European Network of
Transmission System Operators
for Electricity

entsoe

Cost Benefit Analyses

ENTSO-E Guidance document for national implementation for network codes on grid connection

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DESCRIPTION

Summary

What is required in the CNCs from a CBA?

Each of the Connection Codes contains a chapter dedicated to Cost Benefit Analysis with two articles which specify how a CBA is to be applied. These are as follows:

RfG articles 38 & 39:
38 - Identification of costs and benefits of application of requirements to existing power generating modules
39 - Principles of cost-benefit analysis

DCC articles 48 & 49:
48 - Identification of costs and benefits of application of requirements to existing transmission-connected demand facilities, existing transmission-connected distribution facilities, existing distribution systems and existing demand units
49 - Principles of cost-benefit analysis

HVDC articles 65 & 66:
65 - Identification of costs and benefits of application of requirements to existing HVDC systems or DC-connected power park modules
66 - Principles of cost-benefit analysis

When do the CNCs require a CBA?

The use of CBAs is required in the codes as follows. This table also specifies in which of these instances a public consultation is required.

Proposal in CNCs	Public Consultation	CBA	Articles in Network Code		
			RfG	DCC	HVDC
Application to existing equipment	Yes	Yes	4	4	4
To set 'type' thresholds in RfG	Yes	No*	5	-	-
To progress a derogation	Yes**	Yes	62 & 63	52 & 53	77 & 78

Points of clarification, expanded later in this guidance document:

*Except where a revised threshold is to apply retrospectively
** In the case of a derogation proposed by a facility owner, no consultation on the CBA is required.

ACER FWGL

The ACER Framework Guideline on Electricity Grid Connections (July 2011) sets out the principles as expected to be detailed in the Connection Network Codes for CBAs on the occasion that it is proposed to either:

- Apply elements of the codes to existing equipment; or
- Where a derogation from the codes is proposed for specific equipment

Objective

The objective of this Guidance Document is to set out the requirements for CBAs as described in the connection codes and, by expanding on these requirements and providing explanations, to help provide guidance to TSOs on how to approach a cost benefit analysis (CBA).

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	The following specific requirements for CBAs are covered: • Methodology for first stage (preliminary or qualitative CBA) and second stage (quantitative CBA) • Quantifying benefit aspects • CBAs for retrospective application • CBAs for derogations • Consideration of (market) alternatives
NC references: Articles in the CNCs containing references to CBAs	Apart from the chapter in each code setting out the principles and application of CBAs, other articles in the connection codes contain provisions with regard to CBAs and set out where a CBA should be used. These articles and their purposes are set out below: **Statement of intent and purpose of code** Recitals RfG recital 8 as shown; similar in DCC recital 7 and HVDC recital 8 *In view of the need to provide regulatory certainty, the requirements of this Regulation should apply to new generating facilities but should not apply to existing generating modules and generating modules already at an advanced stage of planning but not yet completed unless the relevant regulatory authority or Member State decides otherwise based on evolution of system requirements and a full cost-benefit analysis, or where there has been substantial modernisation of those generating facilities.* **CBAs for Retrospective Application** Application to existing power generating modules Article 4 in RfG as shown below; similar provisions for application to existing equipment in Article 4 of both DCC and HVDC *3. Following a public consultation in accordance to Article 10 and in order to address significant factual changes in circumstances, such as the evolution of system requirements including penetration of renewable energy sources, smart grids, distributed generation or demand response, the relevant TSO may propose to the regulatory authority concerned, or where applicable, to the Member State to extend the application of this Regulation to existing power generating modules.* *For that purpose a sound and transparent quantitative cost-benefit analysis shall be carried out, in accordance with Articles 38 and 39. The analysis shall indicate:* *a) the costs, in regard to existing power generating modules, of requiring compliance with this Regulation;* *b) the socio-economic benefit resulting from applying the requirements set out in this Regulation; and*

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c) the potential of alternative measures to achieve the required performance.

4. Before carrying out the quantitative cost-benefit analysis referred to in paragraph 3, the relevant TSO shall:

a) carry out a preliminary qualitative comparison of costs and benefits;

b) obtain approval from the relevant regulatory authority or, where applicable, the Member State.

Note that the significant points here are that the CBA is to be carried out by the TSO in two stages (qualitative and then quantitative) and is subject to public consultation and regulatory approval before being finalised.

