Draft Cost-Benefit Analysis Methodology for Public Consultation

Document prepared for the purposes of a Public Consultation starting 25 July 2013. Feedbacks and comments are expected to be received by 02 September 2013 COB.

Brussels,
25 July 2013

Contents

1. General Terms

This section introduces common features of the Energy System-wide Cost Benefit Analysis (ESW CBA) and the Project Specific Cost Benefit Analysis (PS CBA). These areas are the legislative background, the time horizon and data set.

1.1. Legislative Background

The present methodology stems in the ENTSOG responsability, as mentioned in the Regulation[1] to issue and publish an energy system wide cost-benefit analysis methodology at Union level for projects of common interest falling under the categories set out in Annex II.2.

The Regulation determines the framework for the CBA methodology in that it defines the key elements of the methodology as well as the criteria and indicators to be used for project assessment.

According to article 4 of the Regulation, the Projects of Common Interest (PCIs) shall meet the following general criteria:

a) *"the project is necessary for at least one of the energy infrastructure priority corridors and areas;*
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; and*
c) *the project meets any of the following criteria:*
   i. *involves at least two Member States by directly crossing the border of two or more Member States;*
   ii. *is located on the territory of one Member State and has a significant cross-border impact as set out in Annex IV.1;*
   iii. *crosses the border of at least one Member State and a European Economic Area country.*
   iv. *For gas projects falling under the energy infrastructure categories set out in Annex II.2, the project is to contribute significantly to at least one of the following specific criteria:*
      i. *market integration, inter alia through lifting the isolation of at least one Member State and reducing energy infrastructure bottlenecks; interoperability and system flexibility;*
      ii. *security of supply, inter alia through appropriate connections and diversification of supply sources, supplying counterparts and routes;*

[1] Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013, on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009

iii. *competition, inter alia through diversification of supply sources, supplying counterparts and routes;*
iv. *sustainability, inter alia through reducing emissions, supporting intermittent renewable generation and enhancing deployment of renewable gas;"*

The CBA Methodology provides a tool to reflect the contribution of the candidate PCIs to meet the criteria requested by the Regulation. These criteria represent the societal benefits of the planned projects.

The methodology consist of two main parts; one covering an Energy System-Wide Cost Benefit Analysis (ESW CBA) for gas to be carried out by ENTSOG in the framework of the ten-year network development plan (TYNDP) and the other one relating to an individual project analysis to be performed by the respective project promoter: the Project Specific Cost Benefit Analysis (PS CBA).

1.2. Time horizon

The time horizon of the analysis is common for both the ESW CBA and the PS CBA.

According to the Regulation Annex V/1 "*The methodology shall be based on a common input data set representing the Union's electricity and gas systems in the years n+5, n+10, n+15, and n+20, where n is the year in which the analysis is performed.*" As a consequence the input data provided within the analysis shall be available for the entire time horizon.

The above section of the Regulation defines the time horizon of the input data to be used for the analyses, but it does not define the time horizon for the analyses itself. Therefore a consensus has to be reached to apply such a time horizon, which enables the consistent comparison of the results produced by the analyses.

Ensuring in practice the comparability of the results when applying a consistent time horizon is raising important questions. For these considerations, please refer to the *Questions to the Draft CBA Documen*t Annex.

1.3. Consistent input data set for the Cost-Benefit Analysis

The Cost-benefit analysis is based on different sources of data: TSOs, third parties, Member States (MSs), NRAs, International Agencies etc. The quality, reliability and availability of the data provided by these parties has a significant impact on the robustness and relevance of CBA results. Therefore, it is worth noting, that the successful development and further application of the CBA methodology depends to a large extend on stakeholders' engagement and submission of reliable input data, which are beyond TSOs' remit.

This chapter provides an overview of the common data set to be used within the ESW and PS CBA.

More specific definitions that relate only to the Project Specific data requirements, are detailed in Chapter 3.

The input data section of the ESW CBA serves as a reference data set for the whole CBA methodology. Such input data, directly provided or referenced, shall be used for the analysis of the project. This common set of data ensures the *consistency* and *comparability* of the results. Data come from three main sources:

> *ENTSO-G Ten Year Network Development Plan,* these data set a common framework (capacity, supply and demand scenarios and cases) [2] for the assessment of the whole list of PCIs and each individual project.

> *Referenced sources*, these data will focus on framework conditions (e.g. *macroeconomic data*, *interest rate* or *energy mixes, policy scenarios, cost of disruption* etc.) and internationally recognised prices used for monetization. Such data will come from internationally renowned data providing institutions that could include the following institutions: s.a. *Eurostat, IEA, UN, National Statistical Bureaus,* Institutions of the European Union, Eurostat, Institutions of Member States, World Bank, ENTSO-E etc.

> *Project promoter* data, these data concern project specific information (*CAPEX*, *OPEX*, *implementation schedule*, etc.).

1.3.1. Data from ENTSOG TYNDP

Existing TYNDP process will serve to collect supply and demand data together with project specific data.

Data from TYNDP will include:

Data from ENTSOG TYNDP		Application of Data
PCI Status	Applicant/ Already PCI	ESW CBA
Infrastructure Capacity Data	Capacity of the existing and planned infrastructure along the time horizon	ESW & PS CBA
Supply Data of Zones within Europe	Data provided for the time horizon	ESW & PS CBA
• *National Production*		
• *LNG sendout capacitites*		
• *UGS working volume, withdrawal- and injection capacities*		
• *Other Supply sources*		
Demand Data of Zones within Europe	Data provided for the time horizon	ESW & PS CBA
• *High Daily Demand*	Data provided for the time horizon	
• *Average Daily Demand*		
• *Annual Demand*		
• *Reference Scenario*	To be defined	
• *Sensitivity Analysis Scenarios*	To be defined	
Disruption scenarios		ESW CBA

By definition the TYNDP data has had a Ten Year time horizon and the same applies for the associated data set. This time horizon will have to be extended to twenty years. The potential requirement of PS CBAs to be carried out on the same number of years of project operation in

[2] In case significant changes happen between the time of submission of data within the data collection for TYNDP and the analysis (whic by definition cannot be more then 2 years, as PCI process is repeated every two years), project promoter will have to chance to highlight such significant changes within the Qualitative Part of the PS CBA.

order to ensure comparability of the economic performance indicators (NPV, IRR, B/C ratio), the TYNDP data set could require further extrapolation. About potential alternatives to handle this issue, please refer to the *Questions to the Draft CBA Document* Annex, section *The issue of time horizon.*

1.3.2. Data from referenced sources

It is envisaged that additional data from internationally recognised sources will be used to provide context to the sensitivity analysis and where relevant to monetize benefits. The table below provides a non-exhaustive list of data items that ENTSOG, along with ENTSO-E, will discuss with Member States, Commission and ACER in preparation of the final CBA methodology. Objective is to provide a common set of referenced information and scenarios from recognised Sources and making consensus among stakeholders.

The sensitivity analysis part of the CBA methodology, will also be run based on different scenarios of the below data.

Data from Referenced Sources		Application of Data
Prices	Data necessary for the time horizon	PS CBA
• *Fuel Prices of coal, lignite, natural gas, oil*		
• *Cost of emmission - CO_2 price*		
Physical Constants	Constant data	PS CBA
• *Gross/Net Calorific value of fuels*		
• *Specific CO_2 emission of fuels / gross or nett energy released*		
• *Gross/Net Thermal efficiency of power plants*		
EU Policy Scenarios for Energy Mix of countries	Reference for the time horizon	PS CBA
• *Post 20-20 framework scenario*		
• *BAU scenario*		
• *Gas enhanced scenario*		
Macroeconimic Data		PS CBA
• *MS specific data, such as cost of disruption*	Specific Data from Members States; potential usage depending on availability and discussion with MSs and Stakeholders	
• *Social discount rate*		

1.3.3. Project specific input data

For the ESW CBA some project specific data is acquired from Project promoters. Additional information will be necessary to enable the Project promoter to undertake their PS CBA if required to do so. The data required from the project promoter for ESW and PS CBA are detailed below:

Project Specific Input data, provided by the Project Promoter		Application of Data
Identification of the project	Definition of the project	ESW&PS CBA
CAPEX	Along construction phase	ESW&PS CBA
OPEX	Along operation phase	ESW&PS CBA
Implementation schedule	Occurance of CAPEX along construction	ESW&PS CBA
Request for exemption	Yes/No	ESW CBA
Cross-border Cost Allocation request	Yes/No	ESW CBA
Financial Assistance request	Yes/No	ESW CBA

1.3.4. Quantitative indicators

An indicator is *"a tool that provides a clue to a matter of larger significance or makes perceptible a trend or phenomenon that is not immediately detectable"*[3]. An indicator's main defining characteristics are that it quantifies and simplifies information in a manner that promotes the understanding of problems, to both decision-makers and project promoters. Above all, an indicator must be practical and realistic, given the many constraints faced by those implementing and monitoring projects.

The methodology provides a set of quantitative indicators (both for ESW CBA and PS CBA), as useful tools to quantify the impact of a proposed infrastructure, within the area of analysis and across different countries.

The development of the quantitative indicators is based on the premise that the criteria defined for the eligibility of PCIs are closely interlinked (in particular market integration, competition and security of supply) and indicators should thus not be directly related to any specific criteria (see the List of the Quantitative Indicators in the Annex IV).

The quantitative indicators used in the analysis will be calculated for two scenarios: "*with the project*" scenario and "*without the project*" scenario. Based on this incremental approach, the quantitative analysis will reflect the cross-border impact and the level of significant impact.

2. Energy System Wide – Cost Benefit Analysis

2.1. Introduction

Based on the provisions of the Regulation, ENTSOG shall submit an ESW CBA, which shall be applied for the preparation of each subsequent TYNDP. In line with this provision, the ESW CBA will be an integral part of the TYNDP and will take benefit from the continuous improvement of this report. Additional enhacements should be done to enable TYNDP to serve as a basis for the ESW CBA and the whole CBA methodology with regards to input data, time horizon and the sustainability part of the assessment chapter.

2.2. The applied methodology for the analysis within ESW CBA

The ESW CBA methodology, in line with the provisions of the Regulation, build on the methodology already applied within TYNDP. Therefore the effect of the FID/Non-FID PCI candidate projects as a whole will be evaluated against the already existing/FID gas infrastructure. In the following chapters are higlighted some enhancements to be implemented to the current TYNDP methodology. These enhancements include the modification of the currently applied clustering within TYNDP, the applied indicators and the sustainability chapter of the TYNDP.

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[3] EEA Core Set of Indicators – Guide, 2005

The fundamental logic of the TYNDP analysis, such as defining cases for the purpose of modelling and evaluating the results is not subject to change and can be studied within the *Methodology* chapter of the TYNDP 2013-2022.

2.2.1. Clusters

The ESW CBA will analyse the effects of PCI candidate projects as a whole on European gas infrastructure as part of the TYNDP. Therefore in addition to the existing clustering criterion of FID status, a new one, based on the fact that a project is a PCI candidate or not, will be introduced.

TYNDP 2013-2022 comprises two cluster combinations:

- Existing + FID projects and

FID projects
Existing Infrastructure

- Existing +FID + Non- FID projects.

Non-FID projects
FID projects
Existing Infrastructure

In order to assess the effect of PCI candidate, the new clusters of PCIs (PCI FID and PCI Non-FID) will be introduced. This will enable to specifically assess the effect of PCI clusters.

Non-PCI Non-FID	PCI Non-FID
Non-PCI FID	PCI FID
Existing Infrastructure	

In case a project is commissioned during the two years period between two PCI selection processes, the project will be included into the *Existing Infrastructure + Non-PCI FID* cluster combination for the subsequent processes.

