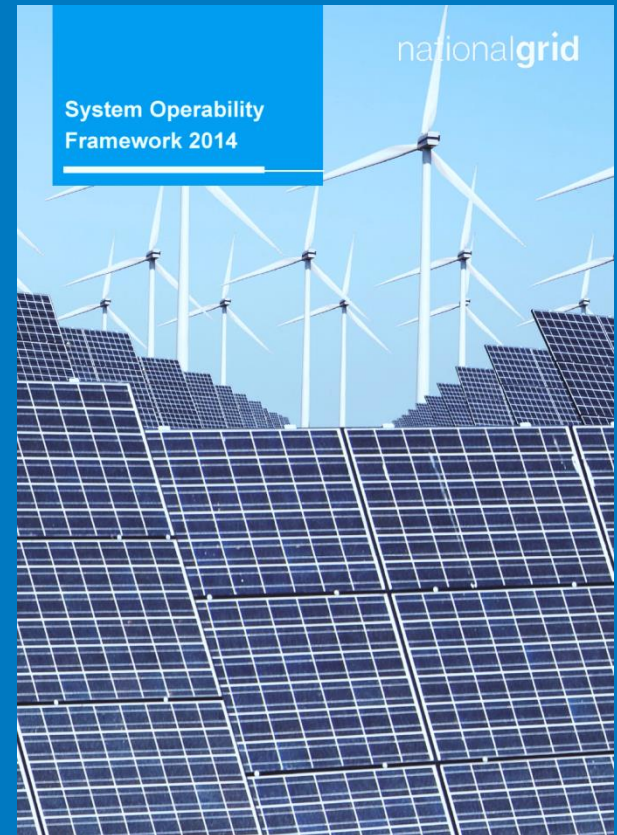


System Operability Framework (SOF) 2014

Post consultation activities

Ben Marshall
Transmission Network Services
GCRP- 21st January 2015



Agenda

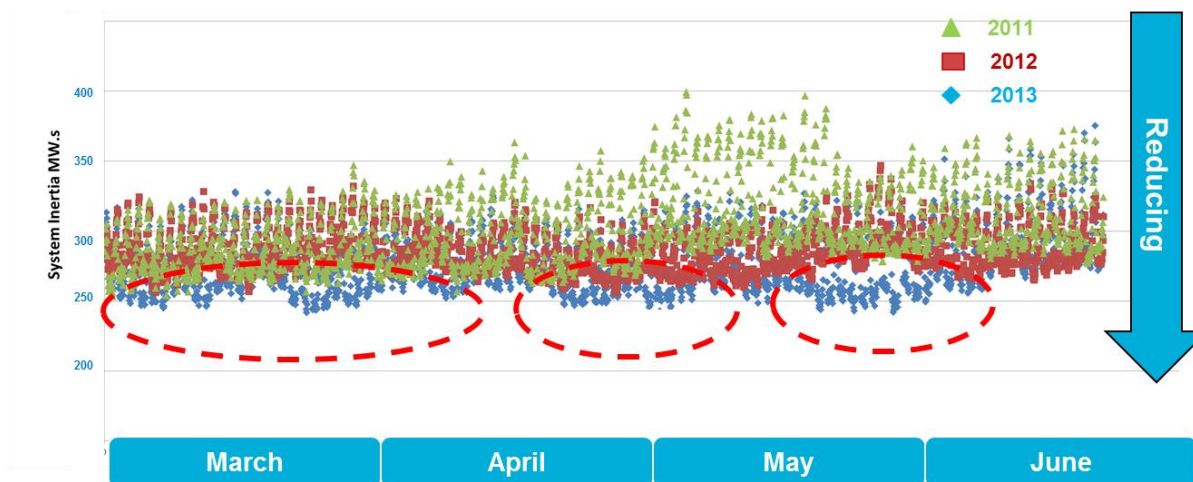
- Why do we need a SOF?
- How SOF works and example of results
 - Challenges and Opportunities
- Summary of Industry Consultation
- Current activities on SOF topics
- Next steps and how SOF 2015 will be developed

Our System is Changing...

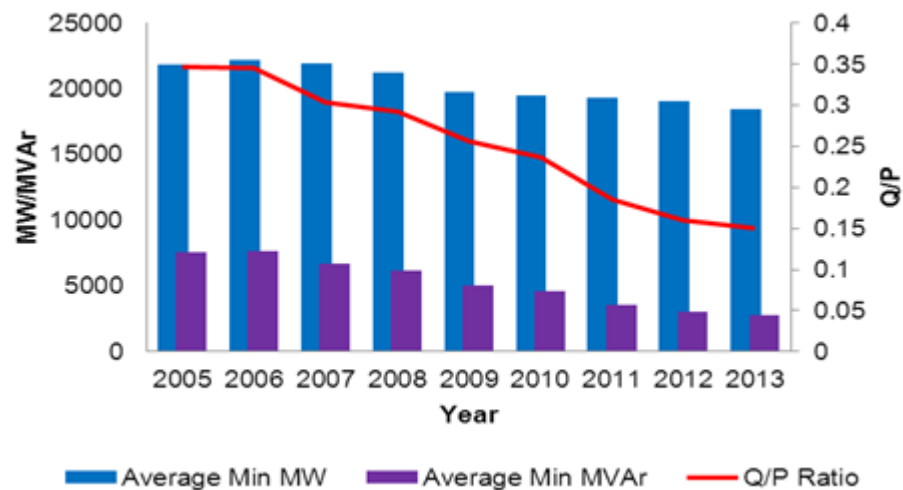


And the Impact?

