Business Process

BP_SO 10.1 Perform Long-Term & Short-Term Scheduling

EirGrid and SONI support the provision of information to the marketplace by publishing operational data, processes, methodologies and reports. This information is key to a well-functioning market and as a transparency measure, assisting understanding of our decision making processes. It is recognised that the detailed elements of our operational processes need to remain agile in the context of service priorities and technical considerations of the new market. Consequently, as operational documents these are subject to change. EirGrid and SONI therefore make no warranties or representations of any kind with respect of this document, including, without limitation, its quality, accuracy and completeness, neither do EirGrid or SONI accept liability for any loss or damage arising from the use of this document or any reliance on the information it contains.

EIRGRID SONI

Table of Contents

1 ASSUMPTIONS

Assumptions made during the design of this process include:

- This is an all-island business process, meaning the same process will be used across both jurisdictions on the island, Ireland and Northern Ireland. It can be conducted by the relevant team in either Dublin or Belfast;
- The following business processes addresses all requirements, including roles, tools, and activities that will enable the TSO to achieve scheduling objectives;
- All required systems, including MMS are in place. They offer all required functionalities to support business needs; and
- The Short Term Scheduling process will be largely automated, with the system being configured to automatically run this process every 15 minutes.

2 PROCESS REFERENCES

2.1 RELATED RULES REFERENCES

The following table provides references to the documents that govern the design of this business process.

Document Title	Relevant Section	Description
SONI Grid Code	SDC1 Scheduling and Dispatch Code No. 1 & 2	The SONI Grid Code sets out the principles governing SONI's relationship with users and technical standards to be complied with by SONI and users. The Code specifies procedures for planning, connecting to and operating the transmission system during both normal and exceptional circumstances.
EirGrid Grid Code	SDC1 Scheduling and Dispatch Code No. 1 & 2	The EirGrid Grid Code sets out the principles governing EirGrid's relationship with users and technical standards to be complied with by EirGrid and users. The Code specifies procedures for planning, connecting to and operating the transmission system during both normal and exceptional circumstances.
SEM-15-065	System Operation in the I-SEM	Sets out high level guidance related to the scheduling and dispatch process.

2.2 RELATED DOCUMENTS

The following table provides a list of documents that are related to this business process.

Document Title	Relationship	Description
Balancing Market Principles Statement	Information	A Guide to Scheduling and Dispatch under the revised Single Electricity Market arrangements which includes descriptions of the LTS, RTC and RTD.
MMS User Guide	System guide	ABB MMS OUI User Guide.
Issue Dispatch Instructions	Output of this process	The scheduling runs covered by the processes within this document will provide an advisory schedule of dispatch instructions which will be reviewed and issued as appropriate as part of this dispatch process.
Dispatch Wind Units	Output of this process	The scheduling runs covered by these processes will provide an advisory schedule for wind units which will be reviewed and issued as appropriate as part of this dispatch process.

Data Feeds Contingency Process for Scheduling Runs	Fall back process	This process will outline the steps required should any of the data feeds or inputs to the scheduling process.

3 PROCESS CONTEXT

3.1 BUSINESS MODEL RELATIONSHIP

The Perform Long Term and Short Term Scheduling processes sit within the 'Scheduling' process group within the Transmission Systems Operator (TSO) processes. The 'Scheduling' processes are required to manage the available resources to ensure the system is dispatched to meet security, priority, economic and other statutory objectives. The 'Dispatch' process group can be considered the output of these 'Scheduling' processes in real time.

A set of Physical Notifications (PNs) from the Day Ahead Market results are the starting position for this process. Taking other market and system information in to account, the scheduling process identifies the commitment and de-commitment decisions that are necessary to satisfy all the system constraints (e.g. security, priority dispatch and other statutory reasons). Since some generators have long notice times to synchronise this process must start well in advance of real-time. The indicative schedule can and will change as market information including PNs and prices due to the increased gate closures and system information including demand and wind forecasts etc. change. The Market Management System which the TSO uses as part of scheduling will thus include 3 different runs to manage this increased frequency of gate closures:

1. The Long Term Schedule (LTS) run's main objective is to determine additional sync and desyncs needed for units with "long" notification times, thus it will begin developing indicative schedules for 30 hours in advance of delivery.

2. The Real-Time Commitment (RTC) run then provides a closer view of real time and its main objective is to determine additional sync and desyncs needed for quick start units (i.e. those with relatively short notification times). It may also be used to determine advisory SO-SO trades on Interconnectors if trading optimisation is enabled in the system. It will be executed every 15 minutes developing indicative schedules for execution time plus 30 minutes to execution time plus 4 hours (i.e. a duration of 3½ hours); and

3. The Real Time Dispatch (RTD) run will provide security constrained economic dispatch (SCED) advice close to real time consisting of incremental and decremental MW advice. This process will be executed every 5 minutes and will produce a schedule for execution time plus 10 minutes to execution time plus 70 minutes.

