

ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects

Frequent Asked Questions

12 June 2013

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1. GENERAL QUESTIONS: USE OF CBA

Topic	Question	Answer
CBA use	What is CBA intended for?	<p>System wide Cost Benefit Analysis (CBA) is intended to allow an assessment of all TYNDP projects [link: TYNDP 2012 - ENTSO-E - European Network of Transmission System Operators for Electricity] in a homogenous way.</p> <p>The use of CBA's improves transparency in displaying costs and benefits of projects in a homogenous way at a European-wide scale.</p> <p>CBA is also an input for the Projects of Common Interest (PCI's) selection process of the EU Regional Groups, as set up by the Regulation (EU) No. 347/2013 [link:http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:115:0039:0075:EN:PDF]</p>
CBA use	What is the role of ENTSO-E in CBA?	<p>Firstly, ENTSO-E has the role to define a robust and consistent methodology. Secondly, in the context of TYNDP, it is the responsibility of each ENTSO-E regional group to assess TYNDP projects, TSO projects as well as Third Party projects, using the CBA methodology. ENTSO-E guarantees a coordinated process, based on common grid and market simulations. The result of the assessment is published in the TYNDP. However, ENTSO-E doesn't rank the projects.</p>
CBA use	How are the projects ranked?	<p>It is the responsibility of EU Regional Groups to rank candidate Project of Common Interest (PCIs) within their Region. Then, it is the responsibility of the European Commission to approve the final European-wide PCI list. Note that there is no European ranking of PCIs.</p>
CBA use	Why a multi-criteria approach?	<p>The CBA identifies a number of indicators, in fact two cost elements and seven benefit indicators. Not all of them can be faithfully monetised and added [see "CBA Introduction"]. Hence the CBA presents a 'multi- criteria' approach; one assesses all the indicators, and presents the results in what we term the 'multi-criteria approach'. For example, depending on each particular context, these indicators do not have always the same weights in decision making (see "FAQ - How does one rank projects" below).</p>
Scope of CBA?	Is the CBA fully comprehensive?	<p>It is as comprehensive as possible recognizing the level of uncertainties at time of calculation, and uses international existing best practice techniques for examining system impacts on the scale of the European network.</p> <p>Hence the most important requirement of this CBA is to be as robust and reliable as possible. The 2-year timeframe for the TYNDP process also limits the extent for the CBA. Moreover, the current CBA methodology is not fixed indefinitely but will be reviewed after the analyses of the TYNDP 2014 process are completed. The resulting gain in experience from the practical application of the methodology on a European-wide basis will influence the future improvement of CBA.</p>
Scope of CBA	Can CBA be used for electricity storage projects?	<p>Yes, the Regulation (EU) No. 347/2013 requires that CBA can be used for storage PCI candidate projects >225MW with a net annual generation of 250GWh, although storage is not in the scope of all TSOs. Appendix 6 is devoted to this topic in the CBA Guideline document.</p>

Scope of CBA	Does ENTSO-E publish calculation of benefits per Member State?	No. The primary focus of the CBA methodology is the EU recognised appraisal of Social-Economic Welfare benefits. These are suitable for system wide evaluation but are less robust when calculated at smaller geographical scales. Nevertheless, the methodology allows for these calculations, which may be performed if requested.
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Scope of CBA	Should results of CBA be used for Cost Allocation?	Results of CBA may be one of the inputs for Cross Border Cost Allocation, but should not be used in a systematic or mechanical way, since the results are very dependent on scenarios and horizons.
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2. DEFINITION OF PROJECTS

