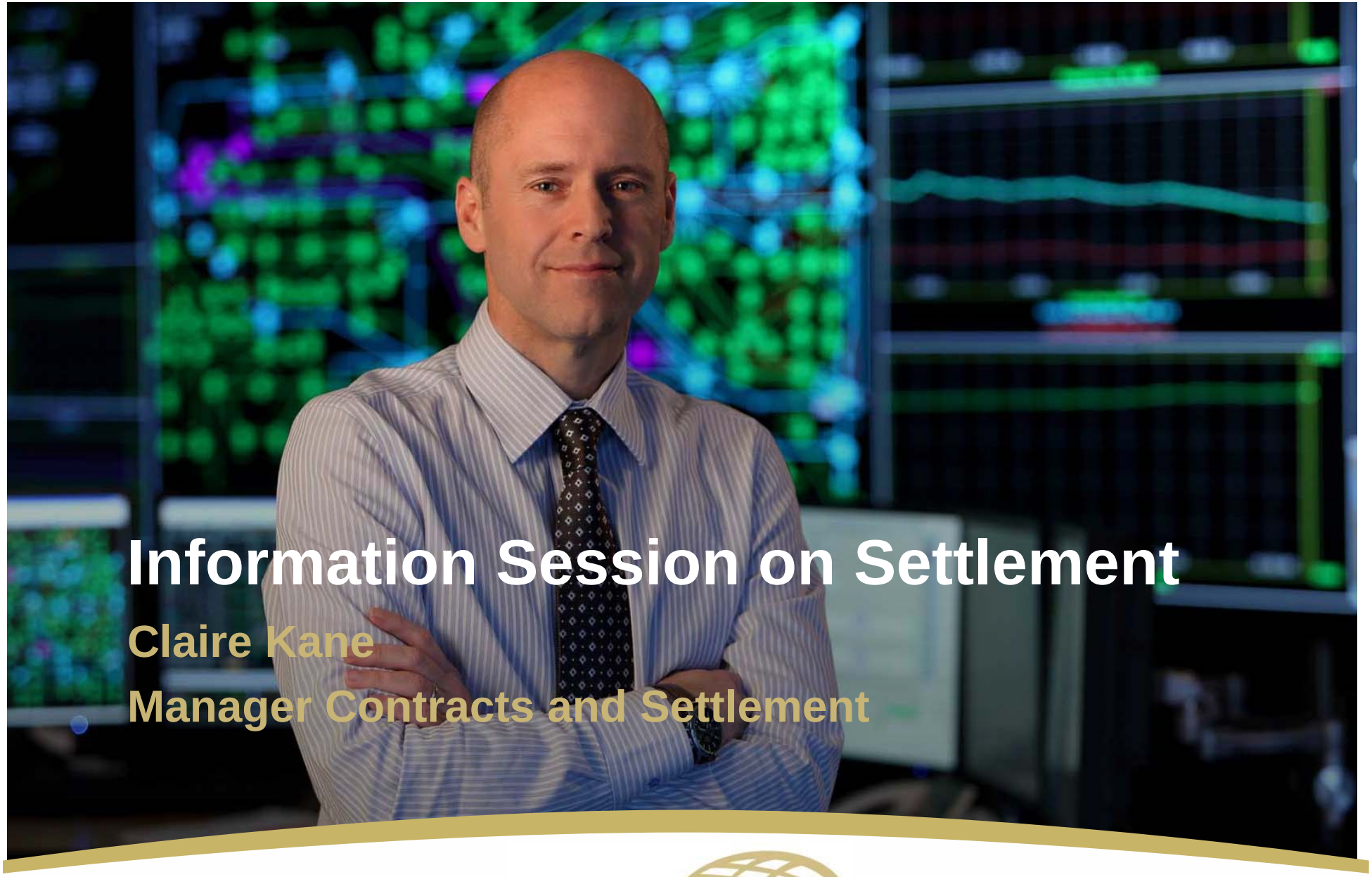

Information Session on Settlement

Claire Kane

Manager Contracts and Settlement

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Agenda

Time	Item	Presenter
10:30-10:35	Introduction	Claire Kane
10:35-10:55	DS3 Overview	Jonathan O'Sullivan
10:55-11:35	Settlement Calculations	Colm Lowery
11:35-12:15	Settlement Reports	Meave Heaney
12:15-13:30	Q & A	Claire Kane

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DS3 Overview

Jonathan O'Sullivan

Manager Innovation

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but what is DS3 really trying to do?

 Installed Wind	**3000 MW**	**5000 MW**
 Annual RES-E	**22 %**	**40 %**
 Curtailment	**5 %**	**5-7 %**

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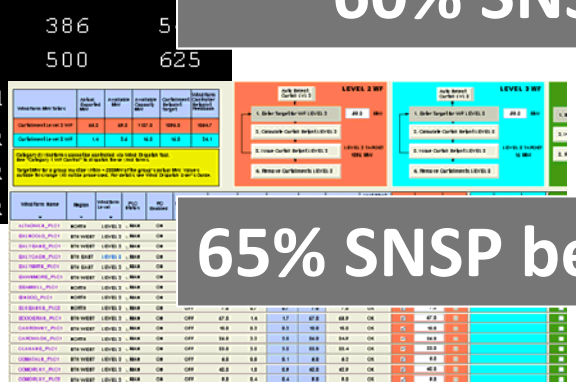
so what is DS3 doing this year?

Control Centre tools and studies

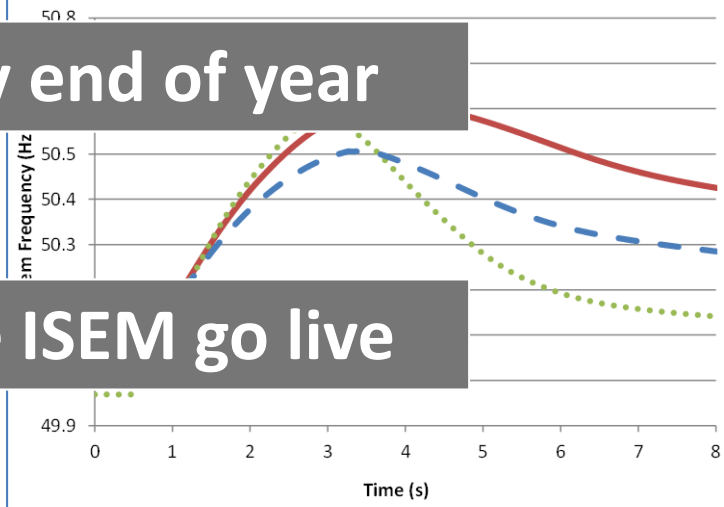
RESERVE MW	Req'd	Act
SOUTH POR	242	2
SOUTH SOR	386	5
SOUTH TOR	500	625
Max Infeed		
ISLAND POR		
ISLAND SOR		
ISLAND TOR		



60% SNSP by end of year

65% SNSP before ISEM go live

EWIC Increased Exports



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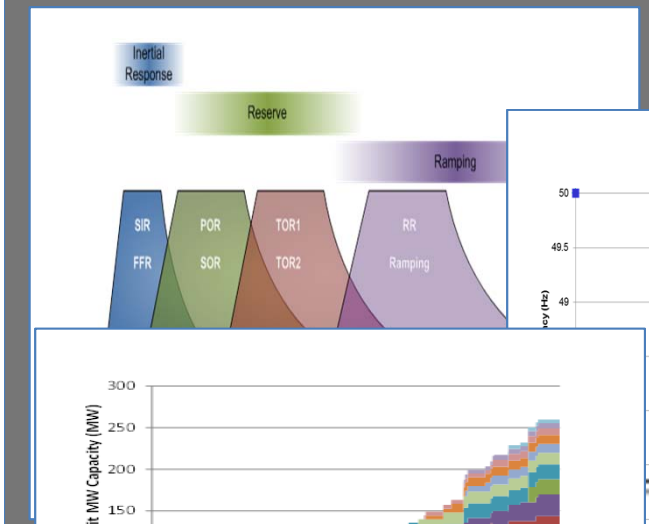
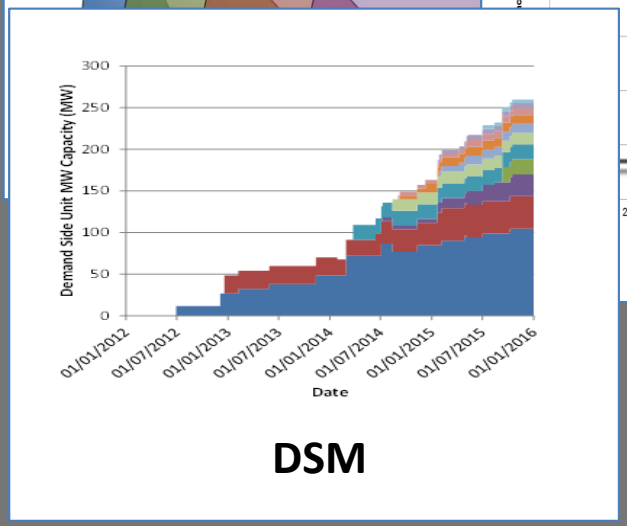
But what needs to be done for 2020?

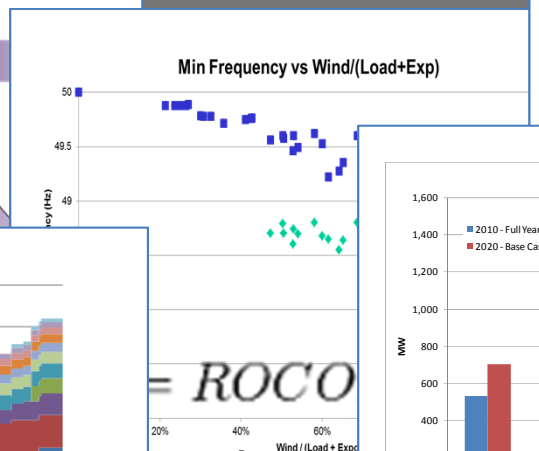
Performance



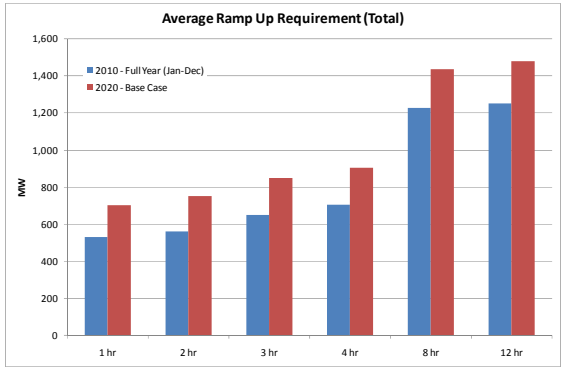


DSM

Policy

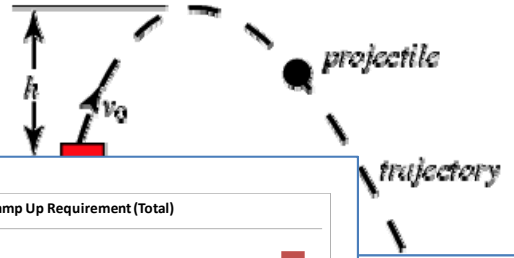


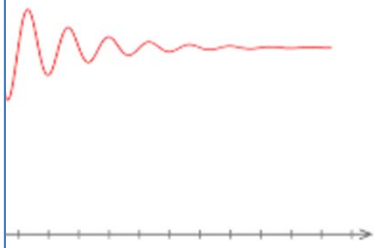
Enduring



Ramping

Tools





Lookahead Stability assessment

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What will we achieve with interim SS?

