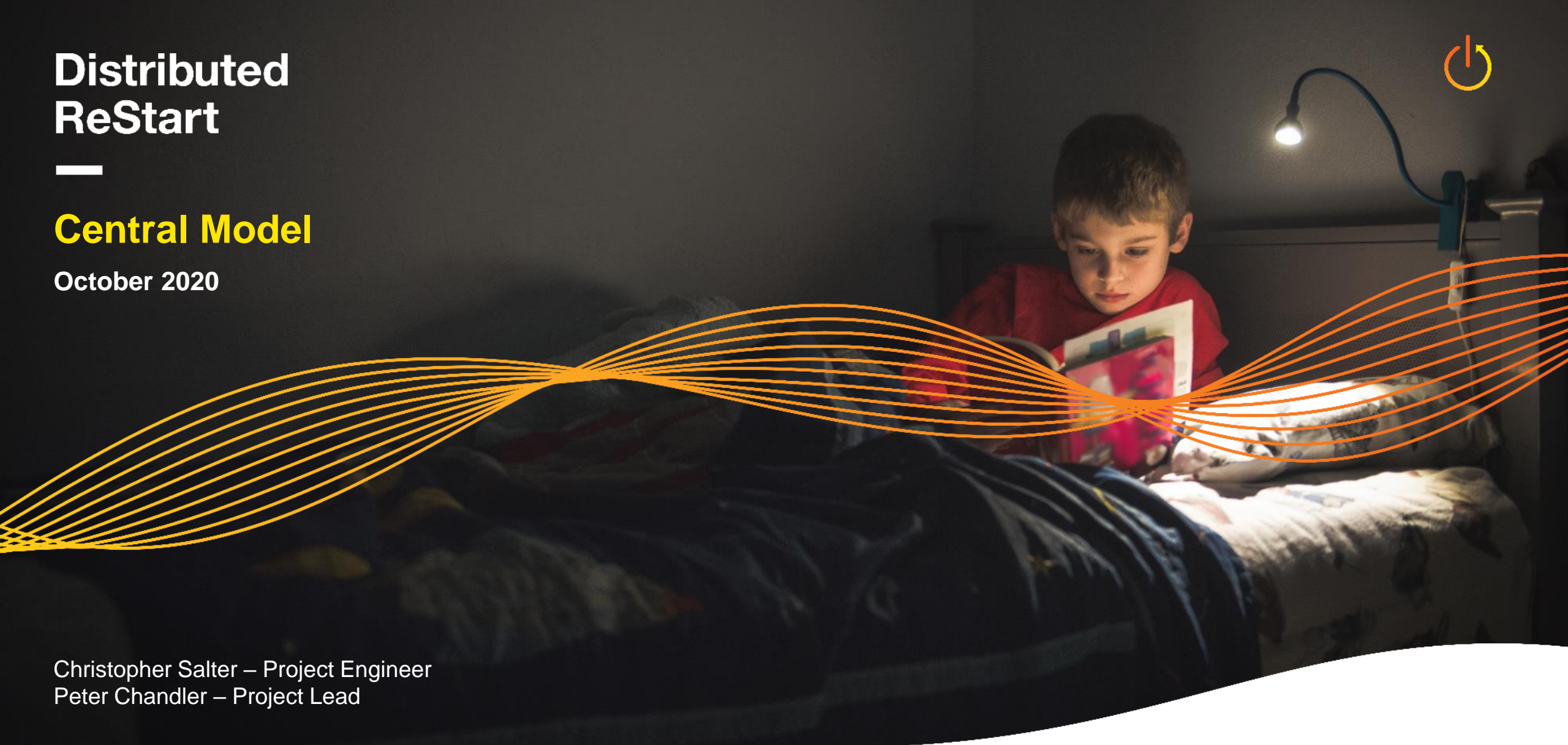


Distributed ReStart

Central Model

October 2020



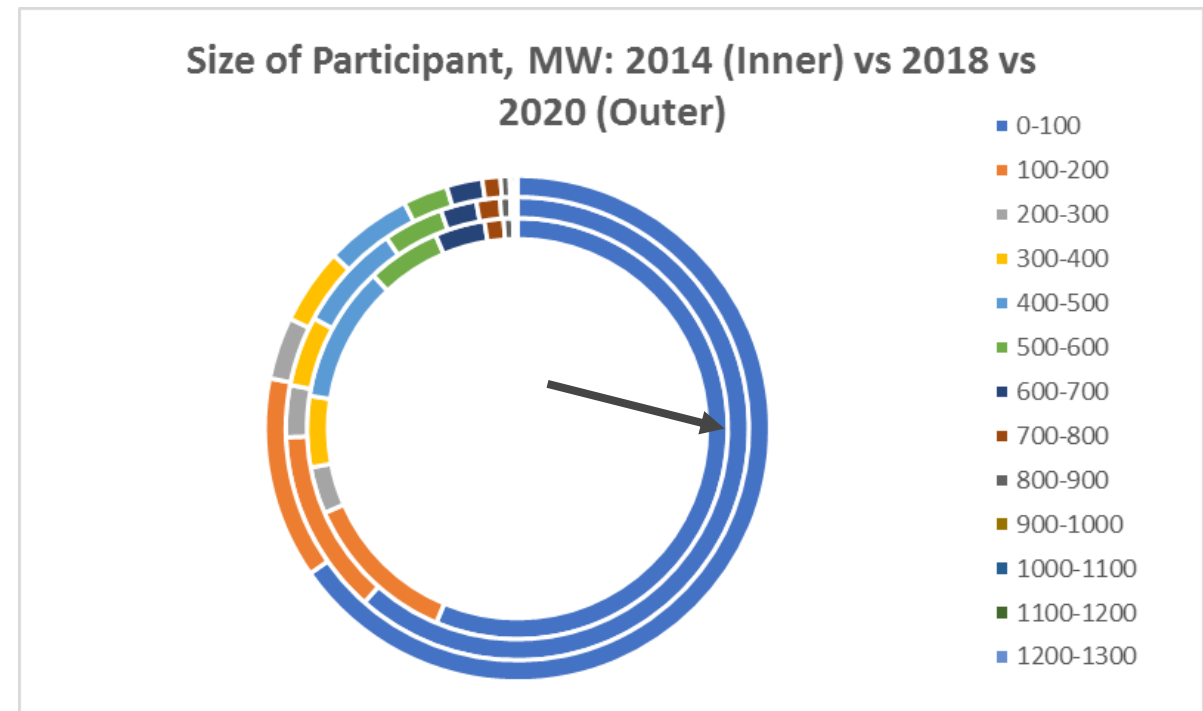
