System Operability Framework (SOF) 2014

Post consultation activities

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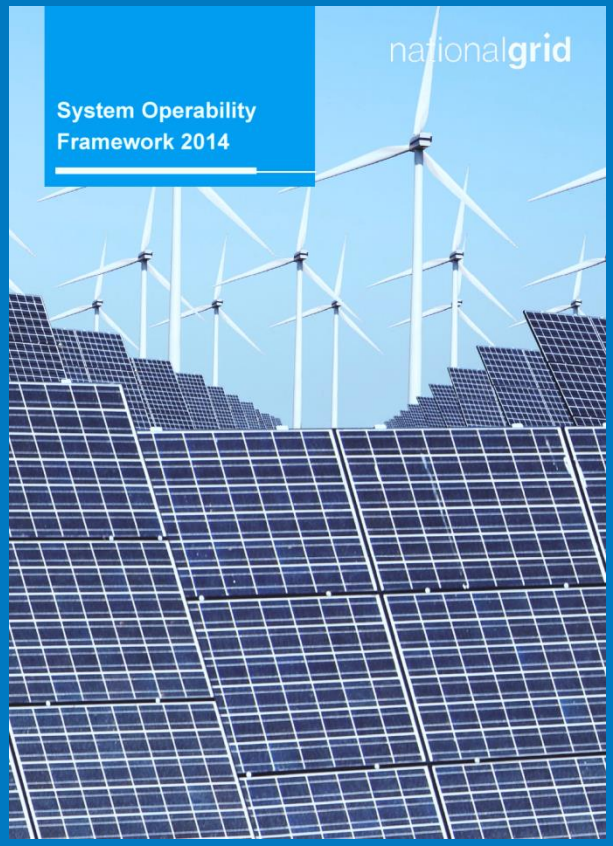
Transmission Network Services
GCRP- 21st January 2015