2.2.2. Indicators and assessments used

The indicators expressed below originate from the TYNDP except for the N-1 indicator. They are still under consideration and might be improved or changed until the submission of the methodology in November 2013. Indicators will be used to evaluate the effects of PCI candidate projects against the current European energy infrastructures. These indicators are already in use within the TYNDP and have proven their capability to analyse FID and non-FID projects.

In contrast with the current TYNDP these indicators will have to be applied on an extended time horizon and on the new infrastructure clusters to be introduced.

All formulas presented below are explained in detail in Annex IV.

2.2.3. N-1 Indicator[4]

The Regulation stipulates in Annex IV/3/c the following, regarding the application of the N-1 rule:

"Security of gas supply shall be measured by calculating the additional value of the project to the short and long- term resilience of the Union's gas system and to enhancing the remaining flexibility of the system to cope with supply disruptions to Member States under various scenarios as well as the additional capacity provided by the project ***measured in relation to the infrastructure standard (N-1 rule) at regional level in accordance with Article 6(3) of Regulation (EU) No 994/2010.****"*

The Regulation 994/2010 stipulates the following in Article 6/3:

*"****Where appropriate****, according to the risk assessment referred to in Article 9, the* ***Competent Authorities concerned may decide*** *that the obligation set out in paragraph 1 of this Article shall be fulfilled at a regional level, instead of at national level. In that event, joint Preventive Action Plans pursuant to Article 4(3) shall be established. Point 5 of Annex I shall apply."*

Based on the above provisions, in case the Member States define the region and calculate the indicator on regional level or it is calculated by the MSs on the national level, the results will be highlighted within the methodology. In case however it is not calculated by MSs as defined in the Regulation 994/2010, it will not be covered within the methodology. ENTSOG will not carry out its own calculation within the ESW CBA and thus the project promoters will not calculate it within the PS CBA.

$$N\text{-}1\ [\%] = \frac{\mathbf{IP+NP+UGS+LNG-I}}{\mathbf{Dmax}} * \mathbf{100}$$ [5]

2.2.4. Import dependence index

- The formula expresses the Zone's dependence on import
- The Index captures the capability of the local infrastructure to cover the demand, thus also the need of imports to balance demand throughout the year

$$\frac{\mathbf{1}}{\mathbf{1 + NP + (0.5 * UGS)}}$$

Aggregated share of storage and National Production deliverability (expressed as a percentage

[4] This indicator has not been considered previously within the TYNDP.

[5] The parameter labels have been substituted compared to the Regulation, inline with the TYNDP.

of the Average Daily Demand of a Zone) are used to measure the dependence on imports (the 1+ term is introduced to obtain the value of 1 for a country completely dependent on imports all over the year). A factor 0.5 has been introduced for the UGS component as it is assumed that storage has a neutral balance over the year.

2.2.5. Import route diversification index

To measure competition the methodology takes into account the diversity of sources and routes and fulfils the objective of the regulation that stipulates in Annex IV/3/b:

"Competition shall be measured on the basis of diversification, including the facilitation of access to indigenous sources of supply, taking into account, successively: diversification of sources; diversification of counterparts; diversification of routes; the impact of new capacity on the Herfindahl-Hirschmann index (HHI)calculated at capacity level for the area of analysis as defined in Annex V.10."

For this purpose, the TYNDP already utilizes Import Route Diversification formula, which is an HHI-type index.

$$\sum_{l}^{Xborder}\left(\sum_{k}^{IP} \%\, IP_k\, Xborder_l\right)^2 + \sum_{j}^{Source}\sum_{i}^{IP}\left(\%\, IP_i\, from\ source_j\right)^2 + \sum_{m}(\%\, LNG\ terminal_m)^2$$

Aggregated values are used for Interconnection Points between European Zones as those physical points are likely to largely depend on common infrastructure. Import points for non-EU gas are considered individually as upstream infrastructures are often much more independent.

2.2.6. Remaining flexibility at Zone level

- This Indicator is used to assess the infrastructure resilience and examines the ability of the infrastructure to transport large quantities of gas under high daily demand conditions .
- The assessment is used for the identification of investment gaps and potential remedies, thus it can be used to assess the PCI candidate projects capability of filling such gaps.
- The indicator can be calculated only if modelling is applied, as in the numerator it contains entering flow.

$$Remaining\ Flexibility = 1 - \frac{\sum Entering\ Flow}{\sum Entry\ Capacity}$$

The indicator at Zone level considers both the gas staying in the Zone to face demand and the gas exiting to adjacent systems.

The identification of investment gaps is based on the level of the Remaining Flexibility at Zone level. Investment gaps are identified when the indicator is:

- below 5% under Reference Cases
- Below 1% under Supply Stress cases as part of the flexibility has been used to counteract the Supply Stress

The Supply Stress considered in TYNDP 2013-2022 cover technical, transit and supply disruptions together with an overall minimization of LNG delivery to Europe. The details of such stress can be found in the Methodology chapter of TYNDP. The exact definition of the supply stress to be included in the ESW will depend on the stakeholder engagement process of TYNDP 2015-2024 to be organized first half of 2014. Indicator used to assess the European resilience to low LNG deliverability identifies Zones requiring an LNG minimum Send-Out above 20 %.

2.2.7. Supply source dependence assessment

> Supply Source Dependence assessment aims at the identification of Zones where satisfying demand is largely dependent on a single source.
> The indicator can be calculated only if modelling is applied.

This assessment is carried out under the 1-day Average situation in order to identify the strong dependence of some Zones on a single supply source throughout the year. Zones requiring at least a 20% share of a given source are identified as source dependent.

2.2.8. Infrastructure Adaptability to Supply Evolution

> The assessment of the Adaptability to Supply Evolution looks at the European infrastructure's ability to face very different supply mixes as resulting from short-term signals or long-term trends.
> The indicator can be calculated only if modelling is applied.

This assessment is carried out under the 1-day Average demand situation in order to identify the ability to balance every Zone when one of the supply sources increases or decreases. Where no flow pattern enables to reach the Potential Supply scenarios, the limiting factor is identified being a lack of alternative supply or an infrastructure.

2.2.9. Supply Source Diversification

> The assessment of the Supply Source Diversification at Zone level aims at determining the ability of each Zone to access each identified supply source. It has been carried out under the 1-day Average demand situation
> The indicator can be calculated only if modelling is applied.

The assessment identified access based on 2 supply share thresholds (5% and 20%). The supply reach is tested non-simultaneously for each source and targeted Zone.

2.3. Sustainability

As mentioned within the introduction, certain enhancements have to be made to the current TYNDP framework, in order to comply with the provisions of the Regulation. The Regulation stipulates in Article 4, among the specific criteria, that the projects shall contribute significantly to "*sustainability, inter alia through reducing emissions, supporting intermittent renewable generation and enhancing deployment of renewable gas*". Therefore the contribution of projects to the sustainability criterion should be highlighted within the ESW CBA as well. The required enhancement will be defined during the Stakeholder engagement process of TYNDP 2015-2024 during the first half of 2014.

2.4. Sensitivity analysis

The result of the analysis depends on the input data and modelling assumptions. Taking into consideration this sensitivity and the long time horizon, mitigation action shall be taken, in the form of a sensitivity analysis for both the ESW and the PS CBA. The sensitivity analysis aims at covering a range of future trends as a consequence of modifications or alternative forecasts of some variables in order to ensure that the decision makers can take into consideration numerous alternatives when evaluating the projects. The ESW CBA will build on the TYNDP methodology with regard to simulating the network under various cases. The cases will be defined in a way, that their simulation serves as sensitivity analysis for TYNDP input parameters within the ESW CBA. In the current TYNDP, more then 200 cases have been developed, determined by a *year*, an *infrastructure cluster*, a *demand situation* and a *supply situation*. The modelling of the same cases applied with the newly defined PCI Clusters will show how PCIs as a whole could improve the already existing and FID infrastructures.
Complementarily, the sensitivity analysis within the PS CBA will be focused on alternative trends or forecasts of the input data within a certain range. For assessing the sensitivity of the results to the change in the energy mix, EU policy scenarios will be used to define the energy mix of the specific countries such as Beyond 20-20-20 policy scenario assuming that the Member States will reach their individual renewable targets.

Data from ENTSOG TYNDP		Application of Data	Considered for Sensitivity Analysis
PCI Status	Applicant/ Already PCI	ESW CBA	No
Infrastructure Capacity Data	Capacity of the existing and planned infrastructure along the time horizon	ESW & PS CBA	No
Supply Data of Zones within Europe	Data provided for the time horizon	ESW & PS CBA	**No**
• *National Production*			
• *LNG sendout capacitites*			
• *UGS working volume, withdrawal- and injection capacities*			
• *Other Supply sources*			
Demand Data of Zones within Europe	Data provided for the time horizon	ESW & PS CBA	**No**
• *High Daily Demand*	Data provided for the time horizon		
• *Average Daily Demand*			
• *Annual Demand*			
• *Reference Scenario*	To be defined		No
• *Sensitivity Analysis Scenarios*	To be defined		Yes
Disruption scenarios		ESW CBA	No
Data from Referenced Sources		**Application of Data**	**Considered for Sensitivity Analysis**
Prices	Data necessary for the time horizon	PS CBA	**Yes**
• *Fuel Prices of coal, lignite, natural gas, oil*			
• *Cost of emmission - CO_2 price*			
Physical Constants	Constant data	PS CBA	**No**
• *Gross/Net Calorific value of fuels*			
• *Specific CO_2 emission of fuels / gross or nett energy released*			
• *Gross/Net Thermal efficiency of power plants*			
EU Policy Scenarios for Energy Mix of countries	Reference for the time horizon	PS CBA	**Yes**
• *Post 20-20 framework scenario*			
• *BAU scenario*			
• *Gas enhanced scenario*			
Macroeconimic Data		PS CBA	
• *MS specific data, such as cost of disruption*	Specific Data from Members States; potential usage depending on availability and discussion with MSs and Stakeholders		No
• *Social discount rate*			No
Project Specific Input data, provided by the Project Promoter		**Application of Data**	**Considered for Sensitivity Analysis**
Identification of the project	Definition of the project	ESW&PS CBA	No
CAPEX	Along construction phase	ESW&PS CBA	Yes
OPEX	Along operation phase	ESW&PS CBA	Yes
Implementation schedule	Occurance of CAPEX along construction	ESW&PS CBA	Yes
Request for exemption	Yes/No	ESW CBA	No
Cross-border Cost Allocation request	Yes/No	ESW CBA	No
Financial Assistance request	Yes/No	ESW CBA	No

Within the ESW CBA for TYNDP input data (cases defined based on demand and supply situations), the following indicated input data will be subject to sensitivity analysis.

3. Project specific cost benefit analysis (PS CBA)

3.1. Objectives

The PS CBA is to be used by Regional Groups to assess in detail the viability of a PCI project. In designing the methodology ENTSOG has been mindful of the following objectives:

- To enable Project promoters to carry out a detailed analysis of their projects according to a robust and consulted methodology
- Ensure consistency between results of different project assessment, and between the PS and the ESW CBA
- Enable the assessment of the foreseeable impact of the project on the European gas infrastructures using specific indicators

All project promoters applying for PCI label, should submit a PS CBA analysis in the following instances:

- when applying for PCI status to the Regional Group (Annex III.2) having reached sufficient degree of maturity
- when submitting the cross-border cost allocation request (Art.12.3)
- when requesting financial assistance (Art.14.2.)

The PS CBA consists of a financial analysis describing the financial aspects of the project and an economic analysis describing the socio-economic benefits of the project. In terms of a Project of Common Interest the economic benefits of the project are how the project contributes to competition, market integration, security of supply and sustainability. For this reason, the methodology developed by ENTSOG focuses on the economic analysis. For the financial elements of the CBA methodology, ENTSOG makes reference to the DG Regio Guide to CBA of investment projects (the latest available version).

