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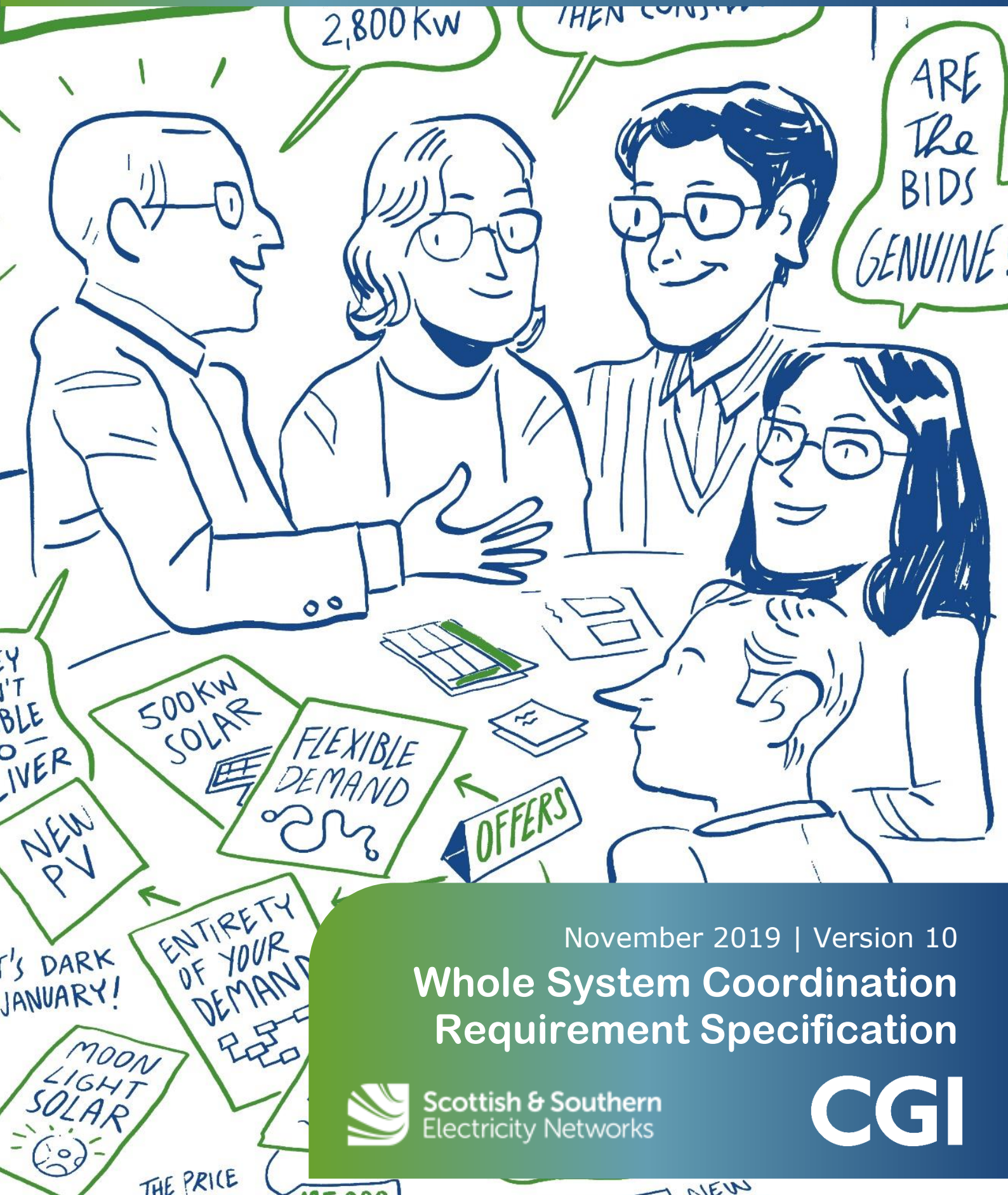


November 2019 | Version 10

Whole System Coordination Requirement Specification

Scottish & Southern Electricity Networks

CGI

Amendment History

Date	Issue	Status / Reason for Change	Author
16 Apr 19	01	First draft	Colin Walsh
25 Apr 19	02	Second draft following internal discussion	Colin Walsh
17 May 19	03	Draft issued to SSEN for informal review	Colin Walsh
07 Jun 19	04	Draft issued to SSEN for formal review	Colin Walsh
21 Jun 19	05	Amended for SSEN comments	Colin Walsh
12 Jul 19	06	Amended for SSEN comments and approved by SSEN	Colin Walsh
15 Aug 19	07	Amended for ASC. Issued to Greg Bartayres, SSEN, for security review	Colin Walsh
27 Aug 19	08	Added constraint solution estimates, and sensitivity estimates. Removed Location.	Colin Walsh
30 Aug 19	09	Issued to SSEN for review.	Colin Walsh
30 Oct 19	10	Constraint solution analysis diagram added. Various cosmetic changes. Measurement of Dispatch added. Post-Fault Processing added.	Colin Walsh

Table of Contents

1 Introduction

1.1 Background

1.1.1 The necessity to move towards a low carbon economy and the advent of technologies that enable widespread generation and storage of power on the electricity distribution network present the UK National Grid and Distribution Network Operators (DNO) with significant challenges. These challenges are being addressed in part through the Energy Networks Association (ENA) initiative of the Open Networks Project (ONP).

1.1.2 The ONP has several strands of work being led by DNOs. One such strand is the TRANSITION programme, for which Scottish and Southern Electricity Network (SSEN) is the leading partner. The TRANSITION programme envisages a change in the way the DNOs are structured. The new structure will see many functions move from each DNO to a related Distribution System Operator (DSO). The DSOs are expected to need modified IT systems to help manage and improve operating capabilities. This includes a new IT system to orchestrate the interactions between:

(i) a number of future DSO internal systems;
(ii) a new Neutral Market Facilitation (NMF) system;
(iii) coordination between DSOs and the new Electricity Service Operator (a part of the UK National Grid).

1.2 Purpose

1.2.1 This document defines the requirements for a Whole System Coordinator (WSC) system. The WSC aims to:

a) Integrate the functionality of the NMF system with DSO and ESO internal systems;

b) Present DSO Control Rooms with analytical information regarding potential constraints and constraint solutions;

c) Automate constraint solutions where possible;

d) Provide a standardised communications channel for DSO and ESO cooperation in managing constraints.

1.3 Scope

1.3.1 The scope of this document is limited to:

a) Interactions between the WSC, the NMF system and specified DSO systems;

b) Interactions between the WSC at a given DSO and WSCs belonging to other DSOs and the ESO;

c) Provision of functionality for the DSO Control Room to view and manage WSC information;

d) A reporting capability for analysis of WSC data;

e) Technical functionality to manage the day-to-day operation of the WSC.

1.4 Derivation

1.4.1 This document addresses the WSC aspects of the TRANSITION Project Request for Proposal Work Package 2 and Work Package 5 (§1.5a).

1.5 References

a) TRANSITION Request for Proposal.

b) Open Networks Workstream 3: Product 2 Functional and System Requirements.

c) ENA Least Regrets Workstream 3 Product 3.

d) Low Carbon London Learnings Report.

1.6 Document Structure

1.6.1 This document contains the following chapters:

a) **Introduction**, this chapter;

b) **To-Be Business Model** (TBBM), outlining the overall context of the WSC and aspects of the TBBM that are common to all the remaining chapters;

c) **Business Use Cases** (BUCs), that define the business processes and business rules for the WSC;

d) **Management Reports**, outlines specific reports that should be output by the WSC, for example statistical reporting for senior management decision making;

e) **Non-Functional Requirements**, those business requirements which cannot easily be specified as functional requirements (ie in the BUCs) but nonetheless have significance (often global) to the TBBM;

f) **Appendices**, containing supporting information referenced elsewhere in the TBBM.

1.7 Glossary

1.7.1 See also the Energy Network Association Glossary.

Term	Meaning
ANM	Active Network Management
BRP	Balance Responsible Party
BUC	Business Use Case
DMS	Distribution Management System
NMF	Neutral Market Facilitation
PSA	Power System Analysis
TBBM	To-Be Business Model
WSC	Whole System Coordination

2 To-Be Business Model

2.1 Introduction

2.1.1 The TBBM consists of the following chapters of this document:

a) To-Be Business Model (§2);

b) Business Use Cases (§3);

c) Management Reports (§4);

d) Non-Functional Requirements (§5).

2.1.2 This chapter addresses requirements which have relevance across all aspects of the TBBM.

2.1.3 A guide to understanding the content of the TBBM and its diagrams can be found in the TBBM Guide §6.1.

2.1.4 Support for ENA Future Worlds by this TBBM

a) **World A: DSO managed NMF.** This World is supported assuming that a NMF Request/Offer/Bid involves Energy Resources that are all within the DSO network managing that NMF. In this event there is an instance of an NMF and an instance of a WCS at each DSO. ESO would also have a WSC but not an NMF.

b) **World B: ESO/DSO managed NMF.** Assuming this World results in a single NMF instance then World B is supported in a similar manner to World D, perhaps with different owner of NMF. Otherwise it is supported in a similar manner to World A.

c) **World C: Price Driven Market.** Whilst the NMF TBBM provides a pricing mechanism for flexible energy, neither the NMF TBBM nor this WSC TBBM envisages a data set distributed across all Industry Actors. Both TBBMs assume there to be either one or a small number of NMFs curated at DSO level to which Industry Actors have access.

d) **World D: ESO managed NMF**. This World results in a single NMF instance managed by ESO. The ESO and each DSO would have a WSC instance.

e) **World E: Joint Ownership of NMF.** This World is supported in a similar manner to World D but with a different owner of the NMF.

2.2 Stakeholders

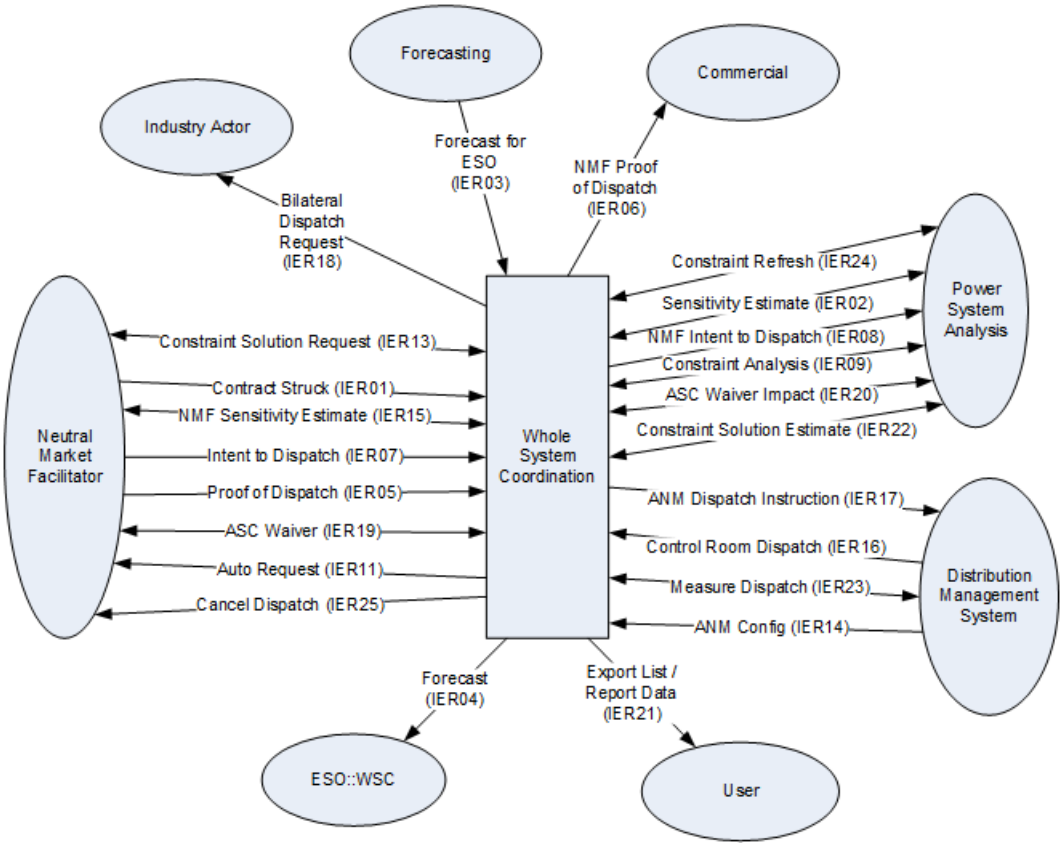
2.2.1 The key stakeholders in the WSC system requirements are given below:

Stakeholder	Stake
CGI	Production of this Requirement Specification for the NMF system.
SSEN	Company leading the TRANSITION project.
OFGEM	Funding for TRANSITION project.
ENWL	Partner in the TRANSITION project.

Stakeholder	Stake
Open Networks Project / ENA	Overarching programme that includes TRANSITION.

2.3 Context Diagram

2.3.1 The external scope of the WSC is shown in the Context Diagram below. Each external entity (ovals) exchanges data with the WSC as noted by the arrows. The arrows reference the Information Exchange Requirement (IER) which is presented in Appendices §6.2. The IER provides more details (including a reference to the relevant BUC) for each data flow. A more detailed explanation of the Context Diagram and IER can be found in the TBBM Guide §6.1.5.



2.3.2 The following table describes the entities in the Context diagram (anti-clockwise from Neutral Market Facilitator):

Entity	Description
Neutral Market Facilitator	The NMF that is supported by the WSC for a given DSO. For a given DSO, the data interactions as indicated with the NMF are defined as Primary. Data flows generated by the given DSO WSC to other DSO WSC are Secondary.
ESO::WSC	The WSC implemented at the Electricity Service Operator
User	A WSC user may download lists and reports they produce to their workstation.

Entity	Description
Distribution Management System	DMS, an operational system that is used by the DSO Control Room to perform day-to-day monitoring and management of their electricity distribution network.
Power Systems Analysis	PSA, a system used by a DSO to analyse the operational impact of forecasts, investment proposals and other changes to their electricity network.
Commercial	A system used by a DSO for financial settlements.
Forecasting	An operational planning system used by a DSO to produce forecasts of supply and demand for their electricity distribution network.
Industry Actor	Counter party to the DSO in a NMF Bilateral Contract

2.3.3 Automatic acknowledgements by external entities of the receipt of a message from WSC are not noted in the Context Diagram. External entities should provide these acknowledgements for all WSC outbound data flows.

