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# RIIO Electricity Transmission Workshop
# 15th November

Talking Networks

Claire Spedding
*RIIO-T1 Price Review*

# Stakeholder Engagement: Round 3

- This round of workshops will focus on the areas where you have asked for more detail and the areas where we would like to explore your views further
- What's different this time?
  - We have built in more time for discussion so that we can fully explore your thoughts and opinions
  - We are asking you to provide written responses to the questions we are discussing following the workshop, to ensure we are interpreting the discussions here today correctly
- We want to ensure that our plans are delivering what you want from our network

# Agenda

| Time | Description |
|---|---|
| **10:00 – 10:30** | **Coffee & Registration** |
| **10:30 – 10:45** | **Welcome – Nigel Williams** |
| **10:45 – 11:45** | **Business Plan**<br>An overview of our July submission and how stakeholders' views have influenced our plans<br>**SMART Operation**<br>An overview of smart operation |
| **11:45 – 12:30** | **The Changing SO Environment** |
| **12:30 – 13:00** | **Lunch** |
| **13:00 – 13:45** | **Control Room Tools & Influencing our System Operator Approach** |
| **13:45 – 14:30** | **Consumer Benefits** |
| **14:30 – 15:30** | **Renewable UK Stakeholder Engagement** |

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# RIIO Electricity Transmission Workshop
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Talking Networks

Nigel Williams
*Electricity Operations Manager*

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# UK energy landscape is changing

**Sustainability**

**Affordability**

**Security of supply**

**Existing power station closures**

**~25%**

**of total capacity by 2020**

**Gas from UK sources**

**~25%**

**of total supplies by 2020**

# The future – efficiency, decarbonisation and electrification

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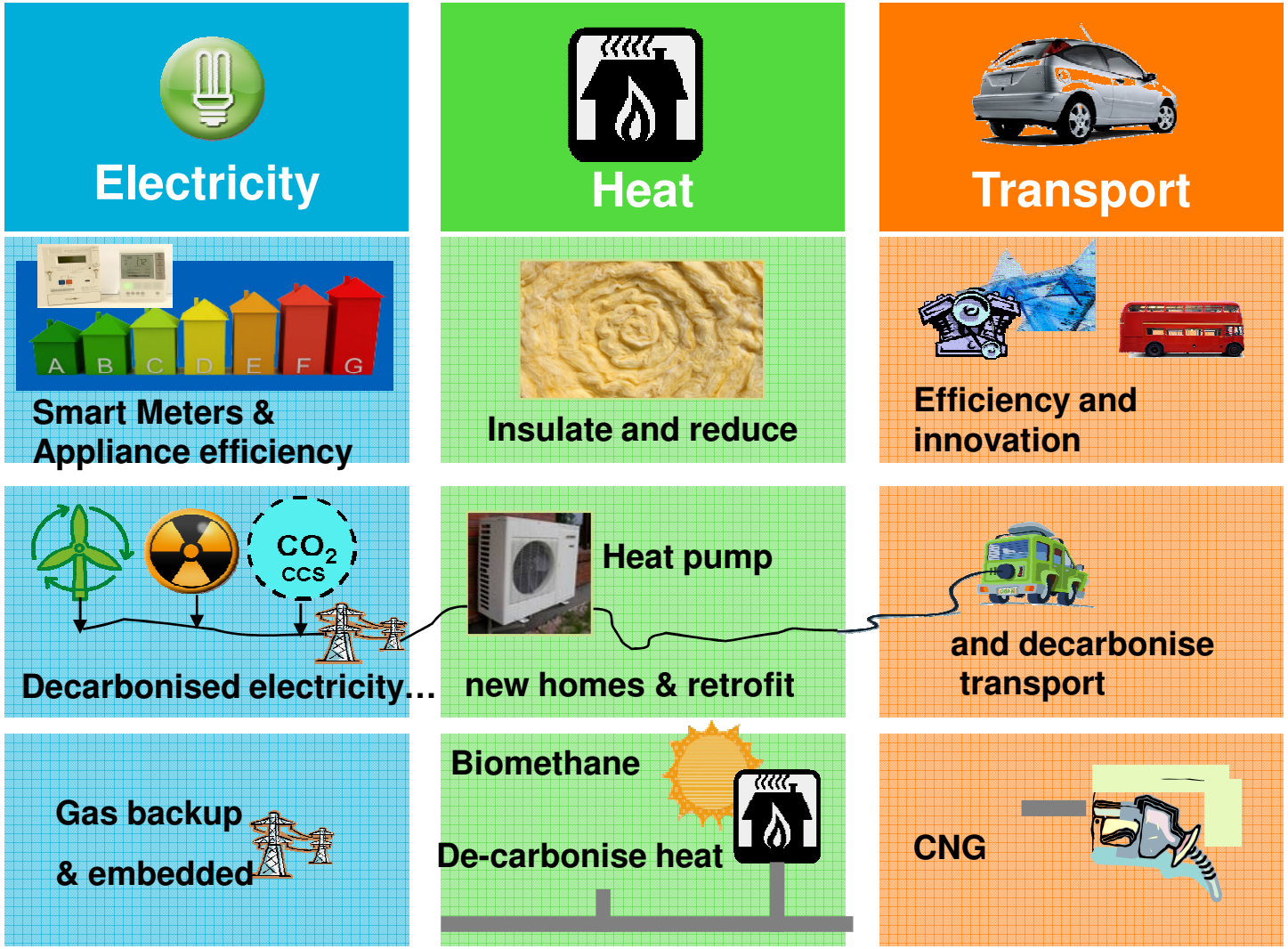

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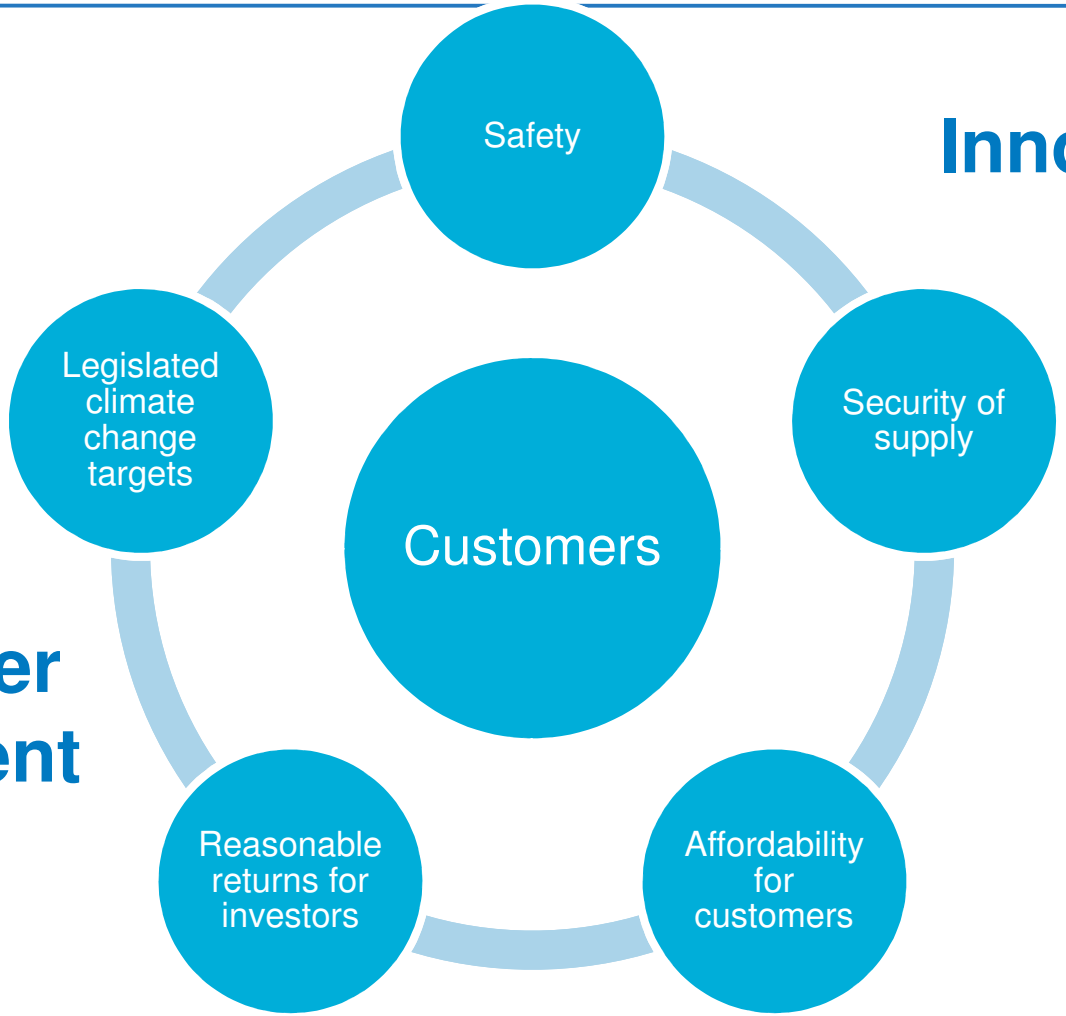
# Business Plan Q&A

Talking Networks

Richard Lamb

*RIIO-T1 Price Review*

# The business plans




**Innovation**

**Stakeholder Engagement**

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# We developed our plans in conjunction with stakeholders' views

| Safety | Environment | Reliability | Customer Satisfaction | Customer Connections | Innovation |
|---|---|---|---|---|---|
| "Safety is non negotiable" | "Facilitate low carbon energy" | "Reliability must be maintained" | "Improve customer service" | "Process must be improved" | "Innovation is crucial" |

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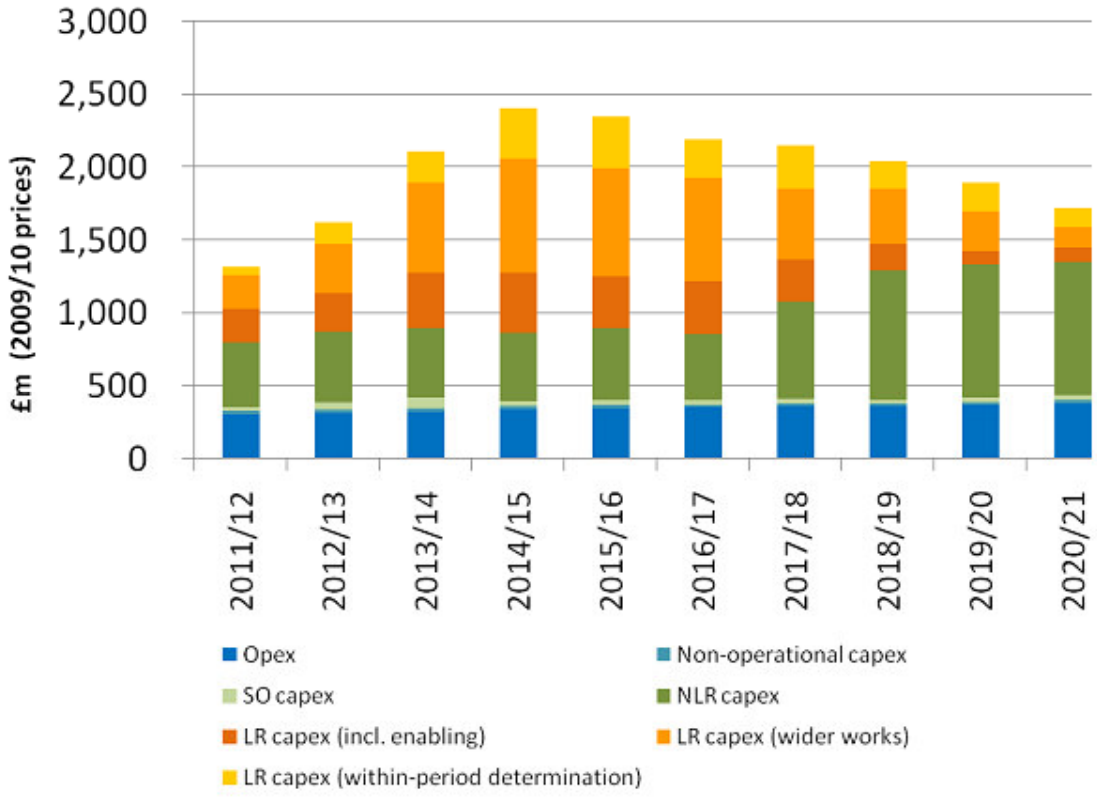
# Baseline plan expenditure




| Capex | | Opex | | 'Totex' |
|---|---|---|---|---|
| £14bn | + | £2.8 bn | = | £16.8 bn |

# Our baseline plan will transform our network to meet customer's needs

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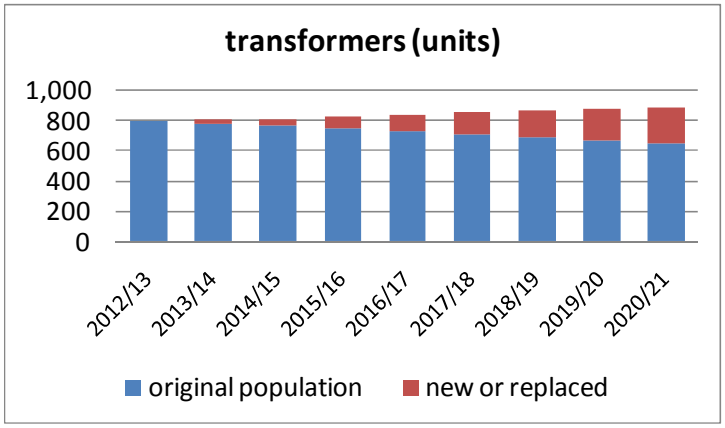
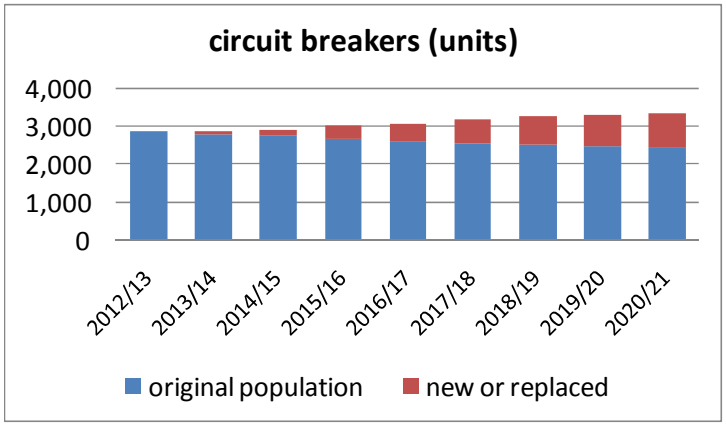
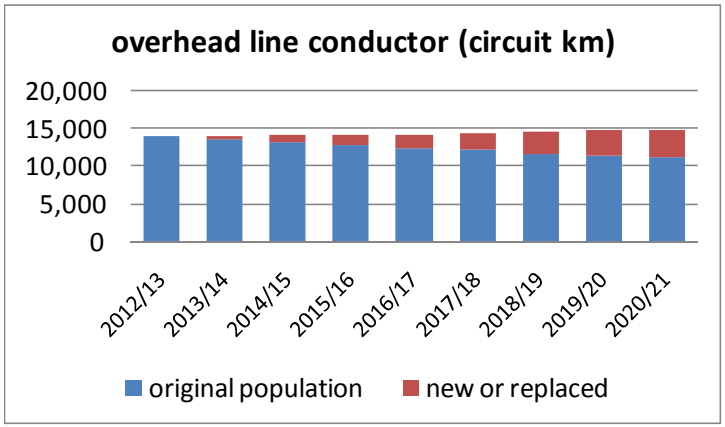
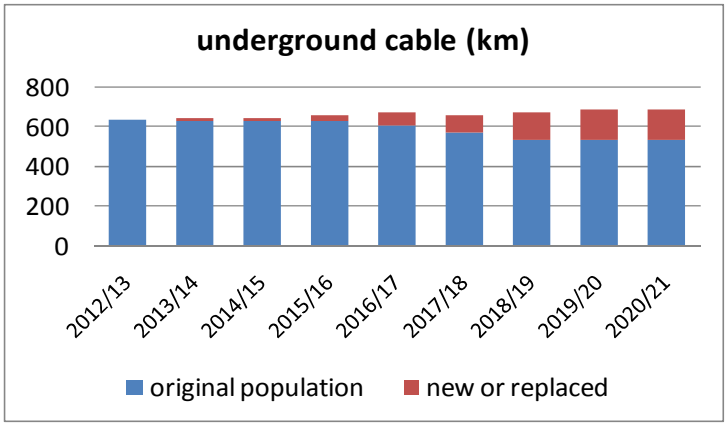