The project promoter shall perform a financial analysis, for at least the following reasons:

- The financial viability of the project could be evaluated only based on the financial analysis
- Financial analysis will provide useful information to assess whether regulatory incentives/public funds are needed and appropriate;
- To provide a comparison between the financial costs of a project and the potential economic benefits.

Project promoters shall provide both the financial and economic analysis of their projects to the Regional Group when required.

3.2. General considerations

The economic analysis appraises the project's contribution to the economic welfare of the society.

Where possible, the economic analysis should give a monetary view on the level a project fulfills the objectives and specific criteria requested by the Regulation.

In this respect, the methodology for the project specific analysis will provide necessary tools to assess and quantify/monetize, within the economic analysis, the externalities and the level (magnitude) in which they are affecting the impacted countries.

Appropriate quantitative indicators combined with technical and commercial assumptions will support the economic analysis.

Calculation assumptions shall be clearly and transparently presented.

The beneficiaries and the corresponding value of the benefit (competition, market integration, security of supply and sustainability) should be identified.

In addition to the input data set defined in the General Terms of the present document, the following data are necessary to perform the PS CBA:

Output data from ESW (Energy-System Wide-CBA)	
Assesssment results	Network modelling, flow patterns and assessment of the network under different scenarios
	Flow patterns and resulting assessment of the network under different scenarios needed to develop incremental approach (as difference between two different situations: "with the project" vs "without the project"

3.3. Set of project specific input data6 for the economic analysis:

- Investment costs:[7]
  - Fixed investment costs[8]
  - Start-up costs[9]
- Operating costs[10] (direct costs related to consumption of materials and services, personnel, maintenance, general costs and administrative and general expenditures).

[6] The set of data is considered from the perspective of the economic analysis and any additional data requested for the financial analysis will follow the guidance provided in the DG Regio "Guide to Cost Benefit Analysis of Investment projects"

[7] These data are reflected also in the ESW CBA (General Terms Chapter)

[8] The information will be taken from the feasibility study data on localisation and technology. The data to consider are the incremental cash disbursement encountered in the single accounting period to acquire the various types of fixed assets: steel, land, building machinery, etc.

[9] According to a standard definition, all those costs that are incurred in view of the effects that will accrue beyond the financial period in which the relative disbursements were made are of an investment nature. Although the tax rules may not allow for the capitalization of these costs, they should be included in the total investment costs. These include several start-up costs, such as: preparatory studies (including the feasibility study itself), cost incurred in the implementation phase, contracts for the use of some consulting services, research and development, training expenses etc.

Additional[11] set of project specific input data for the economic analysis:
- Residual value of the investment[12]
- Decommissioning costs[13] (if applicable)

3.4. Identification of project

For all types of infrastructure and technology, in order to correctly identify the project it is necessary to:
- State its scale and dimension
- Describe the engineering features of the infrastructure with basic functional data[14]:

Input data from ESW (Energy-System Wide-CBA)	Data Description
1. Pipeline including compressor stations	Name of the pipeline section
1.1 Data	Length of the pipeline in km
	Diameter (in mm)
	Additional Compressor Power (in MW)
1.2 Internal development projects, those enhancing the increase of IP capacities, including compressor stations	Interconnection Point//Entry/Exit Capacity (GWh/d) (Incremental capacity of the transmission grids[15])
1.3 Reverse flow projects – (Specific type of pipeline projects, fulfilling the requirements of the SoS Regulation 994/2010)	Interconnection Point//Entry/Exit Capacity (GWh/d)

[10] In the calculation of operating costs, all items that do not give rise to an effective monetary expenditure must be excluded, even if they are items normally included in company accounting. These data are also reflected in the ESW CBA (General Terms Chapter

[11] Compared to data set already described in the General Terms chapter.

[12] The residual value should always be included at end year of the analysis (time horizon), and can be defined as the virtual liquidation value. The way to calculate it is defined in the DG Regio Guide to CBA of Investment Project (latest version)

[13] Decommissioning costs could be not relevant for the economic analysis, considering, on one side, the time horizon of the analysis and on the other side the long lifecycle of the asset.

[14] Please note that Nm^3 refers to m^3 at 0°C and 1.01325 bar (as defined in the EASEEgas CBP 2003-001/01)

[15] The impact of the infrastructure project on the gas transmission grid is assessed through the capacity increment the project is bringing to specific interconnection points. It is therefore necessary to indicate these capacity increases by referring to these interconnection points, indicating the capacity increase in both flow directions (entry and exit). The flow direction is the direction the gas takes from the perspective of the project's commercial operator. "entry" means that the gas is entering the commercial operator's system. "exit" means that the gas is exiting the commercial operator's system. This applies whether the system is a transmission system, a pipeline, a storage facility, or a LNG terminal."

2. LNG	Expected increment in yearly volumes (bcm/y)
	Berth size
	Increment of daily send- out
	Capacity in mcm/d
	Increment of storage capacity (m^3 LNG)
3. UGS projects	Increment of working volumes in m^3
	Increment of withdrawal capacity in m^3/d
	Increment of injection capacity in m^3/d

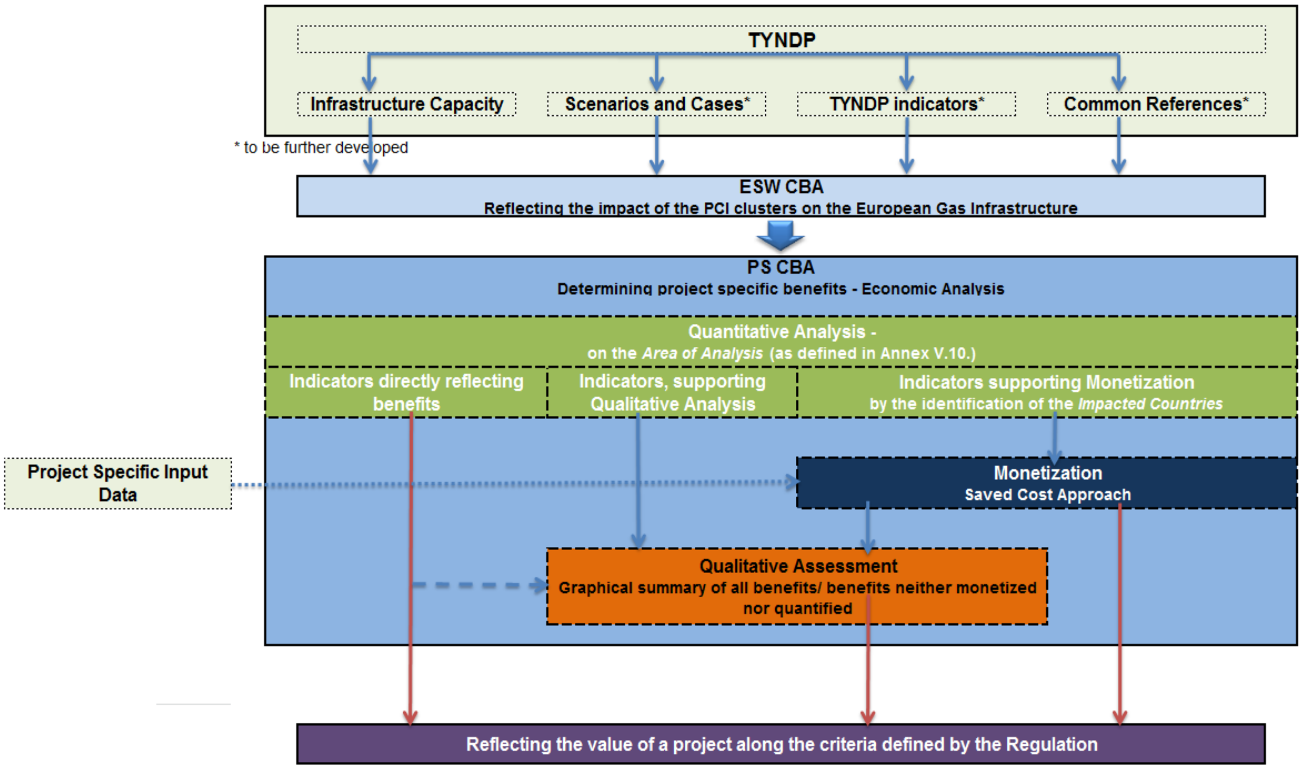
The project's benefit regarding the specific criteria for PCIs, as defined in the Regulation (Article 4.2. b), should be proven by the output of the economic analysis.

3.5. Economic analysis

For the assessment of the benefits related to a PCI, an approach using monetisation, quantitative measures and qualitative assessment is proposed for the following reasons:

- Ensure that all benefits of the project related to security of supply, market integration, competition and sustainability including those that are not able to be quantified or monetised are captured;
- Ensure that the impact of the project on Member States is accounted for;
- Avoid double counting of the benefits accruing from the project

Therefore the combined use of monetisation, quantitative analysis and qualitative assessment ensures that accurate and justifiable measures are consistently used in the Project Specific analysis.



3.5.1. Quantitative analysis

> The scope of the quantitative analysis

The main role of the quantitative analysis is to assess the candidate PCIs according to the criteria defined in the Regulation (Annex IV.3), as presented in the General Terms of document.

The quantitative analysis is based upon a number of quantitative indicators whose main purpose is to enable the project promoter to identify, within the area of analysis:

- The potentially significantly impacted countries
- The potential distribution of gas flow patterns between potentially impacted countries
- The improvement, based on the successive recalculation of the indicators, in the impacted countries considering the potential distribution of gas flow patterns.

The quantitative indicators will reflect a general assessment of the project, and the Member States impacted. Where relevant the quantitative indicators can also be used as an input for monetization and the qualitative assessment.

The distribution of gas flow between significantly impacted countries could be also an output of the ESW CBA, based on the modelling tool.

Input/Output for the quantitative analysis- check list:

> Input (Source: ESW CBA)

- Output of the assessment of the European gas infrastructures needed to develop an incremental approach, reflecting the consequences of implementing the project, in comparison with the previous situation (without the project) for the time horizon of the analysis:

Input for the quantitative analysis	Description
Data from ESW –CBA	
Demand data	Scenarios and cases
Supply data (imports and National Production)	Scenarios and cases
Infrastructure capacity by clusters:Existing infrastructure/FID PCI/FID not PCI/non FID-PCI/non FID non PCI	Capacity of European Ips (EU-IPs)
	Capacity of Import Pipelines (IPSs)
	LNG terminal send out capacity
	UGS maximum withdraw/working volumes
Project specific data	
Area of analysis	As identified by the project promoter based on the definition provided by the Regulation (Annex V (10)
Quantitative indicators[16]	To be applied on the above mentioned data

> Output

Output of the quantitative analysis	Description
Availability	Information regarding the capability of a new project to deliver cross-border benefits according to the Regulation
Need	Information regarding the need to take the benefits of a new project, in interconnected countries
Impacted countries	Level of impact
	Distribution of gas flow pattern between impacted countries

[16] The set of indicators may change based on stakeholders feed-back and internal refinement of methodology

How to understand the Regional impact

Identification of the area of analysis and of the impacted countries:

The Regulation describes in Annex V, (10) and (11) how to identify the ***area of analysis***, "…*which shall cover Member States and third countries on whose territory the projects shall be built, all directly neighbouring member States and all other Member states significantly impacted by the project. Each cost-benefit analysis shall include sensitivity analysis concerning the input data set, the commissioning date of different projects in* ***the same area of analysis and other relevant parameters****….*"

The Regulation brings some clarifications regarding the significant cross-border impact (Annex IV,(1) (c), (d):

"A project with ***significant cross-border***[17] *impact is a project on the territory of a Member State, which fulfils the following conditions:*

a) for gas transmission, the project concerns investment in reverse flow capacities or changes the capability to transmit gas across the borders of the Member States concerned by at least 10 % compared to the situation prior to the commissioning of the project;

b) for gas storage or liquefied/compressed natural gas, the project aims at supplying directly or indirectly at least two Member States or at fulfilling the infrastructure standard (N-1 rule) at regional level in accordance with Article 6(3) of Regulation (EU) No 994/2010 of the European Parliament and of the Council (1)"

The above pre-conditions of the Regulation will be checked in the quantitative analysis.

