Technical Feasibility Assessment

Issue 98

Legacy Balancing (Pre-2027)

Contents

1. Purpose

The purpose of this document is to describe which business processes and systems within Balancing are impacted. It does not cover any impacts to any other part of NGESO (e.g. Contracts, Settlements, Networks) as these are covered by separate impact assessments. However, where applicable to progress the Balancing solution, we may make assumptions that cover these areas.

2. Background (from Discovery Document)

This section contains information which the reader will need to understand before the documented analysis can be understood. Those familiar with the concepts being explained can skip to section 3.

2.1. The Balancing Mechanism (market) and submitted data

The Balancing Mechanism (the market itself, as opposed to the IT system by the same name) is the primary way in which NGESO ensures electricity generation and demand are balanced, whilst also ensuring that power system constraints are managed – all at the lowest cost for end consumers.

A key part of the BM is that participating generators – known as Balancing Mechanism Units, or simply BMUs – must submit technical and commercial data to NGESO, so that NGESO can optimise the decision of which BMU should be instructed at any time. Those data include, but are not limited to:

- Ramp rates (how fast a BMU can increase or decrease its MW output)
- Maximum Export Limit (the maximum MW level a BMU can generate)
- Stable Export Limit (the stable minimum MW level a BMU can generate)
- Minimum Non-Zero Time (the minimum time a BMU must be turned on for in order to run at a stable level)
- Bid/Offer Prices (the costs to either increase or decrease a BMU's MW output)

These data regularly change, in particular as BMUs sell their energy in wholesale electricity markets, or as wider system conditions change.

2.2. Ofgem Industry Letter (29th September 2020)

2.2.1. The letter

Ofgem submitted an open letter to all BMUs on 29th September 2020, following on from an investigation which found that one market participant had *"breached its obligations by submitting to the ESO false and misleading information, in relation to both its dynamic parameters and its best estimate of expected generation (physical notifications, or 'PN's)".*

The open letter was for Ofgem to remind market participants that dynamic parameters should reflect the true technical capabilities of their BMUs, with Bid/Offer prices the only clear exception; the open letter also stated Ofgem's willingness to take action if it found dynamic parameters were **not** reflective of the true technical capabilities of their BMUs.

Note that Ofgem's letter does make an exception for certain ancillary services where NGESO can pay for a BMU to be run in a less stable manner for a short period – such as SuperSEL contracts, where NGESO pays for a BMU to submit a lower SEL than would otherwise be manageable (with the costs intended to be reflective of additional wear and tear the BMU would undergo).

Ofgem's letter can be found here:

https://www.ofgem.gov.uk/publications/open-letter-dynamic-parameters-and-other-information-submitted-generators-balancing-mechanism

2.2.2. Industry response

The response from Industry, and particularly from Energy UK, was to raise Issue 98. In it, Energy UK claim that strict compliance with market manipulation rules following Ofgem's letter *"may lead to a less economic/efficient outcome than what some generating plant was doing prior Ofgem's open letter being published"* and are seeking industry issue group to review the setting of dynamic parameters.

The main argument behind the claim that Ofgem's letter may lead to a less economic outcome is that there is a difference between the technical maximum level at which a BMU can operate, vs. the most economically efficient levels at which a BMU can operate; by forcing a BMU to submit their dynamic parameters at the technical maximum, Ofgem is therefore forcing a market participant to run their BMU in an economically **inefficient** way.

Issue 98 initially included three industry options for solving the stated problem, though more industry options could be raised during Issue workgroups.

3. Technical Feasibility Overview

3.1. Summary

Industry asked NGESO to complete a light-touch technical feasibility assessment of whether three potential options could be implemented in the legacy balancing system timescales (pre-2027).

- Option 3 – Multiple sets of Dynamic Parameters
- Option 5 – Explicitly Model Sub-Assets
- Option 6 – Convert more parameters to be Dynamic

As NGESO is currently transitioning from legacy balancing systems to the new Open Balancing Platform (OBP), we have looked at this from both technical feasibility in legacy systems viewpoints and what is feasible within the future systems as part of the pre-2027 transition roadmap. As such, some of these options may be feasible only because we are expecting NGESO to have already transitioned before 2027 to modules of OBP that provide the functionality required. As NGESO is currently undergoing a Strategy Review[1] of Balancing Capability, it may be that this transition roadmap changes and the results in this report are superseded.