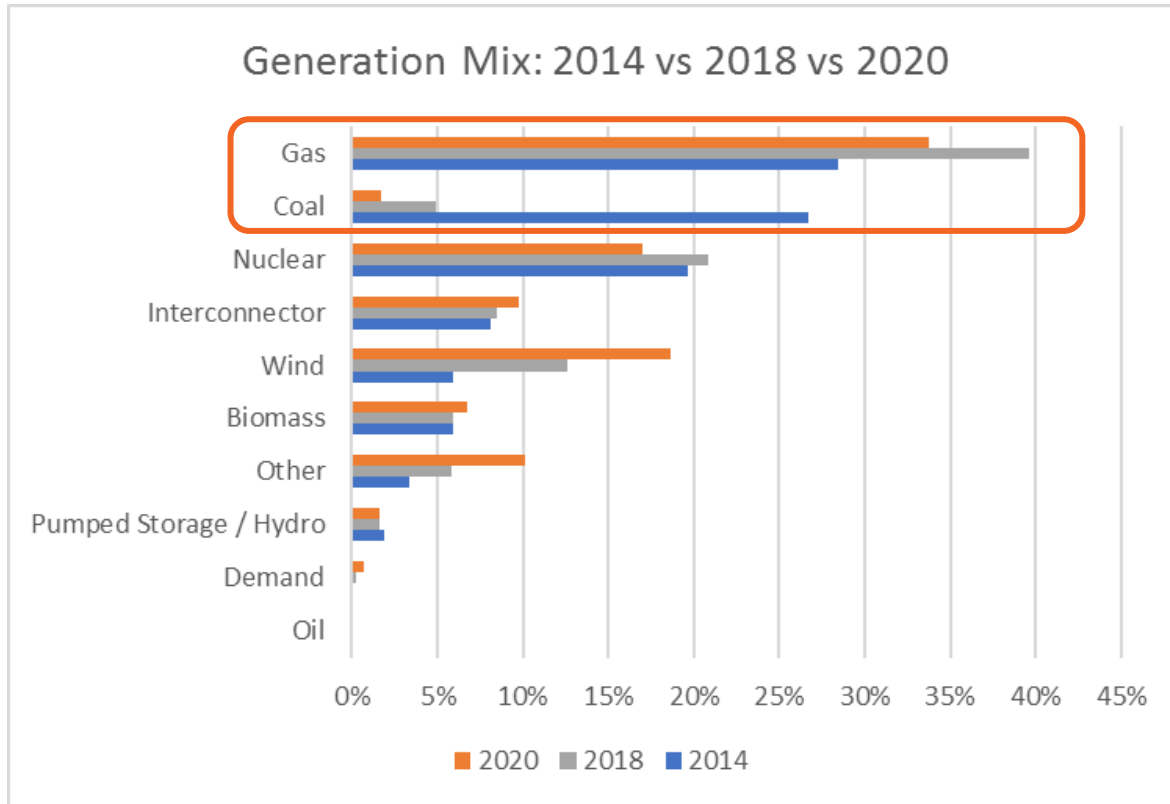
Christopher Salter – Project Engineer
Peter Chandler – Project Lead

