RaaS - Resilience as a Service

Stage Gate Stakeholder Engagement

Overview

RaaS
Resilience as a Service

Scottish & Southern
Electricity Networks

Welcome

each day @10.30am

Tues 2nd Nov	**Overview** - an introduction to the RaaS project, the work undertaken in Phase 1, and considerations for Phase 2
Weds 3rd Nov	**Technology** - detail on the design of the RaaS solution and its integration into the distribution network
Thurs 4th Nov	**Business Case** - considering both the DNO and Service Provider perspectives on the value of RaaS and benefits of a reduction in loss of supply events
Fri 5th Nov	**Market Structure & Procurement** - sharing thinking and gathering feedback on how DNOs might tender for RaaS, the potential participants in a scheme, and associated market arrangements that should underpin delivery

Today's session

RaaS
Resilience as a Service

Purpose

Introduce and invite feedback on the RaaS concept and project plans

Agenda

- Welcome & housekeeping
- Scene setting
- Overview of the RaaS project
- Key Phase 1 conclusions
- Questions & comments

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RaaSintro

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What type of stakeholder are you ?

ⓘ Start presenting to display the poll results on this slide.

Scene setting

Scottish & Southern Electricity Networks

SSEN and Innovation

Scottish & Southern Electricity Networks

SHEPD

780,000
homes and businesses connected

49,000 km
overhead lines and underground/subsea cables

SEPD

3.1m
homes and businesses connected

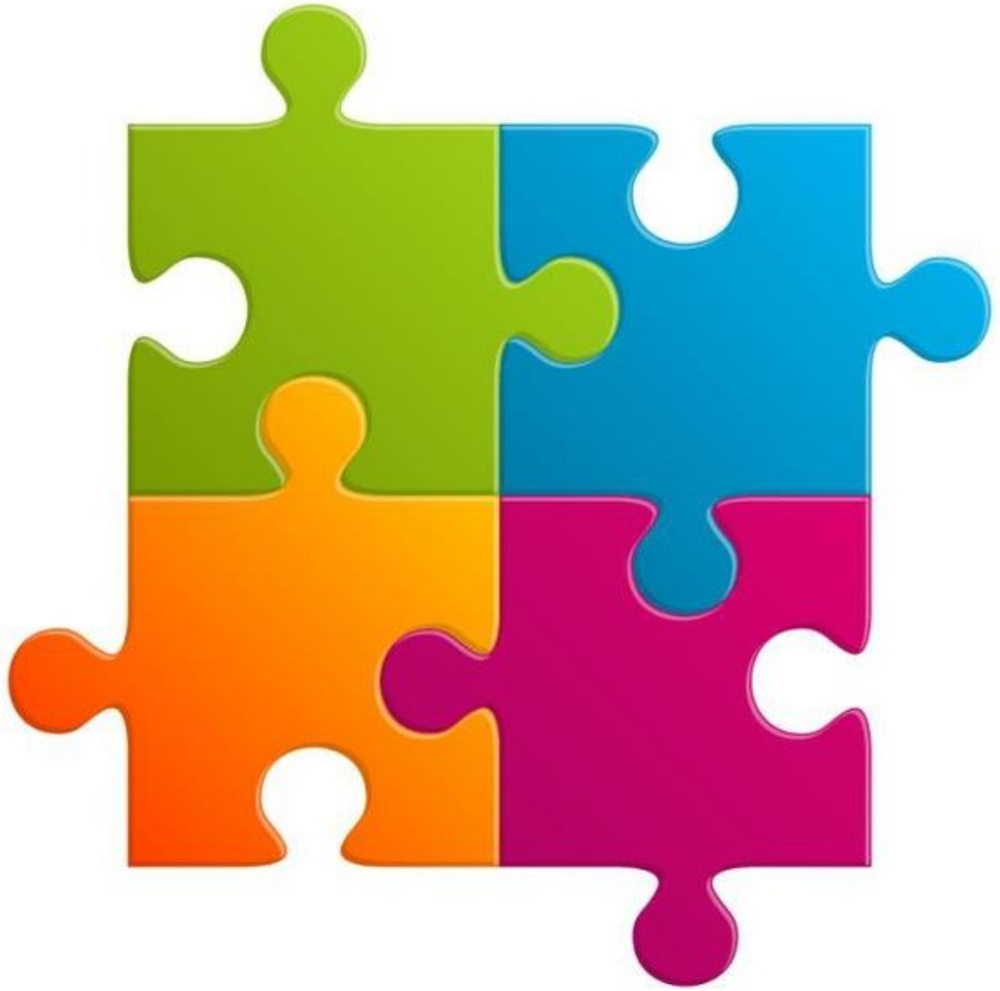
78,000 km
of overhead lines and underground/subsea cables

