



Shaping our electricity future

**Preparing for at least
70% clean electricity by 2030**
Industry Forum 22 April 2021

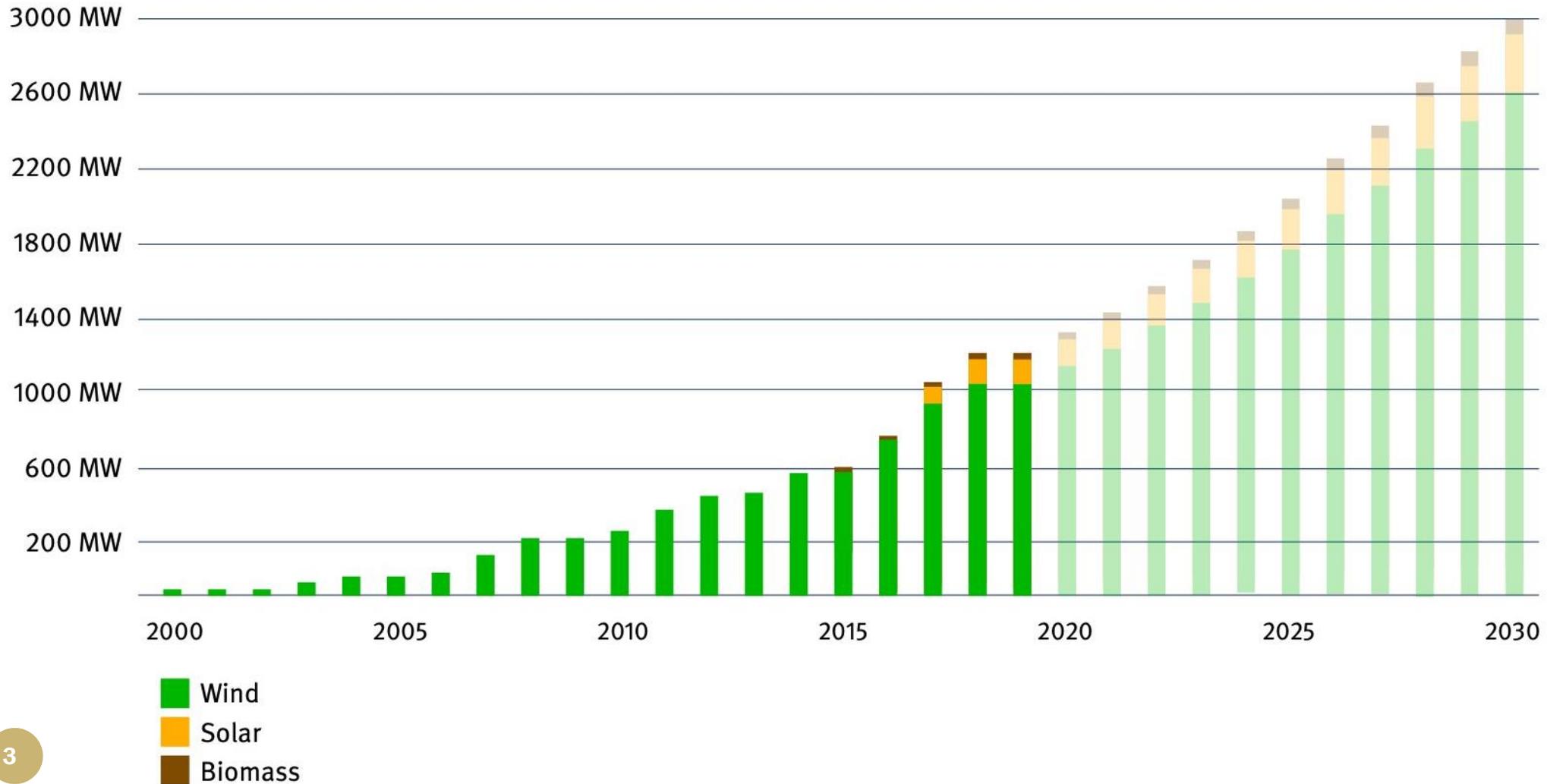




The UK government is aiming for Net Zero carbon emissions by 2050 – and Northern Ireland is now developing an interim target.

The Economy Minister, Diane Dodds MLA, has stated her ambition of reaching at least 70% clean electricity by 2030.

Much progress achieved, but still more to do...





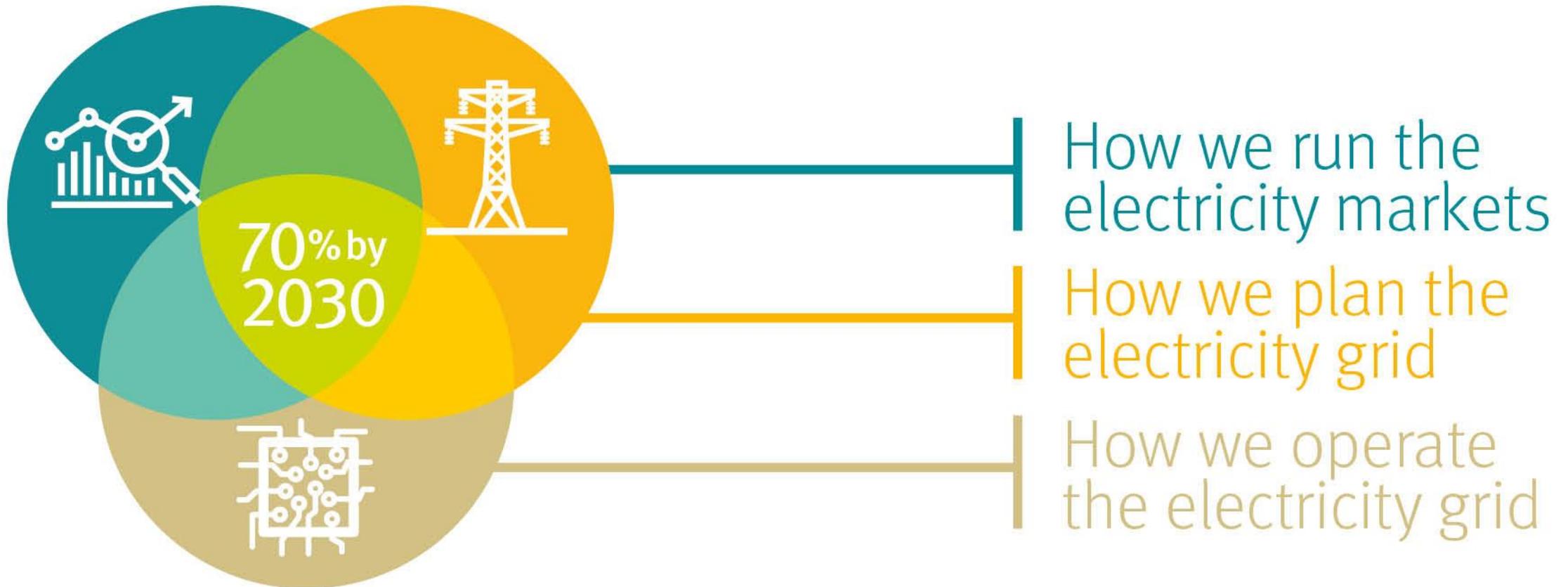
Finding a balanced solution

SONI will seek to deliver the optimal solution to achieve 70% by 2030 while **maintaining a secure supply of electricity** and **minimising the cost** to the electricity consumer.

- Natural gas will be an important transition fuel
- Where possible, we aim to propose final solutions that reflect the public's views – and so are more likely to be accepted.
- Co-operation, collaboration and innovation will be the foundation of our approach.



What must change to reach at least 70% by 2030?





Partners for progress

- The goal of at least 70% by 2030 is driven by UK government policy and anticipated interim goals for Northern Ireland.
- Achieving this ambition will need flexibility and innovation right across the electricity sector.
- Some of the approaches depend on the actions of stakeholders to succeed.
- All approaches need timely public consent – which is why we’re consulting so extensively.





Our plans to hear the views of stakeholders

- **Agricultural community:** Working with Ulster Farmers' Union to host a workshop with farmers and landowners.
- **Businesses:** Partnering with representative organisations on workshops and member engagement – including NI Chamber of Commerce, CBI NI and Londonderry Chamber.
- **Young people:** Bespoke TEDx event for 16 to 25-year-olds.
- **Industry Forum:** Dedicated event to inform and engage with generators, developers, large energy users and suppliers.
- **Civil Society Forum:** Stakeholders from academia, community, environment, sustainable development, consumer and social justice organisations participating in a Civil Society Forum.