No costs or times have been quantified as part of this assessment. We highly recommend that a full Impact Assessment (IA) is completed before a decision is made as there are likely to be further system and process impacts that have not been identified in this light-touch feasibility review.

All three options will have a development and testing impact. However, Option 6 we believe will have the least impact and is our recommended option for progression to full IA to quantify how much it will cost to deliver. Option 5 requires more information before we can accurately assess if it is technically feasible in legacy systems or legacy timescales (pre-2027), but we have considered that part of this will be possible. Option 3 is considered technically feasible, however, will be the most challenging of all the options to deliver and as such as do not recommend this option.

Further details on all three options are given below.

3.2. Multiple sets of Dynamic Parameters (Option 3)

3.2.1. Overview (from Discovery Document)

This option would allow for multiple combinations of dynamic parameters and associated pricing options for a single Balancing Mechanism Unit (BMU) in the BM.

This would allow a market participant to submit, as a minimum, one set of dynamic parameters and prices for the true technical limits of a BMU and another set which represents the most economically efficient running of a BMU (with potentially other sets where appropriate).

3.2.2. High Level Epics (from Discovery Document)

Epic ID	Epic	Product
I98_01	NGESO **must** be able to receive multiple sets of Dynamic Parameters from each BMU	Balancing
I98_02	NGESO **must** be able to optimise between sets of Dynamic Parameters within balancing decisions	Balancing
I98_03	When NGESO sends an instruction to a BMU, it **must** track which set of Dynamic Parameters have been ‘activated’.	Balancing
I98_04	Once a set of Dynamic Parameters have been ‘activated’, NGESO **must** continue to use that set of Dynamic Parameters for a pre-determined period. **Note:** the detail of this would need to be agreed at workgroup, were this option chosen.	Balancing
I98_05	NGESO **must** record details of which Dynamic Parameters have been ‘activated’.	DAP

[1] https://www.nationalgrideso.com/electricity-transmission/industry-information/balancing-services/balancing-programme/strategic-capability-review

I98_06	NGESO **must** be able to determine which sets of Dynamic Parameters are applicable for any Ancillary Service contracts	Balancing, STAR
I98_07	NGESO **must** use the correct sets of Dynamic Parameters in Settlements processes	STAR
I98_08	NGESO **must** use the correct sets of Dynamic Parameters in automated reporting processes **Note:** the detail of this would need to be agreed at workgroup, were this option chosen.	Balancing, DAP, Commercial
I98_09	NGESO **must** be able to audit the following information: • Submitted sets of Dynamic Parameters • 'Activated' sets of Dynamic Parameters	DAP, Commercial
I98_10	NGESO **must** ensure the correct set of Dynamic Parameters is sent to Network Analysis processes **Note:** the detail of this would need to be agreed within NGESO, were this option chosen.	Balancing, Networks
I98_11	During an outage of the primary Balancing system, NGESO **must** ensure the backup system can inform users of which sets of Dynamic Parameters are 'active'	Balancing
I98_12	During an outage of the primary Balancing system, for each BMU without an 'active' set of Dynamic Parameters, NGESO **must** ensure the backup system is aware of at least one set of Dynamic Parameters per BMU **Note:** During Impact Assessment a view can be taken on whether the backup system would know about all sets of Dynamic Parameters, or only a "preferred" set.	Balancing

3.2.3. Summary of Known Changes & Impacts

To meet I98_02, there will be a new optimisation problem to determine which set of parameters a Unit should use for a given time period. The most feasible solution is to do this in advance on a regular timescale (to be agreed with industry) for it to feed into both scheduling and dispatch optimisers. This will require significant work to build and test a new optimiser module. Currently all dynamic parameters can be submitted up until real time and these changes require the optimiser to rerun with the new parameters. However, if we must perform pre-optimisation to determine which set of parameters are best used by the existing scheduling/dispatch optimisers, we will have to rerun both the pre-optimiser with the new dynamic data to determine if this parameter set is still the optimal parameter set for that unit for that time period and then rerun the existing scheduling/dispatch optimisers. There will be significant processing impacts but they cannot be quantified at this time.