SSEN is part of SSE, a UK-listed company that operates across the energy sector and its activities and investments contribute £7.7bn to the UK economy every year. We are Fair Tax Mark and Living Wage accredited, showing our commitment to pay the right level of tax at the right time and to ensure fair pay through our supply chain. SSE has set out four Sustainable Goals to achieve by 2030,of which SSEN will play a significant part in delivering.

Innovation & Collaboration

RaaS
Resilience as a Service

Sharing learning between innovation projects and initiatives



Innovation & Collaboration

RaaS
Resilience as a Service

Local Energy Oxfordshire

NORTHERN POWERGRID

- Microresilience

transition
Moving to a smart future

Distributed ReStart
Energy restoration for tomorrow

electricity north west

- Value of Lost Load

ena
energynetworks association

- Open Networks

Scottish & Southern Electricity Networks

- EV readiness, E-Tourism, LEVEL
- Heat strategy

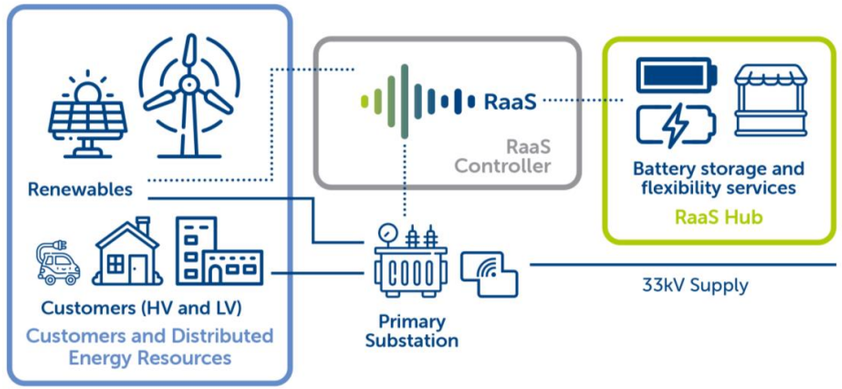
Overview of the RaaS project

Scottish & Southern Electricity Networks

RaaS - Project Overview

RaaS Concept

Providing resilience to the downstream network utilising local energy storage and generation resources to restore supply in the event of a fault



Deployment Potential

Following successful trial, 114 potential sites identified across GB

Project Objective

Develop and demonstrate the delivery of local network resilience through services procured from Distributed Energy Resources

Where did the idea come from?

Established from the joint industry call for ideas
- strong interest from WPD, UKPN and SPEN

Why now?

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

What benefits will it deliver?

Potential financial benefit of £146m by 2050 with deployment across GB in addition to improved service to local communities