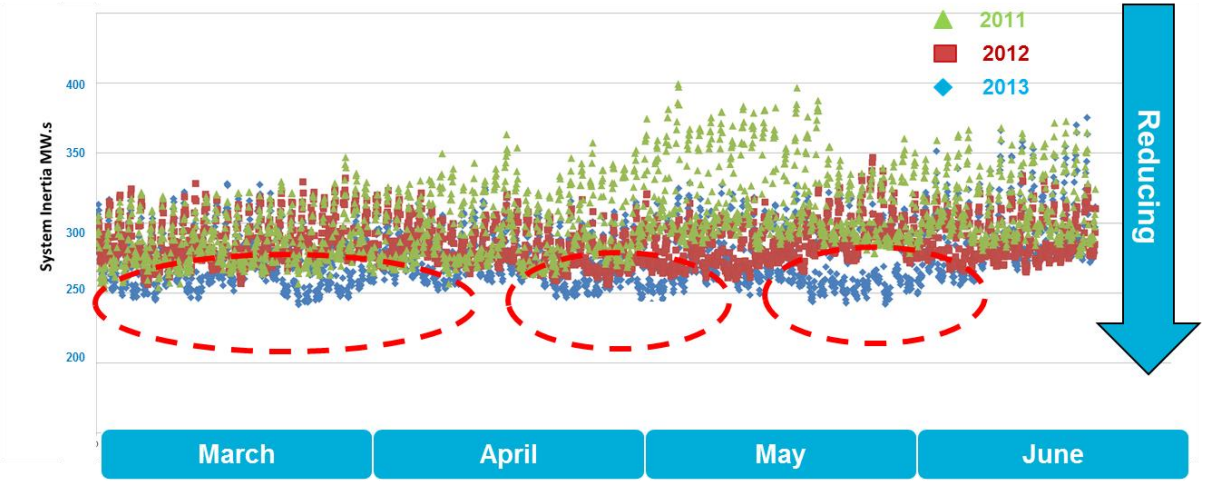
Agenda

- 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



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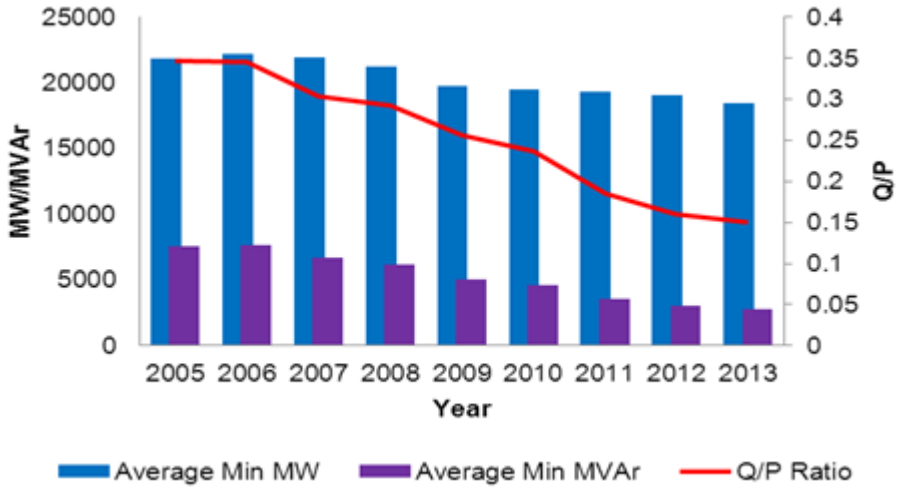
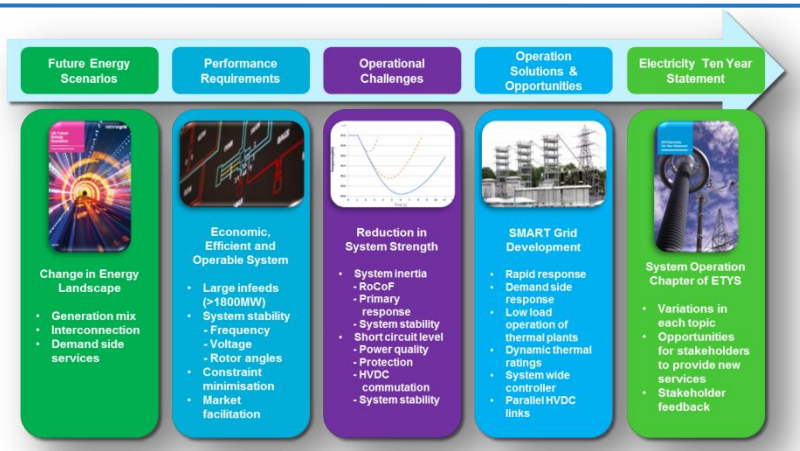
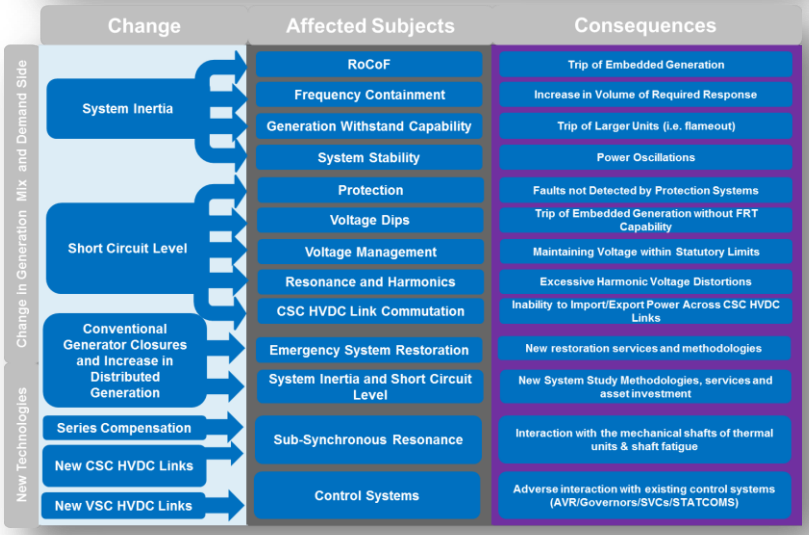
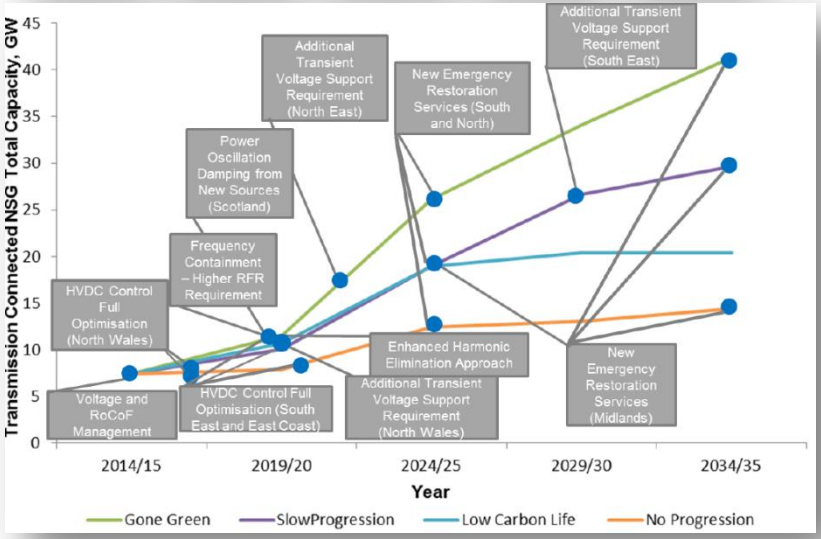