Topic	Question	Answer
Definition of projects	What is an investment?	An investment is an individual equipment or facility, such as a transmission line, a cable or a substation.
Definition of projects	What is a project?	A project is either a single investment or a set of investments, clustered together to form a project, in order to achieve a common goal.
Definition of projects	What is the reason for clustering investments?	In some cases, several individual investments rather than a single investment are required to deliver the desired result (for example to achieve a full grid transfer capability increase), and therefore the investments are clustered to form a project. For example, to reinforce one transmission boundary, it is sensible to uprate two circuits in series, and the three substation ends of these circuits. In such a case, investments are clustered together, to permit a common appraisal of the project.
	What are the criteria for clustering different investments?	<p>An investment should be included into a project only if the project without this investment does not achieve the desired effect and when:</p> <ul style="list-style-type: none"> • investments are located in the same area or along the same transport corridor; • investments achieve a common measurable goal; • investments belong to a general plan for that area or corridor. <p>The general criterion for clustering a candidate investment into a main project is the influence of the investment on the total increase of GTC. If the influence is not substantial, i.e. lower than 20% of the main investment increase, the investment will not be considered as a part of the project.</p> <p>Only complementary (not competitive) investments may be clustered. One cannot cluster investments which are to be commissioned more than 5 years apart.</p>
Clustering	In the clustering of investments, it says that it is only allowed if influence is more than 20%. Why this 20%?	The “influence” criterion was introduced in order to avoid excessive clustering. A 20% increase was deemed significant by ENTSO-E experts, and was not objected to during the November CBA workshop. It will be tested during the TYNDP 2014 and reviewed if necessary.
Clustering	Why can't you cluster investments whose commission is more than 5 years apart?	The “time limit criterion” was introduced in order to avoid excessive clustering. It was one of the demands formulated by stakeholders at the November CBA workshop. 5 years was deemed significant by ENTSO-E experts. It will be tested during the TYNDP 2014 and reviewed if necessary.

3. COSTS AND OTHER IMPACTS

Topic	Question	Answer
Costs	In the CBA, is the cost-of-capital pre-Tax or post-Tax?	<p>Transmission reinforcement costs are expressed as paid by Transmission System Operators, and hence they are pre-Tax.</p> <p>Different Tax regimes across different European regimes would make it impossible to apply Tax on a consistent basis.</p>
Social and Environmental Impacts	How does the methodology monetise the social and environmental impact of projects?	Any project impact that can be mitigated or compensated will be included in the total cost of the project (C1). However, if such measures do not fully eliminate such impacts and the resulting <i>residual impact</i> cannot be (objectively) expressed in monetary terms, this residual impact is presented separately under indicator S.1 (environmental impact) and S.2 (social impact).
Social and Environmental Impacts	The definition of “project costs” that is presented in the methodology appears to double-account environmental impact, as both indicator C.1 and S.1/S.2 make mention of such impacts.	Please refer to “How does the methodology monetize the social and environmental impact of projects?”
Social and Environmental Impacts	How are the social and environmental impact of projects measured in early project stages, e.g. before the final route has been determined?	<p>In early project stages there is usually insufficient information available to assess the social and environmental consequences of a project in a meaningful way. These indicators may therefore be left blank when a project enters the TYNDP, and are scored in a successive version of the TYNDP once preliminary studies (that provide a basis for such scoring) have been performed.</p> <p>Note that the quantification of the social and environmental impact indicators will generally be presented in the form of a range, the bandwidth of which tends to decrease as the project progresses and more detailed information becomes available.</p>

4. ASSESSMENT FRAMEWORK

Topic	Question	Answer
Assessment framework	What is the reference network based on?	The reference network is the existing network plus all main identified TYNDP developments, allowing the application of the TOOT approach.
Assessment framework	How will competitive investments/projects be dealt with?	The reference network will represent the target capacity, taking into account the investment needs identified through market studies. Hence, the TOOT approach will be adapted on each border in order to take into account both the maturity of the future projects and potentially competitive projects.
GTC calculation	How to assess the GTC increases?	The Grid transfer capability (GTC) is one of main drivers related to network planning activity; this benefit refers mainly to investments as interconnection lines or internal lines across a boundary (eg. within two different bidding areas). The assessment of GTC increase, termed Δ GTC, is based on the identification of the variation of secure capabilities of the boundary with and without the planned investment. The calculation result is the increased boundary capability (Δ GTC) across a boundary due to planned reinforcement.
GTC calculation	The GTC value that is displayed and used as a basis for benefit calculation must be valid for at least 30% of the time. Why 30%?	The GTC value represents a typical value of GTC across the year. 30% was deemed significant by ENTSO-E experts. It will be tested during the TYNDP 2014 and reviewed if necessary.
Results presentation	How will the assessment results be published?	According to the Guideline for Cost Benefit Analysis the numbers will be published. Thresholds are inputs for the EU Regional Groups decision making process.