Budget & Funding

£10.9m Network Innovation Competition funded project

Project Partners

RaaS
Resilience as a Service

P13 application in energy market

Bringing best practice from cross sector

Recognising and resolving tensions between the parties

Most opportunity to benefit

Lead the way in terms of flexibility

Experience working collaboratively on large network projects

Best value for money for demonstrator

Reduce technology risk

Understands DNO painpoints

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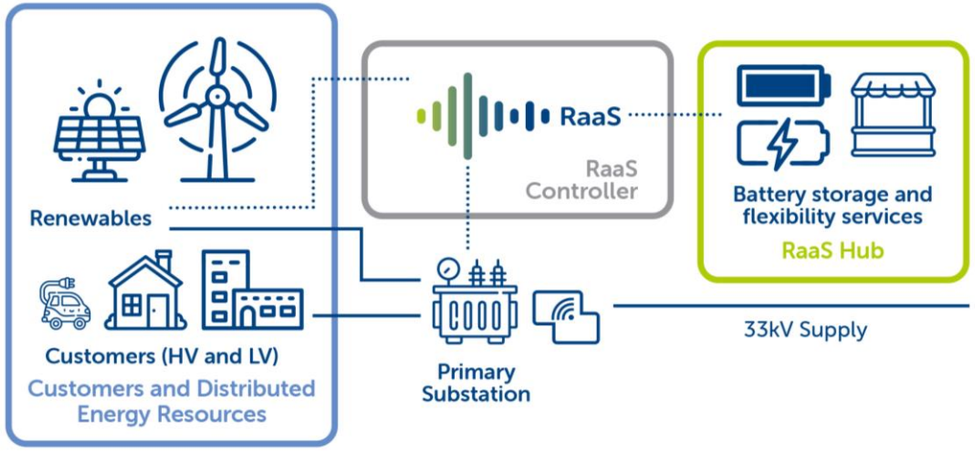
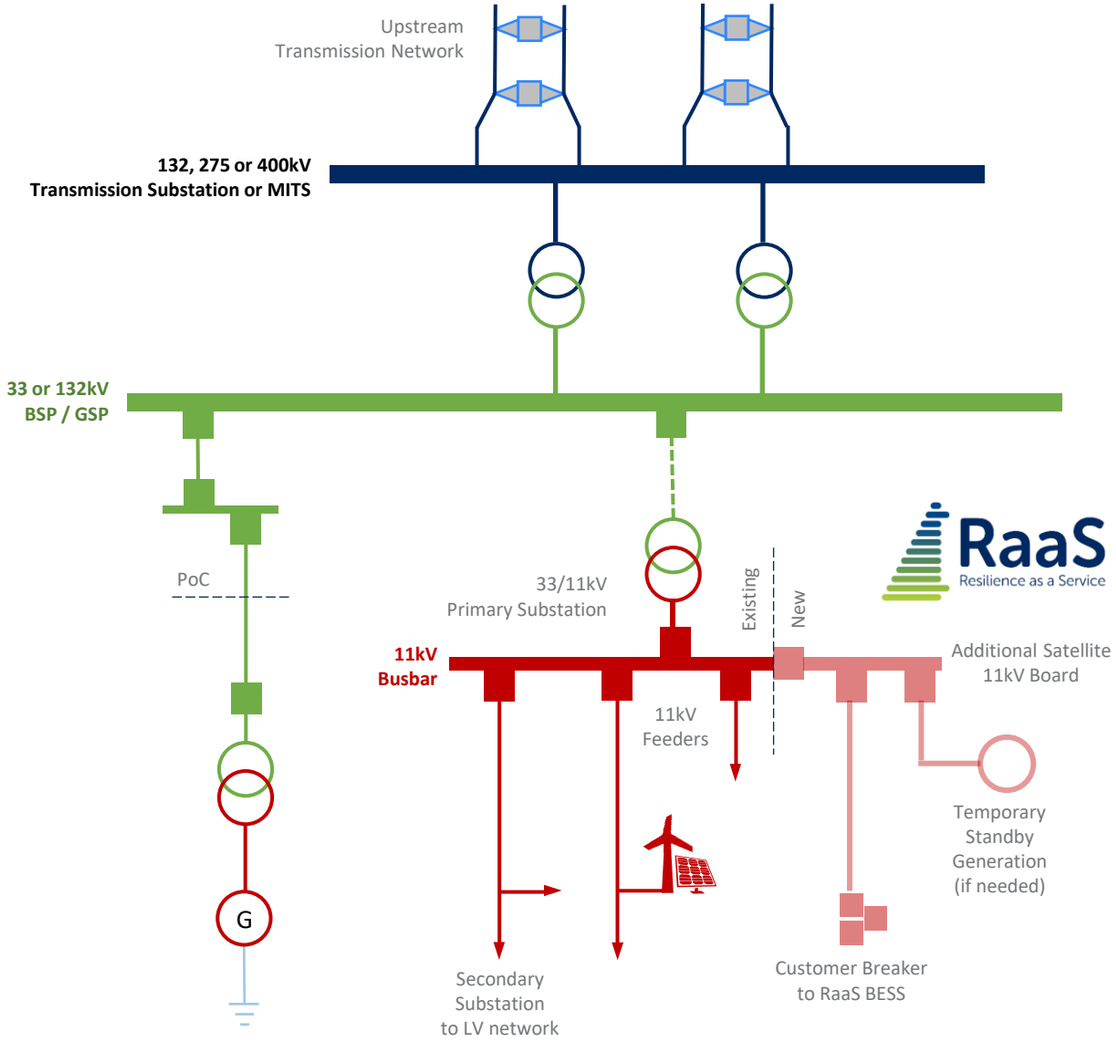
Stakeholder Advisory Board Members

