I-SEM CRM
Consultation Paper Workshop

Capacity Requirement and De-Rating

SEM committee

Agenda

- Introduction
- Capacity Requirement and Marginal De-Rating Methodology
- Interconnector De-Rating

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Introduction: Context to the Consultation

De-Rating

- From CRM1:
  - *"the procurement of Reliability Options under the I-SEM should be based on a de-rated requirement."*
  - *"Central de-rating factors will be technology specific, but make allowance for the impact of plant size. [De-rating factors will] be based on **marginal contribution** to meeting the capacity requirement."*
- *From CRM2, De-rating factors will:*
  - *"be centrally determined by the TSOs, with the TSOs determining de-rating factors for groups of technologies;*
  - *be based on TSO analysis of the marginal contribution of the relevant technology to the capacity requirement. That is the extent to which a marginal increment or decrement of nameplate capacity from that technology type impacts the overall requirement for nameplate capacity; and*
  - *vary for characteristics of a technology (e.g. size) that can be parameterised, and which legitimately impacts its marginal impact on the capacity requirement."*
- *Also from CRM2:*
  - *"RAs should develop a methodology to determine the de-rating factors to be applied to interconnectors."*
  - *"the methodology [for interconnector de-rating] will be based on suitable historic and forecast data for GB and the SEM."*

Methodology: Motivation

- Change from SEM to I-SEM
- Changes to GB Market
  - E.g. EBSCR, Carbon Floor Price

→ *Historic prices and flows not representative of the future*

- Little or no scarcity in recent years
- Key timeframe is close to real time

→ *Difficult to calibrate a fundamental model for critical time periods*

- Methodology based on historic data and forecasts unaffected by market changes

Basic Methodology

- Identify periods of scarcity in I-SEM
  - Uses Monte Carlo simulation
- Is there scarcity in GB at these times?
  - If not, then GB can deliver capacity to I-SEM

→ *Determine "Effective Interconnector Capacity"*

- How likely is the interconnector itself to have an outage?
  - Forced and scheduled outage rates
- EIC and outage rates inputs to general de-rating methodology