**Our total load- and non-load related investment will extend, reinforce and replace our existing asset base**



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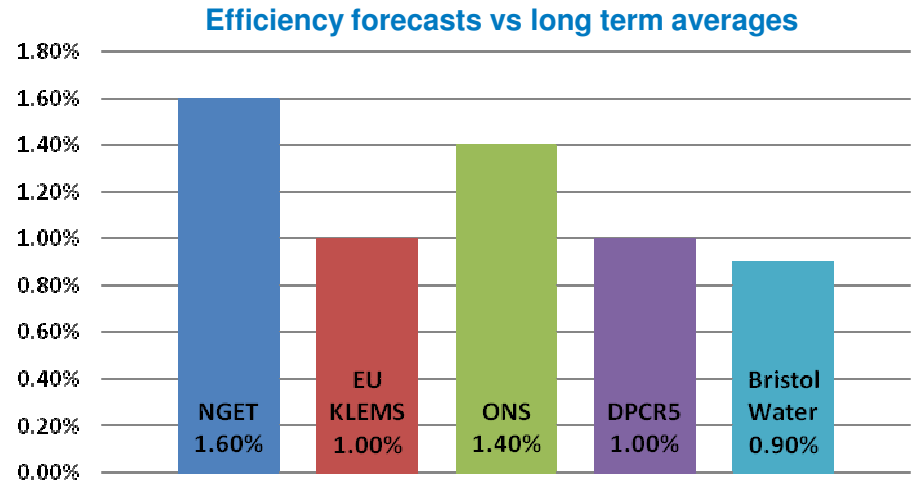
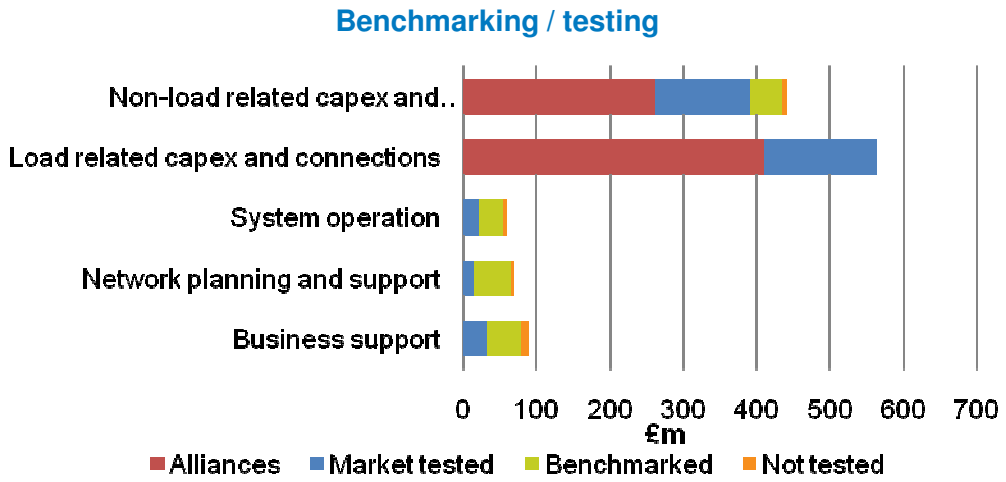
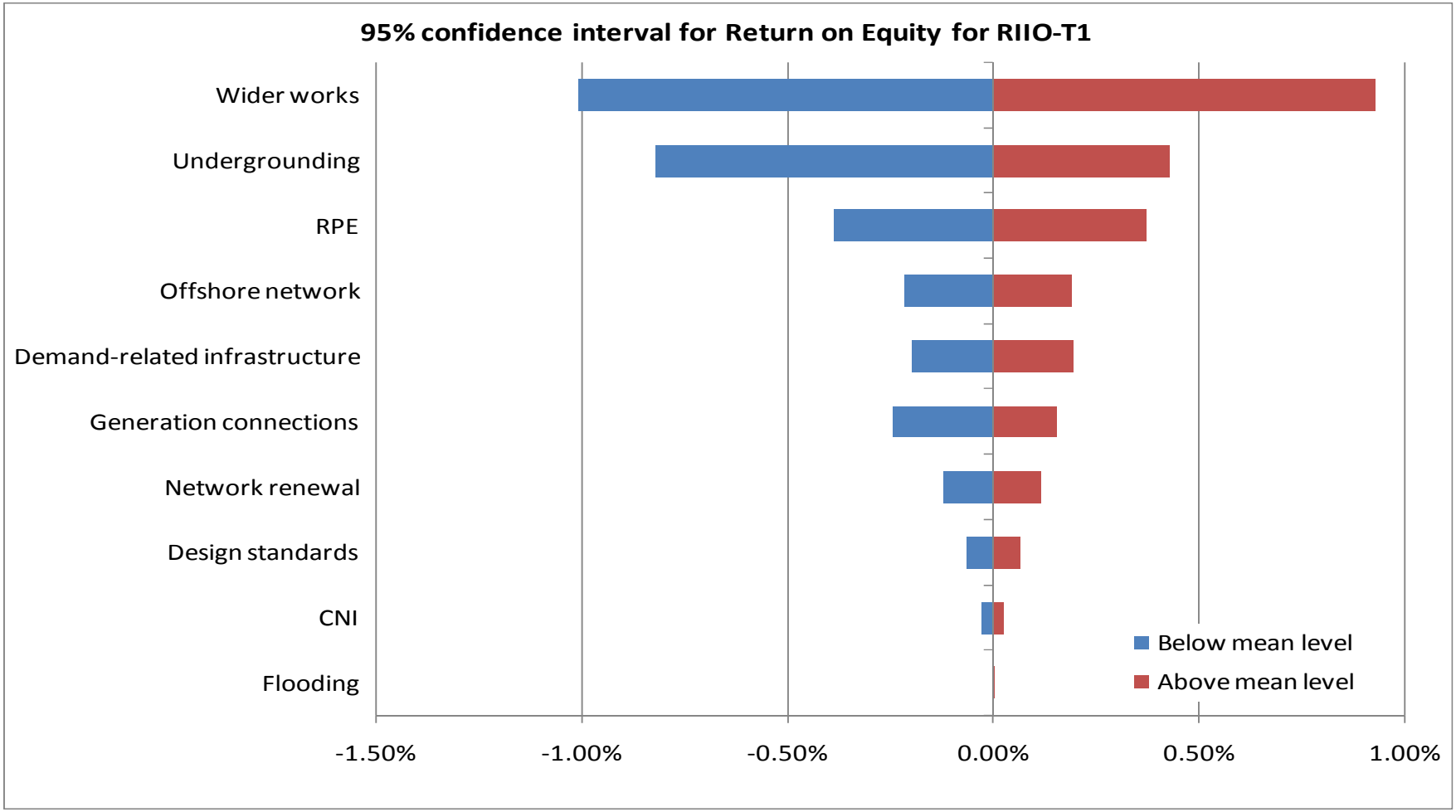
# A challenging baseline plan



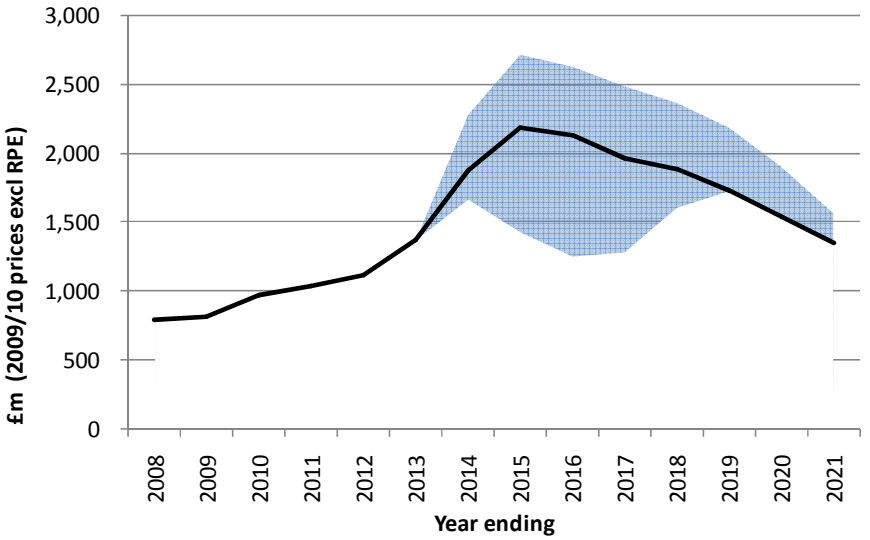



# Managing risk & uncertainty



# Uncertainty Mechanisms

**Our baseline RIIO-T1 plan is only one view of the future…**




Mechanisms we proposed:

- allow the regulatory control to adapt to an uncertain future
- ensure the RIIO-T1 package remains appropriate across a wide range of potential outcomes
- allow us to deliver desired outputs in future scenarios outside what is currently considered credible through the use of specific and targeted ‘re-openers’

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# Any Questions?

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# Smart Operation

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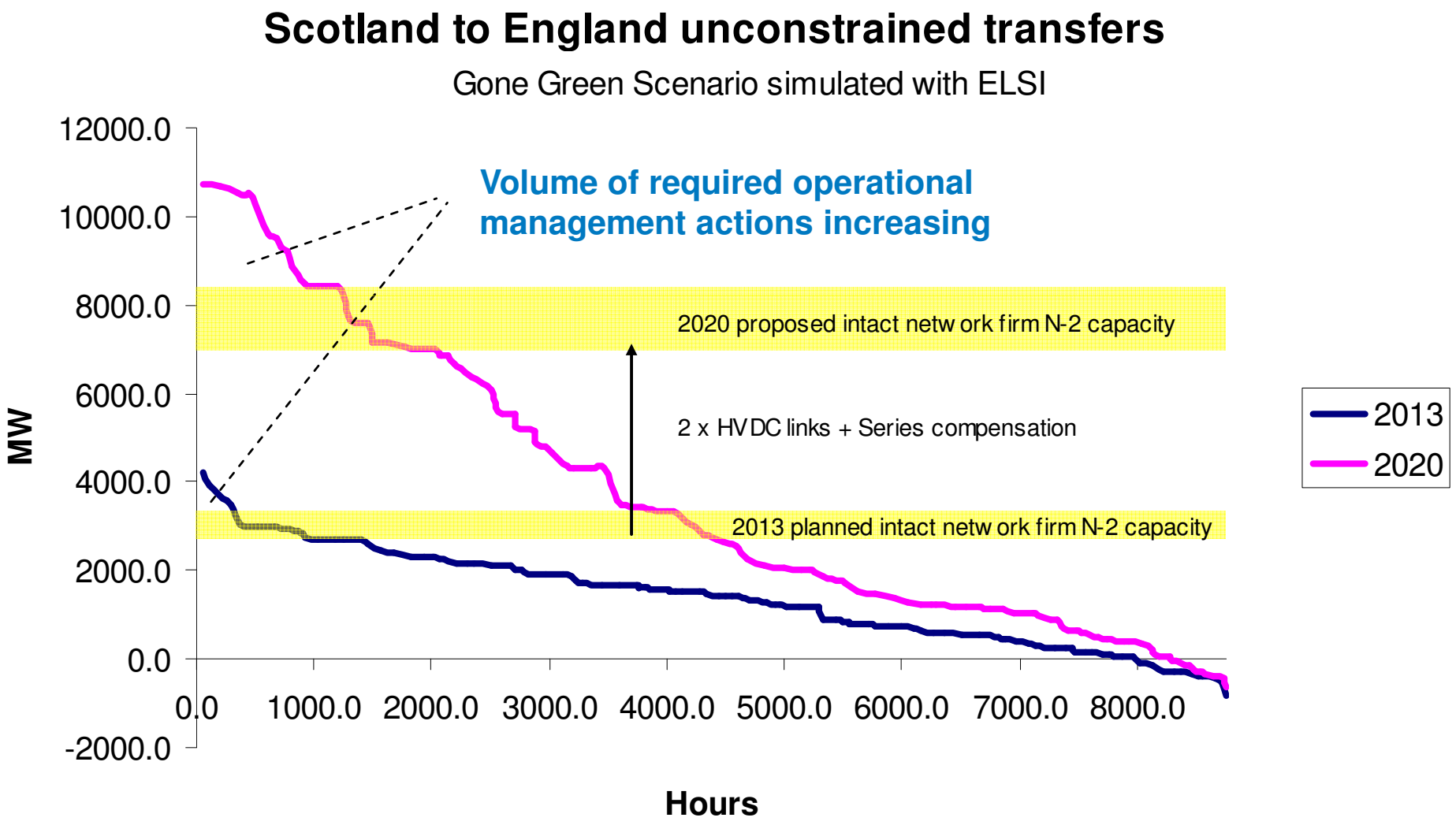
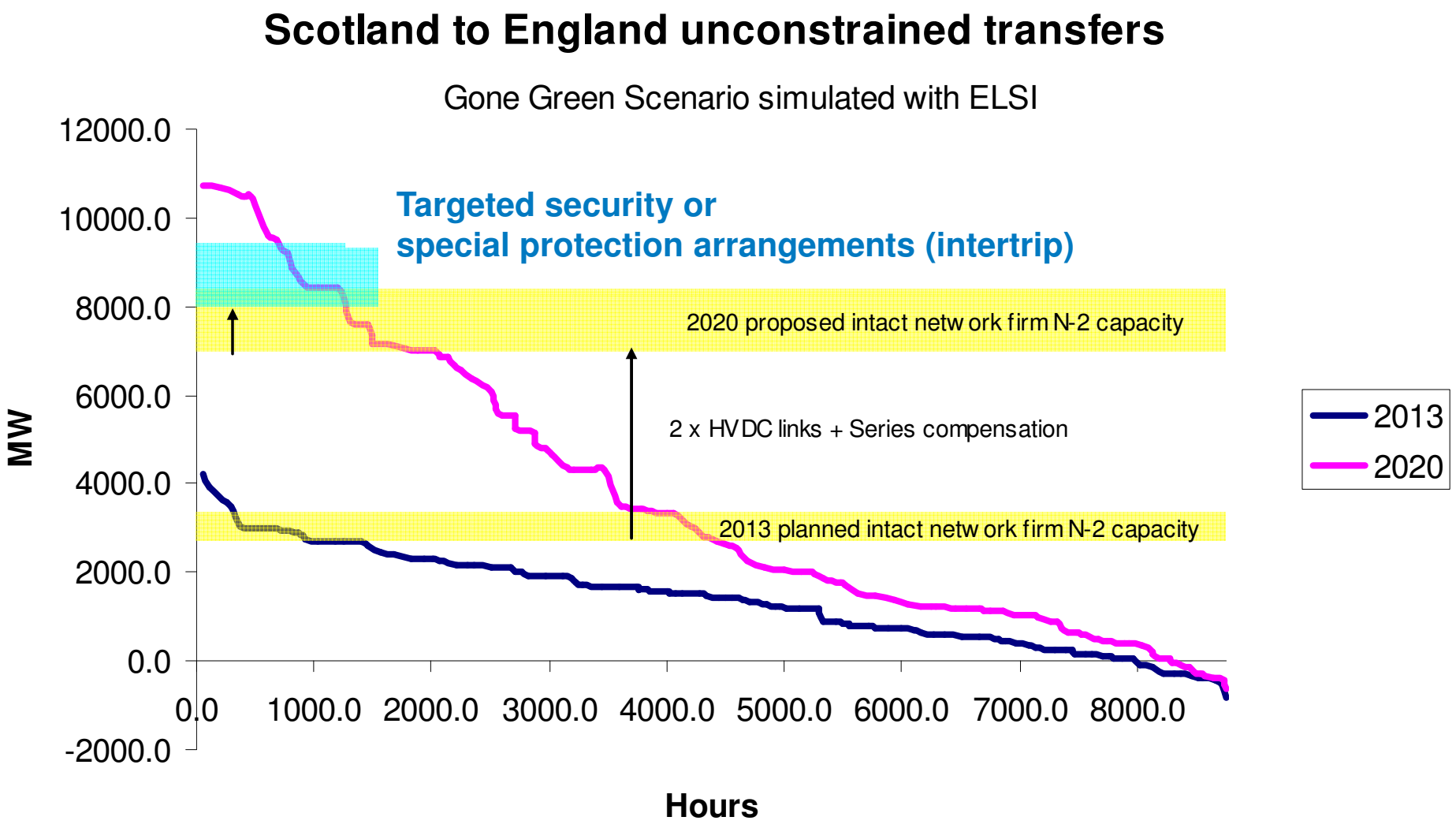
Lewis Dale
*Regulatory Strategy Manager*