Algorithm to identify the most impacted countries

Based on the above definitions, we may consider that a core element of the analysis would be the identification the impacted countries, within the area of analysis. This identification will come as an output of the quantitative analysis and will serve as an input for the monetization as well as input information for a potential cross-border cost allocation. The identification of the impacted countries, determining the distribution of gas volumes between the country where the project is built and the countries which need to take the benefits of these available extra gas volumes, is a required input needed for monetization assessment.

The algorithm is used to identify the impacted countries in case of UGS and LNG projects as long as the value of a certain indicator is improved based on the implementation of such

[17] The significantly impacted countries have the same significance with the "regional level" considering the condition as expressed at point d) ; the area of analysis could be wider than the significantly impacted countries (regional level), whereas the area of analysis includes also non Member States (the significant impact is related only to MSs)

infrastructures. It is also used to identify other countries impacted by a transmission project beyond those where the project is built and the directly neighbouring MSs.
The area of analysis and further on the significant impact, can be determined, by following the steps described below:

> Step1 – Identification of the area of analysis by:
  - Considering the Member States and third countries where the project is built
  - Considering all directly neighbouring MSs

> Step2:

By applying the quantitative indicators starting with the country where the infrastructure is built in order to check if there is any availability for the others countries in the area of analysis. The availability is reflected by the value of the indicator, for the scenario “with the project. In case that the value of the indicator is above the target value, it can be considered that there is a potential for the project built in one country to deliver benefits toward other countries in the area of analysis.

> Step 3:

By applying the quantitative indicator at the level of country within the area of analysis, in order to check which countries are “in need” to take the benefits delivered by a new project, to be built in another country; in case that the level of the quantitative indicators calculated for the scenario”without the project” is lower than the target value of the quantitative indicators, the respective country could be considered as being “in need” and potentially impacted by the project.

> Step 4:

Allocate the residual flow[18] from country where the project is built, toward benefitting countries, being “in need” as determined in the previous step. In order to allocate the residual flow, it is required to check the availability of cross-border interconnection capacity to allow this allocation. The allocation of residual flows after checking this availability of cross border interconnection capacity and the distribution of flow between impacted countries, based on network modelling (if available) or, based on the previous steps, could be done following alternative ways[19]:

- First in need First allocated (FNFA): applicable for those countries with value of indicators below target value (the distribution of volumes starts with the country with the lowest value of the indicator and further allocating remaining volumes, if available to other countries “in need”.
- Pro-rata allocation (PRA): the flow will be allocated pro-rata between the impacted

[18] For questions related to this issue, please follow the Annex “Questions to the draft CBA document”.
[19] Please refer to the Annex “Questions to the draft CBA document”.

countries based on the identified need in these countries.

- Indicator maximization allocation (IMA): the flow will be allocated with priority to one country, with the target of maximizing the value of the indicator in that country up to the target level; it should be checked what extra volumes are necessary for a country to reach a safe/target value of the indicator

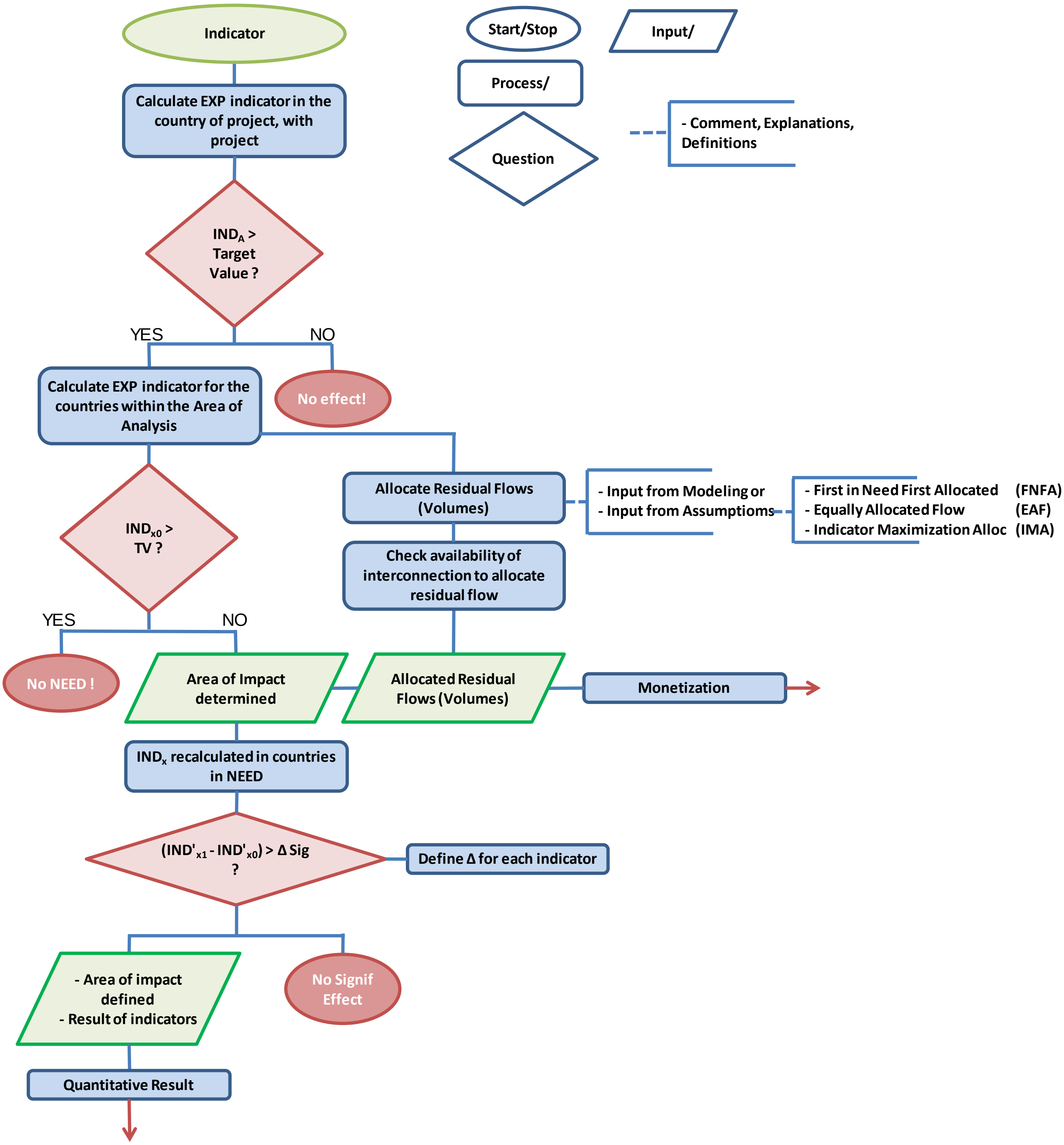
> Step 5:

Recalculate the value of the quantitative indicators, considering also the potential distribution of volumes between country A where the project is built and the impacted countries (as determined in the previous step). The level of improvement is reflected by analysing the value of indicators before and after the distribution of the residual gas flow .

Conclusion: The countries where the value of the indicator has been improved at a certain level, could be considered the area of impacted countries.

The algorithm is presented below:

Algorithm for applying indicators to determine the most impacted countries



3.5.2. Monetization of benefits

In order to compose the economic flow for the monetization of benefits, the project promoter will:

- Identify the projects objectives and area of analysis
- Identify the scenario with and without the project based on the ESW
- Undertake the quantitative analysis having as output the cross-border impact, the identification of the significantly impacted countries, the identification of the potential volumes to be distributed between impacted countries; based on these volumes, the economic flow can be composed in different layers, reflecting positive and negative externalities/country affected.

Approach for monetization

The recommended approach for the composition of the economic cash flow and monetization of externalities is the "saved cost approach".

This approach is based on the monetization of the benefits (for each impacted country[21]) stemming from some differences in prices between the reference scenario BAU (scenario without the project) and scenario "with the project":

- Two periods, as the seasonal storage valued at the difference between the value of summer and winter gas
- The cost of alternative fuels avoided by building a new infrastructure (transportation costs, efficiency, CO_2 emission's cost, etc.)
- The saved cost of gas in case of a new infrastructure diversifying the supply route and by this way bringing the gas at a lower price
- The value of gas of the avoided interruption, multiplied by the probability of the interruption and its duration and the expected volume of interrupted supply covered by a new infrastructure

Irrespective of infrastructure type the calculation of the saved cost should be consistent. Where there is difference between infrastructure types the project promoter should utilise the information from the quantitative analysis to explore the benefits of their specific project.

[20] When two lines paralelly exit a step without condition, both sequences have to be executed.

[21] A layer for monetization per country

Saved cost approach- Structure of the economic flow:

			Time horizon						
No	**Explanation**	**Source of information**	n	n+1	n+2	n+3	n+4	n+....	n+20
A	**Input data**								
I	**Total costs**								
1	Investment costs	**Ec/fin. analysis**	-	-	-	-			
2	Operating costs						-	-	-
3	Other costs							-	
4	Residual value								+
II	**Total Economic benefits**	Quantitative analysis Country specific data							
1	Saved costs in country A						+	+	+
2	Saved costs in country B						+	+	+
3	Saved costs in country C						+	+	+
III	**Social discount rate (SDR)**								
B	**Output data**								
(IV =II-I)	Net economic benefits (if∑Economic benefits>∑Economic Costs)		-	-	-	-	+	+	+
V	Economic Performance indicators								
1	ENPV (>0)								
2	EIRR (>SDR)								
3	B/C (>1)								

Fiscal corrections[22]

Some items of financial analysis can be seen as pure transfers from one agent to another within society, with no economic impact. For example a tax paid to the Member State by the beneficiary of EU assistance is offset by fiscal revenues to the government. Conversely, a subsidy from the government to the investor, is again a pure transfer that does not create economic value, while it is a benefit for the beneficiary. These items should not be included as not being relevant for the economic analysis:

> all prices of inputs and outputs to be considered for CBA should be net of VAT and of other indirect taxes

[22] Reference to DG Regio CBA 2008

- prices of inputs, including labour, to be considered in the CBA should be gross of direct taxes
- subsidies granted by a public entity to the project promoter are pure transfer payments and, should be omitted from revenues under economic analysis

Source for input data- saved cost approach	Data	Description
Quantitative analysis	Impacted countries	
	Pattern for distribution of gas flow toward impacted countries	
Project specific data	CAPEX	
	OPEX	Scenario (reference scenario to be defined)
	Residual value	Existing/FID projects/PCIs
ESW CBA	Reference for prices	Price scenarios for gas and different fuels
	Information related to CO_2	CO_2 price and emmissions for different types of fuels
		Scenarios for CO_2 prices
	Energy mix/country	Scenarios to reflect evolution of energy mix/country
	Flow pattern /infrastructure cluster	Provided by modelling tool

3.5.3. Guidance for monetization of the benefits related to "sustainability" criteria23

The guidance provided within this section is based on the economic model developed by the Security of Supply Division, Energy Department of the EIB JASPERS 's economic analysis of gas pipeline projects.