2.4 Roles

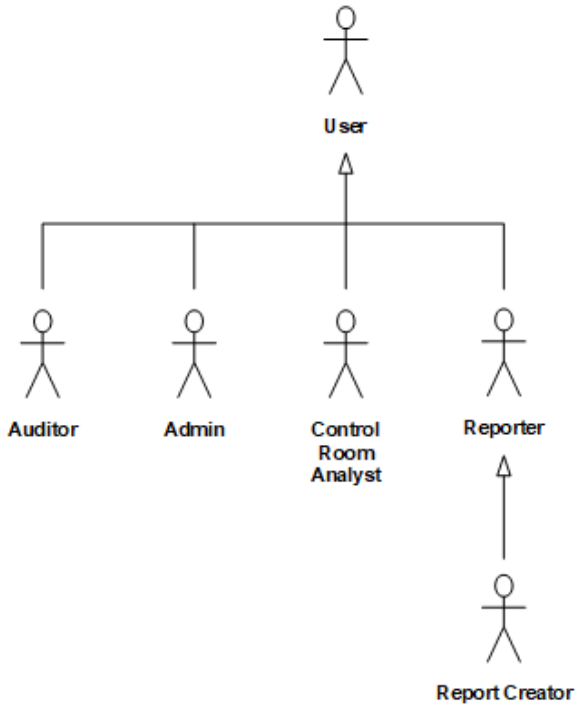
2.4.1 The following roles are required by the WSC system. These roles are specific to the WSC system and are unrelated to any similarly named roles within any other system or company. A detailed explanation about roles can be found in the TBBM Guide §6.1.6.

Role	Description
Admin	A User with technical administration rights for the WSC.
Auditor	A User read-only rights to all WSC data.
Control Room Analyst	A User with the rights to view and manage DSO Control Room functionality.
Reporter	A User entitled to produce management reports.
Report Creator	A Reporter with additional rights to create and maintain report templates.
User	The most generic role for WSC users. Users have view only access to some WSC content.

2.4.2 In addition to formal roles governing actions that can be taken by Roles, this document envisages a DSO Control Room. This is a logical entity which provides the day-to-day operational analysis and activities that a DSO uses to manage its electricity network obligations. WSC would be one of the IT systems supporting the DSO Control Room. Control Room Analysts are likely to participate in the DSO Control Room activities.

2.4.3 Role Inheritance

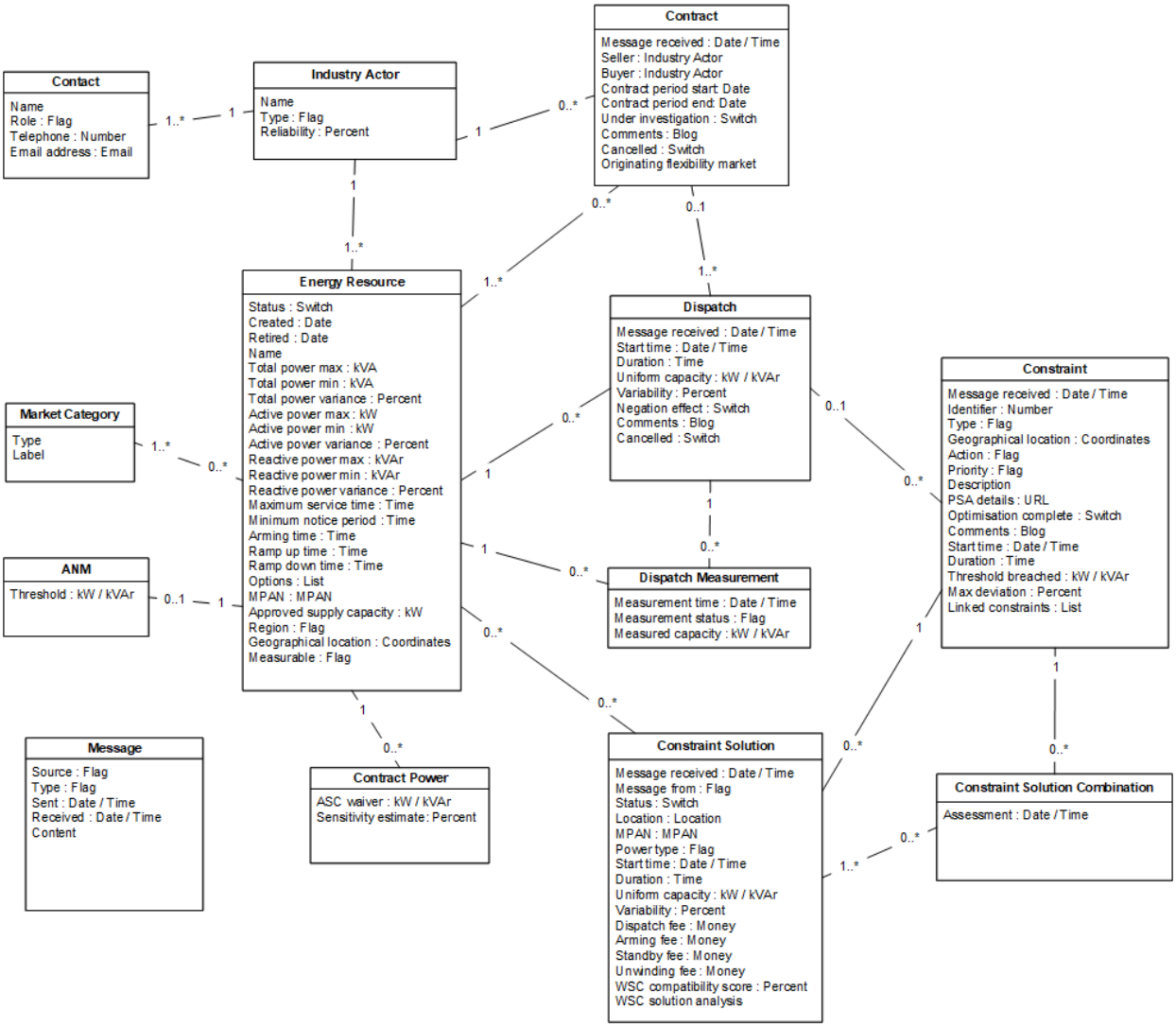
2.4.3.1 The following diagram illustrates the WSC system role inheritance model. Inheritance is a means of describing cumulative increases in access rights and authority. In the diagram, the Reporter role inherits the basic User capabilities and has additional rights to run pre-defined management reports (see §4). The Report Creator role inherits the Reporter role's capabilities and has additional rights to prepare new management report designs. A detailed explanation about role inheritance can be found in the TBBM Guide §6.1.6.



2.5 Domain Model

2.5.1 The following conceptual data model illustrates the data domain for the WSC system. Each rectangle is a data entity which contains a list of data attributes. Attributes can be associated with data types (separated from the attribute name by a colon). More details of the data attributes can be found in the Data Dictionary (Appendix §6.3).

2.5.2 The data entities have relationships with each other as shown with lines. Multiplicity values are given at each end of a line. Thus a Location may be associated with zero or more (0..*) Energy Resources, whereas a given Energy Resource is at exactly one (1) Location. More details regarding the Domain Model structure can be found in the TBBM Guide §6.1.7.



2.5.3 Data Entities

2.5.3.1 The following table describes the entities noted in the Domain Model above. Details of the data attributes can be found in the Domain Model Data Dictionary §6.3. It should be noted that many of the entities are similar to those found in the NMF and reflect the close relationship that WSC must have with NMF.

Entity	Description
Contact	Contact information for relevant individuals at an Industry Actor.
Industry Actor	Companies that are part of the UK electricity ecosystem. The actions of these companies directly or indirectly impact the DSO electricity distribution network.
Contract	Each NMF Contract is a contract between NMF Industry Actors. These may be either as a result of a NMF market auction or a NMF Bilateral Contract. This entity and the associated dispatch schedule implied by the Contract are passed to Forecasting to ensure estimates take into account any proposed future dispatches.
Market Categories	NMF Market Categories are analysis codes used to characterise Energy Resources and Dispatches.
Energy Resource	A physical asset used to produce a Dispatch.
Dispatch	Details of a physical dispatch that an Industry Actor proposes to undertake on a DSO electricity network.
Dispatch Measurement	Measurements of actual dispatched capacity.
Constraint	An abnormal behaviour in the DSO electricity network that may result in degradation or damage to the network.
Constraint Solution	Potentially solutions to a Constraint gathered and assessed by the WSC.
Constraint Solution Combination	Combinations of Constraint Solutions which the WSC assesses to be feasible for mitigating a Constraint.
Message	An inbound communication received by the WSC from another system, or an outbound communication sent by WSC to another system.
ANM	An active network management asset operated by the DSO.
Contract Power	Supports an energy resource that has gained an ASC waiver and/or the estimated sensitivity rating for a dispatch

3 Business Use Cases

3.1 Introduction

3.1.1 The Business Use Cases are high level descriptions of the main business processes that a NMF system should support. This chapter contains most of these BUCs. A small number of BUCs addressing specific functional areas such as Management Reporting are found in their relevant chapters.

3.1.2 The BUCs in this chapter are divided into logical packages. These packages have no special significance and merely provide an aid to understanding related BUCs. The packages are as follows:

a) **Package A**: System Access

b) **Package B**: Message Processing

c) **Package C**: Control Room

d) **Package D**: Miscellaneous

3.1.3 Each package has an associated diagram illustrating the relationship between BUCs in the package and the main actors to which they apply.

3.1.4 A guide to the BUC diagram notation and the BUCs themselves can be found in the TBBM Guide §6.1.8. It is strongly recommended that readers new to BUCs review this Guide before reading the BUCs themselves.

3.1.5 It should be noted that BUC identity numbers are purely to provide a unique reference. They do not follow any particular sequence nor imply an order of processing.

3.1.6 The BUCs are supported by the TBBM Roles (§2.3.3) and TBBM Domain Model (§2.5).

3.2 General Rules & Assumptions

3.2.1 There are a number of business rules and assumptions that are applicable across a range (or all) BUCs. These rules are stated in this section. Except where explicitly identified, BUCs should be read as having these rules applied as well as any specific to a given BUC.

a) The WSC system is assumed to be functioning correctly.

b) The ESO and DSOs may operate one WSC each. For these requirements, the Primary WSC is the WSC that is operated by the organisation to which the System actor belongs. A Secondary WSC is a WSC operated by another organisation.

c) In some cases, a message (or a related message) may need to be forwarded from the Primary WSC to a Secondary WSC system. To avoid a cascade of duplicate messages, Secondary WSCs will forward only to their directly related systems as necessary and will not forward the original message to other WSCs.

d) The Primary NMF is the NMF directly associated with the Primary WSC. Only the Primary NMF may send messages to the Primary WSC.

e) Any list presented to a User should:

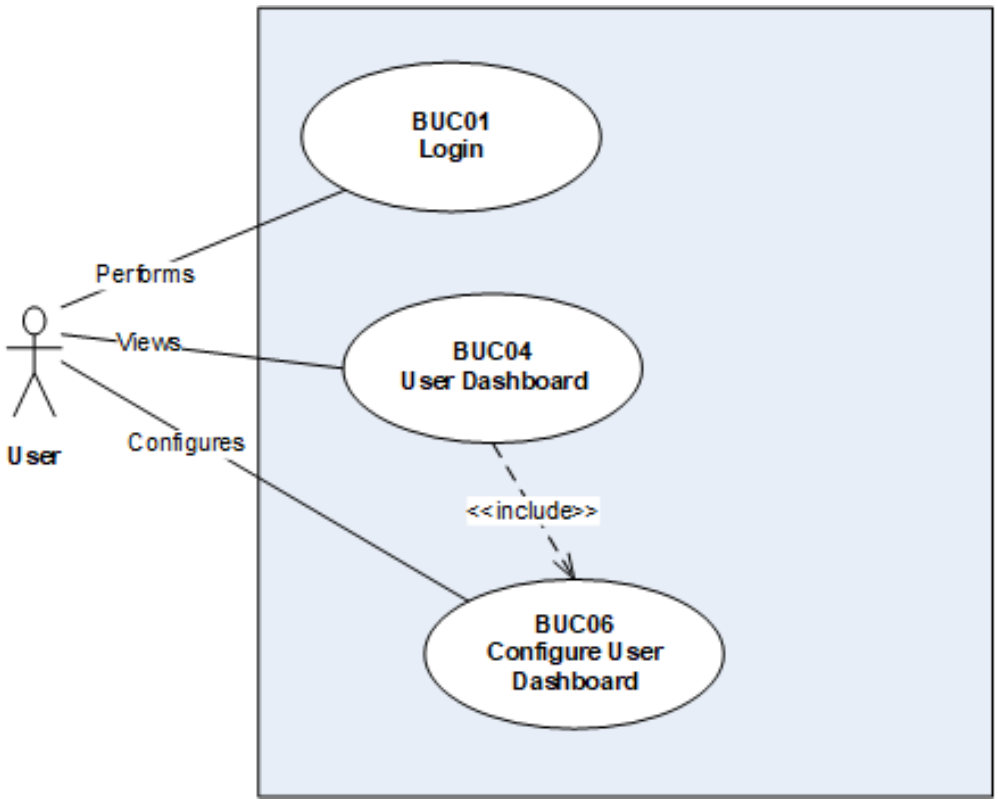
(i) Have search, sort and filter capabilities in a similar manner to Microsoft Excel;
(ii) Retain the last sort/filter choices for a given list during a login session and reapply them whenever the list is re-presented to the User;
(iii) Include a choice to remove any sort/filter criteria from the list and revert to a default list;
(iv) Have pagination of long lists with controls for navigation of the list, for example next page, previous page, start and end;
(v) Indicate the total number of items present in the overall list;
(vi) Export capability of Adobe PDF and Microsoft Excel format.

f) The output data items will contain only the minimum set of data necessary for each external system.

g) All lists of information viewed by the DSO Control Room should be updated on a frequent basis to ensure near real time veracity.

3.3 Package A: System Access

3.3.1 The diagram below illustrates the relationships between the set of BUCs relating to basis user access to the WSC.



3.3.2 BUC01 Login

Users must be able to gain access to the WSC by a simple but secure mechanism. The precise credentials necessary will be determined in conjunction with SSEN security group.

Extend/Include	None.
Roles	User.
Success Criteria	The User is able perform their work with the WSC.
Preconditions	None.
Trigger	User chooses to access the WSC system through their browser.

Main Path

1. User provides their credentials.

Post Conditions

User can access the WSC system.

Alternative Paths

1a. Already logged in

Post. User continues to access the WSC system without further challenge.

1b. Existing login has expired

1b1. User is asked to provide their credentials again. Resume at step 1.

1c. Forgotten credentials

1c1. User is directed to information allowing them to recover their credential.

Post: User is does not gain access to WSC.

1d. Incorrect credentials

1d1. User is warned that their credentials are not valid. Resume at step 1.

1d1a. Too many login attempts

1d1a1. User account is suspended.

Post: User can no longer access WSC until their account is restored.

1e. First time access

1e1. User is asked to enter a new password and other credentials.

1e1a. Credentials are not valid

1e1a1. User is warned that their credentials are not valid. Resume at step 1e1.

1e1b. Too many attempts

1e1b1. Follow step 1d1a.

