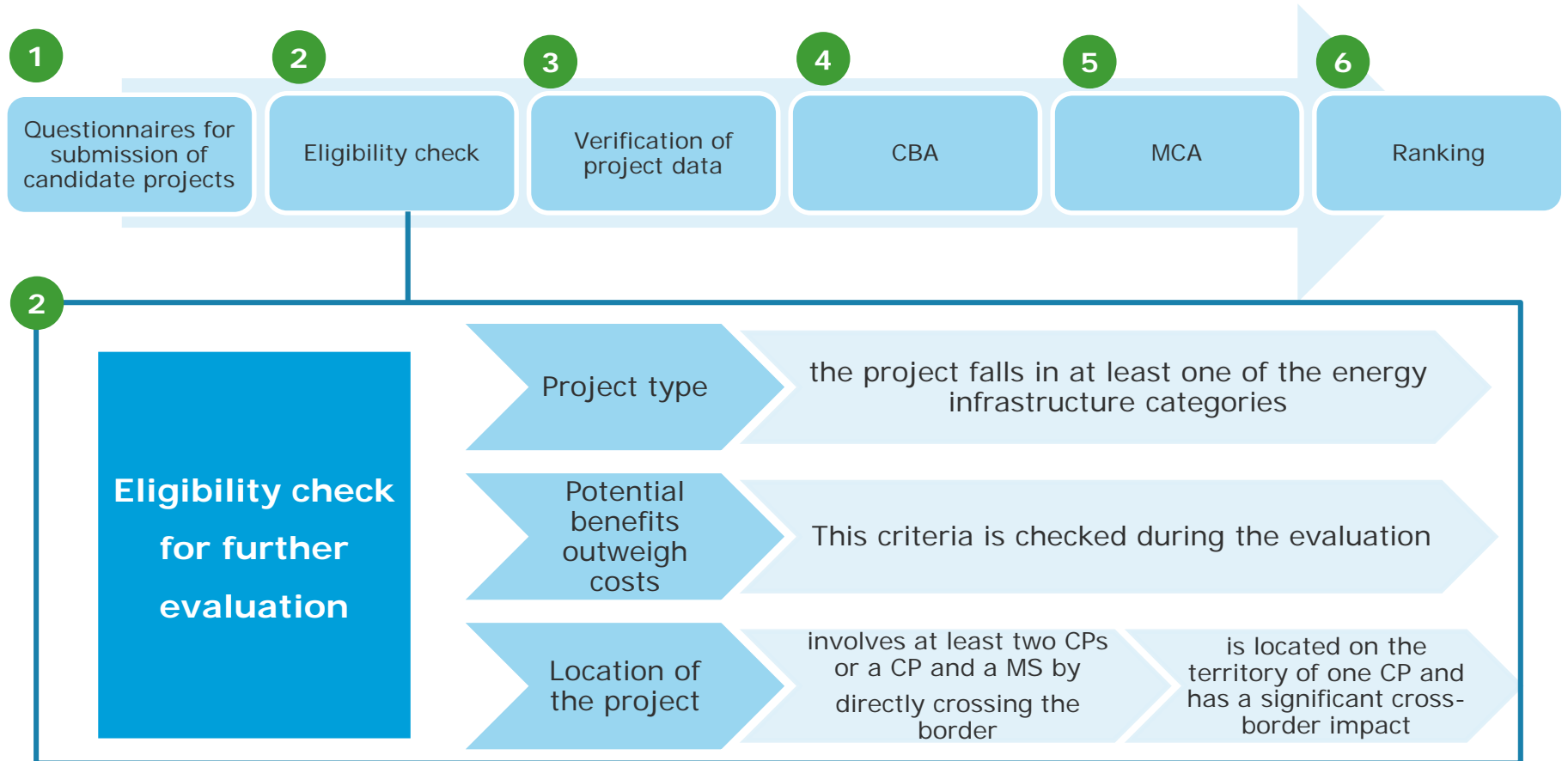1 Question-naires for submission of candidate projects

2 Eligibility check

3 Verification of project data

4 CBA

5 MCA

6 Relative ranking of projects

Project Team

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┌─────────────────────────────┐         ┌───────────────────────┐  ┌───────────────────────┐
│       Project Manager       │   ◄───► │  Energy Community      │  │  European              │
│                             │         │  Secretariat           │  │  Commission DG         │
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│                             │         │  Nenad Sijakovic       │  │  Magny                 │
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Working Group for Gas and Oil

Working Group for Electricity and Smart Grid

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Project Timetable

Oct	Nov	Dec	Jan	Feb	May	June	July	Aug	Sept	Oct

Project/ Data sub-missions

Eligibility check + veri-fication

Project assessment

EnC Approval

2nd meeting of the Groups 11-12 Dec.

3rd meeting of the Groups 13-14 Feb.

Extra meeting if needed

4th meeting of the Groups

List of eligible projects

Draft preliminary list subm. to PHLG – *05 June*

PHLG approval for MC decision – *15 Aug*

PECI list adopted by MC– *15 October*

Inception Report

Methodology Guideline

Draft interim report

Draft final report

Final report

Step 1 – Questionnaires for Submissions of Candidate Projects

| ① Questionnaires for submission of candidate projects | ② Eligibility check | ③ Verification of project data | ④ CBA | ⑤ MCA | ⑥ Ranking |

① Type of projects

Electricity	Transmission lines	Electricity storage
Gas	Interconnectors	Gas storage	LNG
Oil	Pipeline	Storage
Smart grid

- Interconnector projects on the two side of the borders can only be modelled together
- Project promoters are hence requested to submit proposals jointly for the same project
- Oil and smart grid project evaluation follows a slightly different approach: no modelling

Step 2 – Eligibility Check

1	2	3	4	5	6
Questionnaires for submission of candidate projects	Eligibility check	Verification of project data	CBA	MCA	Ranking

2

Eligibility check for further evaluation

Project type	the project falls in at least one of the energy infrastructure categories
Potential benefits outweigh costs	This criteria is checked during the evaluation
Location of the project	involves at least two CPs or a CP and a MS by directly crossing the border	is located on the territory of one CP and has a significant cross-border impact

All eligible projects will be evaluated according to the same approach. The PCI status will be decided on in the final step of the decision making: selected projects will qualify as a PECI or as a Project of Mutual interest. (Art 4 para 5 and 6.)

Step 3 – Verification of Project Data

1	2	3	4	5	6
Questionnaires for submission of candidate projects	Eligibility check	Verification of project data	CBA	MCA	Ranking

3

Verification of project data

Check with PCI, PECI and TYNDP	In case of projects that were submitted to previous evaluations the data consistency will be checked
Check for project groups	In case projects are dependent on each other and has not been submitted jointly by promoters the project promoters are requested to join the project
Check of CAPEX and OPEX	Benchmarking of submitted costs based on ACER guidelines and other relevant literature
Check basic data requirement	In case of missing data project promoters will be asked to submit missing data / to accept assumed data suggested by consultant / to withdraw application

Key data needed for project assessment: capacity (at the border), cost, commissioning date

Step 4 – 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) OR Benefit/Cost (B/C) ratio
- Calculation of the Net Present Value (NPV) and Benefit/Cost ratio 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) OR if the B/C>1

Step 4 – Cost-Benefit Analysis

1 Questionnaires for submission of candidate projects

2 Eligibility check

3 Verification of project data

4 CBA

5 MCA

6 Ranking

4

NPV calculations based on two modelling approaches

Gas market model → REKK EGMM: welfare change will be modelled, monetized benefits calculated (NPV)

PINT → Change in NPV (or B/C) when adding individual projects to the reference → Basic input for MCA

TOOT → Change in NPV (or B/C) when removing individual projects from reference with all candidates → For sensitivity only

Cost-benefit analysis of the project: social NPV of the project calculated for the region
- PINT: put-in-one-at-a-time modelling
- TOOT: take-out-one-at-a-time modelling

Step 5 – Multi Criteria Assessment

1	2	3	4	5	6
Questionnaires for submission of candidate projects	Eligibility check	Verification of project data	CBA	MCA	Ranking

5

Multi criteria assessment		
	Monetized benefits	CBA – input from the modelling
	Other non-monetized benefits	Indicators for benefit categories outside of the CBA
	Scoring	Scores from 1-10 will be assigned to the CBA and to the calculated indicators
	Weights	Weights are assigned to each benefit category to arrive to a final score of each project

- MCA allows integration of monetized benefits (result of CBA) with non-monetized benefits (assessment of additional quantitative and qualitative criteria)

- Outcome will be a relative ranking of all eligible projects (separate for electricity and gas projects)