# The need for more smart actions

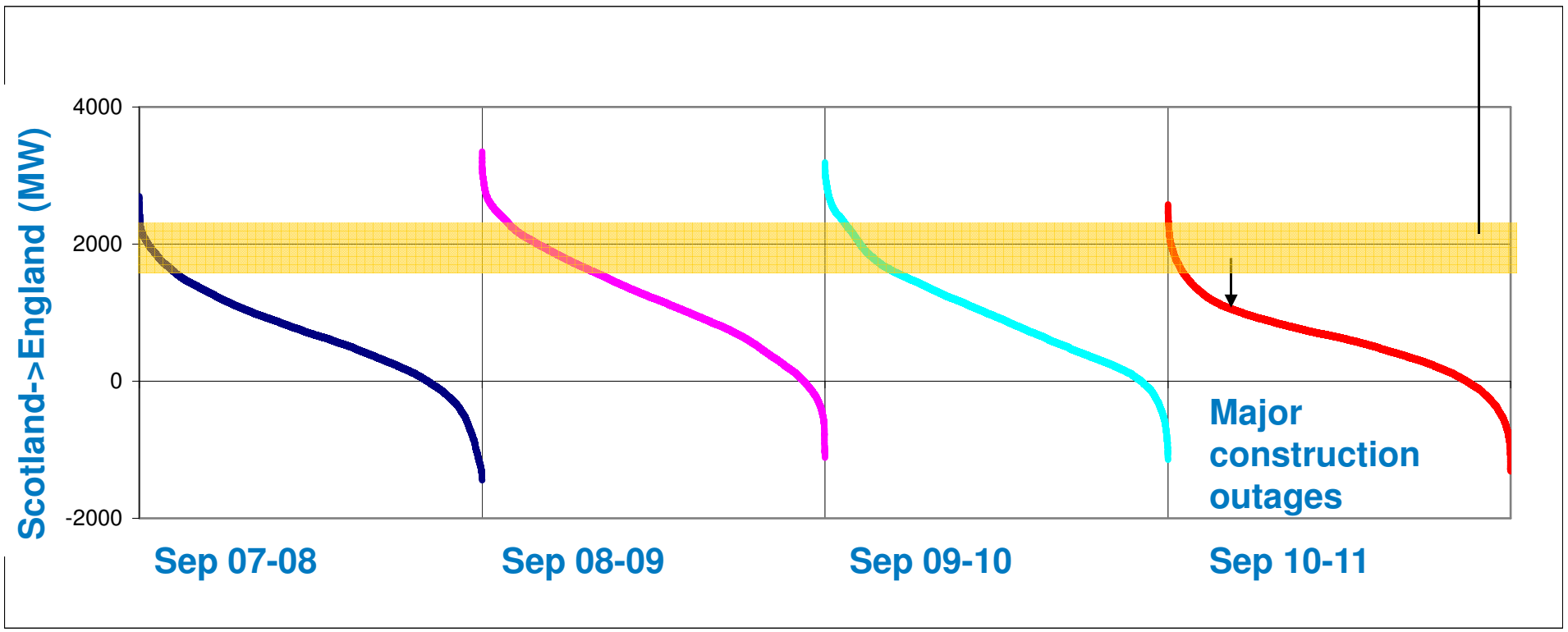


# The role of targeted security



# Current performance

## Achieved flows (metered) following operator actions



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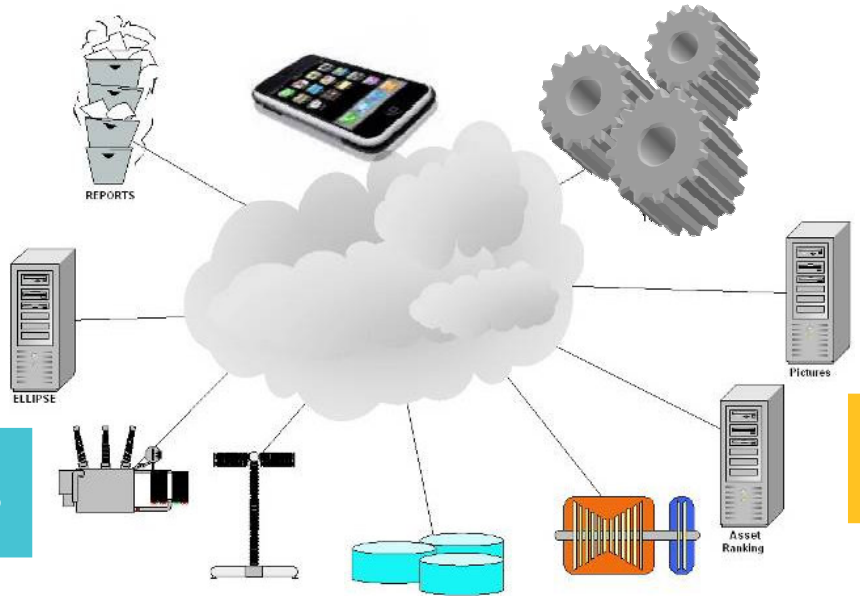
# Is Transmission already Smart?

Condition monitoring

Network Output Measures

Risk management

Remote asset management and monitoring (RAMM)




Voltage Control

Auto-switching schemes

Circuit Rating Enhancement

Operational Tripping Schemes (OTS)

Remote Substation Control

Power Flow Control

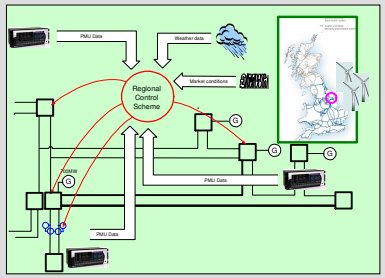
# Investing in a Smarter Grid

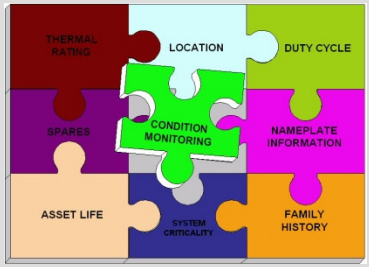
## R&D Pilots

- **Strategic Asset Management**
  - Services to manage system risk & criticality
  - Increase operational efficiency
- **SmartZone**
  - Intelligent automated control & dynamic rating
  - Congestion & demand side management
- **Digital Substation**
  - Speed up & reduce outage durations

## New Technology

- **Integrated HVDC**
  - Reduce Anglo- Scottish constraints
  - Submarine 400km circuit
- **Series Compensation**
  - Increase asset utilisation
  - Reduce constraints
- **Composite conductor**
  - New low sag material
  - Increase circuit capacity
- **IS Transformation**




# Impact of Smart for Stakeholders

**If the Grid is already smart – Why develop it further?**

## Benefits to Stakeholders

- Increasing network access
- Reducing network constraints
- Minimising asset visibility
- Improving asset utilisation
- More transparency

## Implications

- Lower cost than new assets but increased complexity
- Needs to be integrated into a living network.
- Cost impacts across the whole value chain.
- May only delay investment of new infrastructure

# Network Performance & Reliability

How do we preserve reliability and network security?

- Increasing network complexity
- Wider application of control and automation
- Communications resilience
- Cyber security
- Data management

- Consult outside of the Electricity Industry
- Identify best practice
- Understand the risks and impact on system integrity
- Manage innovation through R&D and pilots
- Only roll out production tools

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# Summary

- The Transmission network is already Smart – but needs to be even Smarter to manage the challenges that we are facing
- We are evolving our thinking & assessing technology to make the system Smarter
- We believe these new solutions are not disruptive…
  - but need to be implemented sensibly to ensure reliability and security are not compromised
- Smarter Transmission is addressed in the RIIO plan
- This is work in progress…

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# Any Questions?

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# SO Investment

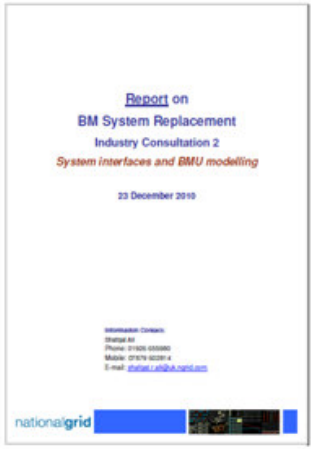

Nigel Williams
*Electricity Operations Manager*

# Agenda

- Our System Operator (SO) plan as part of the total RIIO-T1 submission
- The changing SO environment
- SO capabilities
- Influencing our system operator approach
- Benefits from our SO investments

# Working closely with our stakeholders

- In 2009 we initiated a consultation report setting out our analysis and views on operating the electricity networks in 2020
- Consultation has been updated and published again in June 2011
- Extensive consultation on the replacement of the balancing mechanism
- Operational Forums have been running for over 10 years


**This event focuses on our proposed SO investments in the RIIO-T1 period to manage the electricity system of the future**

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# Our SO plan as part of the total RIIO-T1 submission

# National Electricity Transmission System Operator (NETSO)

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## Transmission Owner

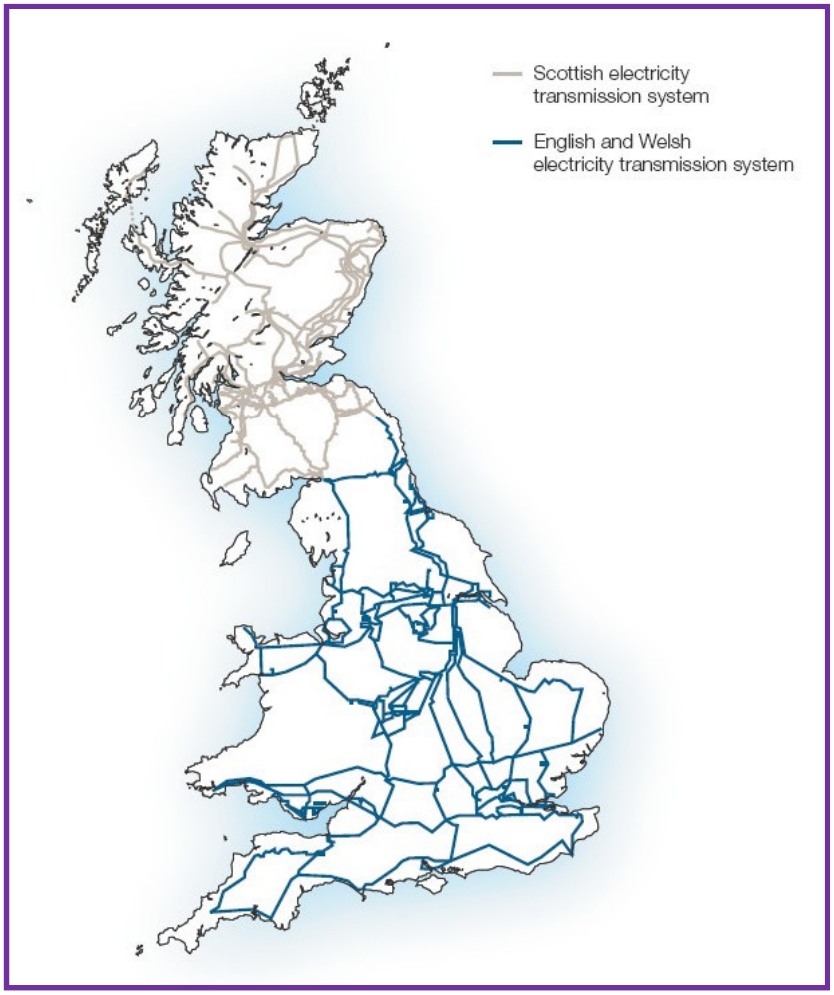
**Responsible for**

**: System Design**

**: Project Management**

**: Maintenance**

**: Connections**




## System Operator

**Responsible for**

**: System Planning**

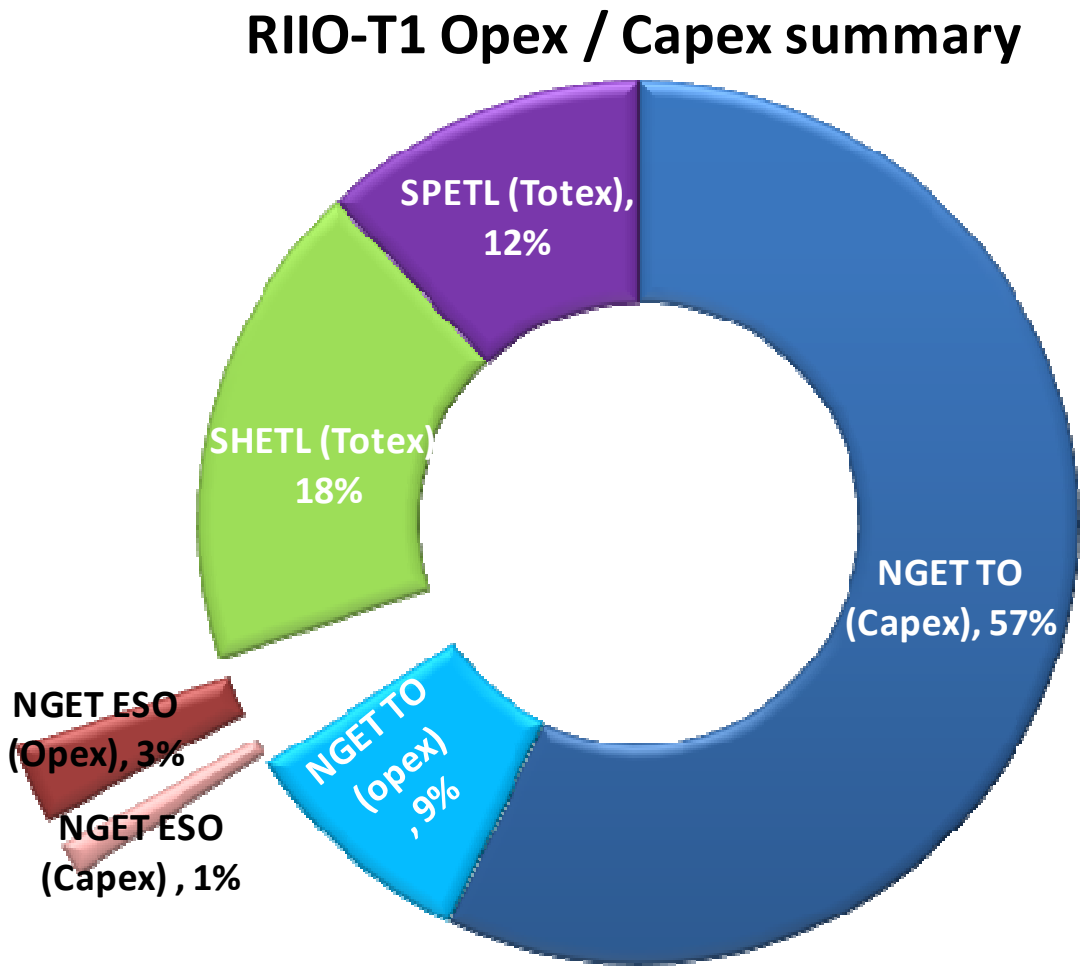
**: System Operation**

**: Market Facilitation**

**: System Access**

**: Role covers all 3 Onshore TOs and new Offshore TOs**

# Electricity RIIO-T1 Investment summary



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# The Changing SO environment