- Developed arrangements that cater for all 14 system services products
- Prudently manage new and emerging technologies.
- Proposed tariffs that allow for an increase in monies in the order of €20 million for next year

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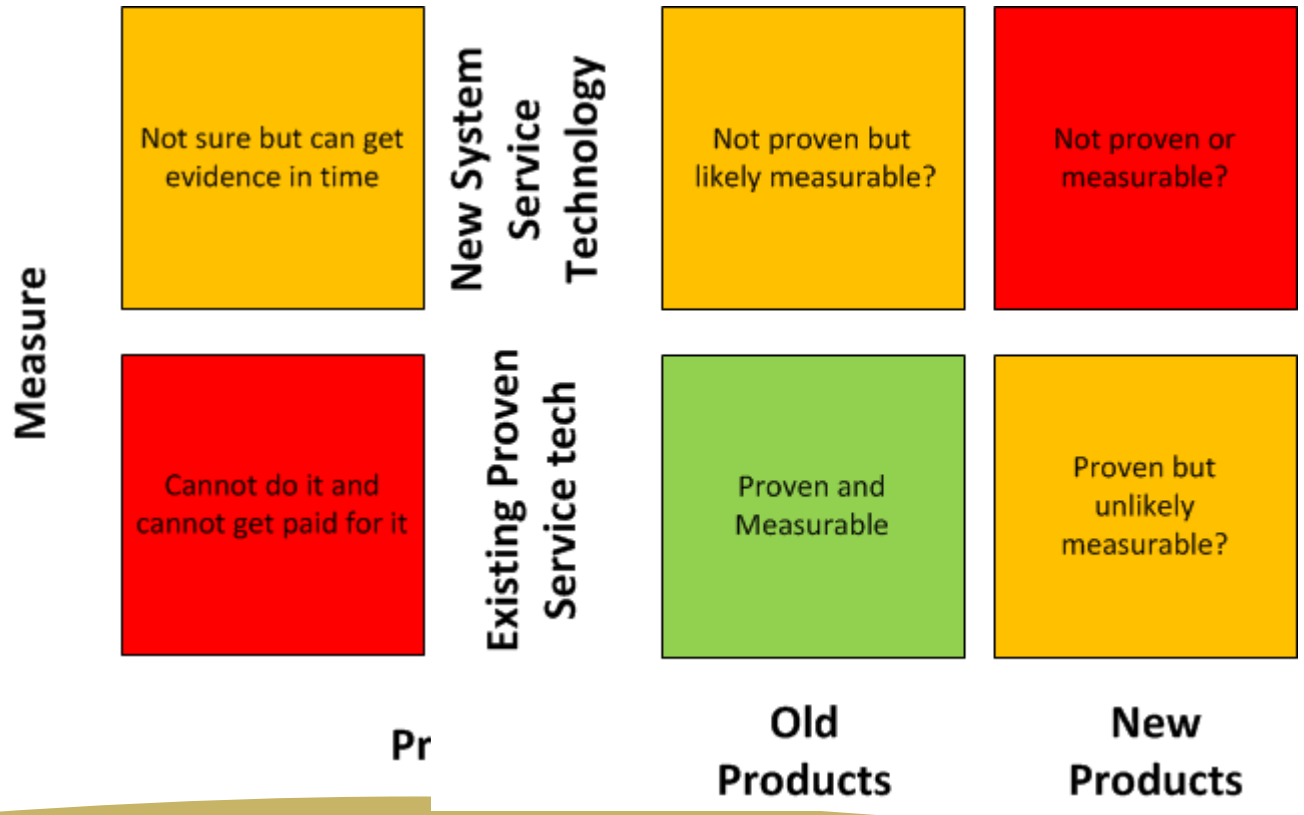
but there are some realities…!!



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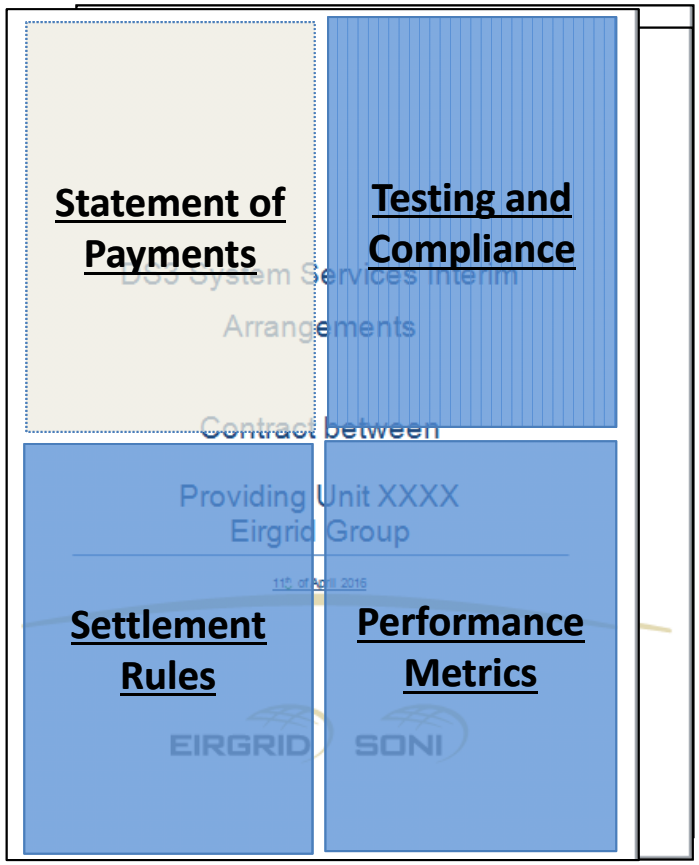
now there is System Services framework



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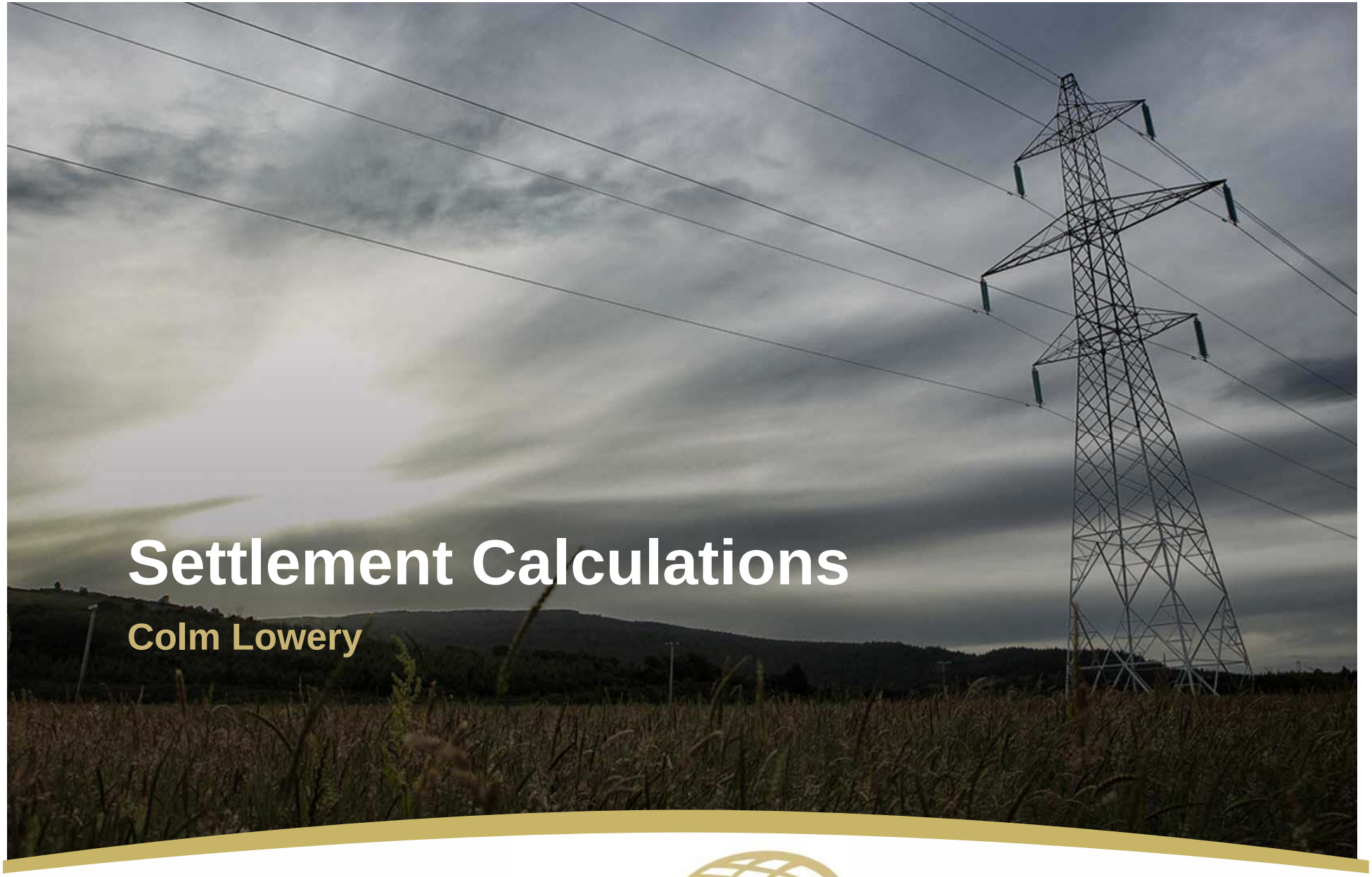

Settlement Calculations

Colm Lowery

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Interim Structure

- 11 services in total
- On a Providing Unit Basis
- Can apply for 1 or all
- Tender split into 2 sections

POR
SOR
TOR1
TOR2
SSRP
RM1
RM3
RM8
SIR
RRD
RRS

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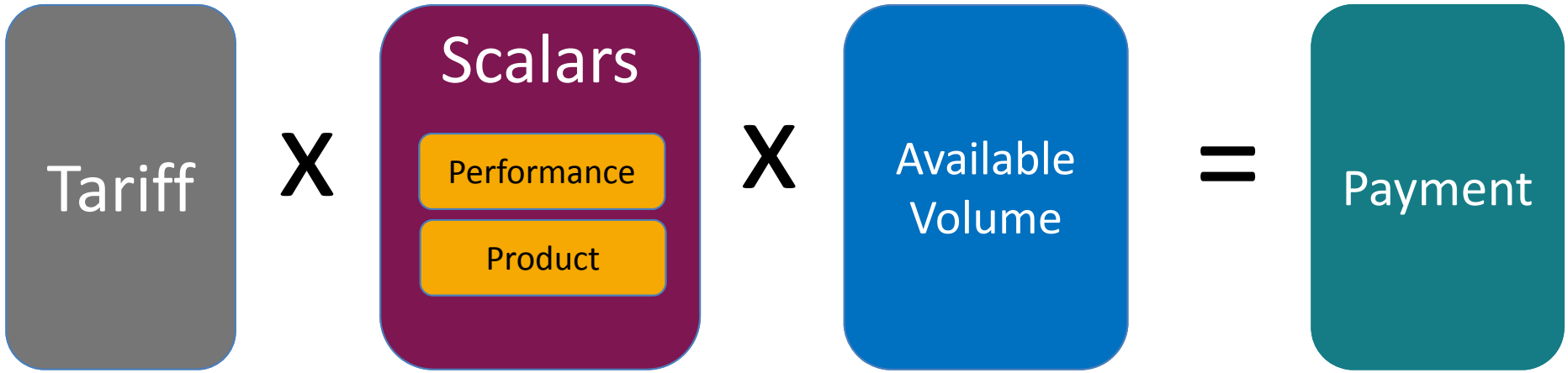
Payment under Interim Arrangements



Note: Scarcity and Volume Scalars will only apply for Enduring Arrangements

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Settlement System

Tariff

- Tariffs fixed in Settlement System to the values in DS3 Statement of Payment

Scalars

Product

Performance

- Performance Scalars inputted to the Settlement System
- Product Scalar specified in contract for intermim arrangements (static/dynamic Reserve, AVR)

Available Volume

- **Settlement System** calculates **Available Volume** of services provided

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Available Volume

1. Measurement of Average Capability to provide Service
2. Ex-post in arrears for each half-hour of a month
3. Determined from fixed contracted capabilities, signals, declarations and metering
4. Settlement calculations adjusted for non-synchronous and synchronous Providing Units

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DS3 System Services

New Services		Existing Services	
SIR	Synchronous Inertial Response	SSRP	Steady-state Reactive Power
FFR	Fast Frequency Response	POR	Primary Operating Reserve
DRR	Dynamic Reactive Response	SOR	Secondary Operating Reserve
RM1	Ramping Margin 1 Hour	TOR1	Tertiary Operating Reserve 1
RM3	Ramping Margin 3 Hour	TOR2	Tertiary Operating Reserve 2
RM8	Ramping Margin 8 Hour	RRD	Replacement Reserve (De-Synchronised)
FPFAPR	Fast Post-Fault Active Power Recovery	RRS	Replacement Reserve (Synchronised)
New design created to calculate Available Volumes in line with Technical Definitions		HAS Design was adjusted to calculate Available Volumes in line with Technical Definitions	

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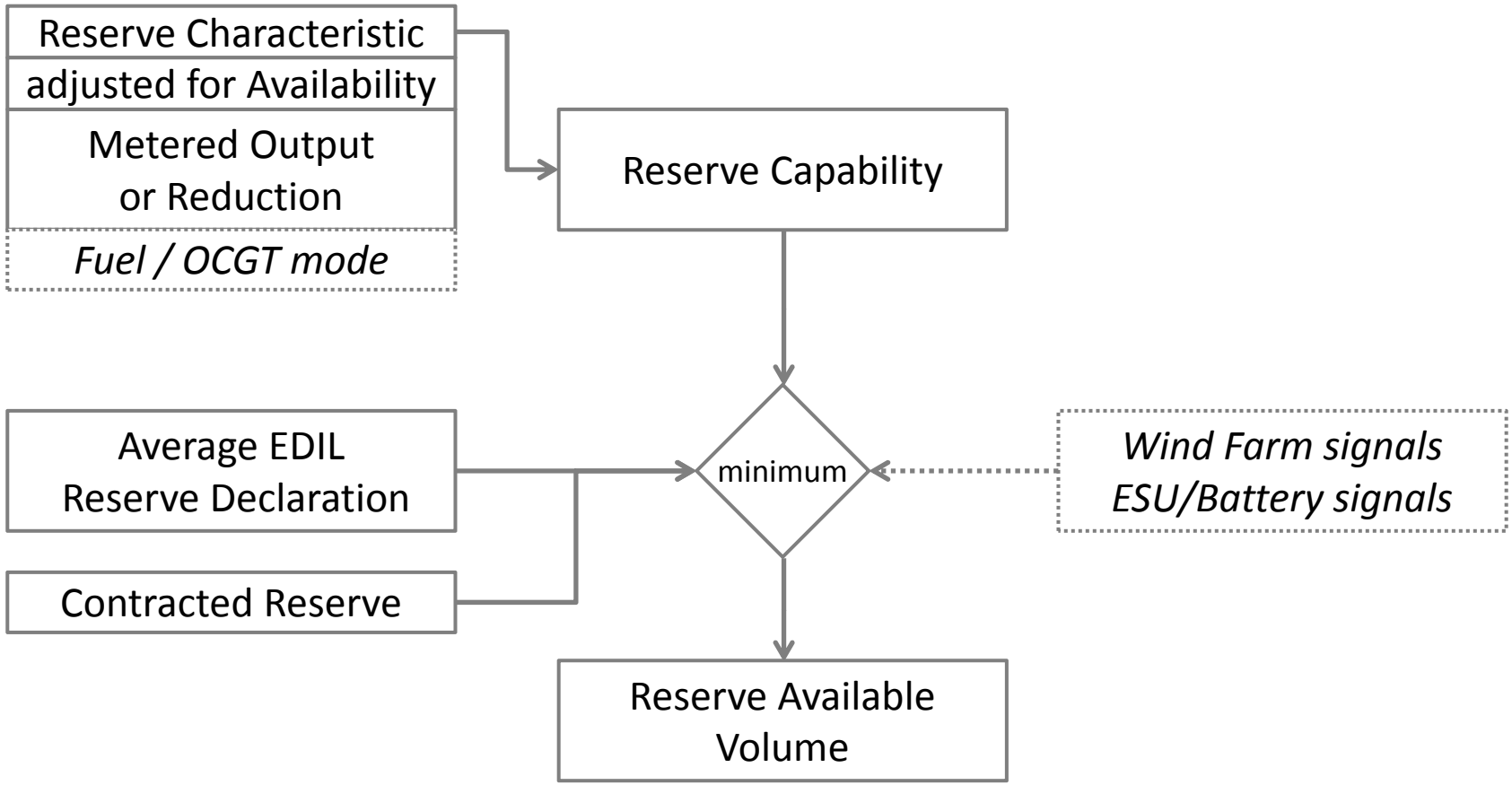
Reserve Available Volume



