RaaS - Resilience as a Service

local energy resources to improve security of supply

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November 2023

RaaS
Resilience as a Service

Scottish & Southern Electricity Networks

OUR NETWORK AT A GLANCE

Our electricity distribution network delivers power to over 3.9 million homes and businesses across the diverse and unique geographies of the north of Scotland and central southern England.

OUR DISTRIBUTION NETWORK AT A GLANCE

Over **3.9million** homes and businesses

More than **888,000** customers on our Priority Services Register

Over **128,000km** of overhead lines and underground cables

Over **460km** of subsea cables powering our island communities

Over **4,100** employees across the country

Figures as at October 2023

RaaS Concept

Improved resilience of the electricity system using local energy storage and generation to restore supply in the event of a power outage

Benefits

- Security of Supply - customers experience fewer and/or shorter interruptions
- Increased uptime - renewables continue to generate and export to grid at times when that energy would otherwise have been lost
- Reduced use of temporary diesel generation
- Additional income stream for storage / flexibility market assets

Why now?

To harness the growing number of third party owned assets and emerging markets for flexibility in addressing network challenges

Project Objective

Develop and demonstrate a new market-based solution to improve network resilience using local energy resources

£10.9m Network Innovation Competition funded project

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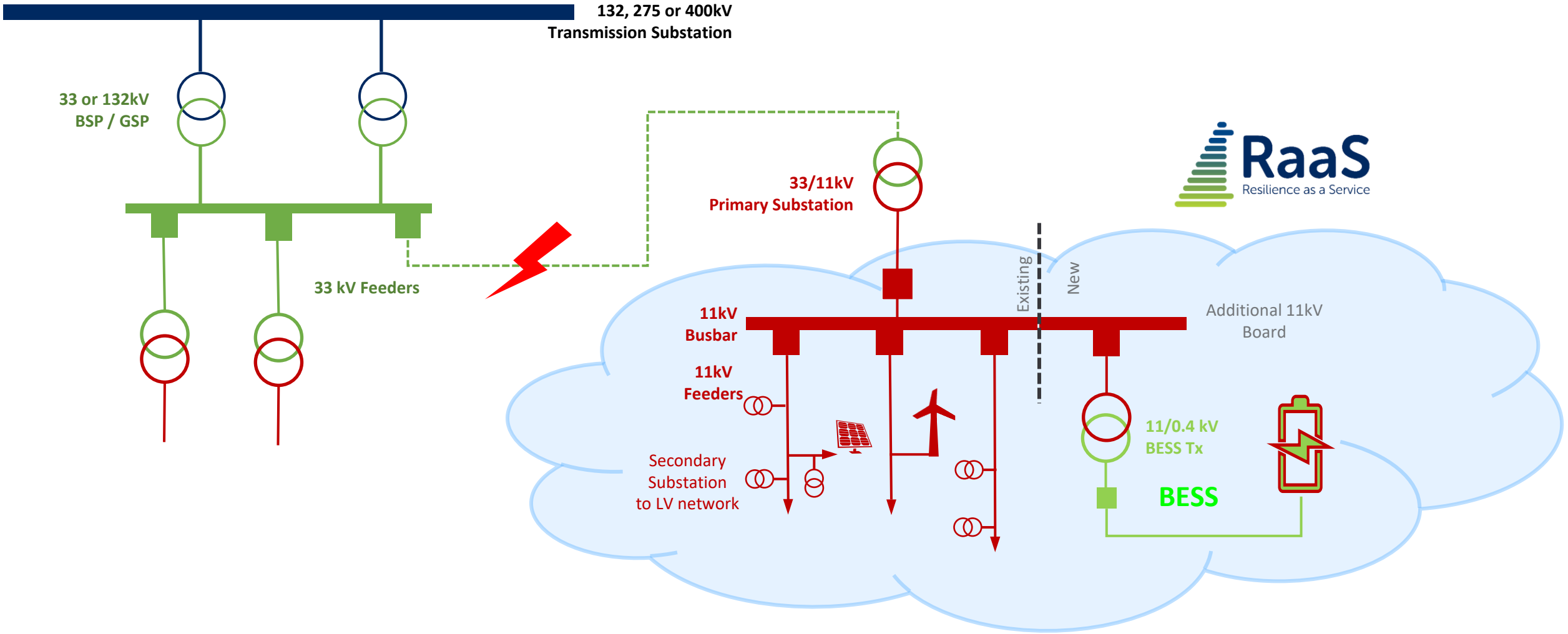
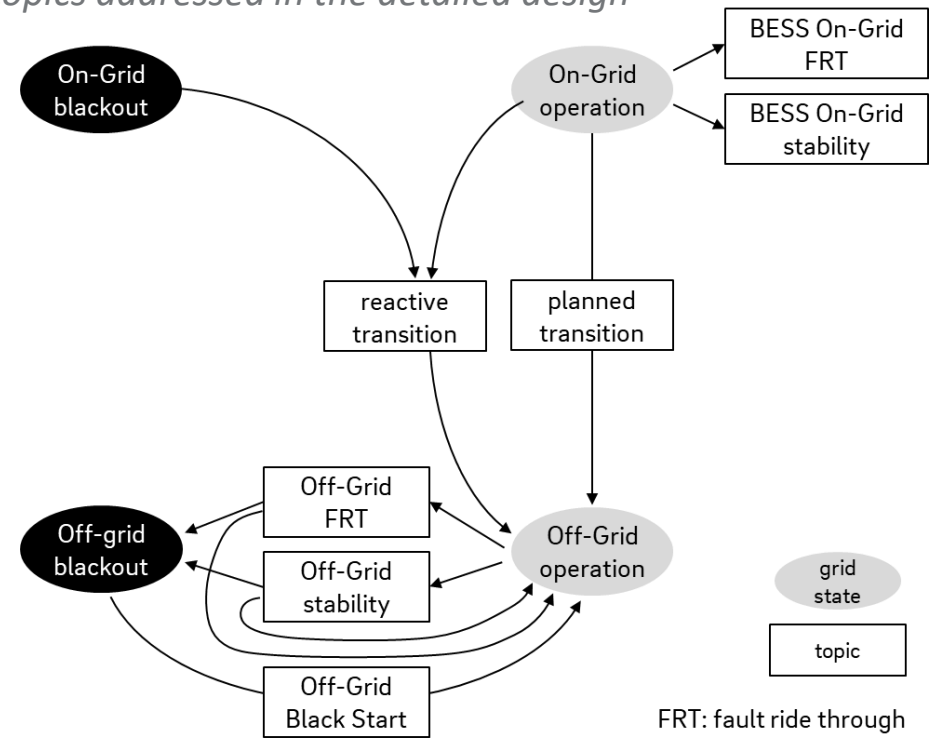
RaaS Technical Solution