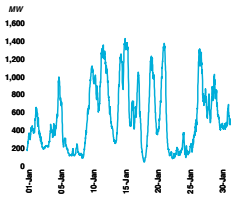
# Culmination of change drivers

## Distributed generation


## Generation Composition

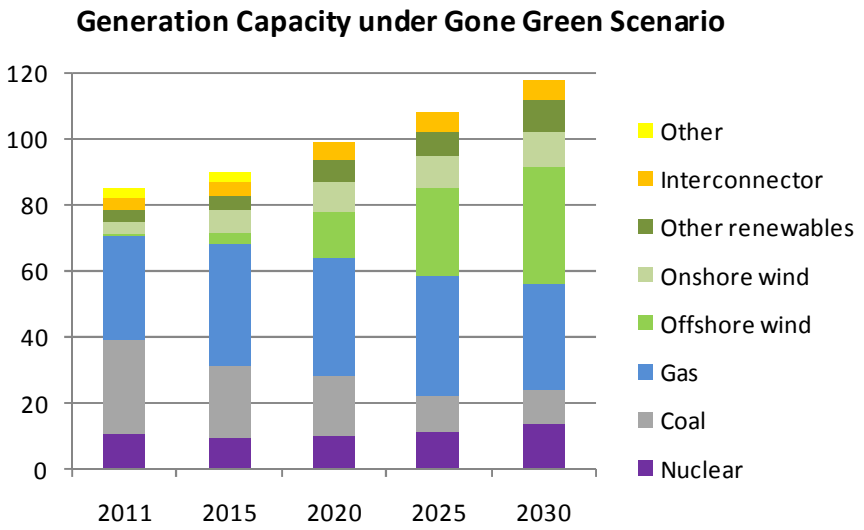


## Supply & Demand volatility

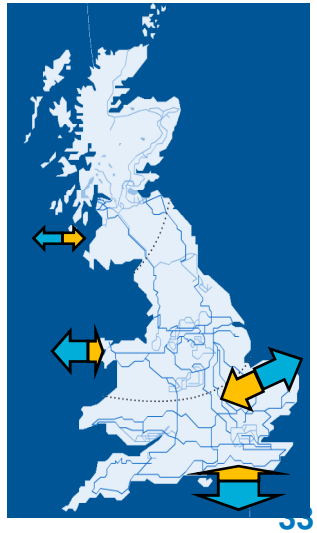


## Active distribution networks

***Smart(er) grids & meters, energy storage***




## Europe



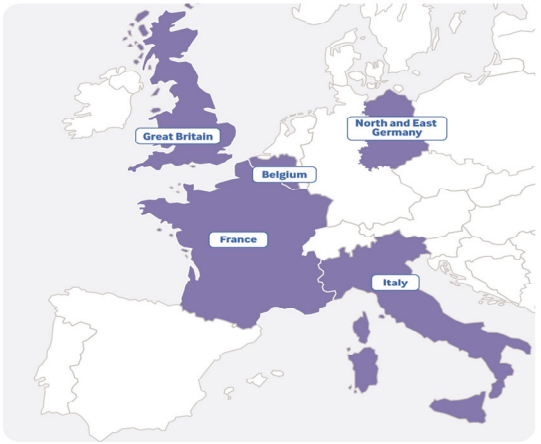
# The changing European environment

## European Environment

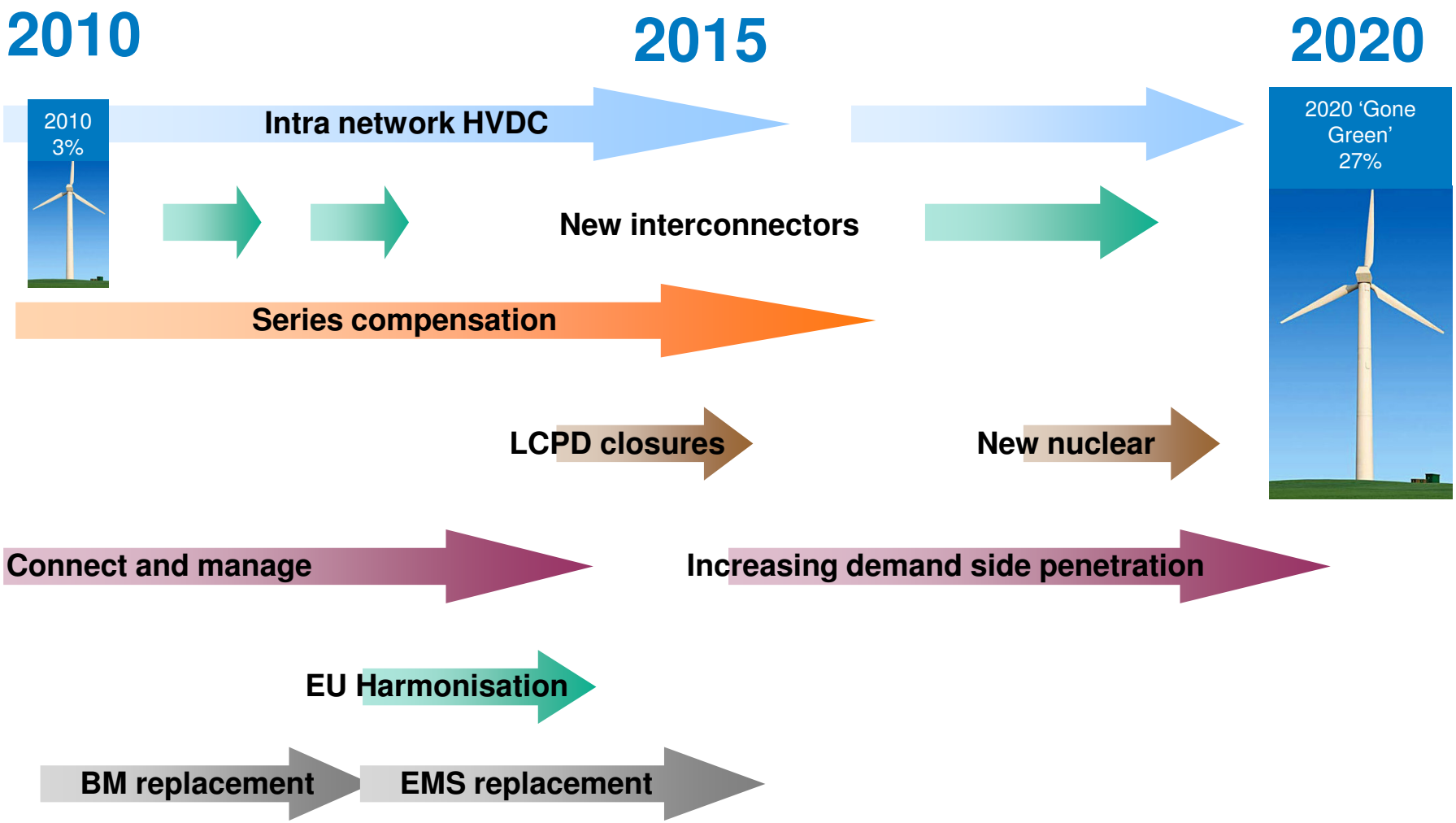
- Increasing amounts of interconnection to Europe
  - Greater security of supply
  - Increased complexity
  - Flows on interconnectors will be only limited under most onerous conditions
- Provisions from the EU 3rd Energy package, shaping market frameworks

## Formation of Coreso

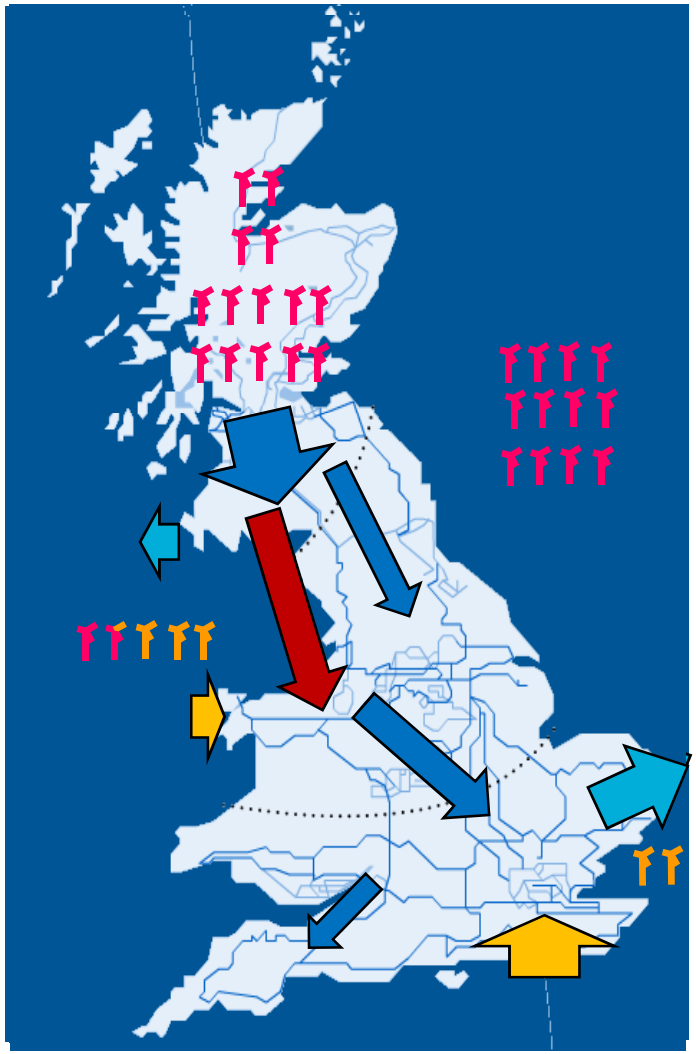
- Founding member of Coreso
- Regional security organisation with other TSOs
- Coordination of inter-region energy transfers
- Shared control room, staffed by a mix of TSO staff



# Indicative timeline



# Operating complexity increases – Why?



- System behaviour is increasingly difficult to predict:
  - Wind output changes
  - Interconnector flows change
  - Boundary flows change
  - Introduction of SMART transmission assets
  - Increase requirement for outages to facilitate TO Capex & Maintenance

# Wind Management: A contemporary issue

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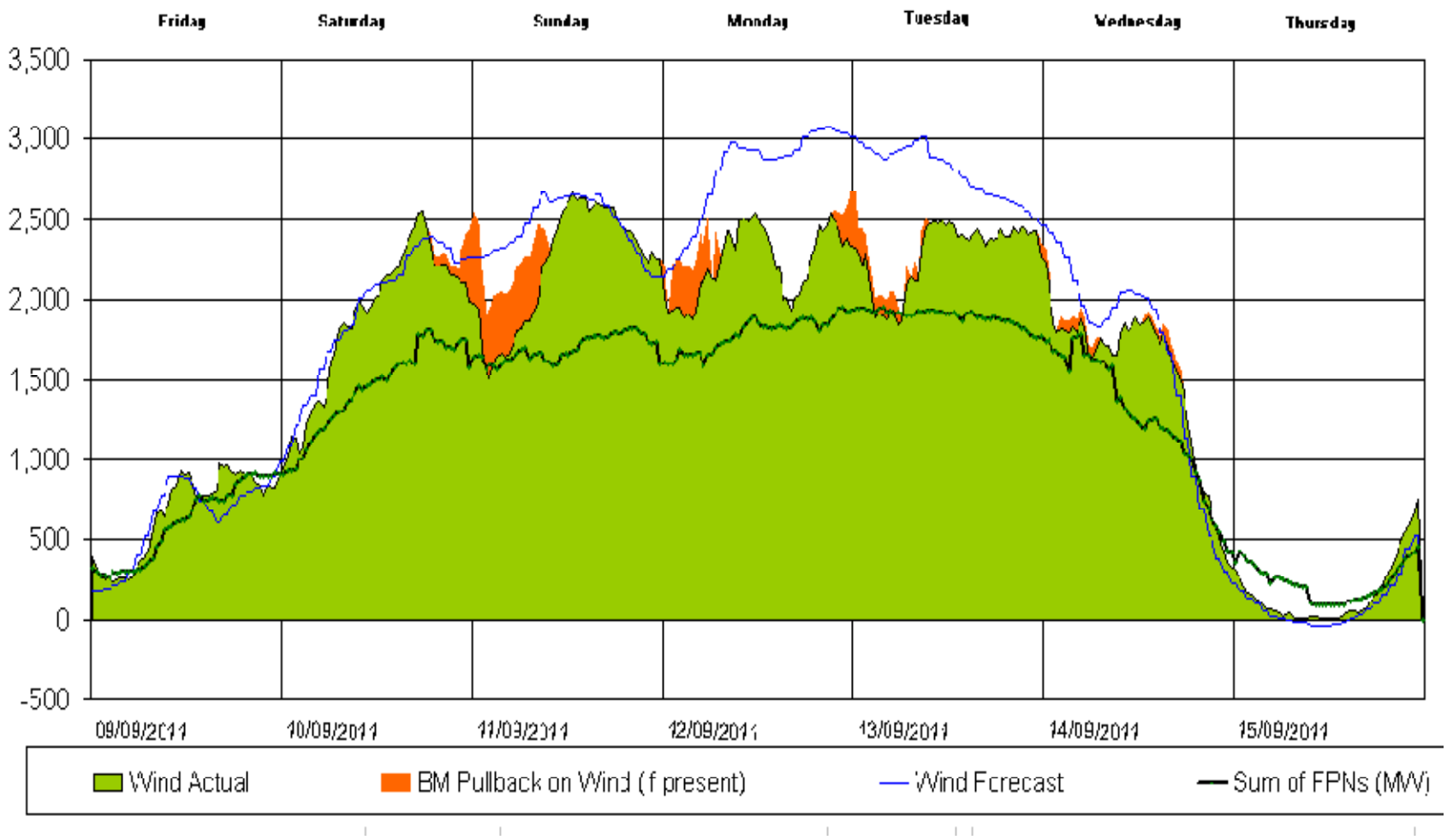

# Wind Management: A contemporary issue

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## Control Room Actions

- On each of the 3 days large number of Bids taken (740 MW) mainly by telephone
- Majority of this volume was curtailment of wind
- Both Balancing Mechanism (BM) and Emergency Instructions (EI) were used

## Management Response

- Wind forecasting improvements
- System to capture real time embedded generation data
- Changes to reserve policy to become more flexible dependent on wind generation
- Establishment of contracts with wind generators to help manage transmission constraints

# A rare, extreme event?

## 2020/21: ~ 30GW Wind Capacity

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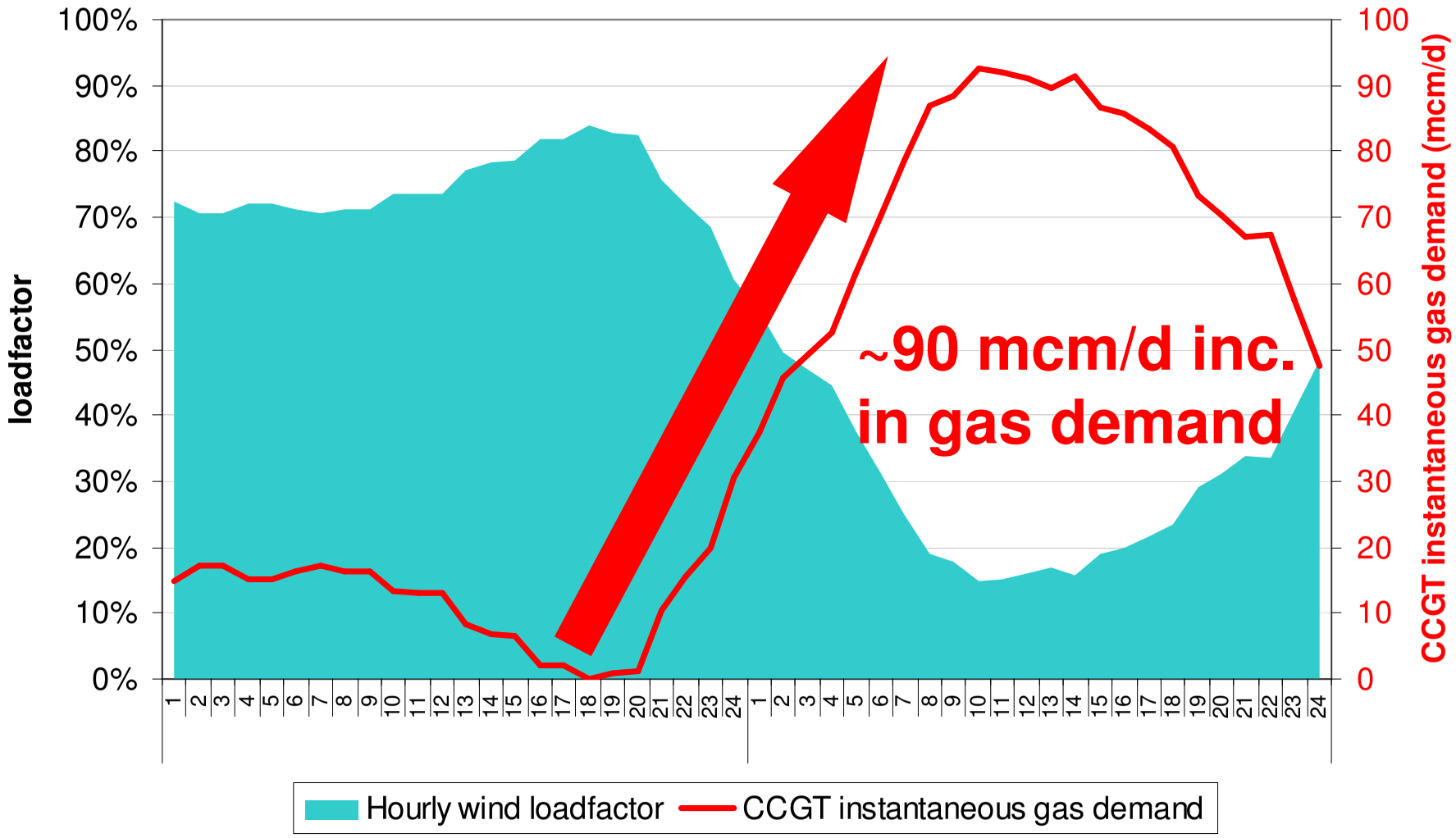