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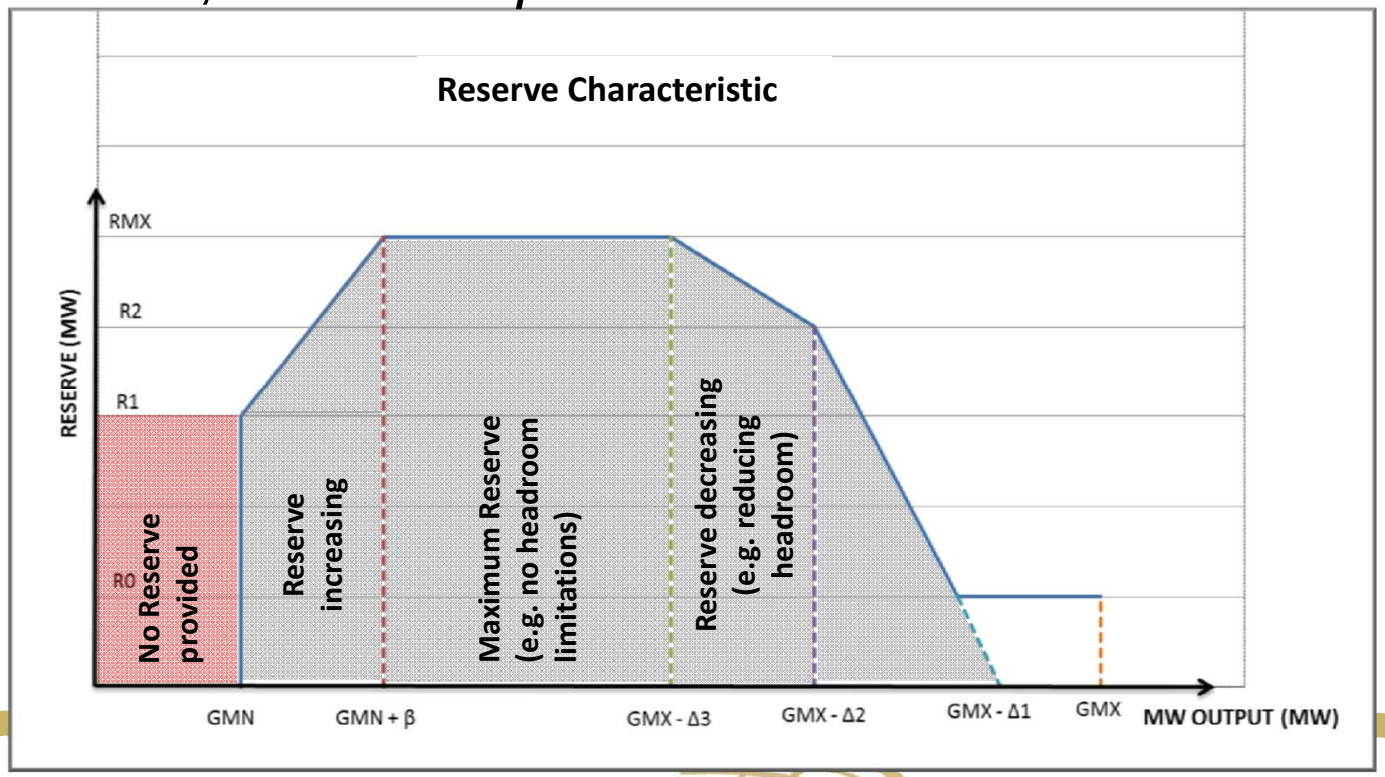
Contracted Reserve Characteristic

- Fixed contracted values *(R0, R1, R2, RMX, ß, Δ1, Δ2, Δ3)*
- Reserve > 0, *if MW Output >= GMN & < GMX*
- Reserve = 0, *if MW Output < GMN*



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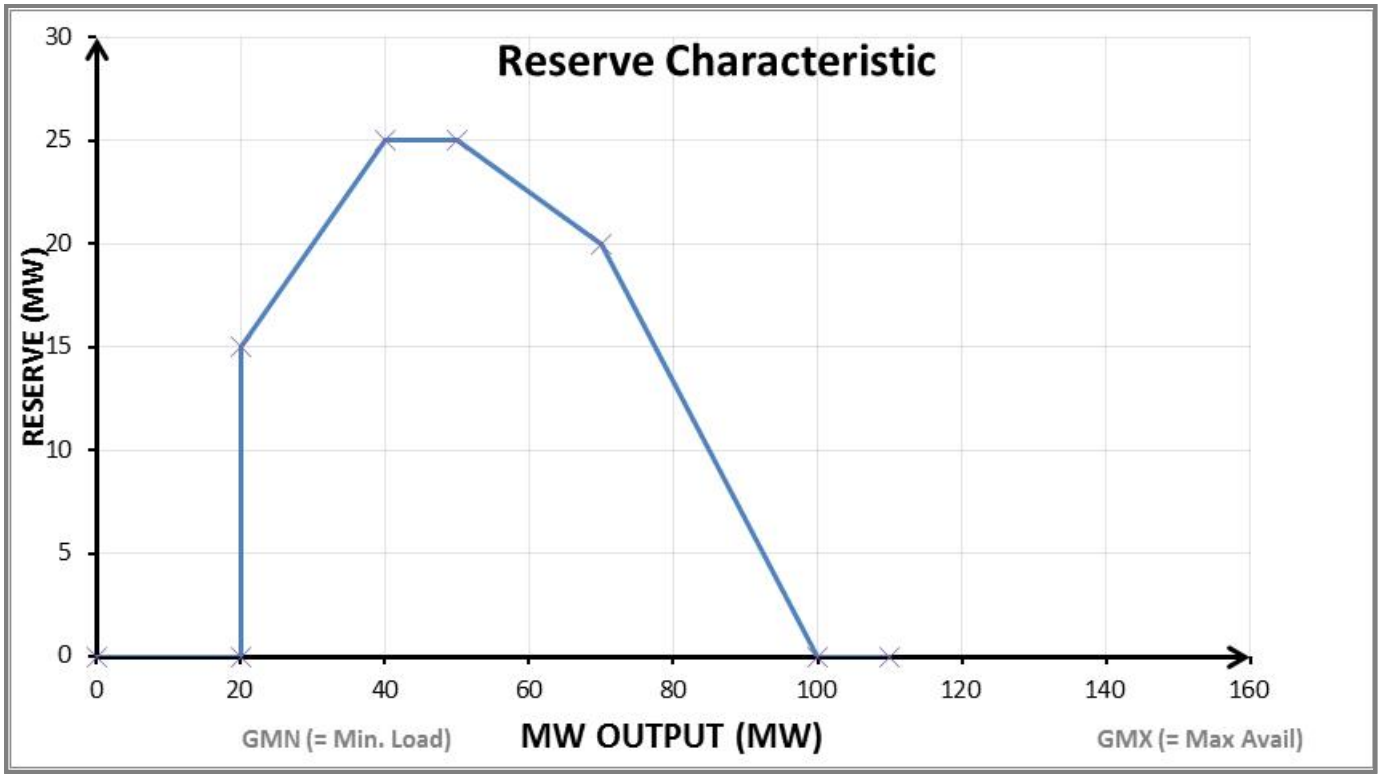
Availability impacts capability



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EDIL Declarations

- In real-time, a Providing Unit may declare temporary reductions in reserve capability via EDIL (POR, SOR, TOR1, TOR2, RRA)
- If EDIL is not used, then contracted maximum is assumed

Reserve Available Volume

= minimum of Reserve Capability and

Average EDIL Reserve Declaration

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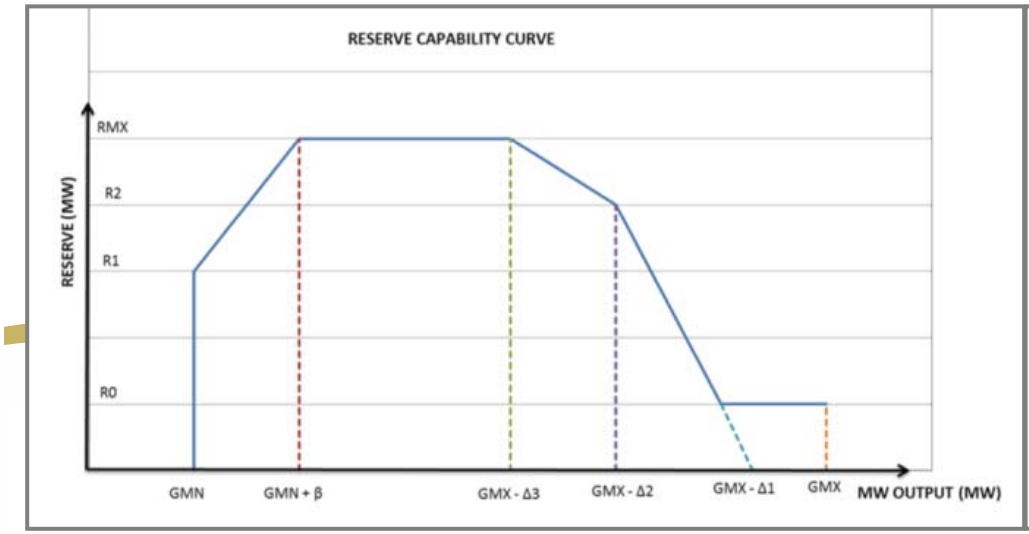
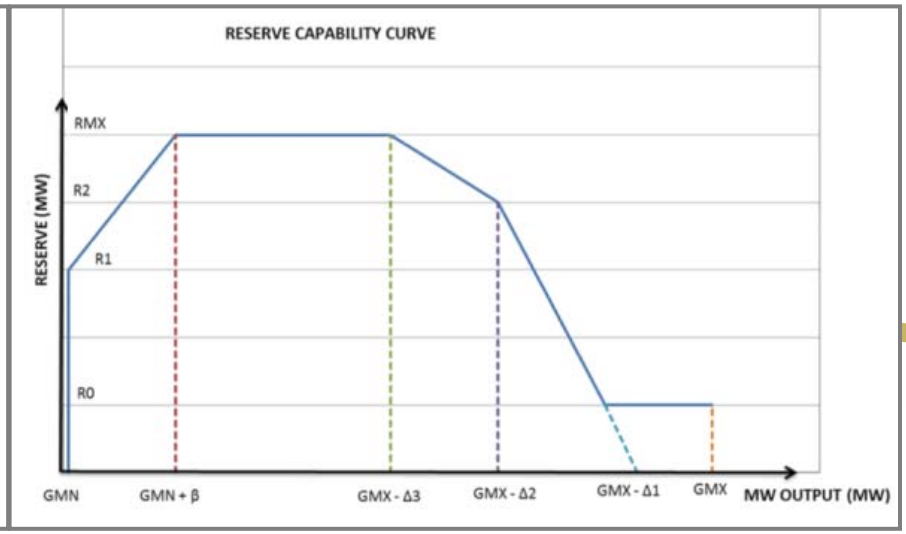
ESU / Battery

- ESU / Battery: Reserve Available Volume
  - non-zero, when energy stored / charge is sufficient
  - zero, otherwise