5. BENEFITS IN CBA

a. BENEFIT 1: SECURITY OF SUPPLY

Topic	Question	Answer
Security of Supply	Why doesn't ENTSO-E want to monetise value of lost load?	<p>ENTSO-E wishes to base its cost benefit analyses on economic parameters established by international bodies or on methodologies approved by international institutions.</p> <p>Hence, CO2 values and fuel costs are based on values published by the International Energy Agency (IEA). Although the Council of European Energy Regulators (CEER) has published a methodology for studies of national VOLL, this methodology has only been applied in a few European countries. ENTSO-E will be able to monetise loss of load when the methodology has been applied throughout Europe in a homogenous way.</p>
Security of Supply	Doesn't this multi-criteria approach implicitly give zero value to security of supply?	No, not with a full multi-criteria approach. ENTSO-E systematically quantifies the improvement of loss of load expectancy achieved by each TYNDP projects (in MWh). This allows comparing the contribution of projects to security of supply benefits on a consistent basis. EU Regional Groups may choose to give a "weight" to security of supply when comparing projects if they wish.
Security of Supply	We understand that there is no European Value of Lost Load, but couldn't national values be given instead?	<p>National values are not available in every country, and those which are available have not been established with comparable methodologies.</p> <p>However, in order to provide as much transparency as possible, ENTSO-E's CBA methodology provides an overview of national values of lost load (appendix 4).</p>
Security of Supply	Couldn't a rough mean European value be used instead?	Generally, VOLL values are very high; they could therefore influence results. Giving a monetary weight based on non-reliable values would distort cost benefit analysis - it would be like comparing apples and oranges.

b. BENEFIT 2: SOCIAL AND ECONOMIC WELFARE

Topic	Question	Answer
Social and Economic Welfare	What is 'Social and Economic Welfare' (SEW)?	<p>In the context of ENTSO-E's CBA, we define Social and Economic Welfare to be the monetary benefit which results from the pan-European generation optimization through the interconnected grid.</p> <p>This means that higher cost generation units in one area may be replaced by lower cost generation units in another area. The benefits may be in the form of greater Trades (mainly cross-border), or in the form of reduced Congestion (including within-country congestion). In both cases, it refers to generation cost savings for society.</p>
Social and Economic Welfare	What is Short Run Marginal Costs?	<p>SRMC is the short run marginal cost of a generating plant. ENTSO-E derives SRMC via data of station efficiency (or heat rate) times a forecast fuel price, plus carbon emission rate times a forecast Carbon price. 'Wear and Tear' costs of operation (per MWh) may be included.</p>
Social and Economic Welfare	How is SEW measured?	<p>SEW is measured in euros, as the difference between these Short Run Marginal Costs (SRMC's) with and without the project. The results may be also being presented as consumer surplus, producer surplus and congestion rent.</p> <p>ENTSO-E carries out market studies which implement the generation optimization, based on their SRMC which is provided by international references such as the IEA (see above).</p>
Social and Economic Welfare	Why do we ignore capital cost of generation in SEW?	<p>The CBA assesses short-run costs of generation and demand response within SEW, given a particular scenario of generation and demand. Inclusion of generation capital costs would imply assessment of a different generation scenario, and is beyond the scope of our CBA.</p> <p>As scenarios evolve between each TYNDP round, implicitly the generation capital costs are evolving in the path being set by European and national policies.</p>
Social and Economic Welfare and Markets	Why do we ignore competition benefits, of greater participation / liquidity in electricity markets?	<p>In its assessments, ENTSO-E assumes a 'perfect market', i.e. that electricity markets are considered perfectly competitive and cost-reflective. Hence zero further competitive benefits can arise. Any other assumption would be difficult to establish, and</p>

subjective (see Annex 1 of CBA Guidelines document).

