Enduring Connection Policy (ECP) 2.2 Constraints Analysis

Initial Assumptions Document

Version 1.0

EIRGRID

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Summary

This document outlines the assumptions made in developing an energy balance, curtailment and constraints model for the Enduring Connection Policy (ECP) 2.2 Constraints Analysis studies.

Feature	Assumptions
Study period	The study horizons are 2025, 2027 & Future Grid (Aligned to SOEF).
Demand	The TER demand is from the Generation Capacity Statement (GCS) 2022 – 2031, median demand scenario.
Generation	Total generation capacity installed under ECP 2.2 is 2.7 GW. Total generation capacity (Wind and Solar) considered in the study is 16.4 GW including up to 5 GW offshore.
Network developments	The network developments are based on the Transmission Development Plan (TDP), Associated Transmission Reinforcements (ATR's) and the latest version of Shaping Our Electricity Future (SOEF).
Security constraints	System Non-Synchronous Penetration, Inertia, RoCoF limit and Min. Set rules are defined for each study year and are based upon the operational pathway and SOEF.
Core ECP 2.2 scenarios	2025: Initial, 33%, 66% & 100% of all offers up to and including ECP 2.2 2027: Initial, 33%, 66% & 100% of all offers up to and including ECP 2.2
Sensitivities	2027: 100% of all offers up to and including ECP 2.2 + 1.5 GW offshore. Future Grid: 100% of all offers up to and including ECP 2.2 Offshore Future Grid: 100% of all offers up to and including ECP 2.2 + 2.2 GW of offshore, 100% of all offers up to and including ECP 2.2 + 4.4 GW of offshore, 100% of all offers up to and including ECP 2.2 + 5 GW of offshore.

Table 1: Summary of Assumptions

Introduction

The Enduring Connection Policy (ECP) 2.2 is the second of three batches of connection offers planned under ECP 2 by the Commission for Regulation of Utilities (CRU) to facilitate opportunities for connections to Renewable Energy Sources (RES) on to the Irish electricity network. The ECP 2.2 Constraints Analysis is carried out by the TSO (as mandated by CRU/20/060 decision on ECP 2) to forecast dispatch down levels for ECP 2.2 wind and solar projects. On completion of this constraint forecast analysis EirGrid plans to publish 12 regional constraints reports, which will provide ECP 2.2 developers with information on forecasted dispatch down levels in each region. The expected time for release of these reports is in Q4 2022.

Even though the CRU considers the progression of offshore wind applications separately from the ECP process, EirGrid has decided to include offshore based study scenarios in the ECP 2.2 constraint forecast as sensitivities to the core study scenarios.

This document briefly presents the current draft working assumptions for performing the ECP 2.2 constraint forecast studies. These assumptions are still in the process of being finalized and any further updates will be communicated through the ECP 2.2 EirGrid web page.

Timeline

Study Scenario Matrix

Each of the study scenarios are based on generation capacities for specific study years. The core ECP 2.2 study years are 2025 and 2027. The RES generation capacity in the initial study includes all generators that are expected to be connected by end of 2024. The remainder of the RES generation in the offer pipeline is split into 33% and 66% to give the respective generation scenarios. The ECP generation scenario includes all the RES generation in the pipeline up to and including ECP 2.2 applicants (some of the ECP 2.2 applicants may not have received offers at this point in time but are still considered within these studies). The sensitivities on the offshore studies include offshore generation split into 33% (for 2027 network only) and then 50% and 100% of Phase 1 offshore projects in addition to the ECP generation on a SOEF roadmap-based network (Future Grid). A 5 GW offshore scenario is also included to align with the SOEF offshore assumption. All studies will include a representative maintenance schedule, we have included a maintenance sensitivity scenario based on the Future Grid network, this study will not include a representative maintenance schedule to indicate its general impact.

