

RoCoF remuneration mechanism and RoCoF GPI process

Industry Workshop

Crowne Plaza Hotel, Dundalk

11th March 2016



Agenda

Item	Time	Speaker
Tea/Coffee	09:15	
Chair Opening & General Overview	09:30	Louis Fisher
Regulator Update	09:40	CER & UR
Questions	09:50	All
RoCoF Study Process Recap	10:00	David Cashman
RoCoF Testing Process	10:15	Karl O' Keeffe
Questions	10:30	All
RoCoF GPI Process	10:45	Amanda Kelly
Questions	11:00	All
RoCoF Remuneration Mechanism	11:15	Amanda Kelly
Questions	11:30	All
AOB	11:45	All
Closing comments	11:55	Louis Fisher

DS3 Overview

DS3 Industry Workshop

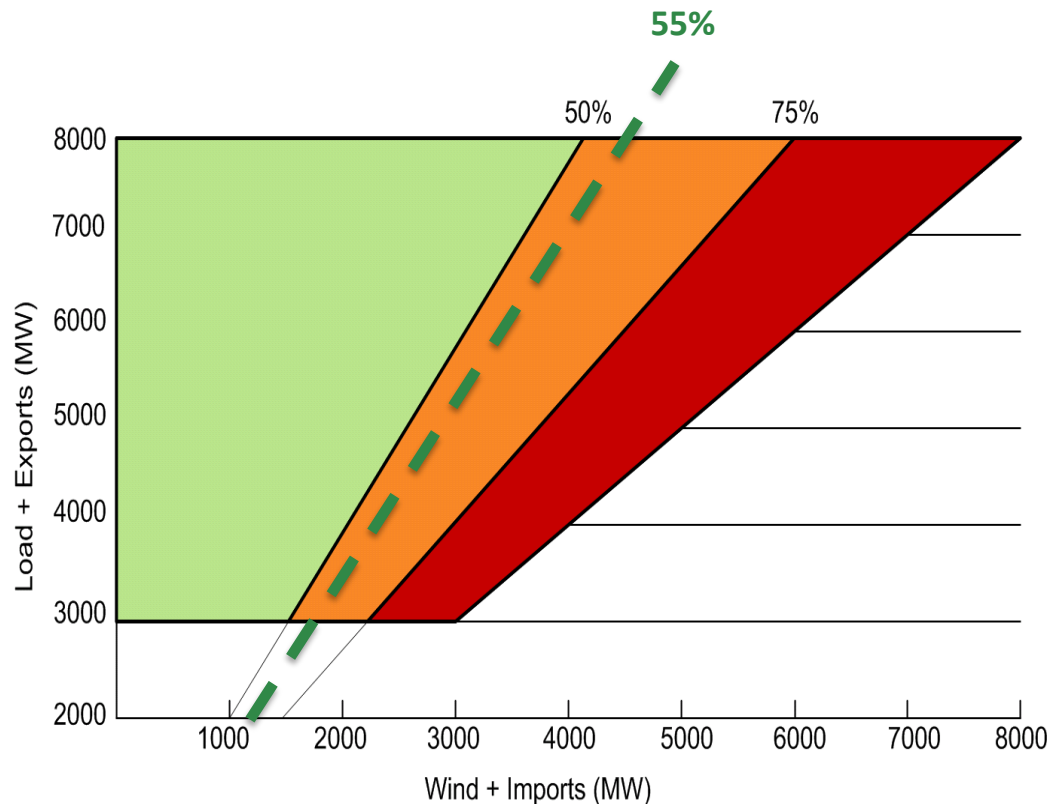
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Louis Fisher



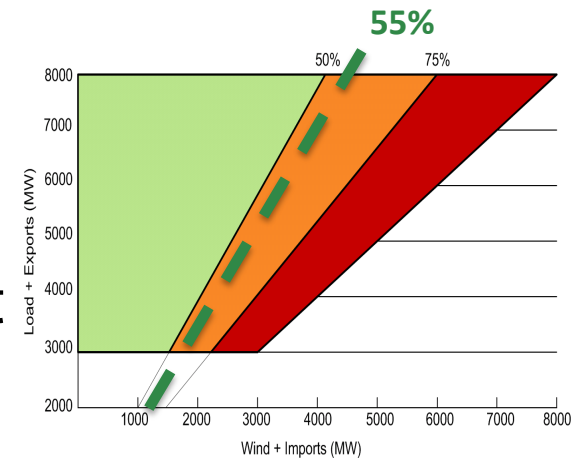
Increase of SNSP to 55%

- Builds on the policies and tools brought through the OPR Committee
- Will inform future operational policy



Observations and Next Steps

- SNSP above 50% for 10% of the time
- No observed differences in system behavior at $50\% < \text{SNSP} < 55\%$
- Detailed analysis of events in this period has been conducted
- OPR have approved Operational limit of SNSP at 55% from March 1st



2016 Focus Areas

RoCoF

- Generator Studies
- TSO-DSO project
- Alternatives Report close out

System Services

- Interim Arrangements: Q4 2016
- Enduring Arrangements: Q4 2017

Operational Policy

- Voltage dip induced frequency dips
- Grid Code
- High Wind Speed Shut-Down
- Operational Metrics: Fast Frequency Response

Control Centre Tools

- EMS Integration Project
- System Services Tools
- Off-line WSAT

Rate of Change of Frequency: Regulatory Update

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Robert O'Rourke

Background

- CER Decision (CER/14/081) published 4th April 2014
 - Extensive discussion at Grid Code (and working group)
 - Independent review by CER's consultants
 - Public Consultation
- Implementation of the new RoCoF standard in principle following completion of the generator studies
 - 18 – 36 month study period
 - RoCoF alternative solutions project required
 - TSO/DSO Implementation project

Context

- CER consider increasing the RoCoF standard to 1Hz/s a crucial step towards Ireland's 2020 RES targets
- Required to increase SNSP to 75%
- Detailed Technical studies of generators to confirm compliance
- CER must balance;
 - the importance of implementing RoCoF quickly;
 - the consumer interest; and
 - the safety and security of the system

