Incorporation of SOGL Article 119 and ramping requirements into the Grid Code

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Tom Ireland, Camille Gilsenan and Louise Trodden

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Agenda

- Why are we looking at interconnector ramping now?
- GB Compliance requirement – actions from SOGL

- Current ramping considerations
- Current operational impact

- Developing a solution
- Next Steps

Why are we looking at interconnector ramping now?

GB Compliance Requirement - Requirements placed upon GB from the SOGL Methodology* (Article 119 – see Annex 1).

These requirements have been retained in GB law via the Statutory Instruments (see Annex 2). Implementing this component of SOGL started in 2017 (when SOGL entered into force) and must now be completed to achieve compliance.

Operational Drivers – The control room already face operational challenges from the current IC ramping arrangements. With an increased number of ICs coming onto the network (5 continental IC by 2022) current IC ramping arrangements will not remain viable (potential full swing of over 12GW at a rate of change of 500MW/min).

This would significantly influence the services needed to manage the system.

*published here. *This document has been approved by Ofgem for mapping to the codes*

Compliance Requirement
Actions for ESO from SOGL

Completed

- A set of requirements within SOGL Regulation Article 118 and 119 required mapping to GB Codes.
- The mapping and accompanying methodologies were written, and sent to Ofgem.
- These obligations have been agreed by Ofgem, however, some of these clauses required methodologies to be published until further mapping was completed.
- The remaining Articles in 118 can be mapped to the codes and the existing processes in the control room

Requires completion

- NGESO to resubmit mapping tables to reflect the updates to SOGL via the Statutory Instruments as a result of EU exit
- The outstanding article for 119 is related to ramping rates for HVDC interconnectors.

See Annex 1 and 2 for the referenced SOGL Articles and Statutory Instrument updates

Currentramping considerations

Interconnectors

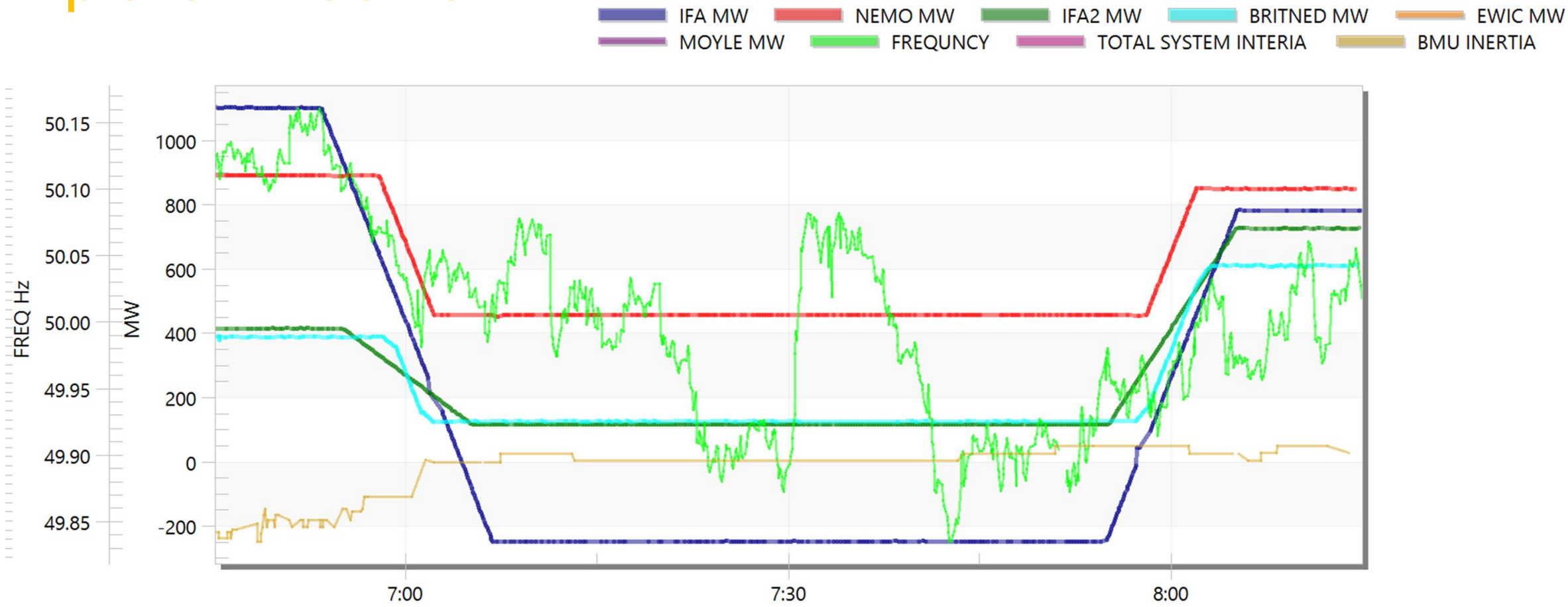
- General Grid Code ramp rate arrangements do not capture interconnectors (see Annex 3), therefore are agreed within bespoke trilateral agreements
- The amount of interconnection is increasing, and this poses a risk should all interconnectors react to coupled market signals at the same time
- The current IC ramping approach and rates are not feasible for the future – this could significantly increase the amount of reserve we need to keep
- For new interconnectors, ramp rates have been based upon past precedents in the interim while an enduring mechanism can be defined