How to submit your views

- Complete the survey or make a submission to the **Public Consultation** at: <https://consult.soni.ltd.uk/>
- Send an email to info@soni.ltd.uk
- Send your submission by post:
Shaping Our Electricity Future
SONI, Castlereagh House
12 Manse Road, Belfast BT6 9RT
- Deadline is 12 noon on 14 June 2021



Agenda

14:00 Welcome and Introduction

14:15 Electricity Markets / Q&A

15:00 System Operations / Q&A

15:45 Break

16:00 Transmission Network / Q&A

16:45 Concluding Comments

17:00 Close



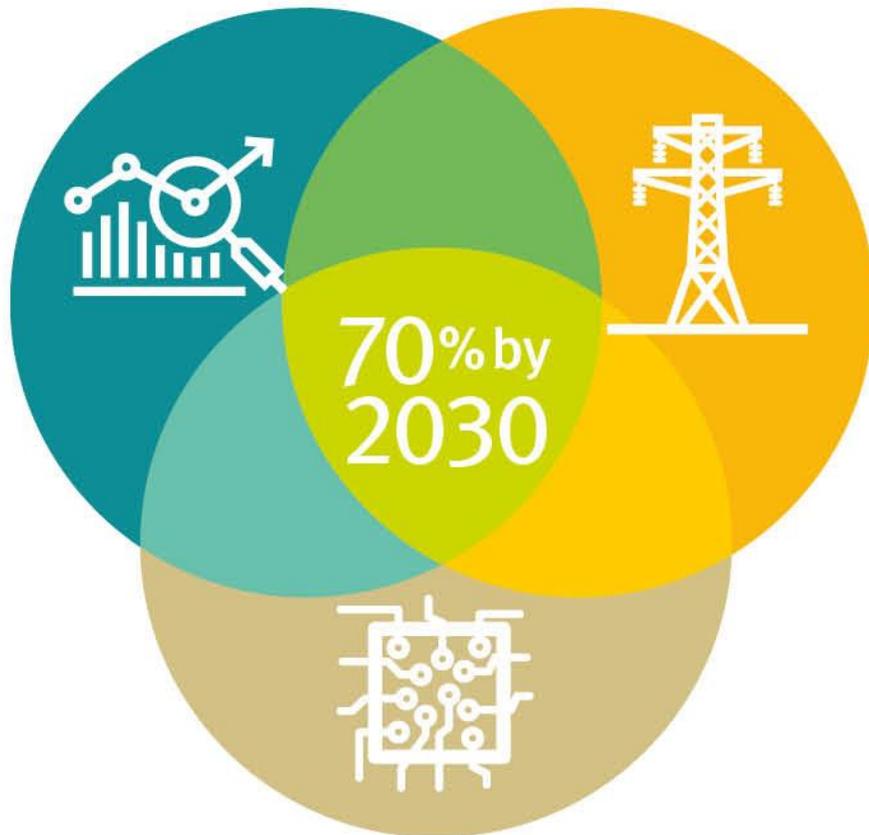
How this seminar works

- Each section will be followed by a Q&A session
- You can submit questions at any stage using the Q&A tool
- All participants can see all submitted questions
- You can upvote or add a comment to submitted questions
- Please note - this seminar is being recorded



Markets

What must change to reach at least 70% by 2030?



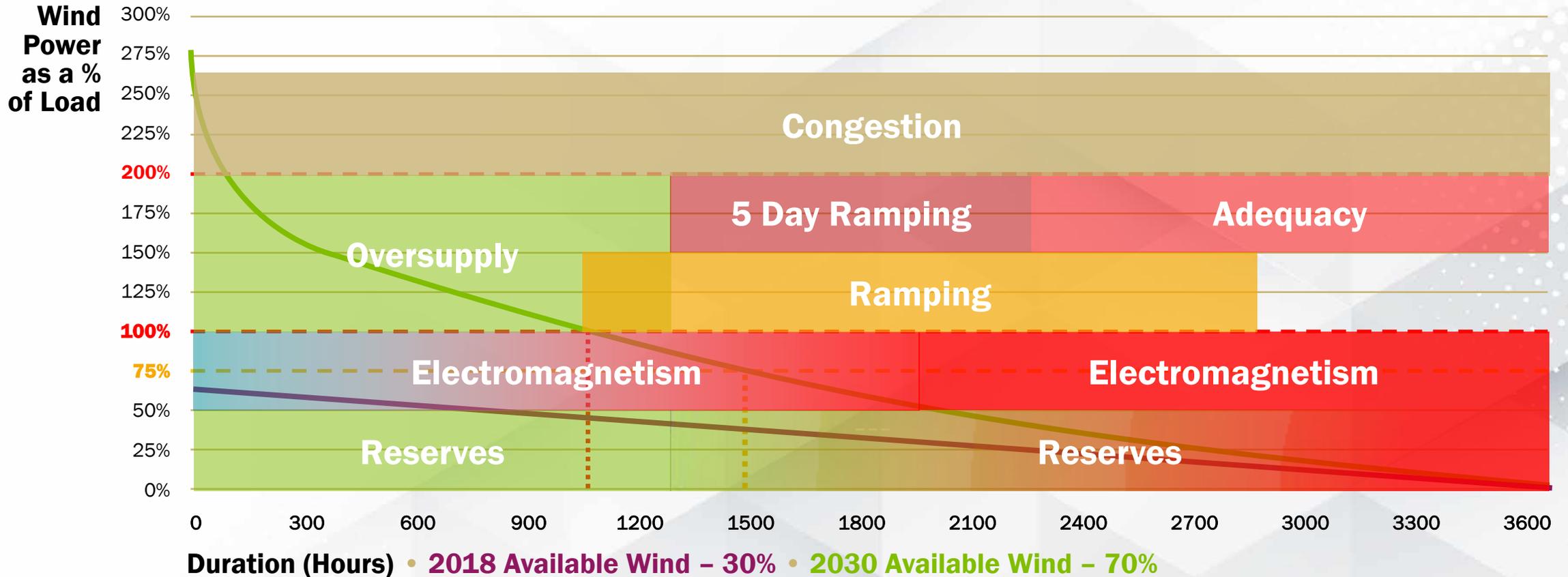
How we run the electricity markets

- We don't generate electricity – we partner in the operation of all-island markets that let generators compete to supply power.
- These markets are subject to regulatory rules, largely driven to the goal of achieving the lowest possible price.
- Lowest possible price for renewable electricity is much lower than fossil-fuel generation: This model will not sustain the cost of developing new sources of clean electricity.
- The markets also need to fund investment in technical solutions to maintain the resilience of the electricity system when there is less wind or sun.
- Consulting with electricity sector to find the best response.

Transforming the System for the Future

	2020	2030	2040
Installed Wind	5,000 MW	15,000 MW	> 20,000 MW
Annual RES-E	~40%	70%	>90%
Real Time Limits / SNSP	70%	>95%	>95%
Curtailement	5-7%	~0%	~0%
Exports / Sector Coupling	50:50	70:30	90:10

Duration of all-island wind penetration





Markets drive 3rd party investment

Investment

- Clarity on risk
- Appropriate reward
- Credible threat of enforcement

Timeliness

- Markets maturity
- Need increases in line with connecting renewables

Affordability

- Transition cost to be able to manage 100% SNSP
- Active participation demand side in all markets improves affordability

Markets Evolution to 2030





Markets Issues

EU and UK Model

Energy only with CB trade and RES supports will deliver high RES....

Our analysis for our situation does not concur.

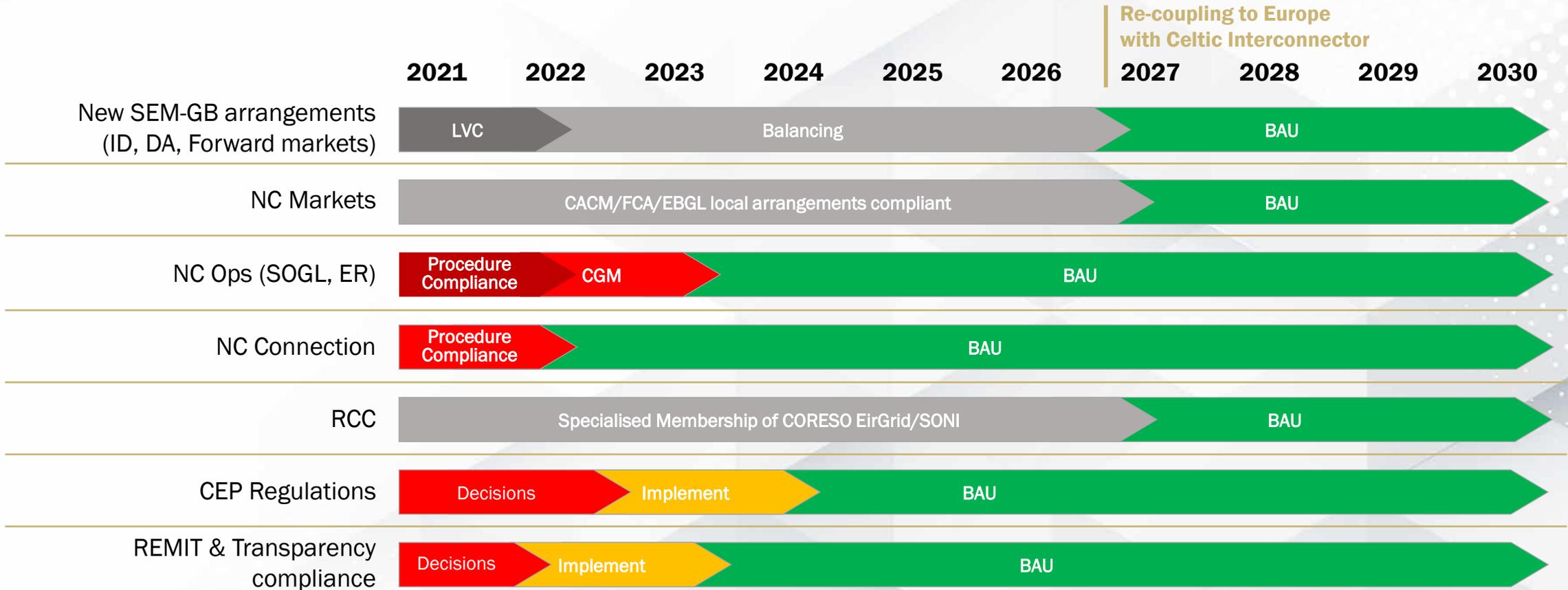
- Pioneering operations with RES
- Increasing constraints
- Oversupply of RES at times – who pays...?