# Why invest now?

- Material impacts on network complexity already being seen, this only exacerbated further by 2014/15 and beyond
- Lead time –SO systems take 2-3 years to design, build and test to ensure that the operation of the system is not affected when they are implemented
- Critical IS systems (e.g. EMS / Balancing mechanism) need replacing for reliability purposes
- By combining the 'refresh' element with delivering enhanced capabilities, Capex savings will be delivered
- The enhanced capabilities enable optimal operating efficiency. Delivering SO and BSUoS / end consumer savings into the future

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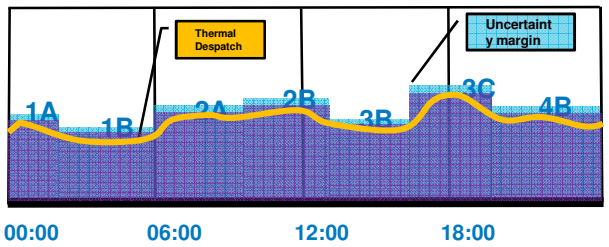
# System Operation Capabilities

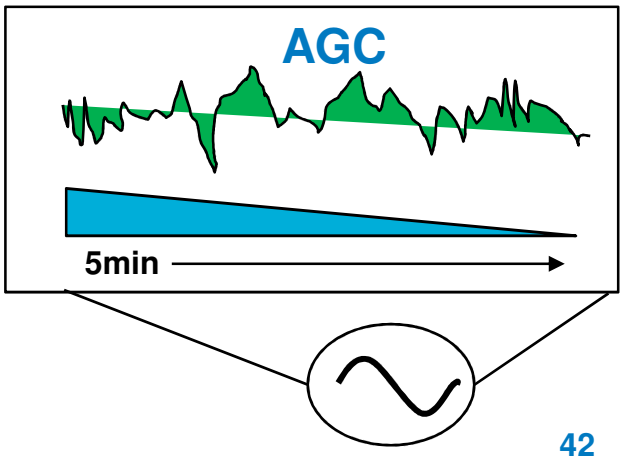

Graham Dolamore

*Electricity Operations, Programme Management and Business Planning*

# SO capabilities



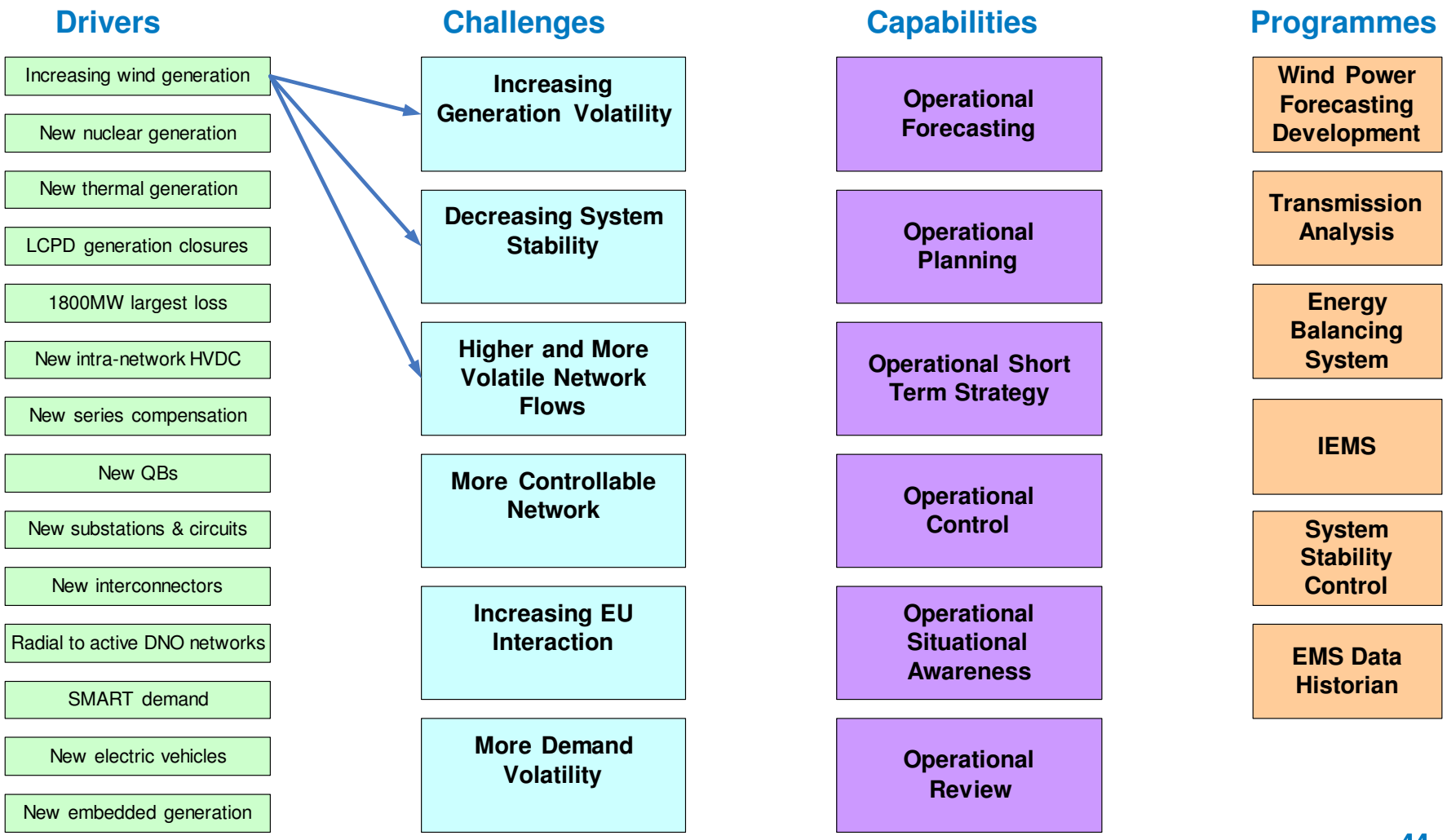

- Forecasting
- Planning
- Short Term Strategy
- Control
- Situational Awareness
- Review



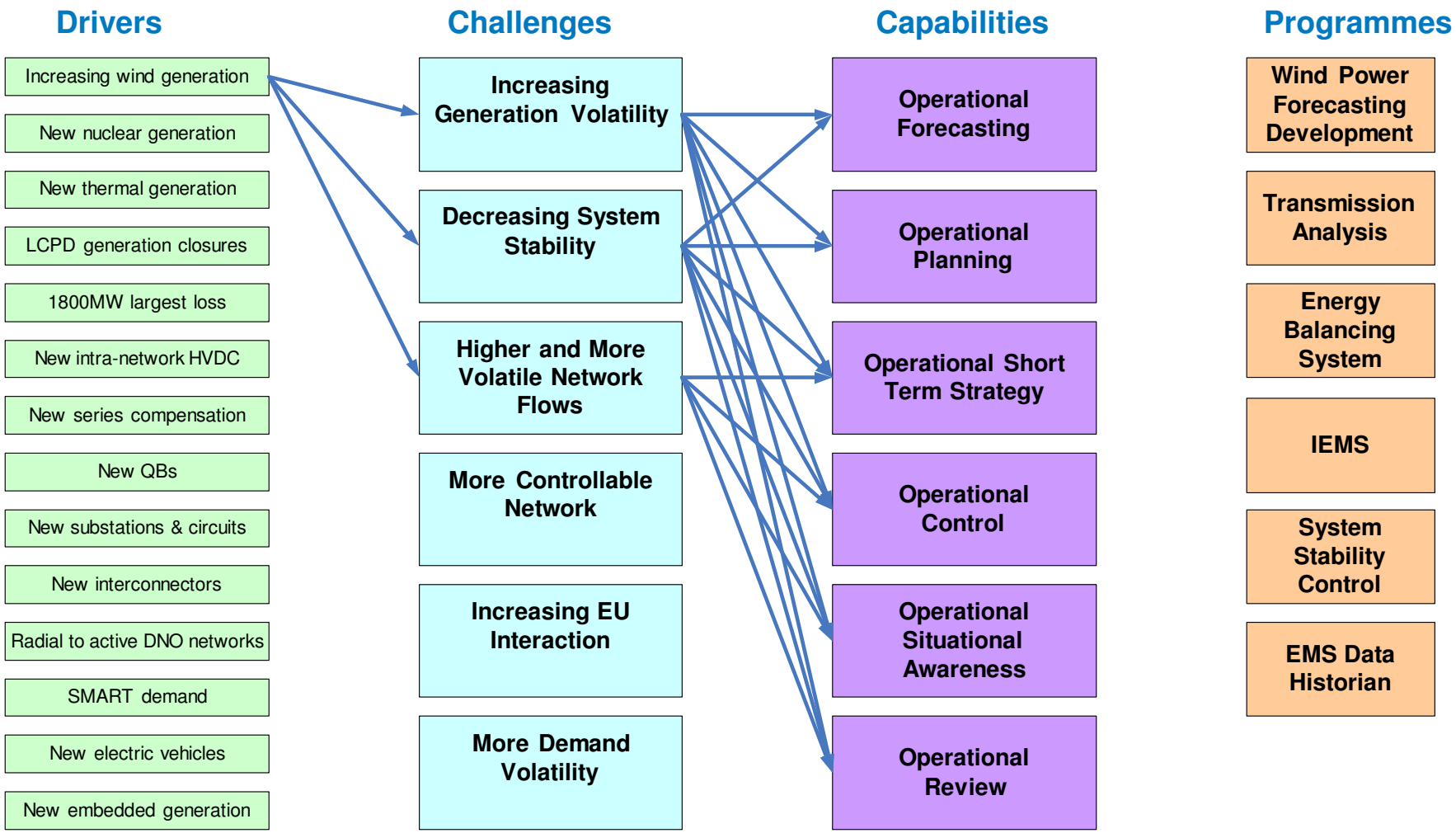
# Linking drivers to programmes

| Drivers | Challenges | Capabilities | Programmes |
|---|---|---|---|
| Increasing wind generation | Increasing Generation Volatility | Operational Forecasting | Wind Power Forecasting Development |
| New nuclear generation | | | |
| New thermal generation | Decreasing System Stability | Operational Planning | Transmission Analysis |
| LCPD generation closures | | | |
| 1800MW largest loss | Higher and More Volatile Network Flows | Operational Short Term Strategy | Energy Balancing System |
| New intra-network HVDC | | | |
| New series compensation | | | IEMS |
| New QBs | More Controllable Network | Operational Control | |
| New substations & circuits | | | System Stability Control |
| New interconnectors | Increasing EU Interaction | Operational Situational Awareness | |
| Radial to active DNO networks | | | EMS Data Historian |
| SMART demand | | | |
| New electric vehicles | More Demand Volatility | Operational Review | |
| New embedded generation | | | |

