TECHNICAL LIMITS CURTAILMENT METHODOLOGY

1. Introduction

1.1 Background

Due to the rapid increase of generators looking to connect to the GB electricity network over the past decade, the majority of our Grid Supply Points (GSPs) are constrained and awaiting significant transmission reinforcement works to allow generators to connect.

To support contracted customers looking to connect to the network, we have collaborated with the Energy Networks Association (ENA) Strategic Connections Group (SCG) which is working with the Electricity System Operator (ESO), Transmission Owners (TOs) and the Distribution Network Operators (DNOs) to accelerate distribution connections through the creation of Technical Limits on the Transmission and Distribution boundary. This allows DNOs to manage the power flows at the interface points to keep within the technical limit and provide some customers with a temporary flexible connection which will allow them to connect, ahead of the transmission reinforcement works being completed. These accelerated connections will need to be managed through Active Network Management (ANM) and will be subject to uncompensated curtailment.

1.2 Introduction to Indicative Curtailment Assessments

This document explains the methodology of the calculation that is applied to the curtailment limit reports for customers that expressed interest for technical limit offer in Phase 1A GSPs. Potential further improvement for the calculation methodology is also presented.

The current process of the curtailment limit is calculated using baseline data and assumptions on the behaviour of different contracted technologies that are yet to connect. All generation technologies in the Appendix G are considered with associated generation profiles assumption, including Photovoltaic Plants (PV) and battery energy storage (BESS), such as gas and diesel generators etc. All time series are on a half hourly basis.

2. Key Assumptions

2.1 Assumed Generation Profile

For PV and Batteries, we incorporate seasonal and intraday behaviours for a more realistic representation. As illustrated in Figure 1, the PV is simulated to export every day between the

hours of 10am and 4pm with the following seasonal scaling factor applied to the export capacity. Please refer to Table 1 for season definition.

Scaling Factors applied to PV:

- Winter – 0.2
- Spring/Autumn – 0.8
- Summer – 1

For batteries we assumed exporting during peak times and importing during minimum wholesale costs, as is shown in Figure 1. At every half hour the battery is acting it is assumed at full export/import.

Export times assumption for BESS:

- 6am up to 10am
- 6pm up to 9pm

Import times assumption for BESS:

- 11pm up to 6am

For other technologies we assumed full export across the day and season.

Table 1 : Season definition

Winter	Spring/Autum	Summer
01 Dec – 28 Feb	**01 Mar – 31 May and 01 Sep – 30 Nov**	**01 Jun – 31 Aug**

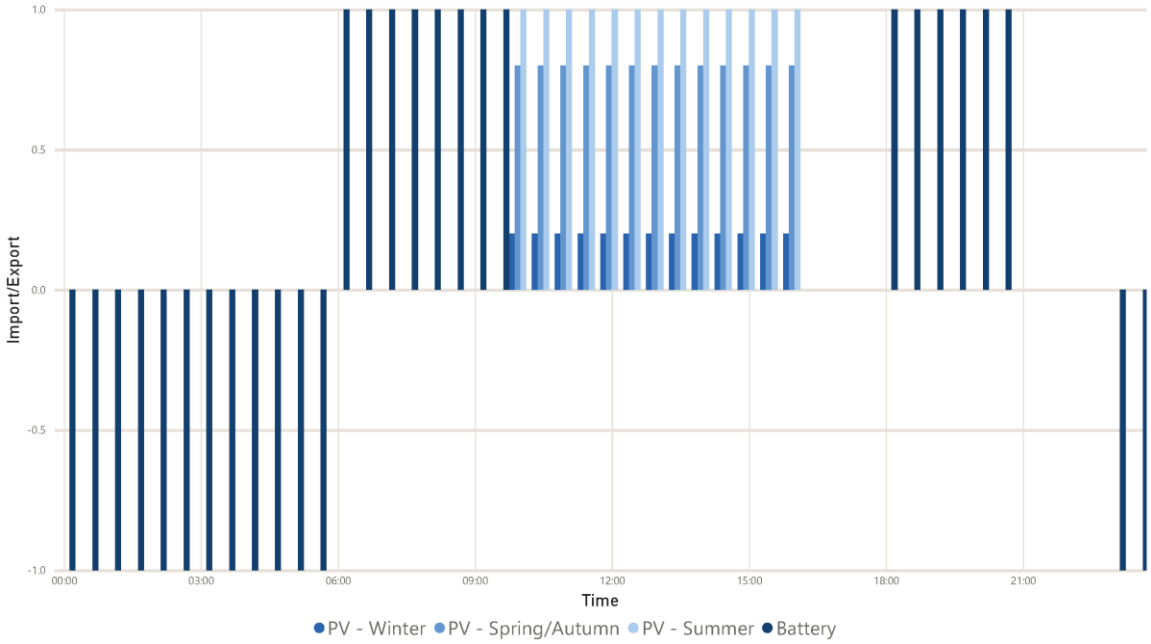

Figure 1: Intraday behaviours assumption of PV and Battery technology

2.2 Assumed Generation Profile

These profiles were applied to all contracted customers queued ahead of the assessed customer including those in both Appendix G Part 2 and Part 4, as per their technology. These stimulated generation profiles are then aggregated on top of the annual Grid Supply Points (GSP) baseline profile to build the indicative net forecast of the GSP. This simulated annual GSP profile is compared against the Technical Limit and curtailment is counted every half-hour timeslot across the year where the forecast profile breaches the Technical Limit. This Technical Limit violation count is summed to give the indicative forecasted curtailment amount, which is provided in hours and percentage of the year.