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The transition has started...



Conventional Black Start providers are on the decline as we move to a decentralised, decarbonised and digital future power system. This means we need to rethink Black Start end to end

Looking to the Future.....

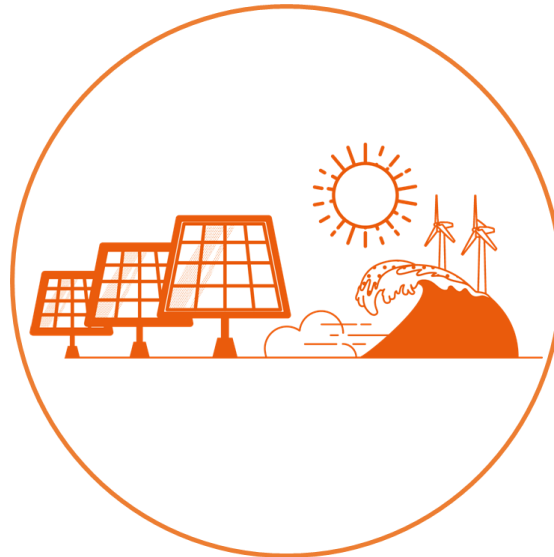
OUR MISSION

To enable the transformation to a sustainable energy system,
and ensure the delivery of reliable, affordable energy for all
consumers.

Distributed ReStart looks to deliver against these success criteria



Reduced costs to consumers of up to £115M by 2050 through enhanced competition and reduced warming costs



Savings of up to 810,000 Tonnes CO₂ Through incorporating renewables and avoiding warming of conventional generation

energy.

with **renewable**

to prove **it's possible**

approach to **black start,**

This project uses a **bottom up**

Key project achievements...