When we get to operate at 100% SNSP then EU/UK theory aligns with our challenges but only then

In the meantime our transition needs to progress successfully while maintaining proactive and positive relationships between SEM/GB/EU

So we need to leverage BREXIT and SEM isolation and aim for longer term reintegration with EU/GB

Agree a plan to deliver for our partners





Markets Issues Usability

Should pay value of service same to all providers if you can use it

- Break down barriers for new tech
- Challenge implicit bias to conventional technology

But Increasing operational challenges

- Constraints
- Curtailment

Balancing the Risk between Investor and Consumer is key

- Where and when investor connects their choice
- Managing constraints and curtailment (redispatch) long term is the TSO responsibility



Markets Principles

Alignment

Markets informed by operational issues at high RES-E

Commitment

Move the risks that are outside of investors control in a balanced fashion to consumers in a predetermined manner over the decade

Clarity

Develop a deep understanding of the service need and break down barriers for all technologies to reasonable deliver

But are our markets delivering 70/30?

Type	Investment	Timeliness	Affordability	70/30
Energy	More volatility and lower prices reduce investment for energy. Conventional use Energy outcomes with carbon as exit signal	Energy not driving complementary investment in a timely manner	Energy markets drives value only for 30% of the volume in 2030.	Need effective energy markets aligned to other markets, supports and operational practice
Capacity	Has had some success in attracting new conventional capacity. But not good for new tech. Not clear investment is the right investment?	Markets discipline is poor in that money given out and capacity not being made available. Periods of scarcity estimated in 2023/24 will need careful management	Reasonably efficient if it delivered	Need to review modelling forward, new tech and markets discipline if it is to get complementary investment
Supports/ Corporates	Rollout of support programmes to make RES projects investible.	RESS designed to deliver new RES in line with objectives. Need NI version soon	Approved scheme require competition. Need to look at oversupply and redispatch down costs	Use of supports needs to be monitored to ensure transition cost affordable. Alignment with markets and ops critical to avoid double payment
System Services	Rollout of new service arrangements apt for 70%	New Future arrangements needed to be effective by 2023	Need to move to volume regulation with appropriate CBA	Critical 3 rd party investment in solving technical scarcities with high RES

A hand holding a pen pointing at a digital financial chart on a screen. The chart displays various data points and lines in blue and green, with a grid background. The lighting is dim, focusing on the screen and the hand.

What are we recommending?

Wholesale Energy Market

- Where possible align the ex-ante market with operational requirements
- Post Brexit - Multi Region Loose Volume coupling (MRLVC) arrangements - need to ensure these do not hinder future pan-EU trading once reconnected to EU
- Significant review of the existing Market Roadmap to enable delivery of required changes to enable 2030 targets
- Enhanced market systems and data management systems will be required to facilitate the above changes and the transition to a 100% SNSP system
- Longer term we will fully engage with regulators and industry to review the future design of the energy market, consider “self” and “central” dispatch models, full EU compliance for when Celtic is operational



Markets: Policy Considerations

Capacity Market

- Align the Capacity Market to a high RES world by altering the modelling from the existing backward casting approach to a forward casting approach
- Integration of new technology and different behaviours of plant
- Clarify that the delivery of reliability needs to be related to both availability and the ability to meet dispatch instructions when issued
- Alignment of the CM with high RES will need to consider the appropriate treatment of the NET CONE calculation and in particular the concept of Best New Entrant plant or equivalent
- Capacity market is time limited to 2027- further consideration of future adequacy considerations will need to start in 2023



Markets: Policy Considerations

System Services Market

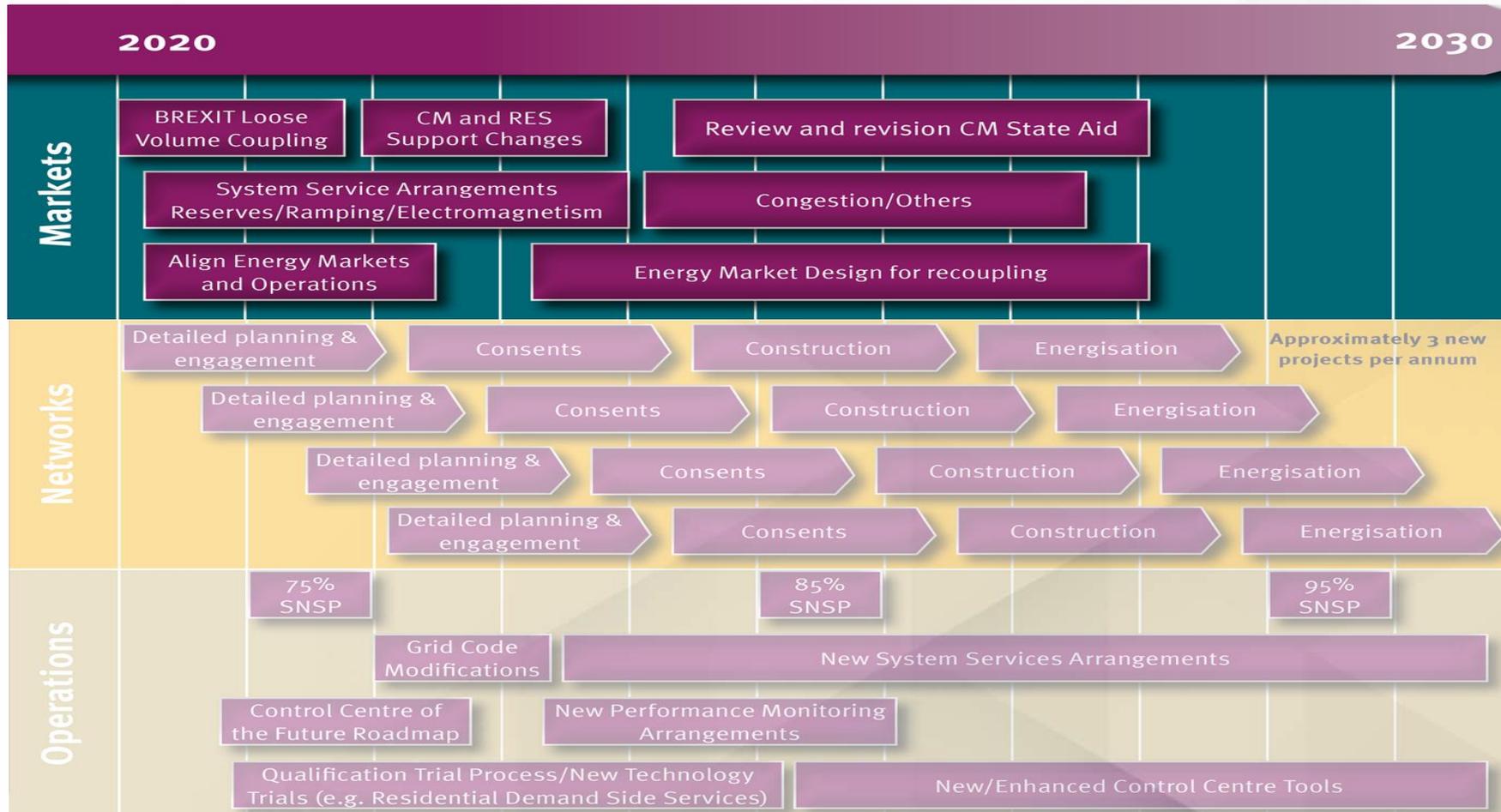
- Move the procurement process from price based to volume based
- Service range - existing services as well as congestion, frequency regulation products and other possible services that emerge as important during technical analysis
- System Services procurement will likely move to daily auctions for service provision where appropriate (will require EU legislation compliance)
- High-level (Regulatory) design work needs to be completed and approved by the end of 2021 – time critical
- New product or provider type testing will be important- we will explore with the regulators how innovation is best supported to ensure timely deployment of new solutions



Markets Issues System Build

- I-SEM built to Central Dispatch/ ex post pricing philosophy
- Operational Systems built with Conventional set the dominant unit – e.g. battery integration difficult
- Capacity and System Services with different vendors
- RES Support changes require Govt intervention (policy maker approval)
- Connection policy and tariff design require Regulatory intervention
- Pragmatically need to phase work across systems across the next 2-6 years

Draft Roadmap - Markets



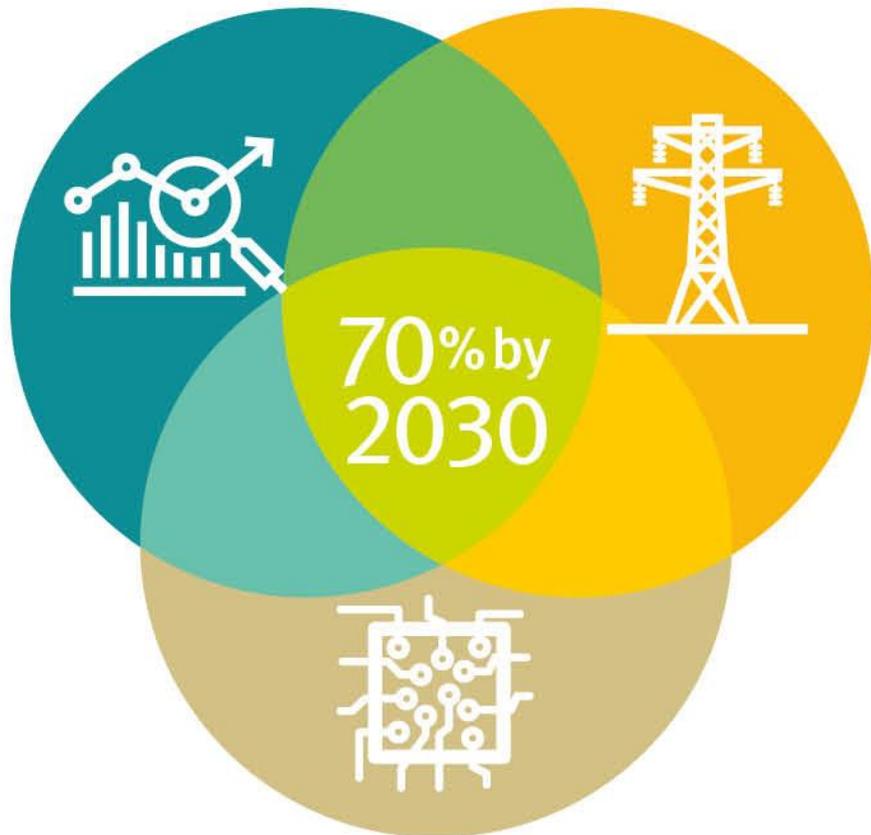


Thank You
Questions?