All runs will provide indicative dispatch advice and will form an input into the dispatch processes (see 'Issue Dispatch Instructions' and 'Dispatch Wind Units') The relationship of these runs will be discussed in greater detail within the scope section of this document.

3.2 BACKGROUND AND SCOPE

Background

As Transmission System Operators, EirGrid and SONI have a responsibility to operate a safe, secure, reliable, economic and efficient power system. The scheduling and dispatch process is at the centre of power system operation.

The SEM Committee ETA decision paper (SEM-15-065) contains a number of guiding principles related to this:

- Insofar as it is possible, the *ex-ante* markets should be left to resolve the energy supply/demand balance;

- The TSOs should not take any action prior to [*Balancing Market*] gate closure unless it is for reasons of system security e.g. reserves, for priority dispatch or for other statutory requirements;
- Costs for constraint [non-energy] actions are economically incurred; and
- Minimise the cost of balancing the system given the PNs at [*Balancing Market*] gate closure.

In addition there are a number of related requirements in both the I-SEM HLD (SEM-14-085a) and ETA decision papers that impact on the scheduling & dispatch process:

- Participation in the *ex-ante* markets is not mandatory;
- Only dispatchable generation and dispatchable demand is required to submit PNs (i.e. wind and non dispatchable demand will not be required to submit PNs);
- PNs will be partially delinked. This means that PNs only have to be linked to *ex ante* trades at gate closure (i.e. FPN should reflect traded volumes). Prior to gate closure, a participant's PN submission should be its best estimate of its FPN (i.e. should reflect their expected final *ex ante* trades); and
- In addition to reflecting the expected or actual ex ante traded volumes, PNs should at all times represent the participant's best estimate of its intended level of generation and/or consumption.

The TSOs have additional obligations with respect to system security, the treatment of priority dispatch or other statutory requirements arising from the Network Codes. Thus the scheduling and dispatch process must balance all of these objectives.

At the core of the TSOs' scheduling and dispatch process are the Security Constrained Unit Commitment (SCUC) and Security Constrained Economic Dispatch (SCED) tools which form part of the Market Management System (MMS). These tools take inputs from market participants (such as PNs, bids and offers) and TSO data such as forecasts and models of constraints and determine schedules (plans) that inform Dispatch Instructions (DIs) issued to Market Participants. SCUC/ SCED will feed advisory dispatch instructions to the Resource Dispatch function where the Operator can review them and then issue them to EDIL to issue to Market Participants. The inputs into SCUC/ SCED for the generating each of the runs include:

- Market Participant Registration (MPR) data: Standing unit data will be used from MPR such as Station name, ID, Dispatchable status, Unit Synchronous Status;
- Market Participant Interface (MPI) data: Participants will submit Physical Notifications (PNs), Technical Offer Data (TOD), Commercial Offer Data (COD) and other market data relevant to Operational Schedule Runs via the MPI in advance of trading periods. TOD can only be changed once per day and only for the full trading day. COD and PNs and be changed any time up to balancing market gate closure;
- Load Forecast data: The LPRED function is the central place of providing load forecasts for scheduling runs. It receives long-term load forecasts for 5 days ahead and actual jurisdictional load from EMS;
- Wind Forecast data: The WPRED function will provide long-term wind forecasts for each wind farm site up to 5 days ahead and submit wind forecasts by jurisdictions;
- Real Time Availability & Dispatch Instruction data from EDIL (Electronic Dispatch Instruction Logger);
- Real Time SCADA / State Estimator data from EMS;
- EMS Network Model;
- System Services' Providers data: Ancillary Service System will provide the most recent reserve data such as fast frequency response (FFR), primary operating reserve (POR), secondary operating reserve (SOR), tertiary operating reserve 1 (TOR1) and tertiary operating reserve 2 (TOR2), Price per MWh (converted to € where submitted in £) per time period for each System Service Provider, Unit inertia MWs, Interruptible loads;
- Interconnector data;
- Group Constraints Data: The Group Constraints Manager function in the MMS will provide all the enabled TCGs to be used throughout the entire study horizon.
- System Service Requirements data;

- TSO Outage data: All planned outage data will come from the Outage Database; and
- TSO Interruptible Load data.

Scope

This process document covers both the long and short term scheduling processes which are the processes that provide unit commitment advice (i.e. advice on unit synchronisation and de-synchronisation).It covers the development of indicative schedules from 30 minutes to 30 hours in advance of delivery time. It does not cover the actual dispatch of either dispatchable or non-dispatchable units but acts as an input and trigger to the dispatching processes.