1f. Password has expired

1f1. User is asked to provide a new password and/or other credentials. Resume at step 1.

1g. Account is suspended

Post. User is prevented from accessing WSC.

1h. Logout

Post. User does not have access to WSC until they provide their credentials again.

1i. Timed out

Post. User does not have access to WSC until they provide their credentials again.

Business Rules

R1. See Security (§5.3) for details regarding valid User credentials.

3.3.3 BUC04 User Dashboard

This BUC presents the starting point for User activities within the WSC system following login. The intent is that the dashboard content may be configurable through BUC06 Configure User Dashboard.

Includes	BUC06 Configure User Dashboard
Roles	User
Success Criteria	User has summary information pertaining to their work in the WSC and can access all functionality relevant to that work.
Preconditions	None
Trigger	User has navigated to their dashboard.

Main Path

1. User has various containers of information and navigation tools.
2. User chooses an information container or navigation item.

Post Conditions

User is navigated to content related to the selected item.

Alternative Paths

2a. Configure dashboard

2a1. User follows BUC06 Configure User Dashboard.

2a2. Resume at step 1.

Business Rules

R1. The content viewed by an ordinary User will be limited to that related to their company. Users with additional privileges as defined for their role(s) may see additional information.

R2. Examples of content that might be presented in the User dashboard include:
- List of recently accessed Dispatches.
- List of Dispatches nearing their notification period.
- Recently received Contract Struck messages.

3.3.4 BUC06 Configure User Dashboard

A means to provide configuration tools to those accessing the WSC through the User Dashboard may be desirable.

Included in	BUC04 User Dashboard
Roles	User
Success Criteria	User has the optimum set of items on their dashboard to efficiently perform their tasks in the WSC system.
Preconditions	None.
Trigger	User has chosen to configure their dashboard.

Main Path

1. User has a list of all available dashboard items for the role(s).
2. User chooses the dashboard items that they want to appear in their personal dashboard.

Post Conditions

Resume in parent BUC.

Alternative Paths

None.

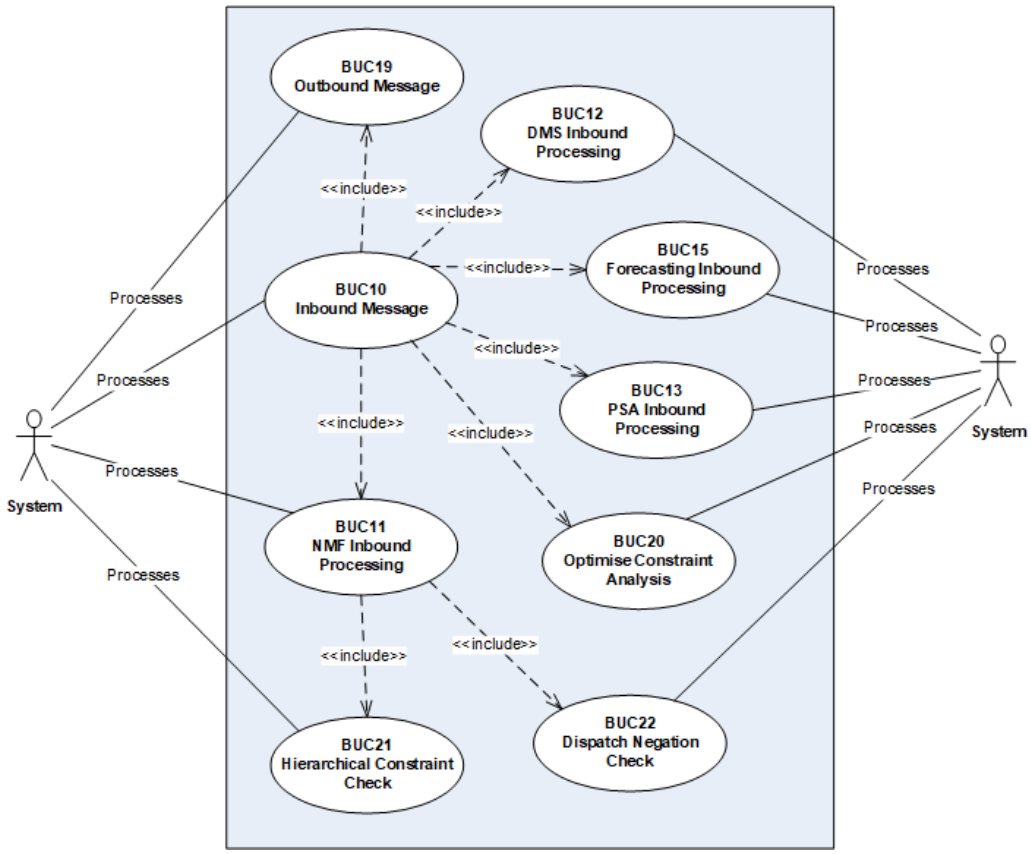
Business Rules

R1. Dashboard items might include:
- High priority constraints
- Recent data transfer acknowledgement errors
- Recent NMF Intent to Dispatch notices
- Recent NMF Contract notices

3.4 Package B: Message Processing

3.4.1 The diagram below illustrates the relationships between the set of BUCs relating to inbound and outbound message processing in WSC.

3.4.2 There is an implicit assumption within the Message Processing BUCs that the internal DSO systems (or a human replacement for these systems) can respond to WSC/NMF activity in a timeframe of at most a few hours and ideally in a few seconds.



3.4.3 See also §6.4 Constraint Solution Analysis process flow diagram.

3.4.4 BUC10 Inbound Message

This BUC provides the generic approach for all data transfers into the WSC. A given inbound message contains an input data item. The WSC system automatically processes the inbound message (alternative paths of step 3) to create output data items as necessary. These output data items are then forwarded to the relevant target systems.

Includes	BUC11 NMF Inbound Processing BUC12 DMS Inbound Processing BUC13 PSA Inbound Processing BUC15 Forecasting Inbound Processing BUC20 Optimise Constraint Analysis BUC19 Outbound Message
Roles	System
Success Criteria	All systems subject to co-ordination have received the appropriate information in a format that they accept.
Preconditions	System has received and queued an inbound message.
Trigger	Inbound message is next in queue.

Main Path

1. System confirms that the source of the inbound message is valid.
2. System sends an acknowledgement of receipt to the source of the inbound message.
3. System processes the input data item contained in the message.
4. System determines that Constraint related to the message does not need optimisation.
5. System follows BUC19 Outbound Message

Post Conditions

WSC has successfully processed the inbound message and, where appropriate, sent outbound messages to target system.

Alternative Paths

1a. Invalid source or content

1a1. System issues a WSC Error.

Post: No further processing is done.

2a. Acknowledgment of transfer

2a1. System marks transfer as successful.

Post: A record of the successful transfer is stored.

3a. NMF inbound message

3a1. System follows BUC11 NMF Inbound Processing

3b. PSA inbound message

3b1. System follows BUC13 PSA Inbound Processing

3c. Forecasting inbound message

3c1. System follows BUC15 Forecasting Inbound Processing

3d. DMS inbound message

3d1. System follows BUC12 DMS Inbound Processing

4a. Constraint needs optimisation of solutions

4a2. System follows BUC20 Optimise Constraint Analysis

4a3. System determines that no output data items are necessary.

4a3a. NMF solution is the only solution available

4a3a1. System populates an output data item for the NMF system to automatically create an NMF Request.

4a4. Resume at step 4.

Business Rules

R1. Only the Primary NMF system may send an original NMF message to the WSC.

R2. The following NMF inbound messages are valid:

- (NMF) Contract Struck
- (NMF) Intent to Dispatch
- (NMF) Intent to Dispatch Cancelled
- (NMF) Proof of Dispatch
- (NMF) Market Estimate
- (NMF) Bilateral Contract Solution
- (PSA) Constraint Analysis
- (Forecasting) Forecast for ESO
- (DMS) ANM Configuration
- (DMS) Control Room Dispatch
- (DMS) Dispatch Measurement
- (DMS) Dispatch Measurement
- (DMS) Dispatch Cancelled

Observation

3.4.5 BUC11 NMF Inbound Processing

Inbound messages to be processed by this BUC are:

- Contract Struck following selection of Offers at the conclusion of an NMF market auction or bilateral deals.
- Contract Cancelled
- Intent to Dispatch issued by an Industry Actor.
- Proof of Dispatch issued by an Industry Actor.
- Market Estimate
- Bilateral Contract Solution
- Request to Exceed ASC
- Cancellation of Request to Exceed ASC
- Request for Sensitivity Estimate

Included in	BUC10 Inbound Message
Includes	BUC21 Hierarchical Constraint Check BUC22 Dispatch Negation Check
Roles	System
Success Criteria	The NMF activity details are available for analysis by the DSO Control Room.
Preconditions	A NMF message has been received and authenticated by the WSC.
Trigger	A NMF message needs processing.

Main Path

1. System updates the WSC database with the input data item.
2. System determines that no output data item is necessary.

Post Conditions

Any necessary output data items have been prepared.

Alternative Paths

2a. Intent to Dispatch

2a1. System populates an output data item for the PSA system.

2a2. System follows BUC21 Hierarchical Constraint Check

2a3. System follows BUC22 Dispatch Negation Check

2b. Intent to Dispatch Cancelled

2b1. System marks the Dispatch and any associated Constraint as cancelled.

2c. Proof of Dispatch

2c1. System populates an output data item for the Commercial system.

2d. Request to Exceed ASC

2d1. System populates an output data item for the PSA system.

2e. Request for Sensitivity Estimate

2e1. System populates an output data item for the PSA system.

2e1a. PSA sensitivity estimate not available

2e1a1. System calculates a sensitivity estimate.

2e1a2. System populates an output data for the NMF system.

2f. Market Estimate

2f1. System populates a Constraint Solution Estimate Request output data item for the PSA system.

2g. Bilateral Contract Solution

2g1. System populates a Constraint Solution Estimate Request output data item for the PSA system.

Business Rules

R1. The output data item for the Forecasting system will consist of a single message containing all the Energy Resources and Dispatches that are components of the Contract:
- Energy Resource identifier and MPAN
- Dispatch type, start time, duration, capacity and variation
- Request that Forecasting updates its data model

R2. The output data item for the PSA system for an Intent to Dispatch will consist of a single message containing all the Energy Resources and Dispatches that are components of the Intent to Dispatch:
- Energy Resource identifier and MPAN
- Dispatch type, start time, duration, capacity and variation

R3. The output data item for the Commercial system will consist of items found in the input data item only.

R4. The output data item for the PSA system for Request to Exceed ASC will request that PSA provides WSC with an analysis of the elements of the network that would be impacted. The message will include:
- Energy Resource identifier and MPAN
- Proposed capacity, start time, duration and variation

R5. A Cancellation of ASC Waiver message does not give rise to an output data item.

R6. Each constraint solution estimate should contain entries for all published flexible capacity that may be suitable. In the event that the NMF market has no available published solutions, an entry will be made to the WSC database indicating that no NMF solution is available.

R7. Where the WSC has to calculate a sensitivity estimate, this will be based on the geographical distance between the target location for the estimate and the source Energy Resource proposed.

R8. The output data item for the PSA system for a Market Estimate will request that PSA provides WSC with a revised analysis of the constraint to include the likely impact of the proposed constraint solution. The message will include:
- Constraint identifier
- Energy Resource identifier and MPAN
- Proposed capacity, start time, duration and variation

3.4.6 BUC12 DMS Inbound Processing

The following messages can be received from the DMS:

- ANM Configuration, a periodic transfer of changes to the ANM configuration suitable for WSC
- Control Room Dispatch, occurs when the DSO Control Room has to arrange one or more dispatches to mitigate a constraint which cannot be done in the time frame of a standard WSC constraint optimisation check.
- Dispatch Measurement, the response to BUC36 Request Dispatch Measurement

Included in	BUC10 Inbound Message
Roles	System
Success Criteria	WSC data is up to date with changes and events in DMS.
Preconditions	None.
Trigger	WSC has received a message from DMS.

Main Path

1. System updates WSC database.
2. System determines that no output data item is needed.

Post Conditions

WSC database is updated from the content of the message.

Alternative Paths

1a. ANM configuration change

1a1. System updates the WSC database ANM data.

1b. Control Room dispatch instruction

1b1. System appends the Dispatch data in the WSC database.

1c. Dispatch measurement

1c1. System appends the Dispatch Measurement to the WSC database.

1c1a. Dispatch measurement error

1c1a1. System raises a WSC Error.

1d. Dispatch cancelled

1d1. System marks the Dispatch as cancelled.

1d2. System prepares an output data item for NMF noting the cancellation.

2a. Dispatch capacity discrepancy

2a1. System raises a new Constraint in respect of the discrepancy.

2a2. System prepares an output data item for each of the following detailing the constraint and requesting a solution(s) that mitigates the constraint:

(i) NMF Bilateral Contracts available to the DSO
(ii) NMF market availability of appropriate flexible resources

Business Rules

R1. DMS has the DSO master dataset for AMN information.

R2. A dispatch capacity discrepancy occurs when a measured capacity does not adequately match the expect dispatch capacity.

R3. The measured capacity may need adjustment to remove any baseline capacity. The baseline capacity would be any capacity being dispatch concurrently but is not part of the original NMF Intent to Dispatch.

3.4.7 BUC13 PSA Inbound Processing

Inbound messages to be processed by this BUC are:

- Constraint analysis
- ASC waiver impact analysis
- Constraint solution impact analysis
- PSA sensitivity estimate

Included in	BUC10 Inbound Message
Roles	System
Success Criteria	The DSO has visibility of constraints associated with a proposed NMF Dispatch.
Preconditions	PSA message has been received and authenticated by the WSC.
Trigger	PSA message needs processing.

Main Path

1. System updates the WSC database with the input data item.
2. System determines that no output data item is necessary.

Post Conditions

All necessary output data items have been prepared.

Alternative Paths

2a. New constraint analysis

2a1. System creates a new constraint.

2a2. System prepares an output data item for each of the following detailing the constraint and requesting a solution(s) that mitigates the constraint:

(i) NMF Bilateral Contracts available to the DSO

(ii) NMF market availability of appropriate flexible resources

2b. Constraint has been rectified

2b1. System closes the constraint and any related solutions.

2b2. System prepares an output data item for each constraint solution requesting NMF cancel any related intent to dispatch or in progress dispatches.

2c. Revised constraint analysis

2c1. System creates a new constraint.

2c2. System closes the existing constraint and links it to the new constraint.

2c3. System determines that the constraint has not changed significantly.

2c3a. Constraint has changed significantly

2c3a1. System prepares an output data item for each of the following detailing the constraint and requesting a solution(s) that mitigates the constraint:

(i) NMF Bilateral Contracts available to the DSO

(ii) NMF market availability of appropriate flexible resources

2d. PSA sensitivity estimate

2d1. System populates an output data item for the NMF system.