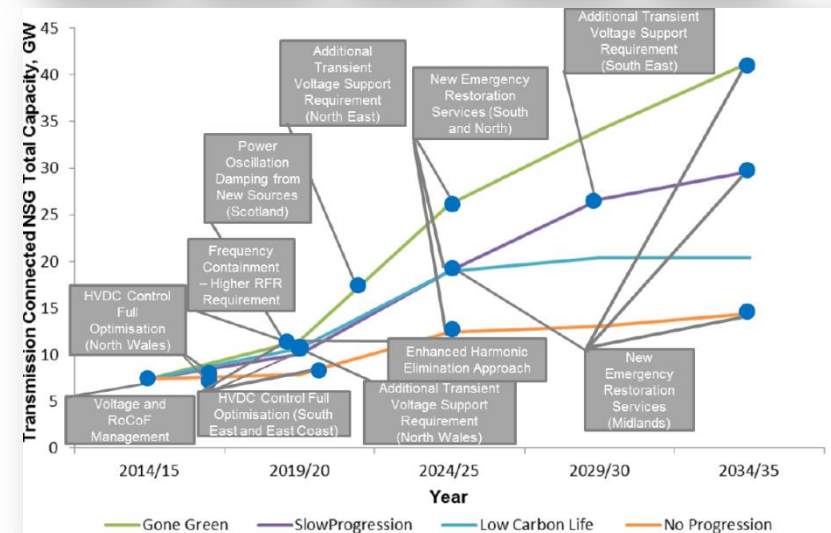
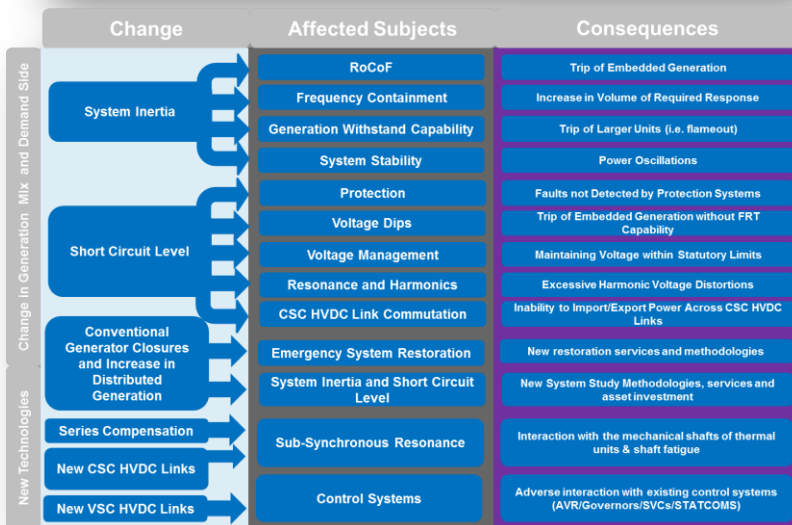
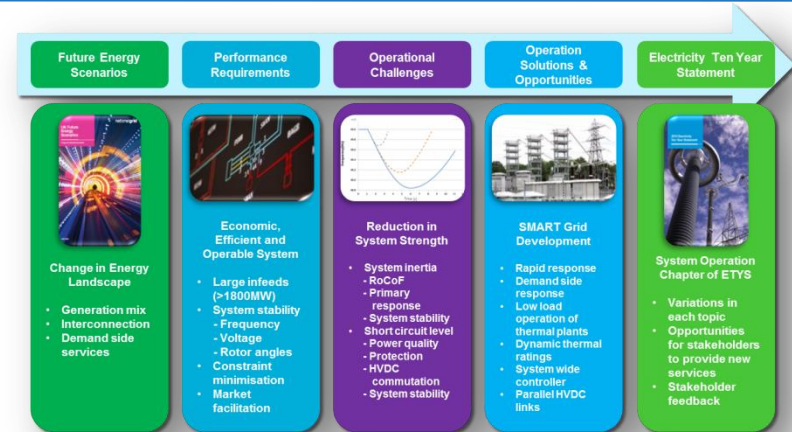
System
Inertia