Operations

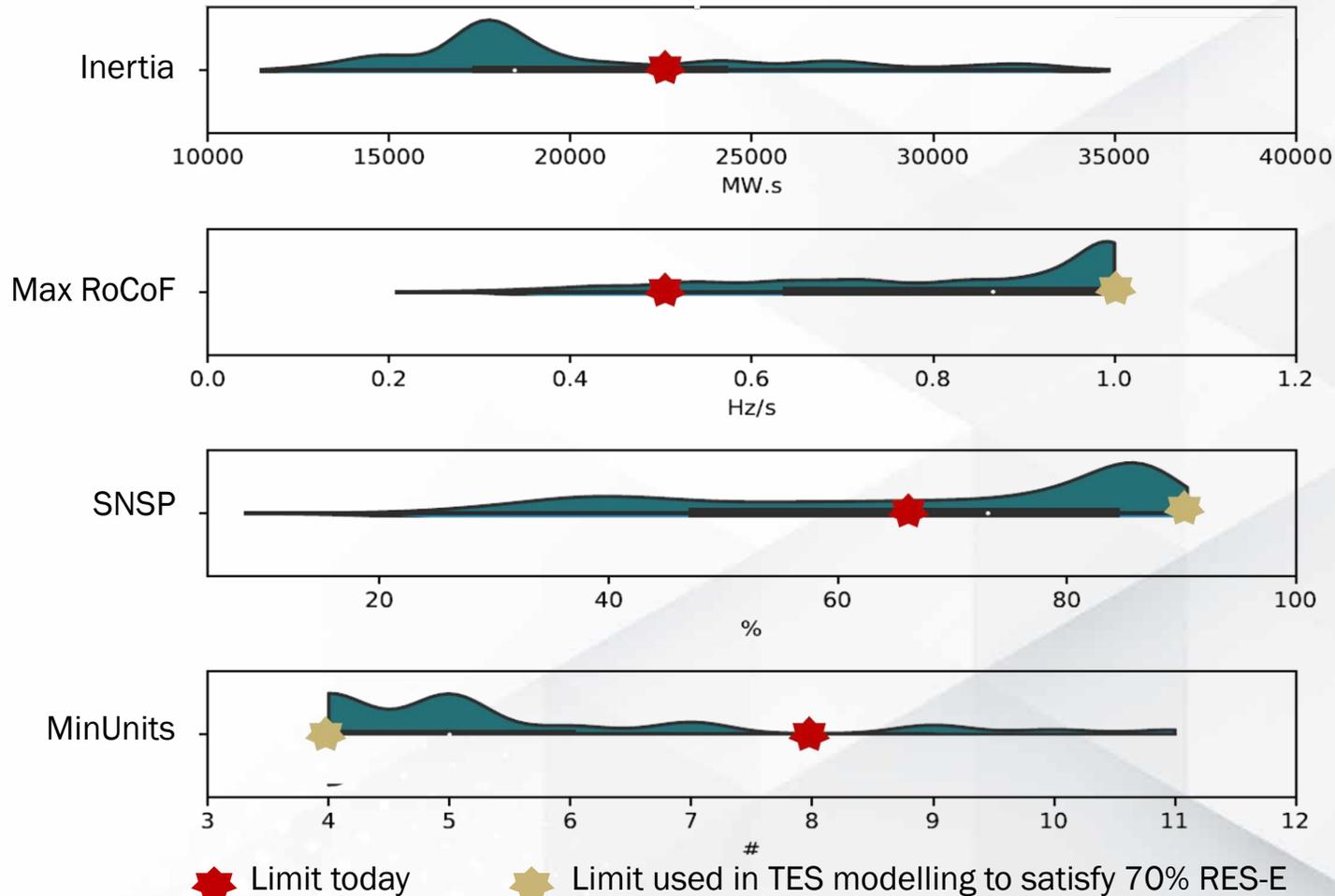
What must change to reach at least 70% by 2030?



How we operate the electricity system

- Many technical issues to run the grid when most power comes from variable non-synchronous renewable sources.
- Overriding goal is to ensure the supply of electricity remains secure and stable.
- New technical solutions, policies and tools needed.
- Consulting with electricity sector to find the best response.

70% RES-E implies unprecedented operation levels



- Inertia levels are below today's minimum allowed level of 23,000 MW.s for ~ 70% of time.
- RoCoF levels are above 0.5 Hz/s for ~ 85% of time.
- SNSP levels are above 65% for ~ 60% of time.
- Number of large units online is below today's minimum allowed level of 8 for ~80% of time

2030 Operational Challenges

Significant technical challenges will emerge if no action is taken



1. Frequency Stability & Control

- Inertia
- Reserve
- Ramping
- Very low Frequency Oscillations



4. Power Quality

- Harmonics



6. Voltage Stability

- Steady-State Voltage Control
- Dynamic Voltage Control
- Reduction in Available Fault Current



2. Congestion

- Lack of Transmission Capacity



5. Other

- Voltage Dip Induced Frequency Deviation
- Frequency Regulation
- Power System Protection
- Power System Modelling
- Forecasting



7. System Restoration

- Less Black-Start Capable Plant



3. Transient Stability

- Reduction in Synchronising Torque
- Reduction in Damping Torque



Curtailment

- Curtailment due to overall power system limitations

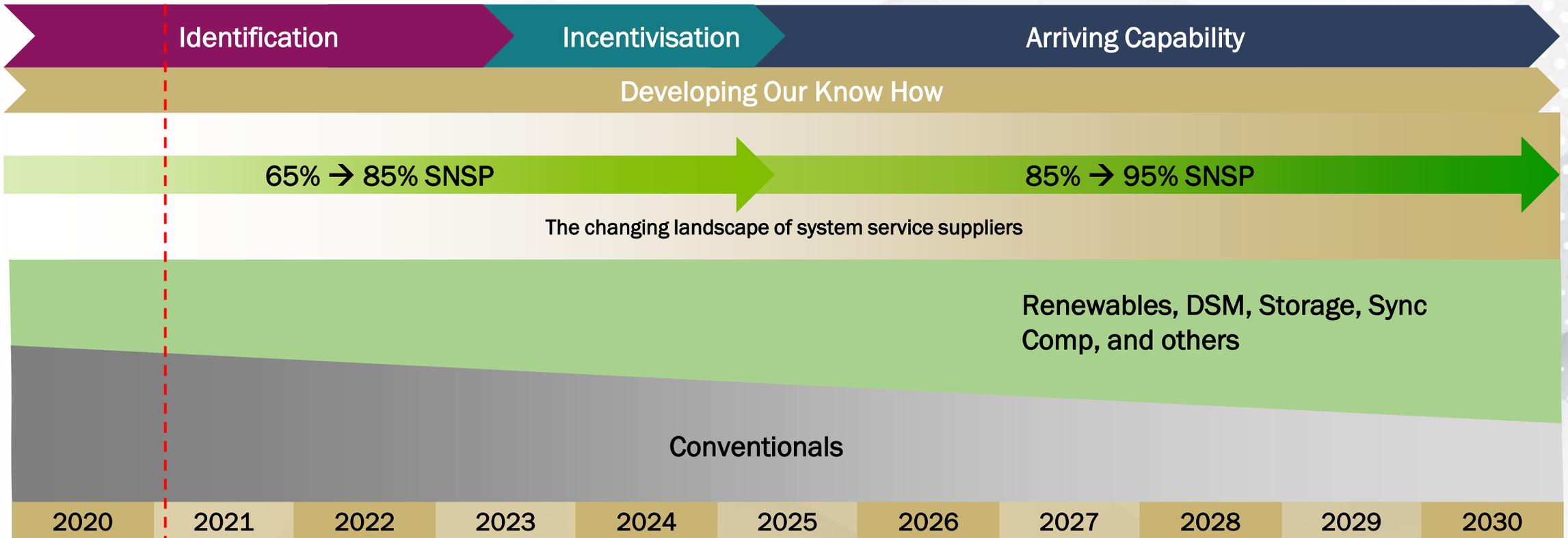


8. Generation Adequacy

- Capacity Margin
- Weather-Related Events

Operational Transition Journey

70% RES-E by 2030 will mean operating at unprecedented levels



Here



TSO-DSO Partnership

- Critical to success of transition
- Aligned approach to key items required e.g. system services