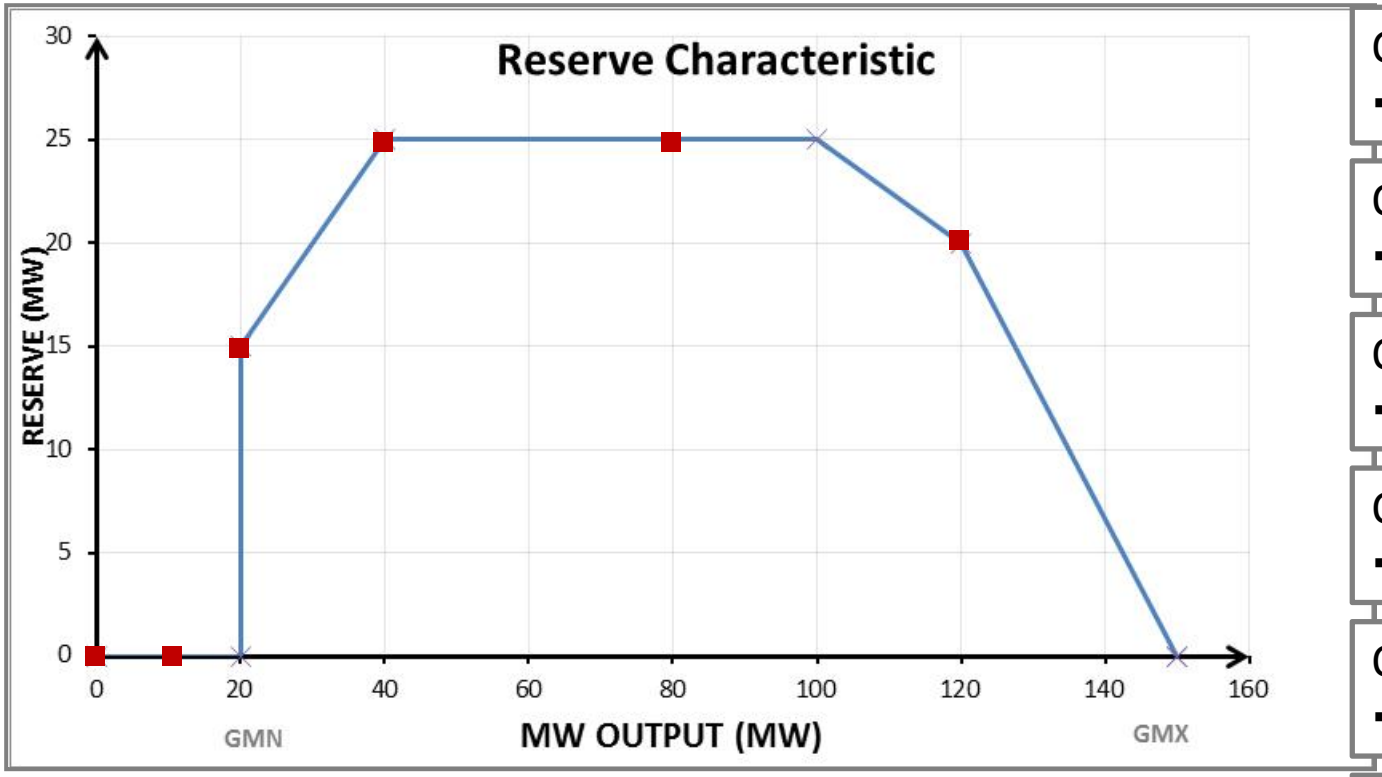
Replacement Reserve

- RR Synchronised
  - Synchronous machines, when synchronised
  - Non-synchronous Providing Unit, when ‘connected’
- RR De-synchronised
  - Synchronous machines, when not synchronised, *where capable from a desynchronised state*





Availability = 150MW



Output = 0
➔ Reserve Cap. = 0

Output = 10
➔ Reserve Cap. = 0

Output = 20
➔ Reserve Cap. = 15

Output = 40
➔ Reserve Cap. = 25

Output = 80
➔ Reserve Cap. = 25

Output = 120
➔ Reserve Cap = 20

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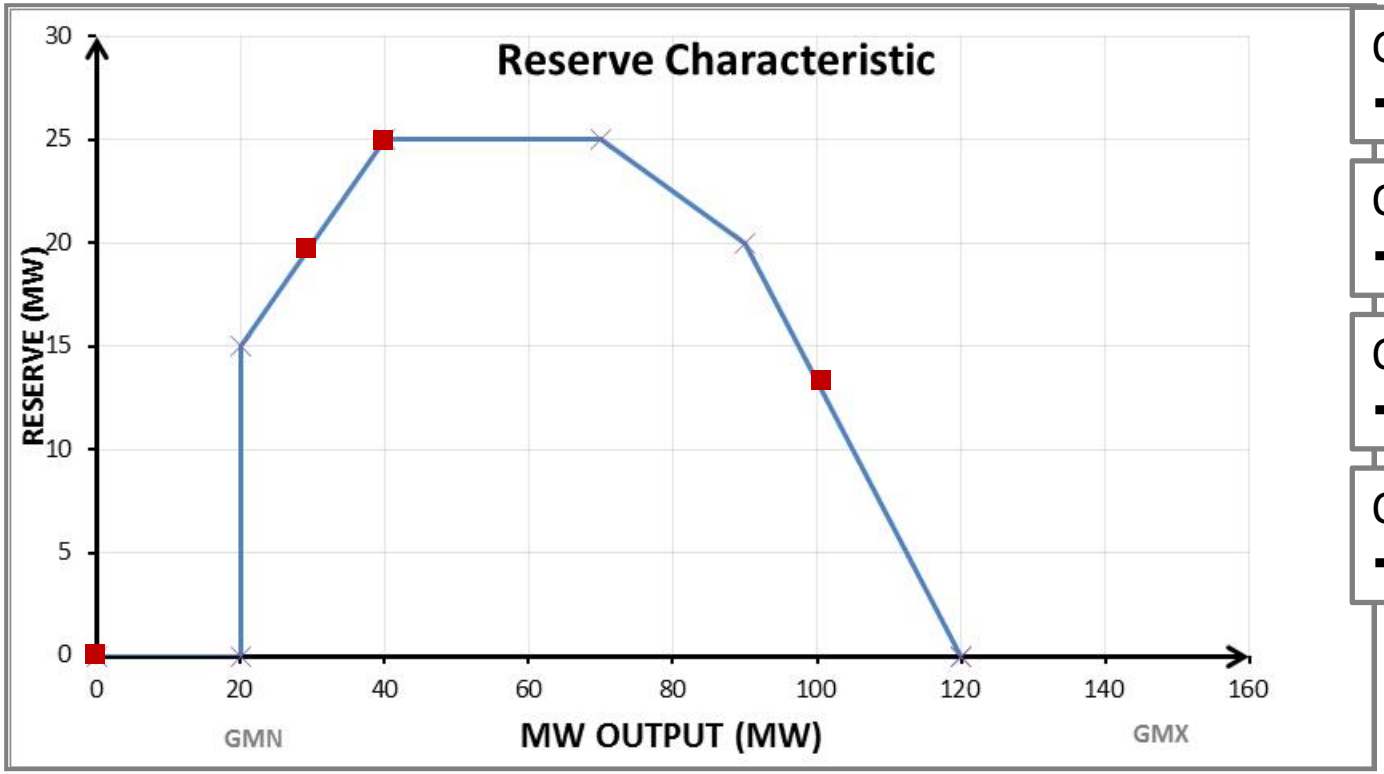
Availability = 120MW



Output = 40
➔ Reserve Cap. = 25

Output = 100
➔ Reserve Cap. = 13.33

Output = 30
➔ Reserve Cap. = 20

Output = 0
➔ Reserve Cap. = 0

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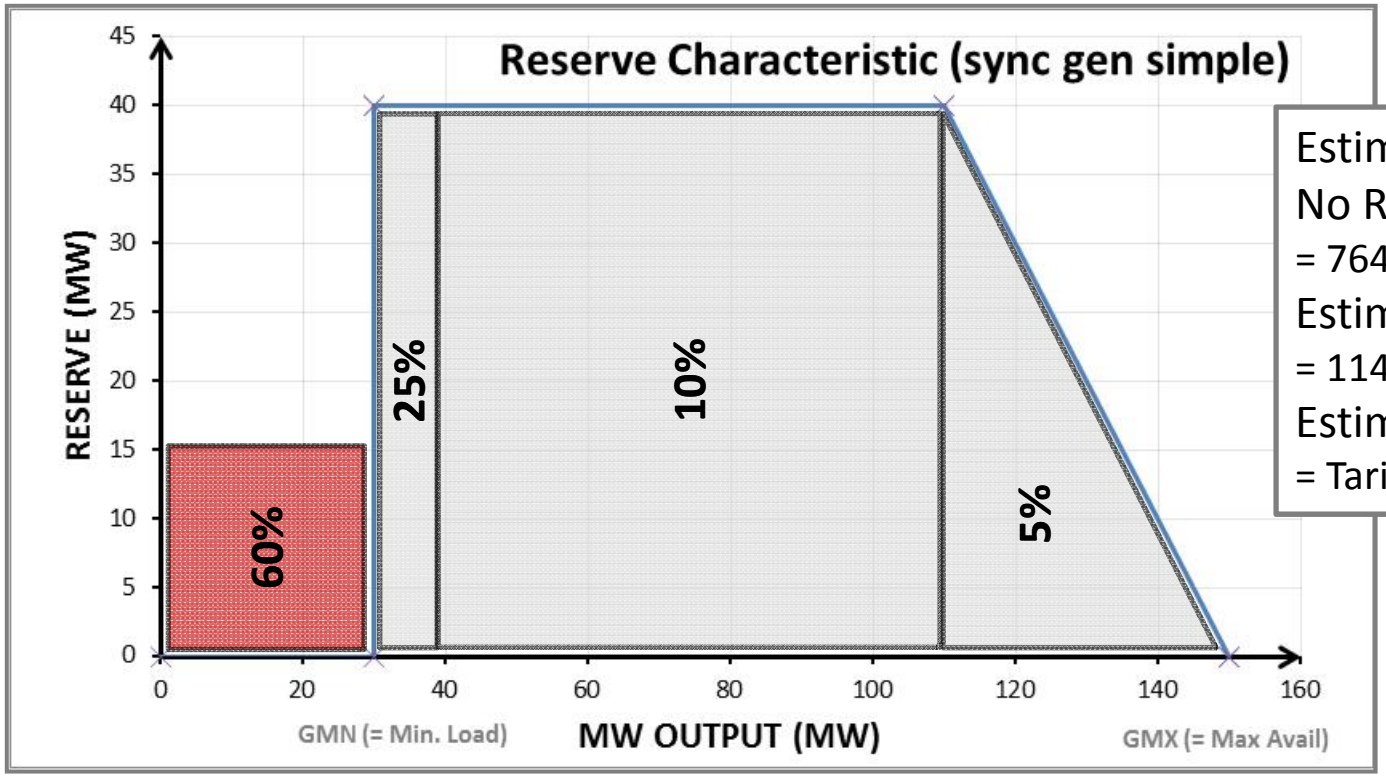
Estimating Reserve Revenues



Estimated Outages (10%)
No Reserve (3%)
= 7647 hours
Estimated Volume
= 114,705 MW
Estimated Revenue
= Tariff x Scalars x Volume

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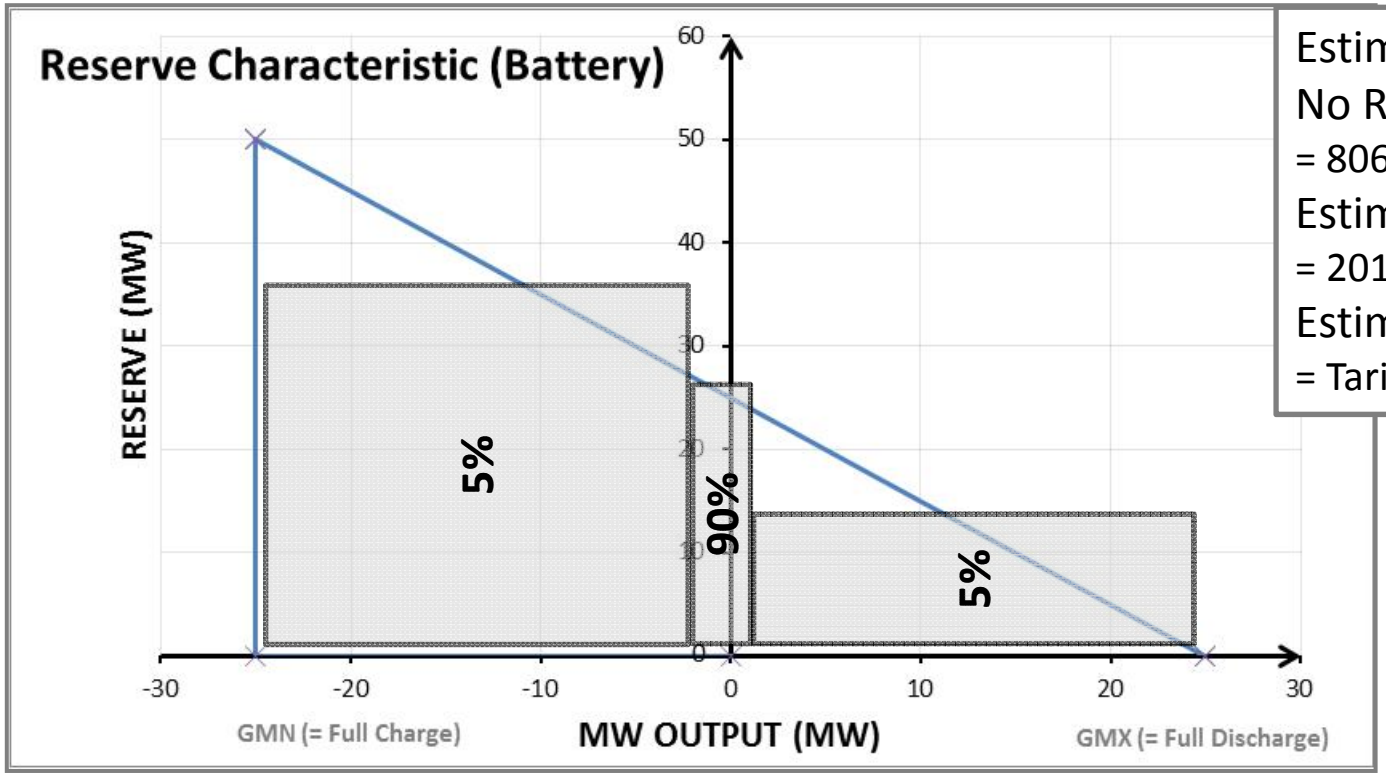
Estimating Reserve Revenues