MVAr
Demand

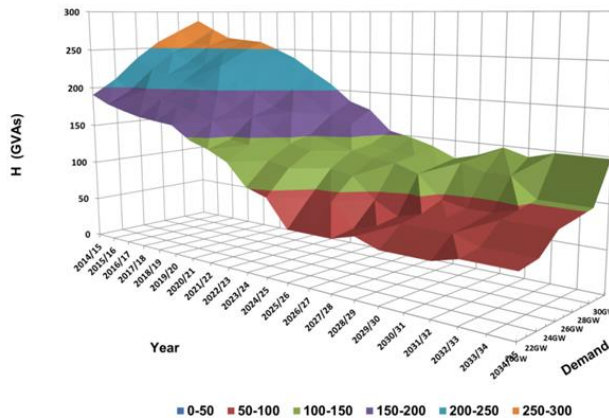


What was SOF? Recap

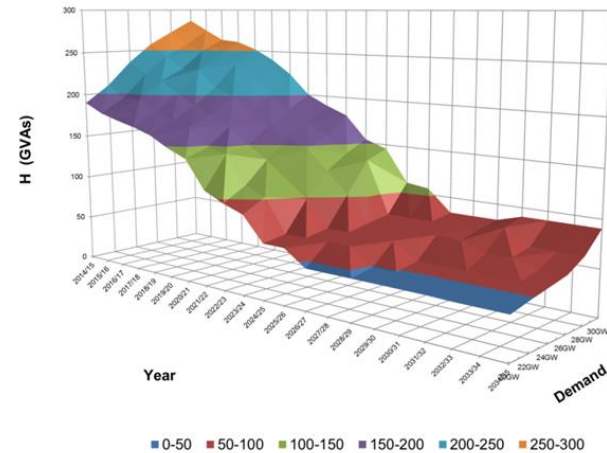


Example - System Inertia

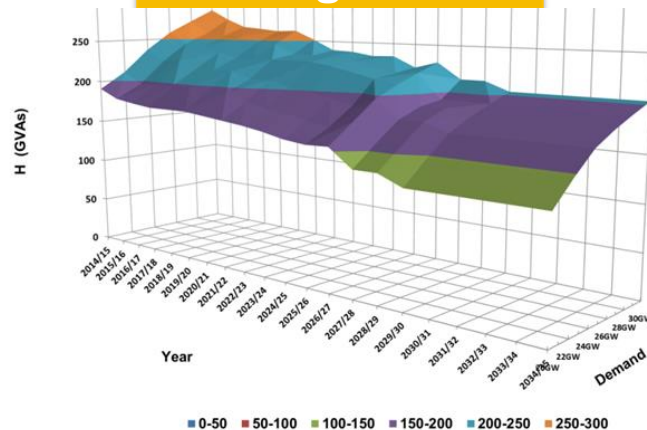
Low Carbon



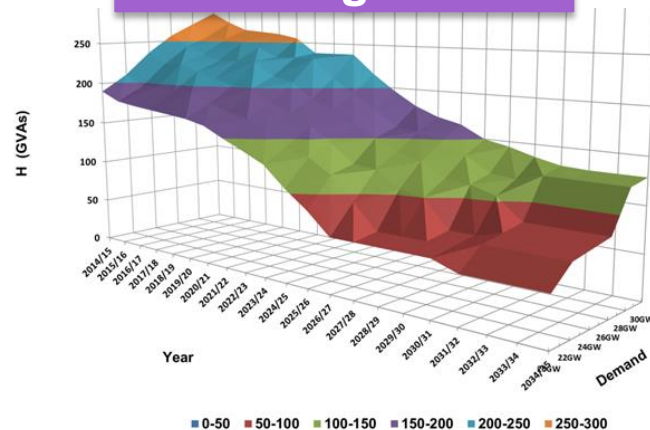
Gone Green



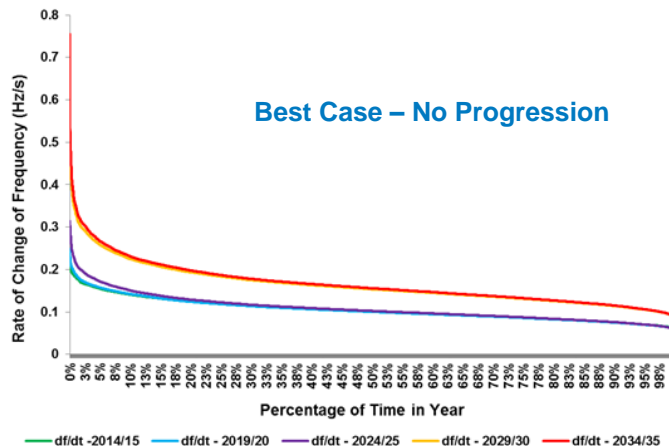
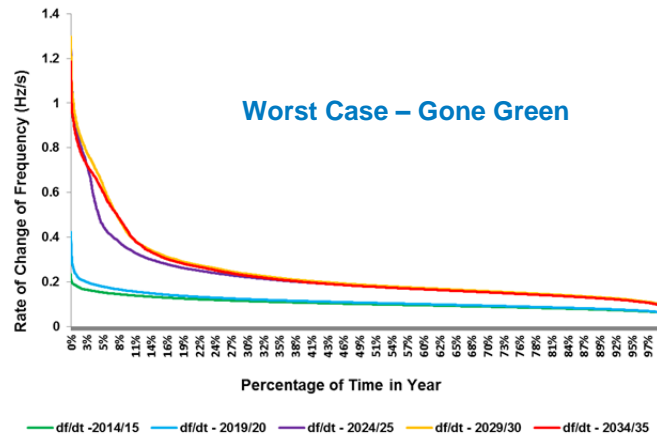
No Progression