Wider BMU's

- Renewables and battery storage are also capable of ramping to full import or export as there is no requirement to 'warm up'
- Windfarms are also able to ramp at a much greater rate, and where there are non standard BMU configurations can cause issues which are not fully reflected in the Grid Code.
- The current Grid Code ramping rates are based upon thermal plant, which is not reflective of the types of generation we use to operate the system today, or planned for the future.

This modification is purely based upon the requirements for HDVC Interconnectors to comply with SOGL 119, however it's clear that this is an issue for further discussion and investigation

Example: 9th Feb 2021



- 4 ICs ramp down and then up, in synchronisation
- 2100MW change over ten minutes at 7am - frequency was pre-emptively moved high to give headroom

Development of a solution

- There is an immediate need to work towards a solution to better address interconnector ramping
- NGESO has had initial discussion with the interconnector community

Feedback from initial discussions with interconnectors	
	There is a cost to the consumer if an IC cannot be flexible to respond positively to market signals – this needs to be balanced against any cost saving, against less actions to deal with ramping
	The true issue is that changes to GB supply and demand do not precisely match up, as a result of the inherent market design. Blunt ramping constraints should not be the automatic solution.
	Each of the three synchronous area borders will need different ramping arrangements.
	Cross border flow should not be artificially constrained but market based actions taken with the ICs.
	What about other classes of party – why is this just for IC?

Next Steps

Review feedback to support preparing proposal to raise code modification (ensuring to target the SOGL compliance)

Continue to explore holistic ramping and market options for system resilience

Continued engagement with Ofgem and Industry

Raise a code modification and arrange and commence workgroups

Annex I

LFC Block Operational Methodology for Article 119 (1) (c)

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LFC Block Operational Methodology for Article 119 (1) (c)

1. Rules for ramping restrictions on the active power output of each HVDC interconnector between a LFC Block of another synchronous area and the GB LFC block, in accordance with SOGL Article 137(3):

a. The ESO, and the connecting TSOs supervising a LFC block of an HVDC interconnector shall have the right to determine common ramping restrictions in the form of ramping periods and/or maximum ramping rates and shall enter into agreement with the TSOs responsible for operating the interconnector, to determine the processes and mechanisms by which these restrictions will be put in place. These ramping restrictions shall not apply to imbalance netting, frequency coupling, cross-border activation of FRR or cross-border activation of RR. These ramping restrictions shall not apply to any service aimed at maintaining or returning one of the connected electricity systems to a normal system state. ~~The common restriction shall also take into account the restrictions set in the GB synchronous area operational agreement in accordance with SOGL Article 137(1), if applicable;~~

b. The ramping restrictions for each interconnector shall be applied in a non-discriminatory manner. The ESO shall ensure alignment of ramping restrictions between all HVDC interconnectors linking the same two synchronous areas, taking into account the technical capabilities of each HVDC interconnector;

c. A summary of the ramping-restrictions to be applied to HVDC interconnectors connecting to the GB LFC Block, shall be published by the ESO on its website at least one week before the rules are enforced, in accordance with the obligations in SOGL Article 8;

d. The ESO, in order to prevent the GB LFC block from entering into an emergency state, may restrict equitably the ramp rates of GB interconnectors between GB and the same connecting synchronous areas, in coordination with the affected national TSOs and affected interconnector operators according to the terms referred to paragraph (a) of this Article;

e. Within 30 calendar days of an incident which restricted one or more of the HVDC interconnectors, under the process referred to in paragraph (d), the ESO shall prepare a report containing an explanation of the rationale, implementation and impact of this action and submit it to the relevant regulatory authority in accordance with Article 37 of Directive 2009/72/EC and neighbouring TSOs, and also make the report available to all significantly affected system users.