Detailed Design

topics addressed in the detailed design



FRT: fault ride through

SSEN

- Modelling & Feasibility Studies - RaaS at primary substation level - WSP
- Modelling of Inrush Currents During a RaaS Black Start Scenario - WSP
- Protection & Control Settings Study - WSP
- PoW Switching Studies - Enspec
- Detailed DNO Control Scheme Design - SGS

E.ON

- Request for Information & Request for Proposals stages
  - identification and qualification of potential suppliers for BESS components & functionalities
- RaaS BESS Detailed Engineering Design

https://ssen-innovation.co.uk/raas

Trial Site - Drynoch, Isle of Skye

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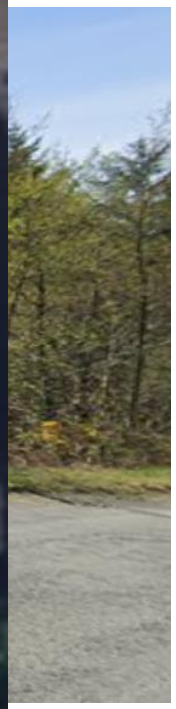

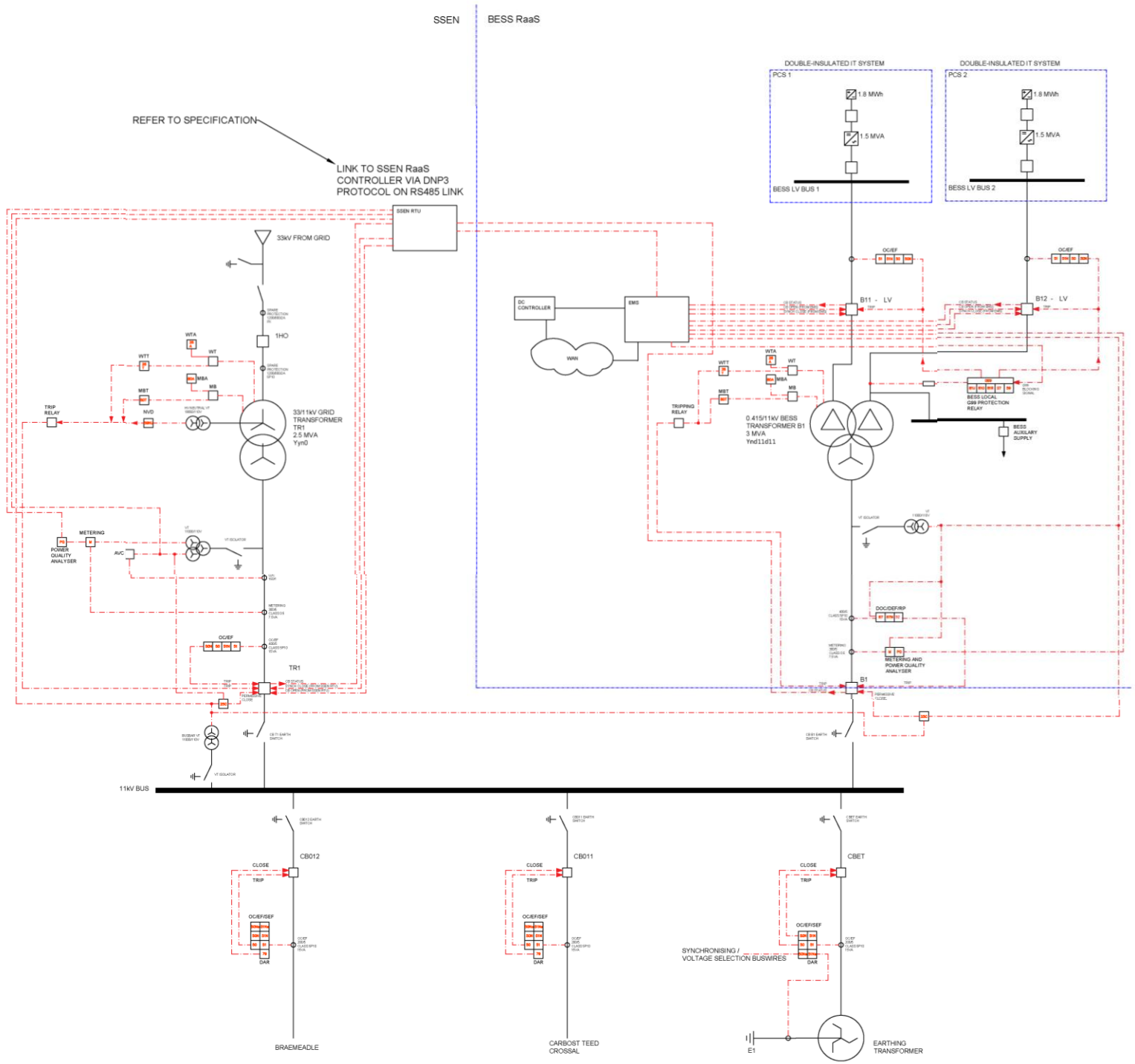

25 SYNCHRONISING DEVICE (A=AUTO SYNC, C=CHECK SYNC)
26 A TEMPERATURE ALARM
26 T TEMPERATURE TRIP
27 UNDER VOLTAGE RELAY
30A ANNUNCIATOR RELAY
32 DIRECTIONAL OR REVERSE POWER RELAY
50 INSTANTANEOUS OVERCURRENT RELAY
50N RESIDUAL INSTANTANEOUS OVERCURRENT RELAY
50 NS SENSITIVE GROUND FAULT PROTECTION RELAY