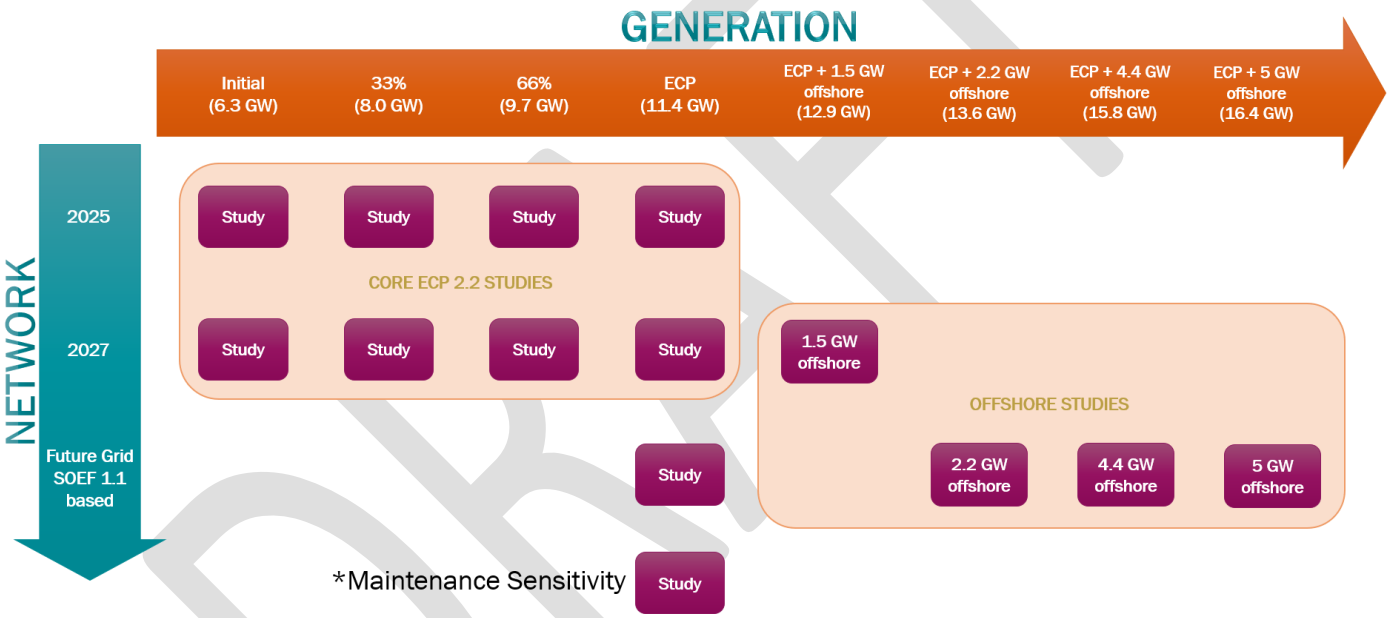

Figure 1: Study Scenarios (GW values only include wind and solar generation)

Demand

Demand in each study year is based on the forecasted median scenario due to be published in the Generation Capacity Statement 2022 – 2031. The shape of demand is based on the 2019 demand year.

Generation

The conventional generation in the ECP 2.2 studies will be obtained from the GCS 2022 - 2031. The RES capacities given in Table 2 below are the sum of all offers (Pre-Gate, Gate 3, Non-GPA, T-4, ECP 1, ECP 2.1 and ECP 2.2) and existing generation. The different study scenarios will have various levels of RES capacities. The total installed capacity (of solar and wind) considered in this study is 16.4 GW, this includes 5 GW of offshore wind. The initial study has the generation expected to connect by the end of year 2024. The installed capacities of the batteries increase from 0.76 GW to 1.52 GW from the initial study to the full ECP study.

This generation data is currently in draft and may be subject to change until the data freeze date of the project.

ECP 2.2 Breakdown of IE Generation Capacity (MW)								
	Initial Study	33% Study	66% Study	ECP All Study	ECP + 1.5 GW offshore	ECP + 2.2 GW offshore	ECP + 4.4 GW offshore	ECP + 5 GW offshore
Battery	759	1,011	1,264	1,524	1,524	1,524	1,524	1,524
Solar	1,231	2,390	3,550	4,744	4,744	4,744	4,744	4,744
Wind	5,059	5,588	6,116	6,661	6,661	6,661	6,661	6,661
Wind Offshore	-	-	-	-	1,500	2,200	4,400	5,000
Totals	**7,049**	**8,989**	**10,930**	**12,929**	**14,429**	**15,129**	**17,329**	**17,929**

Table 2: Generation Capacities for IE

Interconnection

Interconnector capacities used in the different scenario years are detailed in Table 3 below. The second North - South Interconnector will be included in the 2027 studies. The hourly capacity modelling of each interconnector is expected to be similar to that used in the ECP 2.1 studies, where the interconnectors to GB are given full export capacity for 65% of the time, while the capacity is reduced for the remainder of the time. This was based upon the interconnector flow analysis conducted during high wind periods over the course of a year. The final decision on ECP 2.2 interconnector capacity will be made after completing an updated analysis on historical interconnector flows.