Estimated Outages (7%)
No Reserve (1%)
= 8065 hours
Estimated Volume
= 201,221 MW
Estimated Revenue
= Tariff x Scalars x Volume

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DS3 Reserve Payments

Tariff

- Reserve Tariffs are fixed for interim

Scalars

Product

Performance

- Product Scalar fixed for Dynamic or Static Response in the case of POR, SOR, TOR1
- Performance Scalar value based on performance during previous events

Available Volume

- Reserve Characteristic adjusted for Availability
- MW Output
- Reserve Declarations
- *Wind Farm, ESU/Battery signals*

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Steady-State Reactive Power (SSRP)

- For Harmonised Ancillary Services (HAS), reactive power calculations were developed for synchronous machines and wind farms
- SSRP Payment is a modification of the HAS RP Payment (Leading/Lagging), standardising for non-synchronous & synchronous Providing Units
- SSRP Available Volume includes scaling component incentivising lower Minimum Generation
- **As SEM-13-098 (Decision Paper)**

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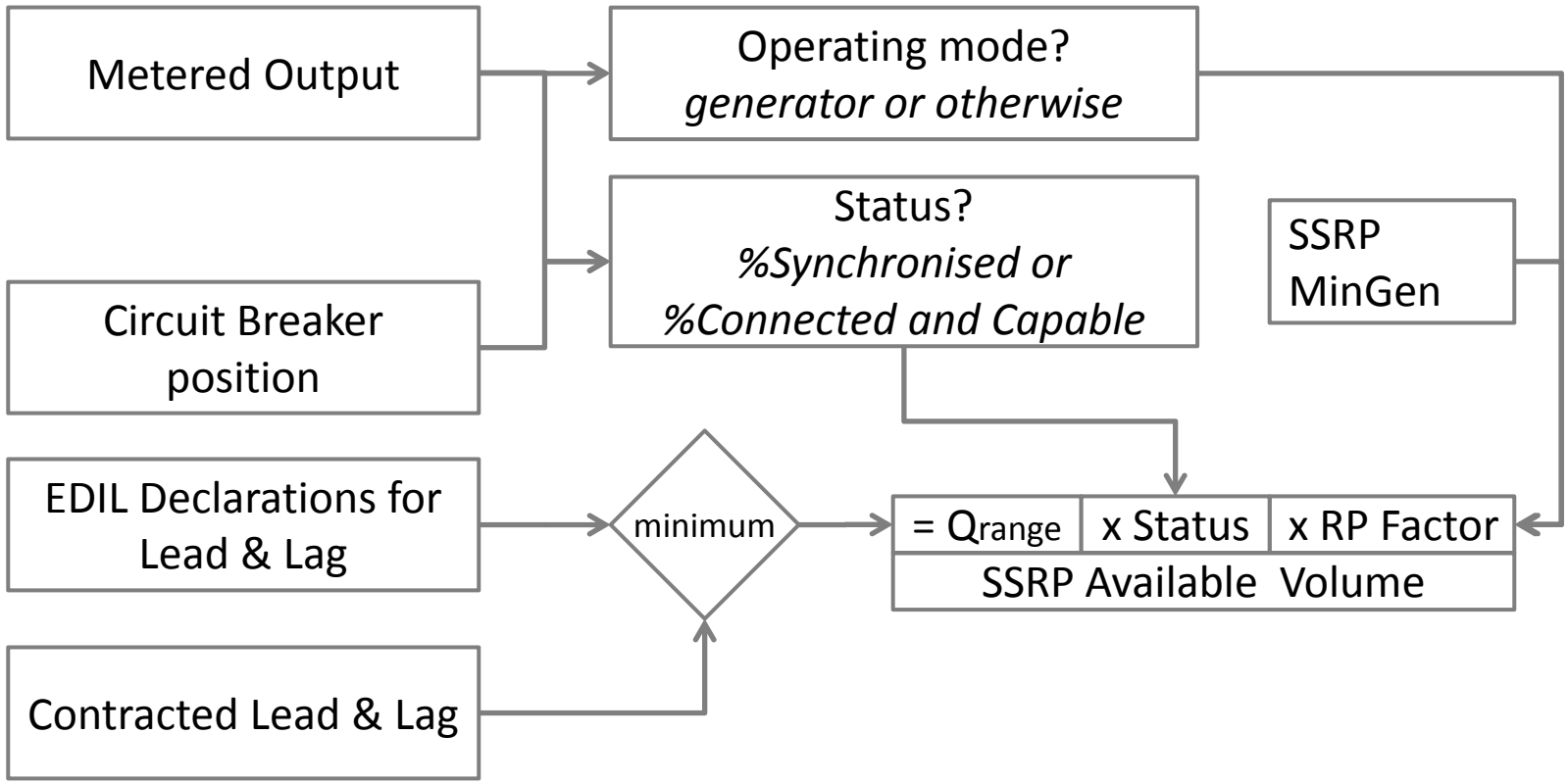
SSRP Available Volume



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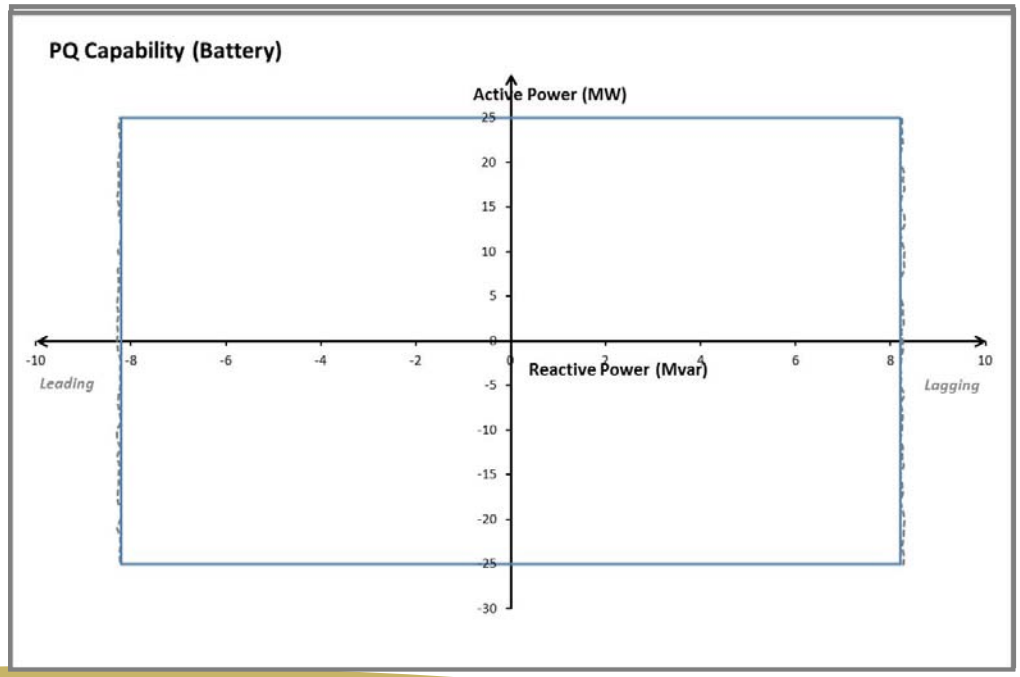
PQ Capability

- Reactive Power capability over full active power range will determine value for:
  - Contracted RP Lead
  - Contracted RP Lag



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EDIL Declarations

- In real-time, a Providing Unit may declare temporary reductions in reactive power capability via EDIL (MDLD, MDLG)
- If EDIL is not used, then contracted maximum RP is assumed

Q_{range} = *Minimum of Contract RP Lead & Decl RP Lead +*
Minimum of Contract RP Lag & Decl RP Lag

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SSRP Product Scalar

- In real-time, a Providing Unit may declare temporary ability/inability to act under AVR (Automatic Voltage Regulation)
- If AVR is ON / Available
  - SSRP Product Scalar = 2
- If AVR is OFF / Not Available
  - SSRP Product Scalar = 1

SSRP Product Scalar = 1 + Average AVR ON

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Mode of Operation / RP Factor

- MW Output determines the operating mode
  - Positive ➔ generation mode (or exporting, discharging)
  - Negative ➔ sync comp (or importing, charging)
- If operating in generation mode
  - RP Factor = (RCAP – SSRP MinGen)/RCAP
- Otherwise
  - RP Factor = 1

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Capable / ‘Status’

Synchronous machine

- Capable when Synchronised
- ‘% Synchronised’ in a Trading Period

Non-synchronous

- When Connected
- ‘% Connected’ in a Trading Period
- For Generators, additionally when MW Output >= MinSRP
- Otherwise, assumed capable

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Synchronous Inertial Response (SIR)

- This is a new service which was not remunerated under Harmonised Ancillary Services (HAS)
- SIR Service can only be provided by synchronous machines
- SIR Available Volume includes scaling component incentivising lower Minimum Generation
- **As SEM-13-098 (Decision Paper)**

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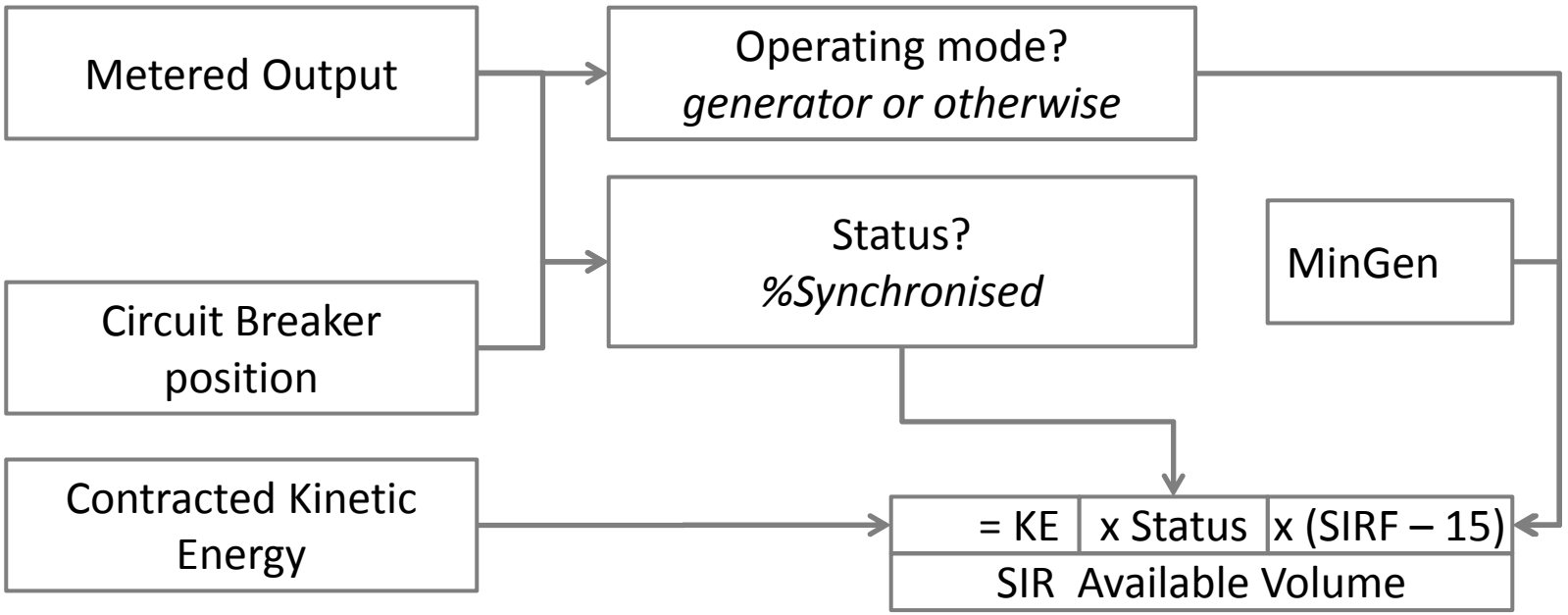
SIR Available Volume



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Mode of Operation / SIR Factor

- MW Output determines the operating mode
  - Positive ➔ generation mode
  - Negative ➔ synchronous compensation / motor mode
- If operating in generation mode
  - SIR Factor = Kinetic Energy / Minimum Generation
- Otherwise
  - SIR Factor = 45 seconds
- **NOTE:** SIR Factor (max. of 45, min. of 15)