Social and Economic Welfare Decomposition	Who are the winners and losers in terms of SEW?	The CBA Guidelines recommend primarily calculating the overall CBA, which represent the total monetary benefits across the entire modelled European Region (plus neighbouring nations). This suffices to determine if a transmission project is beneficial for the European Region as a whole.
Social and Economic Welfare Calculation	How does the CBA Methodology, in the case of an Interconnector, handle the costs resulting from within-country restrictions?	Formally, the case is entirely covered, because the identification and costing of SEW should respect all network restrictions, whether cross-border or within-country. In practice, the case is either fully covered by Network studies or else is handled in Market studies, by down rating a cross-border GTC in unreinforced cases to reflect the within-country restriction.

c. BENEFIT 3: RES INTEGRATION

Topic	Question	Answer
RES	Is not the RES 'extra MW connected' metric inconsistent with the CBA by not considering investment/decommissioning in other generation?	This metric for RES is only expected to be used in cases where the transmission project is closely associated with connecting new RES. In the more general case, e.g. of a cross-border reinforcement, the alternative metric of 'MWh of RES curtailed' is expected to be applied.

d. BENEFIT 4: LOSSES

Topic	Question	Answer
Losses	Don't Transmission reinforcements always reduce Losses?	The main benefit of transmission reinforcements is to facilitate cheaper generation to displace more expensive generation. This cheaper generation is typically more remote from demand and so greater flows and hence transmission losses ensue. Hence the Guidelines require that Losses are assessed including the impacts of generation re-dispatch. It is by no means clear, whether 'typical' TYNDP projects will show a positive or negative Losses benefit.

e. BENEFIT 5: CO2 EMISSIONS

Topic	Question	Answer
CO2	Does a benefit of CO2 saved, double-count against SEW, where SRMCs include Carbon prices?	The Guidelines are careful to specify that this double-counting should be guarded against. Thus if SRMCs include CO2 priced at 10 Euro/MWh, and if one decides to adopt a CO2 price of 25 Euro/MWh for the CO2 indication, then the stated CO2 benefit should be at a CO2 price of $25 - 10 = 15$ Euro/MWh.
CO2	Will Carbon emission rates be public, to enable Third Parties to perform CO2 sensitivities?	Yes, it will be published on ENTSO-E's website.
CO2	Surely, we assume under the Carbon quota systems that the EU will exactly meet Carbon targets. Hence, will not changes to total CO2 emissions always net to zero change?	This is beyond the scope of the CBA. In order to perform the CBA, ENTSO-E has to report reductions in CO2 emission resulting from transmission projects. Whether this reduction is realised as an absolute reduction in European Carbon emissions, or as a substitution of less activities required in other sectors, is beyond the scope of the CBA.

f. BENEFIT 6: TECHNICAL RESILIENCE/SYSTEM SAFETY

Topic	Question	Answer
Technical resilience	Why assess technical resilience?	Electricity networks are complex infrastructures, and all individual components affect overall system performance. Transmission expansions can increase the technical resilience of the system, thereby increasing its ability to prevent outages in case of exceptional contingencies, but modifications to the grid can also negatively affect overall system performance. Before adding new components to the strongly interconnected, meshed European transmission grid, it is thus of vital importance that one assesses the impact of this modification to the network on overall system safety.

Technical resilience	How to perform assessment for technical resilience?	<p>It is necessary to consider all hazards that may affect the power system which result in flow patterns affecting system safety. Most extreme cases have to be selected. Assessment should be performed for:</p> <ul style="list-style-type: none"> • Failures combined with maintenance, • Steady state analysis, • Voltage collapse analysis
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g. BENEFIT 7: ROBUSTNESS/FLEXIBILITY