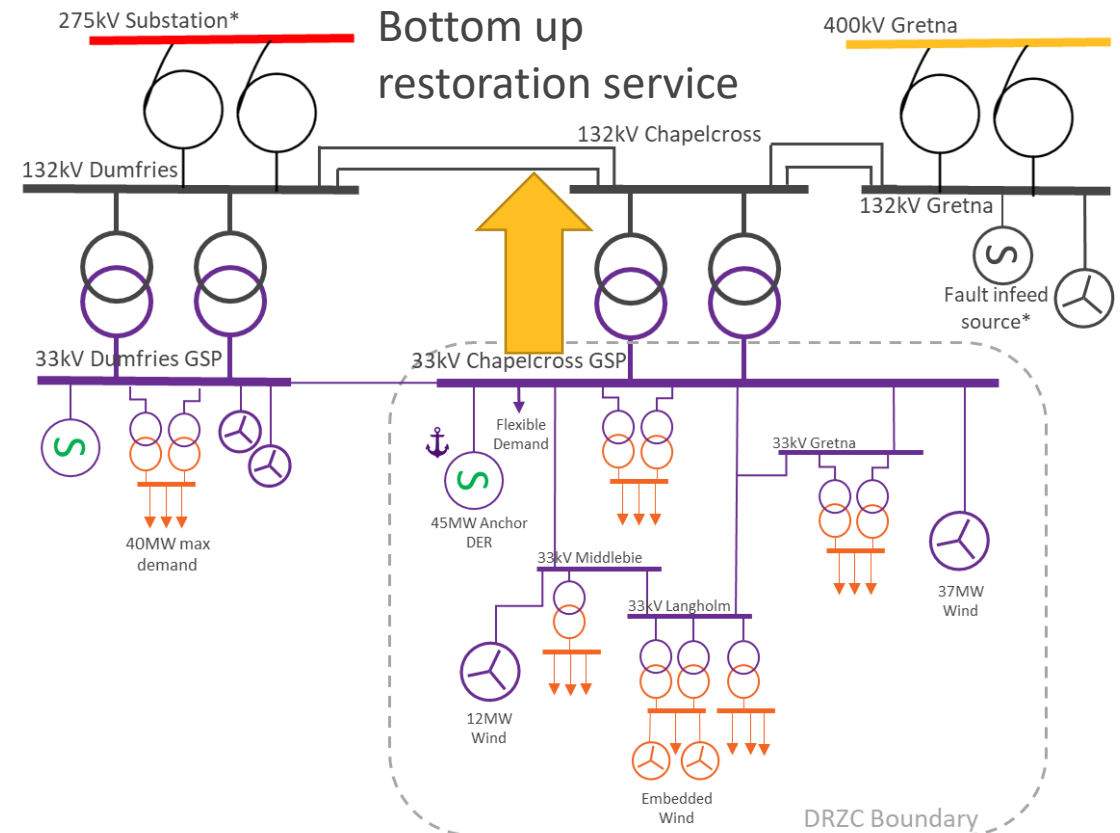
Across the project we have:

- Conducted extensive power system studies to develop restoration strategies
- Developed case studies ready for live trials including hydro generation, biomass, battery energy storage, wind and solar
- Scoped the telecommunication change requirements
- Designed a preferred commercial structure
- **Developed an organisational structure and control procedure**
- Consulted stakeholders at every stage

Our design will enable co-located energy resources in a Distributed ReStart Zone, to provide a bottom-up restoration service

Technical and commercial design stage reports available at:

<https://www.nationalgrideso.com/future-energy/projects/distributed-restart>





Development of the central model, allows us to:

- Leverage the benefits and process risk reduction of a national coordinator
- Leverage the efficiency of a process delivered through the network owner
- Leverage the clear organisational and technical benefits of a DRZC but allow control engineer decision making to supervise/instigate/direct the restoration

Summary

- NGESO are responsible for the instruction of plans and their expansion outside of the contracted region (DRZ), the respective licence area DNO are responsible for the control and supervision of networks and DERs within the contracted region
- Developed starting from the DNO led procedure but overlaying additional command and control communications with NGESO
- Anticipated that operational telecommunications and systems requirements are similar to the DNO led automated procedure due to interface with a DRZC

Benefits and risk analysis



Category	Organisation	Present Capability	Model A	Model B	Model C	Model D	Model E
Control Staff	NGESO	23 control engineers	Yellow	Red	Green	Green	Green
	TOs	2 to 5 control engineers under minimum staffing	Green	Green	Green	Green	Green
	DNOs	2 control engineers minimum	Yellow	Red	Yellow	Red	Yellow
	Providers/DERs	2 control engineers minimum	Yellow	Yellow	Yellow	Yellow	Yellow
Support Staff	NGESO	Dedicated support teams	Yellow	Yellow	Green	Yellow	Yellow
	TOs	Reliant on policy for additional resourcing	Green	Green	Green	Green	Green
	DNOs	Reliant on policy for additional resourcing	Green	Yellow	Yellow	Yellow	Yellow
	Providers/DERs	Do not rely on additional resource	Green	Green	Green	Green	Green
Skill Requirements	NGESO	Energy, strategy, transmission control	Yellow	Yellow	Yellow	Green	Green
	TOs	Transmission control	Green	Green	Green	Green	Green
	DNOs	Distribution control	Yellow	Yellow	Yellow	Yellow	Yellow
	Providers/DERs	Start-up/Shutdown	Green	Yellow	Green	Yellow	Yellow
Training Processes	NGESO	Yearly training	Green	Yellow	Yellow	Green	Yellow
	TOs	Biennial training	Green	Green	Green	Green	Green
	DNOs	Yearly knowledge share	Yellow	Yellow	Yellow	Red	Yellow
	Providers/DERs	During authorisation and assurance	Green	Yellow	Green	Yellow	Yellow
Supplementary Criteria	Meets Black Start Needs	Present needs met	Yellow	Red	Green	Yellow	Green
	Ease of Implementation	Functional Process exists	Red	Yellow	Red	Yellow	Yellow
	Flexibility for the future	Threatened by closure of large conventional providers	Yellow	Green	Yellow	Green	Green
	Alignment with wider industry change	Does not fit the themes of Decentralisation, Decarbonisation or Digitisation	Red	Yellow	Yellow	Yellow	Green