Retrospective Application of Banding Thresholds

TSOs can form proposals to set maximum capacity thresholds for type B, C and D power generating modules in two circumstances:

- As a requirement during the initial national implementation of the code.
- Following the national implementation, and at a minimum of three years after any previous proposals.

In both cases a public consultation is required as set out in article 10.

To be absolutely clear, however, a CBA is **not required** except very specifically where, as set out in article 5.5 of RfG, changing the thresholds leads to an existing generator qualifying for a different type, and it is the intention to apply this retrospectively. In this case only, the process as set out in RfG article 4.3 regarding the application of requirements to existing equipment is to be followed before the requirements for the new type are applied.

CBAs for derogations

Request for derogation by a power generating facility owner

Article 62 in RfG as shown; similar provisions for equipment owners in DCC article 52 and HVDC article 77.

2. A request for a derogation shall be filed with the relevant network operator and include:
d) detailed reasoning, with relevant supporting documents and cost-benefit analysis pursuant to the requirements of Article 39;

Request for derogation by a relevant system operator or relevant TSO

Article 63 in RfG as shown; similar provisions in DCC article 53 and HVDC article 78.

2. Relevant system operators or relevant TSOs shall submit their requests for derogation to the regulatory authority. Each request for a derogation shall include:

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f) a cost-benefit analysis pursuant to the requirements of article 39. If applicable, the cost-benefit analysis shall be carried out in coordination with the relevant TSO and any adjacent DSO or DSOs.

Regardless of the party raising a derogation request therefore, cost-benefit analysis pursuant to the requirements of Article 39 (in RfG, similar provisions in DCC and HVDC) is necessary; but then only where raised by a system operator or TSO does consideration also need to be given to coordination with the relevant TSO and any adjacent DSO or DSOs, and also the running of a public consultation on the results of the CBA.

CBA Methodology	As detailed above, the applicable parties are required to perform a CBA for: • **Retrospective application**: Application of the RfG code to existing power generating modules in limited and specific circumstances and in order to address significant factual changes in circumstances, such as the evolution of system requirements including penetration of renewable energy sources, smart grids, distributed generation or demand response (Article 4). • **Requesting derogations**: A relevant TSO or system operator may seek a derogation for a class of power generating modules connected to or to be connected to their network. A facility owner may similarly seek a derogation for their equipment. **Derogation requests** In the case of a derogation request raised by an equipment owner or TSO/relevant SO, the requirement is to justify the request with a CBA that should be performed on the basis of the principles described in article 39 of RfG and similar provisions in DCC and HVDC. In the case of a derogation requested by TSO/relevant SO the CBA is further required to be submitted to public consultation, in accordance with art.10.1 (RfG) and similar provisions in DCC and HVDC. The derogation request submitted to the regulatory authority, either directly by a system operator or via the relevant system operator for a facility owner. is required to include: • Detailed reasoning, with all relevant supporting documents; • Demonstration that the requested derogation would have no adverse effect on cross-border trade; • A cost-benefit analysis pursuant to the requirements of Article 39. If applicable, for the derogation requested by TSO/relevant SO, the cost-benefit analysis shall be carried out in coordination with the relevant TSO and any adjacent DSO or DSOs.

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Retrospective Application

To apply specific code requirements retrospectively the process set out in figure 1 is to be followed in full.