All data interfaces will need to be updated to accommodate multiple sets of data and pricing such as those defined by EDL/EDT protocols, WAAPI, interfaces between NGESO systems (e.g. SORT, SPICE, CLOGS, Vergil, NED, MODIS, Settlements, etc.) and interfaces to external systems (e.g. Elexon). The data interfaces between NGESO and Market Participants will need to be changed to allow submission of multiple sets of parameters as well as work needed in Market Participant systems as they will need to identify which sets of parameters they are submitting redeclarations for. There will need to be a mechanism to notify providers of the parameters that have been activated for a time period, including the appropriate acknowledgement of messages. Additional data will need to be sent to other systems within NGESO and externally such as to Elexon for settlement purposes. As there is the ability for multiple sets of data, we will also need to create new data variables which will need to be mandatory: notice to change parameters, minimum parameter run time. These changes will require a large development effort and a still larger testing effort. Robust NFRs will need to be designed and agreed to ensure all systems can reliably operate in the given timescales

As the set of parameters the unit operates at will be determined for a period of time by the pre-optimiser, thought will need to be given for how NGESO handles instructions that cut across multiple pre-optimiser periods. A decision will need to be made on whether to return a unit to PN or if an instruction would be locked to one parameter set across multiple periods. This has the potential to make the pre-optimiser problem even more complicated and/or require running more frequently to collect these delta units as they are released from "locked" BOAs.

Some NGESO balancing systems cannot be changed within these timescales and we will be required to develop a workaround such as sending only the parameter set identified by the pre-optimiser for that time period so the system can continue to use the existing functionality of one set of dynamic parameters.

3.2.4. Technical Feasibility

Whilst considered technically feasible in the legacy balancing systems based on a light-touch review, we expect to find that this option is the most expensive and most time consuming when a full Impact Assessment is completed and as such do not recommend this option is progressed.

3.2.5. High Level Assumptions

Assumption Reference	Assumption Description
I98_A01a	We assume that it is acceptable that we run a pre-optimiser in advance that determines which parameter set will be active and fed into the scheduling and dispatch optimisers.
I98_A01b	We assume that all time frames regarding the pre-optimiser are approved
I98_A01c	We assume that it is possible to create an optimiser that can calculate the most optimal set of parameters for all units that are part of the Balancing Mechanism.

3.3. Explicitly Model Sub-assets (Option 5)

3.3.1. Overview (from Discovery Document)

Some BMUs are comprised of a single generating unit. Others are comprised of linked generating units, with each individual generating unit a ‘sub-unit’ or ‘sub-asset’ of the main BMU. Some examples of BMU types that have sub-assets are as follows:

- Combined Cycle Gas Turbines (CCGTs) – these BMUs have one or more Gas Turbines (GTs) connected to a single Steam Turbine (ST)
  - The BMU can be configured to run in different modes: 1ST+1GT, 1ST+2GTs, 1ST+3GTs, etc.
  - It takes time to change modes, and each mode has a different MEL, SEL, etc.
- Cascade Hydro – these BMUs are comprised of a sequence of generators along a river
  - Each individual generator can be stopped by temporarily stopping the river’s flow, but that has a knock-on impact on downstream generators (albeit with a time lag)
- Aggregated BMUs – these BMUs are comprised of several small generators
  - each generator individually is too small to be commercially viable as a BMU, but aggregated together they can be
  - each generator is independent from the others, unlike in CCGTs and Cascade Hydro BMUs.

For these types of BMUs, the sub-assets and their interdependencies are not currently modelled. Some owners of such BMUs have argued that sub-assets can make it difficult to accurately submit their technical parameters; as part of Issue 98, one identified option is to model these sub-assets explicitly. Clearly this would only benefit those sites with sub-assets and would be of no benefit to BMUs comprised of a single generating unit.

