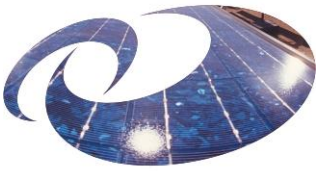
Audit of Incremental Transfer Capacity Programme



EirGrid

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UNIT APPROVAL	**Name**	**Date**
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REVISION HISTORY RECORDS

Revision	**Date**	**Creation / Update summary**
R1	01/03/2010	Dusko P. Nedic

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Audit Purpose

The Gate 3 Direction published on 16th of December 2008 by CER (CER/08/260) ('Criteria for Gate 3 Renewable Generator Offers and Related Matters –Direction to the System Operators')(hereinafter referred as 'the Gate 3 Direction') stipulates the appointment of an independent technical auditor to audit the ITC Programme (Section 5.22):

> *"The ITC programme and the methodology employed to achieve its results will be subject of an independent technical audit to provide the market with full confidence as to its objectivity and fairness in applying the above rules. The auditor will be appointed by Eirgrid with terms of reference approved by the Commission, and that Eirgrid report issues a report following the audit to be published on its website".*

The purpose of the audit is to provide assurance to applicants and the industry in general that the methodology for the ITC Programme conforms to Gate 3 Direction (notably Paragraphs 5.16, 5.18 and 5.19) and that the methodology has been applied in a fair and objective manner for the specified audit period.

Executive Summary

Based on the audit findings TNEI is satisfied that the methodology applied by EirGrid in the ITC Programme conforms to the Gate 3 Direction (CER/08/260) and that the methodology has been applied in a fair and objective manner for the audited period 2010-2023.

During the audit TNEI was given all necessary information to carry out the validations that would meet the audit requirements.

The ITC Programme is based on a complex and computationally demanding automated calculation which requires a significant amount of input data.

TNEI inspected the input data used in the ITC Programme through a number of manual and automated assessments. To validate certain audit requirements TNEI was given all permission to debug the calculation tool used for the ITC programme.

One of the most important segments of the ITC programme is the selection of network upratings on year by year basis. This is a complex internal procedure whose objective is to decide which network limitations and bottlenecks should be given priority to grant the Gate 3 applicants firm capacity as soon as possible. TNEI carried out a detailed inspection of the network limitations and bottlenecks based on the ITC results for each year and validated that the prioritisation of the network upratings in the ITC Programme was implemented in a fair and objective manner.

1 Background

TNEI was commissioned by EirGrid to carry out an audit of the Incremental Transfer Capacity (ITC) Programme. The ITC Programme is a calculation used to identify the scheduled firm transmission capacity to be provided to each of the eligible Gate 3 projects for each year in the specified audit period.

TNEI carried out this audit in two stages. In the first stage (Stage 1) TNEI audited the first nine years 2010-2018, while in the second stage (Stage 2) TNEI audited the subsequent five years 2019-2023.

TNEI Services is a consultancy and software company with offices in Manchester and Newcastle upon Tyne and is focussed on the New & Renewable Energy sector in addition to supplying products and services to electrical infrastructure companies. Our operations are split into four main areas:

- Power Systems Analysis
- Renewables Projects
- Carbon Management
- Software Development

Our Power Systems group provides power system analysis consultancy services in the areas of:

- Transmission system analysis
- Distribution system analysis
- Distributed generation
- Active networks
- Industrial systems (including Oil & Gas)
- Generation plant (including the latest wind turbine technologies)
- Power Quality

2 Audit Requirements

The audit requirements were listed in 'Independent Technical Audit of ITC Program - Terms of Reference' and can be summarised as follows:

1. ITC Programme allocates scheduled firm access quantities in line with the ITC rules set out in the Gate 3 Direction, paragraphs 5.16, 5.18 and 5.19.
2. The correct 'receipt date' for Gate 3 applicants is used in the ITC Programme.
3. All shallow works[1] are included in Year 0 (2010) of the ITC Programme (except for Seecon (Galway) and Bellacorrick(Mayo) nodes where the respective applicants are modelled on the existing local 110 kV until such time as the 220 kV and/or additional 110 kV shallow connection infrastructure is assumed to be in place based on standard construction lead times).
4. The transmission network uprates are included in the ITC Programme in accordance with Section 2 of the ITC Technical Assumption Document[2] i.e. "*the timing of the addition of line uprates to the ITC model for each of the years 2011 through to 2025 will be based on those lines identified from the previous years' ITC run as being the most restrictive from a firm access perspective*".
5. EirGrid's proposed new transmission network build programme is reflected in the ITC Programme runs.
6. The ITC Programme's firm capacity test tolerance is 0.5MW (ref Section 4 of the ITC Technical Assumption Document).
7. The firm capacity identified in any given year is included in the base case model for all subsequent ITC annual runs.
8. All conventional applications which are not either:
    a. One of the 'non-firm' offers[3].
    b. One of the 'partially firm'[4] offers.
    c. Part of the first 500 MW of full firm access determined by the ITC Programme (in addition to the projects in a. and b.) or
    d. Small-scale (<5MW) generation projects, auto-producers or non-wind renewable projects which meet certain public interest criteria (Section 6.20 of CER/09/114).

    are **removed** from the list of applications to be included in future runs of the ITC Programme once 500 MW of full firm access is determined by the ITC Programme (in addition to the projects in a. and b.).
9. All other interconnector applications **are removed** from the list of applications to be included in future runs of the ITC Programme once full firm access is determined by the ITC Programme for one interconnector application.
10. The firm access quantities provided by EirGrid correctly factor in the shallow works and the corresponding shallow works lead-times.

[1] For the purpose of the ITC Programme shallow works are defined as those works required to transfer the total MEC at node(s) to the meshed transmission system.

[2] 'Technical Assumptions to be applied in Gate 3 (July 2009)'

[3] Tawnaghmore (104MW), Kippagh Lough (70 MW), TG81 Knocknagreenan (70 MW), TG79 Suir (98 MW), TG89 Caulstown (58 MW), TG158 Eddenderry (116 MW), TG123 Cuilleen (98.4 MW) and TG124 Kilbridge (280 MW).

[4] P184 Great Island additional capacity of 215 MW.

3 Audit Process

The ITC Programme is based on a complex and computationally demanding automated calculation which requires a significant amount of input data. A simplified data flow diagram of this calculation is shown in Figure 1. This diagram captures only the data and calculation flow that is relevant for the validation process.

The heart of the ITC programme is *ITC Software Tool* that uses the *ITC Network Models (*there are three different network models for three different operational regimes – Winter Peak, Summer Peak and Summer Night Valley*)* to carry out the calculation for each Gate 3 project. These network models are .sav files that can be loaded directly in PSS/E power system analysis software to carry out load flow calculations and contingency analysis that is implemented in *ITC Software Tool*. These .sav files are derived by applying a set of change files to the base case data extracted from the EirGrid network model database. The changes files are .raw PSSe files which contain only the changes that should be accounted for with respect to the base case.

The change files needs to be provided for shallow works, upratings and the new build programme (*ITC Shallow Works Change Files*, *ITC Upratings Change Files*, *ITC New Build Change Files*, see Figure 1).

The *ITC Software Tool* calculates the ITC value for each Gate 3 project (*ITC Results*) and for each year. The *ITC Results* are fed back into *ITC Database* while some of the side results such as for example the most restrictive lines are fed back to a complex internal procedure to decide which upratings should be selected for the subsequent year analyses. The selected lines are then added to *ITC Upratings Change Files* for the subsequent years.