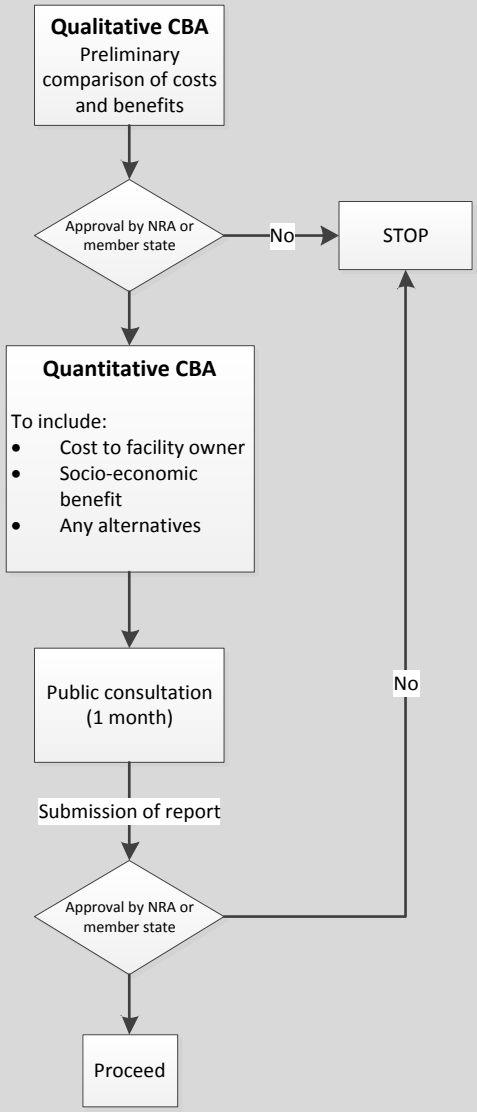

Figure 1 – retrospective application process

Qualitative CBA

In considering retrospective application of requirements the TSO must firstly carry out a qualitative comparison of costs and benefits related to the requirement under consideration. This comparison shall take into account available network-based or market-based alternatives.

The relevant TSO may only proceed to undertake a more detailed quantitative cost-benefit if the qualitative comparison indicates that the likely benefits exceed the likely costs and if the TSO obtains approval from the relevant NRA or Member State. If, however, the cost is deemed high or the benefit is deemed low, then the relevant TSO shall not proceed further.

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The TSO is not required to consult on the qualitative analysis although it may of course be useful to work with stakeholders in seeking to determine their approximate costs.

Quantitative CBA
After a qualitative assessment has been carried out and approved the case can then proceed to a sound and transparent quantitative cost-benefit analysis carried out for RfG in accordance with Articles 38 and 39 (Articles 48 and 49 in DCC and Articles 65 and 66 in HVDC),. The analysis shall indicate:

(a) the costs, with regard to the designated power generating modules, of compliance with the specific requirements being analysed;
(b) the socio-economic benefit resulting from applying these requirements; and
(c) the potential of alternative measures to achieve the required change in performance.

The difference between the quantitive and qualitative analysis is in the depth of evidence and justification required which for the quantitative analysis must be able to bear public scrutiny. The report summarising the results of the quantitative analysis and the consequent proposal (art.38.3 RfG) also are required to go through a public consultation and should thereafter incorporate where appropriate the views of stakeholders.

Consultation
As part of the quantitative analysis on proposals to extend the applicability of this Regulation to existing power generating the TSO is required to run a public consultation. This is required to include stakeholders and the competent authorities of each Member State and shall last at least for a period of one month.

The views of stakeholders resulting from a consultation need to be taken account of prior to any submission for approval by the regulatory authority. In all cases, a sound justification for the way in which the views of the stakeholders are reflected shall be provided and published in a timely manner before, or simultaneously with, the publication of the proposal.

In terms of the timing of a consultation, this is to be after the quantitative analysis has been performed but before final submission. Exact timing may vary depending on the nature of the requirements under consideration, how well defined the case for these already is, and what level of engagement from stakeholders there has already been. It is generally better to involve stakeholders as early as possible.

Cost Benefit Analysis Calculating Principles

The relevant TSO or power generating facility owner is required to base its cost-benefit analysis on one or more of the following calculating principles:
(i) the net present value;
(ii) the return on investment;
(iii) the rate of return;
(iv) the time needed to break even

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Quantifying benefits

Cost and benefit categorisation

In both quantitative and qualitative analysis, the case for a change in the applicability of the code justified through a cost benefit analysis can be broken down into various categories of cost or benefit. While the need to do this systematically is more defined for the quantitative analysis, it is helpful to follow similar considerations for the qualitative analysis as well.

According to article 39 of RfG (article 49 in DCC and article 66 in HVDC), as part of the cost benefit analysis the relevant TSO or power generating facility owner is required to include at least:

1. The socio-economic benefits in terms of improvement in security of supply including at least:
   - the associated reduction in probability of loss of supply over the lifetime of the modification;
   - the probable extent and duration of such loss of supply;
   - the societal cost per hour of such loss of supply

2. The benefits to the internal market in electricity, cross-border trade and integration of renewable energies, including at least:
   - the frequency response;
   - the balancing reserves;
   - the reactive power provision;
   - congestion management;
   - defence measures;

3. The costs of applying the necessary rules to existing power generating modules – and similar principles should be applied in the case of a derogation, including at least:
   - the direct costs incurred in implementing a requirement;
   - the costs associated with attributable loss of opportunity;
   - the costs associated with resulting changes in maintenance and operation