Step 6 – Relative Ranking
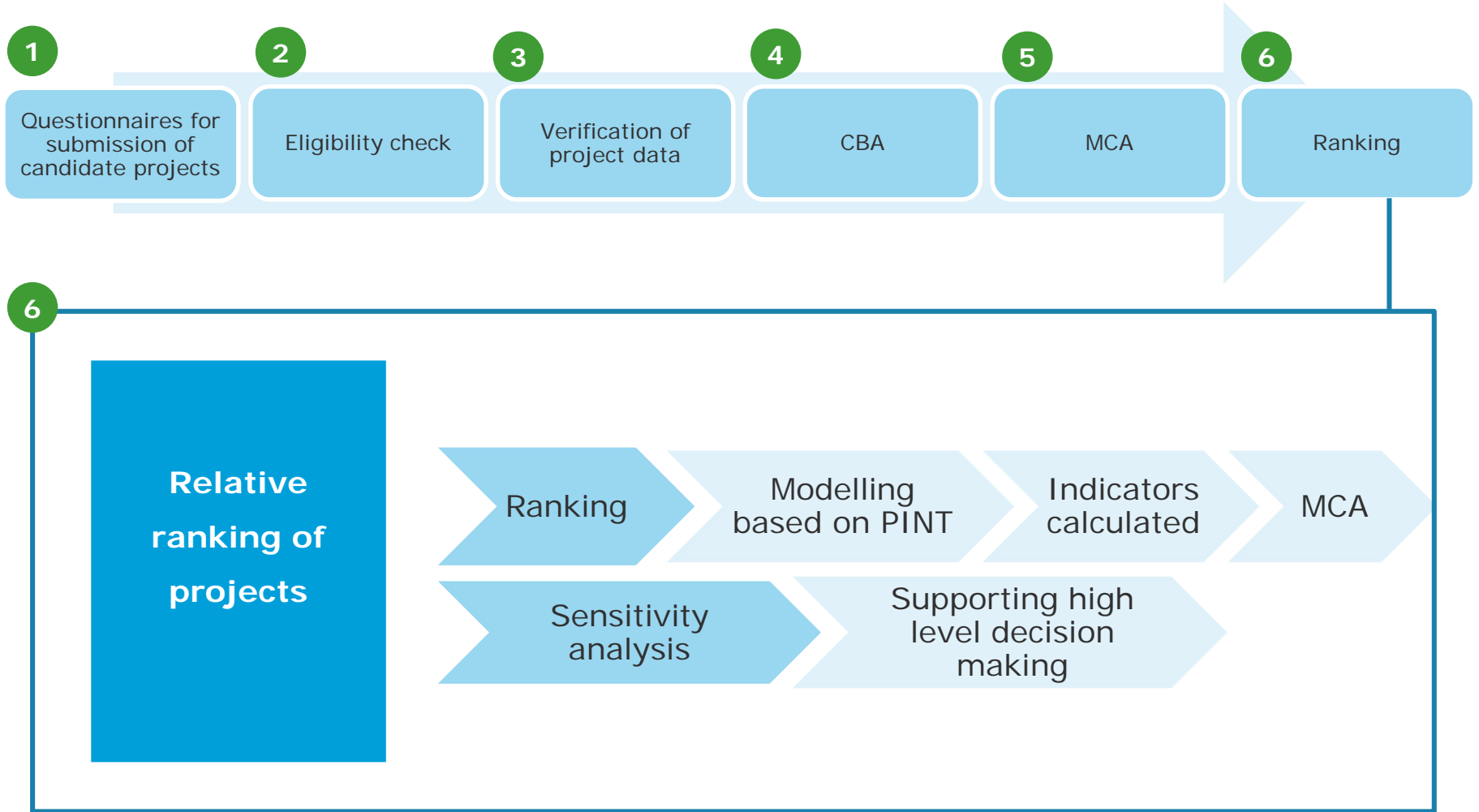
Assessment of Oil Projects – eligibility check

Evaluation	- The proposed methodology is based on our previous PECI project assessment and on the ministerial decision 2015/09/MC-EnC adopting 347/2013 Regulation - We suggest to follow this approach and evaluate smart grid projects talking into account eligibility **and specific criteria**
Eligible project categories	ANNEX I. (3) 1. Pipelines used to transport crude oil 2. Pumping stations and storage facilities necessary for the operation of crude oil pipelines; 3. Any equipment or installation essential for the system in question to operate properly, securely and efficiently, including protection, monitoring and control systems and reverse flow devices
Geographical eligibility criteria	Art. 4. 1(c) 1. Directly crossing the border: involves at least two CPs; or a CP and an MS or more 2. Located in one CP only, but has a significant cross-border impact

Assessment of Oil Projects

Art. 4.2. (d) and ANNEX III (5) of Ministerial Decision 2015/09/MC-EnC adopting 347/2013 Regulation
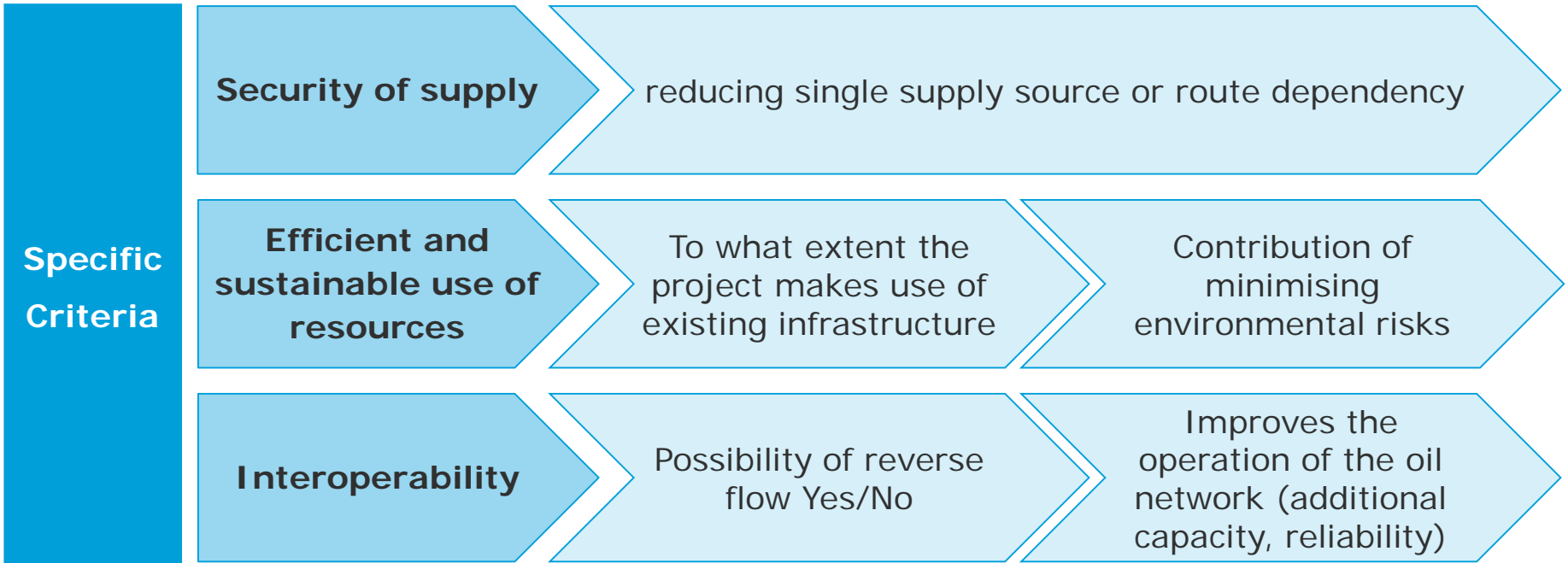
Specific Criteria	Security of supply	reducing single supply source or route dependency	
	Efficient and sustainable use of resources	To what extent the project makes use of existing infrastructure	Contribution of minimising environmental risks
	Interoperability	Possibility of reverse flow Yes/No	Improves the operation of the oil network (additional capacity, reliability)

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General Approach for Cost-Benefit Analysis

- Taking the ENTSO-G CBA methodology as a basis, and monetize the benefit categories where data availability allows it

- Use of the European Gas Market Modell to monetize welfare change due to the analysed project (project added to reference) under normal and security of supply (SOS) circumstances

Monetized benefits (+)

- Market integration effect = the total welfare change under normal circumstances

- SOS effect = the welfare change under a monthly cut of the largest import route of the region (through Ukraine) (one in 20)

- CO2 emmission reduction effect = Accounted for as if gas would substitute a mix in of the primary energy of the respective countries

Verified CAPEX and OPEX costs (-)

NPV = 0.95*Total welfare change(normal)+ 0.05*Total welfare change (SOS) - Investment cost + (CO2)

B/C=(0.95*Total welfare change(normal)+0.05*Total welfare change(SOS) + CO_2 effect)/Investment cost