Interconnector	Export/Import	2025	2027	Future Grid
Moyle Capacity (MW)	**Export**	400	400	400
	Import	450/410	450/410	450/410
EWIC Capacity (MW)	**Export**	500	500	500
	Import	500	500	500
Celtic Capacity (MW)	**Export**	-	700	700
	Import	-	700	700
Greenlink Capacity (MW)	**Export**	500	500	500
	Import	500	500	500

Table 3: Interconnector Export/Import Capacities

Network Developments

The network development in each study year is obtained and based upon the information published within the:

- Ten Year Transmission Forecast Statement
- Program Management Office data
- Transmission Development Plan
- Shaping Our Electricity Future Roadmap.

Operational Constraints

The list of operational constraints applied in the study are given in Table 4. Other system specific operational rules and system constraints are modelled in the studies and will be detailed in the final report.

Active System Wide Constraints		ECP 2.2 Assumptions
Non-Synchronous Generation	There is a requirement to limit the instantaneous penetration of asynchronous generation connected to the All-Island system.	2025 – 85% 2027 – 85% 2030 – 95%
Operational Limit for RoCoF	There is a requirement to limit the RoCoF on the All-Island system.	2025 – 1 Hz/sec 2027 – 1 Hz/sec 2030 – 1 Hz/sec
Operational Limit for Inertia	There is a requirement to have a minimum level of inertia on the All-Island system.	2025 – 20,000 MWs 2027 – 17,500 MWs 2030 – 17,500 MWs
Minimum Sets (IE, NI)	There is a requirement to have a minimum number of conventional generators in Ireland and Northern Ireland.	2025 – 6 (3/3 jurisdictional split) 2027 – 5 total (no jurisdictional limit) 2030 – 4
Reserve (IE, NI)	The amount of spare capacity in the system to manage any system disturbance.	POR, SOR, TOR I, and TOR II

Table 4: Operational Constraints

Modelling Approach to Dispatch Down

The main modelling approach for each of the ECP 2.2 constraint forecast studies is given below.

- Renewable generation is modelled at 110 kV stations
  - A 110 kV station can have wind/solar Priority Dispatch (PD), Non-Priority Dispatch (non-PD) or Uncontrolled generation connected to it.
  - Wind and solar hourly profiles are used within the model.
- Oversupply Dispatch Down
  - Applied if there is not enough demand, or export capability to meet renewable generation.
  - For each hour, the Non-PD renewable generators are dispatched down first (pro-rata all island).
- Curtailment
  - Following dispatch down for oversupply reasons, curtailment is applied to meet operational limits e.g. SNSP, Inertia, Min Sets Rules, Generator Must Runs, Operating Reserve.
  - For each hour, curtailment is shared equally between PD and Non-PD renewable generators (applied pro-rata all island).
- Constraint
  - Following curtailment, generation constraint is applied to solve localised transmission issues.
  - The model dispatches down by individual station to mathematically minimise the total renewable generation dispatch down.
  - For annual energy, the results are then averaged across adjacent 110 kV stations.
  - PD and Non-PD renewable generators are dispatched down equally.

Definitions:

1. Oversupply Dispatch Down: Dispatch down applied for energy balancing when generation exceeds demand + interconnector export. Applied According to Article 12 i.e. non-priority dispatch generation dispatched down ahead of priority dispatch generation.
2. Curtailment: Dispatch down applied to ensure operational limits are met. Applied to all priority dispatch and non-priority dispatch generation pro-rata.
3. Constraints: Dispatch down applied to manage network constraints. Applied to all priority dispatch and non-priority dispatch generation at relevant nodes.

ECP 2.2 Analysis Process

The constraint forecast modelling will use Plexos software to model the generation, loads, transmission lines and operational constraints. Three studies will be run in sequence, as shown in the figure below to simulate the dispatch down of the RES generation at each stage. A post calculation methodology is also employed in the final stage to process the results according to the assumptions.