Annex 2

Statutory Instrument Updates to SOGL

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Approval of terms and conditions or methodologies of TSOs - Article 6 (3)

Article 6

Approval of terms and conditions or methodologies of TSOs

3. The proposals for the following terms and conditions or methodologies shall be subject to approval by the regulatory authority ~~all regulatory authorities of the concerned region~~, on which ~~a Member State~~ the Secretary of State may provide an opinion to the concerned regulatory authority:

(e) methodologies and conditions included in the LFC block operational agreements in Article 119, concerning:

(i) ramping restrictions for active power output in accordance with Article 137 (3) and (4);

Synchronous area operational agreements - Article 118 (1)

Article 118

Synchronous area operational agreements

1. By 12 months after entry into force of this Regulation, all TSOs of ~~each~~ the GB synchronous area shall jointly develop common proposals for:

(a) the dimensioning rules for FCR in accordance with Article 153;

(b) additional properties of FCR in accordance with Article 154(2);

(c) the frequency quality defining parameters and the frequency quality target parameters in accordance with Article 127;

~~(d) for the Continental Europe ('CE') and Nordic synchronous areas, the frequency restoration control error target parameters for each LFC block in accordance with Article 128;~~

(e) the methodology to assess the risk and the evolution of the risk of exhaustion of FCR of the synchronous area in accordance with Article 131(2);

(f) the synchronous area monitor in accordance with Article 133;

(g) the calculation of the control program from the netted area AC position with a common ramping period for ACE calculation for a synchronous area with more than one LFC area in accordance with Article 136;

(h) if applicable, restrictions for the active power output of HVDC interconnectors between synchronous areas in accordance with Article 137;

(i) the LFC structure in accordance with Article 139;

(j) if applicable, the methodology to reduce the electrical time deviation in accordance with Article 181;

Ramping restriction for active power output- Article 119 (1)

Article 119

LFC block operational agreements

1. By 12 months after entry into force of this Regulation, all TSOs of each LFC block shall jointly develop common proposals for:

(a) where the LFC block consists of more than one LFC area, FRCE target parameters for each LFC area defined in accordance with Article 128(4);

(b) LFC block monitor in accordance with Article 134(1);

(c) ramping restrictions for active power output in accordance with ~~Article 137 (3) and (4)~~ Article 137(4);*

**Inconsistency in SI – NGESO to check this section with OFGEM as there seems to be an error with 119(1)(c) and the removal of the reference to article 137(3)*

Ramping restriction for active power output - Article 137 (3) & (4) of SOGL

Article 137
Ramping restrictions for active power output

~~1. All TSOs of two synchronous areas shall have the right to specify in the synchronous area operational agreement restrictions for the active power output of HVDC interconnectors between synchronous areas to limit their influence on the fulfilment of the frequency quality target parameters of the synchronous area by determining a combined maximum ramping rate for all HVDC interconnectors connecting one synchronous area to another synchronous area.~~

~~2. The restrictions in paragraph 1 shall not apply for imbalance netting, frequency coupling as well as cross-border activation of FRR and RR over HVDC interconnectors.~~

3. All connecting TSOs of an HVDC interconnector shall have the right to determine in the LFC block operational agreement common restrictions for the active power output of that HVDC interconnector to limit its influence on the fulfilment of the FRCE target parameter of the connected LFC blocks by agreeing on ramping periods and/or maximum ramping rates for this HVDC interconnector. Those common restrictions shall not apply for imbalance netting, frequency coupling as well as cross-border activation of FRR and RR over HVDC interconnectors. All TSOs of the GB ~~a~~ synchronous area shall coordinate these measures within the synchronous area.

4. All TSOs of an LFC block shall have the right to determine in the LFC block operational agreement the following measures to support the fulfilment of the FRCE target parameter of the LFC block and to alleviate deterministic frequency deviations, taking into account the technological restrictions of power generating modules and demand units:

(a) obligations on ramping periods and/or maximum ramping rates for power generating modules and/or demand units;

(b) obligations on individual ramping starting times for power generating modules and/or demand units within the LFC block; and

(c) coordination of the ramping between power generating modules, demand units and active power consumption within the LFC block.