Parameters of the Cost-Benefit Analysis
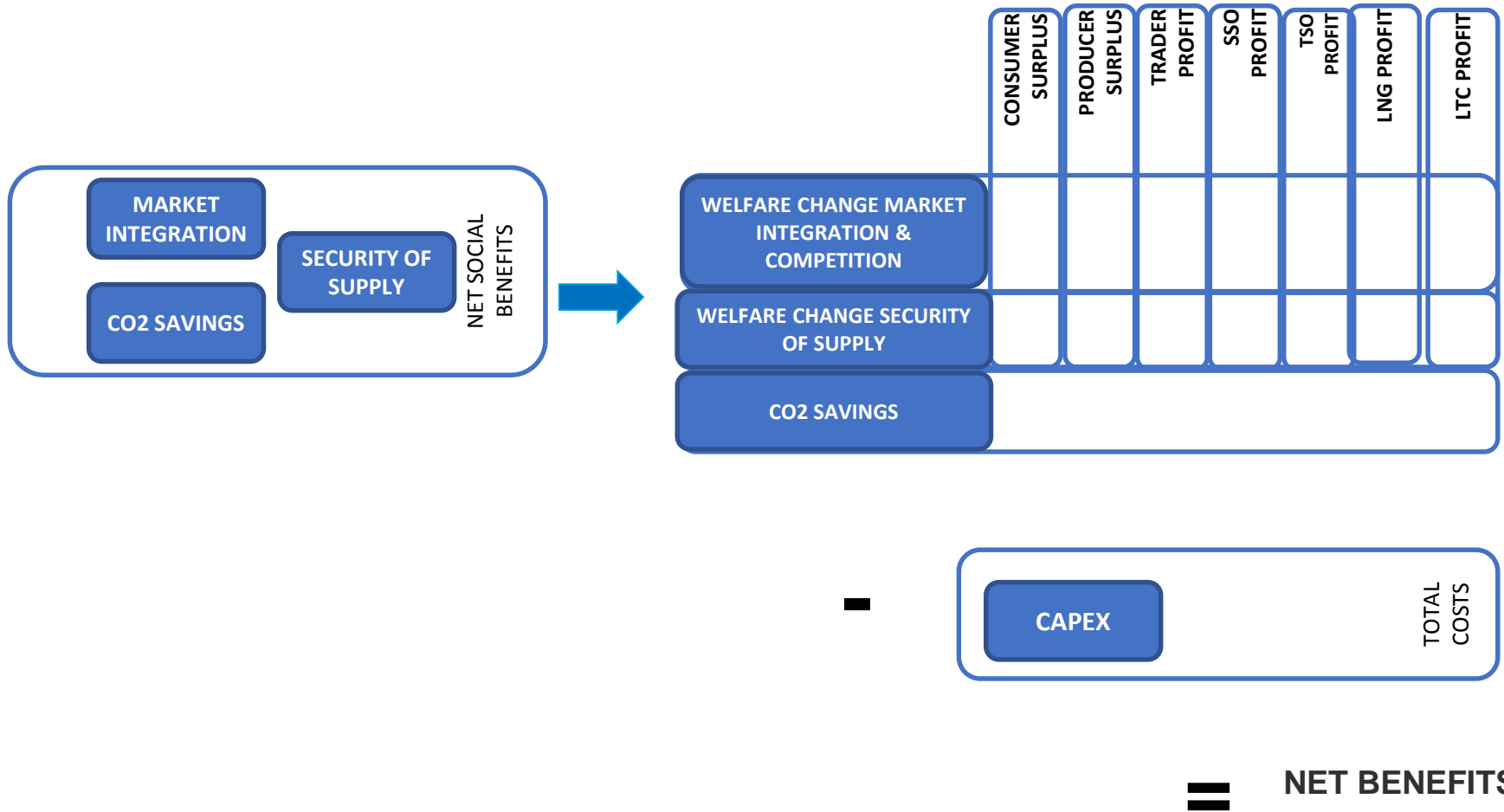
Components of Net Present Value Calculation

- Modelled welfare components: Total welfare change= CS + PS+ TSO + LTC holder + SSO + LSO

  - CS: Consumer surplus change in the countries of the area of analysis compared to reference
  - PS: Producer surplus change in the countries of the area of analysis
  - TSO, SSO, LSO: Change in profit
  - Change in LTC contract holder's profit
  - Investment cost: verified investment cost
  - CO_2: Calculated according to the selected option

- When calculation the NPV or B/C ratio 25 years of lifetime and a residual value of zero are applied → ACER recommendation

- Values between 2018-2050 are modelled by EGMM yearly → harmonized with ENTSOG methodology

- Real social discount rate: 4 % → ENTSOG methodology

- Reference scenario built up till 2045:

  – Infrastructure development according to ENTSO-G TYNDP

  – Production and demand in the Region as agreed with the Group

  – All proposed and verified infrastructure elements are assessed individually – using the PINT (**P**ut-**IN** one at the **T**ime) approach

European Gas Market Model – Major Characteristics
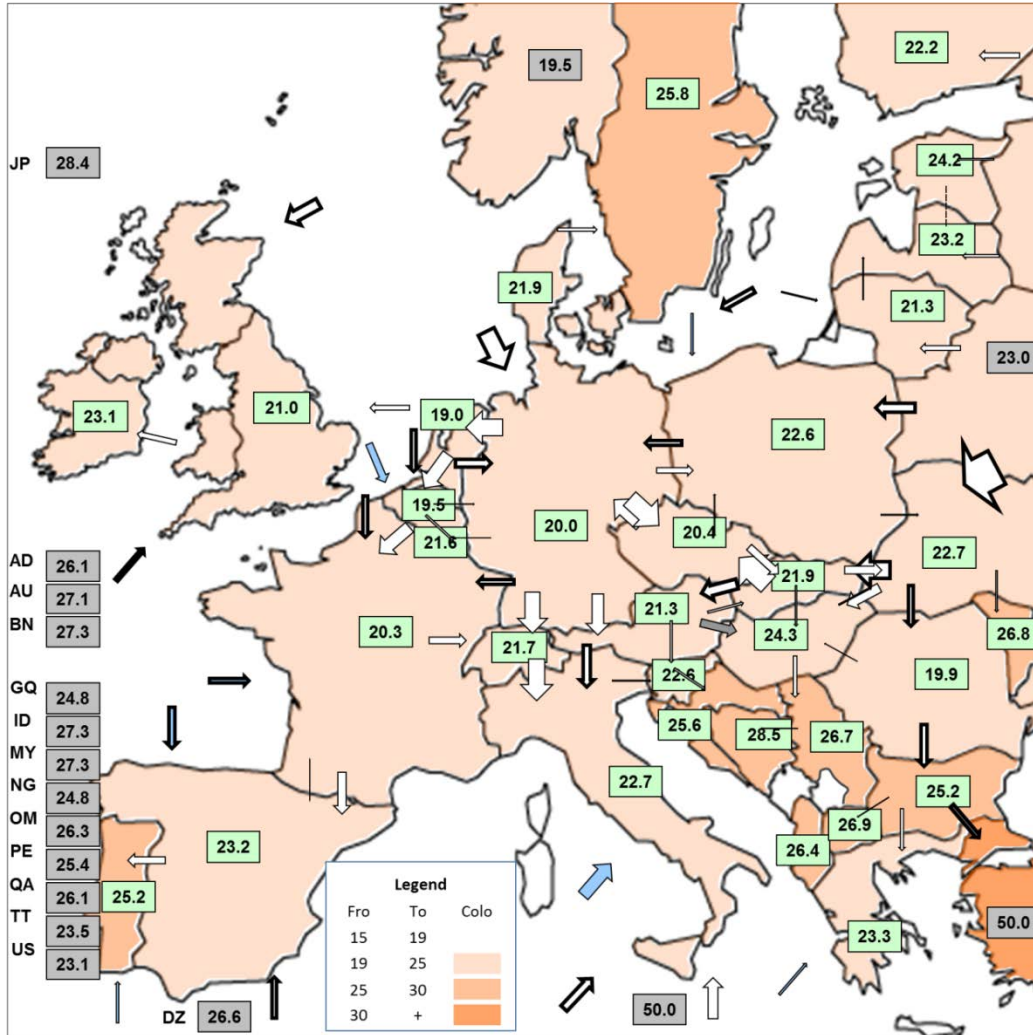
- Whole Europe (35 countries) is modelled

- Competitive prices by countries; price modelled for each 12 months

- Trade is based on long term contracts and spot trade within the EU and with exogenous countries and global LNG market (NO, RU, TR, LNG)

- Natural gas flows and congestions on interconnectors

- Physical constraints are interconnection capacities (transmission tariffs are also included)

- Trade constraints: TOP obligations with flexibility

- Domestic production and storage facilities are included

- Arrows: modelled gas flows

- LNG market representation is linked to Asian LNG prices

One Gas Year – 12 Months

INPUT

Demand by countries
(annual quantity, monthly distribution)

Domestic production
(annual quantity, minimum and maximum production)

LTC contract
(ACQ/DCQ), **flexibility**

Infrastructure:
Interconnectors, storage, LNG

Tariffs:
transmission, storage and regasification

MODEL

OUTPUT

Wholesale gas price by country

Consumption by countries

Gas flows on interconnectors

Storage stock change

Import through long term contracts and spot trade

Social welfare:

– Consumer surplus

– Producer surplus

– Storage operation profit

– Storage arbitrage profit

– Net profit from long-term contracts

– TSO auction revenue

– TSO operation profit

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Model Scheme

A Simple Model of Spot LNG Pricing for Europe (in€/MWh)

$$P_{ex>im} = P_{JP} - (C_{ex>JP} - C_{ex>im})$$
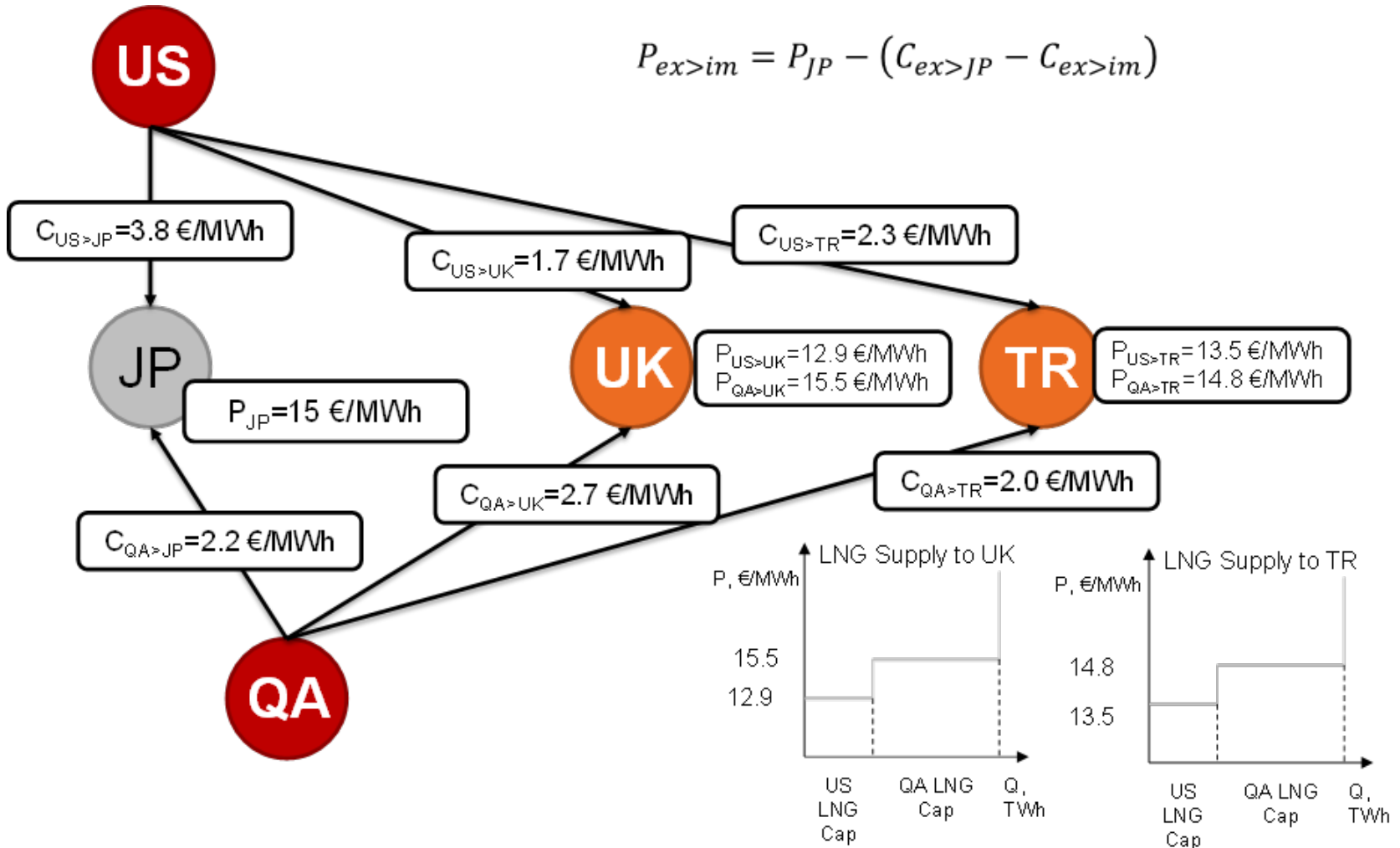
Input Data Sources

Input data	Unit	Source	Comment
Yearly gas demand	TWh/year	Primes ref 2016	For those modelled countries not included in primes: TYNDP 2016 Green evolution
Monthly demand	In % of yearly	Eurostat	Based on fact data from 2013-15
Production	TWh/year	Primes ref 2016	For those modelled countries not included in primes: TYNDP Green evolution
Pipeline Capacity	GWh/day	ENTSOG capacity map 16	For future projects ENTSOG TYNDP 2017
Pipeline Tariff on IP	€/MWh	REKK calculation; regulators websites as of 2017	Except for UA, where 2020 tariffs are used based on Naftogas data
Storage capacity	Working gas: TWh, Inj.. withdr: GWh/day	GSE	Data on each storage site – than aggregated on a country level
Storage tariff	€/MWh	Storage operators websites 2017 Jan	1 €/MWh cap is used
LNG regas capacity	GWh/day	GIE	Aggregated on a country level
LNG regas tariff	GWh/day	Operators websites	Entry into pipeline network is taken into account
LNG liquefaction	GWh/day	GIIGNL 2016	Source is constrained by liquefaction capacity
LNG transport cost	€/MWh	REKK calculation	Distance based. takes into account ship rates and boil off cost
Long term contracts	ACQ: TWh/year. DCQ: GWh/day	REKK collection from press + Cedigaz	TOP. flexibility. except for gas islands
			Delivery point on borders. Pricing based on foreign trade statistics. Delivery routes predefined

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EGMM and EEMM interlinkages

1. step: Gas market modelling ->
PRIMES/Reference gas demand corrected by the
EnC

2. step: Electricity market modelling with gas
price based on the result of EGMM

3. step: Modified gas demand data
-> Reference gas demand +/- gas
consumption changes in the power sector

4. step: New gas market modelling
with updated gas demand ->
this will be the reference gas scenario

5. step: New electricity market modelling
with updated gas prices ->
this will be the reference gas scenario

EGMM

EEMM

EGMM

EEMM

Natural gas
prices

Gas demand
of power
production

Natural gas
prices
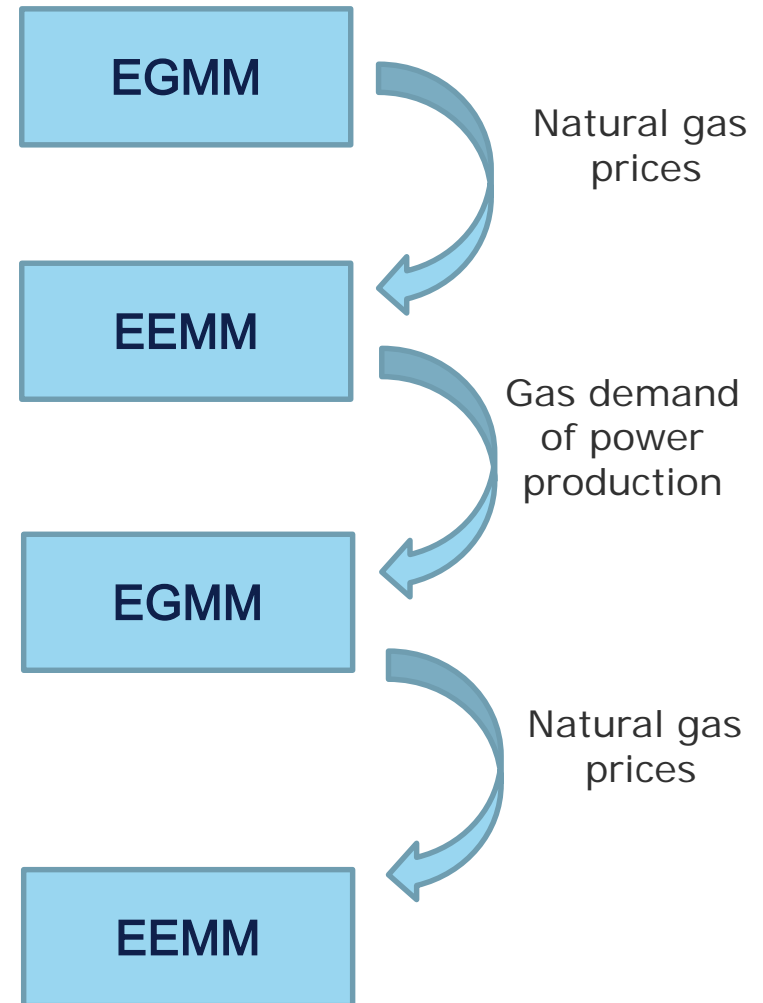
Dummy project: a new transmission pipeline between Greece and Bulgaria

- Bidirectional pipeline:

  - capacity of 90 GWh/day from Greece to Bulgaria and

  - 90 GWh/day capacity form Bulgaria to Greece.

- Commissioning year of the project is 2020.