In terms of how this option impacts NGESO:

- the primary impact will be to Balancing tools, which will need to receive this data and then optimise it within balancing decisions

The other areas impacted would be:

- audit - any data which we use as part of balancing decisions must be available to interrogate post-event
- reporting – we may choose to include the new data as part of current or new market reports

3.3.2. High Level Epics (from Discovery Document)

Epic ID	Epic	Product
I98_28	NGESO **must** be able to distinguish between BMUs that have sub-assets and those that do not	Salesforce, Balancing
I98_29	For BMUs that have sub-assets, NGESO **must** be able to receive data about those sub-assets.	Balancing

Epic ID	Epic	Product
	Note: the details of this data are yet to be determined.	
I98_30	NGESO **must** be able to factor sub-asset data into optimisation decisions	Balancing
I98_31	NGESO **must** ensure dispatch instructions honour submitted sub-asset data	Balancing
I98_32	NGESO **must** be able to audit sub-asset data	DAP, Commercial
I98_33	During an outage of the primary Balancing system, NGESO **must** ensure sub-asset data is available to the Control Room users in some form.	Balancing

3.3.3. Summary of Known Changes and Impacts

There is currently functionality within the balancing systems to model CCGTs and, to an extent, other units with sub assets. This could be expanded at significant effort but would be less so than other options proposed. We would also need to expand the mechanism whereby CCGTs inform ENCC of the configuration they are using so that other units with sub-assets can do the same. This is likely to need work within Market Participant systems also.

As with Option 3, we would need to make changes to the data feeds to enable (re-)submission of differing parameters for each sub asset including those defined by EDL/EDT protocols, interfaces between NGESO systems and potentially interfaces to external systems (e.g. Elexon). Even though the development may be an expansion of existing functionality, it does not negate the significant testing needed, particularly with external data interfaces. However, in this instance, there would be fewer changes than with Option 3 as we are only expecting one price stack to be submitted rather than storing multiple price stacks for multiple potential configurations.

The largest impact for this option will be regarding Aggregate Units. Due to technical limitations, the number of aggregated units would not be able to exceed a set number without requiring major system rework. Without knowing the number of Aggregate Market Participants and the breakdown of their sub-assets, we cannot say if we will hit this hard limit or not. In addition, we do not currently use decimal parameter data and very significant development and testing will be required in the data interfaces as well as within NGESO systems to do so if the sub assets need to submit decimal parameters e.g. submit a 0.7MW MEL value.

Some NGESO balancing systems cannot be changed within these timescales and a workaround will have to be found. More information and analysis is needed before we can give an accurate answer as to whether it is feasible given these system limitations.

3.3.4. Technical Feasibility

We do not currently have enough information regarding the number of Aggregators in the market nor their sub asset parameters to accurately assess if this is technically feasible in legacy balancing systems. This information has been sought but until it is received an analysed, we cannot give an accurate answer regarding feasibility of modelling aggregator sub-assets. It is likely to be feasible for CCGTs and Hydro units in the legacy systems although this still requires a full Impact Assessment.

3.3.5. High Level Assumptions

Assumption Reference	Assumption Description
I98_A02	We assume a single pricing stack remains and that this is updated by Market Participants and not automatically updated by NGESO using configuration data.
I98_A03	We assume that CCGT sub-asset modelling remains as-is and Hydro sub-asset modelling can be expanded from the existing functionality.

3.4. Convert more parameters to be Dynamic (Option 6)

3.4.1. Overview (from Discovery Document)

Some of the technical parameters that a BMU submits must be static – i.e. one fixed value (or set of values) for each BMU – whereas others can be dynamic – i.e. the submission can vary over time. To give an example of each:

- Stable Export Limit (SEL) is a static parameter, so each BMU can only ever have one value for SEL; if the BMU wishes to change its SEL it can do so, but the previous SEL is completely overwritten for all time points in the future
- Maximum Export Limit (MEL) is a dynamic parameter, so each BMU can (and many do) specify how their MEL can change over time. So a BMU could specify that their MEL would be 980MW from 00:00 – 08:00, then 985MW from 08:00 – 08:35, then 990MW from 08:35 – 14:00, etc.

Some industry participants have argued that some of the static technical parameters can change over the course of a day, and that therefore it would only be possible to strictly follow Ofgem's letter if some of the technical parameters were changed to be dynamic.

Note that previously there was a proposed industry modification looking at changing Stable Import Limit (SIL) and SEL to be dynamic (GC0126, found here), however at the time NGESO concluded that it did not provide sufficient consumer benefit. Just before NGESO was due to withdraw GC0126, Issue 98 was raised, and it was agreed[2] that NGESO would wait to see the outcome of Issue 98 before formally withdrawing GC0126.