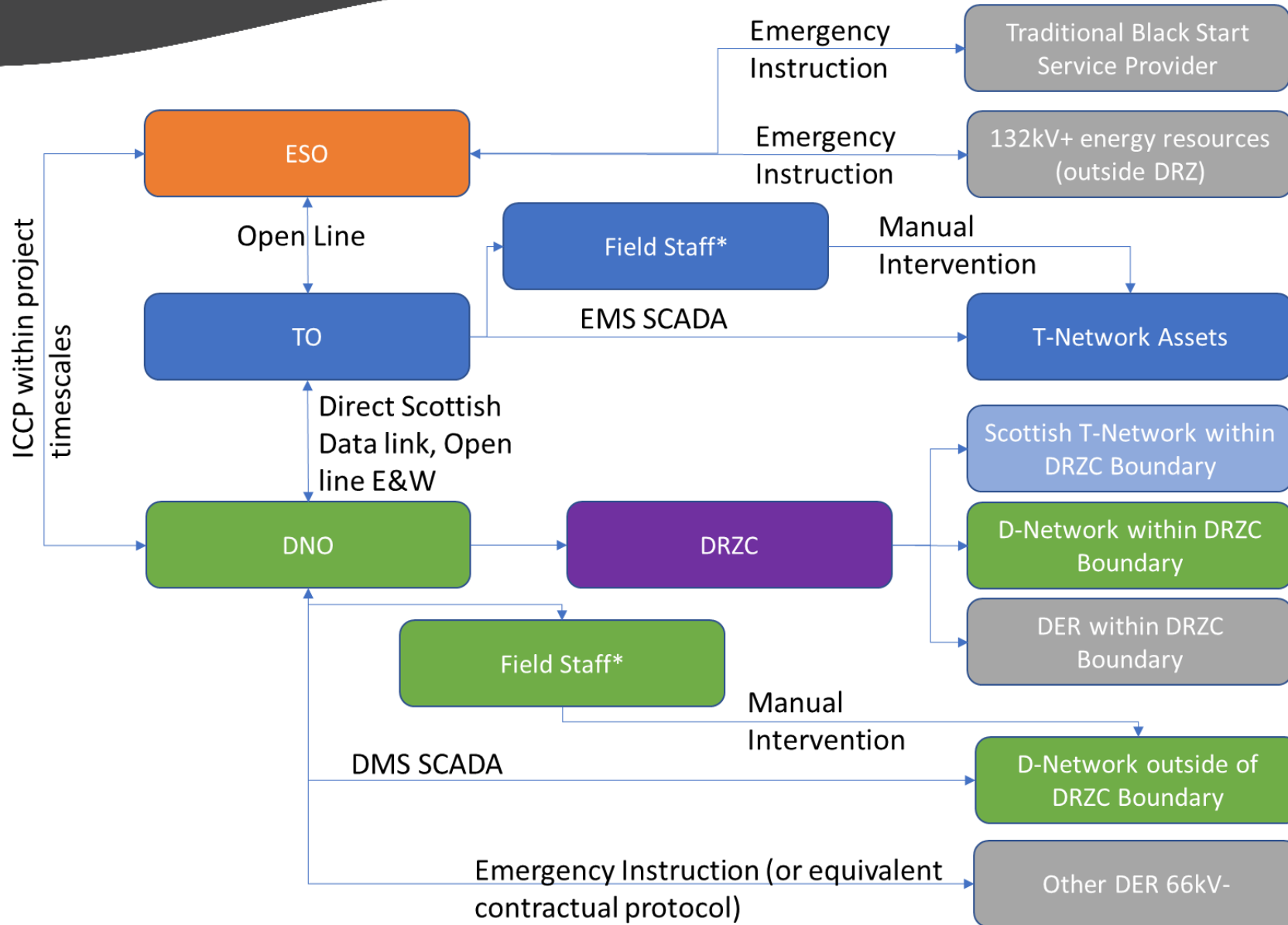
High level actions and responsibilities



ESO and DNOs work cooperatively with a minimum viable DRZC and DMS automation

Action	Responsible under current Black Start	Responsible in DNO led	Responsible in ESO led	Responsible in central model
Declare Black Start	ESO	ESO	ESO	NGESO
Responsible for national strategy	ESO	ESO	ESO	NGESO
Responsible for regional strategy	ESO	DNO	ESO	NGESO
Instruct start of plan	ESO	DNO	ESO	NGESO /Scottish TO, only withheld where a DRZ requires access to the transmission system to sustain supplies for an extended period
Instruct start of anchor DER	N/A	DNO	ESO	DNO
Instruct transmission switching actions	ESO	ESO	ESO	NGESO
Physical transmission network actions	TO	TO	TO	TO
Physical distribution network actions	DNO	DNO	ESO	DNO
Physical actions of contracted generation	Providers	DERs	DERs	Multiple individual providers
Instruct DRZ energisation route	DNO	DNO	DNO	DNO/Scottish TO
Instruct growth option outside of DRZ boundary	N/A	DNO	ESO	NGESO
Instruct DERs within a DRZ	ESO where BS provider	DNO*	ESO	DNO/Scottish TO
Instruct DERs outside of DRZ boundary	Temporary code modification: GC0143*	DNO	ESO	NGESO
Instruct non-contracted DERs (Emergency Instruction equivalent procedure)	Provider	DER	DER	NGESO via DNO instruction
Manage overall distribution power island voltage and frequency	N/A	DNO	ESO	DNO is frequency leader until synchronisation with an energy resource or demand outside of the DRZ

Communications requirements



Restoration Zone Controller



Central controller:

Processes data, interacts with DMS, calculates slow balancing actions to achieve net export requirements at the POC, acts on control engineer input

Expected location: DNO control room

Distributed Controller:

Where 'decision making' capability is needed but requires faster actions than SCADA coms can facilitate, this can take local fast balancing actions.