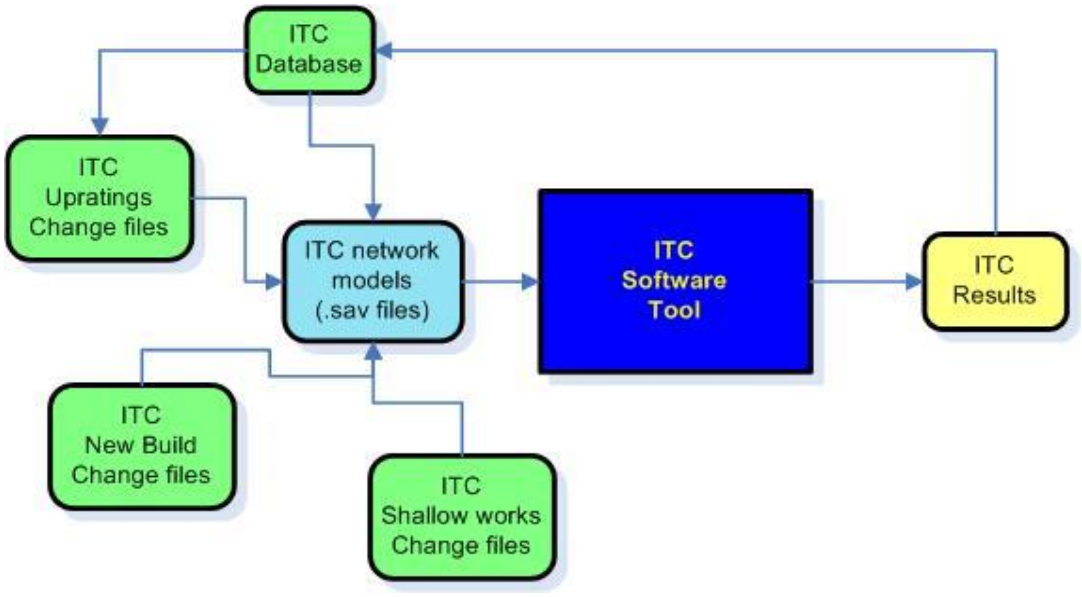

Figure 1 –Simplified data flow diagram for the ITC Programme

TNEI audit general objectives were to carry out where possible manual and automated validations to ensure that:

1. correct input data were used to create change files and network models;
2. network models used by ITC Software Tool contain all input data validated in the previous step;
3. the *ITC Software Tool* outputs are consistent with the published firm access results;
4. the ITC Software Tool side results are considered and used correctly for the subsequent years' runs.

4 Audit Findings – Stage 1

The audit findings for Stage 1 are discussed for each of the audit requirements given in Section 2 as follows:

1. TNEI confirms that the ITC Programme is in line with the ITC rules set out in Gate 3 Direction (paragraphs 5.16, 5.18 and 5.19). Special attention during the audit was devoted to ensuring that the 'n-1 planning standard' was used in the *ITC Software Tool* and the validation request that ITC Programme would benefit of any firm capacity available at a node in a given year in increments in 0.5 MW. TNEI paid attention to all nodes whose firm capacity is smaller than the capacity of applicants. This was undertaken for each year (2010 to 2018) to verify that the firm capacity provided to applicants is rationed on the basis of the received date of the application.
2. TNEI carried out a comparison of the data given in the CER documents 08/260 Appendix 1, and 09/114 Appendix 1, and the input data used for ITC Programme, to verify that correct 'receipt date' was used.
3. TNEI inspected the 2010 to 2018 network models to verify that all shallow works are included in the calculation of firm transmission capacity.
4. TNEI verified that all 2010 to 2018 network models used in the ITC Programme contain upratings selected in accordance with Section 2 of the ITC Technical Assumption Document. Based on the output results TNEI determined the most restrictive branches (those that hold up the largest quantities of firm transmission capacity) for each year, and verified that a correct logic was used when selecting the branches that should be uprated for the subsequent years' runs.
5. TNEI inspected the 2010 to 2018 network models to verify that the proposed new build programme is included in the calculation of firm transmission capacity.
6. TNEI debugged the *ITC Software Tool* to verify that a test tolerance of 0.5MW was used for the calculation of firm transmission capacity.
7. Through inspection of the *ITC Results*, TNEI identified the firm transmission capacity for each year (2010 to 2018) and verified that it was included in the network models for all subsequent years' runs.
8. Through the inspection of ITC Results TNEI identified that the condition specified in the audit requirement 8 (500 MW of full firm access, see Section 2, requirement 8) was met (2018) in the audited period (2010 to 2018). The audit requirement was validated through the inspection of the ITC Results prior to and after the condition was met.
9. Through the inspection of ITC Results TNEI identified that the condition specified in audit requirement 9 (firm capacity is not reached for any of the two interconnectors, see Section 2, requirement 9) was not met in the audited period (2010 to 2018). Therefore, the audit requirements specified for this particular requirement were not further inspected.
10. TNEI inspected the 2010 to 2018 results and shallow works lead-time information provided by EirGrid and verified that all shallow works are correctly factored in the calculation of firm transmission capacity (including shallow works lead-times).