The new elements added, by current methodology, on the top of this approach are:

- Reflection of the cross-border impact: significantly impacted countries/distribution of volumes
- Monetary reflection of sustainability criteria/significantly impacted country considering the energy mix/impacted country

The construction of a new gas infrastructure generally increases the gas transportation capacity or makes additional volumes of gas available to the economy. It is important that the economic analysis only considers the incremental gas amounts expected to be delivered to the market as

[23] See Jaspers Knowledge Economy, Energy and Waste Division – Staff Working Papers/ Economic Analysis of Gas Pipeline Projects

a result of the investment. The incremental gas volumes should be determined on the basis of the differences in transported gas between the “scenario with the project” and the “BAU” scenario.

The same principles applicable for the pipeline projects, could be mutatis mutandi applied on the UGS projects or LNG, based on the assumptions that the working volumes released by an UGS or by an LNG project could replace the consumption of alternative fuels with higher CO2 emissions and costs.

The methodology, applicable to monetize the benefits related to the sustainability criteria, incurred by a project, provides guidance for the project promoter to run the analysis along scenarios and also information regarding reliable reference sources to be used for the input data. A common approach for this section of the economic analysis, from the view of scenarios to be used, and reference for input data, would assure consistency and relevance of the results of the analysis, easing in this way a transparent assessment of the efficiency of the projects.

The costs and benefits of a gas infrastructure will be appraised over a reference period that includes 20 years of operational phase. This time span is sufficiently long to reasonably encompass the likely medium to longer term impacts.

On the cost side, the economic analysis should consider the initial investment outlay and the pipeline operating and maintenance costs including, where relevant, the cost for the replacement of short-life equipment.

As regards the quantification of the benefits, it can be assumed that the additional volumes of gas associated with the project can substitute the consumption of alternative fuels (e.g. coal, oil products, and district heating). On this basis, the benefits to society can be measured as the saved costs the additional volumes of gas that can be supplied to the market as a result of the construction of a new gas infrastructure (pipeline, UGS, LNG).

Moreover, given that natural gas is a relatively clean fossil fuel, the reduction in emissions of greenhouse gases and polluting compounds from the replaceable alternative fuels should also be quantified in the analysis among the project benefits.

The revenues generated by the pipeline operator from gas transportation fees should not be considered here.

Input data for monetization of the sustainability criteria:

- Quantitative analysis:
  - Significantly impacted countries
  - Patterns for the distribution of gas flow between impacted countries
- ESW CBA data:
  - Energy mix/country and evolution of energy mix along the time horizon

- Calorific values of fuels/country (external data)[24]
  - It is needed to convert all fuels quantities into energy equivalent in order to allow comparison and determine the amount of potentially replaceable fuels
  - Calorific values of fossil fuels can be country specific
- Emission factors of fuels
- Power generation to specify efficiency of coal and gas plants and the difference in capital and operating costs:
  - Differences in efficiencies should be also considered when determining the amounts of replaceable energy from alternative fuels
- Gas market structure/country across three different scenarios (in the form of breakdown of gas used in the following three sectors:
  - Power generation, industry and residential/commercial
  - Mix of replaceable fuels in the three sectors: the types and shares of alternative fuels depends on the energy mix/country in the different sectors[25]
- Potential scenarios for the gas market structure:
  - BAU (Business As Usual): it can be assumed that the gas market will not be affected by any significant change in energy policy or regulatory background. For simplicity, under a BAU scenario the structure of the final gas consumption by sector is constant along the time horizon of the analysis.
  - EU Policy scenario: it assumes that the impacted countries would achieve the targets related to the EU 20-20-20 energy goals for 2020: savings 20% of the EU's primary energy consumption, reducing by 20% the emmissions of greenhouse gases and generating 20% of energy from renewable sources by 2020. The impact on gas consumption is country specific, but generally, the gas share in power generation under EU policy scenario should be higher than in the BAU scenario if it is expected that gas would win more market share by replacing coal, than it can lose from renewable sources (or nuclear)
  - Gas Enhanced Scenario (GES): it assumes a significant increase in the consumption of natural gas, particularly in those sections where the potential for replacing alternative fossil fuels is high (ex: power generation)
- Fuel and CO2 price scenarios: base case/low price/high price scenario (for the sensitivity analysis)
- Costs of the gas volumes
- Flow pattern (distribution of volumes between impacted countries)

[24] Reference data can be found in publications of the International Energy Agency

[25] The IEA's Energy Statistics of OECD countries which is updated and published on an annual basis, can be used as a data source to determine the likely mix of alternative fuels to be considered in the economic analysis

- PS CBA
  - The project economic costs
    - Investment costs
    - O&M costs
    - Residual value
- By using these input data, the economic flow related to the sustainability, may be composed in different layers/impacted country, considering the energy mix specific /country and the incremental volumes distributed due to a new project.

Source for input data-sustainability criteria	Data	Description
ESW –CBA	Energy mix/country and evolution of energy mix along time horizon	Gas market structure /country across different scenarios and mix of replaceable fuels
	Calorific values of fuels/country	
	Emission factor of fuels	
	Power generation	Thermal efficency of coal and gas plants
		Difference in capital and operating costs
	Fuels and CO2 price scenarios	Reference scenario and scenarios for sensitivity analysis
Project specific data	**Quantitative analysis**	Distribution of gas flows between countries
		Impacted countries
	Investment costs	
	Opex	
	Residual value	

The choice of the social discount rate[26]

The discount rate in the economic analysis of investment projects - the social discount rate (SDR) – should reflect the social view on how future benefits and costs are to be valued against present ones. Discounting future costs and benefits reflects the concept that a given amount today is worth more than the same amount tomorrow.

Considering that:

- The PCIs have cross-border impacts and benefits could span across different countries/different regions with heterogenous social –economical features
- The level of the SDR has a direct impact on the value of the Economic Net Present Value (ENPV), and ENPV is the most important economic indicator reflecting the economic added value of a project in selecting the PCIs list
- it is important that SDR to be defined as a single /common discount rate to be applied by the project promoters in assessing their individual projects.
- The discount rate can be calculated as real or nominal, in a consistent way with the

[26] Reference to DG REGIO Guide to CBA of investment projects (2008)

valuation of the benefits and costs. For simplicity the constant prices[27] and appropriate SDR could be used for the CBA. When the analysis is carried out at constant prices, the discount rate is to be expressed in real terms, while a nominal discount rate must be used with current prices. The formula for the calculation of the nominal discount rate is:

$$(1+n)=(1+r)*(1+i)$$

> where: n – nominal rate, r – real rate, i – inflation rate

3.5.4. Qualitative analysis (under development)

Will provide flexibility to reflect those benefits related to a project which have not been captured within the monetization or quantitative analysis.

3.5.5. Sensitivity analysis

The main objective of the sensitivity analysis is to identify the "critical variables" of the project, i.e those parameters whose variations -positive or negative- have the greatest impact on a project's financial and/or economic performance.

The following steps could serve as the identification of such variables:

Varying one variable at a time, recalculating the economic performance indicators and noting the differences compared to the base case; as a general criteria, those variable for which an absolute variation of 1% around the best estimate gives rise to a corresponding variation of not less than 1% in the NPV i.e elasticity is unity, a greater variation could be considered critical; considering that is no guarantee that the impact elasticity of the variables will always be linear functions, it is recommended to verify this, by repeating the calculations for different deviations
The switching value of a variable is that value that would have to occur in order for the NPV of the project to become 0 or, more generally for the outcome of the project to fall below the minimum level of acceptability or just to switch from a (-) value to a (+) one and vice versa. The use of switching values in sensitivity analysis allows appraisers to make some judgements on the "riskiness" of the project and the opportunity of undertaking "risk prevention" actions.

[27] Current prices are those indicated at a given moment in time, and said to be in nominal value. Constant prices are in real value, i.e. corrected for the increase in prices in relation to a base line or reference datum

Identification of critical variables:

Category	Example of variables
Quantitative analysis Supply and Demand data along different scenarios	Indigenous production, average demand/high daily demand, average/high daily supply, storage deliverability, etc
Project specific CBA Investment costs	Cost of the base equipment and materials, duration of construction, cost of land, cost of labour, steel, etc.
Load factor	
Operating costs	Prices for goods and services, labour cost, maintenance, etc
Commissioning data	Year of commissioning
Financing costs	Cost of debts associated with delays in implementing the project
Prices	Diferent variations of prices (gas, other fuels, CO_2 emmissions, etc)

Scenario analysis

- Scenario analysis is a specific form of sensitivity analysis. While under standard sensitivity analysis the influence of each variable on the project financial and economic performance is analysed separately, scenario analysis embeds the combined impact of the critical values.
- Scenario analysis:
  - Quantitative analysis will be affected by different scenarios regarding:
    - Supply,demand and infrastructure provided by ESW CBA
- Further on, these sensitivity scenarios will influence the value of the economic performance indicators and also the qualitative assessment
  - Different market scenarios applied for assessment of the sustainability criteria will affect the value of the economic performance indicators
  - Scenarios that consider commissioning[28] date of different projects in the same area of analysis[29]
  - Scenarios taking into account new projects for which a final investment decision has been taken and that are due to be commissioned by the end of the year n+5[30]

[28] *"Each cost-benefit analysis shall include sensitivity analyses concerning the input data set, the commissioning date of different projects in the same area of analysis and other relevant parameters"* (Regulation, Annex V. 11)

[29] To be discussed for the ESW CBA (Regulation, Annex V 11)

[30] Regulation, Annex V (1) b: solved by the cluster in TYNDP: in case that the project is a non FID PCI, the reference scenario ill include "existing infrastructure+FID project" and the project will be added on the top of this cluster.

- The analysis shall identify the Member States on which the project has net positive impacts and those Member States on which the project has a net negative impact. Each cost-benefit analysis shall include sensitivity analysis concerning the input data set, the commissioning date of different projects in the same area of analysis and other relevant parameters.

ANNEX I

1. Price convergence

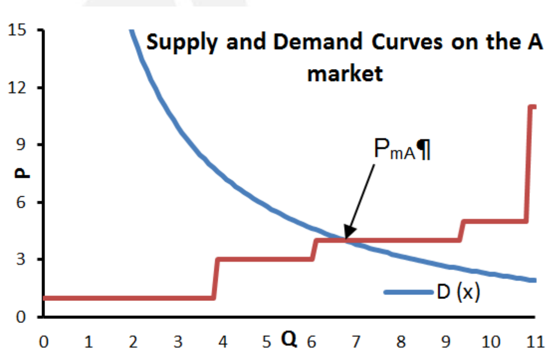
The price convergence theory concerns ESW CBA and also PS CBA. In order to properly assess this dynamic economic phenomenon, the utilization of a market model would be necessary. This market model would be based on TYNDP data (just like the NeMo[31] tool) and additional market data, aiming to analyse the socio-economic impact of the PCI clusters within the ESW CBA and provide market-based flow patterns for the PS CBA.

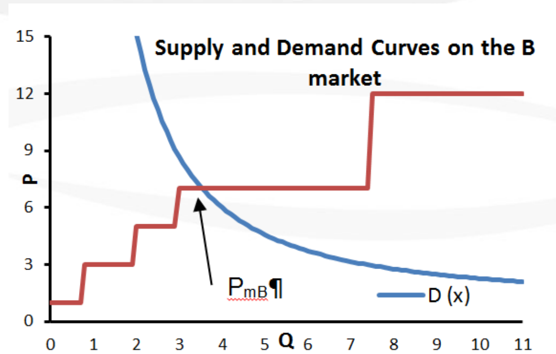
In the following section the theory of price convergence (based on market coupling theory) is reviewed through a simple step-by-step approach. The phenomenon of price convergence, as reflected within the following reasoning, is determined by the capacity of a new gas infrastructure, the price difference between the two markets, and the size of the two markets. The last two define the quantity to be transported between the two markets, in order to reach price convergence. In case the capacity of the new infrastructure is capable of handling the required quantity, full price convergence takes place, otherwise the prices cannot fully converge.