RoCoF Implementation Project Framework

Modification

Approved in
principle

Effective after
confirmation from
studies

18-36 Month
timeline

Implementation

Generator studies;
Independent co-
ordination

TSO-DSO
implementation
project

TSO led alternative
solutions project

Financial Arrangements

No Cost recovery for
study

GPI to be phased in
after 18 months

Payments to be
developed

Generator Status Update

- Trilateral meetings held 1st & 2nd March
- Significant work carried out by generators
- Study Completion on Schedule
 - Several units expected to complete early
 - Some priority one units may slip to Q3 delivery
- No major issues identified by generators
- CER will review EirGrid assessment of completed studies

RoCoF Project Update

- Generator Studies Project expected to complete ahead of schedule
- Alternative/Complementary Solutions Project nearing completion
- DSO/TSO Implementation ongoing
 - Engagement from distributed generation and Wind Farms will be key to success of project

Next Steps

- Q1 2016 RoCoF update to be published in April
- Further Trilateral meetings to take place between Generators, EirGrid, and the CER as required
- Deadline for Phase 1 21st May, 2016
- RAs to consider EirGrid recommendation on remuneration mechanism



Commission for Energy Regulation

An Coimisiún um Rialáil Fuinnimh

Thank you



RoCoF Generator Studies Process

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David Cashman

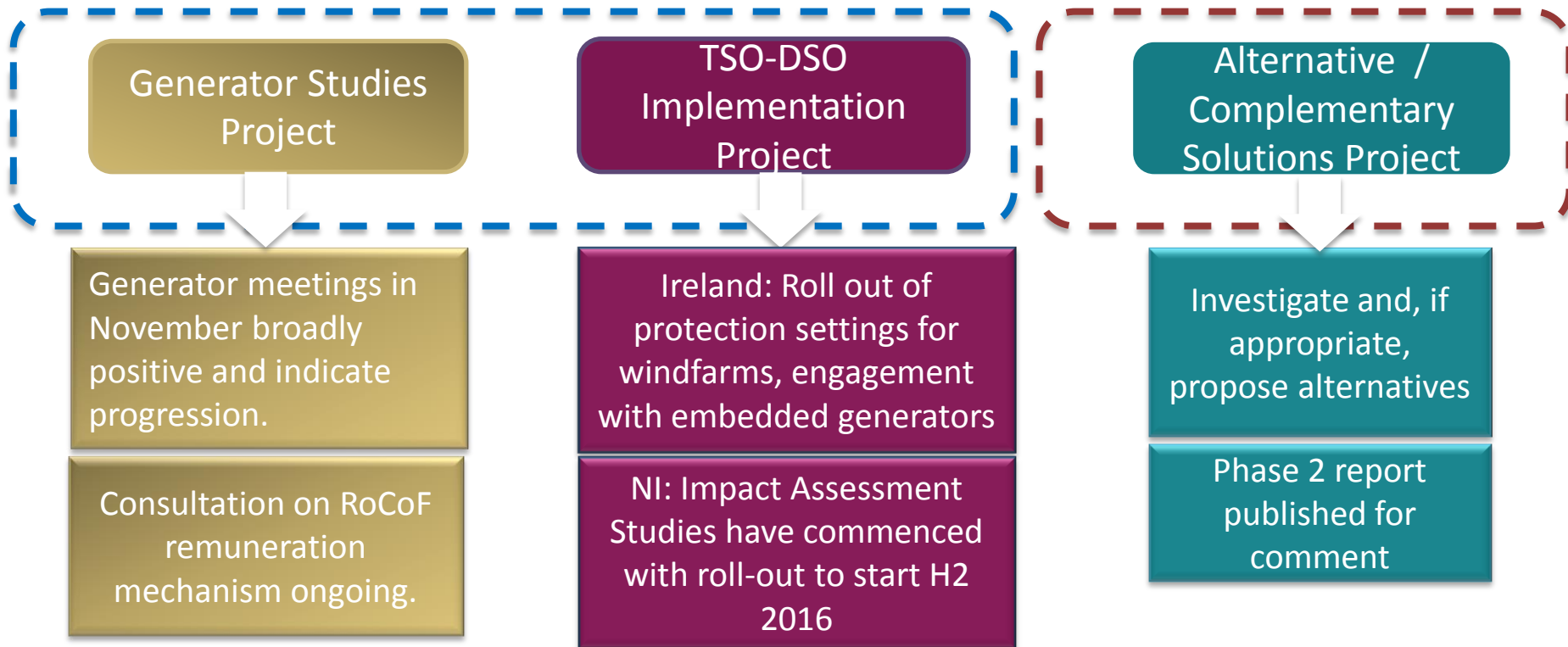


CER & UR Decisions

- Grid Code modification approved in principle
- Three workstreams
 - Generator Studies Project
 - TSO-DSO Implementation Project
 - Alternative Solutions Project
- Generators Studies Project
 - Commence November 2014
 - Categorisation: 18-36 months
 - RoCoF GPI
 - RoCoF Incentive mechanism



RoCoF Implementation Project



TSO-DSO Project: Ireland

DSO Wind

- Requests for protection settings changes issued
- Roll-out of changes on wind farms is continuing
- DSO have provided database of settings to TSO

Embedded non-wind generation

- D-code modification tabled and agreed in principle
- Meetings with representatives to assess impact on existing fleet
- DSO have provided indicative volumes of generation to TSO
- TSO to perform impact assessment studies based on these volumes

TSO-DSO Project: Northern Ireland

Large-scale generation

- Studies to be completed by Q2 with NIE review by Q3 2016
- Commence Roll-out of LoM protection settings Q3 2016
- All large-scale generators have new settings Q3 2017

Small-scale generation

- D-code modification consulted on and currently under review
- Studies to commence Q2 2016
- Commence Roll-out of LoM protection settings Q4 2016
- All small-scale generators have new settings Q3 2017