Firmly within the scope of this document are the LTS and RTC runs which will be generated within the scheduling application of SCUC/ SCED. The RTD run is not explicitly covered by the processes within this document as it is not providing unit commitment advice. It will however be referenced within this section in explaining the relationship between each of the runs and how the scheduling runs provide information for dispatching.

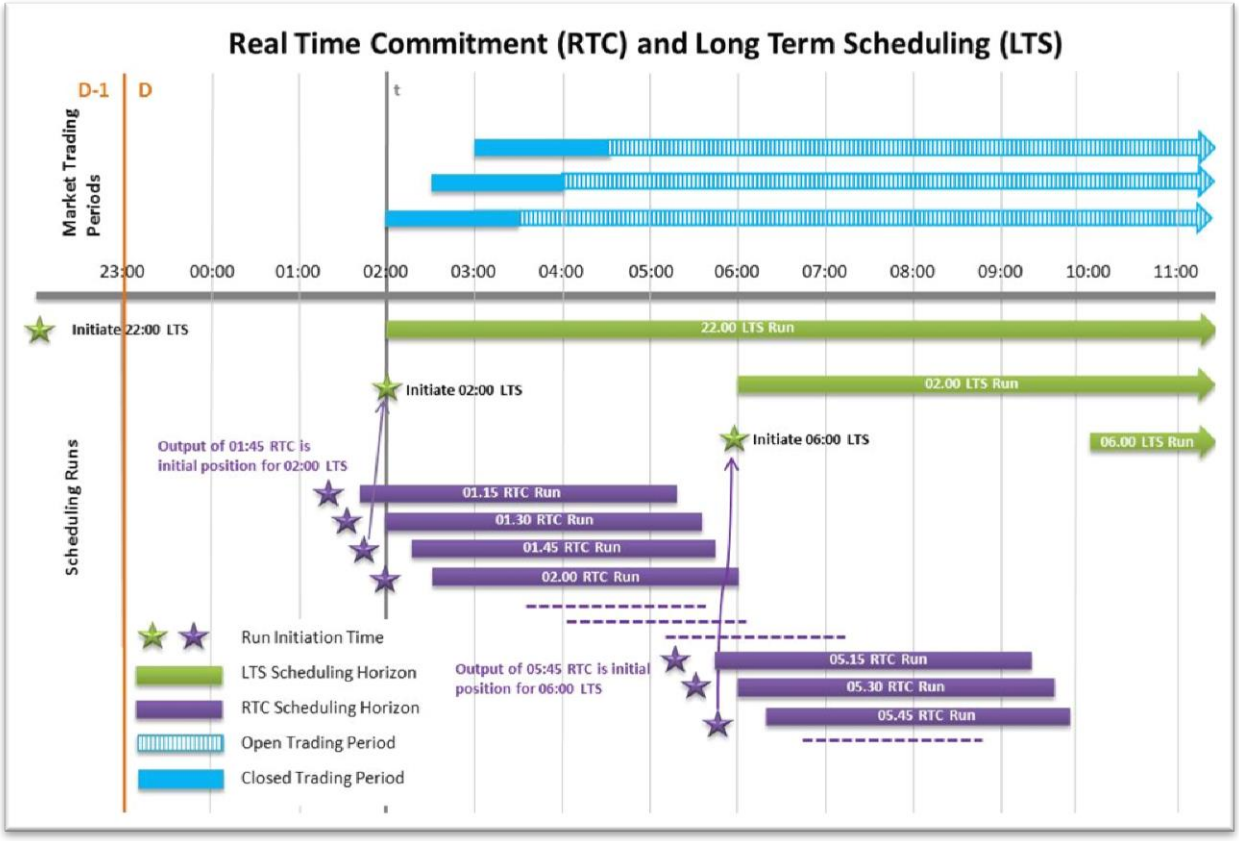
The following describes in more detail each scheduling run, specifically how they relate to one another and how they feed into the dispatch process.

For all runs:

- The input to all process runs are initial conditions from downstream RTD or RTC runs, but also taking EMS data and issued EDIL instructions into account; and
- MMS will store the completed LTS, RTC and RTD outputs in the COP as approved schedules, which will be used as initial conditions for subsequent Operational Schedule Runs.

The Long Term Scheduling Run:

- The LTS run produces secure operational schedules for periods with 30 minute resolution from 4 hours out. For example an LTS run executed at 14.00 on D, typically will provide an indicative schedule from 18.00 on D to 23:00 on D+1;
- The operational schedules generated from the LTS run will have to be approved before they are issued. Once approved the Long Term Current Operating Plan will be updated and any sync or desync instructions for units with long notification times will be sent to the Resource Dispatch function where the operator can review and approve them as part of the dispatch process; and
- The default initial conditions for the LTS run will be the most recent RTC run output. For example in the image below the output of the RTC run executed at 01.45 will be an input for the LTS run executed at 02.00.