→ *Determine marginal de-rating of EIC*

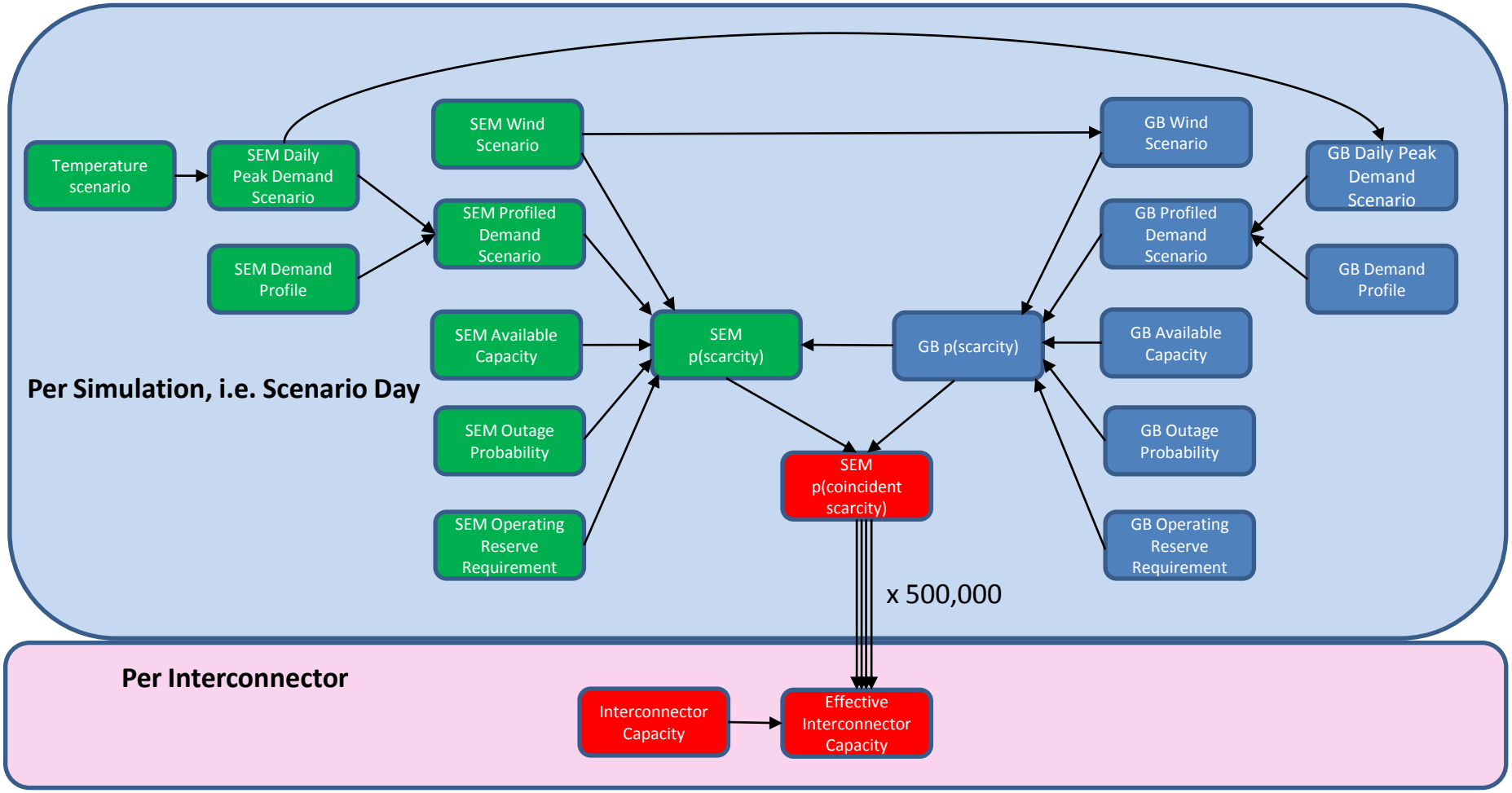
→ *Total Interconnector De-rating*

Drivers of Scarcity

- Demand
  - Including required operating reserve
- Wind production
- Available Generation
  - Basic generation park
  - Coincident outages

Scarcity requires a combination of all three drivers

Methodology Overview



Input Data used in the Paper

- Consultation seeks views on the methodology, but hard to do this without some context.
- To give indicative values the following input data were used:
  - Historic data generally taken for the complete years, 2010-2015
  - Historic weather data taken for the complete years, 1986-2015
  - Forecasts taken from the 2016 GCS for the I-SEM and the 2015 NGC Future Energy Scenarios for GB

NB: the TSO and RA methodologies were determined in parallel, so inputs from the TSO methodology were estimated for the purposes of the consultation paper.

Creating a Demand Scenario

Demand scenarios created for winter week days.

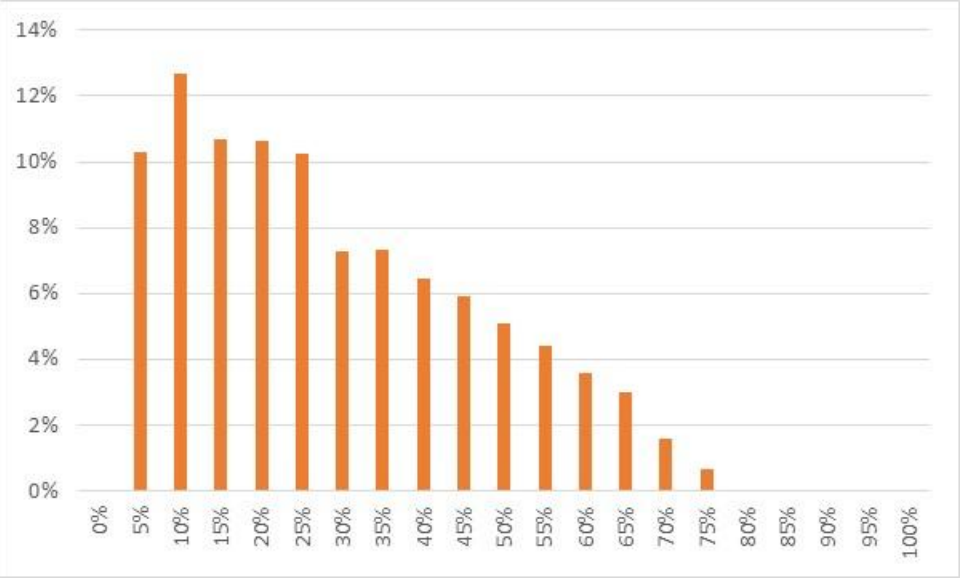
- Random pick of SEM mean daily temperature from historic distribution
- Generate forecast daily peak demand from temperature and accounting for other factors using
  - Forecast of ratio that daily peak represents of annual peak demand; and
  - Annual peak demand
- Half-hourly demand generated using
  - Daily peak demand; and
  - Standard demand profile derived from historic data
- GB forecast daily peak demand derived from the SEM peak demand, based on historic correlations
- Expected Operating Reserve Requirement also determined

Creating a Wind Scenario

Wind scenarios created for winter week days.