Business Rules

R1. ASC waiver requests should not create constraint solution(s). The PSA analysis is to inform a DSO Control Room decision (see BUC35) regarding the waiver request rather than a constraint that needs mitigation. In the event of approval and a subsequent NMF contract is struck, DSO Control Room will have an opportunity to re-assess against the actual contracted dispatch schedule.

3.4.8 BUC15 Forecasting Inbound Processing

The only inbound message that WSC receives from Forecasting is a request to transfer new or updated forecasting information to the ESO.

Included in	BUC10 Inbound Message
Roles	System
Success Criteria	ESO has up to date DSO forecasting information to inform their forecasts.
Preconditions	Forecasting has updated the DSO forecast.
Trigger	WSC has received a request to pass the latest DSO forecasting data on to ESO.

Main Path

1. System prepares an output data item containing the forecast information for transfer to ESO.

Post Conditions

The output data item for ESO is ready to be transferred.

Alternative Paths

None.

Business Rules

None.

3.4.9 BUC19 Outbound Message

This BUC provides the basis for all WSC messages sent to both internal DSO systems and systems that are external to the DSO. It isn't an independent process but is included in other processes that prepare outbound data items.

Included in	BUC10 Inbound Message BUC32 Manage WSC Constraints BUC35 Review ASC Waiver Request
Roles	System
Success Criteria	All systems subject to co-ordination have received the appropriate information in a format that they accept.
Preconditions	None.
Trigger	None.

Main Path

1. System translates the output data item into the communication format required for the target system.
2. System sends the output data item to target system.

REPEAT steps 1 and 2 for each output data item.

3. System receives confirmation from each target system that the output data item has been received.

Post Conditions

WSC has, where appropriate, successfully sent outbound messages to target systems.

Alternative Paths

1a. No outbound data items

Post: No further processing is done.

2a. Output system not in use

2a1. System will not send a message to the output system.

3a. No acknowledgement received

6a1. System issues a WSC Error regarding the failed data transfer.

Post: DSO Control Room is aware of the failed data transfer.

Business Rules

R1. Acknowledgements of outbound data transfers should be received within a WSC system-defined time period on a per external entity basis.

3.4.10 BUC20 Optimise Constraint Analysis

Following receipt of new or updated constraint information from PSA, the WSC looks for and analyses possible solutions that mitigate the constraint.

Included in	BUC10 Inbound Message
Roles	System
Success Criteria	DSO Control Room have information regarding possible solutions that can inform decisions for mitigating a constraint.
Preconditions	A constraint exists which needs mitigation.
Trigger	All responses from external entities invited to provide solutions for the constraint have been received or have timed out.

Main Path

1. System assesses each solution against the Constraint and allocates a compatibility score.
2. System assesses feasible combinations of Constraint Solutions.
3. System marks the Constraint as having optimised solutions.

Post Conditions

Each solution has a compatibility score.

Alternative Paths

None.

Business Rules

R1. The assessment of each Constraint Solution should include evaluation of:
- Potential impact of any available ANM capabilities
- Proximity of the proposed solution dispatch to the constraint location
- Ability to fulfil the power capacity and duration needed to mitigate the constraint
- Risk that the solution would detrimentally impact other constraints or solutions
- Suitability of the energy resource(s) given the circumstances of the constraint
- Reliability of the Industry Actor proposing the solution
- Estimated cost of the solution

R2. Details of the assessment performed to reach the compatibility score should be recorded in the Constraint blog.

R3. A system level parameter should be used to determine the lower limit for a compatibility score. Any solution with a score below this limit should be recorded as not suitable.

3.4.11 BUC21 Hierarchical Constraint Check

It is possible that a dispatch across a circuit may be within that circuit's safe usage tolerances, but that dispatch, plus potentially other discharges scheduled at the same time on related circuits, have a detrimental impact on the parent circuits that feed these child circuits. This BUC outlines the checks for the risk of constraints in the hierarchy of parent circuits above that hosting a dispatch.

Included in	BUC11 NMF Inbound Processing
Roles	System
Success Criteria	Potential constraints in the hierarchical DSO electricity feeder system caused by a distribution level dispatch have been notified to the Control Room.
Preconditions	An NMF Intent to Dispatch message has been received.
Trigger	A check is need for the potential for a dispatch having an impact on feeder circuits in the hierarchy of locations to which the dispatch is being applied.

Main Path

1. System determines the parent location as the next point to check for constraints.
2. System gathers a list of all the planned dispatches in child location(s) where the dispatch period overlaps that of the NMF Intent to Dispatch.
3. System calculates total dispatch uniform capacity for the overlapping periods.
4. System creates an output data item for the overlapping periods requesting PSA analysis.
5. System continues at step 1.

Post Conditions

Output data items for PSA have been created for constraint checking.

Alternative Paths

1a. Location is a Grid Supply Point

1a1. System has completed the traversal of the location hierarchy. Resume at Post Condition.

Business Rules

R1. The starting point of the hierarchical checking is the location of the NMF Intent to Dispatch. System then goes up one step in the hierarchy of locations with each repetition of step 1. This continues until a GSP is reached. Checking is not done for the GSP itself.

3.4.12 BUC22 Dispatch Negation Check

It is possible that two dispatches in proximity to each other may have effects that cancel each other out. This will potentially negate the benefits expected from performing the dispatches.

Included in	BUC11 NMF Inbound Processing
Roles	System
Success Criteria	Potential negating NMF dispatches are notified to the DSO Control Room.
Preconditions	An NMF Intent to Dispatch message has been received.
Trigger	A check is need for the potential for an NMF dispatch to have negating effects on other planned dispatches.

Main Path

1. System gathers a list of all the planned dispatches which share a feeder location and overlap the timing of the NMF dispatch.
2. System compares each of the planned dispatches to the incoming NMF dispatch to determine if a negation effect may occur.
3. System marks the NMF dispatch as having a potential for negation.

Post Conditions

The NMF dispatch is marked for negation effect as appropriate.

Alternative Paths

3a. No negation effect

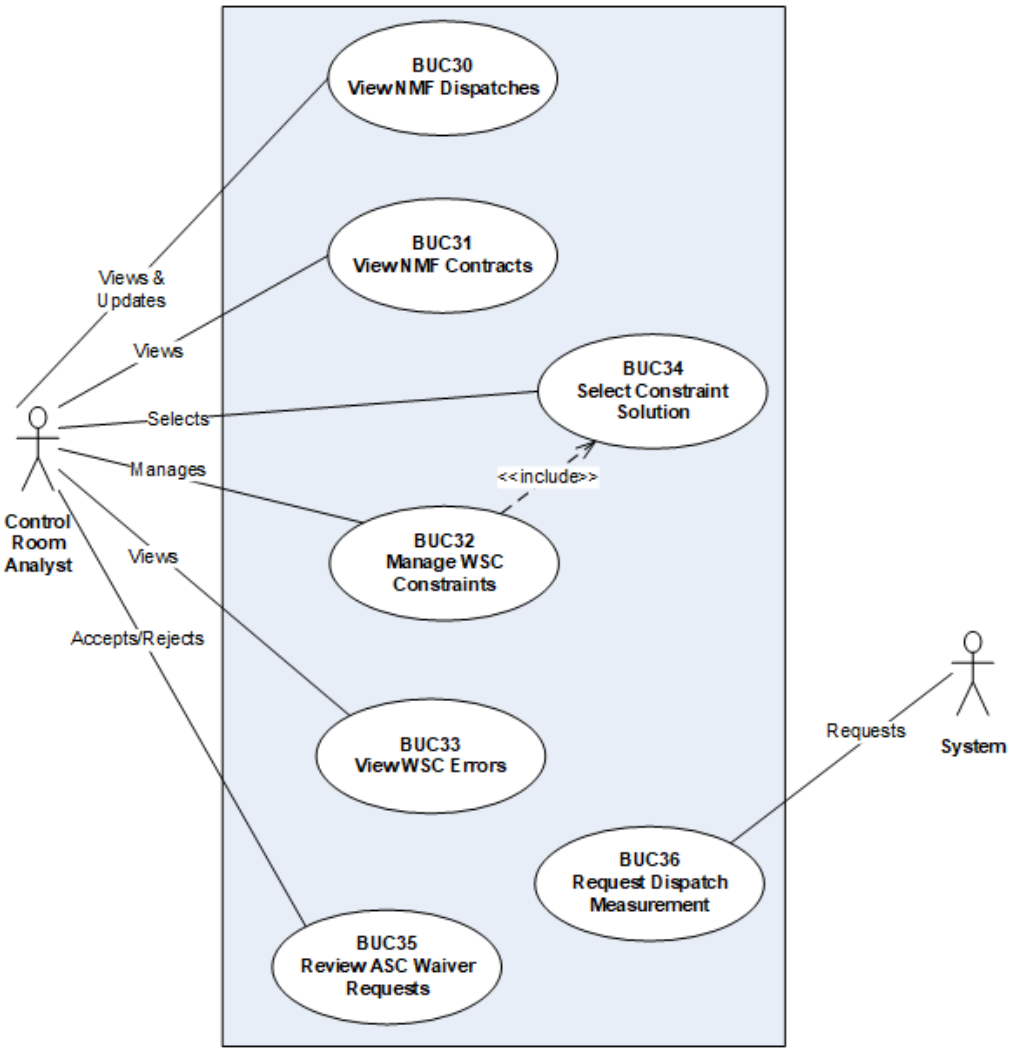
3a1. System determines that no negation effect is likely to occur.

Business Rules

R1. A negation can occur when two (or more) simultaneous dispatches in close proximity to each other in the electricity network generate opposite electrical characteristics. Whilst it is possible that the effect is as planned, it should be checked by the DSO Control Room. For example, for a given location:
- A dispatch of demand reduction occurring at the same time as a dispatch increasing supply generated capacity could partially or wholly cancel each other out.
- A dispatch increasing supply generated capacity at the same time as a dispatch reducing supply generated capacity could partially or wholly cancel each other out.

3.5 Package C: Control Room

3.5.1 The diagram below illustrates the relationships between the set of BUCs relating to visualisation of WSC data in the DSO Control Room.



3.5.2 BUC30 View NMF Dispatches

DSO Control Room need to be able to see dispatches, particularly those which may need checking.

Extends	None
Roles	Control Room Analyst (CRA)
Success Criteria	DSO has been able to make an informed decision on whether proposed Dispatches warrant further analysis or action.
Preconditions	None.
Trigger	CRA decides to view dispatch information held be WSC.

Main Path

1. CRA has a list of Dispatches.
2. CRA selects a Dispatch to view the details.
3. CRA view details of the Dispatch.

Post Conditions

Control Room Analyst has been informed of the characteristics of the Dispatch.

Alternative Paths

1a. Dispatch has been previously identified

1a1. CRA has navigated to this BUC with a particular Dispatch already identified. Resume at step 3 for the Dispatch indicated.

3a. View constraint details

3a1. CRA selects a Constraint to view the details.

Post: CRA is navigated to the details of the Constraint in the PSA System.

3b. Make a comment

3b1. CRA appends a comment to the Dispatch. Resume at step 3.

3c. Unset negation effect

3c1. CRA decides that the negation effect will not occur and unsets the Dispatch negation switch.

3c1a. Set negation effect

3c1a1. CRA decides that a negation effect may occur and sets the Dispatch negation switch.

3c2. Resume at step 3.

Business Rules

R1. Default list is of open Dispatches which, in order of priority, are:
- Within the notice period
- Not yet in the notice period
- Being dispatched

R2. A Dispatch is considered to be closed once its period of dispatch is complete.

R3. Dispatches with associated constraints predicted by the PSA System will be highlighted.

R4. It must be possible for Control Room staff and Auditors to find, view lists of and select closed Dispatches.

R5. Dispatches with the potential for causing a negation effect will be highlighted.

3.5.3 BUC31 View NMF Contracts

DSO Control Room need to be able to see incoming messages regarding NMF contracts that have recently been struck and which may need checking.

Extends	None
Roles	Control Room Analyst (CRA)
Success Criteria	DSO has been able to make an informed decision on whether the contracts struck warrant further analysis or action.
Preconditions	None.
Trigger	CRA decides to view contracts struck.

Main Path

1. CRA has a list of contracts.
2. CRA selects a contract to view the details.
3. CRA views details of the contract.

Post Conditions

Control Room Analyst has been informed of the characteristics of the contracts.

Alternative Paths

1a. Contract has been previously identified

1a1. Resume at step 3.

3a. View contract details

3a1. CRA chooses to view details of a bilateral contract in the Contract Management system.

3b. Make a comment

3b1. CRA appends a comment to the Contract. Resume at step 3.

3c. Set investigation flag

3c1. CRA decides that the Contract may present a risk to the DSO network.

3c1a. Unset investigation flag

3c1a1. CRA decides that the Contract is unlikely to present a risk.

Business Rules

R1. Default list is of open contracts under investigation and then new Contracts which have been received in the previous fortnight.

3.5.4 BUC32 Manage WSC Constraints

Provides the user with facilities to view and update constraint data held in WSC.

Includes	BUC34 Select Constraint Solution
Roles	Control Room Analyst (CRA)
Success Criteria	DSO Control Room are aware of any constraints identified by the WSC and can make informed judgements for actions supported by WSC analytics.
Preconditions	None
Trigger	CRA decides to view the WSC constraints analysis functionality.

Main Path

1. CRA has a list of Constraints.
2. CRA selects a Constraint to view the details.
3. CRA view details of the Constraint.

Post Conditions

Control Room Analyst has been informed of the characteristics of the Constraint and any associated analytics.

Alternative Paths

1a. Constraint has been previously identified

1a1. CRA has navigated to this BUC with a particular Constraint already identified. Resume at step 3 for the Constraint indicated.

3a. View PSA constraint details

Post: CRA is navigated to the details of the Constraint in the PSA System.

3b. Close constraint

3b1. CRA chooses to close the Constraint.

3b1a. Reopen constraint

3b1a1. CRA chooses to reopen the Constraint.

3b1a2. CRA selects a reason for reopening the Constraint.

Post. The Constraint becomes relevant again.

3b2. CRA selects a reason for closure.

Post: The Constraint is no longer relevant.

3c. Set constraint priority

3c1. CRA selects a priority for the Constraint. Resume at step 3.

3d. View constraint solution

3d1. CRA selects a Constraint Solution to view the details. Resume at step 3.

3e. Request revised PSA analysis

3e1. CRA chooses to request a revised analysis for the Constraint from PSA.

3e2. System prepares an output data item for a PSA analysis refresh.

3e3. System follows BUC19 Outbound Message

Post. A request to PSA for a revised analysis has been sent.

3f. Make Comment

3f1. CRA adds a comment to the Constraint. Resume at step 3.

3g. Amend constraint solution

3g1. CRA selects a constraint solution to amend.

3g2. CRA alters the values of the selected constraint solution.

3g2a. Sensitivity factor estimate

3g2a1. CRA chooses to request a sensitivity factor estimate.