5 Audit Findings – Stage 2

The audit findings for Stage 2 are discussed for each of the audit requirements given in Section 2 as follows:

1. TNEI confirms that the ITC Programme is in line with the ITC rules set out in Gate 3 Direction (paragraphs 5.16, 5.18 and 5.19). Special attention during the audit was devoted to ensuring that the 'n-1 planning standard' was used in the *ITC Software Tool* and the validation request that ITC Programme would benefit of any firm capacity available at a node in a given year in increments in 0.5 MW. TNEI paid attention to all nodes whose firm capacity is smaller than the capacity of applicants. This was undertaken for each year (2019 to 2023) to verify that the firm capacity provided to applicants is rationed on the basis of the received date of the application.
2. TNEI carried out a comparison of the data given in the CER documents 08/260 Appendix 1, and 09/114 Appendix 1, and the input data used for ITC Programme, to verify that correct 'receipt date' was used.
3. TNEI inspected the 2019 to 2021[5] network models to verify that all shallow works are included in the calculation of firm transmission capacity.
4. TNEI verified that all 2019 to 2021 network models used in the ITC Programme contain upratings selected in accordance with Section 2 of the ITC Technical Assumption Document. Based on the output results TNEI determined the most restrictive branches (those that hold up the largest quantities of firm transmission capacity) for each year, and verified that a correct logic was used when selecting the branches that should be uprated for the subsequent years' runs.
5. TNEI inspected the 2019 to 2021 network models to verify that the proposed new build programme is included in the calculation of firm transmission capacity.
6. TNEI debugged the *ITC Software Tool* to verify that a test tolerance of 0.5MW was used for the calculation of firm transmission capacity.
7. Through inspection of the *ITC Results*, TNEI identified the firm transmission capacity for each year (2019 to 2023) and verified that it was included in the network models for all subsequent years' runs.
8. Through the inspection of ITC Results TNEI identified that the condition specified in audit requirement 8 (500 MW of full firm access, see Section 2, requirement 8) was met during the audit of the previous period (2010 to 2018). The audit requirement was validated through the inspection of the ITC Results prior and after the condition was met.
9. Through the inspection of ITC Results TNEI identified that the condition specified in the audit requirement 9 (full firm access is obtained for the one of the interconnectors was met in 2020 (the 350 MW interconnector). The audit requirement was validated through the inspection of the ITC Results prior and after the condition was met.
10. TNEI inspected the 2019 to 2023 results and shallow works lead-time information provided by EirGrid and verified that all shallow works are correctly factored in the calculation of firm transmission capacity (including shallow works lead-times).

[5]Network models for 2022 and 2023 were not inspected considering that the 2021 ITC Results show that only 3 applicants (P36, P190 and TG84) were not successful. Instead of completing a conventional ITC run, a study was completed to identify what would be required to connect these applicants by 2023.TNEI inspected the study results and verified that the proposed network modifications and the calculated firm transmission capacity for these three applicants meet the audit requirements.