What was SOF? Recap

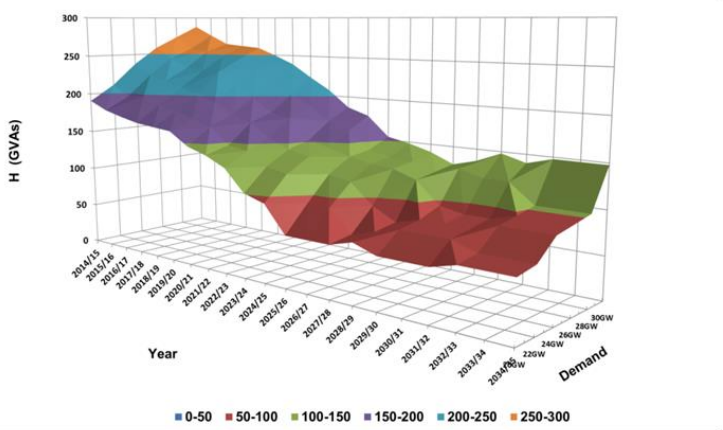




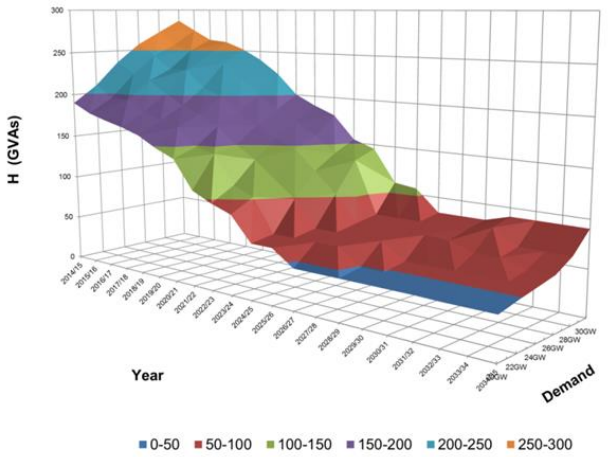


Example - System Inertia

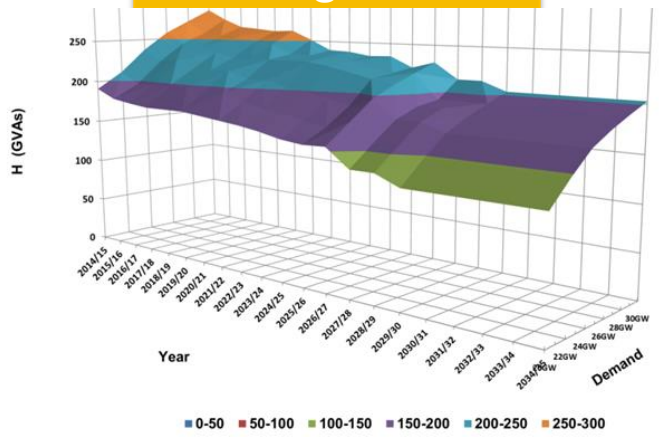
Low Carbon



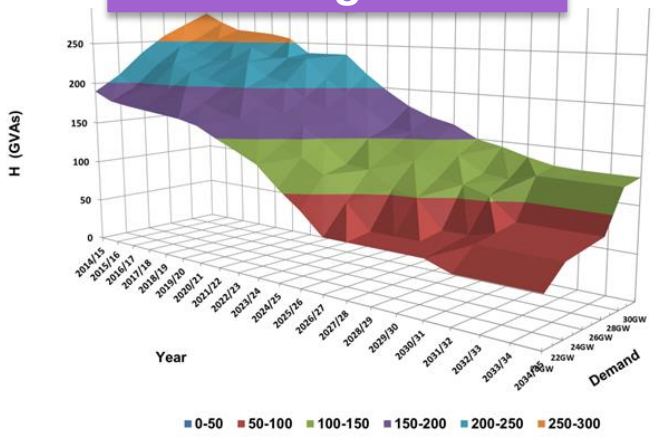
Gone Green



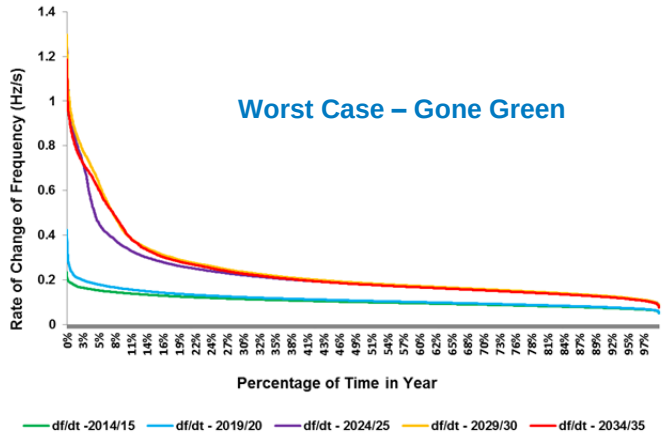
No Progression

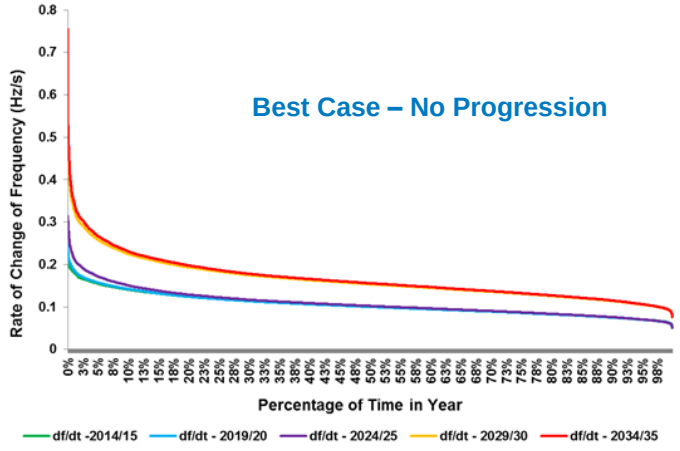


Slow Progression