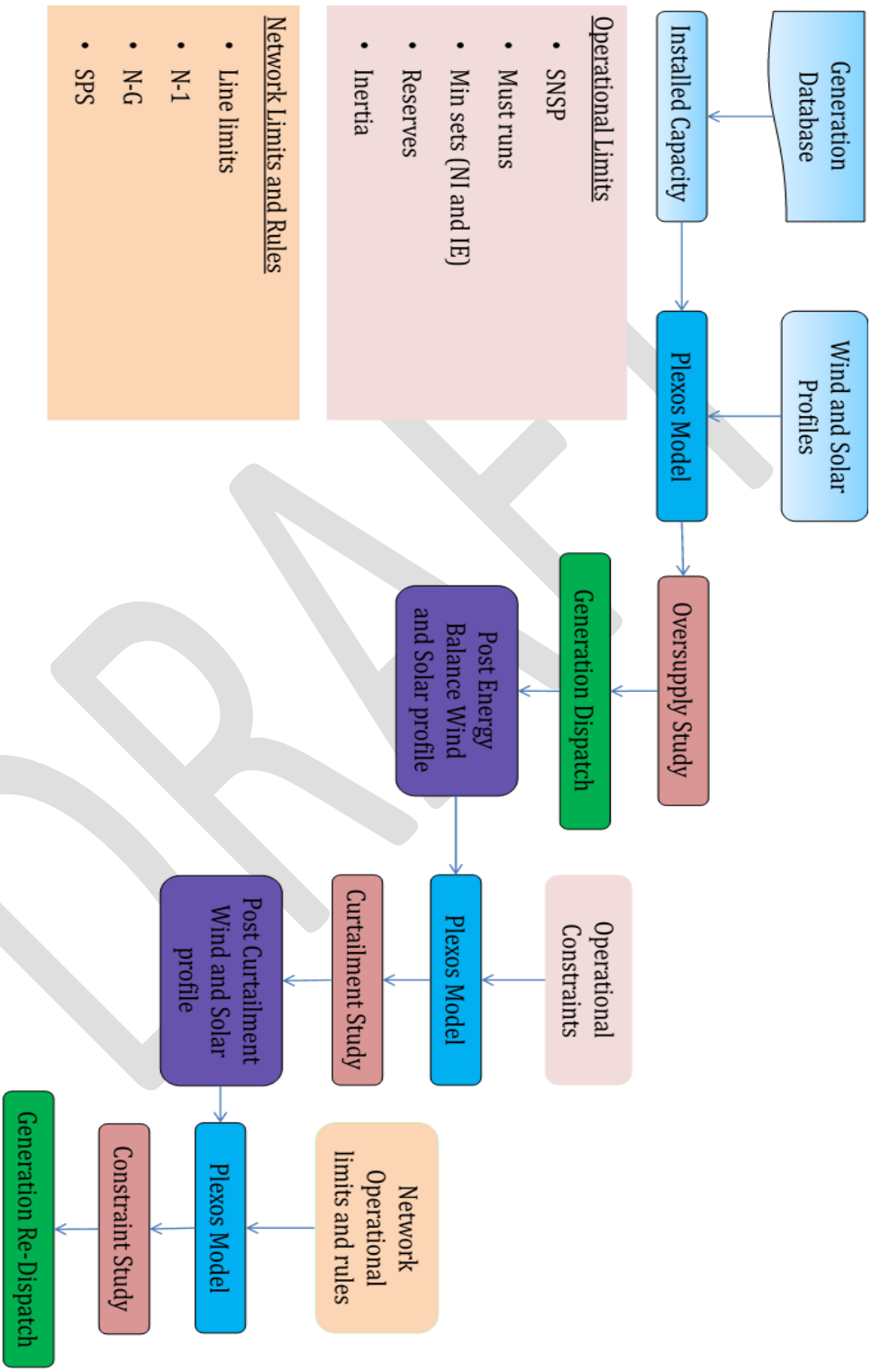

Figure 2 ECP 2.2 Analysis Process Flow Chart

Other Assumptions

Fuel Costs – Current volatility in wholesale fuel and carbon prices could offset projections. EirGrid is investigating the best approach to capture this volatility on to projected values and will update this accordingly in the modelling phase of the project.

Wind Profile – The available wind profile for each area is generated by averaging profiles from the respective areas for the year 2020.

Solar Profile – Solar profiles are currently not finalized.

Batteries – The batteries are currently modelled to provide reserve provision, however, this may change as we are currently investigating and testing the batteries to provide energy arbitrage. This will be decided upon in the final phase of modelling.