- BEIS
- Citizens Advice
- ENA
- Minginish Community Council
- National Grid ESO
- Northern Powergrid
- Ofgem
- Scottish Government
- Sustainability First

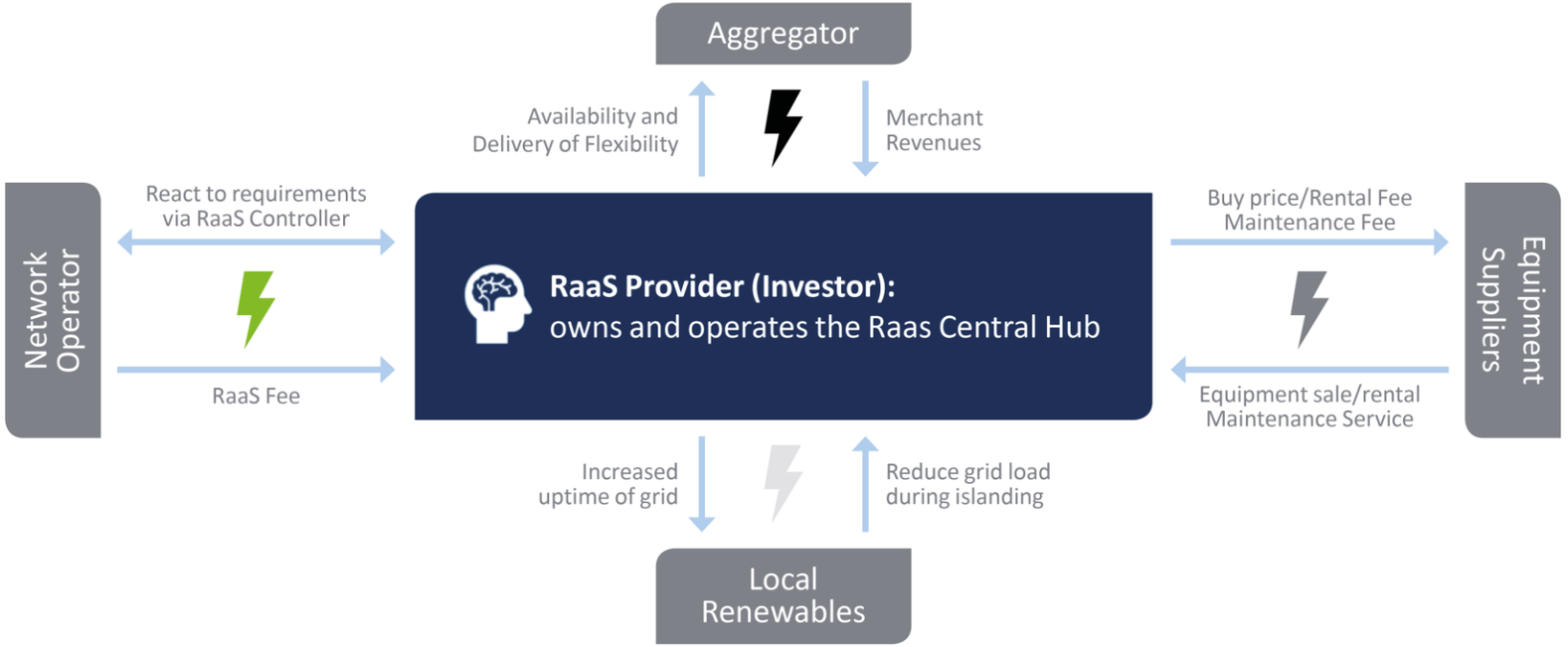
RaaS Technical Solution





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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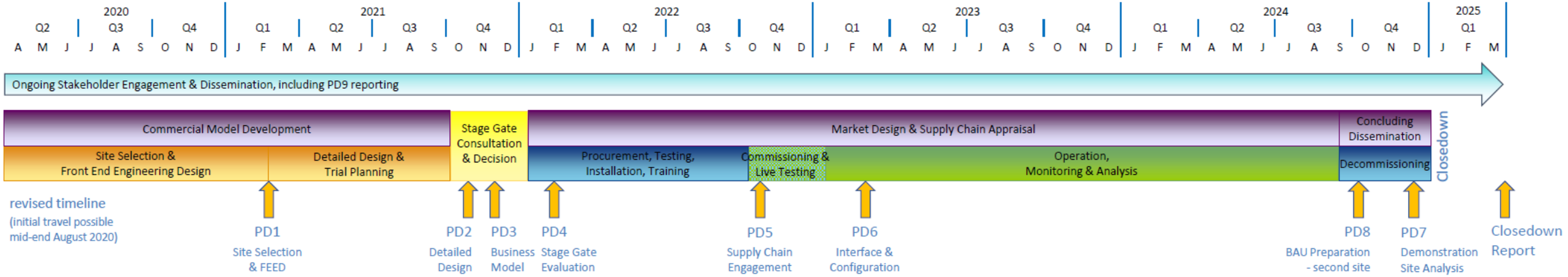
Project Timeline

RaaS
Resilience as a Service

RaaS Timeline - indicative dates



Stage Gate

after the detailed design and before construction

Stop, **Modify** or **Proceed**

- ✔ Check for continued alignment with the open Networks Project ad industry
- ✔ Incorporate learnings from other relevant projects
- ✔ Consider wider policy and regulatory issues
- ✔ Refine the cost, risks and programme for trial deployment
- ✔ Review the business case

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Project Work Packages

RaaS
Resilience as a Service

Work Package	Title	Lead Project Partner
WP1	Project Coordination	Costain
WP2	Front End Engineering Design	E.ON
WP3	Detailed Design	E.ON
WP4	Planning for Operational Commercial Optimisation	E.ON
WP5	Business Model	E.ON
WP6	Supply Chain Engagement	Costain