In a logical sequence, the following steps will ease the understanding of this theory and its applicability:

Step 1

Consider two markets and assume D and S curves for both markets, resulting in an equilibrium price (P_{mA} and P_{mB}). In our example P_{mA}[32]<P_{mB}[33].





[31] Network Modeling Tool applied by ENTSOG within TYNDP

[32] P_{mA}: Price in market A - the export market

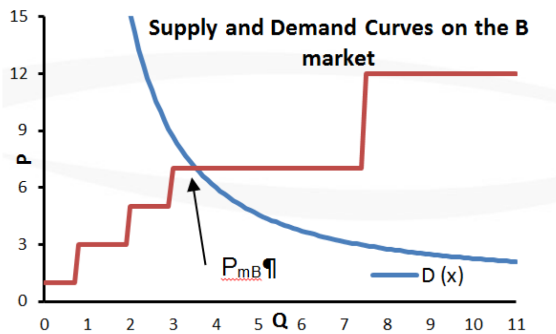
[33] P_{mB}: Price in market B – the import market

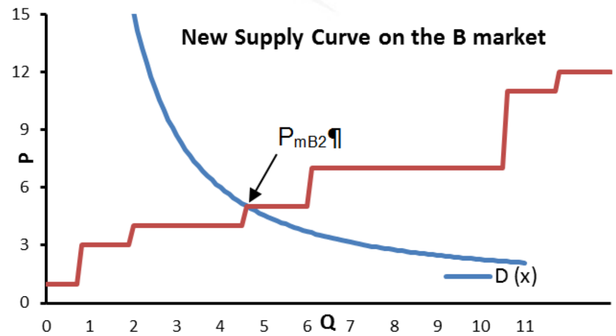
Step 2

A new interconnector is being commissioned, enabling the connection between the two markets. In this case the gas will start to flow from market A to market B, because P_{mA} becomes accessible in market B as well.

Step 3

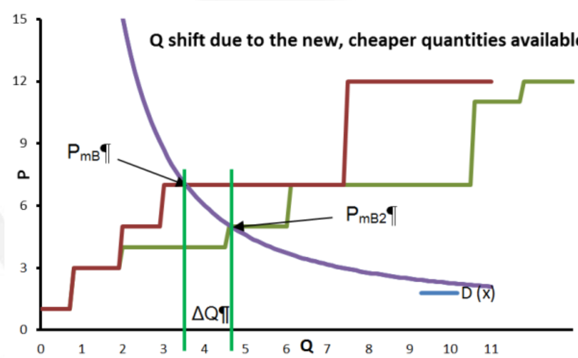
The fact that P_{mA} becomes available in market B, will shift the Supply curve of market B in the below manner[34], causing a new equilibrium price on market B (P_{mB2}). The transformation of the curve happens due to the fact that P_{mA} becomes available with a quantity that equals the capacity of the new interconnector.[35]





Step 4

The new price on market B, will also cause a growth in consumption, compared to the situation, when the IP had not been available (depending on the price-elasticity of the consumption, which is the gradient of the D curve in country B[36]).



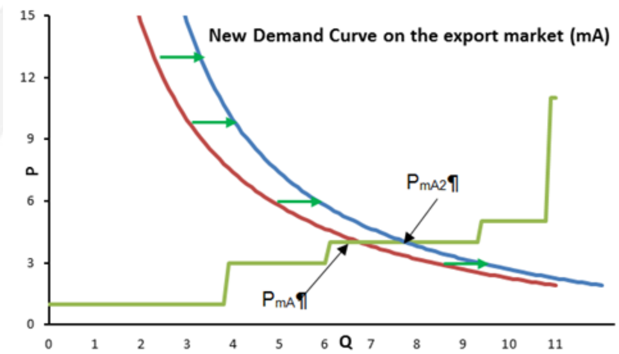
[34] The residual amount of gas from market A becomes available on market B, in the amount of the 100% capacitiy of the new interconnector, thus the supply curve shifts right. (Or in the moment that PmA=PmB, then the fill up of the IP stops).

[35] This statement although is a simplification, as the price of the new source (P_{mA}) depends also on the quantity bought from it in market B, due to the elasticity on market A.

[36] The smaller the gradient, the more elastic is the consumption.

<u>Step 5</u>

The growth in the consumption on market B, will result in the rightward shift of the D curve in market A, because the additional quantity bought at the market B is originated from the market A, resulting in a new equilibrium price on market A. The new P_{mA} then becomes the new available price on market B, which then might shift the S curve in market B again and might result in a fall of consumption on market B.



In reality, this dynamic process is constantly happening. The purpose is to highlight the dynamics of the price convergence, which cannot be evaluated based on static assumptions, but only if market modelling is applied. In its current form, the CBA methodology is not utilizing market modelling, thus it would be pre-mature to assess price convergence for the different countries or zones with the current methodology.

The above process means, that we are facing a dynamic balance, depending on the S and D curve of each markets (elasticity).

Annex II

1. Assumptions for monetization of benefits related to different types of infrastructures

1.1. UGS projects

In case of underground gas storage (and, to a certain extent, of LNG regasification terminals), the economic analysis identifies and quantifies the main role for storage projects and their associated benefits (or avoided costs):

- Benefits related to the price component, stemming in seasonal storage valued at the difference between the value of summer and winter gas (value of swing)
- Benefits related to the physical availability of the infrastructure: Storage facilities can be used to meet demand on above-average cold or hot days, thereby avoiding a shortfall between averages contracted import quantities and peak day demand. This shortfall would otherwise lead to actual shortages or shifting to more expensive fuels. The value of peak shaving is estimated by costing the alternative fuels, which have been assumed to be gasoil (for residential) and fuel oil for power/industry
- The benefit of security of supply could be also estimated as the value of gas of the avoided interruption, multiplied by probability weighted expected volume of interrupted supply covered by the storage (this part could also be extended to LNG terminals considering the LNG tanks capacity).
- The economic analysis of an UGS should also reflect the positive impact of price arbitrage and the potential higher flexibility of UGS in case of severe climacteric conditions combined with high demand or in case of disruption.
- Some other positive collateral effects of the UGS to be addressed are: impact on sustainability, market integration, on competition especially in the adjacent interconnected areas.

1.2. *Pipeline projects*

In case of pipeline project, the economic analysis identifies and quantifies the main role for transmission projects and their associated benefits (or avoided costs):

- Positive price impact stemming from the diversification of the gas supply
- Increase the competition on market, considering that a second or third source of gas to the market could enable market participants to negotiate better commercial gas supply clauses
- The benefits related to the price convergence[37] as a consequence of a better interconnection between systems
- Increase the remaining flexibility and resilience of the system and of the interconnected

[37] See the section related to price convergence analysis

systems

- Benefits from quantifying the contribution to the sustainability criteria: saved costs of switching from other fuels (more expensive fuel prices, higher CO_2 costs and emissions, transport costs) to natural gas
- Connection with the neighbouring systems, increases the access of the interconnected systems to other gas infrastructures (UGS, LNG terminals)
- Benefits from the contribution to market integration, competition, security of supply, sustainability especially for reverse flow.

1.3. *LNG projects*

In case of LNG terminal project, the economic analysis identifies and quantifies the main role for regasification projects and their associated benefits (or avoided costs):

- Benefits related to diversification of supply sources and routes
- Benefits related to the short term flexibility provided by the LNG in covering the peak demand and the avoiding costs of shifting to other more expensive fuels
- Benefits related to security of supply, increase competition, market integration, sustainability

Annex III

1. The social discount rate- theoretical background

For the 2007-2013 period it has been recommended (see DG Regio CBA Guide) to use two benchmarks SDR: 5.5% SDR for the Cohesion countries and 3.5% for the others. It has been also considered that every Member State should assess its country specific SDR, but in any case there may be good arguments in favour of using these two benchmarks values for broad macro-areas in terms of their potential for economic growth.

SDRs that differ from the benchmarks may, however be justified on the basis of individual Member States, specific socio-economic conditions of each country, type of investment project, nature of the investor (e.g. PPP project). To ensure that the discount rates used for similar projects in the same region/ country, Member States should provide their own benchmark for discount rate in the guidance documents, and then apply them consistently in the evaluation of projects at national level. SDR that differ from benchmarks may, however be justified on the basis of individual member States, specific socio-economic conditions of each country , type of investment project, nature of the investor (eg: PPP project). To ensure that the discount rates used for similar projects in the same region/country, Member States should provide their own benchmark for discount rate in the guidance documents and then apply them consistently in the evaluation of project at national level.

The governments often use the Social Time Preference Rate (STPR) as the discount rate in appraisal of different investment projects. The STPR is "the rate at which society values the present compared to the future". For example, a 3.5% STPR is recommended by the HM Treasury Green Book as the discount rate.

According to DG REGIO CBA Guide, consensus is growing around the social time preference rate (STPR) approach. This approach is based on the long term rate of growth in the economy and considers the preference for benefits over time, taking into account the expectation of increased income, or consumption, or public expenditure. An approximate and generally used formula for estimating the social discount rate from the growth rate can be expressed as follows:

$$r = eg + p$$

- where r is the real social discount rate of public funds expressed in an appropriate currency (e.g. Euro);
- g is the growth rate of public expenditure;
- e is the elasticity of marginal social welfare with respect to public expenditure, and
- p is a rate of pure time preference.

All the values in the formula are country specific, especially those of consumption growth (*g*) that depends directly on GDP, which is quite different across the 27 Member States. Social and individual preferences affect the marginal utility parameter (*e*); life expectancy and other individual characteristics influence the time preference parameter (*p*).

Although there must be some degree of doubt concerning appropriate values for both utility discount rate (p) and the long-term rate of per-capita consumption growth (g) , the biggest concern is the value of elasticity of marginal utility of consumption(e). While revealed social values approaches advocate a near unitary value for (e), significant doubts have been raised concerning the reliability of evidence on (e), produced by behavioural models.

There are various academic studies aiming to find the best approach for the SDR. In this regard it has been recommended that in relation with social projects appraisal in EU countries, governments should try to agree on a single generally preferred method of discounting. Consistency of approach should result in the application of similar discount rates by countries. Some papers argue for a standard benchmark European discount rate of 3-4% based on social time preference (STPR).

When the costs fall to companies to be financed but benefits accrue to consumers or society more widely, another approach considered within the academic studies to is the “Spackman” approach which consists in discounting all costs (including financing costs as calculated based on a WACC – weighted average cost of capital) and benefits at the STPR.

Annex IV

1. Project specific economic performance indicators[38]

The performance indicators to be used are presented in detail within the DG Regio "Guide to CBA"for investment projects.

The main project performance indicators for CBA analysis are: Net Present Value (NPV), Internal Rate of Return (IRR) and the Benefit-Cost Ratio (B/C). Within the analysis, nominal prices should be considered, as discounting is applied for the time series to calculate NPV.

The indicators provide concise information about project performance and are the basis for ranking projects. The preferred indicator is the NPV but the IRR and B/C ratio could complement the assessment and enhance its value. The same indicators will be calculated for the financial analysis and for the economic analysis, with the difference that for each analysis (financial or economic) the results of the performance indicators reflect different aspects: while the financial performance indicators reflect the sustainability of the project and the efficiency, from the perspective of the investor/project promoter, the economic performance indicators reflects the efficiency of the project from the perspective of the society.

1.1. The Net Present Value

The Net Present Value of a project is the sum of the discounted net flows of a project. The NPV is a very concise performance indicator of an investment project: it represents the present amount of the net benefits (i.e. benefits less costs) flow generated by the investment expressed in one single value with the same unit of measurement used in the accounting tables.

The aggregation of costs and benefits occurring in different years can be carried out by weighting them. This boils down to applying appropriate coefficients, decreasing with time in order to measure the loss of value of the numeraire.

Such a coefficient is discounting factor at= $(1+i)^{-t}$where t is the time, i is the rate of discount and at is the coefficient for discounting a value in year t to obtain its present value.