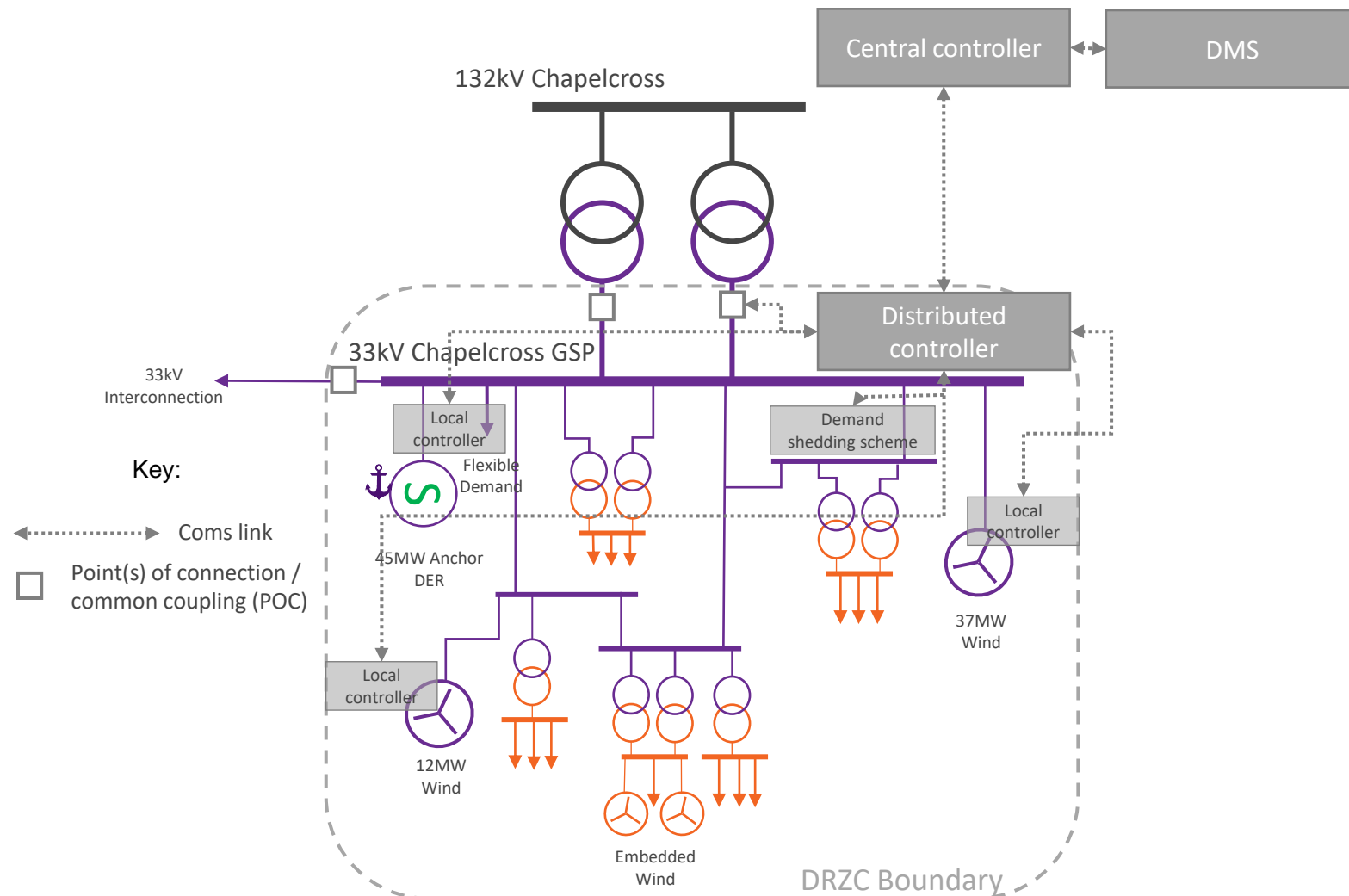
Expected location: DNO substation

Local controller:

Where very fast acting response or additional control/monitoring is needed to maintain stability

Expected location: Next to DER RTU

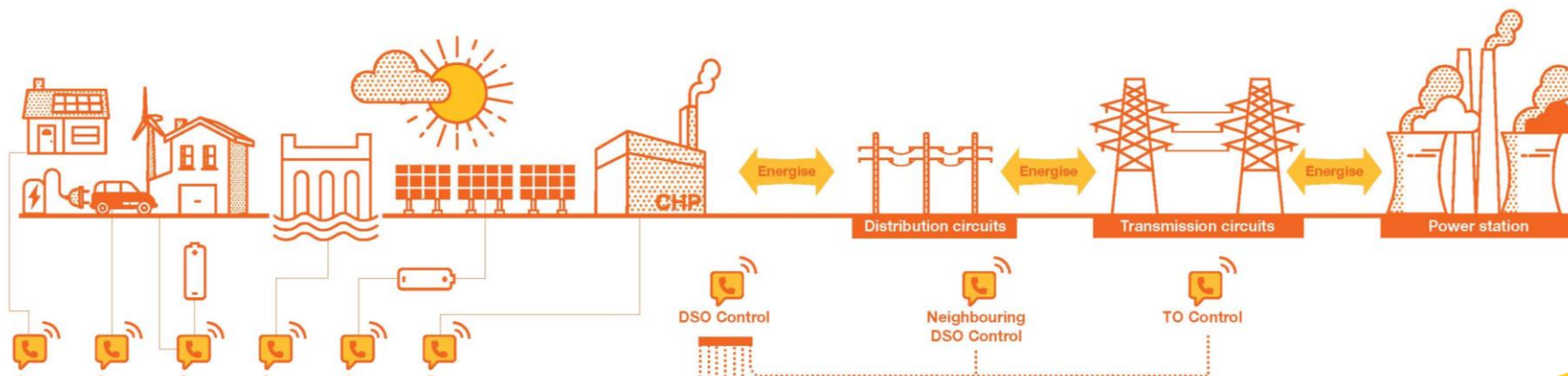
Not all designs use all levels of controller so this will depend on the final design



What to look out for...



- Live trials at case studies will test our modelling – October 2020 – December 2021
- Functional specification for telecommunications and control will be published - 5th December 2020
- Functional specification for DER participants will be published - 5th December 2020
- Functional specification for a restoration zone controller will be published - 5th December 2020
- Desktop exercises will be used to refine control processes – Spring 2021
- Build and RTDS of a restoration zone controller – Spring 2021



Distributed ReStart



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