Slow Progression



System Inertia – RoCoF



Key Messages

df/dt > 0.125 Hz/s

Gone Green

Slow Progression

Low Carbon Life

No Progression

2014/15

2024/25

2034/35

19%

92%

90%

19%

38%

96%

19%

88%

93%

19%

23%

82%

df/dt > 0.5 Hz/s

Gone Green

Slow Progression

Low Carbon Life

No Progression

2014/15

2024/25

2034/35

0%

5%

8%

0%

1%

8%

0%

2%

3%

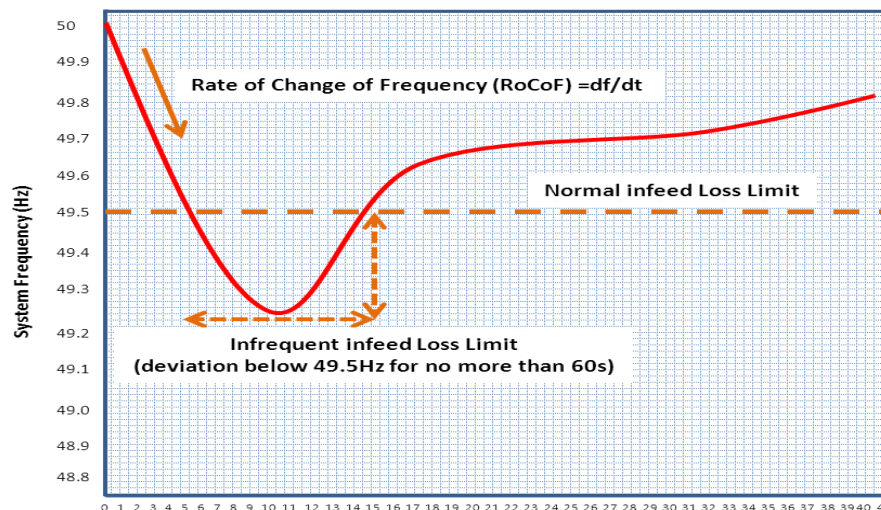
0%

0%

1%

df/dt > 1 Hz/s less than 1% of time in all scenarios

Example - System Inertia & Frequency Containment (1)

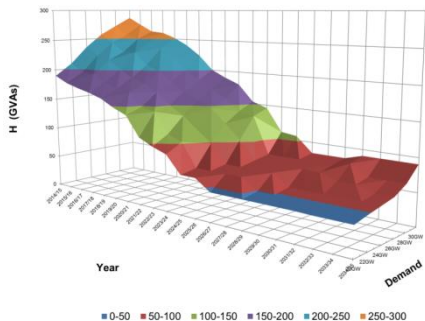


RoCoF (Hz/s)	Slow Progression	Gone Green	Inertia GW.s	Action Time (to reach 49.2 Hz)	Response Rate (MW/s)
0.125**	2013/14	2013/14	360	9	185
0.2	2019/20	2018/19	225	4	400
0.22	2022/23	2019/20	205	3.4	489
0.25	2023/24	2020/21	180	2.4	679
0.3	2024/25	2021/22	150	1.2	1148

Three times greater than current system capability

*Figures assume a 2s delay between detection/response activation time

Example - System Inertia & Frequency Containment (2)



Conventional Services

Solution

Cost (2020 Gone Green)

Constrain generators

Extra £600m

Constrain largest infeed/outfeed

Extra £130m-£270m
(depending on when the large infeeds are connected)

Carry larger volumes of response

Extra £210m

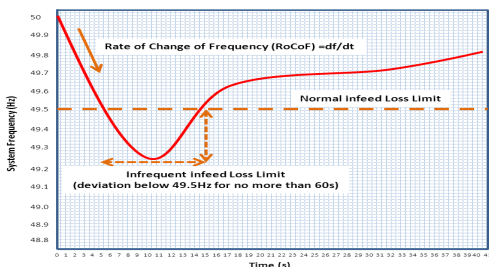
New Services

Solution

Enhanced Frequency Control
(Fast Response)