Operations Roadmap to 2030

Safely and securely increase the instantaneous amount of renewable generation that can be accommodated on the power system to 95% SNSP:

1. On-going studies and analysis on technical scarcities and potential solutions
2. Setting and clarifying operational standards, including grid codes and system services protocols, and subsequently monitoring performance against these standards
3. Enhancing the DS3 System Services arrangements to introduce new services and facilitate service provision by new and innovative technologies



Operations Roadmap to 2030

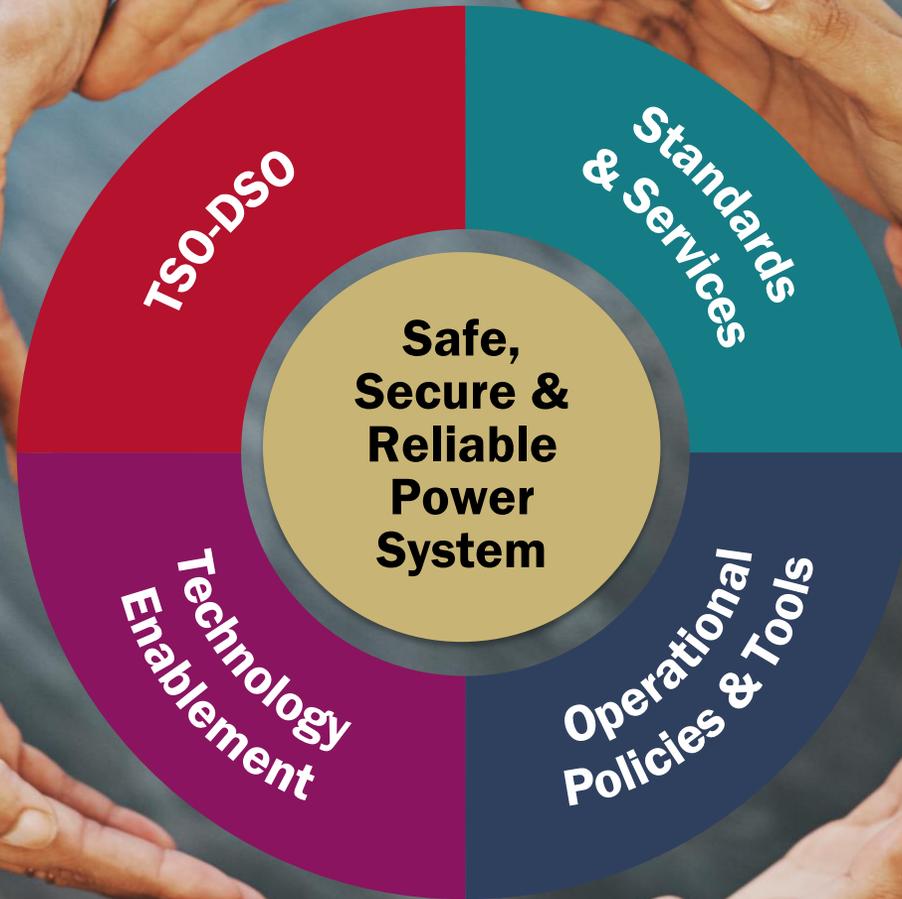
Safely and securely increase the instantaneous amount of renewable generation that can be accommodated on the power system to 95% SNSP:

4. Removing barriers to entry and enabling the integration of new technologies at scale
5. Continued evolution of operational policies e.g. minimum number of generation units
6. Developing new and enhanced control centre tools and systems

System Services – Future Arrangements



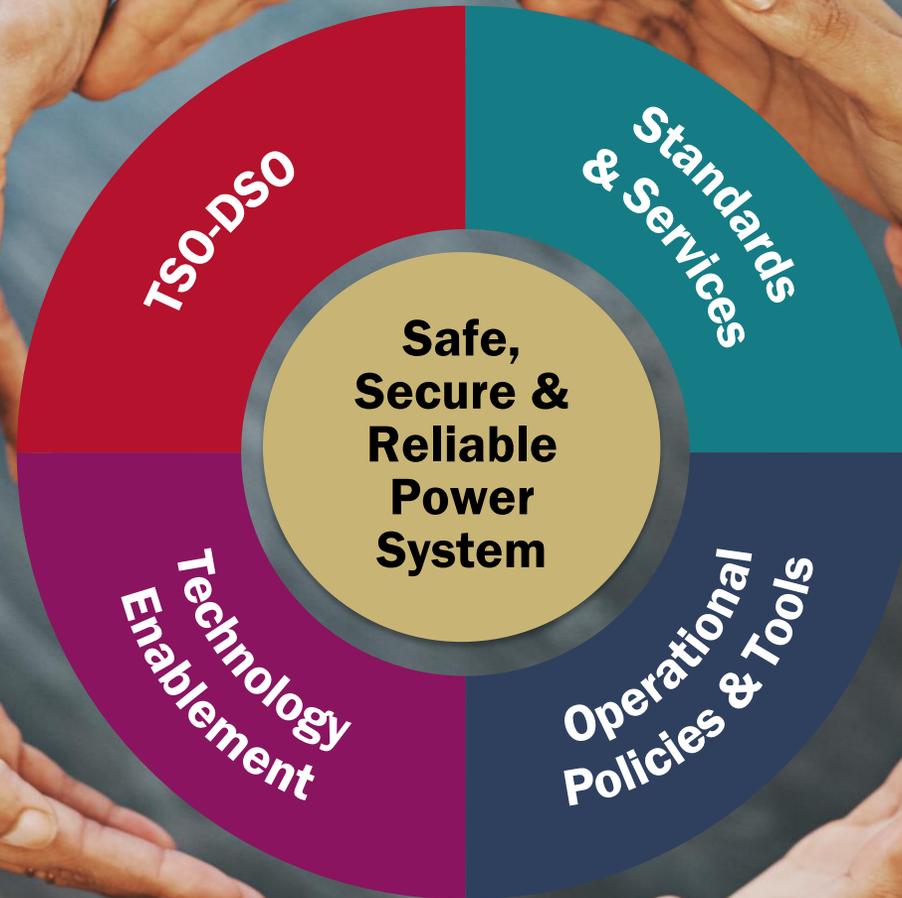
System Operations in 2030



Overview of Programme

TSO-DSO Operating Model	DS3+ System Services
Flexible Network Coordination	TSO-DSO Interfaces

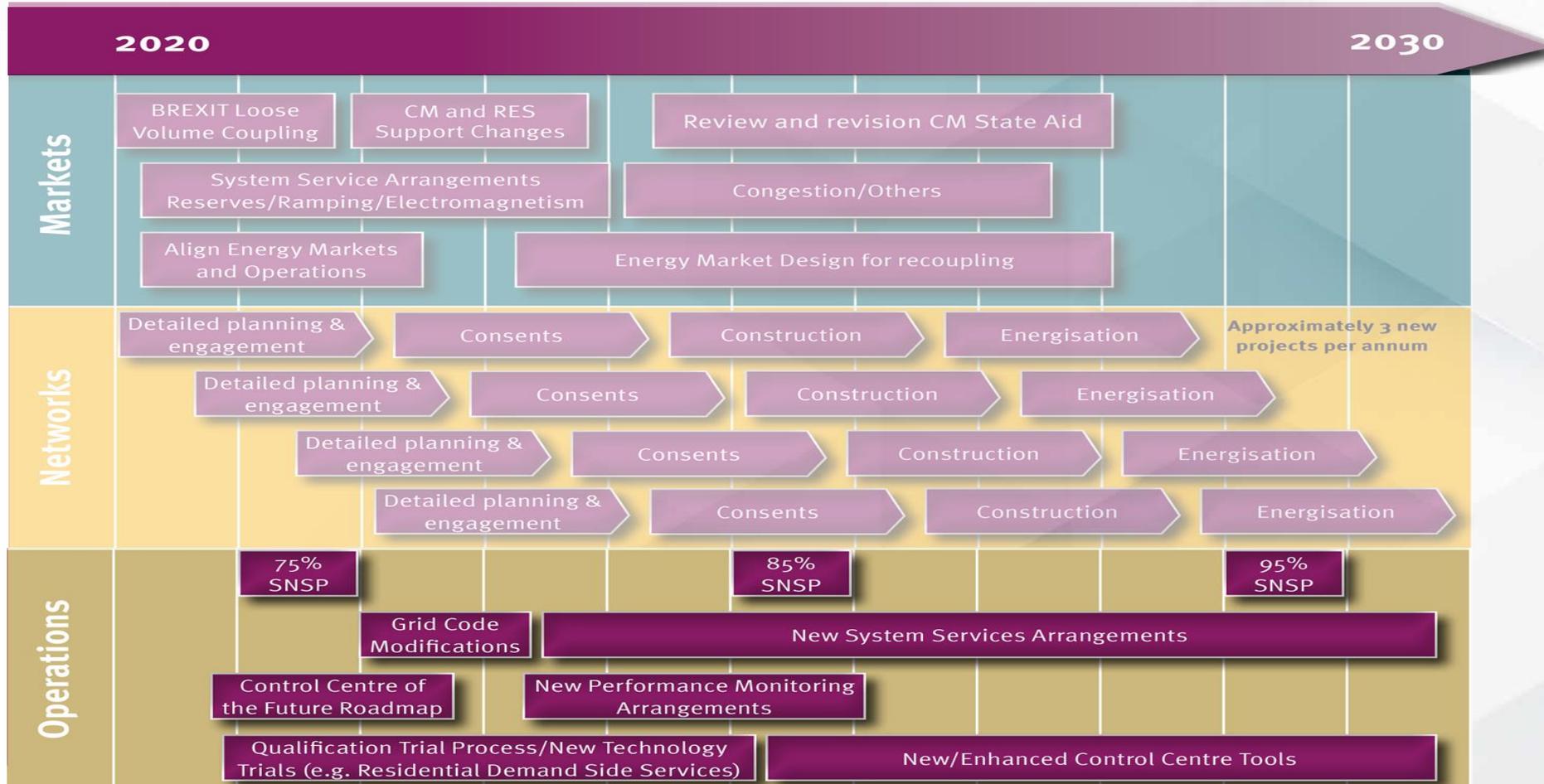
FlexTech	
DSM	Hybrids
Renewables & SSG	Storage
Large Energy Users	