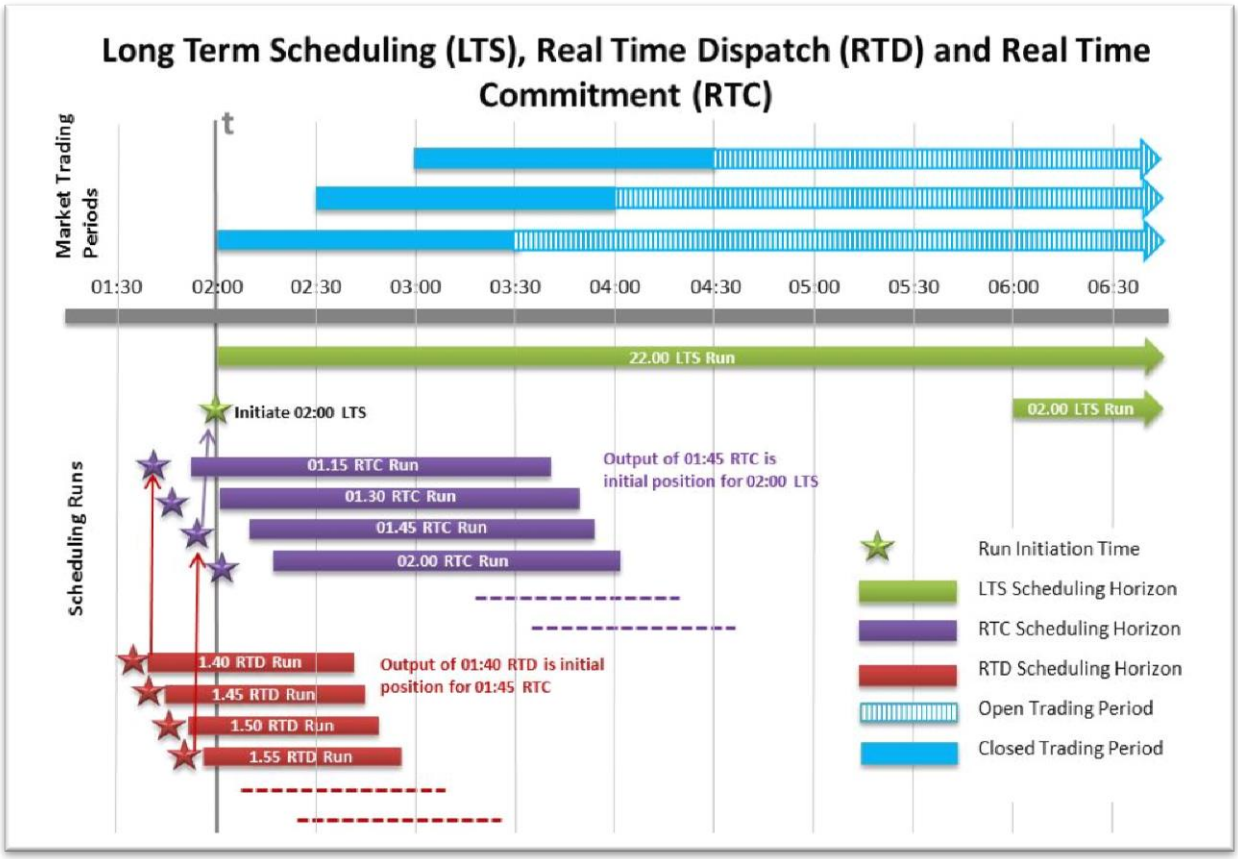


The Real Time Commitment Run:

- The RTC run produces secured operational schedules for periods with 15-minute resolution and a scheduled time horizon of execution time plus 30 minutes to execution time plus 4 hours (i.e. durations of 3½ hours). For example an RTC run executed at 01.15 on D will provide an indicative schedule from 01.45 to 05.15. Within a day there will be 96 RTC runs automatically initiated every 15 minutes;
- The output of the RTC runs will not require the Operator to approve them but the Operator will continuously have to monitor the output to ensure it is providing safe and secure schedules. The Near Time Current Operating Plan will be updated with the output and any sync or desync instructions for units with short notification times will be sent to the Resource Dispatch function where the operator can review and approve them as part of the dispatch process;
- The RTC may also provide outputs for advisory SO-SO trades if trading optimisation is enabled; and
- The default initial conditions for the RTC run will be the most recent RTD run output. For example in the image below the output of the 01.40 RTD run will be an input for the RTC run executed at 01.45.

The Real Time Dispatch Run:

- The RTD produces secure operating schedules based on real-time data from EMS; and
- Similarly to the RTC run, the RTD run outputs will not require approval but will automatically update the Real Time Dispatch Operating Plan and advisory dispatch instructions will be sent to the Resource Dispatch function where the operator can review and approve them as part of the dispatch process.