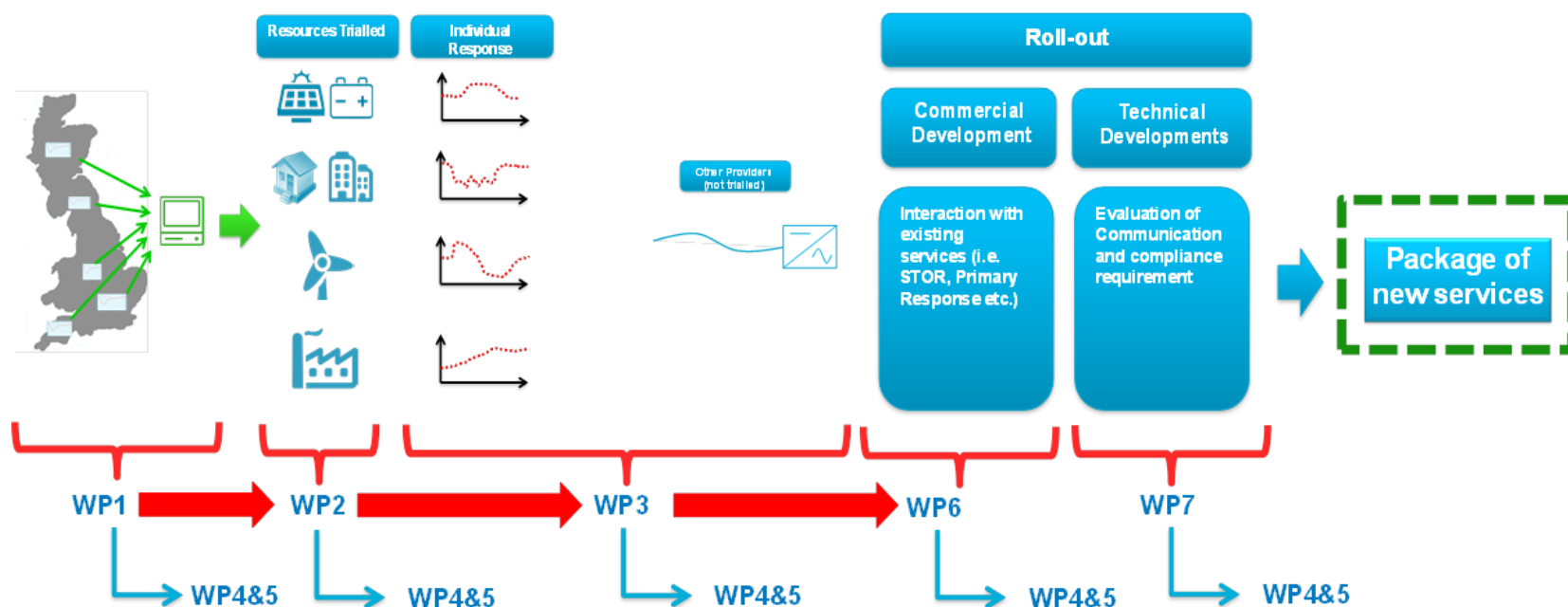
Low Load Operation of Thermal Plants

Synchronous Compensator



System Inertia – Frequency Containment (3) – Innovation

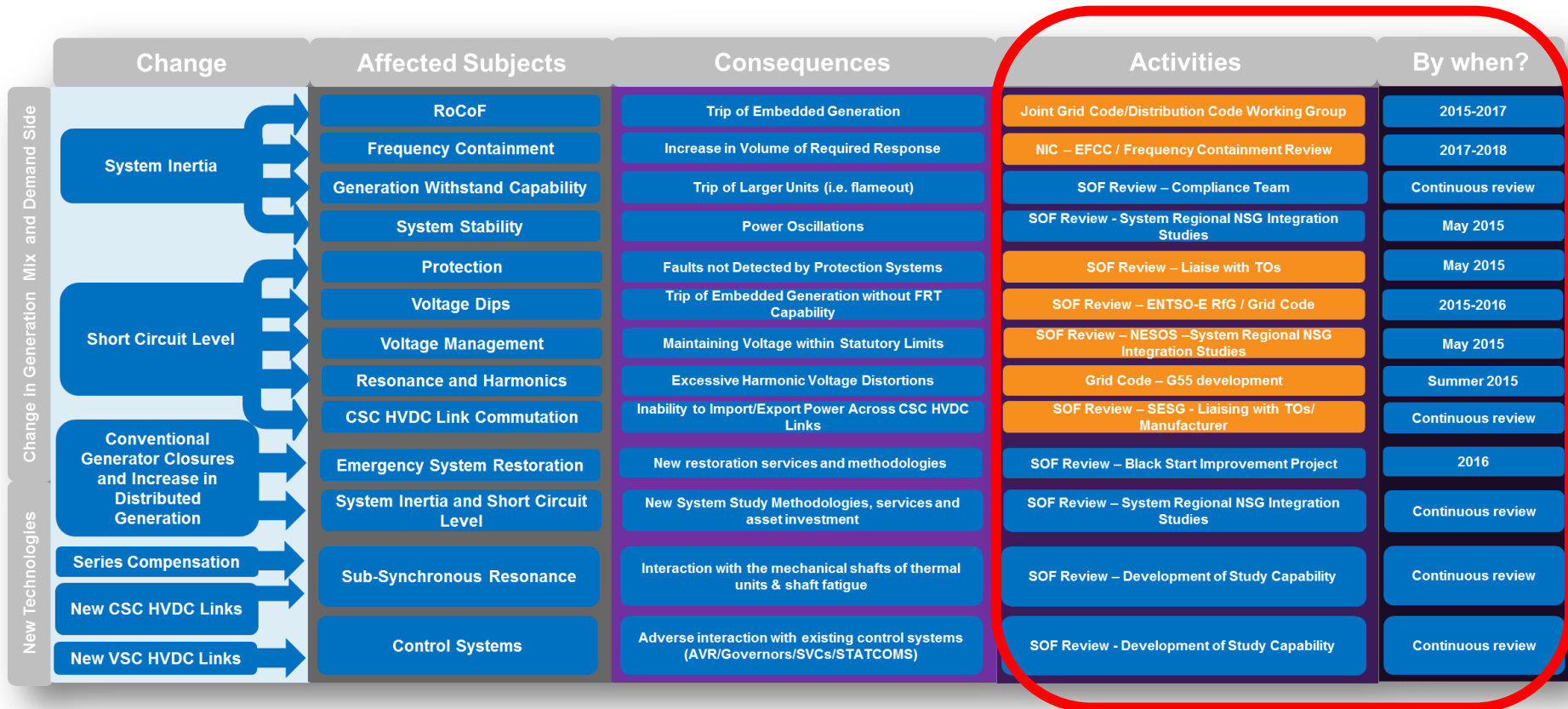
- Need for fast response was identified as part of SOF
- Enhanced Frequency Control Capability (EFCC) will demonstrate the effectiveness of such service