Generator Studies Timeline

Q2 2014
CER & UR
decisions

Q2 2016
Complete
Category 1
Studies

Q4 2016
Complete
Category 2
Studies

Q4 2017
Complete
Category 3
Studies

Category 1 Generator
Studies

Category 2 Generator Studies

Category 3 Generator Studies

Generator Study Process

- Generators to provide TSO with sufficient evidence that unit can withstand RoCoF event
- Declaration that safety & integrity issues have been resolved
- Dynamic stability assessment of unit per TSO outline
- Revise dynamic models of generator if required
- TSO reviews generator submissions and advise CER on results

RoCoF Frequency Traces

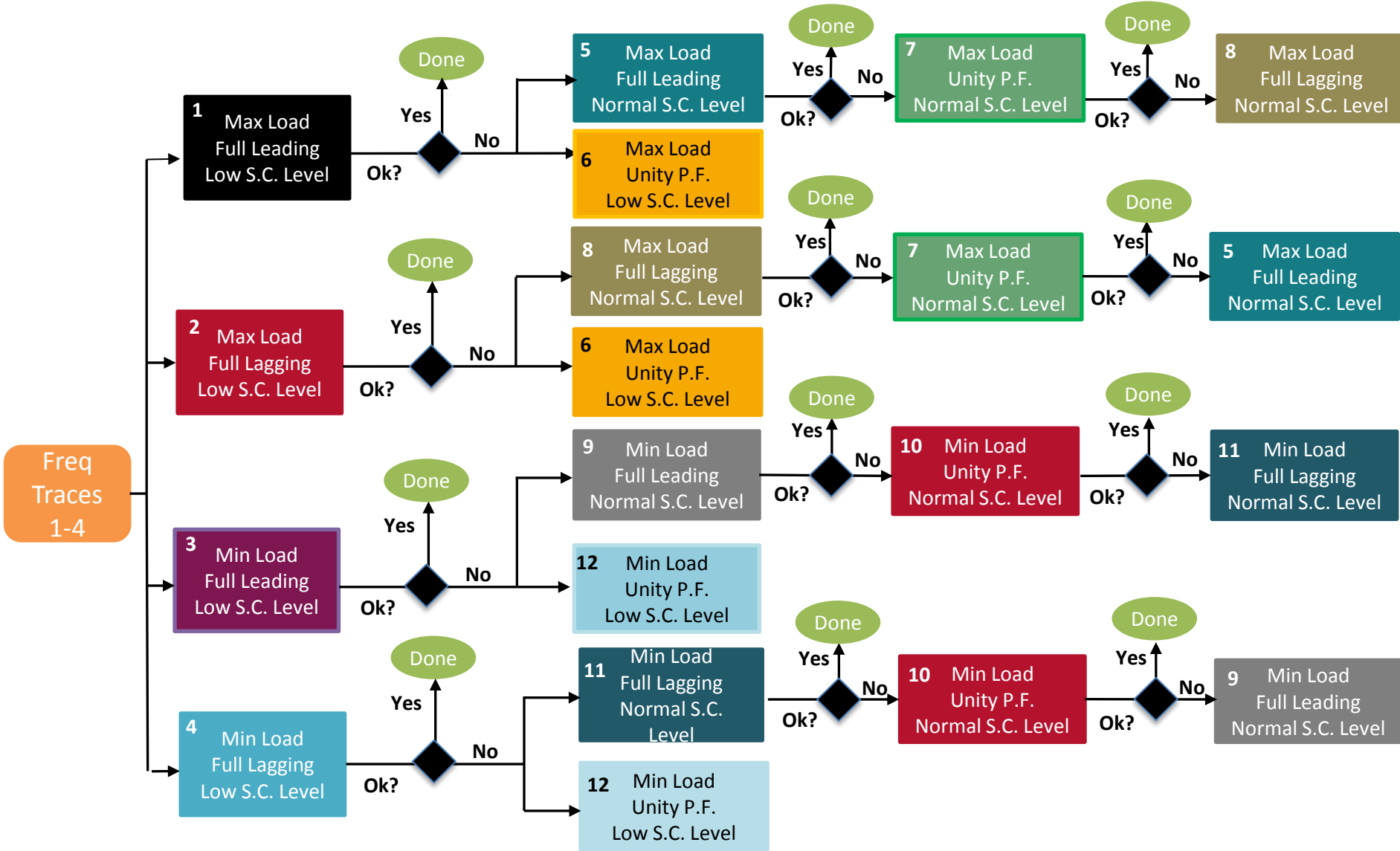
- Four Representative 1 Hz/s RoCoF Traces
- Two additional 2 Hz/s traces for NI units

Frequency rise;

Frequency rise with subsequent fast drop resulting in under-frequency;

Frequency drop with subsequent fast recovery resulting in over-frequency;