- The total investment cost is 220 m€, distributed evenly between the two countries and spent evenly:

  - BG: 110 m€ real 2016

  - GR: 110 m€ real 2016

Price effect of the Dummy project (BG-GR) in a sample year, 2030

Gas wholesale price change (€/MWh) „normal"
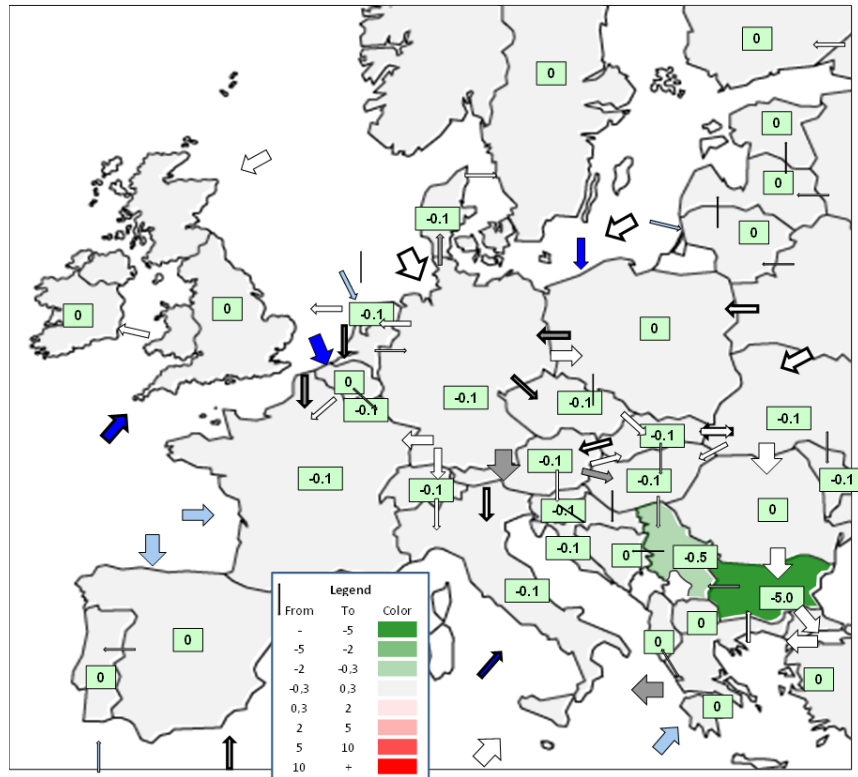
Gas wholesale price change (€/MWh) „SOS"
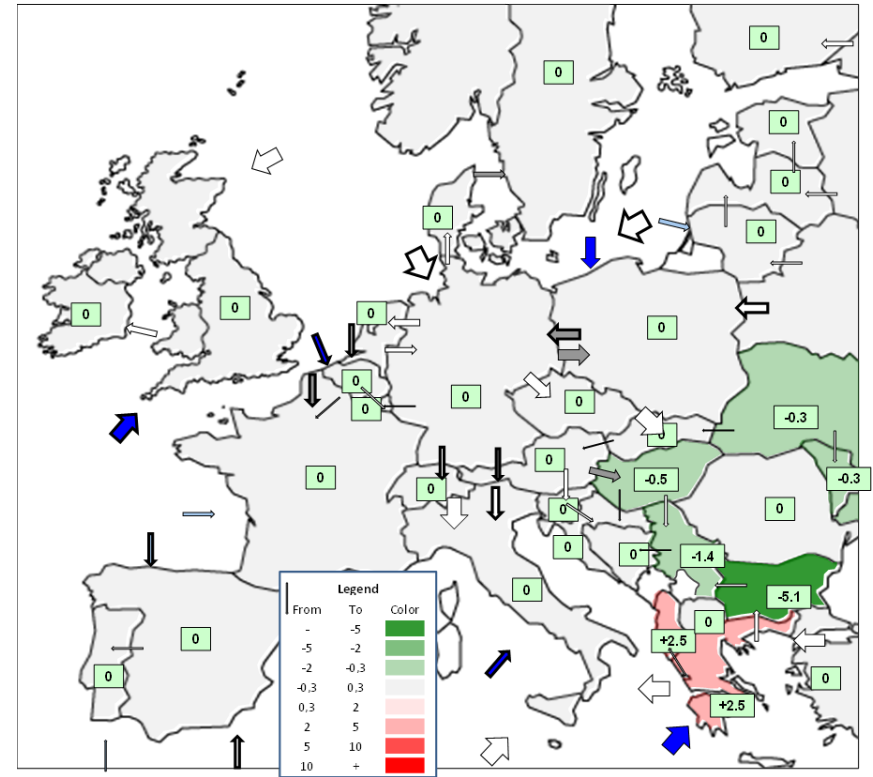
- A new bi-directional interconnector is commissioned connecting BG and GR (capacity 151 GWh/day)
- Effect: spot LNG gas flows may reach Serbia

GR-BG Interconnector Welfare Change Effects for 2030 - normal

Change in welfare (m€), „normal"
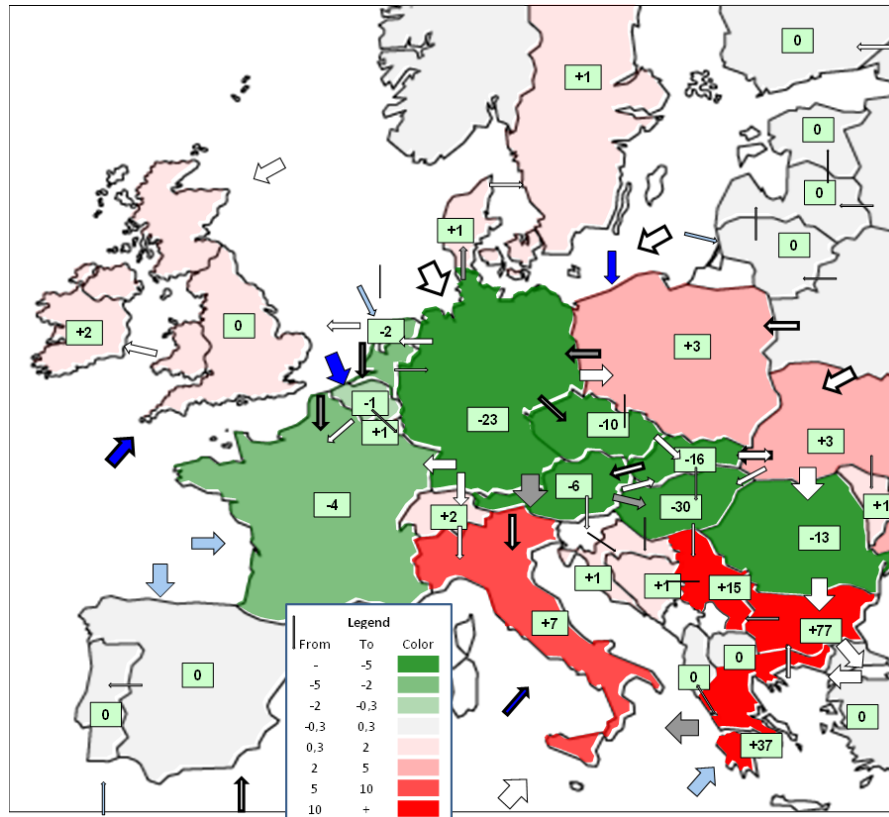
- **BG:**
  - Consumer surplus surges due to lower prices
  - Producer surplus and LTC holder profit drops, since the domestic production can be marketed at a lower price

- **GR**
  - TSO profits and LNG terminal operator profits increase, due to higher utilisation of infrastructure
  - Consumer surplus decrease is outweighted by TSO and LSO profit increase

GR-BG Interconnector Welfare Change Effects for 2030 - SOS

Change in welfare (m€), „SOS"
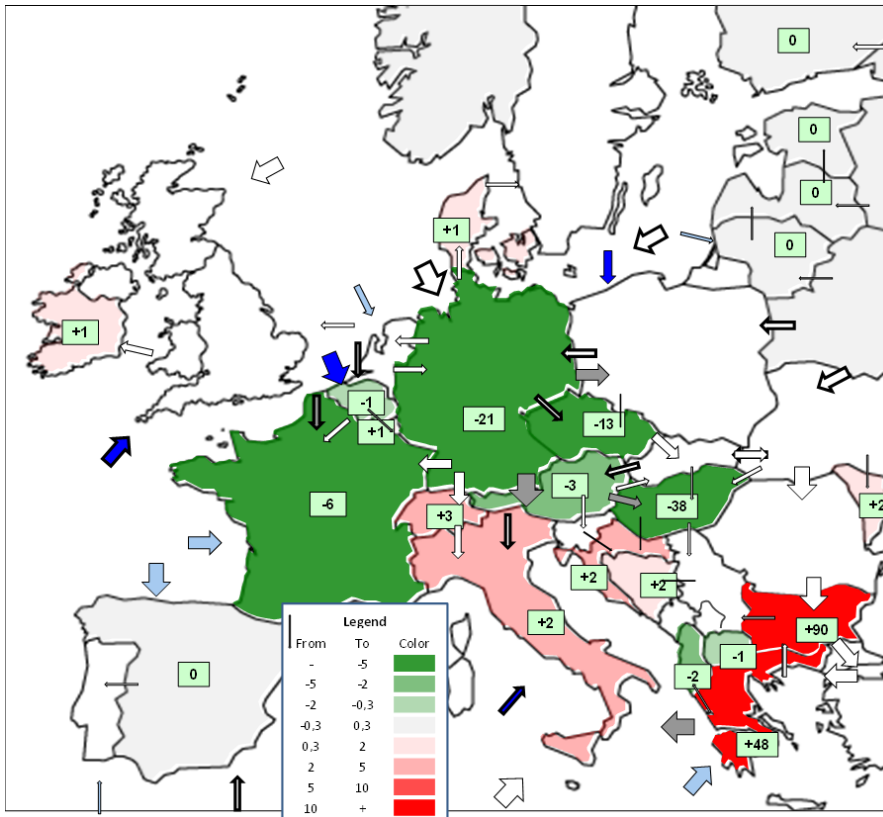
- **BG:**
  - Consumer surplus surges due to lower prices is much higher – the pipeline offers an alternative rout to a prviously isolated country
  - TSO operating profits increase due to higher flows on the newly commissioned pipeline