The Net Present Value of a project is defined as:

$$\text{NPV}= \sum_{t=0}^{n} a_i S_t= \frac{S_0}{(1+i)^0} + \frac{S_1}{(1+i)^1} +....+ \frac{S_n}{(1+i)^n}$$

,where

$\boldsymbol{S_t}$ is the balance of cash flow at time t and a_t is the discount factor chosen for discounting at time t.

It is important to notice that the balance of costs and benefits in the early years of a project is usually negative and it only becomes positive after some years. As $a_t$decreases with time,

[38] Reference to DG Regio Guide to CBA of Investment projects

negative values in the early years are weighted more than the positive ones occurring in the later years of a project's life. The value of the discount rate and the choice of the time horizon are crucial for the determination of the NPV of a project.

A positive NPV, NPV>0, means that the project generates a net benefit (because the sum of the weighted flows of costs and benefits is positive) and it is generally desirable either in financial terms or in economic terms. When different options are considered, the ranking of the NPVs of the alternatives indicates the best one.

A project is desirable from a socio-economic point of view if ENPV>0, which means that it is adding benefit to the overall society.

1.2. The Internal Rate of Return

The Internal Rate of Return (IRR) is defined as the discount rate that zeroes out the net present value of flows of costs and benefits of an investment, that is to say the discount rate of the equation below:

$$\text{NPV (S)} = \Sigma\,[\text{St} / (1+ IRR^{t})] = 0$$

The Internal Rate of Return is an indicator of the relative efficiency of an investment, it provides an indication about the quality of an investment and should be used only to complement the other economic indicators. It is an indicator with some sensitivities:

to economic life (time horizon) when projects with different time horizon are compared, the IRR approaches inflates the deliverability of a short life project because IRR is a function both of the time period and of the size of the capital to the timing of benefits: when there are projects that fail to yield benefits for many years, the IRR tends to be lower compared to projects with a fairly even distribution of benefits over time , even if the NPV of the former may be higher

The IRR cannot deal with cases in which time varying discount rates are used . In these cases, the NPV rule allows discount rate changes to be incorporated easily in calculation

EIRR (Economic Internal Rate of Return) as calculated for the economical cash flow should be higher than the social discount rate used in appraisal. Generally, EIRR>SDR applied for a project to be positively considered.

1.3. Benefit-Cost ratio (B/C)

The B/C ratio is the present value of project total benefits divided by the present value of project total costs. If B/C>1 the project is suitable because the benefits, measured by the Present Value of the total inflows are bigger than the costs, measured by the present value of the total outflows.

Like the IRR, this ratio is independent of the size of investment, but in contrast to IRR it does not generate ambiguous cases and for reason it can complement the NPV in evaluating different projects . The B/C ratio assesses the efficiency of a projects, no matter the size of investment.

1.4. Project specific CBA as a tool to inform the cross-border cost allocation

> According to Article 12. "*Enabling investments with cross-border impact*" of the Regulation:

> *"As soon as such a project has reached sufficient maturity, the project promoters, after having consulted the TSOs from the Member States to which the project provides a significant net positive impact, shall submit an investment request. That investment request shall include a request for a cross-border cost allocation and shall be submitted to all the national regulatory authorities concerned, accompanied by the following:*

a) *a project-specific cost-benefit analysis consistent with the methodology drawn up pursuant to Article 11 and taking into account benefits beyond the borders of the Member State concerned;*

b) *a business plan evaluating the financial viability of the project, including the chosen financing solution, and, for a project of common interest falling under the category referred to in Annex II.2, the results of market testing; and*

c) *if the project promoters agree, a substantiated proposal for a cross-border cost allocation."*

> The project specific CBA performed according to the guidance provided by this methodology, will support -as a tool- the cross-border cost allocation, with the following information:

- Significant impact and countries significantly impacted
- Distribution of flows between impacted countries
- Societal value of the project impacted countries (positive and negative)
- Sensitivity analysis to reflect the impact of some critical parameters and sensitivity scenarios over the economic performance indicators

INFRASTRUCTURE INDICATORS	DEFINITION	FORMULA	APPLICABILITY		
			Source of information	ESW-CBA/PS CBA	Assumptions/ Instructions
1. Daily peak exposure (PE)	The indicator is applicable for UGS and LNG directly, for transport projects indirectly, reflects the level in which peak demand (seen as difference *between high daily demand and average daily demand)* is covered by national production (domestic production) storage and LNG facilities ; the lack of domestic production, storage and LNG supply increases the vulnerability of a country to natural gas imports. The indicator may be used to reflect the	***Proposed formula:*** $$EXP = \frac{NP + UGS + LNG - (D_h - D_a)}{(D_h - D_a)}$$ $$EXP' = \frac{Q_{alloc} + NP + UGS + LNG - (D_h - D_a)}{(D_h - D_a)}$$ *Where:* Q_{alloc} is the Flow allocated from originator country used in the second step of application NP is daily domestic production UGS is daily storage extraction LNG is daily LNG send out used as last resort D_h is the high daily demand D_a is the average daily demand $(D_h - D_a)$ is the difference between high daily demand and average daily demand in a certain country (peak demand). ***If EXP is >0*** reflects the total coverage of peak demand from domestic sources; it indicates how much additional flexibility the local infrastructure provide besides covering fully peak exposure. ***If EXP is < 0*** means a total lack of domestic supply sources (NP, LNG and UGS) and the fact that the uninterrupted consumption is based on reliability of import supply;	TYNDP/ESW – for all entry data in the formula (considering the scenarios with and without the project for the period of analysis).	PS CBA[39]	> The capacity of all indigenous sources ie Production, Storage and LNG is available as energy – ie molecules of natural gas > D_a is covered by Import Pipelines > D_h situation is assumed – short term reflection > Better control assumed on local infrastructure in D_h situation then on IMP pipeline. > Another check is necessary to verify free capacity to neighbouring country to allocate flows from local infrastructure. Application is according to the Algorithm explained in 3.5.1.2 Application for transit projects is done by identifying existing residual volumes not reaching countries in need. In case such a situation is solved due to the transportation project, it has a benefit.

[39] Project specific CBA indicator

	benefits of a transmission project by enabling the distribution of residual gas volumes toward the countries in need.				
2. Additional capacity provided by the system in relation to the infrastructure standard (N-1 rule) at regional level	Assessment of the level of resilience of a network based on infrastructure Capacities The indicator describes the ability of the technical capacity of the gas infrastructure project to satisfy total gas demand in the region/ country where calculated in the event of disruption of the	$$N\text{-}1=\frac{IP+NP+UGS+LNG-I}{Dmax}*100\%$$ The N-1 will be calculated on an incremental basis, in comparison with the initial value of the (N-1) indicator Where ***IP:*** technical capacity of entry points (in mcm/d), other than production, storage and LNG facilities covered by NPm, UGSm and LNGm, means the sum of technical capacity of all border entry points capable of supplying gas to the calculated region, taking into account the contractual restrictions of the border entry points to the calculated region. Contractual restrictions are included in the border entry points that connect third countries with the calculated	TYNDP/ESW for the elements included in the formula; Project promoter-specific input data regarding the area of analysis and significant impact;	PS CBA	Assumptions used: > MS have published their level of N-1 or additionally have established a regional N-1 > Please refer to the Annex *Questions to the Draft CBA Document* for further considerations regarding the N-1 indicator.

	single largest regional infrastructure during a day of exceptionally high demand occurring with a statistical probability of once in 20 years. If $(N\text{-}1)_0 < 100\%$ => there is need to implement gas infrastructure project with a view to meet the infrastructure standard (N-1 rule) at regional level (the gas infrastructure is essential for the supply of gas in the calculated region) => **$(N\text{-}1)_1 > 100\%$**	region. The border entry points take into consideration only the entry points from the adjacent region. ***NP:*** maximal technical production capability (in mcm/d) means the sum of the maximal technical daily production capability of all gas production facilities, including but not limited to gas mixing facilities and low-methane natural gas conversion facility, which can be delivered to the entry points in the calculated region, taking into account their respective physical characteristics (e.g. lower production capability of gas production facilities during high demand period). ***UGS:*** maximal storage technical deliverability (in mcm/d) means the sum of the maximal technical daily withdrawal capacity of all storage facilities connected to the transmission system which can be delivered to the entry points in the calculated region, taking into account their respective physical characteristics. ***LNG:*** maximal technical LNG facility capacity (in mcm/d) means the sum of the maximal technical send-out capacities at all LNG facilities in the calculated region, taking into account critical elements like offloading, ancillary services, temporary storage and re-gasification of LNG as well as technical send-out capacity to the system. ***I*** means the technical capacity of the single largest gas infrastructure (in mcm/d) of common interest. The single largest gas infrastructure of common interest to a region is the largest gas infrastructure in the calculated region that directly or indirectly contributes to the supply of gas to the Member States of that region and shall be defined in the joint Preventive Action Plan, according to Regulation 994/2010 concerning the measures to safeguard security of supply. ***D_{max}*** means the total daily gas demand (in mcm/d) of the			

	calculated area during a day of exceptionally high gas demand occurring with a statistical probability of once in 20 years.			
3. Import dependence index	$IDI = \frac{1}{1 + (\text{National Production } share) + \frac{UGS\ share}{2}}$ $IDI' = \frac{1}{1 + Q_{alloc} + (\text{National Production } share) + \frac{UGS\ share}{2}}$ Where: Q_{alloc} is the Flow allocated from originator country used in the second step of application **National Production share** is the aggregated shares of NP deliverability (share of the average daily demand (Da) of a zone) **UGS share** is aggregated shares of UGS deliverability (share of the Da of a zone) > The objective of the indicator is to reflect the vulnerability of a country to import. The lower the value of the index, the lower the vulnerability. > The formula expresses the Zone's dependence on import. > The Index captures the capability of the local infrastructure to cover the demand, thus also the need of imports to balance demand throughout the year.	TYNDP-Methodology chapter	ESW CBA PS CBA	Assumptions used: > 0.5 factor considered for the UGS, as the storage has a neutral balance over the year > Da situation is assumed – medium term reflection This indicator could be applied for all types of projects. Aggregated share of storage and National Production deliverability (expressed as a percentage of the Average Daily Demand of a Zone) are used to measure the dependence on imports (the 1+ term is introduced to obtain the value of 1 for a country completely dependent on imports all over the year). A factor 0.5 has been introduced for the UGS component as it is assumed that storage has a neutral balance over the year. A Zone having enough National Production to cover exactly its demand will score 0.5.
4. Import route diversification index	HHI type formula to assess the import route diversification $\sum_{l}^{x\,border}\left(\sum_{k}^{IP}\%IP_k Xborder_l\right)^2 + \sum_{j}^{Source}\sum_{i}^{IP}(\%IP_i from\ source_j)^2 + \sum_{m}(\%LNG\ terminal_m)^2$ Where, > Aggregated values are used directly for IP between European zones	TYNDP-Methodology chapter	ESW CBA PS CBA	Aggregated values are used directly for Interconnection Points between European Zones as those physical points are likely to largely depend on common infrastructure. Import points for non-EU gas are considered individually as upstream