Frequency drop



Submission Requirements

Electrical Study Report

- As per reporting format outlined by TSOs

Mechanical Study Report

- Demonstrate evidence that unit can comply

Dynamic Model updates

- Revisions to generator models where necessary

Declaration that unit can comply

- Outline of any works/upgrades

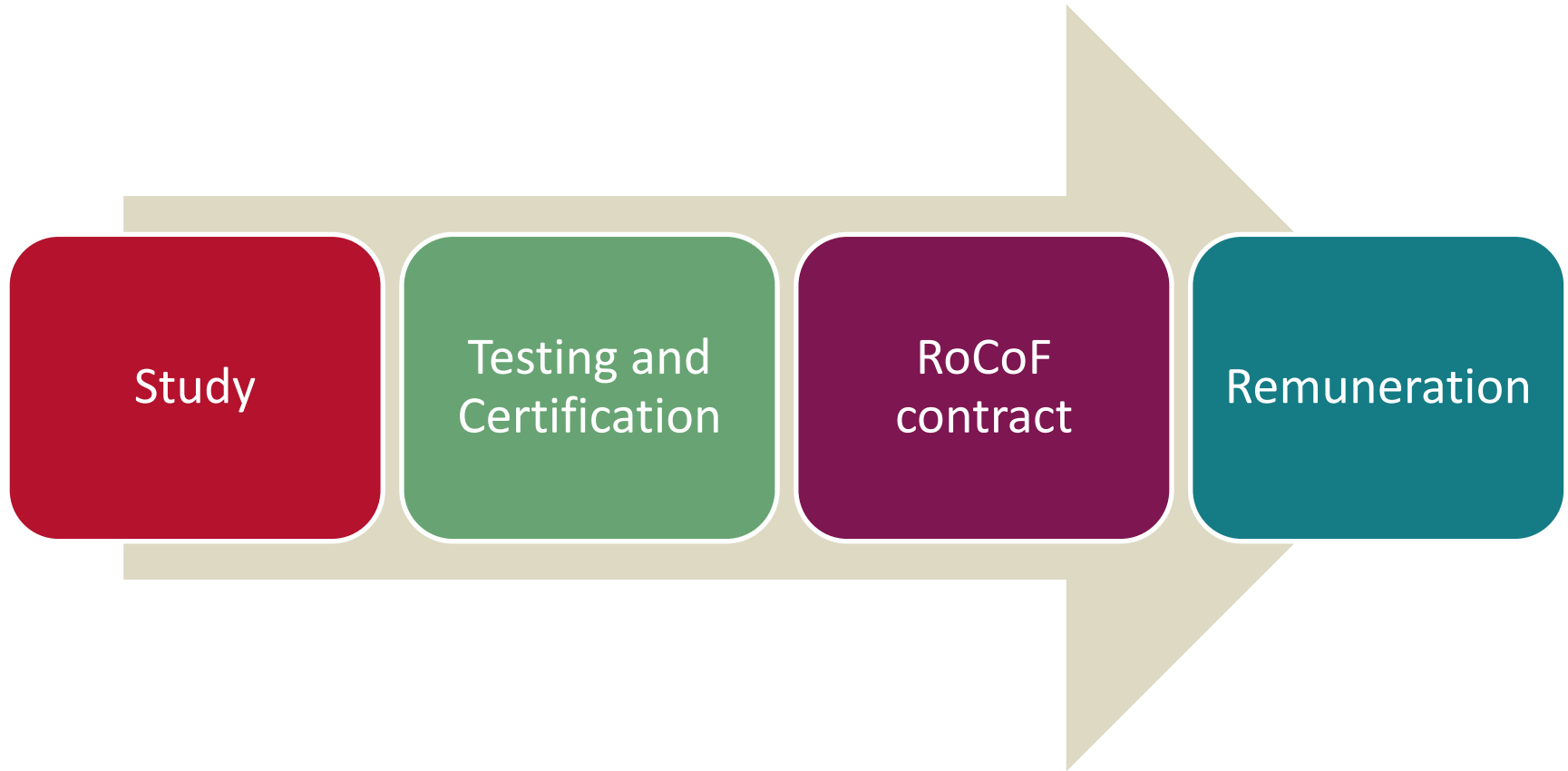
RoCoF Testing Requirements

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Certificate Process



Purpose of Testing

- **Ensure safe, secure and economic operation of the Power System**
 - Operate with higher SNSP levels
- Assess the level of impact on **other users** and the **performance** of the Power **System**
- **Demonstrate** compliance with a standard
 - Issue compliance Certificate
 - Address non-compliance via remedy and/or derogation
 - Contract for RoCoF remuneration

RoCoF Testing Schedule

- Phase A
 - Data Sheets and settings
 - RoCoF Study
 - Scope of works required
- Phase C
 - Protection and setting changes confirmed
 - Frequency Injections

Customer Role

- Demonstrate compliance with standard
- Manage project through process
- Notify TSO of Proposed modifications to Installed Plant - SOW
- Agree testing programme
- Submit and agree Test Procedures
- Submit Test profiles to Neartime & SEMO
- Execute test and submit data
- Completion of Test Reports

C&T Team Role

- Review SOW and agree test plan
- Review Test Procedures
- Co-ordination of testing with NCC, CHCC
- Witness test
- Review and provide feedback on data and report
- Issue Compliance Certificate

RoCoF Frequency Injections

No.	Load Level	Frequency Injection	Estimated response with a 4 % droop	Hold Step for a minimum of stability or
1	Min load	-0.5Hz (ramp of 1Hz/sec)	+25%	10 minutes
2	Min load	+0.5Hz (ramp of 1Hz/sec)	TBC	10 minutes
3	75%	-0.5Hz (ramp of 1Hz/sec)	+25%	10 minutes
4	75%	+0.5Hz (ramp of 1Hz/sec)	-25%	10 minutes
5	90%	-0.5Hz (ramp of 1Hz/sec)	+10%	10 minutes
6	100%	+0.5Hz (ramp of 1Hz/sec)	-25%	10 minutes

The RoCoF Generator Performance Incentive

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Purpose of this presentation

To provide information regarding the TSO process on

1. RoCoF GPI (as set out in the RAs decision papers published in 2014)
2. RoCoF remuneration mechanism (as proposed in the paper “A proposal for Rate of Change of Frequency Remuneration Mechanism Consultation 2015”)

Background underpins the implementation of RoCoF Generator Performance Incentive (GPI)

The RAs RoCoF modification to Grid Code paper set out the GPI will start according to the deadline associated with unit category.

CER paper¹

“Units will become eligible for the GPI according to the deadline associated with their categorisation.”