System Inertia – RoCoF





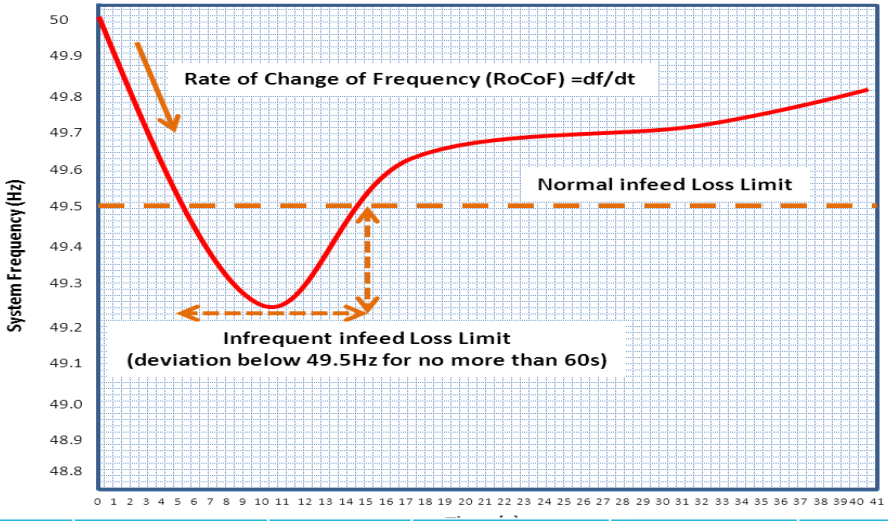
Key Messages

df/dt>0.125Hz	2014/15	2024/25	2034/35
Gone Green	19%	92%	90%
Slow Progression	19%	38%	96%
Low Carbon Life	19%	88%	93%
No Progression	19%	23%	82%

df/dt>0.5Hz	2014/15	2024/25	2034/35
Gone Green	0%	5%	8%
Slow Progression	0%	1%	8%
Low Carbon Life	0%	2%	3%
No Progression	0%	0%	1%