51 A.C. TIME DELAY OVERCURRENT RELAY
51 NS SENSITIVE GROUND FAULT PROTECTION RELAY
51N SBY BACK UP EARTH FAULT PROTECTION RELAY
52a CIRCUIT BREAKER FOLLOWER
52b CIRCUIT BREAKER INVERSE FOLLOWER
52c CIRCUIT BREAKER SERVICE POSITION FOLLOWER
52d CIRCUIT BREAKER SERVICE POSITION INVERSE FOLLOWER
52T CIRCUIT BREAKER TRIP COIL
59 OVER VOLTAGE RELAY
61 DENSITY SWITCH OR SENSOR
64 REF RESTRICTED EARTH FAULT RELAY
67 AC DIRECTIONAL OVERCURRENT RELAY
67N AC DIRECTIONAL EARTH FAULT PROTECTION RELAY
79 AC RECLOSING RELAY
80A BUCHHOLZ RELAY ALARM
80T BUCHHOLZ RELAY TRIP
81O OVERVOLTAGE RELAY
81R RATE-OF-CHANGE-OF-FREQUENCY RELAY
81U UNDERFREQUENCY RELAY
86 TRIP/LOCKOUT RELAY
94 TRIP OR TRIP FREE RELAY
kWh kWh METER
M MULTI-FUNCTION METER
VPIS VOLTAGE PRESENCE INDICATION SYSTEM
VOLTAGE TRANSFORMER (2W)
TRANSFORMER (3W)
EARTHING TRANSFORMER
A AMMETER
CURRENT TRANSFORMER
CIRCUIT BREAKER
BATTERY STORAGE CLUSTER
POWER CONVERSION SYSTEM
PQ POWER QUALITY SYSTEM

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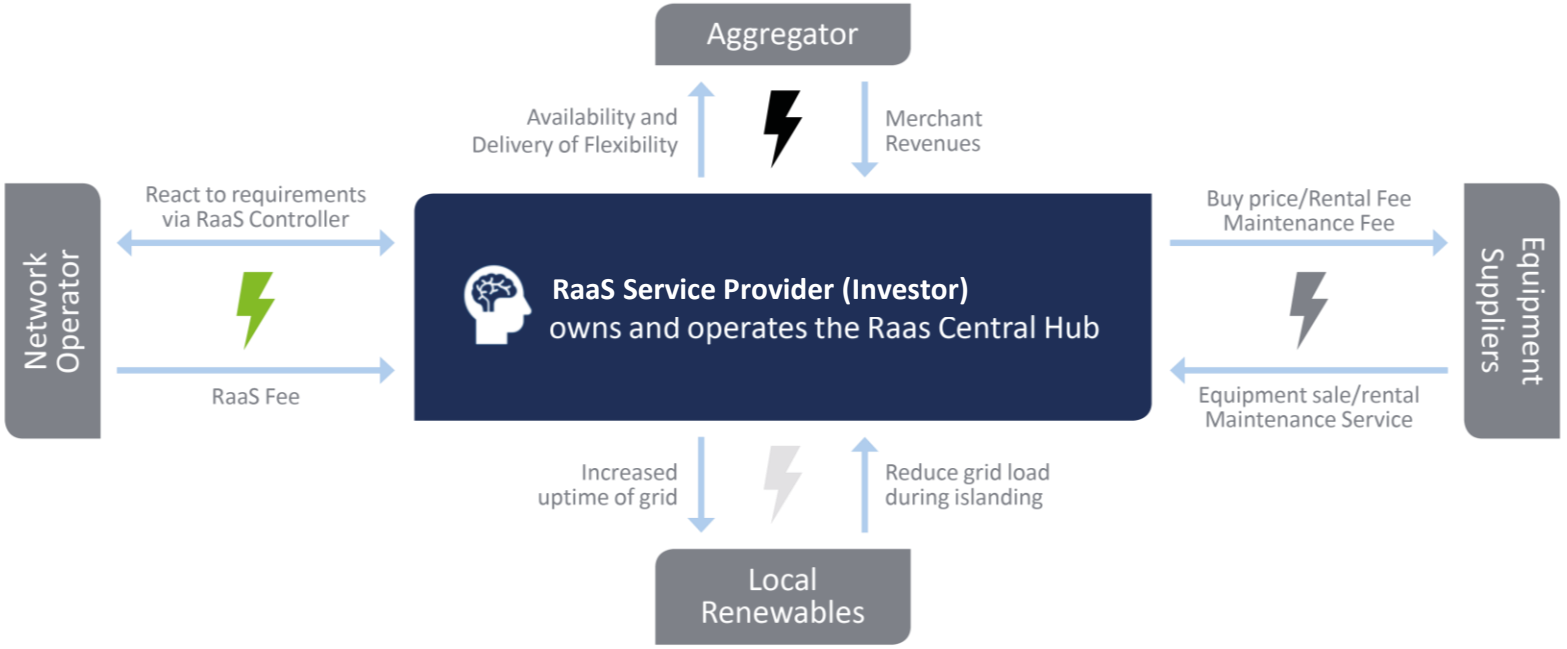
RaaS Commercial Solution