UR paper²

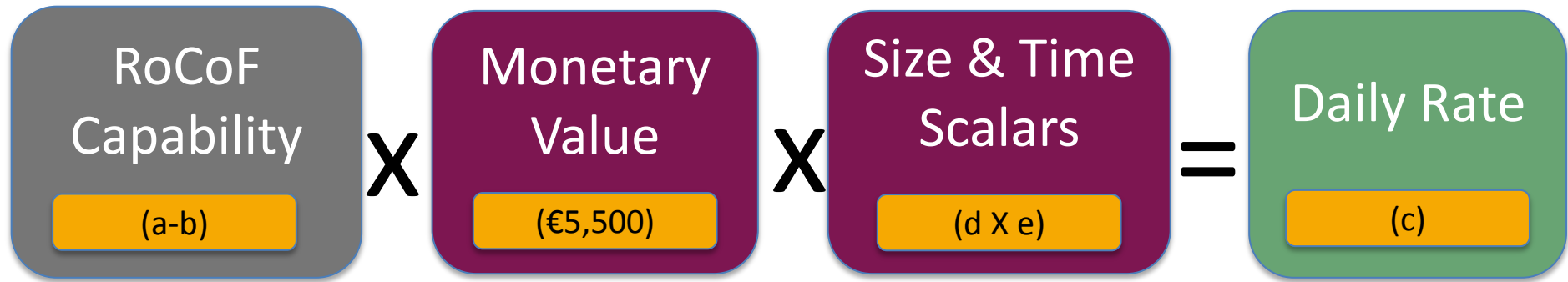
“Both the Utility Regulator and CER have revised the design of the GPI and have decided to phase its introduction. Units shall become eligible for the GPI according to the deadline associated with their categorisation.”



¹ <http://www.cer.ie/docs/000260/CER14081%20ROCOF%20Decision%20Paper%20-%20FINAL%20FOR%20PUBLICATION.pdf>

² http://www.uregni.gov.uk/uploads/publications/Decision_Paper_on_the_Rate_of_Change_of_Frequency_Grid_Code_Modification.pdf

GPI formula set out in RAs' decision papers



Where

a = RoCoF standard;

b = Unit's RoCoF level;

d = scalar associated with size of unit;

e = scalar associated with the period of time from the publication of paper; and

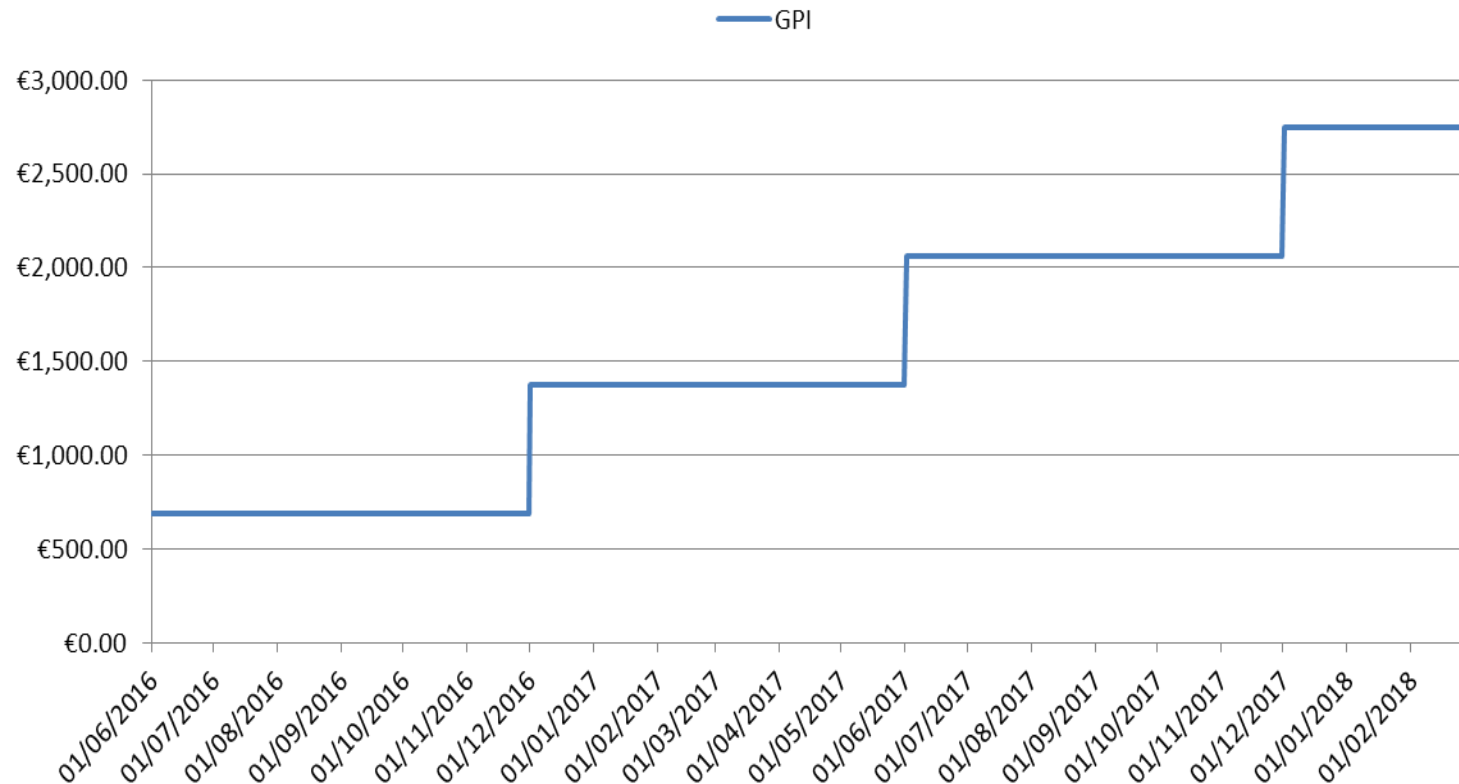
c = daily charge

RoCoF GPI – set out in RAs' decision paper

- It is an enduring arrangement under Other System Charges
- Implementation will begin June 2016 in line with the CER and UR decisions

GPI

Illustration of the daily rate increase over the period of the scheme for a 400MW unit