WP7	Demonstration Site Construction & Operation	SSEN
WP8	Dissemination	Costain

WP2 - Front End Engineering Design

E.ON - *close collaboration with SSEN*

- Site assessment and selection report - E2a.1, E.ON
- FEED report - E2a.2, E.ON

"Many thanks for making the RaaS FEED report available to us. It strikes me as a helpful document that sets out the thorough engineering work undertaken so far."

"it's a very comprehensive report and an exciting project … looking forward to seeing how the system will be tested and eventually deployed"

"The project is very exciting … the level of detail was certainly there regarding operation, protection and hierarchy of command protocol"
"I look forward to the follow up documentation"

"There are parallels with the ESO's Distributed ReStart project, but these are overlaps not duplications. Both projects are timely and relevant to addressing the Net Zero challenge and I would expect there to be mutual benefits."

"Congratulations, I can see a lot of good work is being put into the RaaS project"

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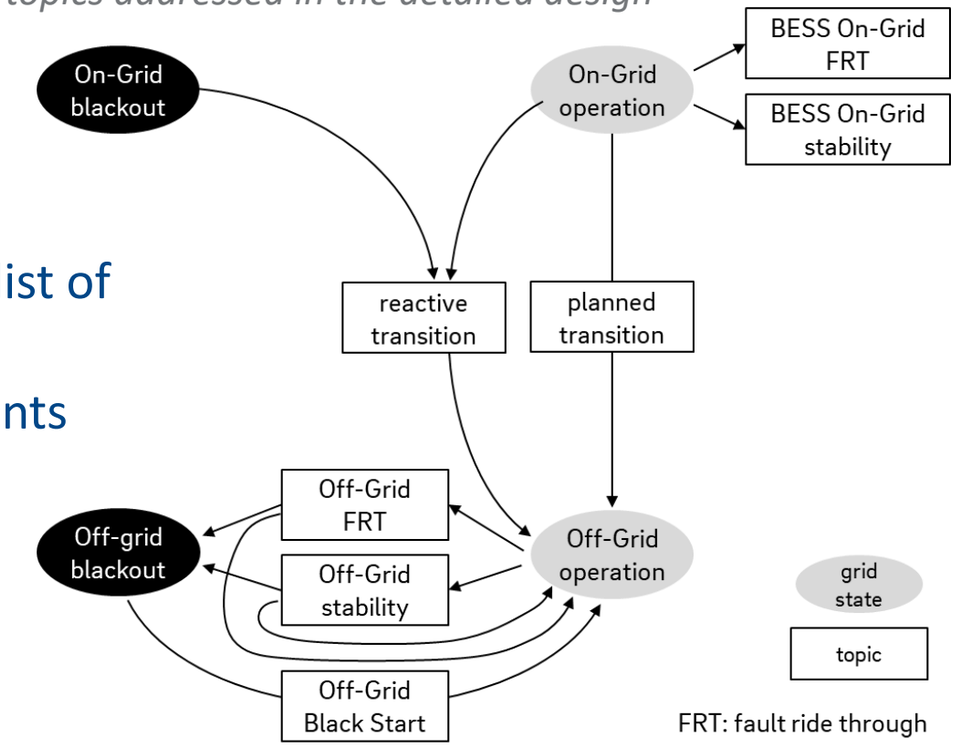
WP3 - Detailed Design