3g2a2. CRA sees the sensitivity factor estimate.

3g3. Resume at step 3.

3h. Activate constraint solution

3h1. CRA follows BUC34 Activate Constraint Solution

3i. Linked constraint

3i1. CRA adds a constraint to the list of linked constraints.

3i1a. Remove linked constraint

3i1a1. CRA removes a constraint from the list of linked constraints.

3i2. Resume at step 3.

3j. Cancel dispatch

3j1. CRA chooses to cancel a constraint solution dispatch.

3j2. System prepares an output data item for NMF to cancel the dispatch.

3j3. System follows BUC19 Outbound Message

Resume at step 3.

3k. Constraint Refresh

3k1. CRA chooses to request a refresh of all existing constraint analysis.

3k2. System prepares an output data item for a PSA constraint analysis refresh.

3k3. System follows BUC19 Outbound Message

Post. A request to PSA for a revised analysis for all existing constraints has been sent.

Business Rules

R1. Default list is of open constraints in order of priority and within that those with the most imminent start date.

R2. A Constraint is automatically deemed to be closed when its time period of constraint has passed.

R3. It must be possible for Control Room staff and Auditors to find, view lists of and select closed Constraints.

R4. Constraint solution values that are manually amend should be highlighted.

R5. Constraint solution values may not be activated or amended after the start of the constraint period.

R6. Requesting a revised constraint analysis from PSA should block changes to the Constraint until the revised constraint analysis has been received from PSA.

R7. Cancelling a constraint solution dispatch can occur due to, for example, a network re-configuration or unplanned outage being resolved. The dispatch can be either an intent to dispatch or an in-progress dispatch.

R8. A constraint refresh should only be necessary when a substantial re-configuration of the distribution network occurs. This could be a DSO Control Room response to, for example, a major unplanned outage. See also BUC82 Constraint Refresh

3.5.5 BUC33 View WSC Errors

DSO Control Room need to be able to see any data transfer errors.

Extend/Include	None
Roles	Control Room Analyst or Admin
Success Criteria	DSO Control Room are made aware of any failures related to WSC and have sufficient information to undertake mitigations.
Preconditions	None
Trigger	CRA decides to view WSC errors.

Main Path

1. Role has a list of WSC errors.
2. Role selects a WSC error to view the details.
3. Role views details of the WSC error.

Post Conditions

The Role has been informed of the characteristics of the WSC errors.

Alternative Paths

None

Business Rules

R1. Types of errors include:
- Invalid inbound transfer data
- Acknowledgement period timeout errors
- ANM information update failure
- Dispatch measurement failure

3.5.6 BUC34 Activate Constraint Solution

DSO Control Room are given an opportunity to select one or more of the available constraint solutions identified by WSC for activation. They may also decide to do other actions outside the scope of WSC, for example network reinforcement.

Included in	BUC32 Manage WSC Constraints
Includes	BUC19 Outbound Message
Roles	Control Room Analyst
Success Criteria	DSO Control Room have selected appropriate mitigations for the constraint.
Preconditions	WSC has completed the optimisation process for the constraint solutions.
Trigger	CRA decides to activate a constraint solution.

Main Path

1. CRA marks one or more constraint solutions as selected.
2. System executes the chosen solutions.

Post Conditions

Activation of selected solutions has begun.

Alternative Paths

1a Unset selection

1a1. CRA removes all the selection marks from the constraint solutions. Resume at step 1.

1b. Cancel selections

1b1. CRA chooses to cancel the selections made.

Post. Selections are removed and no activation takes place.

2a. Contracted ANM selected

2a1. System populates an ANM Dispatch Instruction output data item for DMS.

2a2. System follows BUC19 Outbound Message

2b. NMF Bilateral Contract selected

2b1. System populates a Bilateral Dispatch Request output data item.

2b2. System follows BUC19 Outbound Message

2c. NMF market request selected

2c1. System populates an Auto Request output data item for NMF.

2c2. System follows BUC19 Outbound Message

Business Rules

R1. Once the solution activation process has begun, it cannot be cancelled through WSC. A manual process would have to be followed:
- The contracting party for Contracted ANM would be contacted directly by CRA
- The contracting party for a Bilateral Contract would be contacted directly by CRA
- The NMF Request would have to be cancelled in NMF

R2. A Bilateral Dispatch Request is a correspondence sent to the Industry Actor that is the counter party to the DSO in the Bilateral Contract. It requests that the Industry Actor performs a dispatch based on the constraint solution. The relevant Industry Actor would then raise an Intent to Dispatch in NMF as per the normal NMF process for NMF Bilateral Contracts.

3.5.7 BUC35 Review ASC Waiver Requests

DSO Control Room need to be able to see any data transfer errors.

Includes	BUC19 Outbound Message
Roles	Control Room Analyst (CRA)
Success Criteria	.
Preconditions	None
Trigger	CRA decides to view requests from NMF Industry Actors for ASC waivers.

Main Path

1. CRA has a list of outstanding ASC waiver requests.
2. CRA selects a ASC waiver request to view the details.
3. CRA sees details of the ASC waiver request.
4. CRA chooses to approve of the ASC waiver request.
5. System prepares an output data item for NMF.
6. System follows BUC19 Outbound Message

Post Conditions

NMF Industry Actor has been informed of the decision regarding the ASC waiver request.

Alternative Paths

4a. Reject ASC request

- 4a1. CRA chooses to reject the ASC waiver request.
- 4a2. CRA provides a reason(s) for the rejection.

4b. Accept ASC request with caveats

- 4a1. CRA chooses to accept the ASC waiver request with caveats.
- 4a2. CRA provides details of the caveats.

Business Rules

R1. Default list is of ASC waiver requests is ordered by date starting with the oldest outstanding request first and more recent thereafter.

R2. It should also be possible to view lists of ASC waiver requests for which a decision has been made.

3.5.8 BUC36 Request Dispatch Measurement

It is of value that the WSC should know whether or not a dispatch of flexible power is successfully underway. To do this WSC needs a telemetry measurement immediately after the start time of the dispatch to compare with the intended capacity. Should the values not match then WSC can inform the DSO Control Room of the constraint and suggest solutions.

This BUC begins the dispatch measurement process. Subsequent processing is done through BUC12 DMS Inbound Processing

Extend/Include	None.
Roles	System.
Success Criteria	WSC is informed of the current state of a dispatch.
Preconditions	A NMF Intent to Dispatch has been raised.
Trigger	System checks for dispatches that need measurement.

Main Path

1. System determines that a dispatch should be measured.
2. System prepares an output data item for DMS requesting a measurement.
3. System follows BUC19 Outbound Message

Post Conditions

The DMS receives a message requesting a dispatch measurement.

Alternative Paths

None.

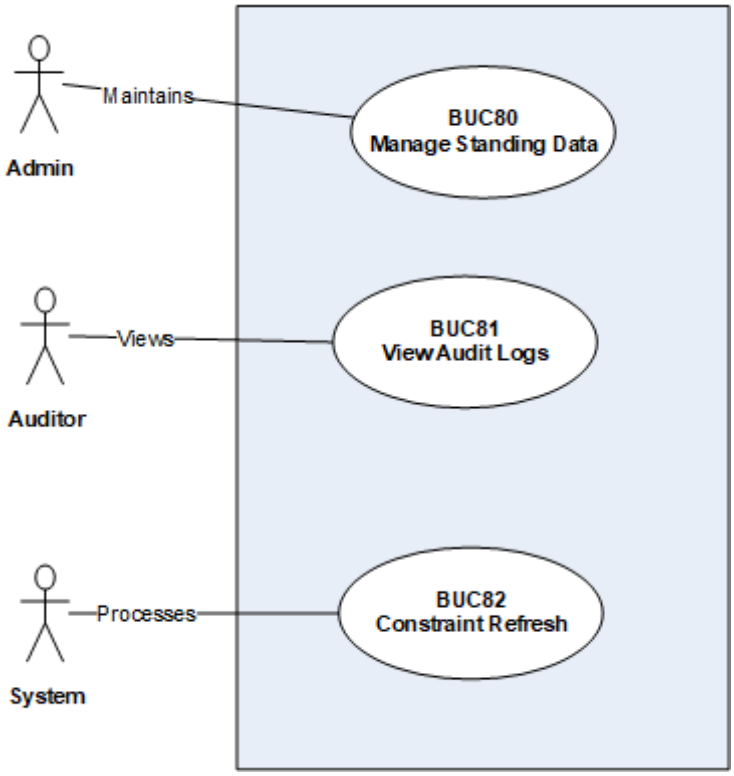
Business Rules

R1. A dispatch measurement should be requested at a system-defined time after the start time of a dispatch.

R2. Not all energy resources have the necessary telemetry capability to make real time measurements possible for a DSO. WSC does not raise measurement requests for these resources.

3.6 Package D: Miscellaneous

3.6.1 This package contains various BUCs which don't have a clear home in any of the other packages.



3.6.2 BUC80 Manage Standing Data

Various standard codes and associated data are used in WSC. These standing data need to be maintained over the long term to accommodate changes when they occur.

Extend/Include	None.
Roles	Admin.
Success Criteria	WSC continues to function correctly following the standing data amendments.
Preconditions	None.
Trigger	Admin navigates to the standing data management capability.

Main Path

1. Admin selects the data set to be managed.
2. Admin selects a data item from a list of items.
3. Admin changes the selected data item.
4. Admin sees the changed data item in the list.

REPEAT 2 to 4 until changes complete.

Post Conditions

All changes to the chosen data set are completed.

Alternative Paths

2a. Add a data item

- 2a1. Admin chooses to create a new data item.
- 2a2. Admin enters the date on which the data item comes into use.
- 2a3. Admin enters the data items details.
- 2a4. Admin sees the new item in the list. Resume at step 2.

2b. Mark a data item as not used

- 2b1. Admin provides the last date on which the data item is to be used.
- 2b2. Admin sees the marked data item in the list. Resume at step 2.

Business Rules

R1. The maintenance of standing data should be easy to use for a non-technical administrator.

R2. The standing data that should be amended through this process includes:

- PSA output rules.
- Forecasting output rules.
- Commercial output rules.
- PSA input rules.
- Forecasting input rules.
- …

3.6.3 BUC81 View Audit Log

This BUC provides for a means by which an auditor can examine all actions affecting WSC.

Extend/Include	None.
Roles	Auditor.
Success Criteria	Auditor has gained an appropriate understanding of the history of changes made in the WSC.
Preconditions	Auditor has a need to review the audit log of one or more aspects of the WSC.
Trigger	Auditor navigates to the audit log viewing capability.

Main Path

1. Auditor selects an audit log to review.
2. Auditor views the content of the audit log.

Post Conditions

Auditor has found the audit data sought.

Alternative Paths

2a. Sort/filter audit log list

2a1. Auditor chooses criteria to sort and/or filter the audit log. Resume at Main Path 2.

2b. Export audit log

2b1. Auditor chooses to export the audit log with the current sort/filter criteria applied to a file on their workstation. Resume at Main Path 2.

Business Rules

R1. Default is most recent action first.

R2. Should include:
- Sequence number
- Date/time
- User identifier
- Function used
- Action performed
- Data item(s) impacted (eg field label, document ID)

R3. Before/after values for data items are not required.

3.6.4 BUC82 Constraint Refresh

Changes to Constraints can occur outside of the scope of WSC, for example where the distribution network has been re-configured to help mitigate the constraint. This BUC provides a means by which WSC can be updated for all changes to PSA constraint information.

Includes	BUC19 Outbound Message
Roles	System.
Success Criteria	WSC can provide accurate analysis for the DSO Control Room.
Preconditions	None.
Trigger	Time.

Main Path

1. System prepares an output data item for a PSA constraint analysis refresh.
2. System follows BUC19 Outbound Message

Post Conditions

The WSC database has up to date Constraint data.

Alternative Paths

None.

Business Rules

R1. It must be possible to set this BUC to execute on a periodic basis.

4 Management Reports

4.1 Introduction

This chapter outlines the management reporting requirements for WSC. It is organised into two sections:

a) The Required Reports section outlines the content of the required management reports.

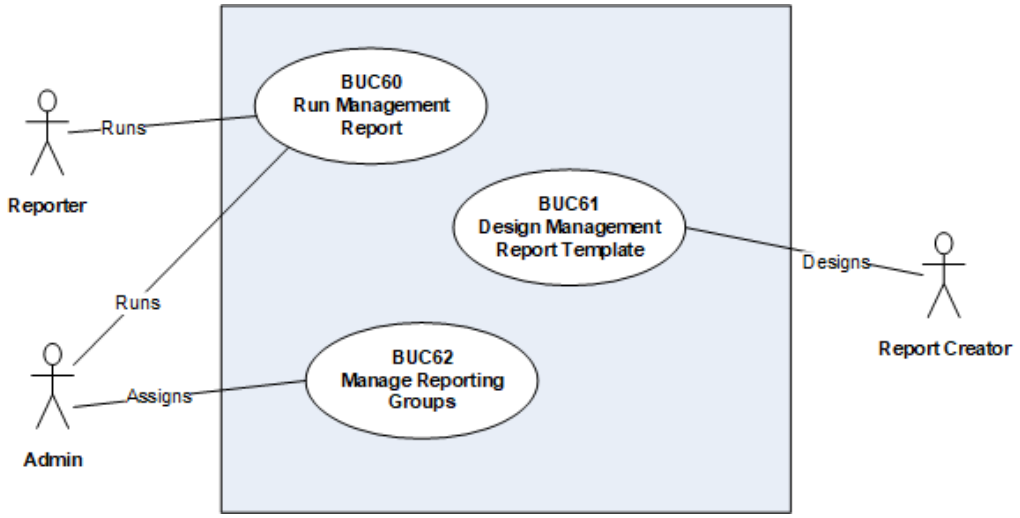
b) The Use Cases section gives the BUCs illustrating the functional elements of producing management reports within the WSC system.

4.2 Required Reports

4.2.1 Not yet defined.

4.3 Use Cases

4.3.1 The diagram below illustrates the relationships between the set of BUCs relating to WSC management reporting.



4.3.2 BUC60 Run Management Report

Complex reports, statistical reporting and dashboard type reports need to be produced. This BUC addresses the need for executing these more complex reports as pre-designed templates suitable for use by non-specialist staff.

Extend/Include	None.
Roles	Reporter, Admin.
Success Criteria	Information has been produced that enhances management decision making.
Preconditions	A management report is needed.
Trigger	Reporter navigates to the Management Reports capability.

Main Path

1. Reporter selects report template to run.
2. Reporter enters run time criteria.
3. Reporter chooses protective marking for the output.
4. Reporter sees report output.

Post Conditions

The report output is saved for future viewing.

Alternative Paths

1a. View saved report

1a1. Reporter selects a previously run report to view its output. Resume at step 3.

1b. Delete report

1b1. Reporter selects a previously run report to delete.

Post. The selected report is deleted.

2a. Background report

2a1. Reporter chooses to run the report in background.