TSO Proposals for GPI Process

1. GPI starts if study submitted late against category deadline
2. GPI stops for late study submission following TSO acceptance of study
3. No GPI for 6 months period following completion of our study assessment
 - 6 months to allow for upgrade works and or testing phase
 - Regular reporting and monitoring of progress
 - On expiry of 6 month period, GPI starts
4. There will be no refund of GPI charges

Study Phase

Date 1: Generator study submitted to TSO

- No issue identified
- Upgrade required identified
- Major issue identified

Date 2: TSO (and Independent Expert) Review

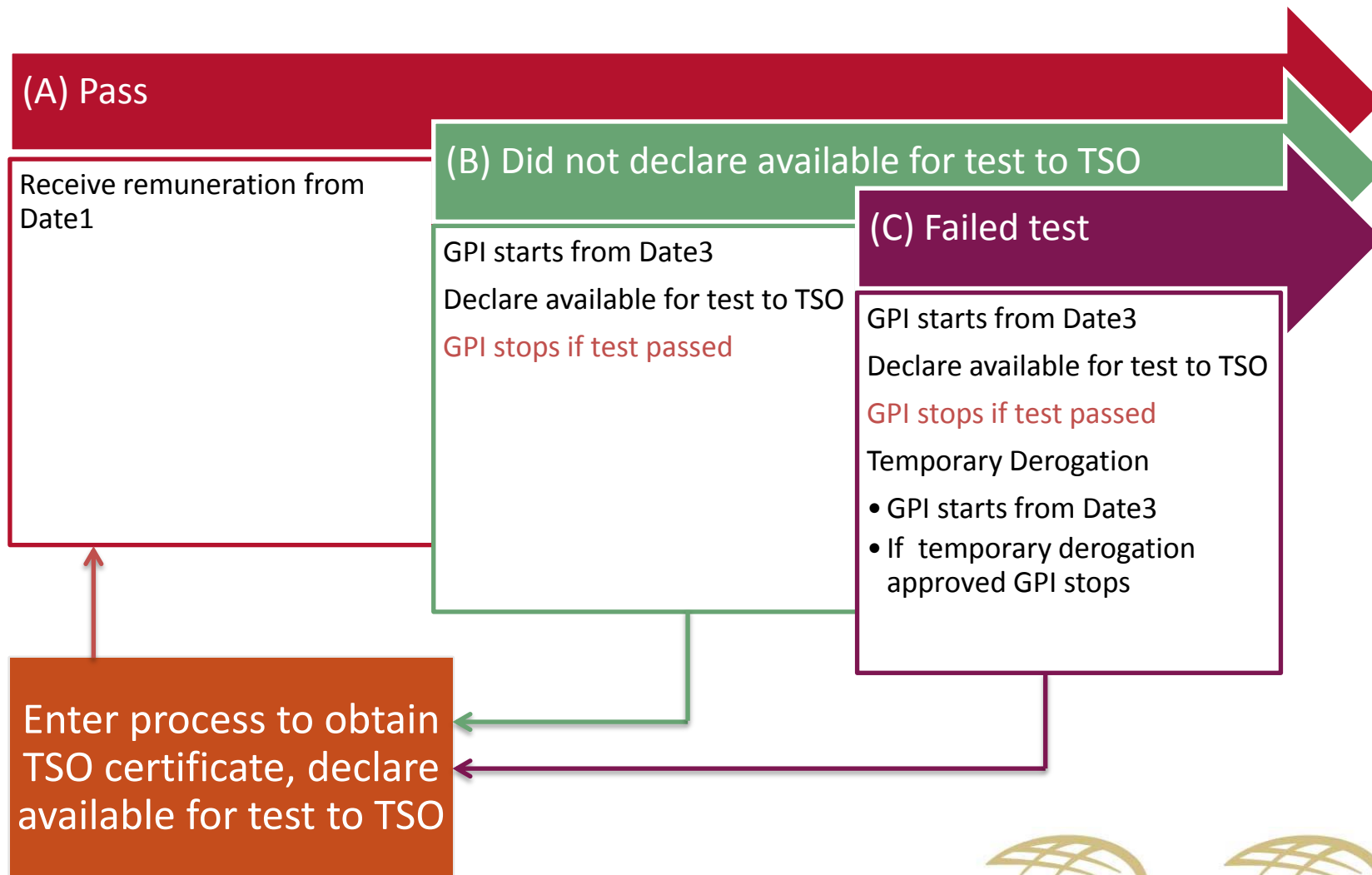
- Study meets TSO criteria
- Any questions relating to the study have been clarified
- Additional data or models submitted to TSO

Date 3: 6 month period after Date 2, during which GPI is not applied

- Enter process to obtain TSO certificate
- Declare availability for test to TSO
- Date3 extension if any delay in TSO test scheduling

GPI starts if: the study is late,
6 month period expires.
There will be no refund of GPIs

Testing phase



Generic Examples

- Generic Example 1 (study identifies no issue)
- Generic Example 2 (study identifies upgrade)
- Generic Example 3 (study identifies major issue)

Generic Example 1 – no issues

- 200MW unit
- Category 1 = Deadline 01/06/16
- Study identifies no issue

Generic Example 1 - Summary

Study

- Category 1 deadline on 01/06/2016 (Date 1)
- Unit submits study on time

Study

- Study assessment completed on 15/07/2016 (Date 2)
- 6 months expiry (Date 3) on 15/01/2017

Testing

- Unit declared available for testing to TSO on 19/07/2016

Testing

- Unit completed testing phase and obtained TSO cert on 06/09/2016

Generic Example 1 – GPI

Billing Period 01/06/2016 – 31/07/2017

Scheme/ Money	RoCoF GPI (deadline)	RoCoF GPI
€	0	0

Generic Example 2: Late Study Submissions

- 200MW unit
- Category 1 = Deadline 01/06/16
- Study identifies upgrades required
- Example Cases:
 - 2a – Testing within 6 months
 - 2b – No test completed or failed

Generic Example 2a – Summary

Study

- Category 1 deadline on 01/06/2016
- Unit submit study late 01/09/2016 (Date 1)