Summary of Industry Consultation

- **Generally positive (very good engagement)**
- **SOF Topics**
 - Number comments indicated the impact of change at the distribution level needs to be better articulated, i.e. DSR, EVs, etc.
- **SOF Solutions**
 - Better balance between market based products (i.e. wherever the technology is already capable), and new requirements
 - Solutions in long terms which require contract at early stages (i.e. synchronous compensator)
 - Solutions capable of providing number of services (i.e. Interconnectors, Storage)
- **SOF Engagement**
 - Strong desire to be involved at different stages of development of SOF, making it a GB Operability Framework

Key areas and we are doing about it



Internal Activities

Joint activities / working groups

Existing Engagement Forums

SOF Engagement

Generation

Operational Forum - Grid Code Review Panel - Compliance Meetings

- New services
- New generation technologies
- Generation withstand capability
- Modelling issues
- Installations worldwide
- Compliance issues
- Grid services to the generators
- Joint innovation projects

Transmission

SQSS - STC – JPC- Grid Code Review Panel - Liaison Meetings

- Investment optimisation for design and operation
- New transmission technologies
- Operability and regional strategies
- SQSS and Code development
- Modelling issues and data exchange
- Joint innovation projects

Distribution

ENA Grid Code & Distribution Code Review Panel – T&D Liaison

- Investment optimisation for design and operation
- New demand side technologies (i.e. heat pumps, DSR, storage)
- Operability and regional strategies
- SQSS, Grid Code and Distribution Code development
- Modelling issues and data exchange
- Joint innovation projects