- **GR**
  - TSO profits and LNG terminal operator profits increase, due to higher utilisation of infrastructure

Summary table of the CBA results (2020-2045)

	Normal welfare	SoS welfare	Welfare 95% normal +5% SoS	CO$_2$	Investment	NPV
AL	-22	-45	-23	0	0	-23
BA	52	72	53	0	0	53
BG	1244	1654	1264	9	110	1163
GR	527	650	533	0	110	423
HR	28	14	28	0	0	28
HU	-280	-492	-291	0	0	-291
IT	-123	-163	-125	2	0	-124
KO*	0	0	0	0	0	0
ME	0	0	0	0	0	0
MK	-4	-14	-5	0	0	-5
MD	23	24	23	0	0	23
PL	95	79	94	0	0	94
RO	-219	-258	-221	0	0	-221
RS	523	664	530	2	0	531
SK	-323	-396	-326	0	0	-326
UA	45	16	43	1	0	44
Region	1565	1807	1577	14	220	1371

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Graphic representation of the results on the main criteria
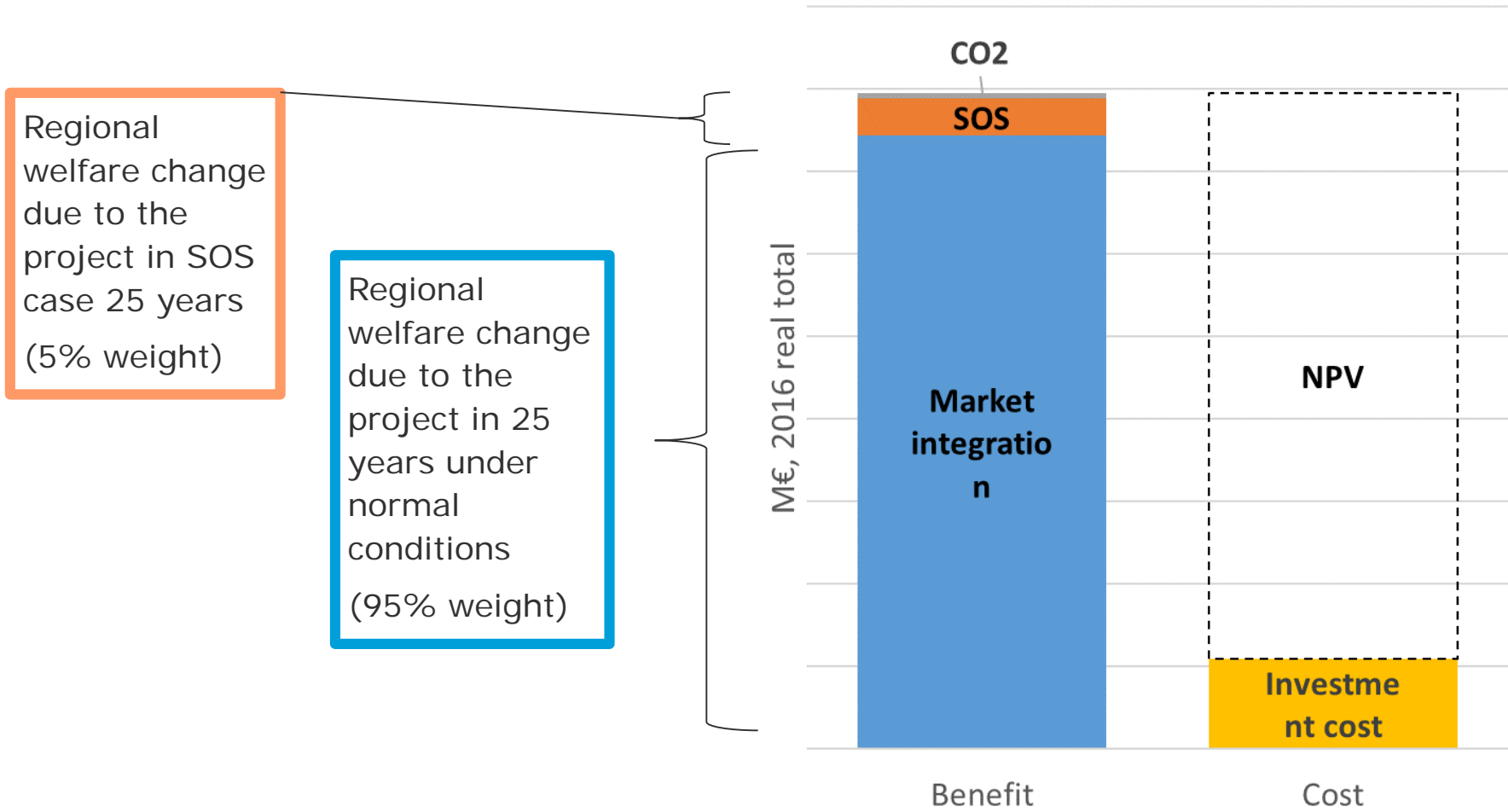
Regional welfare change due to the project in SOS case 25 years

(5% weight)

Regional welfare change due to the project in 25 years under normal conditions

(95% weight)

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Overview on Multi-Criteria Assessment Methodology

Rationale for MCA	▪ Not all dimensions of impacts may be monetised (which is necessary for inclusion within economic CBA) ▪ MCA allows to integrate qualitative criteria with results of the CBA

Step-wise methodology of Multi-Criteria Assessment	**1.**	▪ Identification and definition of criteria
	2.	▪ Specification of indicators to measure criteria
	3.	▪ Weighting of criteria (using the AHP approach)
	4.	▪ Assessment of the fulfilment of each criterion by each investment project
	5.	▪ Calculation of a final score for each project → ∑ score of each criterion * weight of each criterion
	6.	▪ <u>Relative</u> ranking of projects based on the project scores

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Overview of Project Assessment Criteria

Source of criteria	- EU Regulation 347/2013 as adopted by the Ministerial Council Decision - Assessment approach for EU Projects of Common Interest (PCI) - ENTSO-E and ENTSOG methodologies with feedback provided from ACER - Consultant's expertise from previous PECI 2016 selection

	Criterion	**Indicator**
Result of CBA	Change in socio-economic welfare	**1** Net Present Value (NPV) or Benefit/Cost ratio
Additional Criteria of MCA	Improvement of System Reliability	**2** System Reliability Index (SRI)
	Enhancement of competition	**3** Import Route Diversification Index (IRD)
	Project Maturity	**4** Implementation Progress Indicator (IPI)

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Calculation and Scoring of Indicators

Calculation of Indicators	

SRI, IRD	▪ 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

IPI	▪ Index determined by project specific progress reported in questionnaire

Scoring of Indicators	
NPV, SRI, IRD	▪ Score of 1 and 10 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
IPI	▪ Score of 1 assigned for each step completed by individual project

Project Assessment Criteria – Change in Socio-Economic Welfare

1

Change in socio-economic welfare

- Within the economic CBA, *incremental changes in socio-economic welfare from project implementation* measures the project's impact on:
  - **Market integration** via the impact on wholesale price changes (convergence) resulting from reduced congestion, access to sources with lower production costs and enhancement of competition
  - **Security of supply** via change in economic welfare in case of a gas supply disturbance
  - **CO_2 emissions** via impact of changes in gas consumption on the primary energy mix
- The change in socio-economic welfare is measured by the net present value (NPV) or the Benefit/Cost (B/C) ratio
- The higher the NPV (or the B/C ratio) the larger the net benefit
- Score of 1 assigned to project with smallest NPV (or B/C ratio) above zero
- Project with NPV negative but close to zero, will be assigned a score of 0

Dummy project example Bulgaria – Greece interconnector

NPV values of dummy project and three other gas infrastructure projects calculated within CBA

NPV	Value (m€)	Score
Project 1	18.25	1.00
Project 2	350	3.02
Project 3	1500	10.00
IP GR-BG	**1371**	**9.22**

Project Assessment Criteria – Import Route Diversification Index

2

Enhancement of Competition

- *Incremental enhancement of competition* is calculated as change in the simplified **Import Route Diversification (IRD)** index with and without the individual project as aggregate of the impacts in the countries on each end of interconnector

- The higher the value of the index the higher the market concentration

$$IRD = \sum \left(\frac{\text{tech. interconnection capacity at each border}}{\text{total system entry capacities}}\right)^2$$

$$+ \sum \left(\frac{\text{tech. send}-\text{out capacity at each LNG terminal}}{\text{total system entry capacities}}\right)^2$$

Reasoning

- Interconnection / LNG projects may enhance wholesale competition by providing access to alternative import capacities

- Transfer of monopoly rents (i.e. price-mark-ups over production costs) gained by producers / importers / traders to consumers

- Market model (used in CBA) assumes competitive market equilibrium

MCA Example of Dummy Project – Import Route Diversification

Romania

1214 GWh

11 GWh

34 GWh

Bulgaria

480 GWh

27 GWh

199 GWh

FYROM

Turkey

Greece

with dummy project

$$\left(100 * \frac{1214}{1323}\right)^2 + \left(100 * \frac{109}{1323}\right)^2] = 8488$$

IRD for Bulgaria without project

$$\left(100 * \frac{1214}{1413}\right)^2 + \left(100 * \frac{199}{1413}\right)^2] = 7580$$

IRD for Bulgaria with project

Decrease of IRD by 908 indicates improvement in competition due to implantation of dummy project

Bulgaria

199 GWh

49 GWh

10 GWh

Greece

6 GWh

Turkey

LNG

150 GWh

with dummy project

- Applying same approach for Greece results in increase of IRD by 195 (indicating a deterioration of competition).