Study

- Study assessment completed on 15/10/2016 (Date 2)
- 6 months expiry (Date 3) on 15/04/2017

Testing

- Unit completed upgrade works and declared available for testing to TSO on 21/01/2017

Testing

- Unit completed testing phase and obtained op cert on 21/02/2017

Generic Example 2a – GPI

Billing Period 01/06/2016 – 31/07/2017

Scheme/ Money	RoCoF GPI (deadline)	RoCoF GPI
€	(46,750)	0
£	(32,774)*	0

- GPI will start from 01/06/2016 (daily rate at €343.75)
- GPI will stop on 15/10/2016

*Assume exchange rate 0.70106

Generic Example 2b - Summary

Study

- Category 1 deadline on 01/06/16
- Unit submit study late 01/09/16 (Date 1)

Study

- Study assessment completed on 15/10/16 (Date 2)
- 6 months expiry (Date 3) on 15/04/2017

Testing

- On date of 6 months expiry GPI applies because:
 - Did not declare available for test to TSO
 - Or had a failed test result

Generic Example 2b – GPI

Billing Period 01/06/2016 – 31/07/2017

Scheme/ Money	RoCoF GPI (deadline)	RoCoF GPI
€	(46,750)	(95,218)
£	(32,774)*	(66,754)*

- GPI will start from 01/06/2016 (daily rate at €343.75)
- GPI will stop on 15/10/2016
- GPI restart on 15/04/2017 (daily rate at €687.50)

*Assume exchange rate 0.70106

Generic Example 3 – Major issues identified

- 200MW unit
- Category 1 = Deadline 01/06/2016
- Study identifies major issue

Generic Example 3 - Summary

Study

- Category 1 deadline on 01/06/16 (Date 1)

Study

- Study assessment completed on 05/07/16
- 6 months expiry (Date 3) on 05/01/17

Derogation

- Unit applies for derogation on 01/06/16

Derogation

- Derogation approved by the RA on 12/11/16

Generic Example 3 – GPI

Billing Period 01/06/2016 – 31/07/2017

Scheme/ Money	RoCoF GPI (deadline)	RoCoF GPI
€	0	0

Factors influencing timeline which may cause delay

- Information/data is required for
 - Submitting the study
 - Test procedures and the test report
 - Derogation application

It is the responsibility of the unit to ensure you meet the requirement set out by the TSO

The RoCoF remuneration mechanism

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Background underpins the implementation of The RoCoF remuneration mechanism

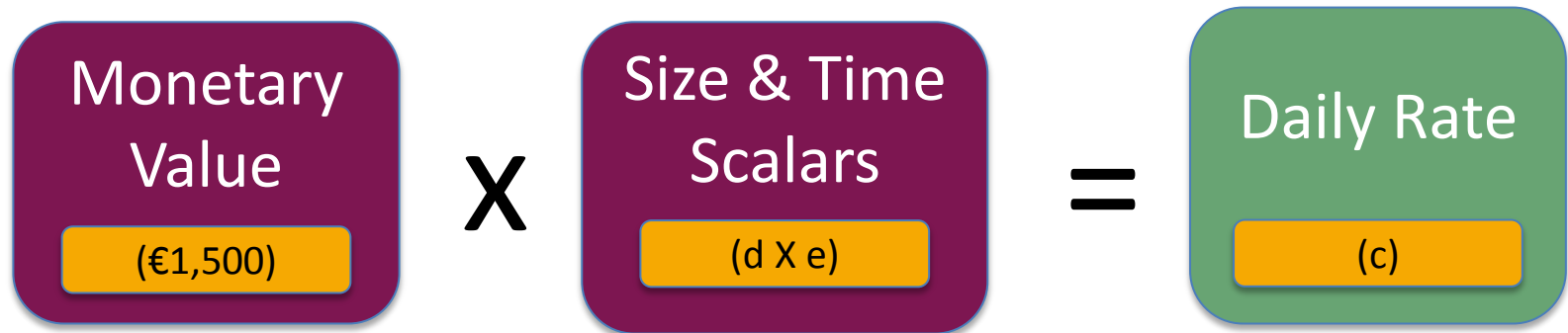
- The methodology is designed to complement the RoCoF GPI calculation
 - Similar scalars used (d & e)
 - Proposed Monetary value of €1,500 is derived from the GPI formula $(a - b) \times \text{fixed value}$
 - Stand-alone scheme – Not HAS

Requested by SEMC to
investigate RoCoF
remuneration mechanism

TSO presented proposal to the
RAs with options

A proposal for Rate of Change
of Frequency Remuneration
mechanism consultation 2015