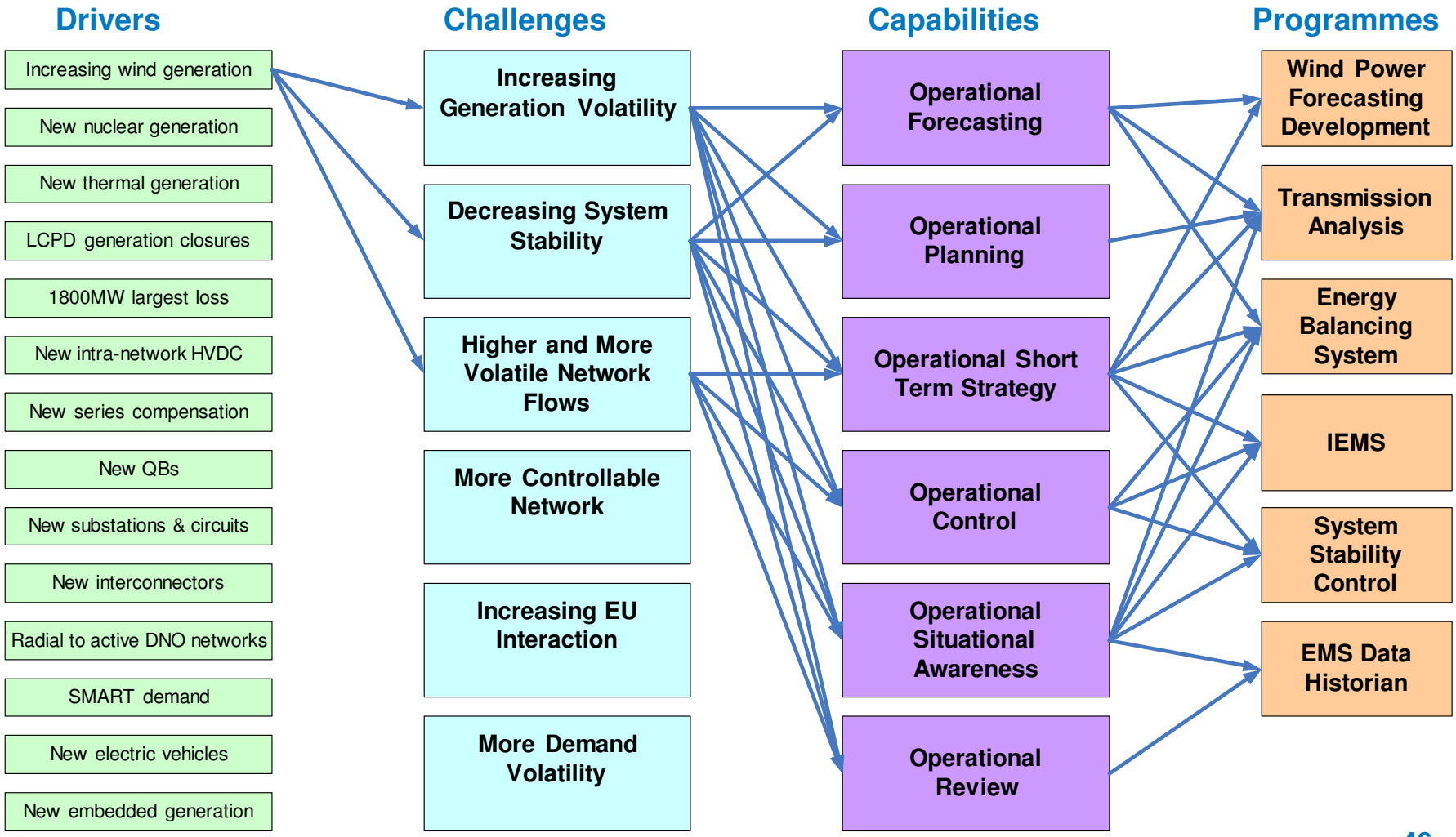
# Linking drivers to programmes



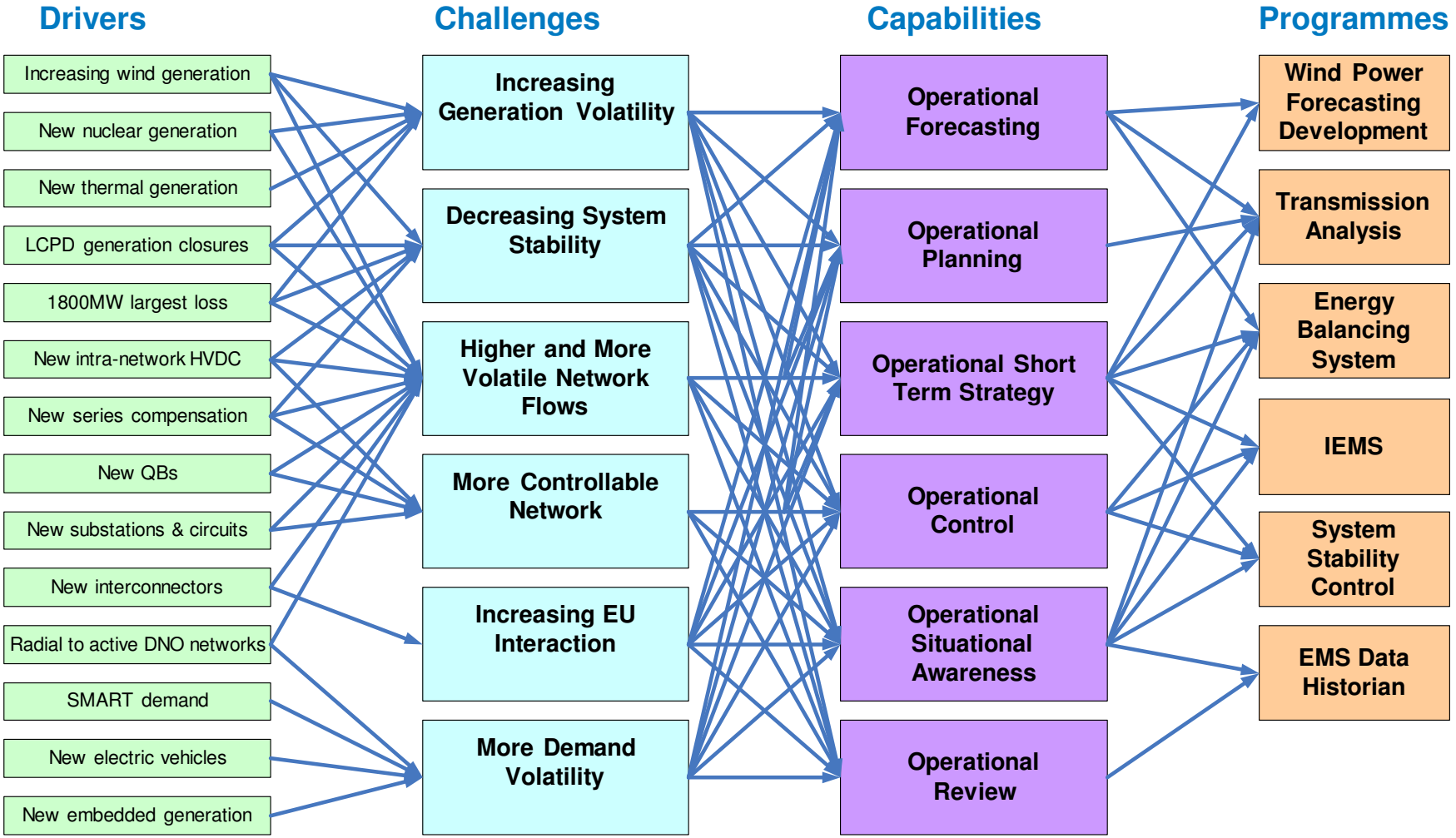
# Linking drivers to programmes



# Linking drivers to programmes



# Linking drivers to programmes



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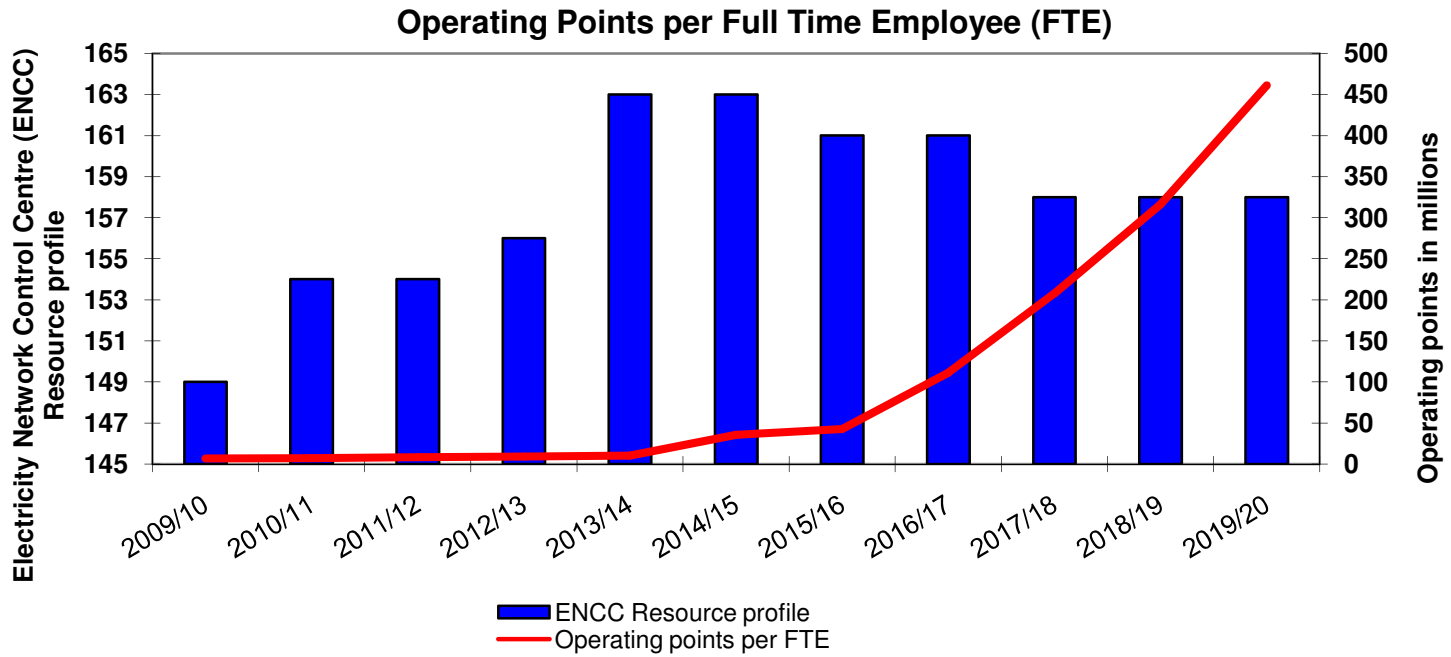
# Influencing our System Operator approach

# Volume of activity – Balance of tasks




- Volume of possible system configurations increases rapidly
- Resource growth minimised by increased IT investments
- Resource growth alone would not be enough to efficiently manage the number of operating points

# System Operator control options

**Increase Staff**

- Would allow a higher volume of activities to manage increasing levels of uncertainty
- Approach does not however enable a significant change in process, does not increase depth of capability

**Improve the existing IT systems**

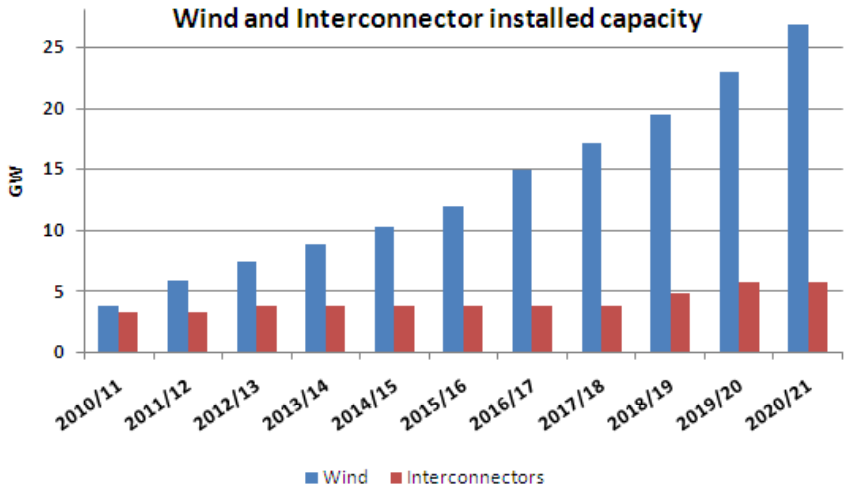
- Would allow increased volume of activities to manage the increasing levels of uncertainty
- Alignment with asset health replacement cycles and expected operating environment changes would allow minimum requirements for lowest cost of capital

**Hybrid Approach**

- Need to enhance our overall capability and make sure that our processes are suitable for the future challenges
- Volumes of work will need greater automation but will still require experienced control room staff to validate and optimise

**Balances existing and future needs whilst minimising system risks**

# Learning from others




- Member of benchmarking and industry organisations such as
  - The International Comparison of Transmission System Operations (ICTSO)
  - The Very Large Power Grid Operators Association (VLPGO)
- Innovative solutions required to manage the changing SO environment
- Investing time and effort in comparing and contrasting ourselves to other TSO's to optimise the solutions we invest in

**Irish Systems**

- 18% of Irish installed generation capacity is wind
- SO has already had to manage meeting 50% of demand through wind

**Iberian Systems**

- Greater amounts of hydro power
- Wind patterns more predictable

**Nordic Systems**

**Chinese Systems**

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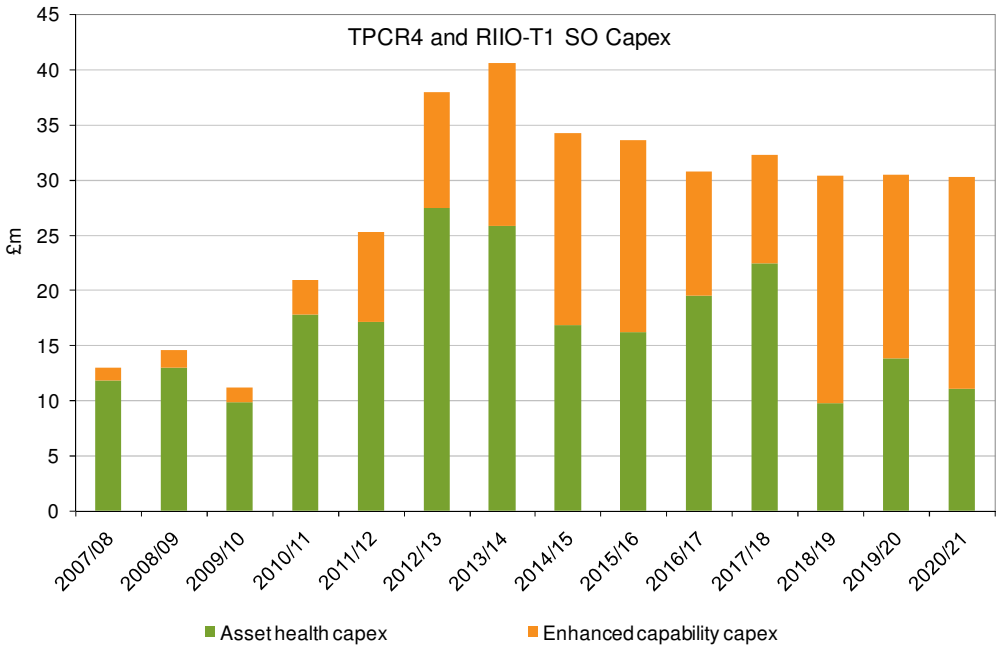
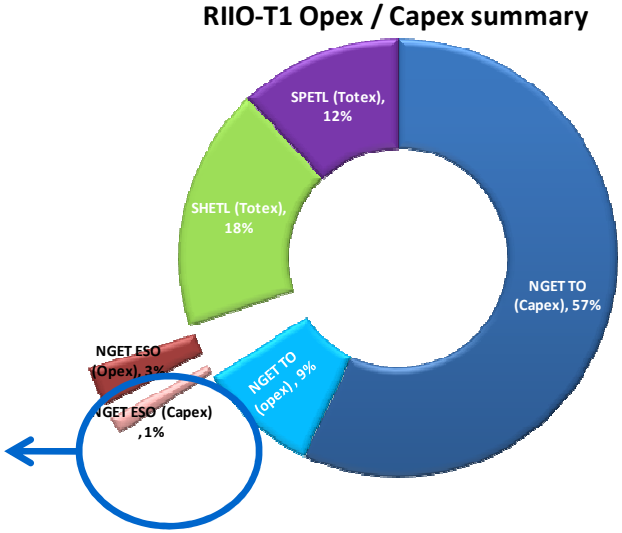
# Benefits from our SO investments


David Wildash

*RIIO-T1 Price Review*

# NGET SO Capex RIIO-T1 forecast




- Asset Health Capex during RIIO period = £135m
- Enhanced Capability Capex during RIIO period = £127m

# Benefits of our SO investments

- By Investing in the enhancement of our future system operator capabilities we can achieve the following benefits:

Reducing future BSUoS / End consumer costs

Maintain Reliability

Avoid System Operator opex costs

Improve Market efficiency

Protect safety of staff, contractors and public

Facilitate Meeting Renewable Targets

# Measuring BSUoS benefits

- Enhancement of our SO IT capabilities has a net positive financial effect
- Benefits are calculated against Balancing Services Incentive Scheme reductions
- Based on current BSIS spending, Reserve and Constraint costs will increase by ~£1.8bn for the RIIO period

| NGET Invests | Balancing Cost Increase |
|---|---|
| £0bn | £1.8bn |
| £0.13bn | £1.1bn - £1.2bn |

**BSIS savings are forecast to be in excess of £0.6bn**

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# In Summary

- The future System Operation Environment will become more complex, shaped by multiple drivers
- Greater uncertainty from generation variability and European interactions
- Requirement to maintain existing systems whilst enhancing our SO capabilities through investing in new and innovative control systems
- Will allow the measurement and maximisation of installed transmission system assets
- Investments will allow us to continue to facilitate meeting renewable targets and improve market information and efficiency
- Investments are forecast to deliver BSUoS / Consumer savings of £0.6bn

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# Questions

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# QUESTIONS

- Do the benefits identified from our investments justify enhancing our control room capabilities?
- Do you think that the timing of our SO investment plan is appropriate?
- Do you agree with our approach in balancing the mix of resources and IT systems in undertaking the SO role?
- How does planned / unplanned outages of our control room systems affect you?

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# Electricity Networks and the Renewables / Decarbonisation Agenda

**Zoltan Zavody**
**Grid Policy Team**

# 1. CONTEXT

# Government Low Carbon Milestones


**Source: The Committee on Climate Change www.the-ccc.org.uk**

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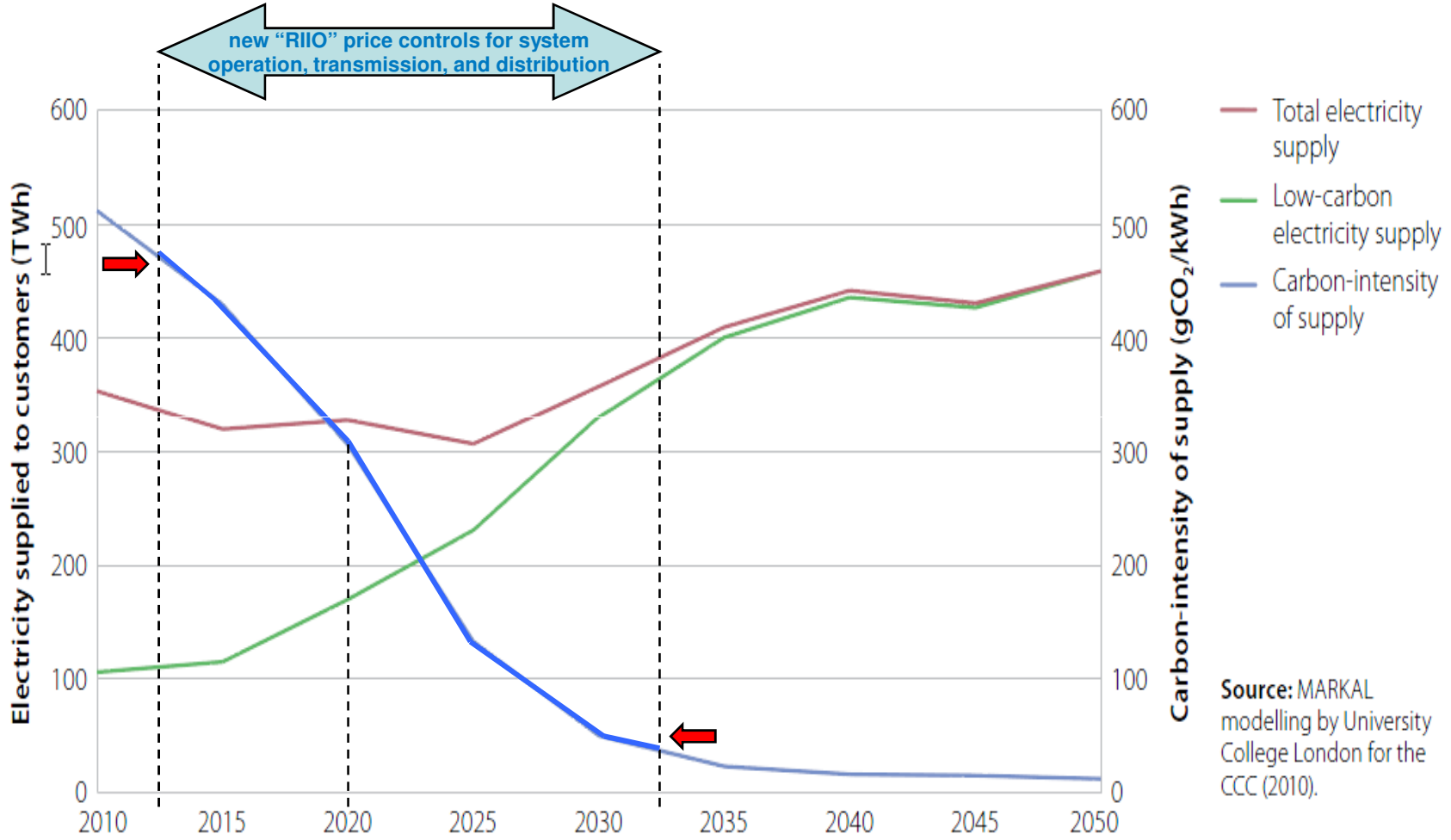
# Government Low Carbon Milestones & RIIO Price Control Review Periods