topics addressed in the detailed design



E.ON

- Request for Information - identification and qualification of longlist of potential suppliers for BESS components - E3a.1, E.ON
- Identification of selected shortlisted suppliers for BESS components - E3a.2, E.ON
- Request for Proposals - functional requirements for BESS components & functionalities - E3a.3, E.ON
- RaaS BESS Detailed Engineering Design report - E3a.4, E.ON

SSEN

- Detailed DNO Scheme Design for the Selected Trial Site (SWP3) - SGS
- Modelling and Feasibility Studies on the RaaS Concept Applied at Primary Substation Level (SWP1) - WSP
- Modelling of the Inrush Currents Experienced During a RaaS Black Start Operational Scenario (SWP2) - WSP
- Detailed Protection and Control Settings Study for the Selected Trial Site (SWP4) - WSP
- PoW Switching Studies - Enspec

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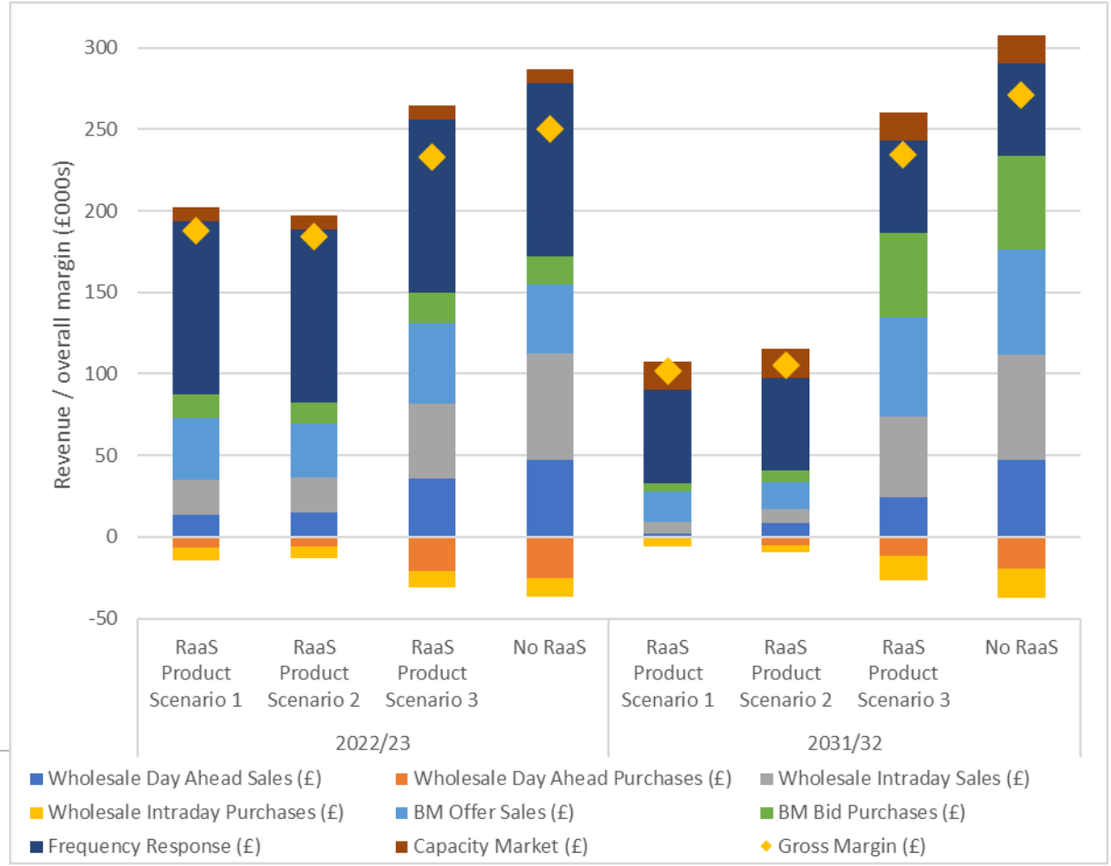
WP4 - Planning for Operational Commercial Optimisation