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Capable / ‘Status’

Synchronous machine

- Capable when Synchronised
- ‘% Synchronised’ in a Trading Period

Non-synchronous

- Not capable of providing SIR

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SIR / SRP Available Volume Overview

- SSRP Available Volume = Q_{range} x RP Factor,
  when synchronised or connected and capable,
  RP Factor depends on operating mode

- SIR Available Volume = Kinetic Energy x (SIR Factor – 15),
  when synchronised,
  SIR Factor depends on operating mode

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Estimating SRP Revenues

- Estimate Synchronised Hours in year (Sync hrs)
- Calculate RP Factor (RPF)
- Annual SRP Volume = Qrange x RPF x Sync hrs

  adjust for Product Scalar (= 1 + AVR ON)

Example
Qrange = 122Mvar
MinGen = 60MW
RCAP = 120MW
RPF = 0.5 (= 60/120)
Estimated Sync hours
7884 hours (= 0.9 X 8760)
Estimated Volume
480,924 Mvarh

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Estimating SIR Revenues

- Estimate Synchronised Hours in year (Sync hrs)
- Calculate SIR Factor (SIRF)
- Annual SIR Volume = KE x (SIRF–15) x Sync hrs

Example
KE = 1000MWs
MinGen = 40MW
SIRF = 25
Estimated Sync hours
701 hours (8%)
Estimated Volume
7,010,000 MWhs²

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DS3 SSRP Payment

Tariff

- SSRP Tariff is fixed for interim

Scalars

Product

Performance

- Product Scalar for AVR ON/OFF
- Performance Scalar value

Available Volume

- PQ Capability
- Reactive Power Declarations
- SSRP MinGen
- MW Output, CB position

EIRGRID GROUP

DS3 SIR Payment

Tariff

- SIR Tariff is fixed for interim

Scalars

- No scalars in Interim

Available Volume

- Kinetic Energy
- Minimum Generation
- MW Output, CB position

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Ramping Margin (RM1 / RM3 / RM8)

- This is a new service which was not remunerated under Harmonised Ancillary Services (HAS)
- Ramping Margin is measured over a Horizon Window and a Duration Window
- Increase in MW Output (or MW Reduction) provided by the end of Horizon Window and sustained for the Duration Window
- **As SEM-13-098 (Decision Paper)**

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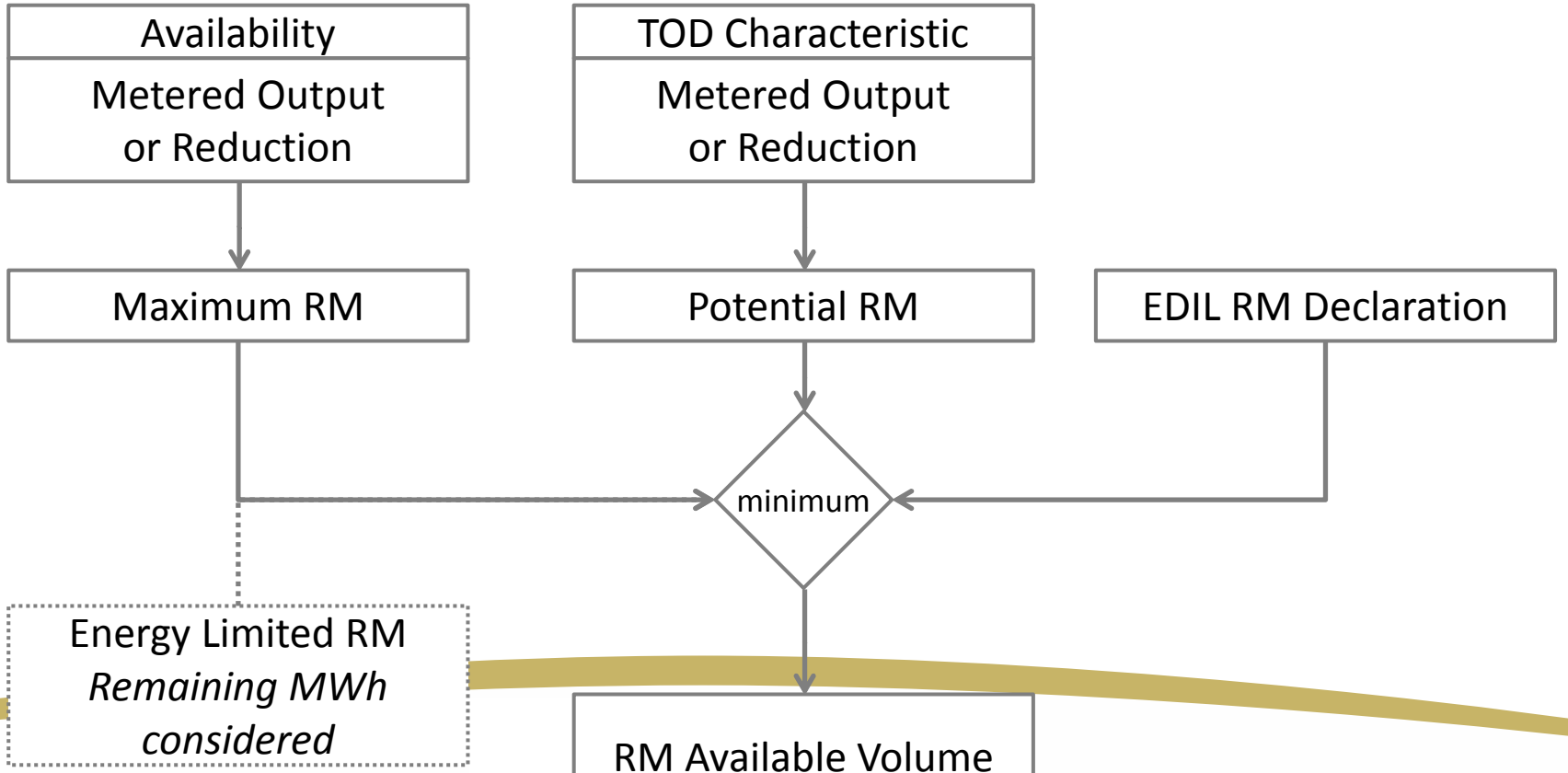
Ramping Margin Available Volume

- RM Available Volume calculation flow



Maximum Ramping Margin

RM Service	Horizon Window	Duration Window	Maximum RM
RM1	0 - 1 hour	1 - 3 hours	= Minimum MW Availability between 0 and 3 hours – MW Output at 0 hours
RM3	0 - 3 hours	3 - 8 hours	= Minimum MW Availability between 0 and 8 hours – MW Output at 0 hours
RM8	0 - 8 hours	8 - 16 hours	= Minimum MW Availability between 0 and 16 hours – MW Output at 0 hours

Maximum RM at a point in time is equal to the difference between the minimum of the Providing Unit's Availability from the start of the horizon window until the end of the duration window and the MW Output at that point in time

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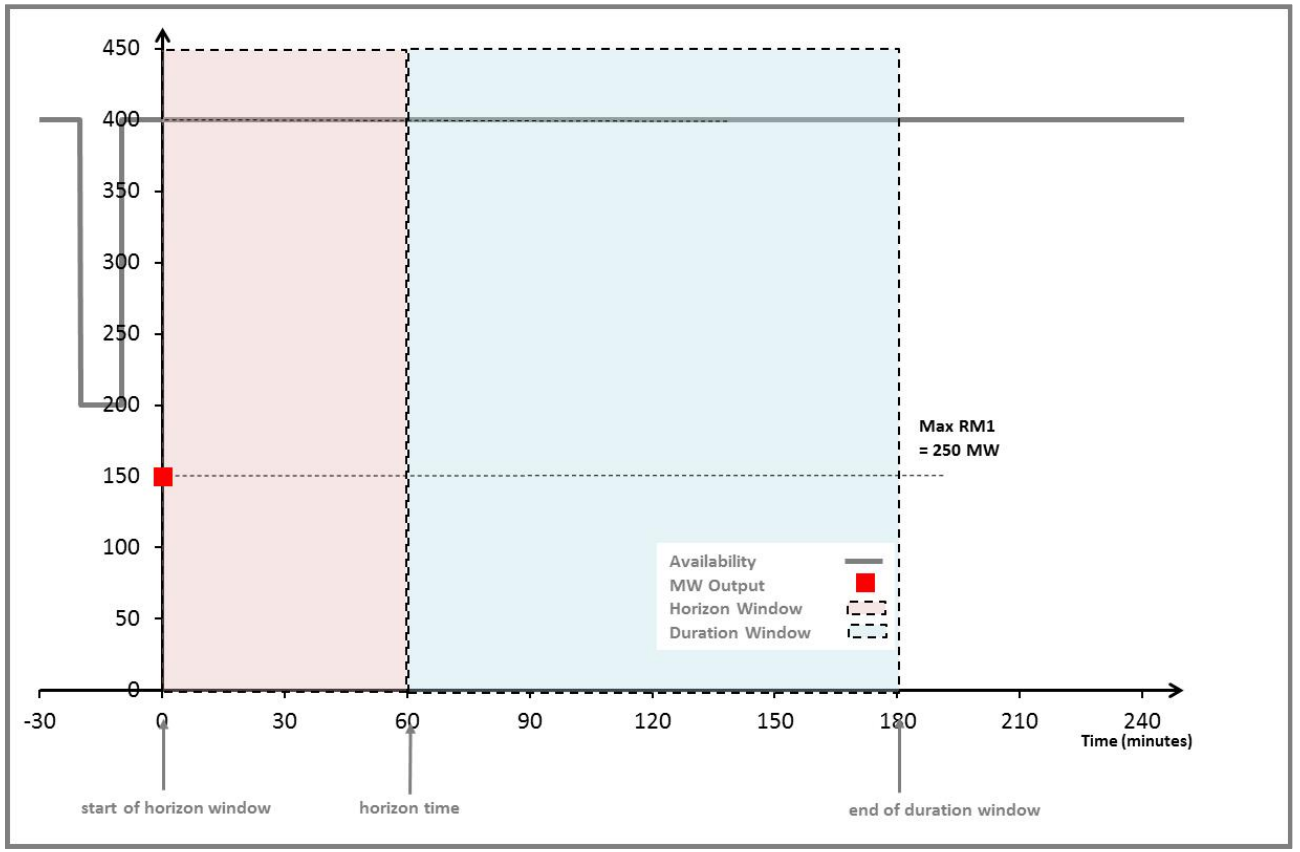
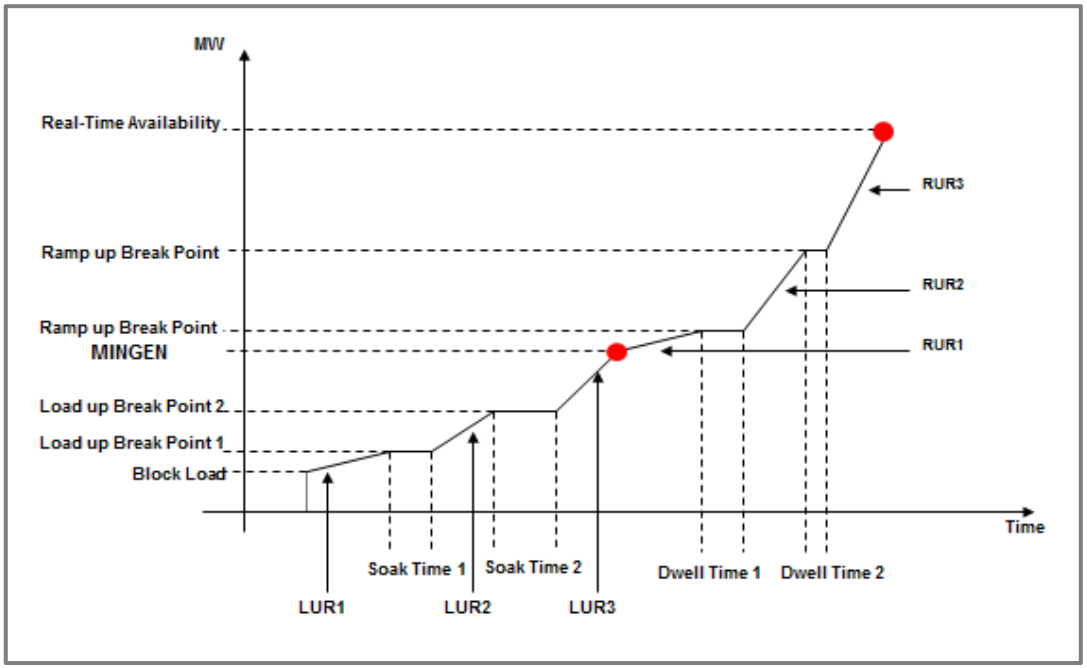
Examples Maximum RM1



Technical Offer Data (TOD)

normal operating modes are load up phase, ramp up phase, ramp down phase and deload phase, each operating phase is described by a piecewise linear trajectory that describes the theoretical Output over time.