Long Term Scheduling (LTS), Real Time Dispatch (RTD) and Real Time Commitment (RTC)
Market Trading Periods
t
01:30
02:00
02:30
03:00
03:30
04:00
04:30
05:00
05:30
06:00
06:30
22.00 LTS Run
02.00 LTS Run
Initiate 02:00 LTS
Scheduling Runs
01.15 RTC Run
01.30 RTC Run
01.45 RTC Run
02.00 RTC Run
Output of 01:45 RTC is initial position for 02:00 LTS
1.40 RTD Run
1.45 RTD Run
1.50 RTD Run
1.55 RTD Run
Output of 01:40 RTD is initial position for 01:45 RTC
Run Initiation Time
LTS Scheduling Horizon
RTC Scheduling Horizon
RTD Scheduling Horizon
Open Trading Period
Closed Trading Period

4 PROCESS OBJECTIVE

There are multiple documents setting out rules and obligations relating to the scheduling and dispatch process covering system security, priority dispatch, economic objectives and other statutory requirements. Some of these documents are listed below however a more comprehensive list can be found in the Balancing Market Principles Statement published by the TSOs:

- European Network Codes
- EirGrid and SONI Transmission Licence
- EirGrid and SONI Grid Code SDC1 Scheduling and Dispatch Code No.1
- EirGrid and SONI Grid Code SDC2 Scheduling and Dispatch Code No.2
- Various SEMC decisions

5 ROLES AND RESPONSIBILITIES

5.1.1 REAL TIME

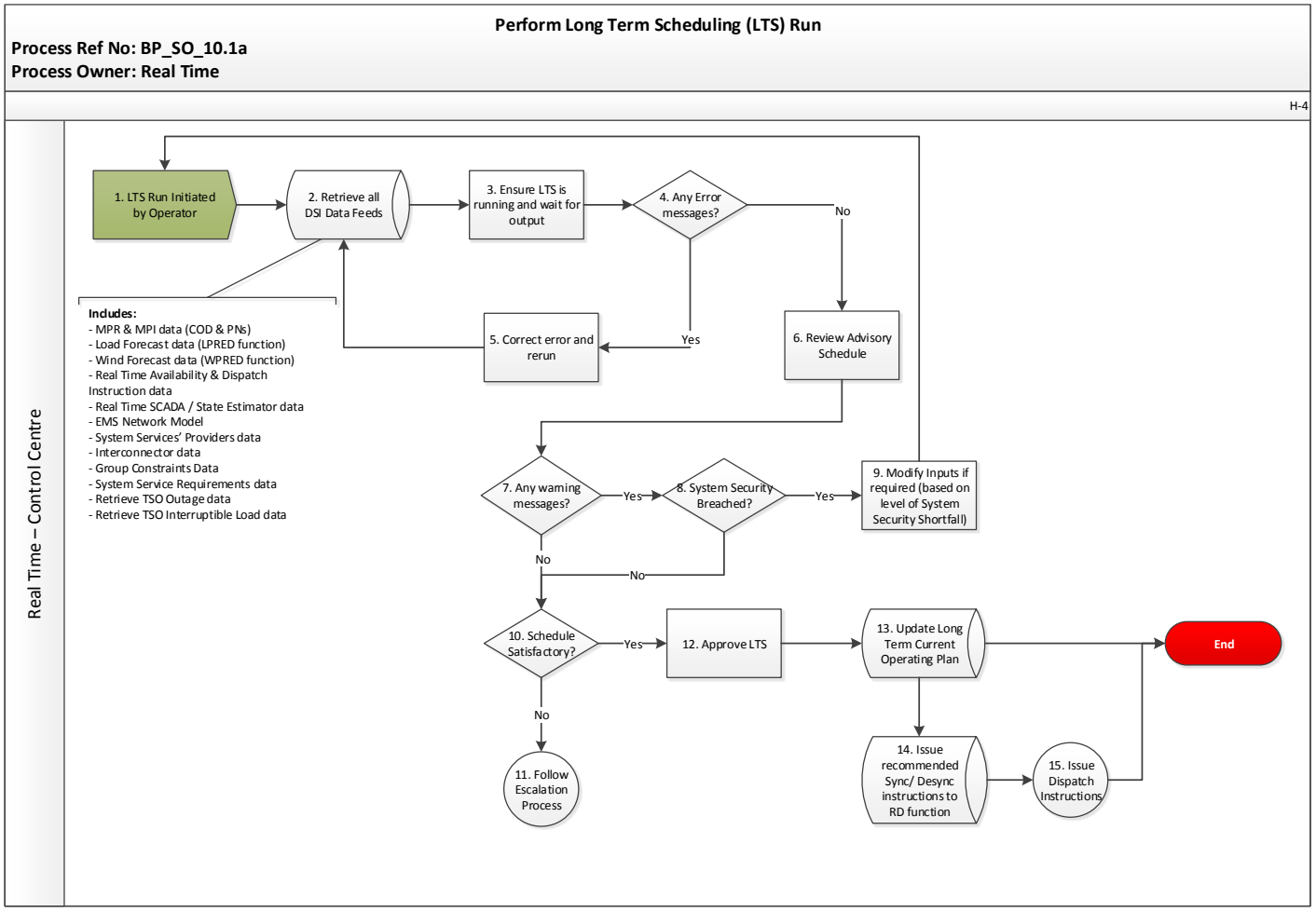
The following table provides a summary of the obligations of Real Time relating to Long Term & Short Term Scheduling processes:

Team Name	Responsibility in relation to process	Timeline Associated
Real Time (Process Owner)	• Ensure scheduling runs are being processed by system, review and approve/reject outputs of run	System will be configured to run: • LTS runs are user initiated • the RTC run every 15 minutes, resulting in 96 RTC runs per day

6 PROCESS DESCRIPTION

6.1 LEVEL 3 PROCESS

6.1.1 PERFORM LONG TERM SCHEDULING (LTS) PROCESS MAP



6.1.2 PERFORM LONG TERM SCHEDULING (LTS) PROCESS STEPS

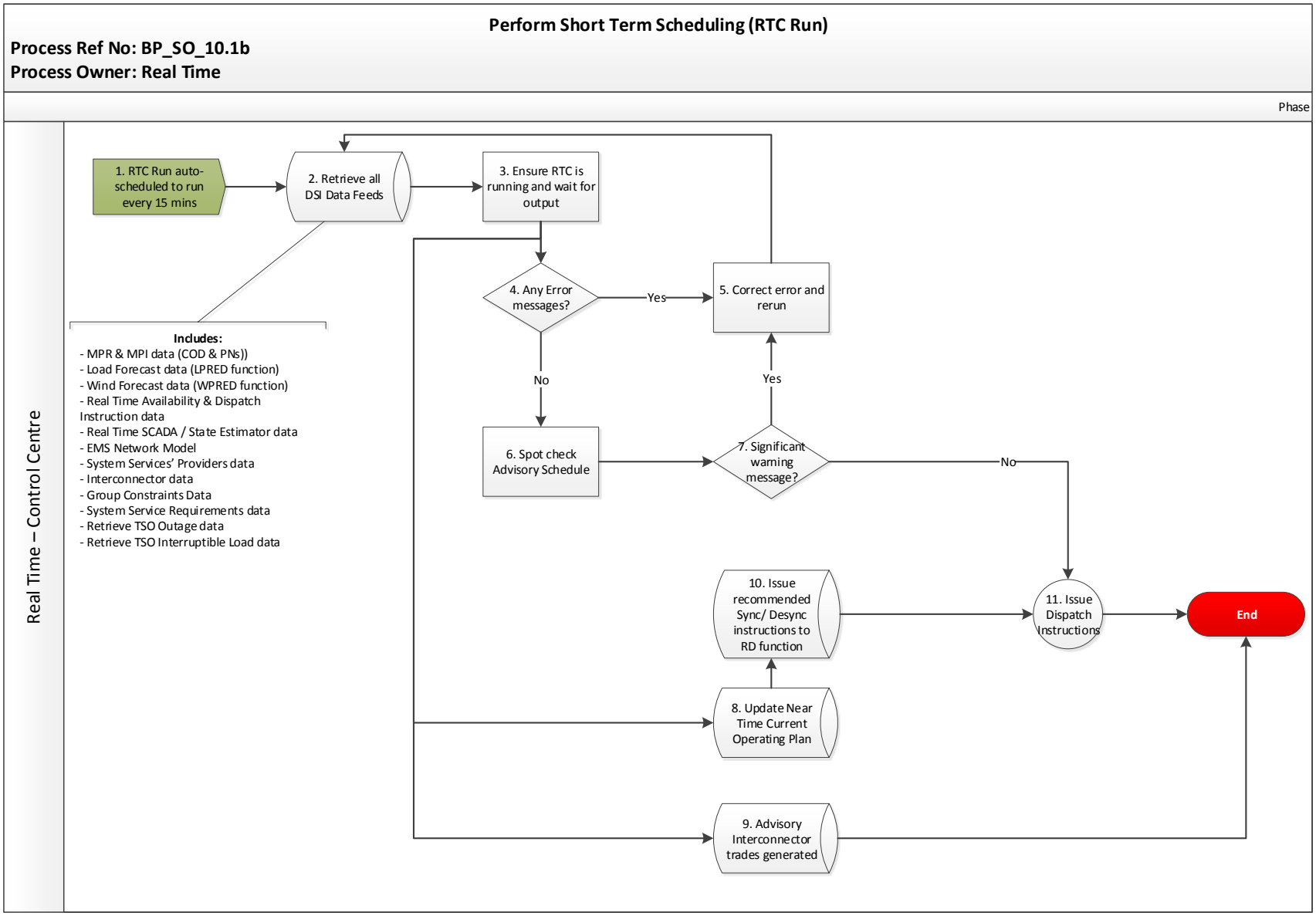
#	Step	Step Description	Responsible Role	Outputs	Indicative Timing/ Frequency	System
1	LTS Run Initiated by Operator.	The process will be triggered by the Operator. The process can also be triggered outside normal plans. For example, following an event which impacts scheduling and dispatch (such as a trip) the LTS may need to be initiated.	Real Time User	N/A	As required	SCUC/SCED
2	Retrieve all DSI (Dispatch Schedule Initialisation) Data Feeds	This is an automated step and will be completed by the system, which will retrieve all the required inputs to run the LTS process, these will include: - MPR & MPI data (COD & PNs) - Load Forecast data (LPRED function) - Wind Forecast data (WPRED function) - Real Time Availability & Dispatch Instruction data - Real Time SCADA / State Estimator data - EMS Network Model - System Services' Providers data - Interconnector data - Group Constraints Data - System Service Requirements data - Retrieve TSO Outage data - Retrieve TSO Interruptible Load data	N/A – System step	N/A	As required	SCUC/SCED
3	Ensure LTS is running and wait for output	Ensure that the LTS run is being processed as per schedule.	Real Time User	Advisory Schedule	As required	SCUC/SCED
4	Any Error messages?	If there are any issues with any of the feeds,	Real Time User	N/A	As required	SCUC/SCED