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

Example - System Inertia & Frequency Containment (1)

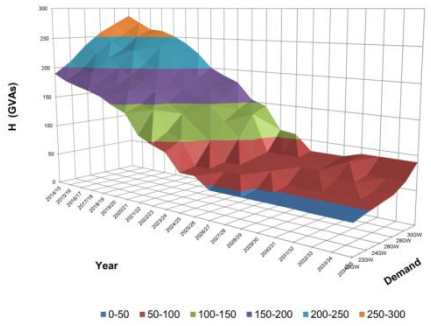


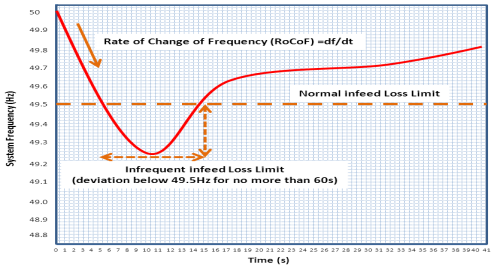
RoCoF (Hz/s)	Slow Progression	Gone Green	Inertia GW.s	Action Time (to reach 49.2 Hz)	Response Rate (MW/s)
0.125**	2013/14	2013/14	360	9	185
0.2	2019/20	2018/19	225	4	400
0.22	2022/23	2019/20	205	3.4	489
0.25	2023/24	2020/21	180	2.4	679
0.3	2024/25	2021/22	150	1.2	1148

Three times greater than current system capability

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

Example - System Inertia & Frequency Containment (2)