Long Term Scarcity Product Design	System Services Commercial Framework
Standards & Performance Monitoring	Flexible Network Framework

Long Term Studies & Scarcity Identification	Short Term Studies & Operational Policy Evolution
Control Centre Tools	Flexible Network Management
Training	

Draft Roadmap - Operations



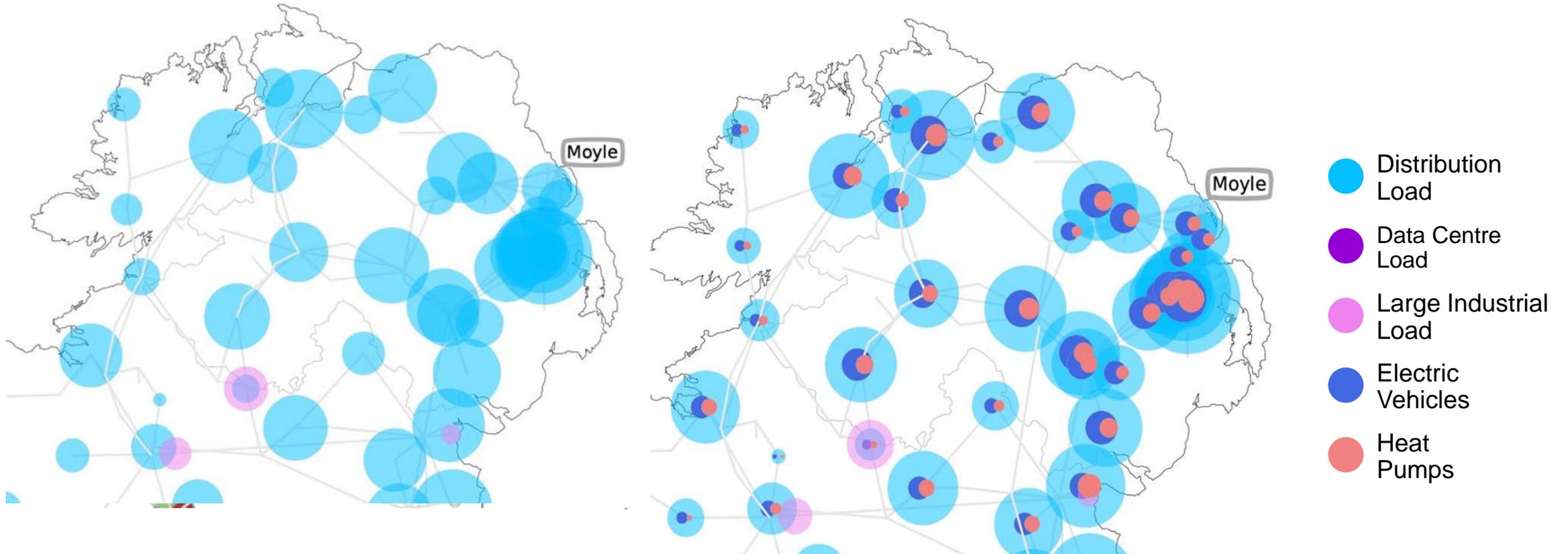


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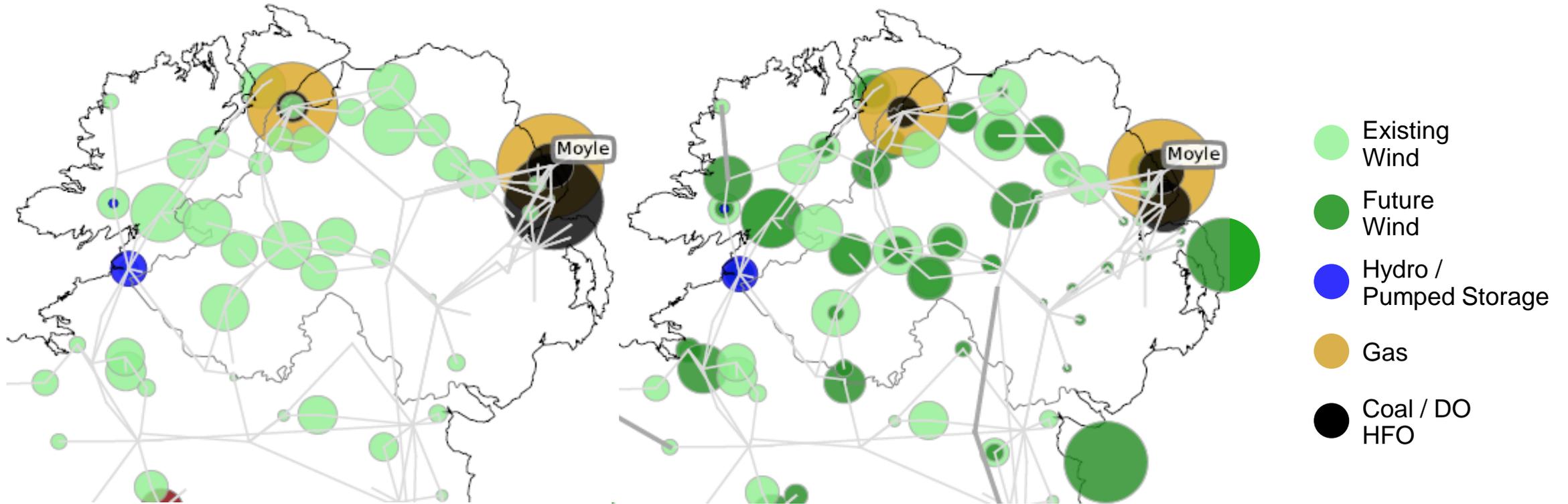