#	Step	Step Description	Responsible Role	Outputs	Indicative Timing/ Frequency	System
		error messages may be generated. If there are error messages, go to step 5. If not go to step 6.				
5	Correct error and rerun	If there have been errors, the User should try to correct them and then rerun the process.	Real Time User	Errors fixed	As required	SCUC/SCED
6	Review Advisory Schedule	Once the process has completed it will generate an Advisory Schedule. The Schedule will provide a set of recommended sync and desyncs needed for units with “long” notification times.	Real Time User	Advisory Schedule	As required	SCUC/SCED
7	Any warnings messages?	Check to see if any system security warning messages have been generated by the run which need to be addressed immediately. If yes, and a warning message or messages have been generated, go to step 8. If no, go to step 10.	Real Time User	N/A	As required	SCUC/SCED
8	System Security Breached?	If there are issues identified with the schedule the Operator must first identify whether system security has been breached. If the breach is minor (< 10 MW) and does not last longer than two trading periods. If yes, go to step 9. If no, go to step 10.	Real Time User	N/A	As required	SCUC/SCED
9	Modify inputs if required (based on level of System Security Shortfall)	If system security has been breached, then the Operator will have to check if there is an issue with the run inputs and modify them as required, based on the level of system security	Real Time User	Modified run inputs	As required	SCUC/SCED

#	Step	Step Description	Responsible Role	Outputs	Indicative Timing/ Frequency	System
		shortfall.				
10	Schedule satisfactory?	Following a full review the Operator must then decide if the schedule is satisfactory and meets all requirements for a secure schedule. If the schedule is satisfactory, go to step 12. If it is not satisfactory, go to step 11.	Real Time User	N/A	As required	SCUC/SCED
11	Follow escalation process	If the Operator is not satisfied with the schedule and thinks further amendments are required, they must follow the escalation process.	Real Time User	N/A	As required	SCUC/SCED
12	Approve LTS	Once satisfied with the schedule following full review, the Operator can approve the LTS report.	Real Time User	Approved LTS report	As required	SCUC/SCED
13	Update Long Term Current Operating Plan	This is an automated system step – once the LTS run has completed successfully and approved the Long Term Current Operating Plan will be updated with the latest information from the LTS run.	N/A – System step	Updated Current Operating Plan	As required	SCUC/SCED
14	Issue recommended Sync/ Desync instructions to RD function	This is an automated system step – once the LTS run has completed successfully and the Advisory Schedule generated, the system issues recommended start-up and shutdown events (i.e. proposed commitment / de-commitment decisions) to the Resource Dispatch function within MMS. For Interconnectors, the User will be able to view advisory information to use in SO-SO trades process, such as prices and proposed	N/A – System step	Recommended Sync/ Desync instructions received in RD	As required	SCUC/SCED

#	Step	Step Description	Responsible Role	Outputs	Indicative Timing/ Frequency	System
		Interconnector volumes.				
15	Issue Dispatch Instructions	The instructions generated from this process are an input into the 'Issue Dispatch Instructions' process.	N/A – System step	Dispatch instructions issued	As required	SCUC/SCED