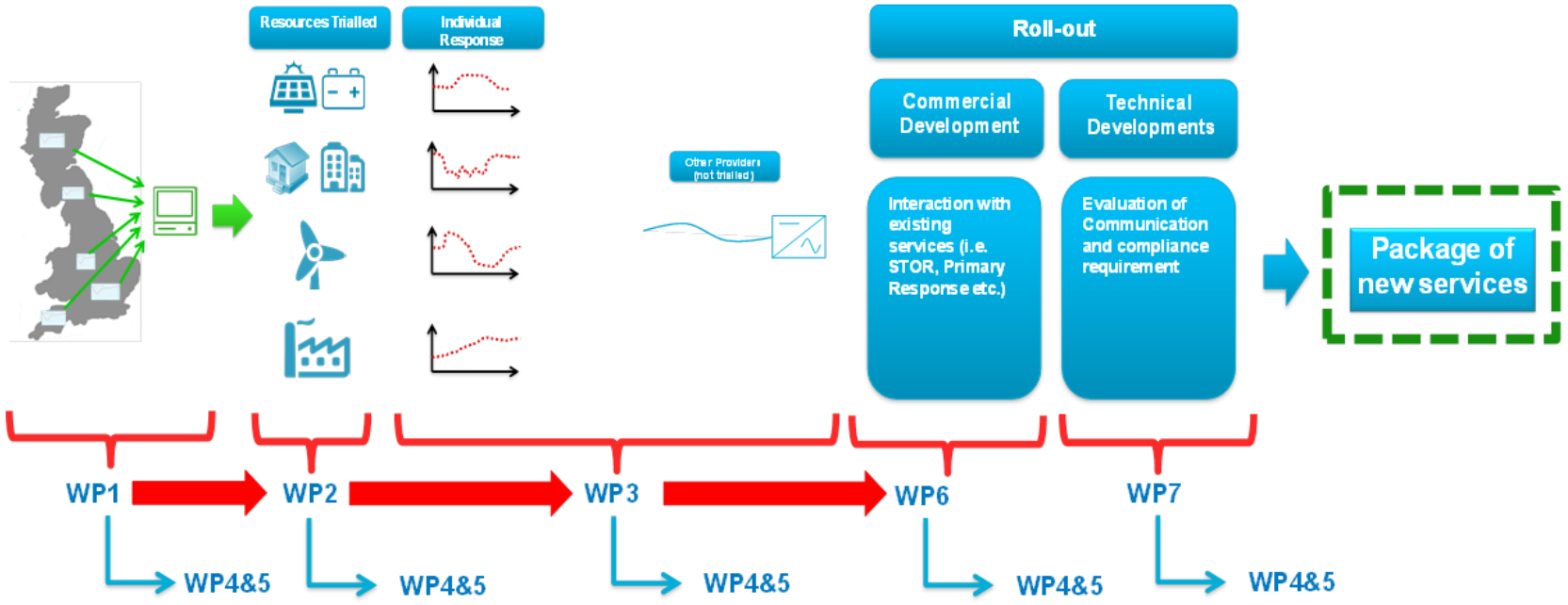


	Solution	Cost (2020 Gone Green)
Conventional Services	Constrain generators	Extra £600m
	Constrain largest infeed/outfeed	Extra £130m-£270m (depending on when the large infeeds are connected)
	Carry larger volumes of response	Extra £210m

	Solution
New Services	Enhanced Frequency Control (Fast Response)
	Low Load Operation of Thermal Plants
	Synchronous Compensator

System Inertia – Frequency Containment (3) – Innovation

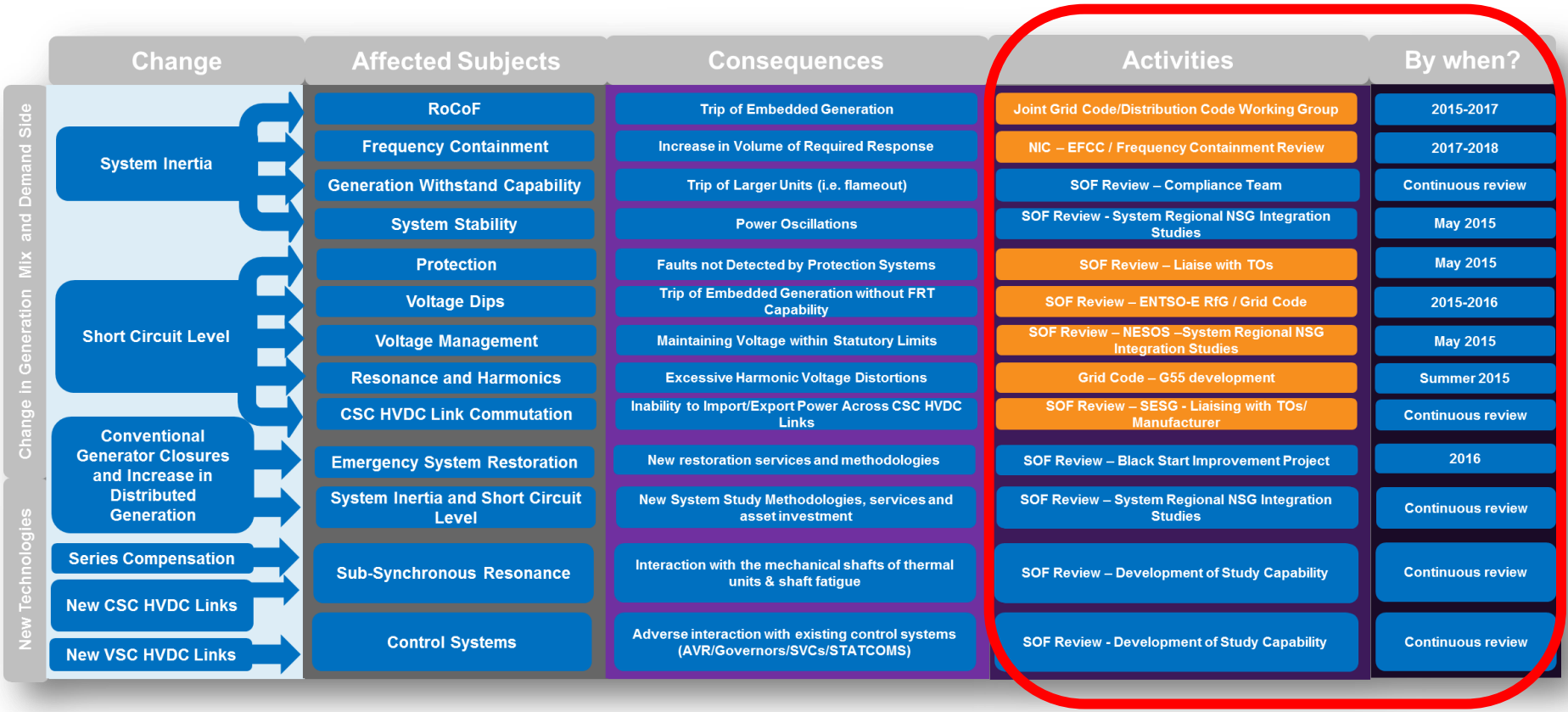
- **Need for fast response was identified as part of SOF**
- **Enhanced Frequency Control Capability (EFCC) will demonstrate the effectiveness of such service**