Post. The report is executed and output saved for future viewing.

2b. Future report

2a1. Admin sets a date and time when a report must be run.

Post. Admin can view the report output after it has been run at the designated time.

2a1a. Recurring report

2a1a1. Admin sets a recurring pattern of execution for the report.

Post. Admin can view the report output after each designated execution.

4a. Drill down

4a1. Reporter chooses to view details of summary report data. Resume at step 3.

4b. Download report

4b1. Reporter chooses a format for the downloaded report.

4b2. Reporter has a file containing the report output saved on their workstation. Resume step 3.

Business Rules

R1. Report output must include the run time criteria used in its execution.

R2. The default file format for report output is Adobe Acrobat (.pdf). It should also be possible to download in Microsoft Excel format.

R4. Report criteria options must be presented in a graphical manner and not be dependent on Reporter understanding a query language such as SQL.

R5. Reporter will only be able to run reports to which they have been granted access (see BUC61 Design Management Report Template).

4.3.3 BUC61 Design Management Report Template

It is likely that, over time, it will become necessary to create new management report designs.

Extend/Include	None.
Roles	Report Creator (RC).
Success Criteria	A report template becomes available for others to execute.
Preconditions	The specification of a new or amended report template is made available to RC.
Trigger	RC navigates to the management report design capability.

Main Path

1. RC selects a report template from a list of report templates.
2. RC designs the report template.
3. RC chooses a group of reporters with which to share the report template.

Post Conditions

Reporters can produce reports based on the report template.

Alternative Paths

1a. Create a report template

1a1. RC chooses to create a new report template. Resume at step 2.

1b. Copy a report template

1b1. RC selects an existing report template to copy.

1b2. RC resume at step 2 with the copied design.

2a. Withdraw report template

2a1. RC marks the report template as withdrawn.

Post. Reporters can no longer produce reports based on the withdrawn template.

3a. Report template is incomplete

3a1. RC chooses not to share the report template.

Post. Revised report template is not available to Reporters.

3b. Test a report template

3b1. RC chooses to undertake a test execution of the template.

3b2. RC reviews the output of the tested report template. Resume at step 2.

Business Rules

R1. The report design capability should be primarily graphical in nature. Both data selection and output presentation design should be performed through a graphical user interface.

R2. A report designer should not have to have knowledge of SQL, HTML or other data manipulation languages to successfully prepare a report template.

R3. It should be possible to limit sharing of a report template to named Reporter groups. Reporter groups are those processed through BUC62 Manage Report Groups.

4.3.4 BUC62 Manage Reporting Groups

This BUC addresses the granting of rights to access management report designs by assignment to reporting groups.

Extend/Include	None.
Roles	Admin.
Success Criteria	Individuals have the appropriate level of access to the management reporting capability.
Preconditions	Changes to access rights to management reports are needed.
Trigger	Admin navigates to the management report administration capability.

Main Path

1. Admin selects a reporting group.
2. Admin adds/removes Reporters from the group.

Post Conditions

Reporters have access to the reporting capabilities they have been granted.

Alternative Paths

1a. Create reporter group

1a1. Admin chooses to create a new reporting group. Resume at step 2.

2a. Drop reporter group

2a1. Admin chooses to drop the reporting group.

Business Rules

R1. There should always be a Report Creator group which cannot be dropped and grants access to the facilities outlined in BUC61 Design Management Report Template.

5 Non-Functional Requirements

5.1 Volumetrics

5.1.1 Volumetric information is not yet known for the TRANSITION trials. However, it is expected that the trials will only have a small number of Industry Actors and small volumes of data.

5.2 Audit & Compliance

5.2.1 All additions, changes and deletions of data in the WSC will generate a clear audit trail of the events.

5.2.2 The audit trail(s) must be readily accessible to appropriate reviewers and be provisioned with tools to allow selective analysis.

5.3 Security

5.3.1 Users of WSC are assumed to be accessing the system through a browser from an appropriately secured network and location.

5.3.2 Security aspects of the WSC system will be specified by SSEN.

5.4 Service Management & Continuity

5.4.1 Service management for the TRANSITION trials will be dealt with by SSEN.

5.4.2 Any cloud based solution hosted outside of SSEN must submit to a service level agreement with SSEN.

5.4.3 Availability early in trials does not have to be very high or strict. However, as the trials progress, the WSC must demonstrate improved availability.

5.5 Archiving

5.5.1 The TRANSITION trials have no specific data archiving requirements.

5.6 Data Migration

5.6.1 No automated data migration from existing systems to the WSC is expected for the TRANSITION trials. Any data needed by the WSC will be dealt with the TRANSITION trials team.

5.7 Training

5.7.1 No specific training is expected to be needed for the TRANSITION trials.

6 Appendices

6.1 TBBM Guide

6.1.1 Overall Structure

6.1.1.1 A Requirement Specification (RS) usually contains three core chapters plus other supporting chapters and appendices as necessary:

a) As-Is Business Model

b) To-Be Business Model

c) Requirements Catalogue

6.1.1.2 The core chapters are described in the following sub-sections.

6.1.2 As-Is Business Model

6.1.2.1 The As-Is Business Model (AIBM) describes the relevant existing business processes within an organisation. The intent is to provide a baseline from which a To-Be Business Model (TBBM) may be developed. The best scenario is that an existing up-to-date AIBM can simply be referenced. Otherwise the AIBM chapter should be finished and approved before the TBBM is written.

6.1.2.2 Where there are no existing business processes, the AIBM is usually minimal.

6.1.2.3 Where there are existing processes it is common that, due to time pressures, the preparation of the AIBM and TBBM overlap once the AIBM is thought to be reasonably well understood.

6.1.2.4 Sections in the AIBM mirror those of the TBBM.

6.1.3 To-Be Business Model

6.1.3.1 The TBBM is the heart of the requirement. It describes the functional business processes, management reports and non-functional requirements needing support by an IT system. Sections usually include:

a) **Business Context** – defines of the scope boundary of the TBBM and the relationship of the TBBM with the rest of the business and external entities. The section will include a diagram of the context. It will be supported by an Information Exchange Requirement (IER) providing a more detailed analysis of flows of data to and from the scope boundary. The IER is usually a spreadsheet presented as an annex to the RS.

b) **High Level Process** – a diagram and brief commentary on the major business processes addressed by the TBBM. The intent is to ensure that the reader can see the “big picture”.

c) **Roles** – the set of business roles needed for the TBBM. These roles play a crucial part in ensuring actions taken in Business Use Cases (BUCs) are attributed to specific groups of people. Roles are central to defining Role Based Access Control (RBAC) for an IT system, influence user training needs and are important in volumetric estimates.

d) **Domain Model** – a diagram showing the data domain of the TBBM. It provides a different view of the TBBM focused on data structures and relationships. It is particularly important for management reporting and database sizing. The diagramming style is similar to a Universal Modelling Language (UML) Class diagram or, alternatively, a Logical Data Structure diagram. Attributes may be recorded but not methods. The diagram is supported by a description of the entities identified in the diagram.

e) **Locations** – a description of the physical and network locations which are expected to be impacted by the TBBM. The locations information is important primarily for non-functional aspects of the TBBM such as physical implementations, service management, business change and training.

f) **Business Use Cases** – BUCs are the core description of TBBM functional business processes requiring IT support. This section consists of a series of use cases divided into logical packages and supported by UML Use Case diagrams. The use cases are written from the perspective of identifying TBBM requirements in a business goal context. They do not specify a technical solution and indeed aim to be solution neutral.

g) **Workflow** – one or more diagrams illustrating the major business life cycle(s) within the TBBM. The diagrams are in Business Process Modelling Notation v2 (BPMN) style using swim lanes. The BPMN diagrams can be quite extensive and so are normally annexed. The workflow diagrams aim to provide a complimentary view of the TBBM to that provided by the BUCs and the Domain Model.

h) **Management Reports** – a series of outline specifications of the management reporting required for the TBBM. It normally does not include simple lists for day-to-day operational support which would be specified in the BUCs. Instead this section commonly identifies statistical reporting (including performance indicators and dashboards) supporting senior management decision making.

i) **Non-Functional Requirement** – this section contains those business requirements which cannot easily be specified as functional requirements (ie in the BUCs) but nonetheless have significance (often global) to the TBBM. Typically this section is divided into various sub-sections, for example:

(i) Audit & Compliance
(ii) Security
(iii) Safety
(iv) Service Management & Business Continuity
(v) Archiving
(vi) Data Migration
(vii) Training
(viii) Business Change

6.1.4 Requirements Catalogue

6.1.4.1 The Requirements Catalogue is a spreadsheet that distils the detail of the TBBM into short, precise statements of requirement. These can then be supplemented with additional information such as prioritisation, solution compliance statements and testing results.

6.1.4.2 The purpose of the Requirements Catalogue is to provide an audit trail tracing the compliance of a solution against the requirements specified in the TBBM. It is an

essential tool during procurement of a solution and during the testing phases of the chosen solution.

6.1.5 Context Diagram

6.1.5.1 The Context Diagram is the top level of a Data Flow Diagram. Dating back to the 1960s, this type of diagram is one of the oldest techniques used to analyse IT systems. They featured as one of the core techniques in the UK Government's SSADM approach to analysis in the 1980s and 1990s.

6.1.5.2 For Requirement Specifications, the Context Diagram provides an overarching view of the external circumstances of the subject of the RS. In this sense they provide a way of viewing the scope boundary of the RS. In particular, the Context Diagram outlines how the subject of the RS interacts with external entities through flows of data into and out of the scope boundary.

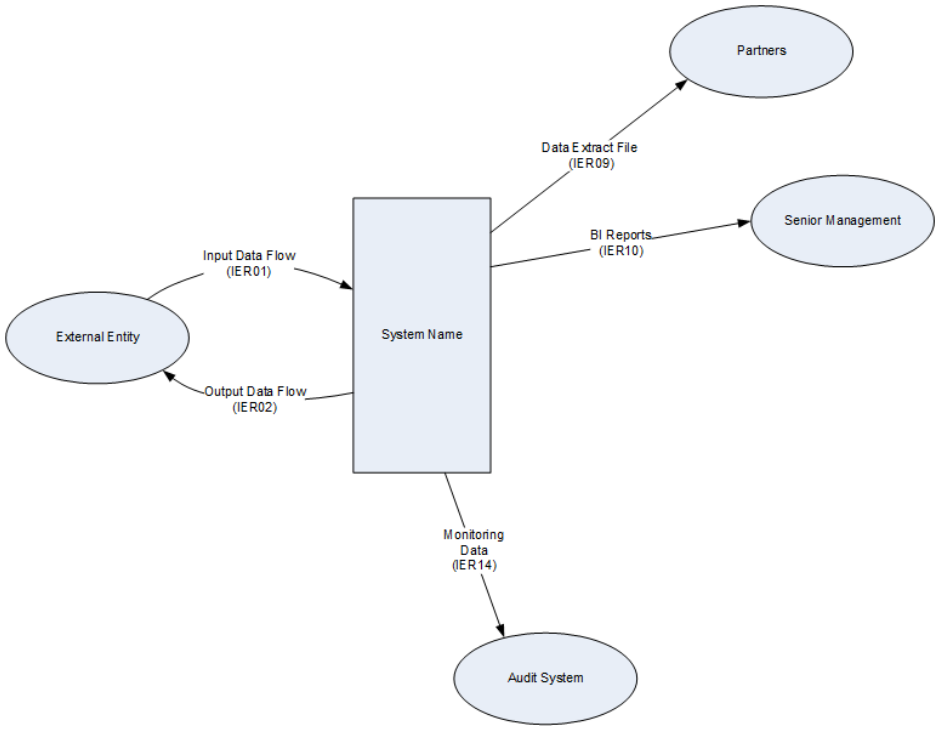
6.1.5.3 A Context Diagram should be supported by descriptions of the external entities in the diagram and the significant flows of data. Data flows might include:

(i) Correspondences, eg paper documents, emails, reports etc
(ii) Batch files of data
(iii) Direct process to process data transfers for real time interactions

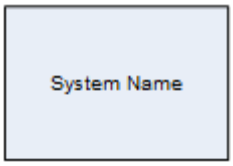
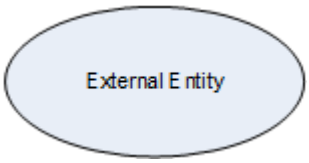
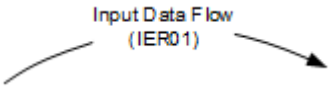
6.1.5.4 The analyst may also choose to support a Context Diagram with an Information Exchange Requirement (IER) to provide a summary of the data flows. This is commonly a spreadsheet provided as an annex to the RS. Where necessary due to quantity or complexity of data flows, a single data flow in the Context Diagram might represent a number of different data items (particularly correspondences) which are fully enumerated in the IER.

6.1.5.5 It is important that each data flow has an associated BUC(s) reference defining the processing and business rules applicable to data flow.

6.1.5.6 The following is an example of a Context Diagram:



6.1.5.7 The diagram has a very small number of symbols:

Symbol	Description
	The central rectangular symbol identifies the subject of the RS. It represents the scope boundary of the RS. There must be exactly one of these symbols in a Context Diagram.
	Ovals represent entities that are external to the scope of the RS, but with which the RS is either a consumer or producer of information. Each entity must be unambiguously named. A given named entity may appear more than once in the Context Diagram provided it has precisely the same name as its counterpart. Generally entities do not include Roles defined elsewhere in the RS as these are by definition in scope. However this is not an absolute rule. For example, a defined Role might download a data file for further processing outside of the RS scope. This data flow should be noted in the Context Diagram.
	The arrow symbols represent data flows, with cardinality determined by the direction of the arrow. The data flow must be named. The name may represent more than a single instance of a data flow (for example different correspondences) provided that the instances are clearly defined elsewhere, typically in an IER.

6.1.6 Roles & Role Inheritance

6.1.6.1 A role is a label given to a set of capability and permissions held by an individual in a BUC. Roles can appear in both the AIBM and TBBM. The scope does not extend beyond the parent business model unless explicitly stated. Thus, for example, where a role is stated in the AIBM and is retained in the TBBM, the TBBM should make this clear and note any changes to the AIBM role.

6.1.6.2 It is important to understand that a role is a simple abstraction for the parent business model. It does not imply an equivalent job title in the organisation specifying the requirements. Translating these abstractions into real job titles/capabilities would be part of the business change plan that implements the TBBM.