Topic	Question	Answer
Robustness/flexibility	Why assess impact on flexibility?	<p>Long-term transmission planning is inherently uncertain given the time horizons involved, the diversity of generation that may or may not be built or decommissioned, the importance of locational siting, the impact of economic growth and smart technologies on demand, etc... Hence, the best investments for the future is necessarily the optimal one in a given scenario, but the most robust one, providing value across a large number of scenarios or planning cases. Moreover, because of the growing share of RES generation, the value of ancillary services in damping rapid fluctuations in the system will increase.</p>
Robustness	How to perform assessment for robustness?	<p>It is necessary to consider:</p> <ul style="list-style-type: none"> • Assessment of Ability to comply with all cases. The scoring of this KPI is based on assessing the ability of the PCI to maintain the planning standards taking into account different cases. • Assessment of variance from foreseen reinforcements. The scoring of this KPI is based on assessing the ability of the PCI to maintain the planning standards when other projects in the regional network are delayed. • Assessment of ability to modify project. • Assessment of balancing services. The provision of balancing services such as power regulation and ancillary services are considered.

Robustness	Will ENTSO-E assess the Ancillary benefits of all projects?	No – such an assessment is not required under the CBA, because there is no homogenous approach to Ancillary or Balancing pricing across Europe. Individual TSOs or promoters are invited to supplement assessment of this benefit 7, according to the principles suggested in Annex 5.
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h. OTHER BENEFITS

Topic	Question	Answer
Benefits	Why is the criteria contribution to 10% interconnection taken into account?	The criterion was established at the European Council of March 2002 in Barcelona and chosen as an indicator in the EU Regulation No 347/2013 (Annex IV 2.a). “All Member States should achieve a level of electricity interconnection equivalent to at least 10% of their installed generation capacity”.
Benefits	How to calculate the contribution to 10% interconnection?	For each Member State the interconnection ratio is obtained as the sum of importing GTCs to the total installed generation capacity. The evaluation must be done for projects with significant cross-border impact at borders between relevant Member States, between relevant Member States and third countries, within relevant Member States and on demand-supply balancing and network operations.
Benefits	Why does the CBA not quote a benefit of retirement of old/inefficient power stations, as facilitated by new transmission?	In the current approach, the scenario(s) of generation present are a given (input data for the CBA), hence calculation of impact of new transmission on retirement of old plants or creation of new plants cannot be performed. It is however acknowledged that transmission expansions have an influence on generation investment/decommissioning. Instead of estimating the consequences of projects for new generation investment in each individual TYNDP, this effect is dealt with by the dynamic nature of the TYNDP process in which successive publications include developments in generation capacity as the basis for their adapted scenarios. Moreover, it is not ENTSO-E’s role to propose investments or retirement of generation.
Benefits	How to deal with investment contributing to two projects whose drivers are different?	As a general rule, an investment should only be included in one project. However, there might be exceptions, which will be treated on a case by case basis, taking due care not to double account.

6. SCENARIOS & PLANNING CASES

Topic	Question	Answer
Scenarios	Why only examine a limited number of scenarios/horizons?	The analysis of a single scenario alone requires a significant workload. There are also an infinite number of scenarios and therefore practically impossible to consider all possibilities. Following consultation, ENTSO-E is confident that its guideline of analysing at least 2 scenarios and considering at least 2 horizons is the best compromise at the pan-European level. This is consistent with international practice over the past number of years and hence is not a reduction on current rigor applied in assessing network reinforcement requirements
Scenarios	How does one perform CBA with multiple scenarios? Should all be given the same consideration? E.g. What if a project is not efficient in the Reference Scenario but very efficient in another scenario? Should the treatment of scenarios be weighted?	The Reference Scenario provides the primary input for determining the colour coding for project indicators. Studying further sensitivities illustrates flexibility – i.e. a range of values. Any weighting of scenarios is up to EU Regional Groups.
Planning case	What if the results of the ENTSO-E Regional Group study are significantly different from the results of a national planning study?	This can occur because of different assumptions, e.g. scenarios, and/or concerns and objectives of national, regional and European studies. ENTSO-E studies are designed to be complementary but to be focussed on identifying different needs and will highlight the European added value of the project, which may not be shown in the national studies.
Planning case	How does one select appropriate planning cases from the market data?	When selecting planning cases, the objective is to study a set of representative system conditions across the year. The suggested way to define most relevant and representative planning cases is explained in Guidelines-Grid studies for projects assessment.