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

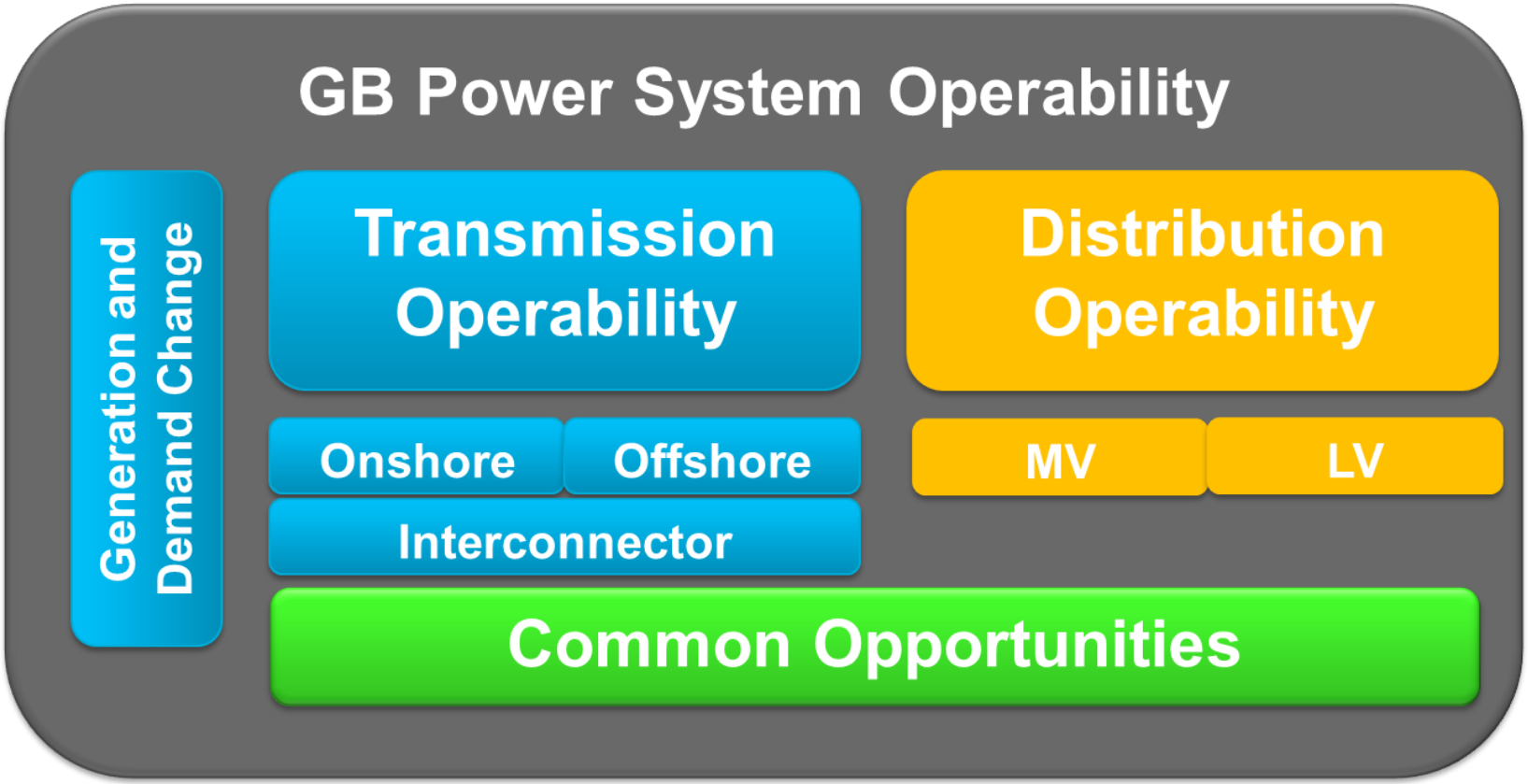
Existing Engagement Forums

SOF Engagement

Generation	Transmission	Distribution	Supply Side
Operational Forum - Grid Code Review Panel - Compliance Meetings	SQSS - STC – JPC- Grid Code Review Panel - Liaison Meetings	ENA Grid Code & Distribution Code Review Panel – T&D Liaison	Operational Forum - Liaison Meetings
• New services • New generation technologies Generation withstand capability • Modelling issues • Installations worldwide • Compliance issues • Grid services to the generators • Joint innovation projects	• 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	• 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	• 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)



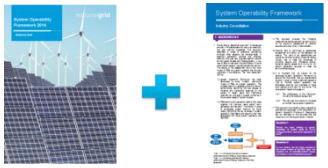