- Adding up both numbers results in an overall IRD impact of the dummy project of -713
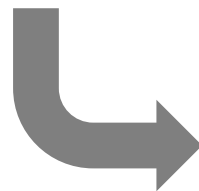
	Change in IRD	Score
Project 1	-312	1.00
Project 2	-520	4.16
Project 3	-905	10.00
IP GR-BG	-713	7.09

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Project Assessment Criteria – System Reliability Index

3

Improvement of System Reliability

- The incremental *improvement of overall system reliability* with regards to the daily operational flexibility and ability of the system to withstand extreme conditions is calculated as the change of the **System Reliability Index (SRI)** with and without the individual project

- The higher the value of the index the higher the level of system reliability

$$SRI = \frac{(\text{import cap. + production + storage + LNG}) - \text{single largest infr.}}{\text{daily peak demand}}$$

Reasoning

- CBA incorporates only some aspects of security of supply measured on monthly basis

- Additional indicator to account for daily operational flexibility and ability of the system to withstand extreme conditions

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MCA Example of Dummy Project – System Reliability Index

$$\frac{(1323 + 11 + 34 - 1214)}{168} = 0.917$$

SRI for Bulgaria without project

daily peak demand of 168 GWh/d

$$\frac{(1323 + 90 + 11 + 34 - 1214)}{168} = 1.452$$

SRI for Bulgaria with project

Increase of SRI by 0.535 indicates improvement in reliability due to implantation of dummy project

- Applying same approach for Greece results in increase of SRI by 0.257 (indicating an improvement of reliability).
- Adding up both numbers results in an overall SRI impact of the dummy project of 0.792

	Change in SRI	Score
Project 1	0.655	1.00
Project 2	0.982	10.00
Project 3	0.85	6.37
IP GR-BG	**0.792**	**4.77**

Project Assessment Criteria – Implementation Progress Indicator

4

Implemen-tation Progress Index

- The **Implementation Progress Index (IPI)** assesses the preliminary implementation potential of each individual project based on information provided in questionnaires

- A score of 1 is assigned for each project implementation step already under-taken

- Evaluation is conducted separately for each proposed investment project

- Where project maturity is significantly different on each side of a border, progress of least developed part will be applied for calculation

- Favours projects which have a clear implementation plan and/or have already commenced their preparatory activities

Reasoning

- Criterion aims to test preliminary implementation potential
- Project (cost) data and implementation timeline of projects at a very early consideration phase is by nature more uncertain

REKK

DNV·GL

MCA Example of Dummy Project – Implementation Progress Indic.

Dummy project example Bulgaria – Greece interconnector

Project implementation steps	Score
Consideration phase	✔ 1
Preparatory studies / pre-feasibility studies	1
Technical feasibility study / Environmental impact assessment	1
Economic feasibility study / cost-benefit analysis	1
Detailed design study (FEED/Main Design)	1
Financing secured	1
Planning approval / permitting	1
Approval by regulatory authority	1
Final investment decision	1
Tendering	1

Assumption only **"consideration phase"** has been completed and recorded in questionnaire for the whole interconnection project (i.e. sections located in both countries)

	IPI	Score
Project 1	1.00	1.00
Project 2	1.00	1.00
Project 3	2.00	2.00
IP GR-BG	**1.00**	**1.00**

Overview on Multi-Criteria Assessment Methodology

Multi-Criteria Assessment

Economic assessment of costs and benefits within CBA key element of the net benefit of an investment project, reflected by large weight of NPV (60%)

Result of CBA

Criteria	*Indicators*	*Ability of each project to fulfil criterion*	*Weights*
Change in Socio-Economic Welfare	Net Present Value	Score 1 to 10	x 0.60
Enhancement of Competition	Import Route Diversification Index	Score 1 to 10	x 0.12
Improvement of System Reliability	System Reliability Index	Score 1 to 10	x 0.18
Project Maturity	Implementation Progress Indicator	Score 1 to 10	x 0.10

Additional Criteria

Total score of each proposed project

Ranking of proposed projects based on scores

Relative Ranking of Projects

- Ranking is done by multiplying the score for each criterion, with the weight of each criterion a total score will then calculated for each project or project cluster (previous slide)

- Based on the calculated total scores of each individual project or project cluster a relative ranking of all eligible projects (i.e. a comparison of each individual project with the other submitted projects) will be provided in the final step

Dummy project example Bulgaria – Greece interconnector

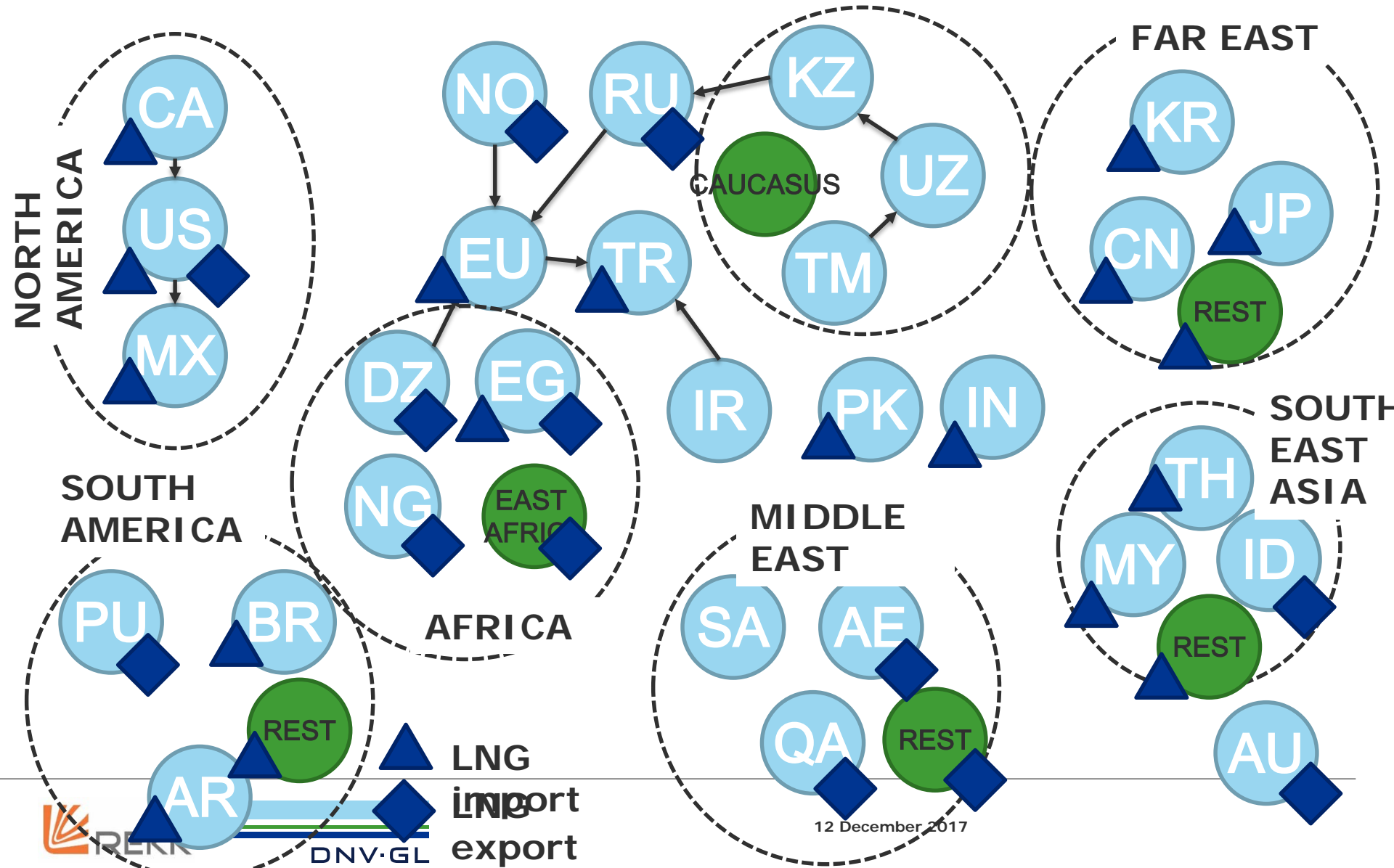| Project	Indicators (Scores)				Weights				Indicators (Weighted Scores)				Total Score	Ranking
	Result of the CBA	Enhancement of Competition	Improvement of System Adequacy	Project Maturity	Result of the CBA	Enhancement of Competition	Improvement of System Adequacy	Project Maturity	Result of the CBA	Enhancement of Competition	Improvement of System Adequacy	Project Maturity		
	Net Present Value (NPV)	Import Route Diversificaiton (IRD)	System Reliability Index (SRI)	Implementation Progress Indicator (IPI)	Net Present Value (NPV)	Import Route Diversificaiton (IRD)	System Reliability Index (SRI)	Implementation Progress Indicator (IPI)	indicator * weight					
P 1	1.00	1.00	1.00	1.00	60%	12%	18%	10%	0.60	0.12	0.18	0.10	1.00	4
P 2	3.02	4.16	10.00	1.00	60%	12%	18%	10%	1.81	0.50	1.80	0.10	4.21	3
P 3	10.00	10.00	6.37	2.00	60%	12%	18%	10%	6.00	1.20	1.15	0.20	8.55	1
IP GR-BG	9.22	7.09	4.77	1.00	60%	12%	18%	10%	5.53	0.85	0.86	0.10	7.34	2