Remuneration mechanism proposed formula

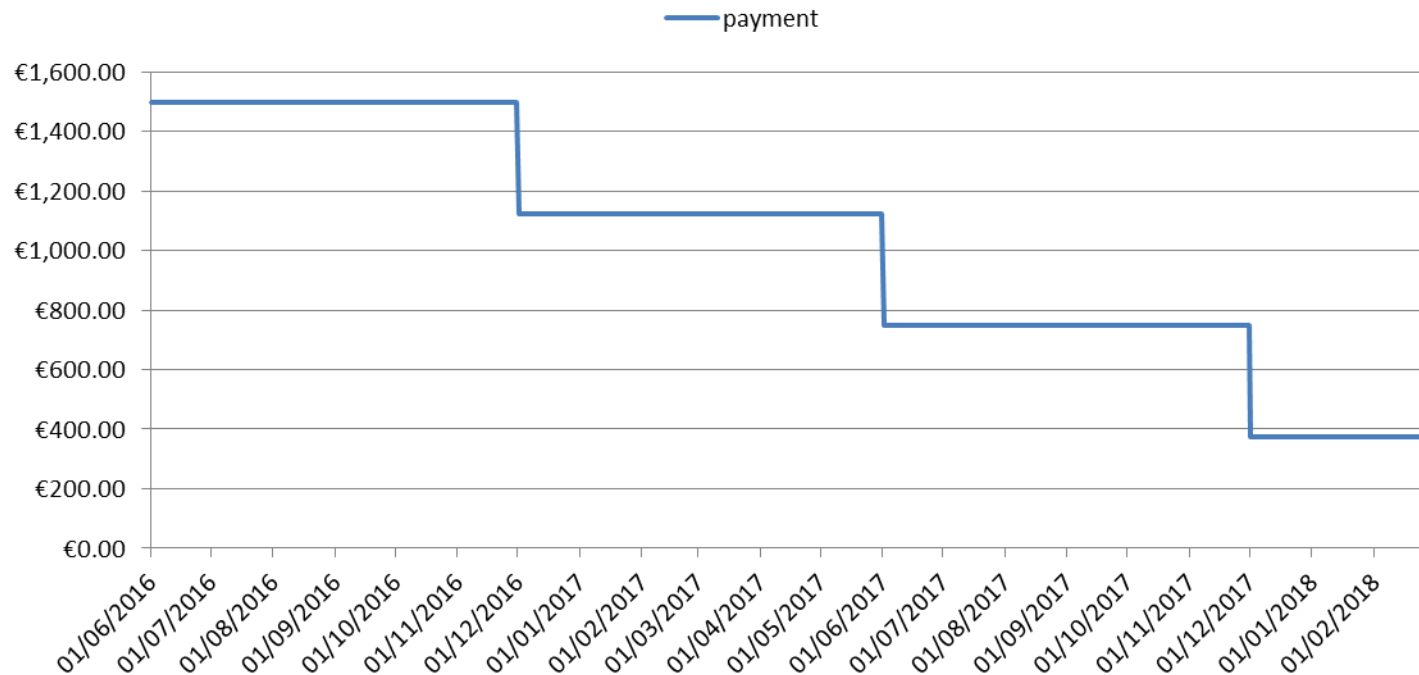


Where:

- c is the daily payment;
- d is a scalar associated with the size of the unit;
- e is a scalar associated the expiration of the defined generator study period which commenced on 21 November 2014; and
- €1,500 is the monetary value.

Remuneration mechanism

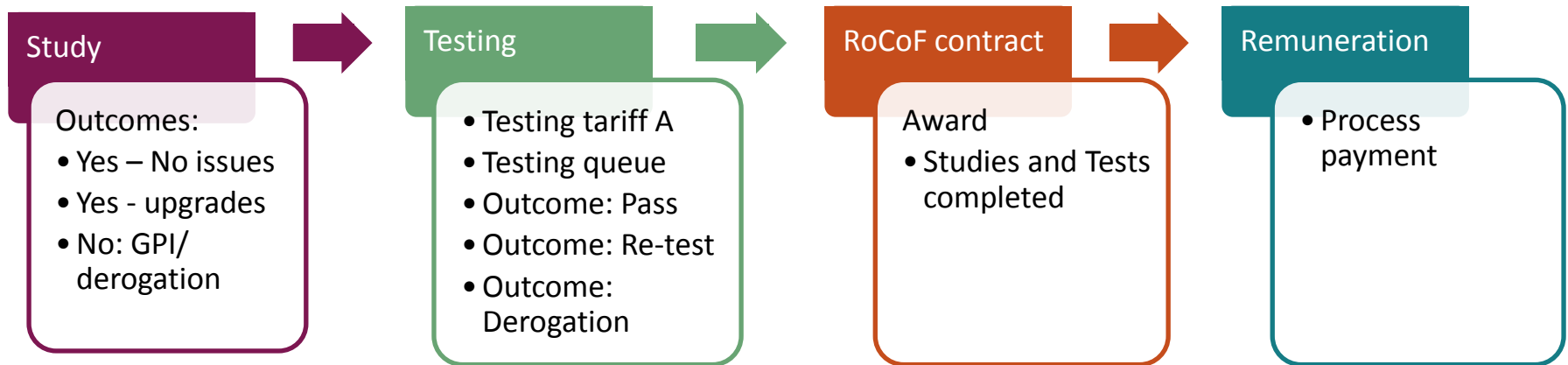
Illustration of the daily rate decreases over the period of the scheme for a 400MW unit



Rate of Change of Frequency Remuneration Mechanism Consultation

- Consultation closed on 8th Feb 2016
- 12 responses received
- Next steps:
 - We will consider the comments received on the consultation paper and make recommendations to the RAs based on these;
 - The RAs will approve/reject the recommendations proposed by us in light of the responses received; and
 - We will implement in accordance with the RAs' decision paper.

Process Principle – Remuneration Mechanism



“Remuneration mechanism will be a standalone scheme separate to the existing HAS arrangement”

This scheme will stand alone from DS3 System Services

Generic Example 1: Remuneration

- 200MW unit
- Category 1 = Deadline 01/06/2016
- Study identifies no issue

Billing Period 01/06/2016 – 31/07/2017

Example	RoCoF remuneration mechanism	RoCoF remuneration mechanism
1	€262,500	£184,028*

*Assume exchange rate 0.70106

Generic Example 2: Remuneration

- 200MW unit
- Category 1 = Deadline 01/06/16
- Late Submission 01/09/16
- Study identifies upgrades required
- Example Cases:
 - 2a – Testing within 6 months
 - 2b – No test completed or failed

Example 2 - Pay

Billing Period 01/06/2016 – 31/07/2017

Example 2	RoCoF remuneration mechanism	RoCoF remuneration mechanism
2a	€193,500	£ 135,655*
2b	0	0

*Assume exchange rate 0.70106

Generic Example 3 – Remuneration

- 200MW unit
- Category 1 = Deadline 01/06/2016
- Study identifies major issue

Billing Period 01/06/2016 – 31/01/2017

Example	RoCoF remuneration mechanism
3	0

Next steps

- TSOs to review industry comments and draft recommendations paper to RAs end-March
- SEM-C to review recommendations paper at April meeting
- Final approval of scheme end-April