6.1.3 PERFORM SHORT TERM SCHEDULING (RTC) PROCESS MAP



6.1.4 PERFORM SHORT TERM SCHEDULING (RTC) PROCESS STEPS

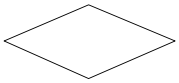
#	Step	Step Description	Responsible Role	Outputs	Indicative Timing/ Frequency	System
1	RTC Run Scheduled to run every 15 mins	Process will be triggered automatically in the system which will be configured to run the RTC process every 15 minutes.	N/A – System step	N/A	Every 15 minutes	SCUC/SCED
2	Retrieve all DSI (Dispatch Schedule Initialisation) Data Feeds	This is an automated step and will be completed by the system, which will retrieve all the required inputs to run the RTC process, these will include: - MPR & MPI data (COD & PNs) - Load Forecast data (LPRED function) - Wind Forecast data (WPRED function) - Solar Forecast data (SPRED function) - Real Time Availability & Dispatch Instruction data - Real Time SCADA / State Estimator data - EMS Network Model - System Services' Providers data - Interconnector data - Group Constraints Data - System Service Requirements data - Retrieve TSO Outage data - Retrieve TSO Interruptible Load data	N/A – System step	N/A	Every 15 minutes	SCUC/SCED
3	Ensure RTC is running and wait for output	Ensure that the RTC run is being processed as per schedule (every 15 minutes).	Real Time User	Advisory Schedule	Every 15 minutes	SCUC/SCED
4	Any Error messages?	If there are any issues with any of the feeds,	Real Time User	N/A	Every 15 minutes	SCUC/SCED

#	Step	Step Description	Responsible Role	Outputs	Indicative Timing/ Frequency	System
		error messages may be generated. If there are error messages, go to step 5. If not go to step 6.				
5	Correct error and rerun	If there have been errors, the User should try to correct them and then rerun the process.	Real Time User	Errors fixed	Every 15 minutes	SCUC/SCED
6	Spot check Advisory Schedule	Once the process has completed it will generate an Advisory Schedule. The Schedule will specify MW output/consumption of each Unit and the MW flow on each Interconnector for each Scheduling Interval. **Note**: in contrast to the LTS run the RTC run automatically updates the Near Time COP and Resource Dispatch function, it does not require the Operator to approve before updating, thus the following steps happen in parallel. Steps 8, 9 & 10 will happen regardless of step 7 as they are automated steps and do not require approval to happen.	Real Time User	Advisory Schedule	Every 15 minutes	SCUC/SCED
7	Significant warning message?	The Operator should be checking for any warning messages which may be generated following the runs. If the Operator notices a system generated warning or alarm (e.g. constraint violations or significant/ unexpected change to unit commitment status e.g. a trip) – they must decide if the issue invalidates the output of the RTC run or particular sync/de-sync advice, and if so they may have to manually adjust a unit commitment decision in RD as the RTC automatically pushes its output	Real Time User	N/A	Every 15 minutes	SCUC/SCED

#	Step	Step Description	Responsible Role	Outputs	Indicative Timing/ Frequency	System
		through to the RD and Near Time COP. If there are significant warnings the Operator may need to rerun the process if so revert to step 5. If no got step 11, no action is required in this process.				
8	Update Near Time Current Operating Plan	This is an automated system step – once the RTC run has completed successfully and the Advisory Schedule generated the Near Time Current Operating Plan will be updated with the latest information from the RTC run.	N/A – System step	Near Time Current Operating Plan	Every 15 minutes	SCUC/SCED
9	Advisory Interconnector trades generated	This is an automated system step – once the RTC run has completed successfully and the Advisory Schedule generated, the advisory Interconnector trades will also be generated (provided that Interconnector Optimisation is enabled within MMS).	N/A – System step	Advisory IC trades created	Every 15 minutes	SCUC/SCED
10	Issue recommended Sync/ Desync instructions to RD function	This is an automated system step – once the RTC run has completed successfully and the Advisory Schedule generated, the system issues recommended start-up (synchronization) and shutdown events (i.e. proposed commitment decisions) to the Resource Dispatch (RD) function within MMS.	N/A – System step	Recommended Sync/ Desync instructions received in RD	Every 15 minutes	SCUC/SCED
11	Issue Dispatch Instructions	The instructions generated from this process are an input into the 'Issue Dispatch Instructions' process.	N/A – System step	Dispatch instructions issued	Continuous	Resource Dispatch & EDIL

7 APPENDICES

7.1 PROCESS FLOWCHART KEY

FLOWCHART KEY	
	Trigger
	Process step
	Process decision / question
	Another business process to be implemented following current step (current step is a trigger for another process)
	Process end
	System (automatic step)