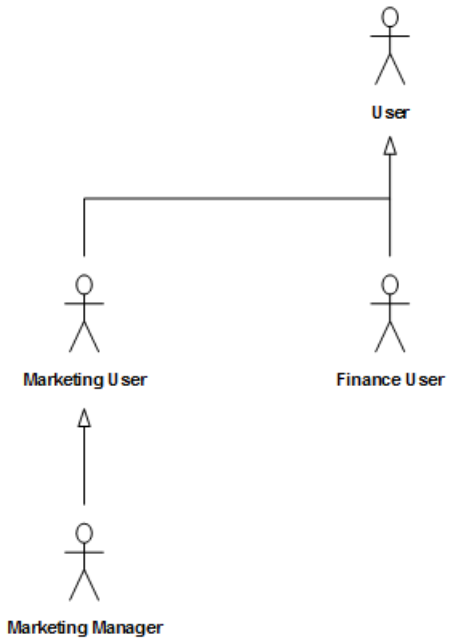
6.1.6.3 Roles are usually shown in a table in the business model consisting of the role name, a brief description of the role and other relevant details. Typically a role will have a short, reasonably appropriate name relevant to the AIBM and TBBM. Abbreviations are acceptable and often used as a means of avoiding longwinded role names.

6.1.6.4 The Primary Role in a given user goal BUC should have all the capabilities and permissions needed complete all the Main Scenario business process steps and related rules in the BUC. This may be relaxed for high level BUCs describing, for example, workflows.

6.1.6.5 A Secondary Role should hold the capabilities and permissions needed to complete the business process steps and rules ascribed to that role. Typically steps for Secondary Roles will appear in the Extension clauses in BUCs.

6.1.6.6 A role "System" should not appear in the Role table. If it proves necessary to have a "System" role (note, not "The System") then it has magical and unlimited capabilities and permissions. Which is one of the reasons why it shouldn't appear.

6.1.6.7 Roles are commonly found to be hierarchical. To avoid duplication of role descriptions in a hierarchy, higher level roles can be said to inherit the characteristics and permissions of a lower level role. This is represented in the Requirement Specification by a Role Inheritance Diagram, for example:



6.1.6.8 In the example, the Marketing User and Finance User roles inherit permissions and characteristics from the User role. However the Marketing Manager inherits only from Marketing User.

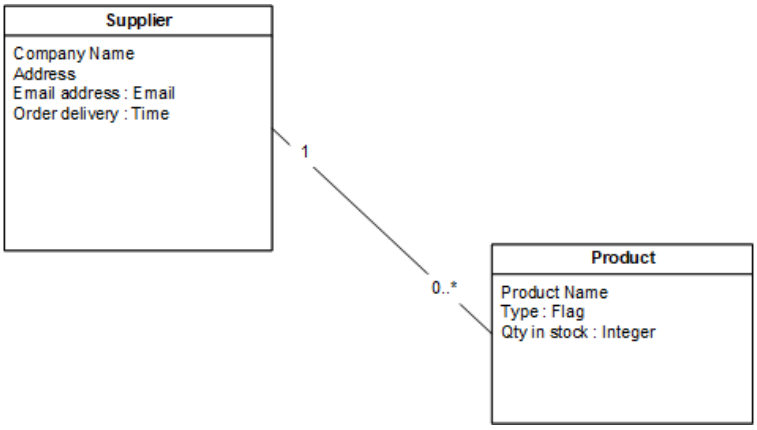
6.1.6.9 In the BUCs, a role of Marketing User may follow any steps assigned to the User role, and the Marketing Manager can in turn follow any steps assigned to a Marketing User. However neither of these roles (or the User role) may follow steps assigned to the Finance User role.

6.1.6.10 Inheritance from more than one lower level role is OK but is discouraged. It can lead to some confusion and even circular inheritance in complex situations.

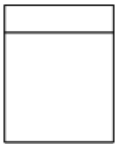
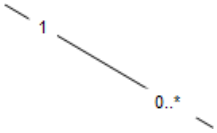
6.1.7 Domain Model

6.1.7.1 The Domain Model is a conceptual data model of the domain of data manipulated by the TBBM. It is conceptual in that it doesn't represent an actual set of data, but instead indicates the general set of data which a solution design should take into account. It is intentionally simplified in order to give a good overview of the data set without becoming pedantic regarding purely technical structures. The intent is that it should be reasonably easy to grasp for a reviewer without needing specialist data modelling skills.

6.1.7.2 The diagram technique employed for the Domain Model in the TBBM is a version of the UML Class diagram. For example:



6.1.7.3 The symbols used for the Domain Model diagram are as follows:

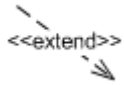
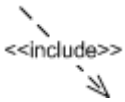
Symbol	Description
	**Entity**. Each entity is a container having an entity name (in the upper rectangle) and a collection of data attributes (in the lower rectangle). Entity names and attribute names should be easily recognisable as their real world equivalents. Each attribute can optionally have a data type indicator, which is separated from the attribute name by a colon. Data types can be as simple as a number or a date, or more complex, for example a document or a list of items.
	**Relationship**. Entities can be linked by relationships. The entities are joined by a line which has a note of the nature of the relationship at each end. In the example diagram above, a Supplier may have zero or more (0..*) Products, whereas a Product must always have exactly one Supplier.

6.1.7.4 The Domain Model may also be supported by a Data Dictionary. The Data Dictionary aims to provide more details regarding each data attribute. This is often presented as a spreadsheet annexed to the Requirement Specification document.

6.1.8 Business Use Cases

6.1.8.1 Business Use Case are usually organised into packages of related BUCs. These packages are summarised with a standard UML Use Case diagram. The BUC diagrams have five symbols. Note that the box enclosing the use case oval symbols is merely a diagramming motif and does not have any special significance.

Symbol	Description
	Roles in BUCs are represented by stick figure symbols in a BUC diagram, the symbol being named for the corresponding role. BUCs that appear in a diagram will usually have at least one role (the primary) associated with it (see below). Secondary roles may also be indicated.

Symbol	Description
	An oval symbol indicates the named BUC, full details of the BUC being provided by the similarly named textual section. A BUC symbol will normally be associated with at least one Actor and may have zero or more extensions and inclusions.
	Indicates the association of an Actor with a particular BUC. It may be labelled with the main action performed in the BUC by the Actor.
	An extension to a BUC is symbolised by the dashed arrow. The arrow points from the extension BUC to its parent. Extensions points will always be listed in the parent BUC, usually as an Alternative Path.
	BUCs that are included in other BUC use a similar dashed arrow as extensions. However the arrow points from the parent to the BUC that is to be included. The parent BUC will always note where inclusions appear in either the Main or Alternative Paths.

6.1.9 BUC Structure & Content

6.1.9.1 Each BUC describes a specific scenario of goal-driven actions for a primary Actor. This is termed the Main Path. The Main Path begins with a trigger and ends with attainment of the goal. Alternative Paths provide process variations of significance from the Main Path which may result in attainment of other related goals. Business Rules in each BUC describe features of the business process that support or constrain the achievement of the goal.

6.1.9.2 BUCs usually aim to be solution agnostic. They try to describe the processing that must be done and rules that apply without reference to a particular technology. This widens the possible set of solutions and thus improves the chances of finding an optimal solution. However in the real world there are often technical or architectural constraints with which the BUCs must be consistent.

6.1.9.3 BUCs are intentionally high level and do not, for example, normally describe details of error conditions and user interface features. The need to express a “System” role processing step generally means too much detail. A BUC describes business processes and rules, not the implementation functionality that will support it. That said, and given IT is often ubiquitous to business processes in the world of today, it is some necessary to mention “System”.

6.1.9.4 BUCs should contain more or less grammatical sentences, but are intentionally written in a terse and precise style. Lots of words can easily lead to confusion about the exact meaning of those words.

6.1.10 BUC Clauses

6.1.10.1 The following section explains the purpose and meaning of each clause of a BUC.

Clause	Description
Level	High Level or User Goal. All BUCs should be fairly high level and not describe fine details of activities. Most BUCs should be User Goal. High Level BUCs tend to be things like descriptions of the main steps in a workflow.

Clause	Description
Title	Of the form: "BUC99 Title". The BUC number is purely to provide a unique identifier. BUC numbers do not imply a relationship with other BUCs nor a processing sequence.
Description	The description is usually an opportunity to put the BUC in a business context. It should be concise and should not repeat information found elsewhere in the BUC. It is perfectly acceptable that no description clause is included. It is important that the description does not contain any statements that could be considered a requirement. Requirement statements should be placed in one of the other clauses of the BUC.
Extends Included in	This clause(s) indicates child relationships with other BUCs to aid traceability. Both extend and include imply that the BUC isn't executed in isolation but in the context of the parent BUC noted in this clause. The difference between extend and include is somewhat theological. Non-specialists reviewers can usually ignore this subtlety.
Extended by Includes	Denotes the corresponding parent relationship as above. Adding Extended/Included BUCs is a technique often used to: • break up a large or complex BUC into smaller, more digestible parts; or • avoid repeating similar chunks of business processes also found elsewhere in other BUCs.
Roles	Roles are the participants in the BUC. They are denoted by their role as found in the Roles section of an As-Is or To-Be business model. The first named role is termed the Primary Role. On normal completion of the BUC, the Primary Role should accrue the benefits of the Success Criteria below. Secondary Roles may also be present. They participate at specific points in the BUC and do not necessarily gain the benefits of the Success Criteria.
Success Criteria	Arguably the most important element of a BUC as it defines its purpose. This clause should answer the question "What does success look like?". The focus of the BUC is in achieving this goal. This should be stated in business terms. It should not merely be a repetition of the Post Conditions.
Pre-conditions	This clause sets the BUC in context. It lays out the circumstances (in business terms) which must be present for the execution of a BUC to begin. In practise to avoid tiresome repetition, pre-conditions that are widely applicable are usually placed in a "General BUC Rules" section of documents presenting BUCs. Well stated pre-conditions are important for accurate testing of a BUC, for example during a UAT.

Clause	Description
Trigger	This clause states the event that causes the BUC to start. This is not the same as the pre-conditions which set the context for the trigger to occur. There must be at least one trigger event, and one event only is the norm. More than one trigger is acceptable, but multiple triggers often implies the underlying business processes aren't well understood.
Main Path	These are the process steps that are the road to the Success Criteria. They must be followed, usually by the Primary Role, in the sequence defined within this clause unless clearly stated otherwise. There must be at least one Main Path step in a BUC. More than 8 steps is rare, and a single step is not uncommon. Each step should begin by denoting an Actor and describes an action taken by the Role. By convention references to other BUCs that are included in a step are underlined.
Post Conditions	The end of the journey to the Success Criteria. There must be at least one Post Condition, and possibly several. However more than two tends to suggest that the BUC is trying to do too many things and may be a candidate for breaking up. Much as for Pre-conditions, accurate Post Conditions are important in testing.

6.2 Information Exchange Requirement

6.2.1 The Information Exchange Requirement given in the table below supports the Context Diagram (§2.3) The columns of the IER have the following meanings:

(i) **ID** A unique Identifier for each dataflow. The whole numbers (eg 02) are as found in the Context Diagram of the WSC Requirement Specification. In some cases, these are broken down into multiple similar content (eg 02.01 and 02.02).
(ii) **Information** A brief description of the dataflow content.
(iii) **I/O** Whether the dataflow is inbound to, or outbound from, WSC.
(iv) **From** The external entity name (or WSC Role name) sending the information.
(v) **To** The external entity name (or WSC Role name) receiving the information.
(vi) **Send** The BUC that is responsible for initiating to an outbound dataflow.
(vii) **Receive** The BUC that is responsible for consuming an inbound dataflow.
(viii) **Data Summary** A summary of the main data items contained in the dataflow. Where these are related to data entities from the Domain Model (§2.5), the name of the data entity is enclosed in square brackets, for example [Energy Resource]. Depending on the business purpose of the dataflow, only a subset of attributes of the Domain Model entity may be include.

6.2.2 Automatic acknowledgements by external entities of the receipt of a message from WSC are not noted below. External entities should provide these acknowledgements for all WSC outbound data flows.

ID	Information	I/O	From	To	Send	Receive	Data Summary
01	Contract Struck						
01.01	Contract Struck	In	NMF	System		BUC11	
01.02	Contract Cancelled	In	NMF	System		BUC11	
02	Sensitivity Estimate	Out			BUC11		
02.01	Request Sensitivity Estimate	Out	System	Power System Analysis	BUC11 BUC32		
02.02	PSA Sensitivity Estimate	In	Power System Analysis	System		BUC13 BUC32	
03	Forecast for ESO	In	Forecasting	System		BUC15	
04	Forecast	Out	System	ESO::WSC	BUC15		
05	Proof of Dispatch	In	NMF	System		BUC11	
06	NMF Proof of Dispatch	Out	System	Commercial	BUC11		

ID	Information	I/O	From	To	Send	Receive	Data Summary
07	Intent to Dispatch						
07.01	Intent to Dispatch	In	NMF	System		BUC11	
07.02	Intent to Dispatch Cancelled	In	NMF	System		BUC11	
08	NMF Intent to Dispatch	Out	System	Power System Analysis	BUC11		
09	Constraint Analysis						
09.01	Constraint Analysis Request	Out	System	Power System Analysis	BUC11		
09.02	Constraint Analysis	In	Power System Analysis	System		BUC13	
09.03	Revised Constraint Analysis Request	Out	System	Power System Analysis	BUC32		
11	Auto Request	Out	System	NMF	BUC10 BUC34		
13	Constraint Solution Request						
13.01	Constraint Market Estimate Request	Out	System	NMF	BUC13		
13.02	Constraint Bilateral Solution Request	Out	System	NMF	BUC13		
13.03	NMF Market Estimate	In	NMF	System		BUC20	
13.04	NMF Bilateral Contract Solution	In	NMF	System		BUC20	
14	ANM Config	In	DMS	System		BUC12	
15	NMF Sensitivity Estimate						
15.01	NMF Sensitivity Estimate Request	In	NMF	System		BUC11	
15.02	NMF Sensitivity Estimate Response	Out	System	NMF	BUC13		
16	Control Room Dispatch	In	DMS	System		BUC12	
17	ANM Dispatch Instruction	Out	System	DMS	BUC34		
18	Bilateral Dispatch Request	Out	System	Industry Actor	BUC34		
19	ASC Waiver						
19.01	Request to Exceed ASC	In	NMF	System		BUC11	
19.02	Cancellation of Request to Exceed ASC	In	NMF	System		BUC11	
19.03	ASC Waiver Request Decision	Out	System	NMF	BUC35		
20	ASC Waiver Impact						
20.01	ASC Waiver Impact Request	Out	System	Power System Analysis	BUC11		

ID	Information	I/O	From	To	Send	Receive	Data Summary
20.02	ASC Waiver Impact Analysis	In	Power System Analysis	System		BUC13	
21	Export List / Report Data	Out	System	User			PDF or Excel format
22	Constraint Solution Estimate						
22.01	Constraint Solution Estimate Request	Out	System	Power System Analysis	BUC11		
22.02	Constraint Solution Impact Analysis	In	Power System Analysis	System		BUC13	
23	Measure Dispatch						
23.01	Request Dispatch Measurement	Out	System	DMS	BUC36		
23.02	Dispatch Measurement	In	DMS	System		BUC12	
23.03	Dispatch Cancelled	In	DMS	System		BUC12	
24	Constraint Refresh						
24.01	Constraint Refresh Request	Out	System	Power System Analysis	BUC82		
24.02	Revised Constraints	In	Power System Analysis	System		BUC82	
25	Cancel Dispatch	Out	Control Room Analyst, System	NMF	BUC32 BUC82		

6.3 Domain Model Data Dictionary

6.3.1 The Data Dictionary given in the table below supports the Domain Model (§2.5) by providing additional information about the attributes in each entity. A glossary of the data types can be found immediately after the Data Dictionary table.