Transmission Network

Demand Changes: 2020-2030



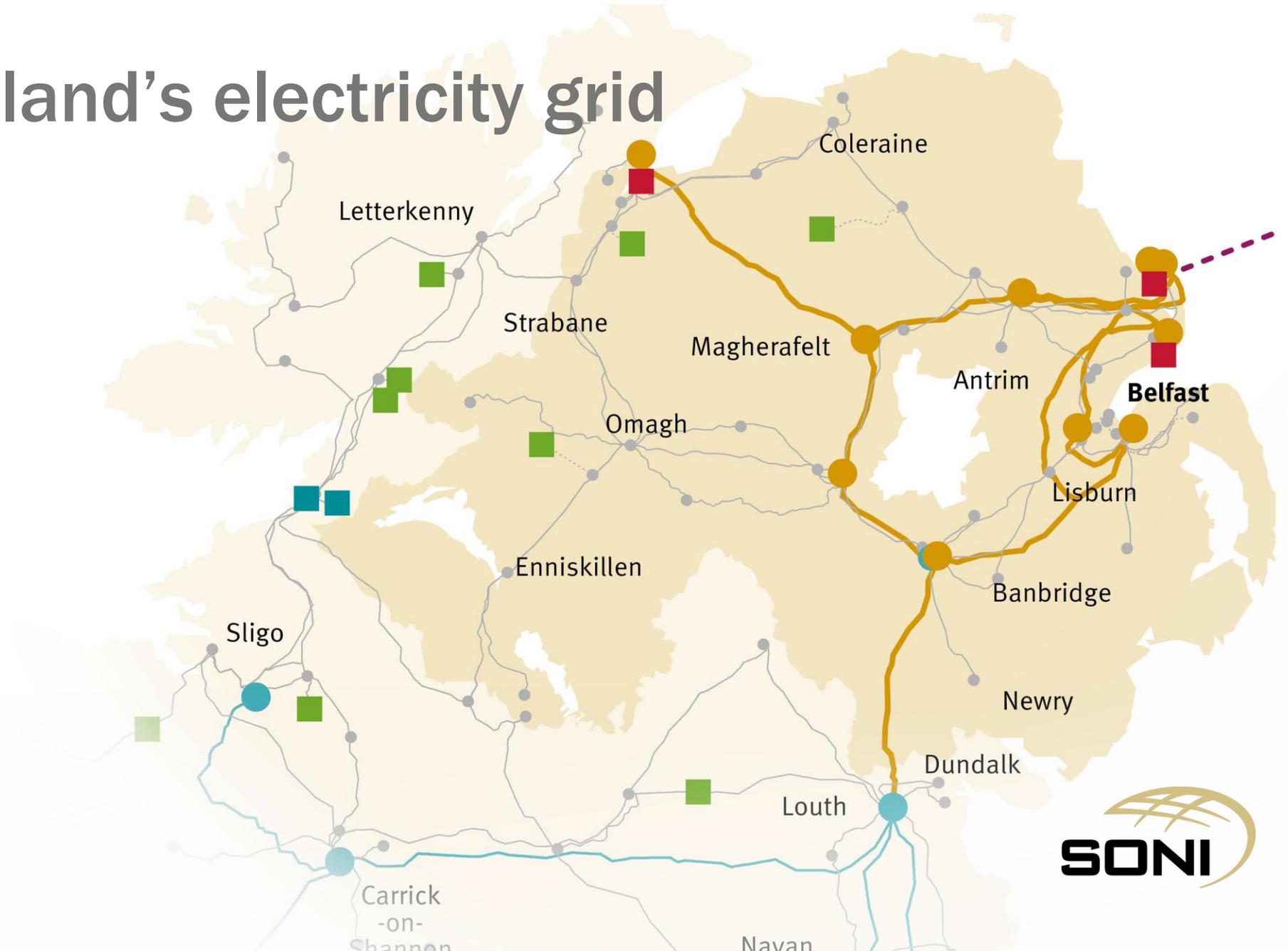
Generation Changes: 2020-2030





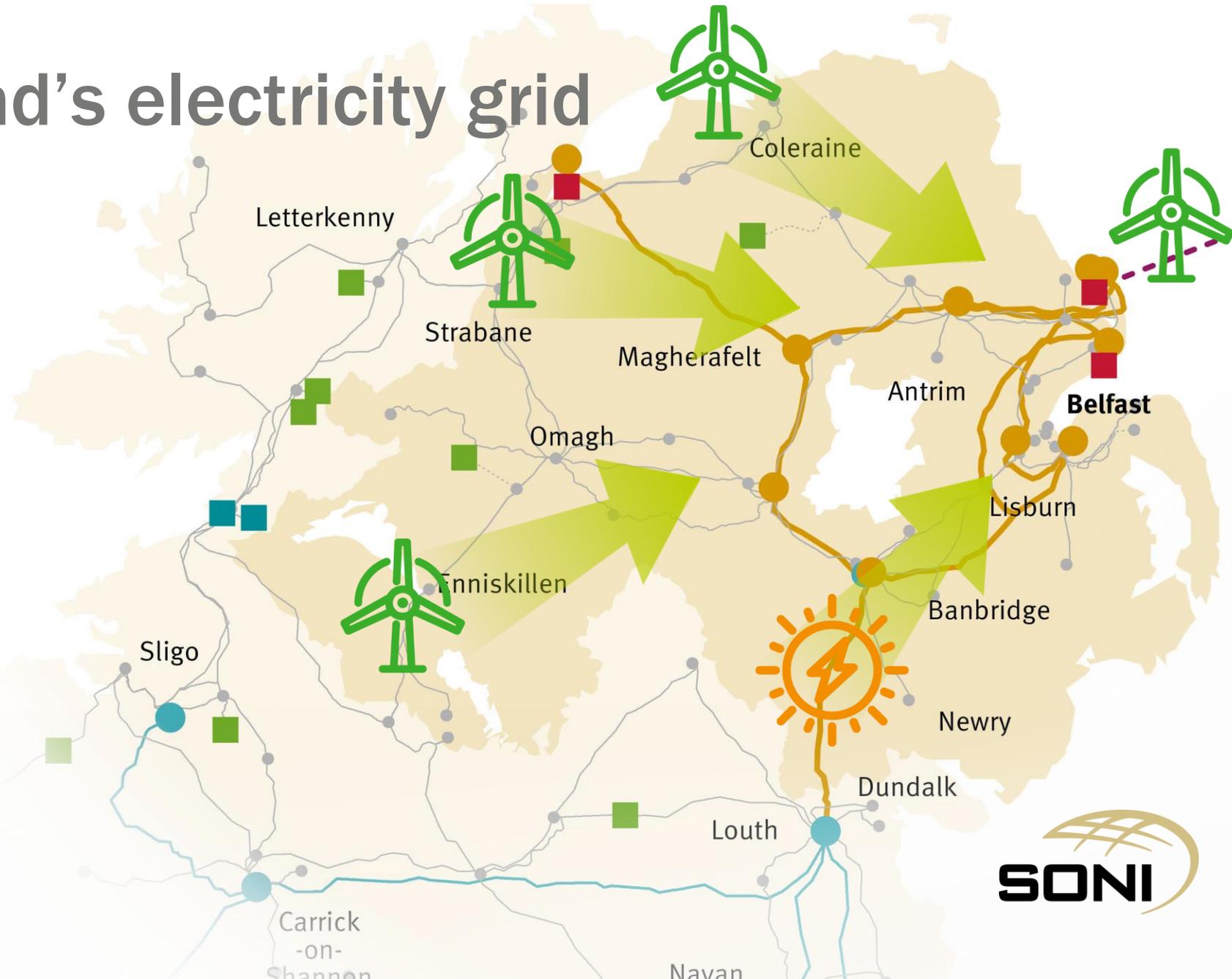
**To achieve at least 70%
clean electricity by 2030,
we need to make the grid
stronger and more flexible.**

Northern Ireland's electricity grid



Northern Ireland's electricity grid

- More electricity will be carried across this grid than ever before, and most of this power will come from renewable sources.
- The grid needs to carry at least 1,300 MW more renewable electricity by 2030.
- Power output from most renewable sources depends on the weather.
- Renewable electricity is typically generated far away from where most electricity is used.



How should we achieve this goal?

Four draft approaches to reach 70% by 2030



Generation-led

Put clean electricity generation close to where most power is used



Technology-led

Try new ways to move clean electricity across Northern Ireland



Developer-led

Let developers decide where to locate clean electricity generation



Demand-led

Put large electricity users close to sources of clean electricity generation



Our final plan will include elements of all approaches, strongly led by one of them.

1

Generation-led

Put clean electricity generation close to where most power is used

- Government policies would determine the best location of new renewable generation.
- Preferred locations will consider the strength of the existing grid and the local demand.
- Likely to lead to more offshore wind generation close to the greater Belfast area, with less need for new onshore renewable generation.
- Requires around 8 Projects / £120m
700 MW offshore wind (east coast)
500 MW solar energy and inland wind farms
- **Highly likely to succeed**



2

Developer-led

Let developers decide where to locate clean electricity generation

- Continue to connect new sources of renewable electricity in any location that developers request.
- This will create a need for a very large number of grid development projects – that would be very challenging to complete by 2030.
- This approach would also see more power being generated than can be used.
- Requires over 19 Projects / £361m
700 MW from inland wind farms
350 MW each from solar and offshore wind
- **Very unlikely to succeed.**



3

Technology-led

Try new ways to move clean electricity across Northern Ireland

- Use innovative ways to move clean electricity from the north and west to the east.
- This will involve an isolated underground cable carrying high voltage direct current – directly from renewable sources to the greater Belfast area.
- This cable would not integrate with the rest of the grid. It would need large, expensive and complex converter stations at both ends of the cable.
- Requires over 14 Projects / £535m
700 MW from inland wind farms
350 MW each from solar and offshore wind
- **Very challenging to complete in time.**



4

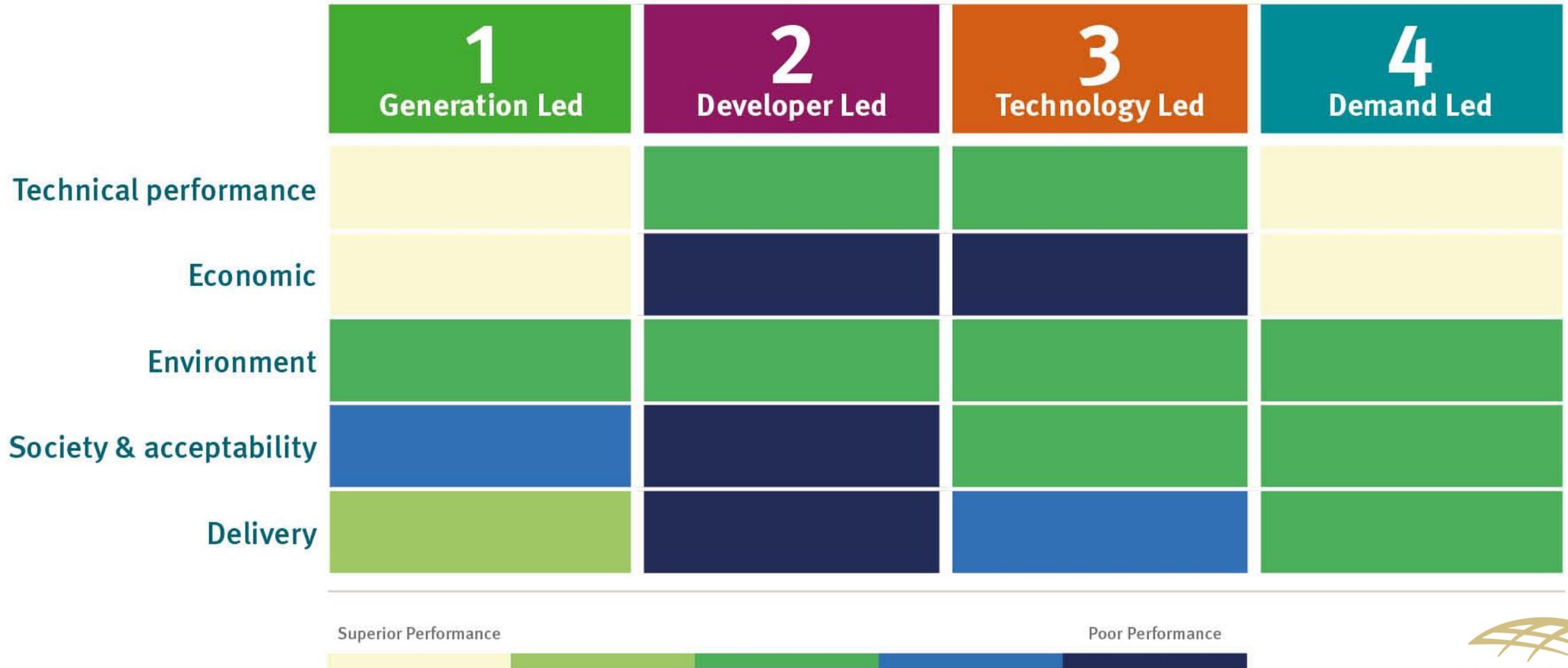
Demand-led

Put large electricity users close to sources of clean electricity generation

- Pharma and high-tech sectors use a great deal of power and often need a direct grid connection.
- Northern Ireland currently has no grid-connected electricity users, but SONI cannot influence where they may locate in future.
- With this approach, future energy/economic policy could compel new high-demand users to locate closer to sources of clean power.
- Requires over 10 Projects / £113m
700 MW from inland wind farms
350 MW each from solar and offshore wind
- **Requires large electricity users to locate in preferred locations to succeed.**