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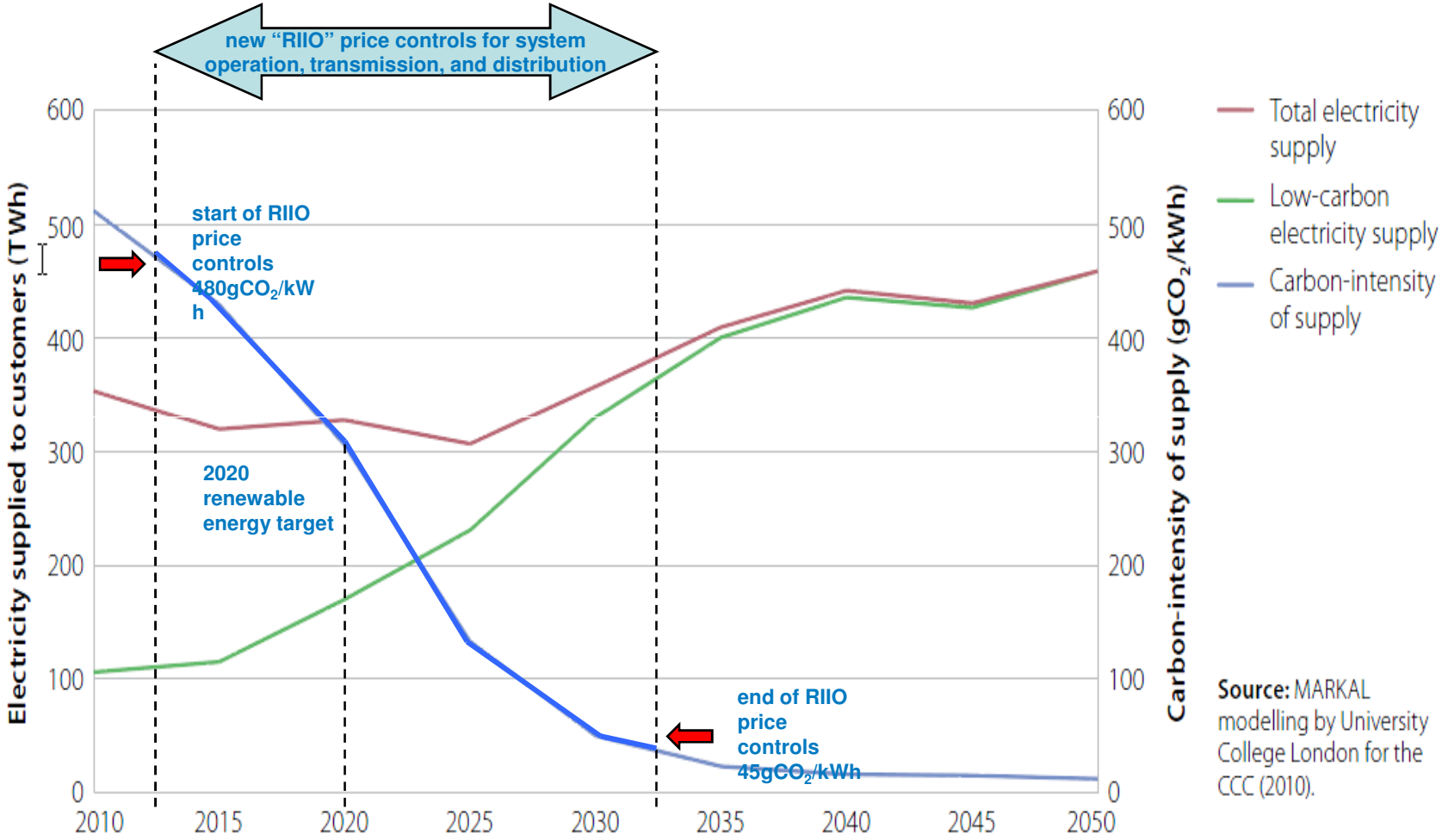
# Government low carbon milestones & RIIO price control review periods

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# Practical Context for Low-Carbon Generation

- “Connect & Manage”
- grid connection requirements
- grid operational development
- cost reduction
- public opinion
- localism

# Role of Network Companies (1)

Network companies do not own or fund generation …

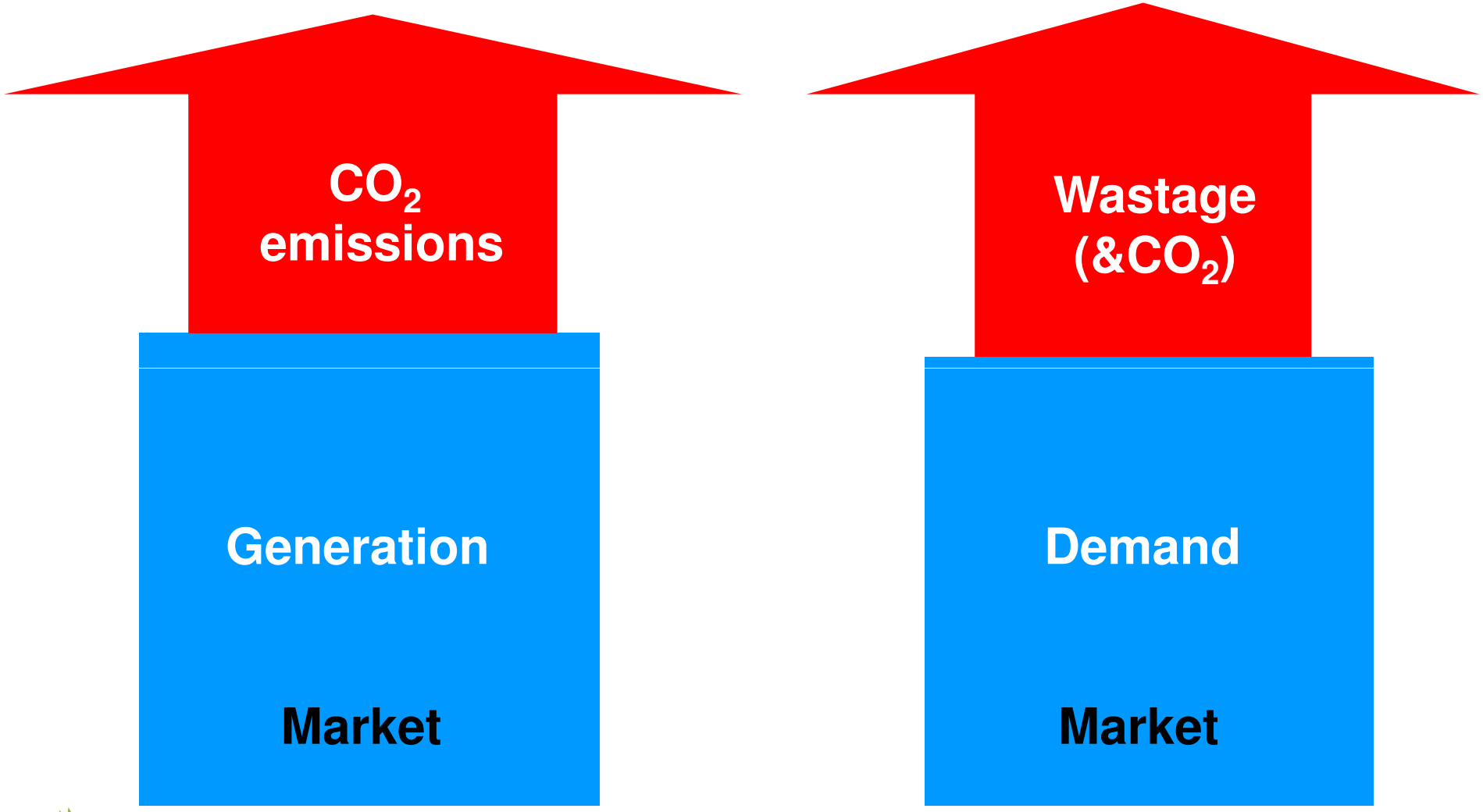
# NGET Business Plan: Areas of Comment

- customer engagement & support
- efficient & timely delivery
- infrastructure solutions
- co-ordination of works & outages
- accommodation of renewable technologies
- pro-active innovation

# Role of Network Companies (2)

… but they can facilitate its deployment and use.

# How can we Encourage the Networks to Play a Full Role in the Sustainable Energy Sector?

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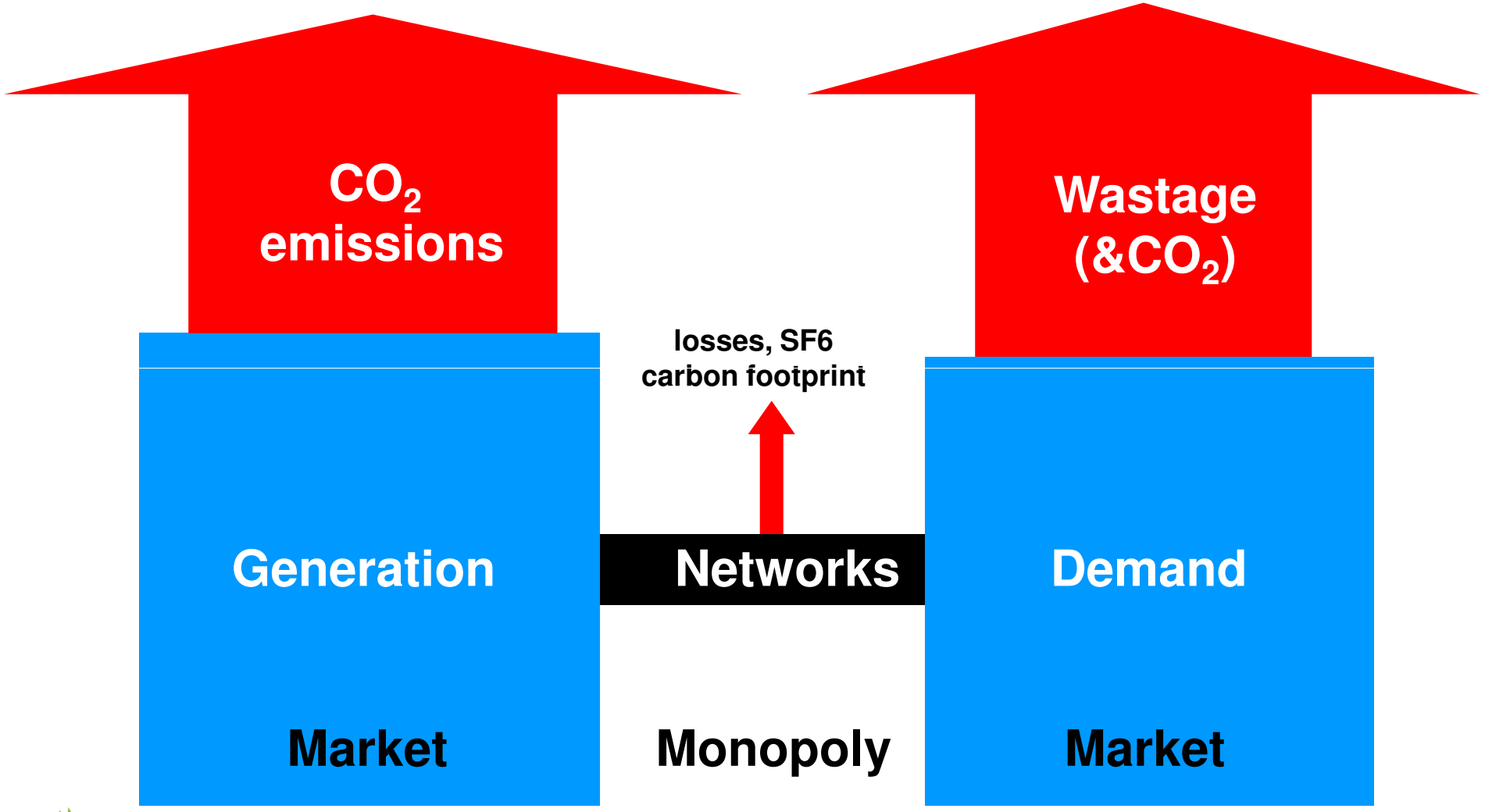


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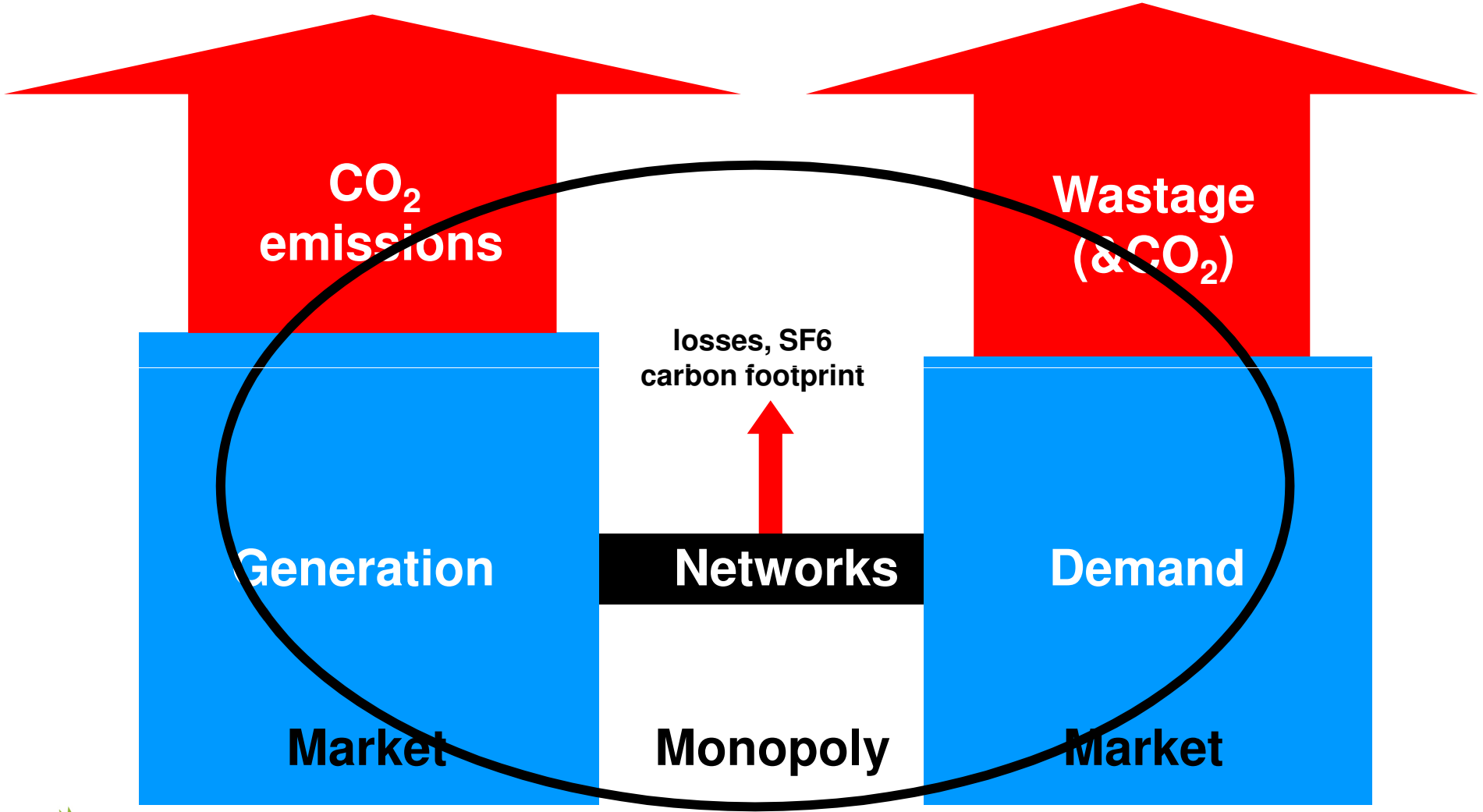