Also note that this is not limited to the SIL and SEL parameters; those which have been raised as part of workgroups so far consist of:

- SIL
- SEL
- MNZT
- Ramp rates
- NDZ

In terms of how this option impacts NGESO:

- the primary impact will be to Balancing tools, which will need to be able to manage more time-varying data, which will increase the optimisation problem to be solved, to a greater or lesser extent

The other areas impacted would be:

- audit - any data which we use as part of balancing decisions must be available to interrogate post-event
- reporting – we may need to update market reports to reflect the change from static to dynamic for some parameters

3.4.2. High Level Epics (from Discovery Document)

Epic ID	Epic	Product
I98_35	For any parameter that becomes Dynamic, NGESO **must** be able to receive and process dynamic data	Balancing
I98_36	NGESO **must** be able to optimise all dynamic parameters	Balancing
I98_37	NGESO **must** be able to store Dynamic data	Balancing, DAP

3.4.3. Summary of Known Changes and Impacts

Currently the system accepts both static and time varying data for different parameters. Changes will be required in a significant number of places to enable the conversion of some parameters from static to time varying within NGESO balancing systems. However, some systems already have this functionality available but disabled and so the effort required to make these changes will be reduced.

EDT has an effective from time field and light touch testing has shown promising results. There would still need to be changes to interfaces between NGESO systems and to external systems. Further analysis and detailed testing would be required as part of a full Impact Assessment but at this stage, it appears that the effort to change the data interfaces would be considerably reduced compared to other options in this report.

Additional development and testing will be needed for BOA functions to update them to operate with dynamic parameters changing during the BOA duration; as well as adding some additional complexity to the optimisers based on a greater number of dynamic parameters.

[2] Between the Regulatory IT team and Code Change Delivery

There will be some additional rules regarding the newly converted dynamic parameters that will need to be agreed. For example, a dynamic ramp rate could increase but NGESO must be given notice of it changing that is longer than the new ramp rate time.

3.4.4. Technical Feasibility

Whilst more testing and a full impact assessment is required, this option is considered to be technically feasible. It is also expected to require least effort in both development and testing and is our recommendation to assess if Industry wishes to progress with this option.

3.4.5. High Level Assumptions

Assumption Reference	Assumption Description
I98_A04	We assume that SIL and SEL will be a step change rather than a ramped change between values.
I98_A05	We assume additional data validation rules are agreed and these cause no further impacts.

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4. Document Control

4.1. Document History

Version	Description of Change	Author	Date
1.0	First Release	Helen Young	04/05/2022

4.2. Document Distribution

Version	Name	Role	Reason
0.2	Carol Carlin	Balancing – Product Owner	Review
0.2	David Bowman	Balancing – Product Owner	Review
0.2	Ed Silverstone	Balancing Transformation - Product Owner	Review
0.2	Daniel Arrowsmith	Regulatory - Lead Business Analyst	Review

4.3. Related Documents

Document Name	Location
Discovery Document	
Issue98-Dynamic Parameters Data Changes (Test Report)	

4.4. Glossary of Terms

Terminology/Abbreviation	Definition
BM	Balancing Mechanism (System)
BMRA	Balancing Mechanism Reporting Agent
BMU	Balancing Mechanism Unit
BOA	Bid Offer Acceptance
BT	Balancing Transformation
CLOGS	Contingency LOGging System
DAP	Data Analytics Platform
DNO	Distribution Network Operator
EBS	Electricity Balancing System
EDL	Electronic Dispatch and Logging
EDT	Electronic Data Transfer
iEMS	Integrated Energy Management System
MDA	Modern Dispatch Algorithm
MDI	Modern Dispatch Instructor
MODIS	Market Operation Data Interface System
MW	Megawatt

NED	National Economic Database
OBP	Open Balancing Platform
SOP	System Operating Plan
SORT	System Operator Real Time
SPICE	Schedule Process in Control Environment
STAR	
TBS	Transfer BMU Data to SORT
VERGIL	VERsatile Graphical Instruction Logger
WA API	Wider Access Application Programming Interface