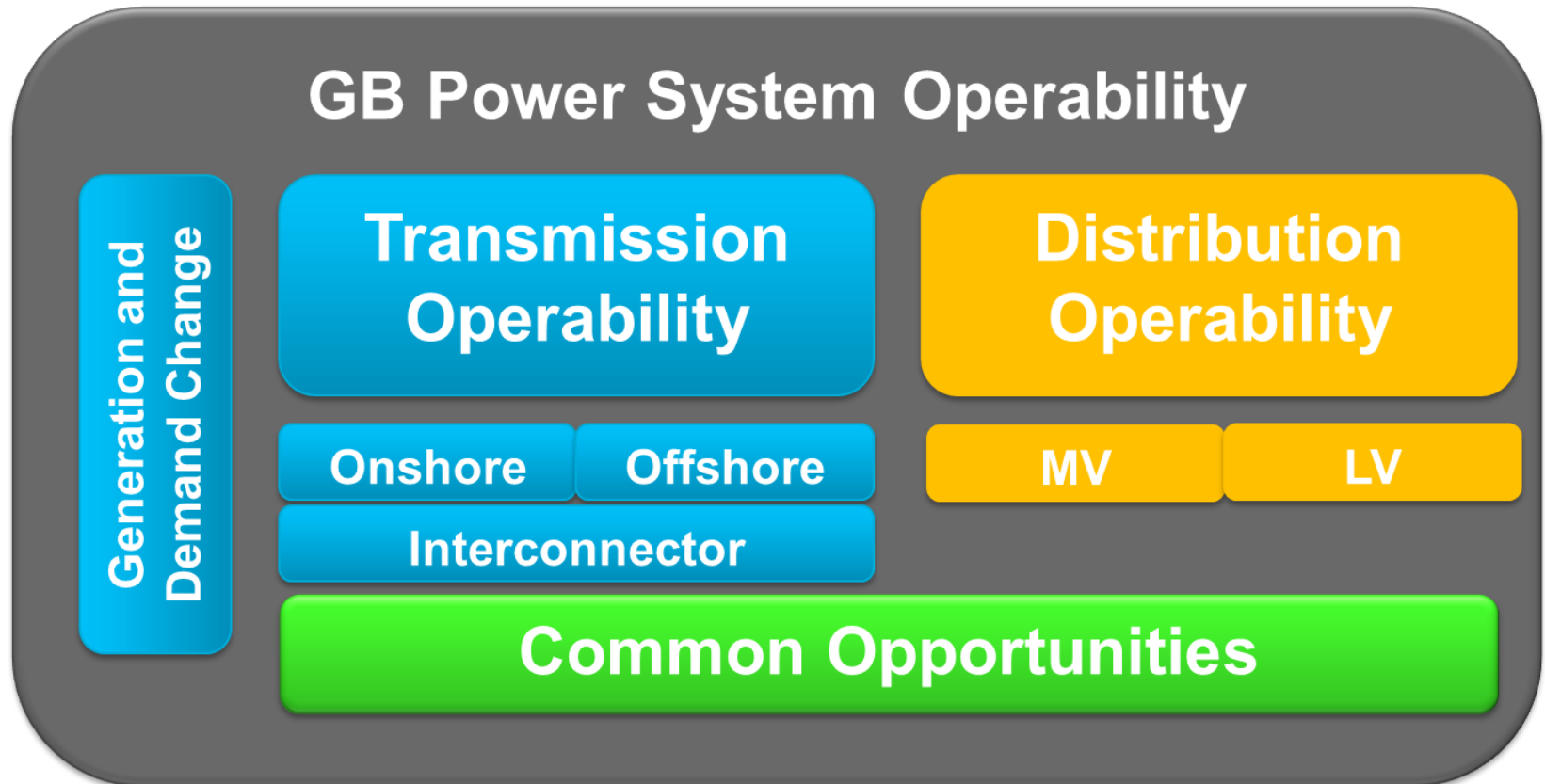
Supply Side

Operational Forum - Liaison Meetings

- Demand Side Services
- Code development
- Operability of new technologies
- Modelling techniques (i.e. modelling DSR effects)
- Joint innovation projects

SOF 2015 looking at whole system

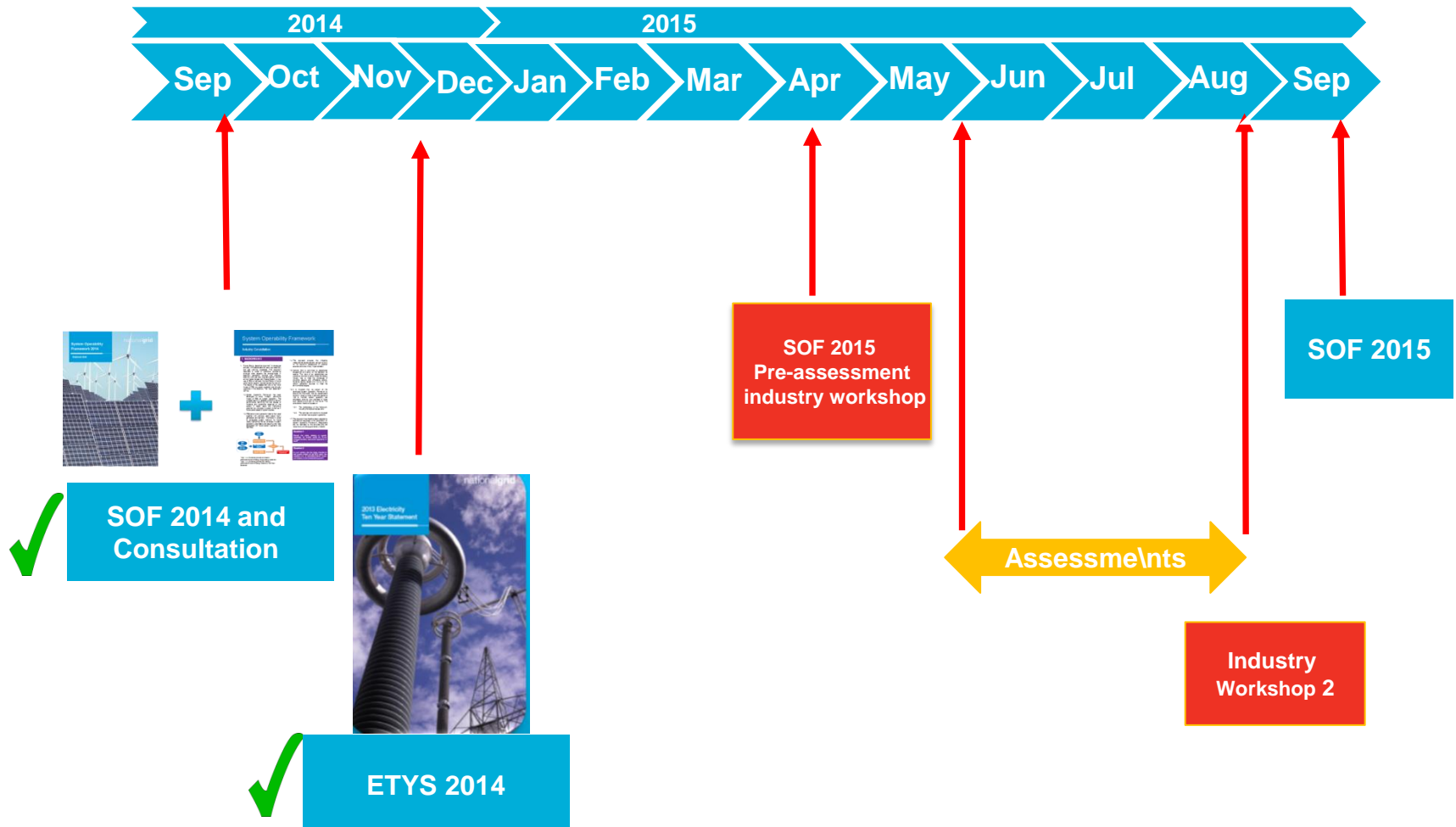
(bearing in mind many SOF 2014 topics are the whole system issue, i.e. Frequency)



a theme for future SOF?