Potential Ramping Margin

- Determine mode of operation
  1. Ramp-up phase
  2. Load-up phase
  3. Desynchronised phase
  4. *Ramp-down phase / deload phase (not considered)*

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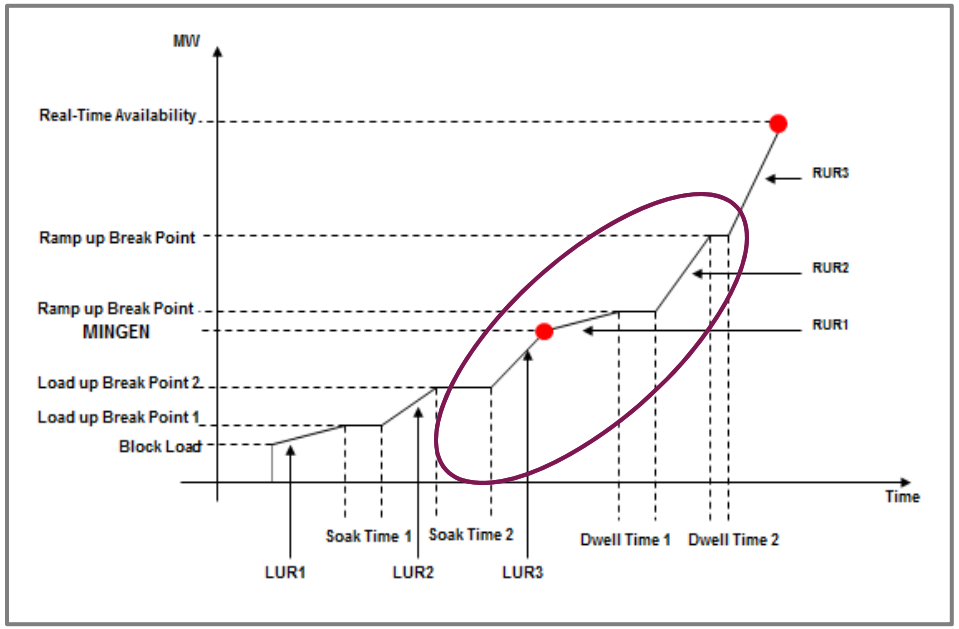
Potential RM (Ramp-up phase)

- Ramp-up phase, when
  - MW Output >= Minimum Stable Generation
- Increase in MW Output from current MW Output given Horizon Window, considering
  - Ramp-up trajectory



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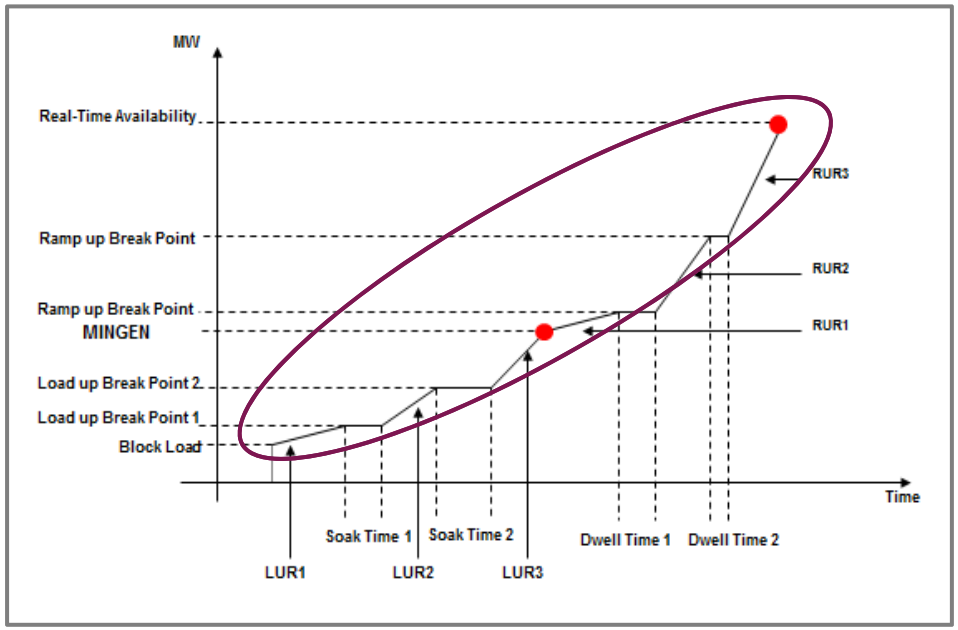
Potential RM (Load-up phase)

- Load-up phase, when
  - MW Output < Minimum Stable Generation, and
  - MW Output > 0
- Increase in MW Output from current MW Output given Horizon Window, considering
  - Warmth State
  - Load-up trajectory
  - Ramp-up trajectory



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Potential RM (desynchronised)

- Desynchronised, when
  - MW Output = 0
- Increase in MW Output from current MW Output given Horizon Window, considering
  - Time since Desynchronisation
  - **Synchronous Start-up Time** (notice time to synchronise)
  - Warmth State
  - Load-up trajectory
  - Ramp-up trajectory

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Technical Offer Data (DSU)

- The DSU Technical Offer Data parameters do not include these phases
- Potential RM considers Maximum Down Time
  - *means the maximum period of time during which Demand Reduction at a Demand Side Unit can be Dispatched*
- If Maximum Down Time < Duration Window
  - Potential RM = 0

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EDIL Declaration

- There is a modification to EDIL which allows a Providing Unit to declare temporary reductions in ramping margin capability via EDIL (RM1, RM3, RM8)
- If EDIL is not used, the declaration is not considered

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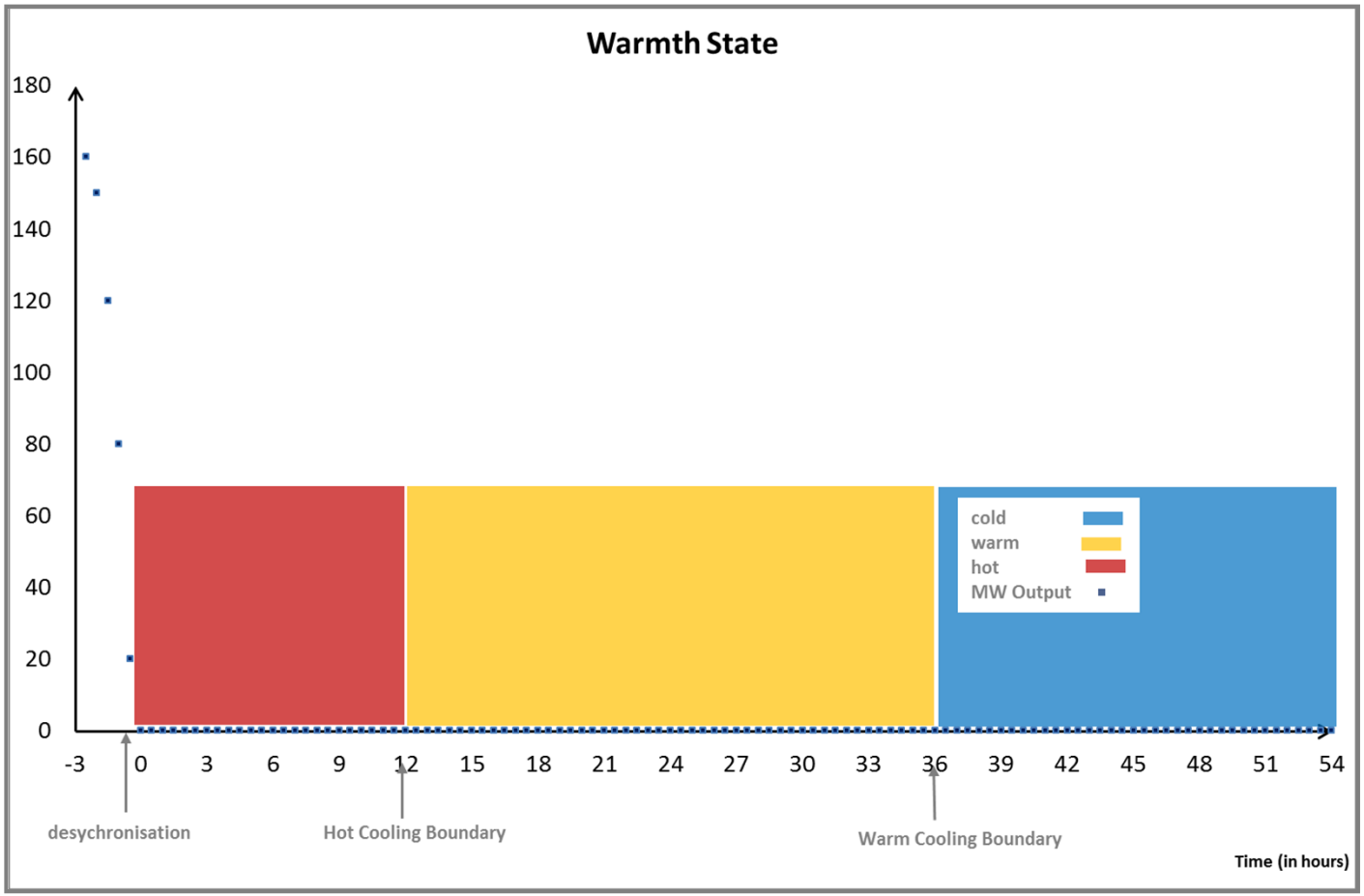
Warmth State



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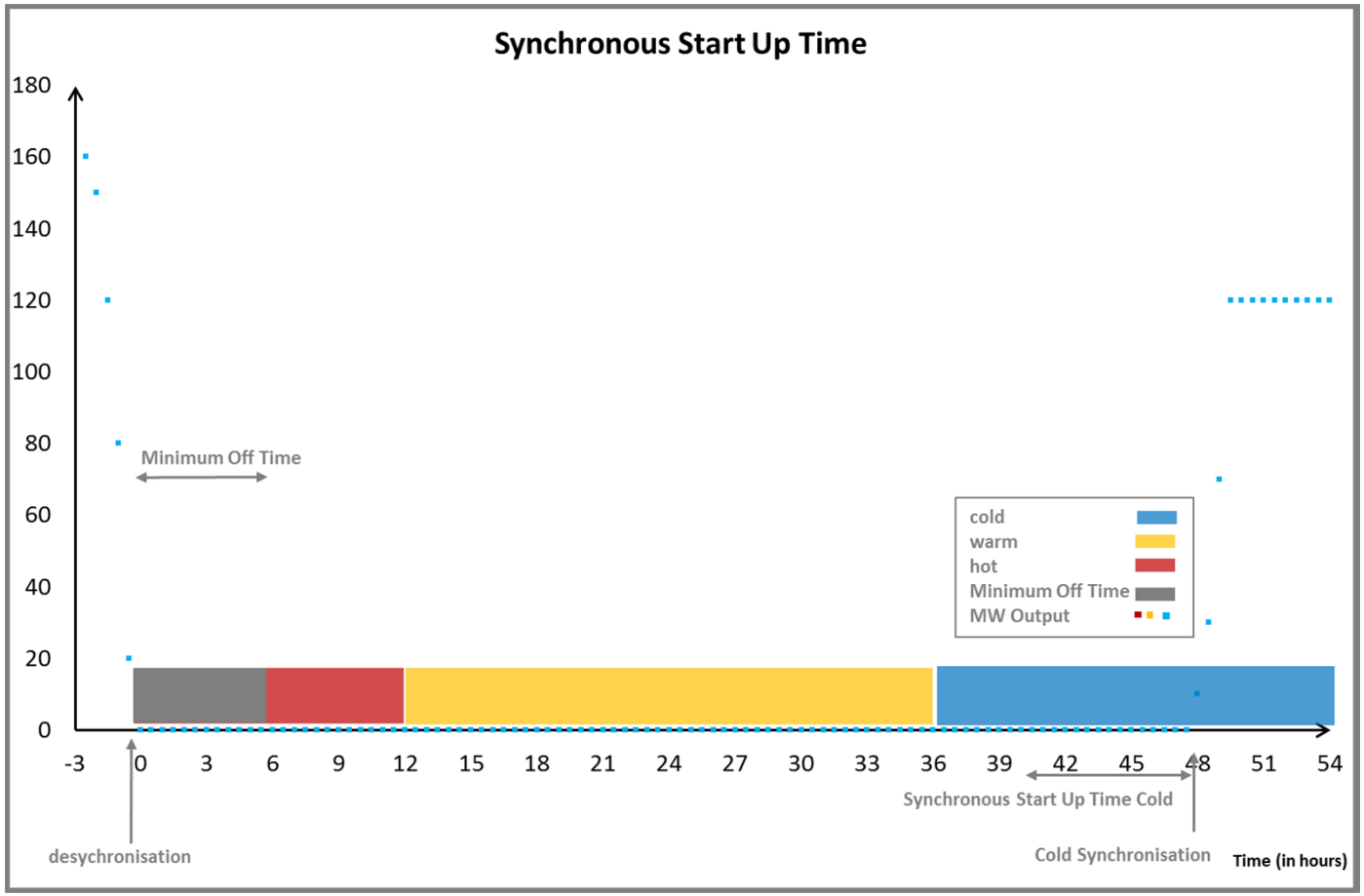
Start up Times