We present an example in Figure 2 below to show the curtailment calculation. The simulated profile is illustrated in grey line, and the allowed operational range for each GSP is contained within the Technical Limit, where demand limit and generation limit are shown by the orange and blue line, receptively in this figure. To be more specific, demand curtailment will be registered for each of the half-hour slot where the associated demand value in the simulated profile is higher than the demand technical limit. Similarly, generation curtailment will be registered for each of the half-hour slot where the associated generation value in the simulated profile is lower than the generation Technical Limit.

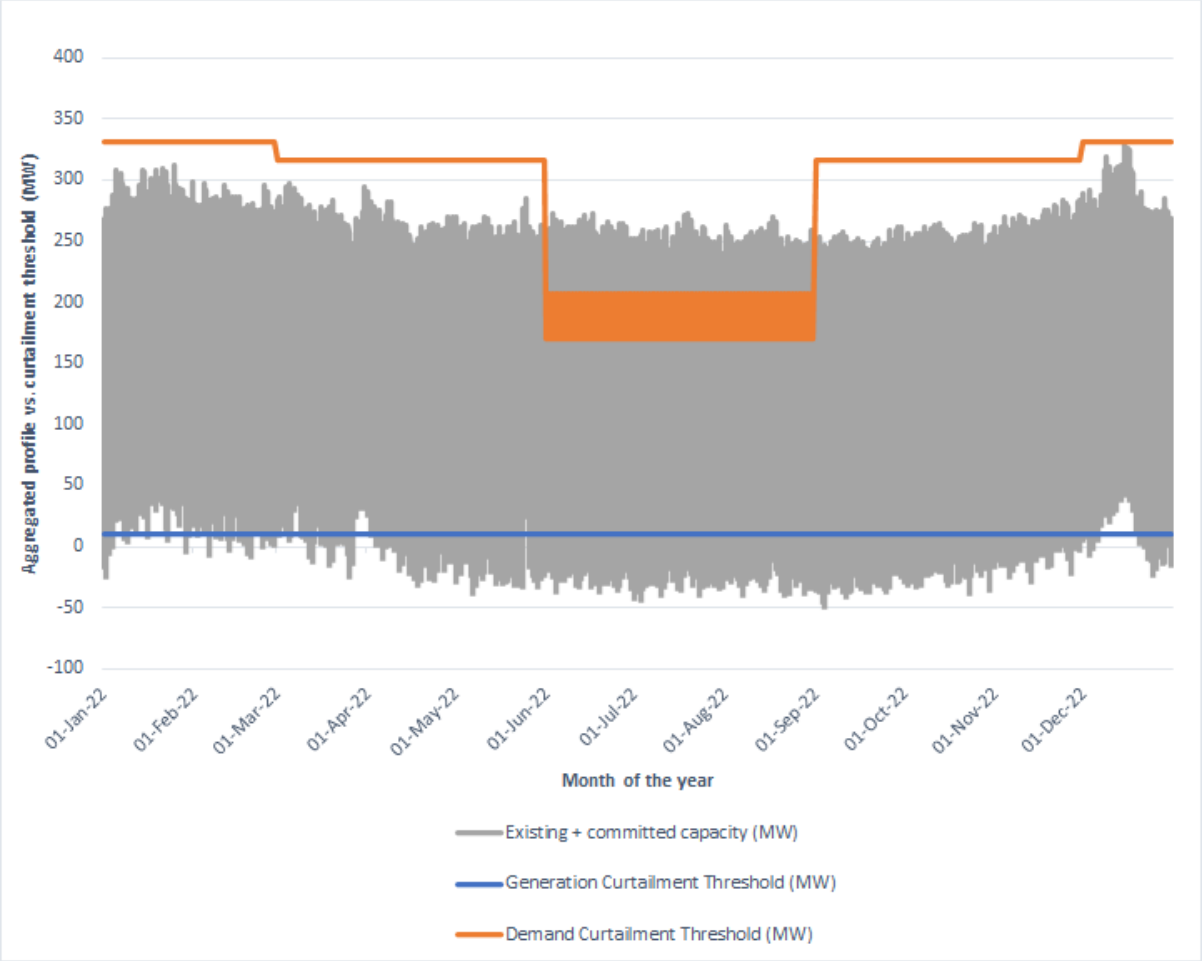

Figure 2: Curtailment Graph

3. Curtailment Scenarios

Our Curtailment Assessments consider two different scenarios.

- Baseline Scenario – This scenario applies to all generators in the queue up to the generator being studied for this curtailment assessment.
- Reduced Queue Scenario – This scenario includes 50% attrition where Part 2 unconnected generators have been scaled down to 50% of their contracted capacity to reflect the attrition factor.

4. Potential improvement in future curtailment methodology

We have identified some alternatives which could be explored in the future to improve out curtailment methodology. We are currently exploring these to ascertain if they will improve the curtailment assessment for our customers. The potential improvements identified are:

- Utilise improved PV profile, averaged across different sites, for the contract PV generators.
- Apply Monte Carlo simulated BESS charging/discharging profile for the contract BESS generators.