NB – the red text outlines the changes made to SOGL as a result of the Statutory Instruments. Ramping Restrictions have been retained in domestic legislation so we are still required to comply with these Articles. The gap in the code is relating to paragraph 3

Annex 3

Current Grid Code Change Legal Text

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Current Grid Code legal text – BC1 BM Unit data

BC1.A.1.1 Physical Notifications

For each **BM Unit**, the **Physical Notification** is a series of MW figures and associated times, making up a profile of intended input or output of **Active Power** at the **Grid Entry Point** or **Grid Supply Point**, as appropriate. For each **Settlement Period**, the first "from time" should be at the start of the **Settlement Period** and the last "to time" should be at the end of the **Settlement Period**.

The input or output reflected in the **Physical Notification** for a single **BM Unit** (or the aggregate **Physical Notifications** for a collection of **BM Units** at a **Grid Entry Point** or **Grid Supply Point** or to be transferred across an **External Interconnection**, owned or controlled by a single **BM Participant**) must comply with the following limits regarding maximum rates of change, either for a single change or a series of related changes :

- for a change of up to 300MW — no limit;
- for a change greater than 300MW and less than 1000MW — 50MW per minute;
- for a change of 1000MW or more — 40MW per minute,

unless prior arrangements have been discussed and agreed with **The Company**. This limitation is not intended to limit the Run-Up or Run-Down Rates provided as **Dynamic Parameters**.

An example of the format of **Physical Notification** is shown below. The convention to be applied is that where it is proposed that the **BM Unit** will be importing, the **Physical Notification** is negative.

Grid Code BC1 and appendix

Annex 4

Additional examples

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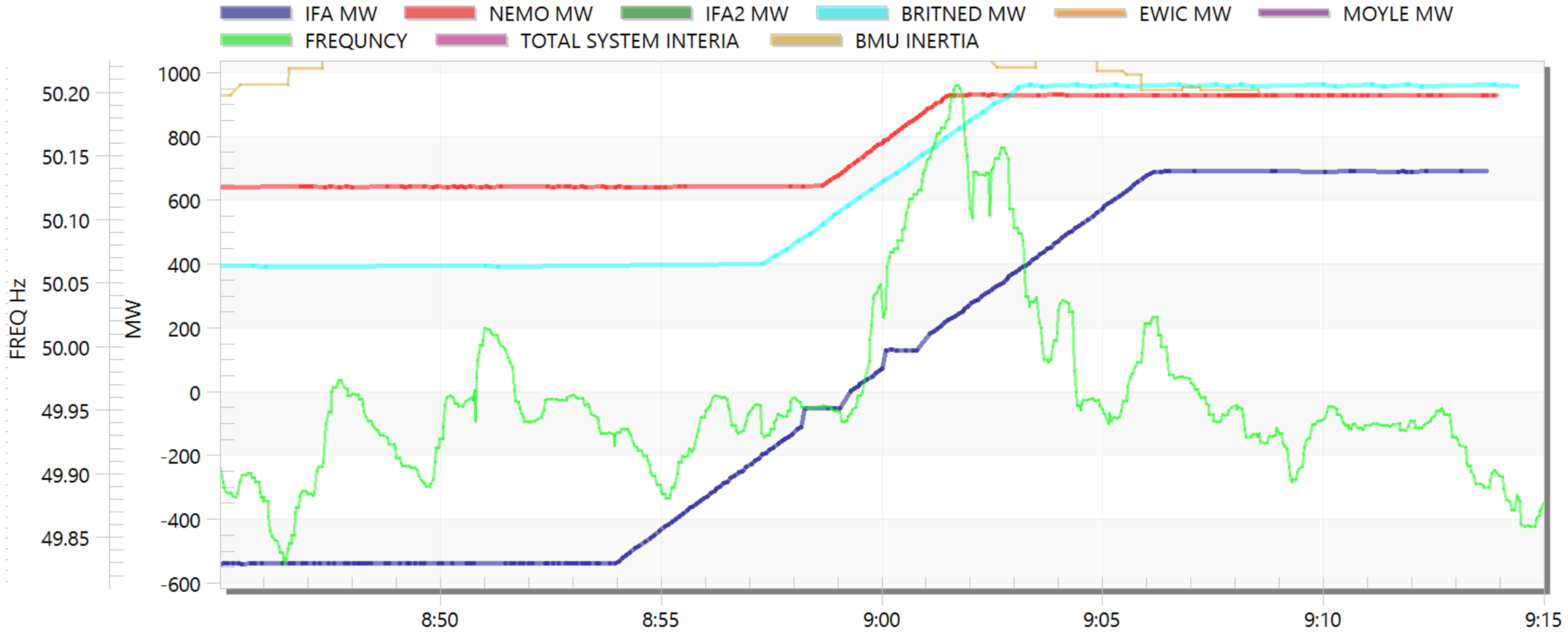
Example 1: 4 Dec 2020