RaaS
Resilience as a Service



Challenges to solve to mitigate risk of RaaS provider:

- Standardisation of requirements
- Operational optimisation
- Inclusion of local renewables
- Equipment Supply Chain

RaaS Supply Chain:

- RaaS Provider as single contractor to DNO
- Technology agnostic and cost optimized procurement structure

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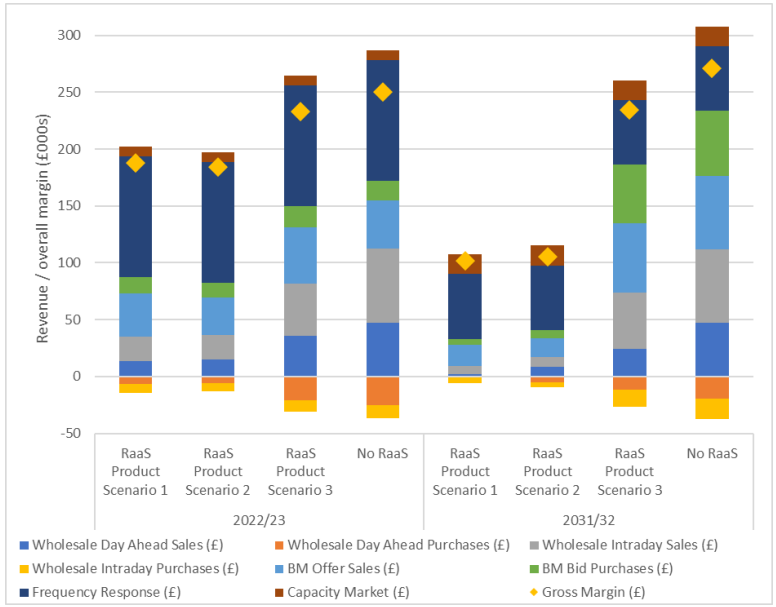
Business Case

RSP valuation - *Willingness to Accept*

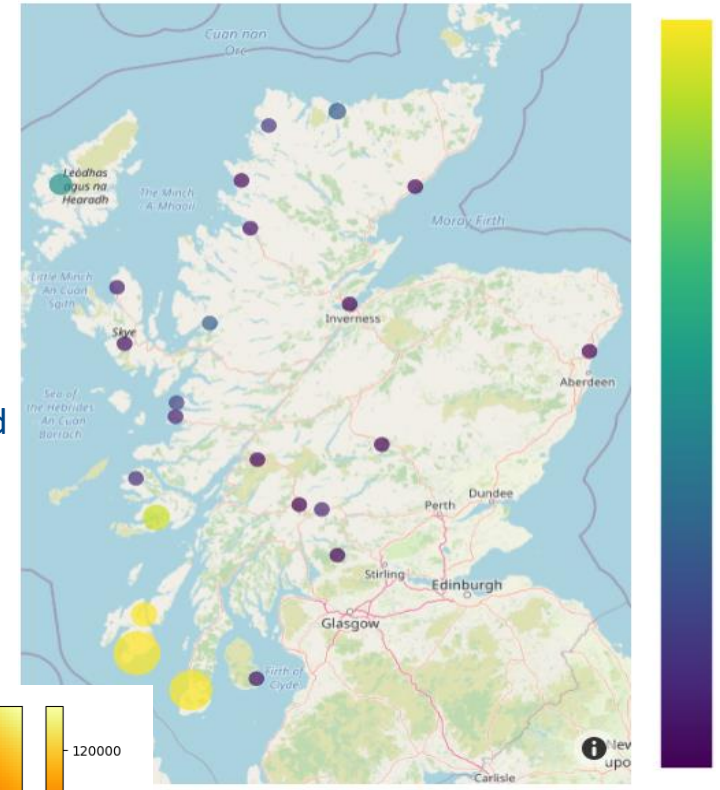
nationalgrid	Dynamic Containment
Wholesale market	Day Ahead Wholesale Market
Wholesale market	Within Day Wholesale Market
nationalgrid	Balancing Mechanism
nationalgrid	Capacity Mechanism
Scottish & Southern Electricity Networks	RaaS Service