	- Import points for non-EU gas are considered individually - The objective of the indicator is to reflect the concentration of the aggregated Entry capacities and the positive impact of a new Entry capacity.			infrastructures are often much more independent.
5. Remaining flexibility at zone level	$RemFlex = 1 - \frac{\sum Entering\ Flow}{\sum Entry\ Capacity}$ Where - The indicator at zone level considers both the gas staying in the zone to face demand and the gas exiting to adjacent systems - The objective of the indicator is to identify investment gaps based on the level of remaining flexibility: - <5% under Reference case - <1% under supply stress (when part of the flexibility has been used to face the Supply stress) - Indicator used to assess the infrastructure resilience, which looks at the ability of the infrastructure to transport large quantities of gas under high daily conditions (supply stress). The assessment is used for the identification of investment gaps and potential remedies.	TYNDP – Methodology chapter	ESW CBA	The indicator at Zone level considers both the gas staying in the Zone to face demand and the gas exiting to adjacent systems. The identification of investment gaps is based on the level of the Remaining Flexibility at Zone level. Investment gaps are identified when the indicator is: - below 5% under Reference Cases - Below 1% under Supply Stress cases as part of the flexibility has been used to face the Supply Stress. Disruption scenarios simulated in the current TYNDP are assuming a lack of gas flows from the concerned supply source at the relevant EU borders. Capacity at EU cross-border IPs is considered technically available, although not always fully exploitable, taking into consideration the proximity of the IPs to the disrupted source and the underlying infrastructure. This is reflected in the model by the fact that, in case of a disruption, the use of Entry Capacity of each Zone is impacted by the flow decrease starting from the disruption and then spread according to transmission capacity level. After crossing a few Zones, the impact becomes strongly

				diluted.
6. Supply Source Dependence assessment	Supply Source Dependence assessment aims at the identification of Zones whose balance depends strongly on a single supply source. This assessment is carried out under the 1-day Average situation in order to identify the strong dependence of some Zones on a single supply source throughout the year. This is achieved through the Full Minimisation of each supply source separately, and the replacement of the corresponding volume by the remaining sources. The supply situation under the Full Minimisation cases reflects, source by source, the ability of the remaining sources to replace a specific supply. For that purpose each import source has been reduced alternatively down to the minimum required to balance each Zone. In order to identify the potential dependence of all Zones in a single modelling, no limit has been set to the alternative supply sources apart from their technical capacity as it is assumed that all Zones will not minimize the predominant supply at the same time. Indigenous production has been kept at Reference Case level and LNG terminal send-out limited to 80% of their capacity. Zones requiring at least a 20% share of a given source are identified as source dependent.	TYNDP – Methodology chapter	ESW-CBA	
7. Infrastructure Adaptability to Supply Evolution	The assessment of the Adaptability to Supply Evolution looks at the European infrastructure's ability to face very different supply mixes as resulting from short-term signals or long-term trends. This assessment is carried out under the 1-day Average demand situation in order to identify the ability to balance every Zone when one of the supply sources move from the Reference Supply to Maximum Potential supply or Minimum Potential Supply scenarios. Where no flow pattern enables to reach the Potential Supply scenarios, the limiting factor is identified. To be further investigated	TYNDP – Methodology chapter	ESW CBA	
8. Supply Source Diversification	The assessment of the Supply Source Diversification at Zone level aims at determining the ability of each Zone to access each identified supply source. It has been carried out under the 1-day Average demand situation through Targeted Maximisation	TYNDP – Methodology chapter	ESW CBA	

	The supply situation under the Targeted Maximisation cases reflects, source by source, the geographical reach of the Maximum Potential scenario. In order to identify a flow pattern enabling the reach of Zones further downstream, more freedom has been given to the flow ranges authorized for each import route compared to the Even Maximisation. Therefore each case requires several simulations in order to test the supply reach in all directions at the level of 5% and 20% share of total supply (including indigenous production) in each Zone			

Annex V

1. Definition of terms

CBA (Cost-Benefit Analysis) means a conceptual framework applied to any systematic, quantitative appraisal of a public or private project to determine whether, or to what extent, that project is worthwhile from a social perspective; such CBA is carried out according to a CBA methodology

CBA methodology means the Cost-Benefit Analysis methodology developed by ENTSOG on the basis of the Regulation and covering the Energy system-wide analysis and Project-specific analysis

Regulation means the Regulation (EU) No 347/2013 of the European Parliament and of the Council on 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision no 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009

Draft Regulation means the Commission's proposal for the Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Decision no 1364/2006/EC as submitted on 19 October 2011

Ten-Year Network Development Plan (TYNDP) means the Union-wide report on the outlook for the European gas infrastructure development including the assessment of the resilience of the system as well as of market integration under multiple scenarios and respective cases; the TYNDP is developed by ENTSOG using the combination of top-down and bottom-up approaches

Energy system-wide analysis means an analysis of the European gas infrastructure as a whole aiming at assessing the overall impact of all TYNDP projects along the criteria of market integration, competition, security of supply and sustainability taking into consideration the energy infrastructure priority corridors defined in the Regulation; this analysis is carried out by ENTSOG within the TYNDP once the Regulation has entered into force

Project-specific analysis means a cost-benefit analysis of a TYNDP project aiming at assessing the impact of a specific project on the European gas infrastructure along the criteria of market integration, competition, security of supply and sustainability taking into consideration the energy infrastructure priority corridors defined in the Regulation; this analysis is carried out by the project's promoter, or on their behalf, to the extent necessary and according to requirements of the PCI process

Project of Common Interest (PCI) means a project which meets the general and at least one of the specific criteria defined in Art. 4 of the Regulation and has been granted the label of PCI project according to the provisions of the Regulation

Network model means an analytical tool for the assessment of the European gas infrastructure along multiple criteria as developed, operated and managed by ENTSOG and used for the production of ENTSOG reports and analysis according to Regulation (EC) 715/2009 or Regulation (EU) 10/994

Stakeholders means parties and authorities directly or indirectly affected by the PCI process

Cross-border cost allocation means a procedure, as well as the results of such procedure, through which concerned National Regulatory Authorities, or ACER where applicable, take a decision on allocating parts or all costs incurred by a (regulated) project promoter in relation to a project in one Member State to an entity, most likely a TSO, in another Member State benefitting from this project. Such cross-border cost allocation may spread across multiple Member States. According to the Regulation, a Cross-border cost allocation should only be launched upon a request by the concerned project promoter(s) and be based, among other things, on the Project-specific analysis; Cross-border cost allocation is not linked to any specific implementation measures for the financial transfers implied by the Cross-border cost allocation

Beneficiary means gas consumers having a benefit from a gas infrastructure project, particularly gas consumers that are located in a Member State different from the location of the gas infrastructure project

Payer means an entity responsible for the financial transfers implied by a specific Cross-border cost allocation

Maturity of a project means a level of a project development; it is assumed that a project has reached full maturity once a Final Investment Decision has been taken

Final Investment Decision (FID) means the decision taken at the level of an undertaking to definitively earmark funds towards the investment phase of a project, the investment phase meaning the phase during which construction or decommissioning takes place and capital costs are incurred. The investment phase excludes the planning phase, during which project implementation is prepared and which includes, where appropriate, a feasibility assessment, preparatory and technical studies, obtaining licences and authorisations and incurring capital costs (*definition taken from Council Regulation (EU) 617/2010 concerning the notification to the Commission of investment projects in energy infrastructure within the European*)

Financial sustainability of a project means the ability of a project to prove a cumulated positive net cash flow over all the years considered for the financial analysis (in nominal or real terms)

Business plan means a financial analysis evaluating the Financial sustainability of a project, including the chosen financing solution

Commercially sensitive information means information of either qualitative or quantitative character whose exposure to non-authorized third parties could incur damage on the party concerned by the information or on its commercial partners; authorized third parties can be either authorities having the right of access to Commercially sensitive information embedded in national or European legislation or third parties, notably consultants, who have signed a confidentiality agreement with the owner of the information

Externality means a secondary or unintended consequence of an activity; externality may be either positive or negative; when non-market impacts do not occur in the transactions between the producer and the direct users /beneficiaries of the project services but fall on uncompensated third parties, these impacts are defined as externalities.

Option analysis means a process aiming at providing evidence that the project can be implemented as proposed and is the best option among all feasible alternatives

Incremental approach means the analysis of differences in the costs and benefits between the scenario with the project and the scenario without the project (Business-As-Usual; BAU) considered in the option analysis

Investment costs (CAPEX) means all those costs that are incurred in view of the effects that will accrue beyond the financial period in which the relative disbursements were made.

Operating costs (OPEX) means all those costs that are incurred after the commissioning of an asset and which are not of an investment nature, such as: direct production/operating costs, administrative and general expenditures, sales and distribution expenditures, etc.

Residual value[40] means the present value at year n+20 (end of time horizon) net of operating costs, the project will be able to generate because of the remaining service potential of fixed assets whose economic life is not yet completely exhausted

Financial analysis means the analysis using the cash flow forecasts to calculate net return indicators especially the Financial Net Present and Financial Internal rate of return

Financial Net Present Value (FNPV)/Economic Net Present Value (ENPV) means the result obtained from the deduction of the expected investment and operating costs of a project (suitably discounted) from the discounted value of the expected revenue from the project

Financial Rate of Return (FRR)/ **Economic Rate of Return (ERR)** means the discount rate that produces a zero FNPV /ENPV

Discount rate means the rate used in discounting future cash flows in order to reflect how the benefits and costs are to be valued against the present ones.

[40] See DG REGIO Guide to Cost Benefit Analysis of Investment Projects

Social Discount Rate which means the discount rate used for the economic analysis, which reflects the social view on how future benefits and costs are to be valued against present ones and could derive from the predicted long term growth in the economy.

Financial Discount Rate which means the appropriate discount rate applied to the financial cash flow in order to calculate the present value of the future cash flows; the financial discount rate reflects the opportunity cost of capital, defined as the "expected return forgone by bypassing other potential investment activities for a given capital".

Economic analysis means the analysis based on and complementary to the financial analysis aiming at assessing a project's externalities and as such its contribution to the economic welfare of a region or country according to specified criteria;

Sensitivity analysis means the analysis aiming at determining the critical variables or parameters of the model whose variations, positive or negative, have the greatest impact on a project's financial and/or economic performance

Main parameters means variables for which an absolute variation of 1% around the best estimate give rise to a corresponding variation of not less than 1% in the NPV

Extrapolation means a projection of input data figures for an additional time horizon where either lack of data or uncertainty prevents the use of concrete figures

Composition of the transmission network means the analytical description of the transmission network through structural elements used for the representation of the network in a network model

Market integration means a process by which formerly separate markets connect with each other both physically and commercially, the latter enabled especially by compatible regulatory frameworks

Interoperability means the ability of two or more systems operated by different entities to exchange natural gas and operate in a compatible and efficient mode including the seamless and efficient execution of transmission system operations and business transactions between TSOs and network users in a manner of conduct which may reasonably be approximated to the conduct of a transmission system as if operated by a single entity *(taken from Framework Guidelines on Interoperability)*

System flexibility means the technical and physical availability of an infrastructure allowing for different flow patterns

Liquidity means the ability to quickly buy or sell reasonable volumes of gas without causing a significant change in price and without incurring significant transactions costs. A key feature of a liquid market is that it has a large number of buyers and sellers willing to transact at all times. The assessment of market liquidity usually includes consideration of the volumes traded, churn rates and the number of players on the market

Competition means rivalry in which every seller tries to get what other sellers are seeking at the same time: sales, profit, and market share by offering the best practicable combination of price, quality, and service. Where the market information flows freely, competition plays a regulatory function in balancing demand and supply.

Diversification of supply sources means a process, and the result of such process, whereby the number of different supply sources that can physically, and to a limited extent also only commercially, reach a certain market increases

Diversification of supply counterparts means a process, and the result of such process, whereby the number of different suppliers (producers) that can physically, and to a limited extent also only commercially, reach a certain market increases

Diversification of supply routes means a process, and the result of such process, whereby the number of different routes that a certain supplier (producer) can use to physically deliver its supplies to a certain market

Sustainability means the contribution of a project to emissions reduction, back-up of renewable electricity generation or power-to-gas and biogas transportation taking into account expected changes in climatic condition under different scenarios

National Production means the energy amount of gas produced from geological formations, delivered by the producer either to the distribution or transmission system.

Brussels, 25 July 2013