- 3 Interconnectors ramp simultaneously
- Total flow change of ~ 1250MW
- Max ramp rate of 275MW /min
- Frequency moved just outside operational limits

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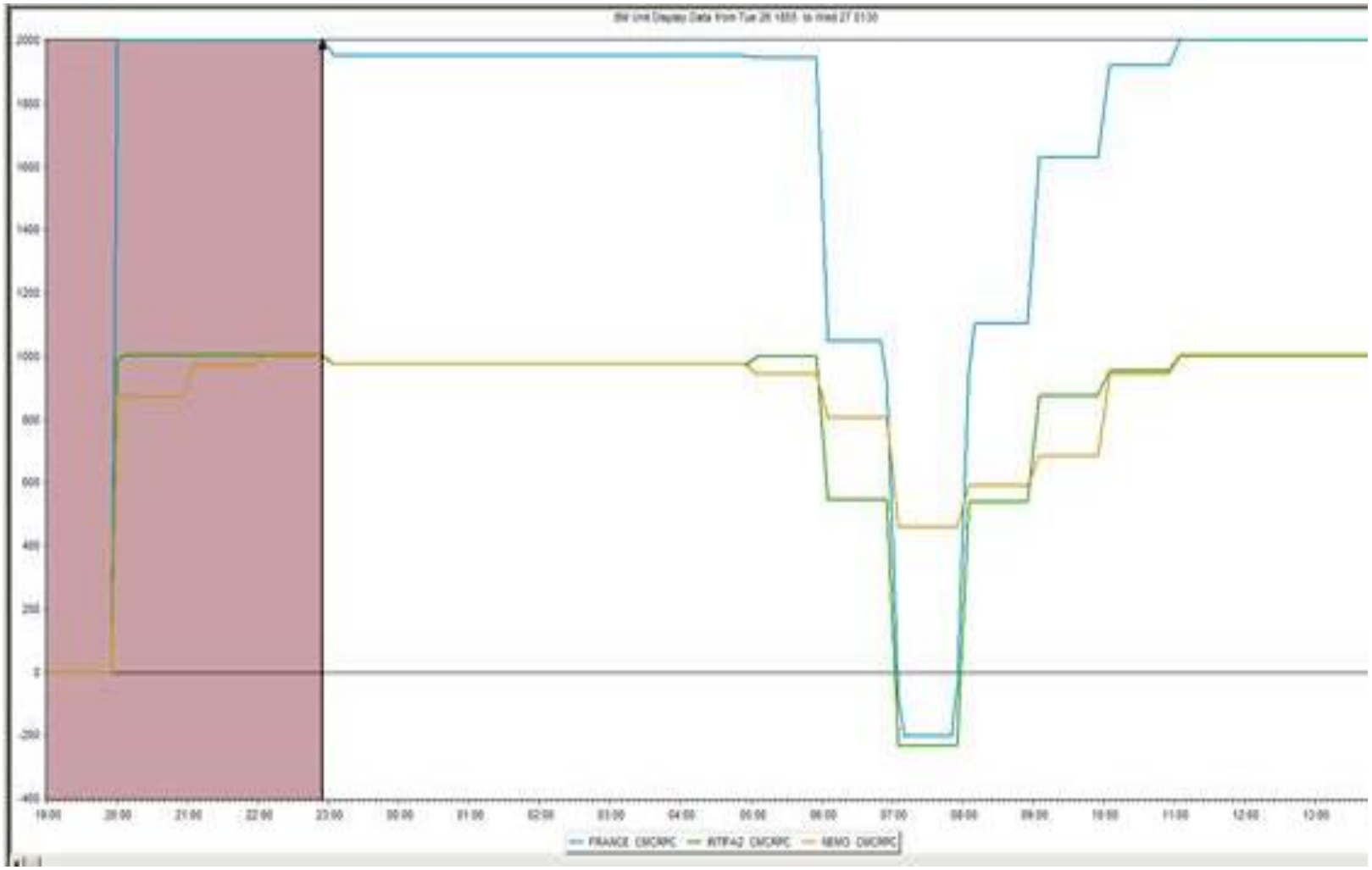
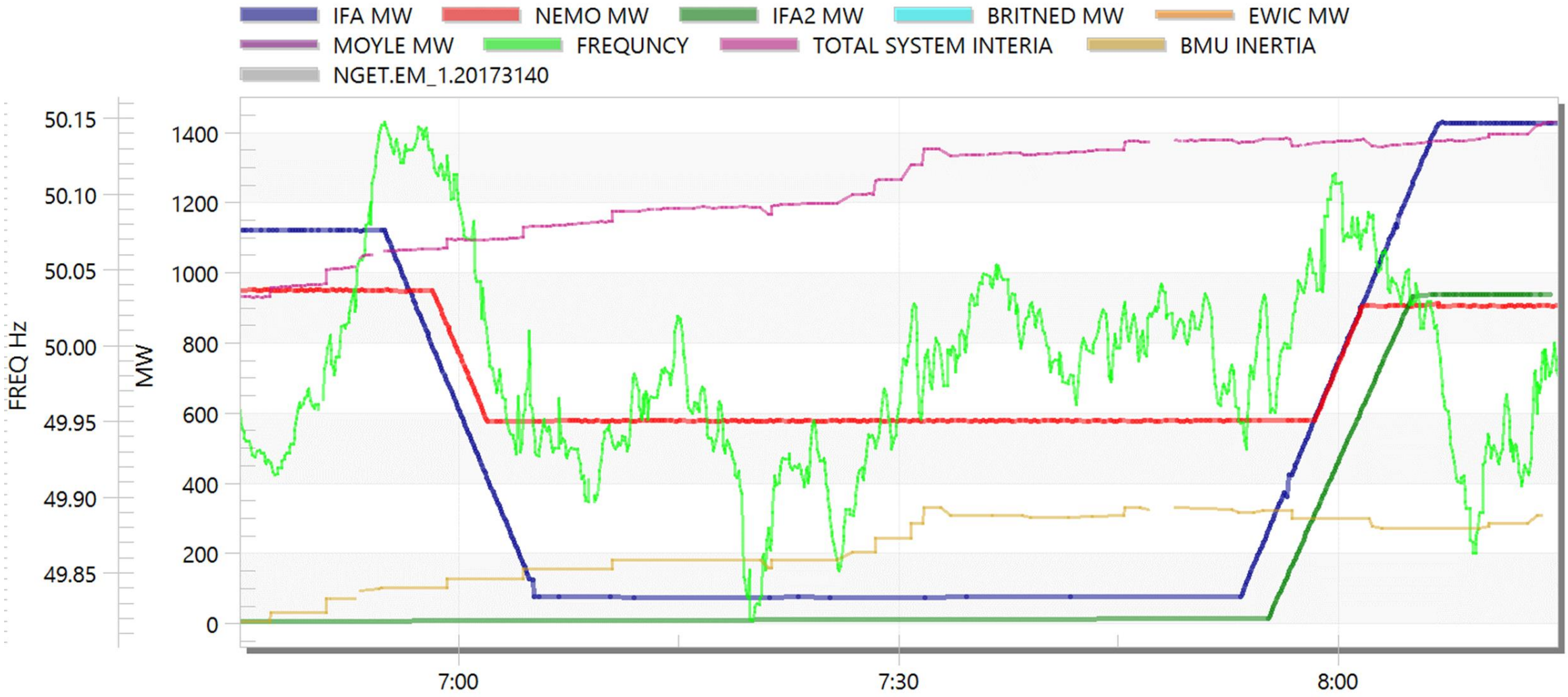
Example 2: 26 January 2021

- This graph shows the reference programs for IFA, IFA2 and NemoLink
- Total flow change of:
  - -1490MW at 06:00
  - -2370MW at 07:00
  - +2200MW at 08:00
- Max ramp rate of 266MW /min



Example 2: 26 January 2021 - Continued



Example 4: 18 March 2021 Example