Data Provision	The conduct of CBAs requires all necessary data for the full assessment of the costs and benefits. The CNCs put obligation upon grid users (power generating facility owners under the RfG, demand facility owners under the DCC, HVDC system owners and DC-connected power park module owners under the HVDC and DSOs, including CDSOs under all CNCs) to assist and contribute to the CBA. They have the clear obligation to provide the necessary data requested by the system operator or TSO performing the cost-benefit analysis, within three months of the request, unless agreed otherwise by the relevant TSO. Data should be provided even if confidential. The CNCs (Art 12 of RfG, Art 11 of DCC and Art 10 of HVDC) provide that any confidential information exchanged or transmitted

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	pursuant to the CNCs is subject to professional secrecy (without prejudice to cases covered by national law or EU law) such that: • Confidential information received by system operators or TSOs for the conduct of CBA may not be divulged to any other person or authority; • Confidential information may only be used for the purpose of carrying out duties under the CNCs. In any case and in order to allow the TSO to carry out a proper CBA, and subject where applicable to public consultation, TSOs/relevant system operators should endeavour to publish at least the aggregated data and the outcome of the analysis made on the requested data. Grid users not providing the necessary data to the system operator or TSO will be in breach of their obligations under the CNCs. A system operator or TSO duly requesting data from grid users but still not receiving it within the 3 months deadline set in the CNCs should not be expected to perform a full CBA; it would perform its CBA on the basis of only the available data, and where applicable assumptions of costs based on the best available knowledge. The system operator or TSO is invited to clearly mention in its CBA any data requests that remain unanswered. Additionally, the system operator or TSO could bring the lack of data provision to the attention of its national regulatory authority (NRA), who is competent to ensure compliance of system users with their obligations.
Further information (examples and references)	Provided by EC: • Electricity Network Codes Roadmap accompanying the network codes. • KEMA report on ENTSOE NC-RfG; contains CBA outputs from European associations of stakeholders that could be considered in order to assess the costs of implementing requirements in power generating modules Provided by National Grid: (GB TSO) • GC0063 'Power Available' GB Grid Code modification. • Work progressed through two separate stakeholder consultations. • Incomplete CBAs due to lack of detail on exact costs from all sides but principles explored. Provided by Eirgrid: (in the attachments) • All island grid study. Work stream 4. Analysis of impacts and benefits. • DS3: System Services Review. TSO Recommendations. • An Estimate of the Value of Lost Load for Ireland ENTSOE: ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects (February 5, 2016). Includes Benefit Categories for grid development projects (on page 26) that can be directly applied to the CNCs.

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EPRI (in the attachments)

- CBA of power system reliability. Determination of interruption costs
- Cost of providing ancillary services from power plants
- Measurement of ancillary services from power plants

Note that national examples are provided for illustration purposes only.

INTERDEPENDENCIES	
Within CNCs	This file covers the current 3 CNCs.
In other NCs	No
System characteristics	N/A
Technology characteristics	N/A

COORDINATION

TSO – MS-NRA	Final approval required by Member State or NRA as applicable to every case as proposed. For retrospective application of requirements to existing generators, the TSO also needs NRA approval of the qualitative analysis to be allowed to progress to consultation and more detailed quantitative analysis.
TSO – generator owner – DSO- CDSO	As stated above under 'Data Provision', all parties are required to cooperate and to provide information as requested in the preparation of CBAs. Article 5.4 of RfG states that in setting the banding thresholds power generating facility owners are to assist in the process and provide data as requested by the relevant TSO. Article 39 of RfG on Principles of cost-benefit analysis (DCC and HVDC similar – articles 49 & 66 respectively) also sets out the requirement for assistance as follows: *1. Power generating facility owners and DSOs including CDSOs shall assist and contribute to the cost-benefit analysis undertaken according to Articles 38 and 63 and provide the necessary data as requested by the relevant system operator or relevant TSO within three months of receiving a request, unless agreed otherwise by the relevant TSO. For the preparation of a cost-benefit-analysis by a power generating facility owner, or prospective owner, assessing a potential derogation pursuant to Article 62, the relevant TSO and DSO, including CDSO, shall assist and contribute to the cost-benefit analysis and provide the necessary data as requested by the power generating facility owner, or the prospective owner, within three months of receiving a request, unless agreed otherwise by the power generating facility owner or the prospective owner.*

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Noting these principles and that where information is not available or forthcoming it is therefore likely that a CBA will be incomplete or based on assumptions, it is expected that this will be taken into account in the decisions made by NRAs or member states on the basis of such analysis but also that parties not providing data may be held to account.

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