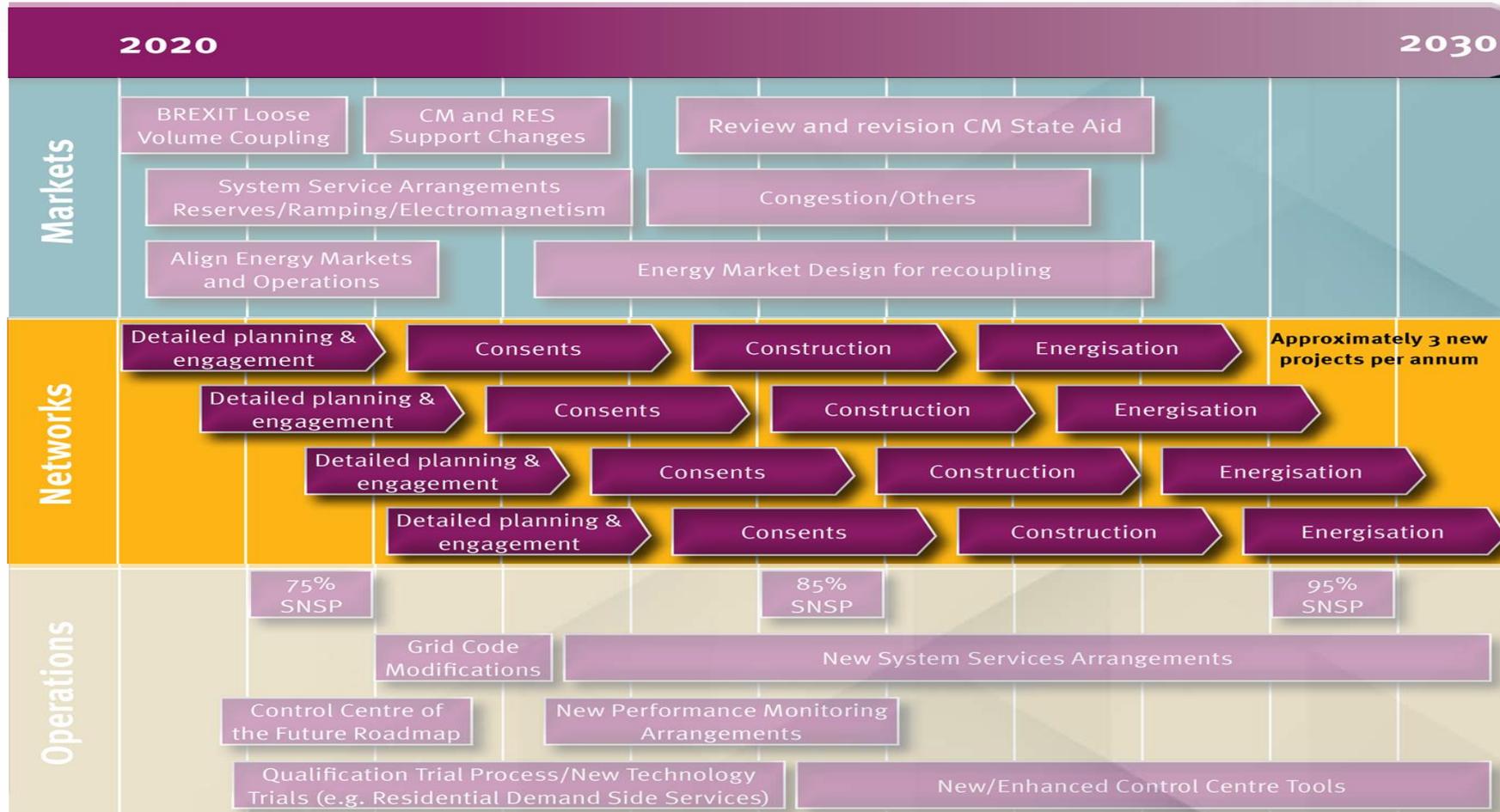
How do these different approaches compare?



A person is seen from the back, looking at a laptop screen. The screen shows a video conference with several participants in a grid layout. The background is a blurred office setting with a pen holder and a glass of water on a desk.

Our four draft approaches to reaching at least 70% by 2030 are open for consultation. Your views will shape our final plans at the end of this year.

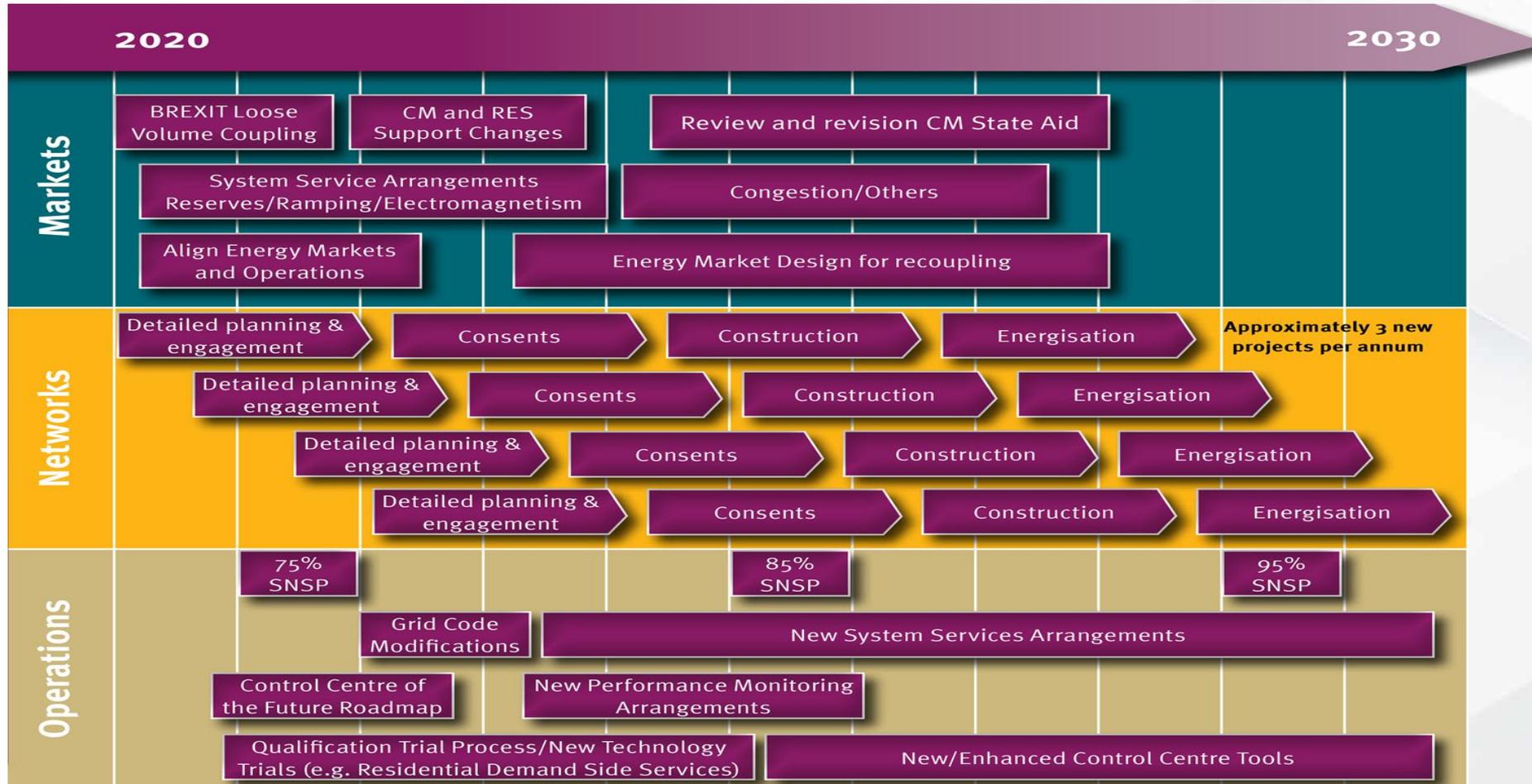
Draft Roadmap - Networks



A photograph of a high-voltage power line tower in a field under a cloudy sky. The tower is a lattice structure, and several power lines run across the frame. The foreground is filled with tall, dry grasses. The sky is overcast with grey clouds.

Thank You Questions?

Draft Roadmap





We are committed to a collective and collaborative form of decision-making. We want to hear from you to shape our final plans.



How to submit your views

- Complete the survey or make a submission to the **Public Consultation** at: <https://consult.soni.ltd.uk/>
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