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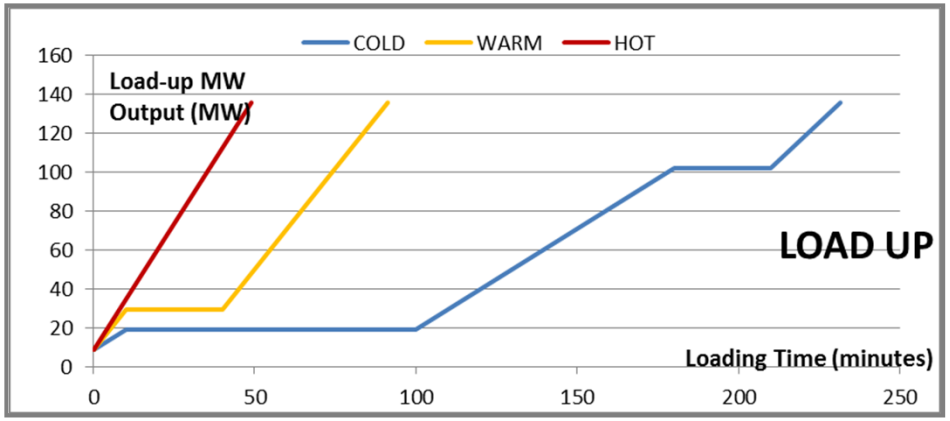
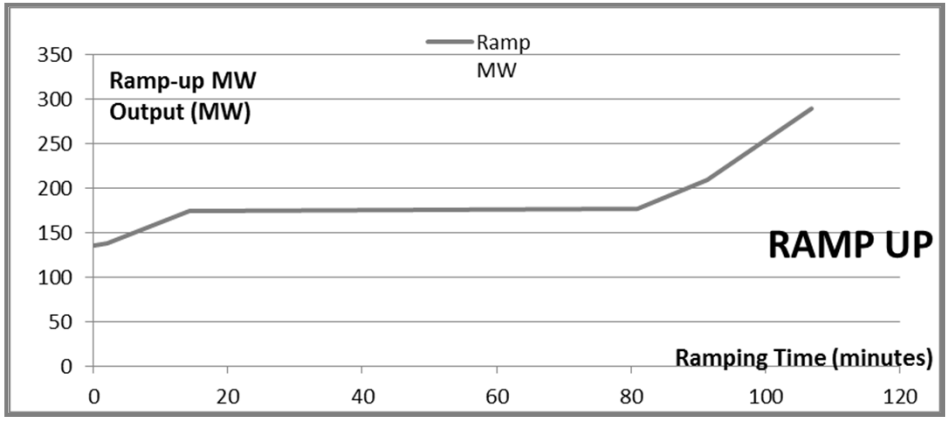
Trajectories





- Load-up phase
  - Sync to Min Gen
- Ramp-up phase
  - From Min Gen

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TOD Trajectory Calculation

- Calculation:
  - 11 TOD parameters for Load-up Cold
  - 11 TOD parameters for Load-up Warm
  - 11 TOD parameters for Load-up Hot
  - 17 TOD parameters for Ramp-up
  - **1 SDW parameter for Ramp-up**
  - 48 distinct parameters in total

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‘Flexible’ Units

- Ability to changeover on fuel
  - designed with 3 x SDW flags (0/1)
  - designed with 3 x SDW values
- Ability to rapidly start in open cycle mode
  - designed with 3 x SDW flags (0/1)
  - designed with 3 x SDW values

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DS3 RM Payment

Tariff

- RM Tariffs are fixed for interim

Scalars

Performance

- Performance Scalar value based on event performance

Available Volume

- Technical Offer Data parameters
- MW Availability
- MW Output
- *Remaining MWh*

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DS3 System Services Settlement

11th October 2016

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System Services Settlement

- System Services Settlement – Updates
- System Services Settlement – Reports overview
- System Services Settlement - Billing Schedule timelines
- System Services Settlement – Query handling

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Updates to Settlement

- Confirmation Statements no longer issued
- Changes in the Settlement Timelines
- New Reports
- Excel Reports
- Introduction of Self-billing Invoicing

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2016/17 Settlement Schedule

Initial Bill Month	Date of Issue	Payment of Invoices	Indicative Reports Release dates *
October 2016	5th December 2016	19th December 2016	28th November 2016
November 2016	9th January 2017	23rd January 2017	3rd January 2017
December 2016	6th February 2017	20th February 2017	30th January 2017
January 2017	7th March 2017	22nd March 2017	28th February 2017
February 2017	5th April 2017	21st April 2017	29thMarch 2017
March 2017	10th May 2017	24th May 2017	3rd May 2017
April 2017	6th June 2017	20th June 2017	30th May 2017
May 2017	5th July 2017	21st July 2017	28th June 2017
June 2017	8th August 2017	22nd August 2017	1st August 2017
July 2017	5th September 2017	19th September 2017	29th August 2017
August 2017	5th October 2017	19th October 2017	28th September 2017
September 2017	3rd November 2017	17th November 2017	27th October 2017

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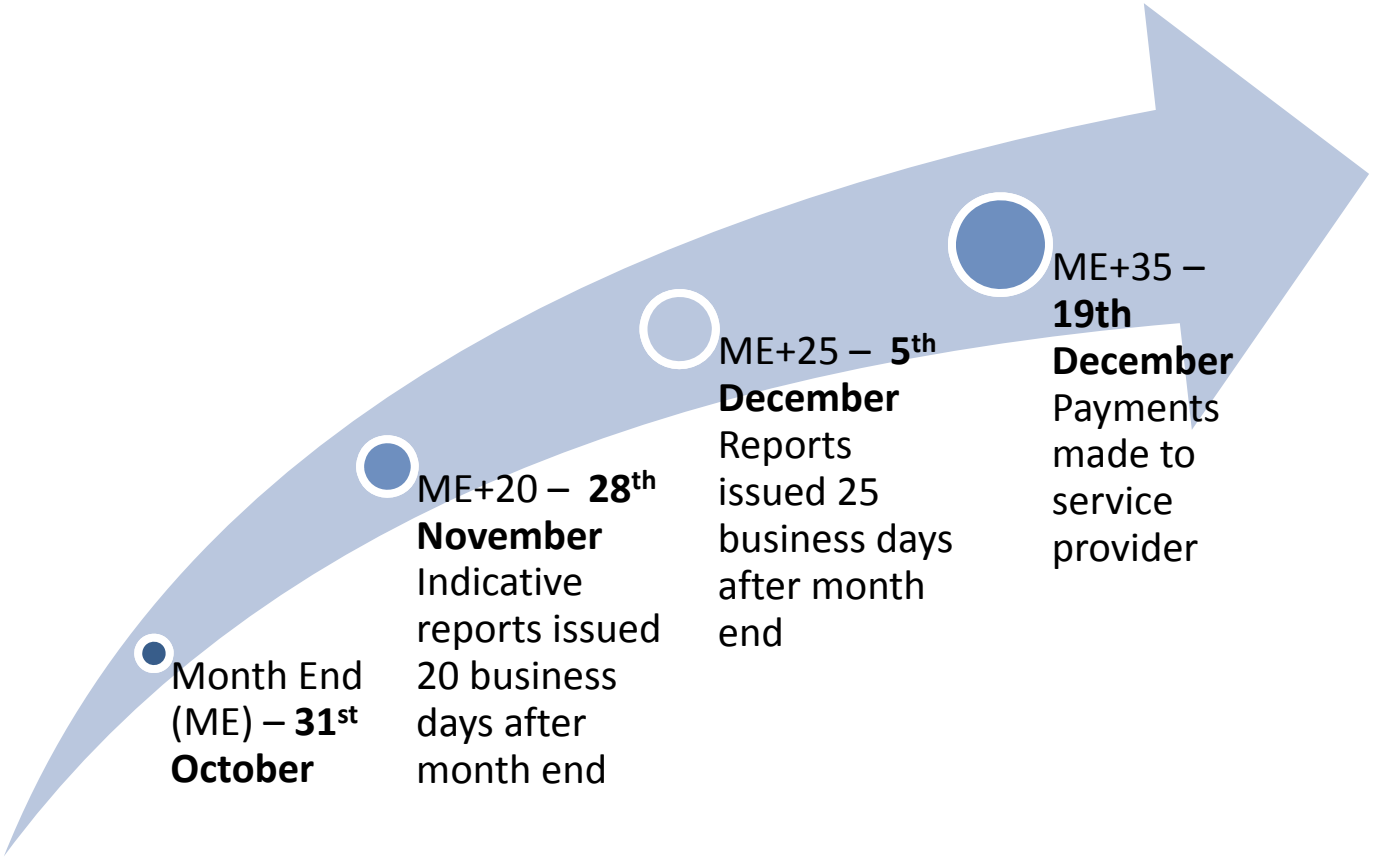
Billing Schedule timelines – October 2016



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New & Changed Reports

System Services Product	Settlement Report Name
Steady State Reactive Power (SSRP)	ASP03
Synchronous Inertial Response (SIR)	ASP 16
Ramping Margin (RM1,RM3 & RM8)	ASP 16
Reserve- POR	ASP17
Reserve- SOR	ASP17
Reserve- TOR 1	ASP 17
Reserve- TOR 2	ASP 17
Replacement Reserve (RRS, RRD)	ASP 17
Summary Reports	SS Monthly Total

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OSC Reports

- Renaming of Existing Reports
- Merging of Reports
- Excel reports now available

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OSC and RoCoF Reports

Product	Report Name
Trips	Daily OSC Events OSC Monthly Unit OSC Monthly Participant
SNDs	OSC Monthly Unit OSC Monthly Participant
GPIs	OSC Monthly Unit OSC Monthly Participant
RoCoF Payments	No change to Confirmation Statements for payments OS Monthly Participant
RoCoF Charges	No change to Confirmation Statements for Charges OSC Monthly Unit OSC Monthly Participant
Summary Reports	OSC Total

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Other Reports

- Trip Report
- Outturn Report

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Ancillary Services Report
2015/2016

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Reserve Payments (€)

	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Total
POR	509,036	527,087	515,314	564,983	516,040	536,216	536,014	539,036	477,155	507,217	534,023	-	5,762,121
SOR	766,295	798,293	775,259	833,444	744,085	782,802	804,226	788,506	669,488	734,329	791,407	-	8,488,135
TOR1	757,878	786,952	745,151	807,835	714,769	758,049	784,628	773,058	631,687	711,617	767,969	-	8,239,594
TOR2	458,817	462,185	444,618	471,407	425,262	450,831	451,534	455,797	380,942	423,730	452,962	-	4,878,083
RR	578,878	673,987	679,002	669,186	616,992	689,651	702,352	712,009	624,145	720,466	667,808	-	7,434,475
Interconnector A8	448,934	432,899	434,235	458,067	445,581	477,437	420,558	455,055	300,968	276,865	265,845	-	4,416,444
RoCoF	-	-	-	-	-	-	-	-	-	-	-	-	-

Reserve Charges (€)

	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Total
POR	-	-	-	-	-	-	-	- 5,226	- 17,414	-	-	-	- 22,640
SOR	-	-	-	-	-	-	-	- 16,044	- 31,315	- 2,177	-	-	- 49,536
TOR1	-	-	-	-	-	-	-	-	-	-	-	-	-

Reactive Power Payments (€)

	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Total
Reactive Power Lagging	717,445	684,817	684,774	742,076	710,548	753,955	717,912	698,254	517,606	715,975	691,813	-	7,635,175
Reactive Power Leading	418,149	391,124	393,490	421,625	399,768	426,315	407,673	403,248	539,877	424,750	413,180	-	4,639,200

Other System Charges (OSC) Trip Report
2015/2016

Date	Unit	MW Lost	Pre-incident [Hz]	Frequency Nadir [Hz]	Trip Type
02/01/2015 08:36	Moneypoint unit 1	120.85	49.97	49.71	Direct
02/10/2015 07:54	Ballylumford CCGT Unit 21 255 MW	168.924	49.991	49.796	Direct
08/10/2015 11:22	Coolkeeragh C30	374.442	50.062	49.672	Direct

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Self Billing Process

- Issuing of Invoices will be from SONI
- All Service Providers will need to complete a new Supplier Form for System Services
- Return the form with bank details on headed paper before COB Friday 18th November
- Payment will be made within 10 Business Days following the issue of final Reports

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Self- Billing Sample Invoice

SONI Limited
12 Manse Road
Castlereagh
Belfast, BT6 9RT
Northern Ireland
Telephone: 028 90794336
Fax: 028 90707560
VAT Reg No. GB945676869

Self-Billing Invoice

Customer Number
Service Provider Name
12 Any Street
Belfast
BT1 2AB
Northern Ireland

For Enquiries Contact cas@soni.ltd.uk
Invoice Number SSI00000001
Invoice Issue Date 42654

Billing Month	Bill Type	Description	Value GBP
Sep-16	Initial	System Services Payments	£88,660.54

System Services for September 2016

Sub Total	£88,660.54
VAT at 20%	£17,732.11
Total	£106,392.65

Payment terms are 10 working days

Payment Due Date 25/10/2016

SONI Registered Office: Castlereagh House, 12 Manse Road, Belfast, BT6 9RT. Registered in N.Ireland NI 38715

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Settlement Queries

- All Queries should be sent to cas@soni.ltd.uk

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Contract Queries

- Any queries with unsigned contracts should be sent to DS3Procurement@Eirgrid.com
- Once Contacts are signed all Contract Queries should be sent to cas@soni.ltd.uk

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GPI Side Letters

- Providers that have previously had a HAS Contract should have received a letter with their GPI Parameters.
- Any Changes to these parameters will need to be agreed with System Support as@eirgrid.com

Publications

- DS3 System Services Statement of Payment
- DS3 System Services Protocol –Interim Arrangements
- Final TUoS Statement of Charges
- OSC Methodology Statement

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Questions

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Settlement Queries

- All Queries should be sent to cas@soni.ltd.uk

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