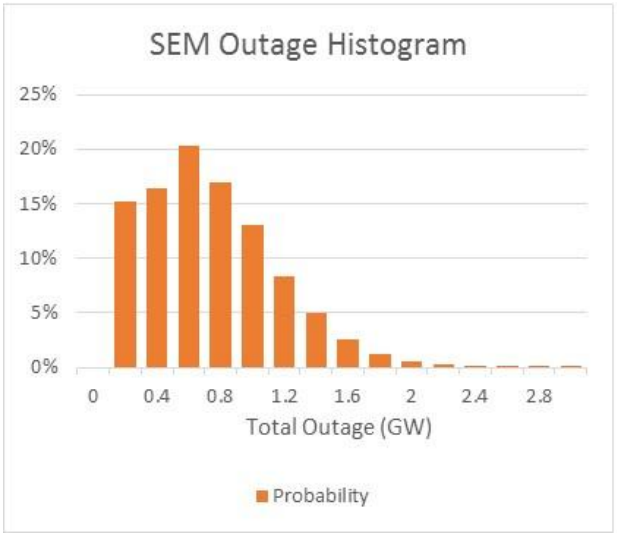
- Based on random pick of wind production from historic distribution via:
  - Forecast of ratio of wind production to installed capacity; and
  - Forecast of installed wind capacity.
- GB wind forecast accounts for correlation between GB and SEM wind
- Single wind value used for each simulated day

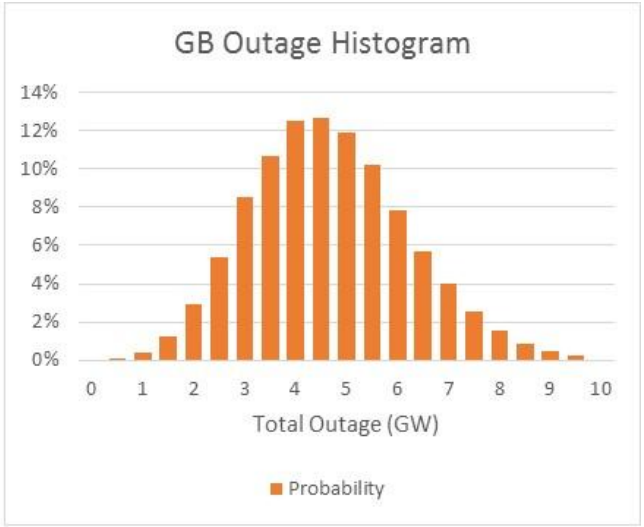
Frequency histogram for SEM wind generation as load factor



Accounting for Available Generation

- Identify underlying generation park
  - SEM: assumed to be that covered by the Capacity Requirement
  - GB: actual generation park from the NGC FES
    - Non-SEM interconnects taken at de-rated values
- Compare underlying generation park to demand (including reserve) less wind production
- How likely are outages to cause generation to be unable to meet the “residual demand”?





Determining Effective Interconnector Capacity

EIC replaces the “nameplate” interconnector capacity in the determination of marginal de-rating factor.

From the Monte Carlo simulations, the probability that GB will have power to export at times of scarcity in the I-SEM can be determined.

Product of “nameplate” interconnector capacity and probability of GB having capacity to export gives the EIC.

Interaction between GB and I-SEM

- If GB has scarcity and I-SEM does not, interconnector flows likely to be *towards* GB.
- So, available capacity in I-SEM is reduced as interconnectors are not contributing.

→ *Scarcity in I-SEM more likely as fewer outages lead to unserved demand.*

- Modelling tries to capture impact
  - Tends to reduce EIC as increases chance of coincident scarcity

Interconnector Outage Rates

- Derived from historic data for Moyle and EWIC
- As far as possible, the same techniques were used to analyse outages as used for generation capacity in the general de-rating methodology
- Interconnectors are considered as a single Technology Class in the general de-rating methodology, analogous to treatment of gas-turbine plant.

Sensitivities

The methodology relies on a range of estimations, simplifications and a view of the future.

To understand the potential impact of these, a range of sensitivities was produced:

- Higher or lower basic generation availability in GB and I-SEM
- Higher assumed outage rates in GB and I-SEM
- The tendency for wind to be lower than “expected” at times of highest demand
- Stronger correlation between I-SEM and GB demand

Indicative Results

- Overall interconnector de-ratings, i.e. combined effect of EIC and marginal de-rating

Scenario	EWIC DRF	Moyle DRF
Base Case	74%	76%
+1GW GB capacity	79%	81%
-1GW GB capacity	67%	69%
-0.25GW I-SEM capacity	73%	75%
Increased outage rate	67%	69%
Reduced wind at peak demand	73%	75%
Increased demand correlation	73%	75%