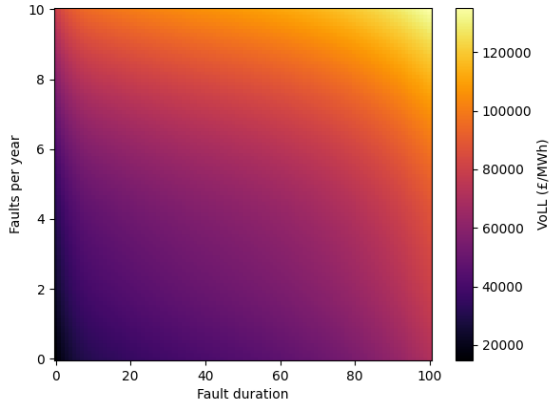
report:
Optimisation Assessment for RaaS Battery Operation



DNO valuation - *Willingness to Pay*

- CIs / CMLs
- VoLL
  - figures drawn from Electricity North West's detailed Value of Lost Load to Customers studies





Next steps…

- Drynoch trial - proving the technical solution for fault response and local resilience
- approach to DNO requirements specification for procurement/tendering
  - level of granularity in requirements definition
  - duration of service - relative costs & benefits
  - specified reserved capacity vs ‘use available capacity’ approach
- the role of forecasting
  - demand - to inform the DNO requirements specification and reserved capacity at different points in time
  - interruptions - to inform DNO decisions re ‘standing down’ a RaaS service at certain points in time
- implications of different RaaS fee structures
  - e.g. fixed / availability / utilisation payments
  - contract vs incentives - rewards / penalties
  - impact of ‘opt out’ option

Wider industry activities

RaaS
Resilience as a Service

Flexibility Markets

- ENA's Open Networks activities to bring standardisation which supports participation in local flexibility market - in line with actions from BEIS' and Ofgem's Smart Systems and Flexibility plan (2021)
- Ofgem's work looking at creation of a System-Wide Flexibility Exchange / Common Digital Energy Infrastructure (CDEI) for flexibility markets
  - 'Consultation: Future of local energy institutions and governance' and 'Call for Input: The Future of Distributed Flexibility' (March 2023)

Network constraints & new connections - recognised as a key issue for network development and the net zero transition

- National Grid ESO's Connections Reform project - ESO 5 Point Plan
- ENA's Strategic Connections Group - Three-Step Action Plan
- Accelerated Strategic Transmission Investment (ASTI)
- Large Onshore Transmission Investments (LOTI) reopener
- Access SCR (Significant Code Review) - implemented for RIIO-ED2

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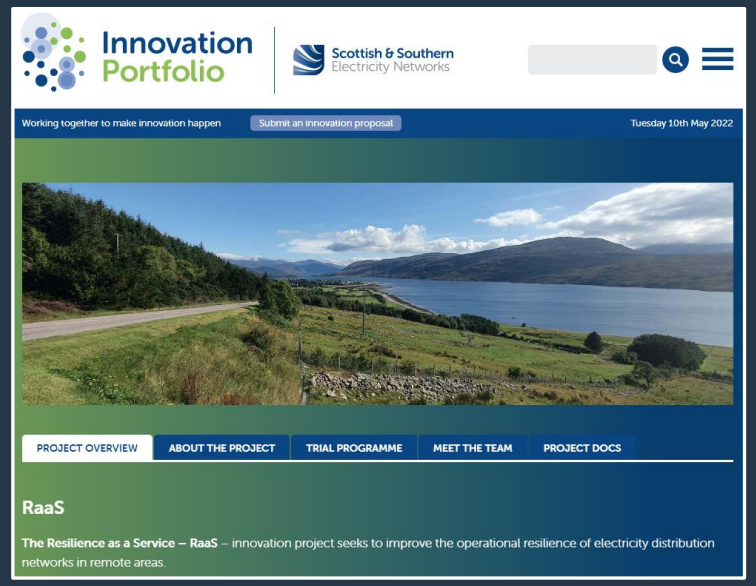
thank you



Questions & comments welcome - RaaS@costain.com

https://ssen-innovation.co.uk/raas

Stand M7

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