Entity	Attribute	Data Type	Description	Values	CIM Equivalent
Industry Actor	Type	Flag	Type of IA	DSO, ESO, Aggregator, Trader, etc.	
Industry Actor	Name	Text	Name of the IA		
Industry Actor	Reliability	Percent	Rating of past reliability in completion of dispatches.		
Energy Resource	Status	Switch	Current status of an energy resource.	Active, Retired	
Energy Resource	Created	Date	The date on which the energy resource is added to the IA holding.		
Energy Resource	Retired	Date	The date on which the energy resource is removed from the IA holding.		
Energy Resource	Name	Text	The name of the energy resource.		
Energy Resource	Total power max	kVA	Maximum total power supplied/removed by the energy resource.		
Energy Resource	Total power min	kVA	Minimum total power that can be supplied/removed by the energy resource.		
Energy Resource	Total power variance	Percent	Maximum expected variance in the total power uniform capacity of the energy resource.		
Energy Resource	Active power max	kW	Maximum active supplied/removed by the energy resource.		
Energy Resource	Active power min	kW	Minimum active power that can be supplied/removed by the energy resource.		
Energy Resource	Active power variance	Percent	Maximum expected variance in the active power uniform capacity of the energy resource.		
Energy Resource	Reactive power max	kVAr	Maximum reactive power supplied/removed by the energy resource.		
Energy Resource	Reactive power min	kVAr	Minimum reactive power that can be supplied/removed by the energy resource.		
Energy Resource	Reactive power variance	Percent	Maximum expected variance in the reactive power uniform capacity of the energy resource.		
Energy Resource	Maximum service time	Time	The maximum length of time that the energy resource can provide its capacity.		

Entity	Attribute	Data Type	Description	Values	CIM Equivalent
Energy Resource	Minimum notice period	Time	The amount time needed to prepare the energy resource for a dispatch.		
Energy Resource	Arming time	Time	The time within the Minimum Notice Period in which the energy resource becomes committed to dispatch prior to ramping up. For example the time needed to gather together appropriate engineering staff prior to power on.		
Energy Resource	Ramp up time	Time	The time within the Notice Period in which the energy resource is "warming up".		
Energy Resource	Ramp down time	Time	The time needed for the energy resource to "warm down" following a dispatch.		
Energy Resource	Options	Flag	Dispatch options available for the energy resource.	Standard system options and resource specific options should be possible.	
Energy Resource	MPAN	MPAN	The MPAN of the energy resource.		
Energy Resource	Approved supply capacity	kW	The limit imposed by the DSO on the amount of power the energy resource may provide to the distribution network. To exceed this limit requires a formal request to the DSO.		
Energy Resource	ASC waiver	List	ASC waiver decisions made by DSO that apply to energy resource.	See BUC35	
Energy Resource	Region	Flag	One of the regional electricity distribution networks.	Each of the 14 licenced distribution networks.	
Energy Resource	Geographic location	Coordinates	The physical location of an energy resource.		
Dispatch	Message received	Date/Time	Date and time at which WSC received the NMF Intent to Dispatch.		
Dispatch	Start time	Date/Time	Date and time of the start of the dispatch.		
Dispatch	Duration	Time	Contiguous time of the dispatch.	Hours	
Dispatch	Uniform capacity	kW / kVAr	Consistent power throughout the dispatch duration.		
Dispatch	Variability	Percent	Maximum variance from target dispatch power		
Dispatch	Negation effect	Switch	Whether or not the dispatch is likely to negate another dispatch(s).	Y/N	
Dispatch	Comments	Blog	Allows users and the WSC System to make notes of additional information and actions taken regarding the dispatch.		
Dispatch	Cancelled	Switch	Whether the dispatch has been cancelled.	Y/N	

Entity	Attribute	Data Type	Description	Values	CIM Equivalent
Contract	Message received	Date / Time	Date and time at which WSC received either a selection of NMF auction winning offer/bid, or Bilateral Contract is approved in NMF.		
Contract	Seller	Industry Actor	The company that is selling the flexible energy.		
Contract	Buyer	Industry Actor	The company that is buying the flexible energy.		
Contract	Contract period start	Date	Date at which the contract begins.		
Contract	Contract period end	Date	Date at which the contract ends.		
Contract	Under investigation	Switch	Whether or not the contract is subject to an investigation by the DSO.		
Contract	Comments	Blog	Allows WSC users and the WSC System to make notes of additional information and actions taken regarding the contract.		
Contract	Cancelled	Switch	Whether or not the contract has been cancelled.	Y/N	
Contract	Originating flexibility market	Text	The flexibility market in which the contract was struck.		
Constraint	Message received	Date / Time	Date and time at which WSC received the constraint message from PSA.		
Constraint	Identifier	Number	A unique identifier for the constraint allocated by PSA.		
Constraint	Type	Flag	The type of constraint foreseen by PSA.	Over supply, under supply, outage…	
Constraint	Location	Location	The location at which the constraint is likely to occur.		
Constraint	Action	Flag	The action chosen by the DSO Control Room to mitigate the constraint.	Accept risk, reinforce, reconfigure, ANM, bilateral contract, flexible power…	
Constraint	Priority	Flag	The impact for action suggested by PSA and amendable by the DSO Control Room.	Critical, High, Medium. Low	
Constraint	Description	Text	A description of the constraint generated by PSA.		
Constraint	PSA details	URL	A link to details regarding the constraint in PSA.		
Constraint	Optimisation complete	Switch	Whether or not optimisation has been completed by WSC.		
Constraint	Comments	Blog	Allows users and the WSC System to make notes of additional information and actions taken regarding the constraint.		
Constraint	Start time	Date / Time	Start of the period of constraint.		

Entity	Attribute	Data Type	Description	Values	CIM Equivalent
Constraint	Duration	Time	Contiguous time of the constraint.	Hours	
Constraint	Threshold	kV / kVAr	Threshold value that the constraint will breach.		
Constraint	Max deviation	Percent	Maximum deviation from the threshold.	Positive = above, negative = below.	
Constraint	Linked constraints	List	A list of other constraints that are related to this constraint.	May be set by DSO Control Room staff or analytics functions.	.
ANM	Threshold	kV / kVAr	Threshold value which will trigger ANM.		
Constraint Solution	Message received	Date / Time	Date and time at which WSC received the constraint solution message.		
Constraint Solution	Message from	Flag	Source of the constraint solution.	Bilateral Contract, NMF market	
Constraint Solution	Status	Switch	Whether or not the constraint solution has been chosen as a mitigation by the DSO Control Room.	Y/N	
Constraint Solution	Location	Location	Location of the constraint solution, if not already indicated by the relevant Energy Resource.		
Constraint Solution	MPAN	MPAN	The MPAN of the energy resource, if not already indicated by the relevant Energy Resource.		
Constraint Solution	Power type	Market Category	If not already indicated by the relevant Energy Resource.		
Constraint Solution	Start time	Date / Time	Start of dispatch period for the constraint solution		
Constraint Solution	Duration	Time	Contiguous period of the dispatch.	Hours	
Constraint Solution	Uniform capacity	kW / kVAr	Consistent power throughout the dispatch duration.		
Constraint Solution	Variability	Percent	Maximum variance from target dispatch power.		
Constraint Solution	Dispatch fee	Money	Price for a dispatch.	per kWh / kVArh	
Constraint Solution	Arming fee	Money	Price for arming time.	Fixed fee	
Constraint Solution	Standby fee	Money	Price for standby time.	Fixed fee	
Constraint Solution	Unwinding fee	Money	Price for unwinding a dispatch following the start of the arming period.	Fixed fee	
Constraint Solution	WSC compatibility score	Percent	Compatibility rating of the solution against the constraint calculated during WSC constraint solution optimisation.		
Constraint Solution	WSC solution analysis	Text	Description of the optimisation analysis generated by WSC.		

Entity	Attribute	Data Type	Description	Values	CIM Equivalent
Constraint Solution Combination	Assessment	Date / Time	Timestamp of when WSC optimisation identified a feasible combination of combination of solutions.		
Message	Source	Flag	The source of a WSC message.	As identified in the IER for inbound messages. WSC for outbound messages.	
Message	Type	Flag	The type of message sent.	As identified in the IER.	
Message	Sent	Date / Time	Timestamp when the originating system sent the message.		
Message	Received	Date / Time	Timestamp when the target system received the message.		
Message	Content	Text	Content of the message.		
Contact	Name	Text	Name of the contact.		
Contact	Role	Flag	Role that the contact holds within the Industry Actor.		
Contact	Telephone	Number	Main contact telephone number.		
Contact	Email address	Email	Email address for the contact.		
Dispatch Measurement	Measurement time	Date / Time	The point in time when the measurement of power being dispatched by an Energy Resource is taken.		
Dispatch Measurement	Measurement status	Flag	The status of the measurement.	Successful measurement Y/N	
Dispatch Measurement	Measured capacity	kW / kVAr	The measured amount of power being dispatched.		

6.3.2 Data Type in the Data Dictionary are:

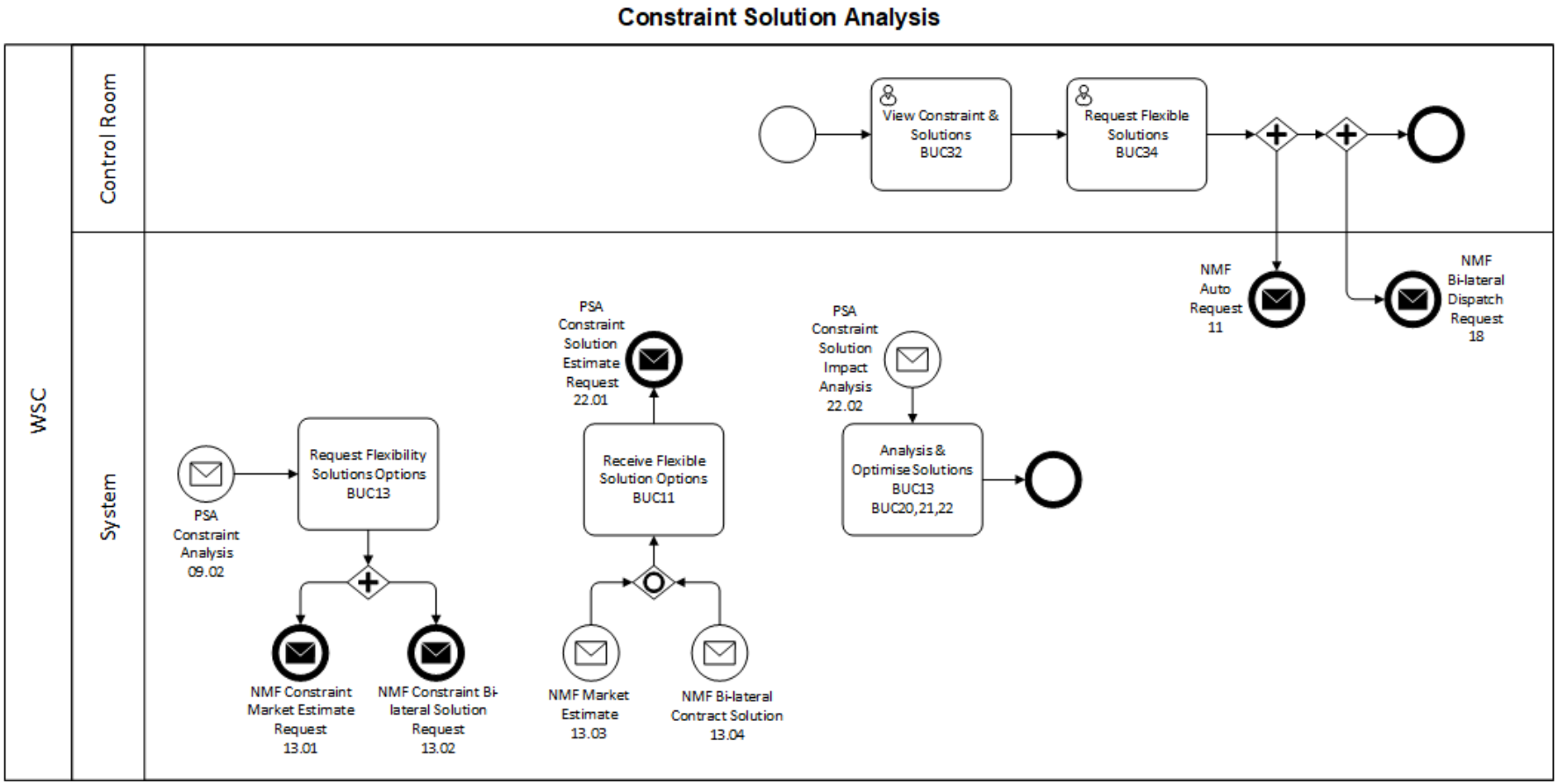
(i) **Text**, alphanumeric characters
(ii) **Money**, GB Pounds (£0.00)
(iii) **Date**, standard UK date (eg, "dd mmm yy")
(iv) **Date / Time**, standard UK date and time (eg, "dd mmm yy hh:mm")
(v) **Document**, one or more MS Office compatible document(s)
(vi) **Switch**, a boolean value (eg, Y/N)
(vii) **Flag**, one value from a defined list (eg "Red", "Amber", "Green")
(viii) **Blog**, textual commentary, eg identifying a user, the time of a posting and free text comment
(ix) **List**, one or more values from a defined list
(x) **Time**, a contiguous duration (eg, days:hours:mins:secs)

(xi) **Percent**, a percentage value
(xii) **Number**, a simple numerical value
(xiii) **kW**, kilowatts
(xiv) **kVA**, kilo volt amps
(xv) **kWh**, kilowatt hour
(xvi) **Calendar**, a collection of date/times
(xvii) **kVAr**, kilo volt amps of resistive power
(xviii) **kVArh**, kilo volt amps of resistive power hours
(xix) **MPAN**, a Meter Point Administrative Number
(xx) **URL**, an Internet or intranet hyperlink

6.3.3 It is also possible for the name of an entity in the Domain Model to be a data type. This can occur for an entity that has many relationships to avoid cluttering the Domain Model diagram.

6.4 Constraint Solution Analysis

The following diagram relates to the key BUCs involved in constraint solution analysis. It illustrates the process flows followed in preparing, optimising and presenting the constraint solution analysis to the DSO Control Room.



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