DNO's Engagement

Timeline for Development of SOF



Key priorities for SOF 2015 - Summary

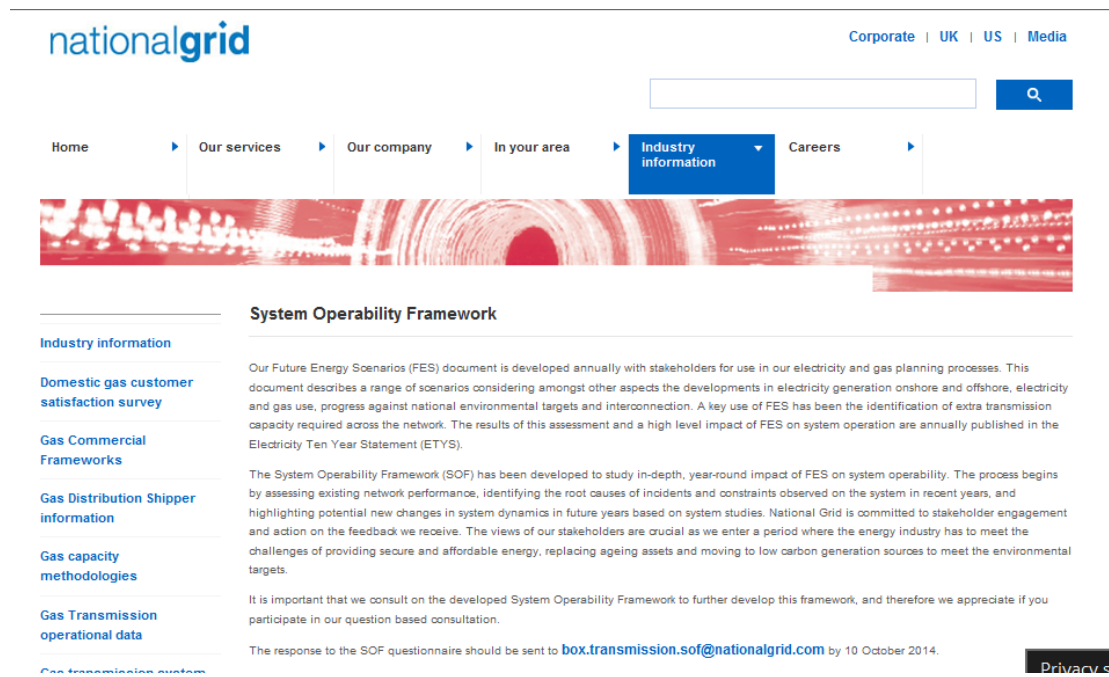
- Stating how we responded to industry's comments on the consultation
- Better articulation of across Transmission and Distribution operability issues
 - Highlighting where the change is coming from, and what's the effect on
- Priority table (operability issues and opportunities)
- Update on innovation activities and what's needed
- Engagement strategy

System Operability Framework

Thank you for your attention

For more information please email:

box.transmission.SOF@nationalgrid.com



The screenshot shows the National Grid website with the 'Industry information' menu item selected. The main content area is titled 'System Operability Framework'. It contains three paragraphs of text explaining the Future Energy Scenarios (FES) document, the System Operability Framework (SOF), and a call to action for a consultation. The left sidebar lists various industry information topics, and the bottom right corner has a 'Privacy' link.

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System Operability Framework

Our Future Energy Scenarios (FES) document is developed annually with stakeholders for use in our electricity and gas planning processes. This document describes a range of scenarios considering amongst other aspects the developments in electricity generation onshore and offshore, electricity and gas use, progress against national environmental targets and interconnection. A key use of FES has been the identification of extra transmission capacity required across the network. The results of this assessment and a high level impact of FES on system operation are annually published in the Electricity Ten Year Statement (ETYS).

The System Operability Framework (SOF) has been developed to study in-depth, year-round impact of FES on system operability. The process begins by assessing existing network performance, identifying the root causes of incidents and constraints observed on the system in recent years, and highlighting potential new changes in system dynamics in future years based on system studies. National Grid is committed to stakeholder engagement and action on the feedback we receive. The views of our stakeholders are crucial as we enter a period where the energy industry has to meet the challenges of providing secure and affordable energy, replacing ageing assets and moving to low carbon generation sources to meet the environmental targets.

It is important that we consult on the developed System Operability Framework to further develop this framework, and therefore we appreciate if you participate in our question based consultation.

The response to the SOF questionnaire should be sent to box.transmission.sof@nationalgrid.com by 10 October 2014.

Privacy

<http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/System-Operability-Framework/>