a theme for future SOF?

DNO's Engagement

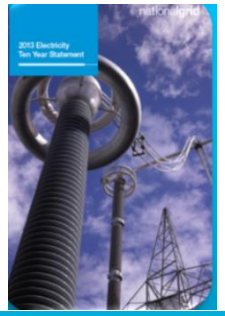
Timeline for Development of SOF

2014 2015

Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep



✓ SOF 2014 and Consultation



✓ ETYS 2014

SOF 2015 Pre-assessment industry workshop

Assessme\nts

Industry Workshop 2

SOF 2015

Key priorities for SOF 2015 - Summary

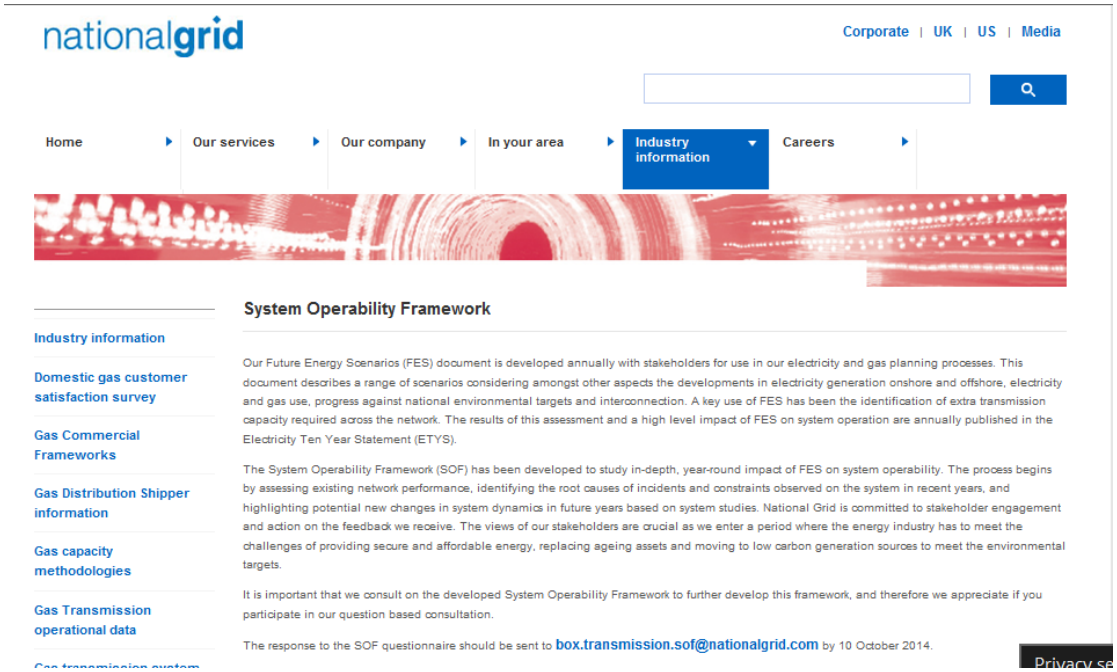
- Stating how we responded to industry's comments on the consultation
- Better articulation of across Transmission and Distribution operability issues
  - Highlighting where the change is coming from, and what's the effect on
- Priority table (operability issues and opportunities)
- Update on innovation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



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