Agenda

1. Overview of general project assessment methodology

2. Cost-benefit analysis (CBA) and Gas market modelling (EGMM)

3. Multi-criteria assessment methodology

4. Country specific data and modelling assumptions

Georgian projects

- Three possible ways to assess them:
  - extending the EGMM with Georgia
  - Use the world model WGMM
  - Use different assessment of benefits for these projects
- The main problem is with eligibility: effect on two EUMS or two CPs
- Geographical region?

WGMM - Network representation

NORTH AMERICA

SOUTH AMERICA

AFRICA

FAR EAST

SOUTH EAST ASIA

MIDDLE EAST

CAUCASUS

CA, US, MX, NO, RU, KZ, UZ, TM, EU, TR, KR, JP, CN, REST, DZ, EG, NG, EAST AFRICA, IR, PK, IN, TH, MY, ID, REST, PU, BR, REST, AR, SA, AE, QA, REST, AU

LNG import
LNG export

12 December 2017

Assessed Geographical Area – Same for All Project Types

- *Ministerial Council Decision 2015/09/MC-EnC Annex IV./(6)*

  - „The area for the analysis of an individual project shall cover all Contracting Parties and Member States, on whose territory the project shall be built, all directly neighbouring Contracting Parties and Member States and all other Contracting Parties and Member States significantly impacted by the project."

  - Our proposal for the definition of area for the analysis:

    - All Contracting Parties

    - Neighbouring EU Member States (Bulgaria; Croatia; Greece; Hungary; Italy; Poland; Romania, Slovakia)

New pipeleline and LNG infrastructure assumed in the reference

Name	Maximum flow GWh/d	Date of commissioning	Basis to include into reference for 2020
IT-CH	368	2018	FID
BG-RS	51	2018	FID
RS-BG	51	2018	FID
CH-FR	100	2018	FID
CH-DE	240	2018	FID
TR-GR2_TAP	350	2019	FID
AZ-TR_TANAP	490	2018	FID
GR-BG	90	2018	FID
GR-BG	151	2021	FID
GR-IT_TAP	334	2019	FID
SI-HR2	165	2019	FID
HR-SI	165	2019	FID
BG-RO	14	2016	FID
RO-BG2	14	2016	FID
IT-AT2	189	2018	FID
AT-DE2	36	2017	FID
DE-AT2	143	2017	FID
GR-LNG expansion	81	2017	FID

Further Modelling Assumptions

- Outside market prices are set exogenously

  - Russia is assumed to trade on spot and LTC basis, using predominantly LTCs for marketing its production to Europe. Spot gas is priced at the TTF and delivered at the entry point of Nord Stream to Europe. Delivery points of the long-term contracts are at the border of the importing countries.

  - Norway is assumed to trade on spot and LTC basis similar to Russia.

  - North-African producers are considered inflexible and no option for spot trade is assumed

- Europe acts as a 'last resort' for LNG. Europe accounts for roughly 15% of global LNG imports, while the most volumes are traded at Asian markets of the Pacific basin. From modelling point of view this implies that European markets are rather following the Asia dominated market developments than forming the global market outcomes. Therefore, the price of natural gas in the Asian markets acts as an indicator for all LNG liquefaction terminals, which are able to trade to either Asian or European markets. The price of LNG sold to Europe is based on the opportunity cost of 'not selling' to Asia.

Assumptions related to Assessed projects

- Extension of capacity or a new pipeline parallel to an already existing one has the same tariff as the „old" pipeline

- New interconnector is modelled with a uniform 1.5 €/MWh tariff (average tariff on EU interconnection points), if no other tariff is indicated by the Promoters in the questionnaire.

Newly gasified countries – NOTE: benefits are overestimated

- Gas demand will be set to 0 in the reference scenario for all those countries that are currently not gasified. Demand increase will only be assumed when the project delivering gas to the respective market is assessed.

- When calculating the consumer surplus the assumption is that the gas demand has always been there, but could not met due to a lack of infrastructure; what will not be done, is to compare for each country, which fuel that has previously been used at which cost for the different purposes (i.e. heating, cooking,…) is now replaced by natural gas. In other words, for the calculation of the consumer surplus, gas is not replacing anything but comes as additional demand. This leads to a (substantial) overestimate of the consumer surplus change.

- In case the new project is gasifying a market that had no gas in the energy mix before, the cost of the distribution system will be taken into account. Additional data need will be asked from the Groups. (Applies to Albania, Montenegro, Kosovo*, and to certain projects in Bosnia and Herzegovina, and maybe to Macedonia)

Assumptions on Consumption and Production

Gas demand TWh/year								
	2016	2020	2025	2030	2035	2040	2045	2050
Albania	0.0	4.9	8.8	12	12	12	12	12
Bosnia and Herzegovina	1.7	2.0	2.2	3	3	3	3	3
Georgia	23.7	28.4	34.1	41	49	59	71	85
Kosovo*	0.0	0.0	0.0	0	0	0	0	0
Moldova	10.0	11.0	12.0	13	14	14	14	14
Montenegro	0.0	0.0	0.0	0	0	0	0	0
FYR of Macedonia	1.8	4.0	3.8	3.6	3	7	7	7
Serbia	21.7	17.0	15.3	16	14	14	14	14
Ukraine	326.9	369	368	371	375	394	394	394
Total	385.8	436.3	444.2	458.6	469.9	502.2	513.9	528.1

Gas production, TWh/year							
	2020	2025	2030	2035	2040	2045	2050
Serbia	5.4	2.8	1.9	0.9	0.0	0.0	0.0
Ukraine	208.1	237.0	251.4	265.8	280.2	294.6	309.0

Source: TYNDP 2015, incl.: BA, SB, FYR of MK. Currently non existent gas markets are set to 0: AL, ME, KO* national forecast UA, MV)

Assumptions on LTCs

- Current supply contracts in the EnC CPs are not expected to expire, but they will be recontracted.

- Supply contracts in the EU are assumed to be recontracted only to 30% of their ACQ, the rest will be offered on a spot trade basis by Russia, Norway and LNG. Russia trades spot only through Nord Stream 2.

Long term supply and transit contracts					
	Supply from	ACQ (TWh/year)	Price in 2016 (€/MWh)	contract expiry	Contract route
Moldova	Russia	10	20.09	yearly	UA-MD
FYR of Macedonia	Russia	1	22.83	yearly	UA-RO-BG-MK
Serbia	Russia	up to 50	34.44	2021	UA-HU-RS
Ukraine		0	-		any short term?

New LTCs	to	ACQ (bcm/year)
SOCAR	Italy	8
	Greece	1
	Bulgaria	1

Consumption forecast for emerging gas markets

- Consumption change in some countries is subject to infrastructure not in place yet

- Will be used only when the projects on the territory of the respective country is modelled

TWh/year	2015	2020	2025	2030
Albania	0	4.9	8.82	11.76
Bosnia and Herzegovina	3.92	8.82	11.76	15.68
Kosovo*	0	0	3.92	5.88
Montenegro	0	0	0.98	0.98
FYR of Macedonia	1.96	6.86	10.78	13.72

Source: ECA Gas to Power Study 2015

New storage facilities assumed in the reference

Storage facility	Market	Capacity			Commissioning
		Working gas	Injection	Withdrawal	
		TWh	GWh/d	GWh/d	
Tuz Gölü	TR	5	159	159	2017
Botas Tarsus	TR	11	319	319	2020
Silivri (Marmara)	TR	46	638	638	2020
Bordolano phase II	IT	7	109	185	2019

Source TYNDP 2017

Sensitivity

- The parameters to be assessed:

  – Natural gas demand: +/- 20% gas demand in EnC CPS

  – LNG inflow to Europe +/- 50%

  – Key infrastructure to the region (Krk LNG terminal, TAP-TANAP)

- Also applying the TOOT methodology is a special case of sensitivity assessment, where the reference network topology changes. The TOOT based assessment will help to identify which projects are competing in the proposed set of projects.

- Sensitivity assessment will be presented in the report in order to demonstrate the range of uncertainty in the modelling. Project NPVs will be calculated for all sensitivity cases in order to check the robustness of the ordering of projects.

Thank you!

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