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# 2. WHAT NEEDS TO HAPPEN

# "RIIO" Objectives set by Ofgem

- "to encourage energy network companies to play a full role in the delivery of the sustainable energy sector"
- "to deliver value for money network services for existing and future customers"

# RIIO-T1 Incentives Proposed by Ofgem

1. Customer Satisfaction
2. Safety
3. Reliability and availability
4. Conditions for connection
5. Social obligations
6. Environmental Impact

# RIIO-T1 Incentives Proposed by Ofgem

| | | |
|---|---|---|
| 1. Customer Satisfaction | - | **unspecific/subjective** |
| 2. Safety | - | **N/A** |
| 3. Reliability and availability | - | **working against each other?** |
| 4. Conditions for connection | - | **unambitious?** |
| 5. Social obligations | - | **N/A** |
| 6. Environmental Impact | - | **low materiality** |

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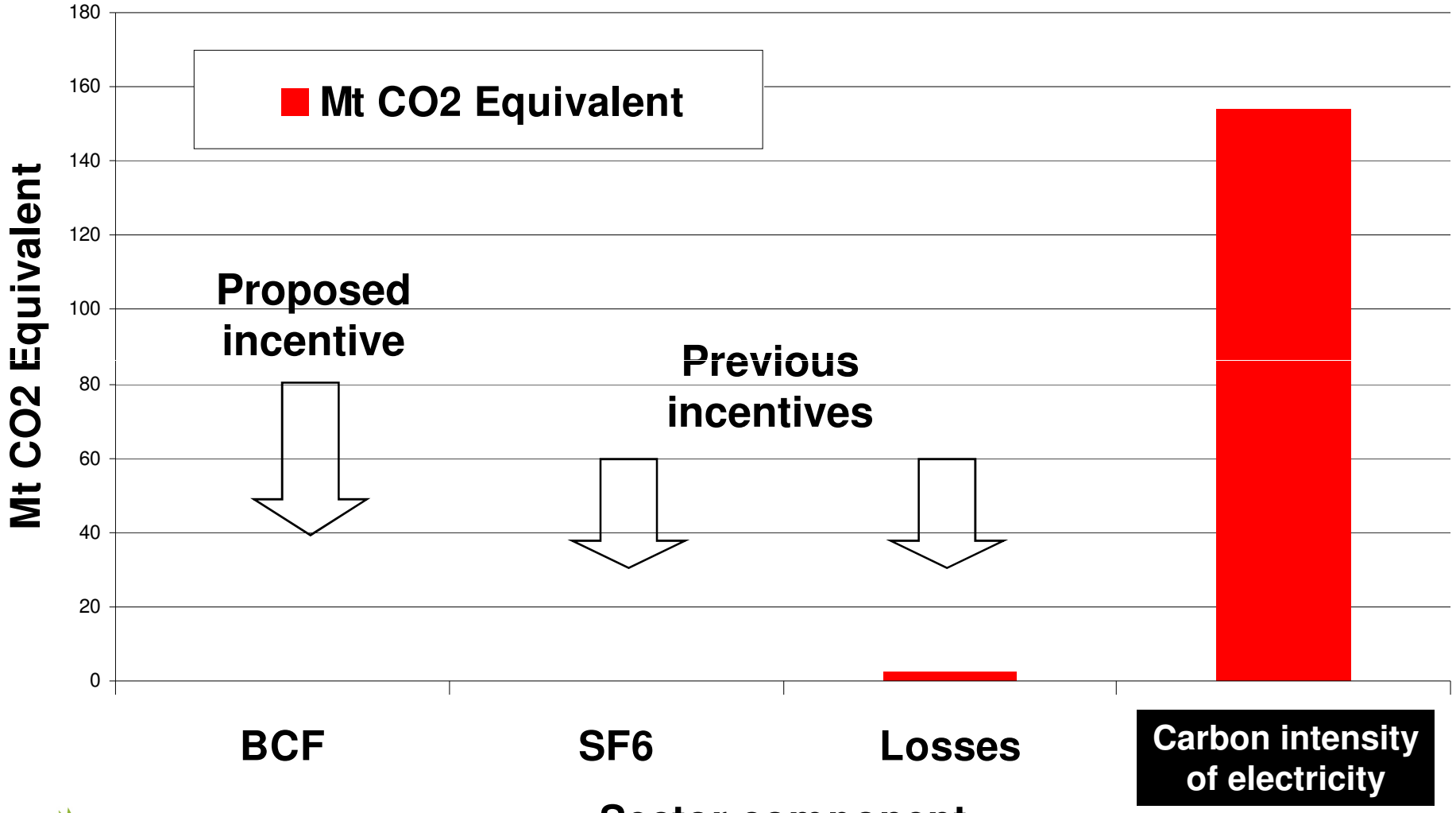
**➡►Will the above ensure that network companies "play a full role in the delivery of the sustainable energy sector" …?**

# Some Other Ideas for Incentives

- specific but not directly related incentives
- specific low-carbon activity incentives
- case by case project re-openers
- damages for specific non-compliance
- cash reward for each low-carbon connection
- risk-based increased rate of return for anticipatory investments
- broad environmental incentive based on national targets

# Shifting Incentives from "Fully Controllable" …

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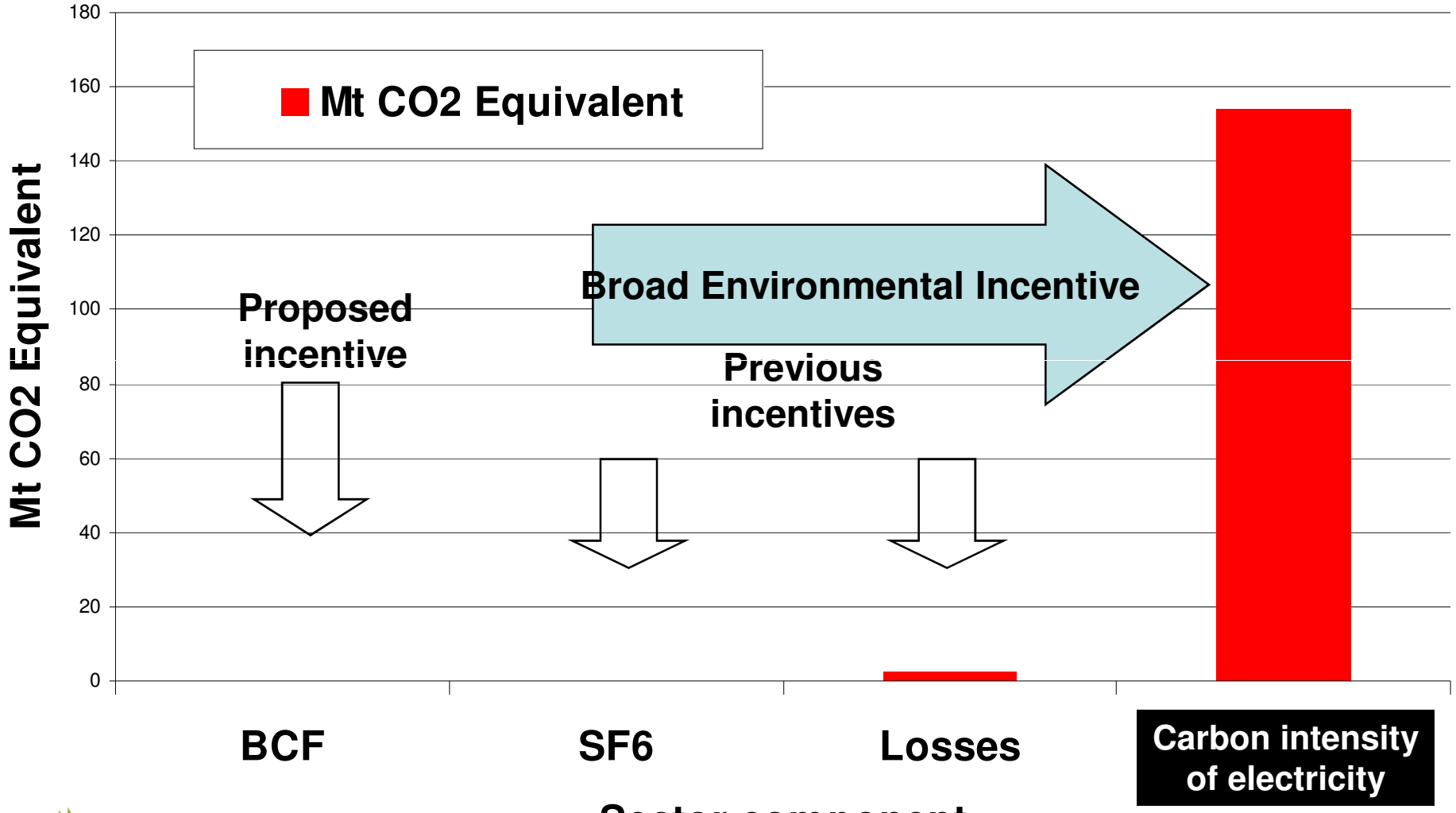
# … to Incentives that are Highly Material

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# What Kind of Broad Environmental Incentive?

- Focused on long-term policy goals
- Linked to electricity decarbonisation trajectory
- Actual energy flow ($gCO_2/kWh$)
- Financial incentive
- Individual and “team” bonus
- Relevant
- Cost-effective

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- Relevant
- Cost-effective
- … a "Low-Carbon Economy Incentive"

See: "The Case for a Low-Carbon Economy Incentive"
Poyry for RenewableUK, October 2011

# Is an Incentive to Work Towards Government Policy Goals Discriminatory?

- No – a low-carbon economy requires a mix of generation.
- No – must still work within licence conditions.
- No – different technologies simply have different needs; the system traditionally favours conventional technologies.

# The Immediate Benefits of a Low-Carbon Economy Incentive

## Project Benefits

| | |
|---|---|
| Reduced timescales | £2.6 - £4.6M |
| Reduced risk | £4.2 - £8.5M |
| Reduced connection costs | £1.5 - £3.1M |
| **TOTAL** | **£7.7M - £15.4M** |

**example for on-shore wind only, 1GW brought forward by 1 year**

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# The Wider Benefits of a Low-Carbon Economy Incentive

| | |
|---|---|
| Project costs saved | £7.7M = £15.4M |
| Carbon saving value | £49M |
| **and** wholesale electricity price saving | ??? |
| **and** saving from innovation in networks | ??? |
| **and** savings in support mechanism | ??? |

**example for on-shore wind only, 1GW brought forward by 1 year**

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# Why a Broad Environmental Incentive?

- Material revenue driver
- Action incentivised
- Encourages innovation
- Focuses on outcome consistent with Government goals

# Why a Broad Environmental Incentive?

- Material **R**evenue driver
- Action **I**ncentivised
- Encourages **I**nnovation
- Focuses on **O**utcome consistent with Government goals

# Facilitated Questions

**In an ideal world, what should a renewables developer experience in terms of connecting to and using the transmission network?**

**How would this be different for other generators?**

# Facilitated Questions

**What, if any, difficulties do you experience as a renewables developer in connecting to and using the transmission network?**

**How is this different to other generators?**

# Facilitated Questions

**How have any of the above difficulties affected your projects?**

**How have these difficulties affected other generators?**

# Facilitated Questions

**What specifically would you like the network to do, or how would you like it to change, to make life easier?**

**How is this different to other generators?**

# Facilitated Questions

**For what reason would the network company change in the way you would like it to?**

# Facilitated Questions

**What can you as an industry player do to make it easier for the network to engage with renewable energy?**

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# Concluding Remarks

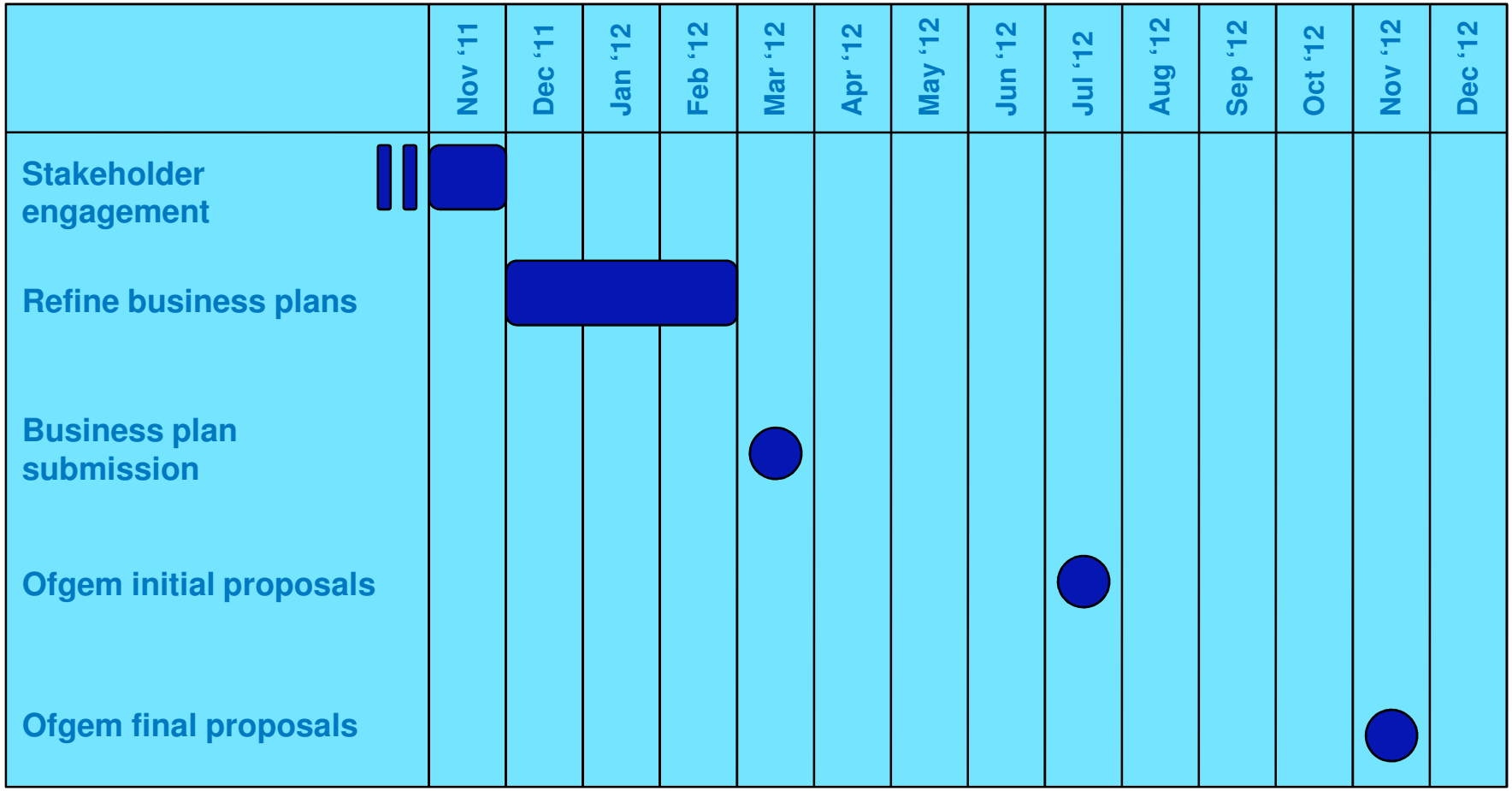
Talking Networks

# Next steps

- We will collate the feedback from today and publish a summary
- We would like your written responses to the questions we have discussed today, to check we have understood what you are saying correctly by 18 November, 2011
- RIIO-T1-2-1
  - If you would be interested in a 1-2-1 to run through your feedback on our business plan, please contact:

    talkingnetworkstransmission@uk.ngrid.com
- We will also ensure that all feedback received by 18 November 2011 is reflected in the development of our business plan

# Timetable


Nov '11
Dec '11
Jan '12
Feb '12
Mar '12
Apr '12
May '12
Jun '12
Jul '12
Aug '12
Sep '12
Oct '12
Nov '12
Dec '12
Stakeholder engagement
Refine business plans
Business plan submission
Ofgem initial proposals
Ofgem final proposals