E.ON

- Future scenarios for flexibility markets in which the RaaS battery system can be optimised
  - E4.1, E.ON
- Commercial optimisation assessment for battery operation at the RaaS trial site and a generic site
  - E4.2 & E4.3, Cornwall Insight & E.ON
- analysis carried out using Cornwall Insight's Storage Asset Optimiser model
  - Wholesale trading
  - Balancing Mechanism
  - Frequency Response
  - Capacity Market



WP5 - Business Model

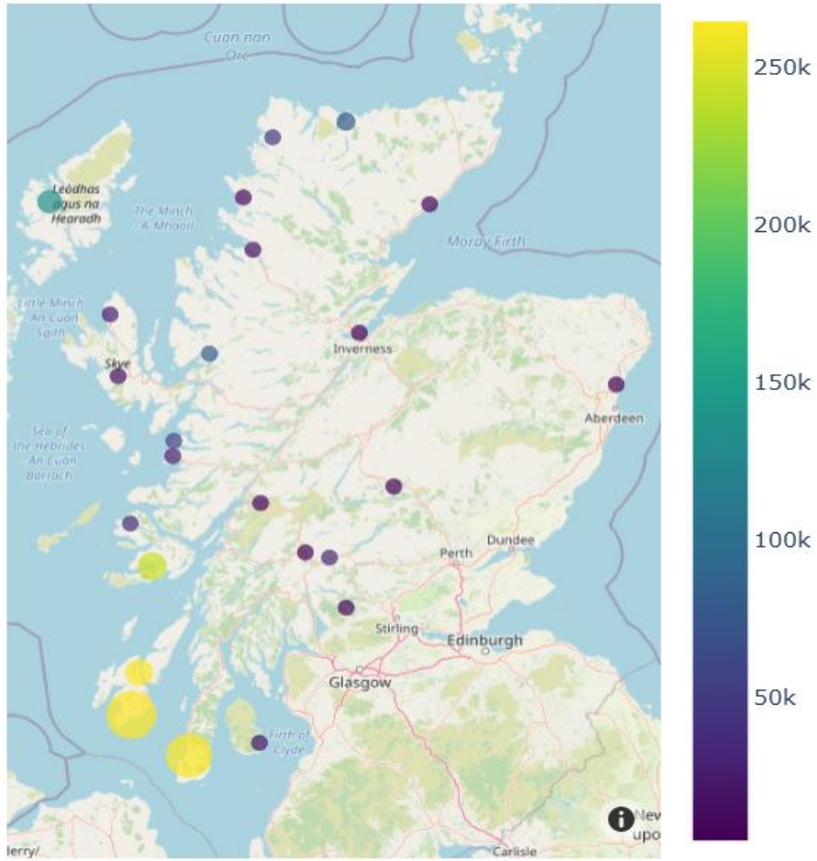
SSEN

DNO Business Case Update (SWP5) - TNEI

- Develop and evaluate methodologies for valuing RaaS services
- Develop and evaluate payment structures for RaaS
- Identify options for forecasting within RaaS services
- Review the original project business case

E.ON

- Investor business case modelling methodology - E5.1, E.ON
- Investor risk evaluation - E5.2, E.ON



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WP6 - Supply Chain Engagement

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Costain

- Investigation into the wider potential of RaaS - C6.1, Costain
- Risk evaluation for RaaS roles and suggested procurement strategies - C6.2, Costain
- stakeholder engagement contributing to market analysis and flexibility markets assumptions - inc. DNOs, NG ESO, the ENA Open Networks project

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To what extent do you think RaaS will benefit customers in remote or rural locations ?

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Key Phase 1 conclusions

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Chosen Trial Site - Drynoch

positive stage gate decision → demonstration scheme at Drynoch primary substation on the west coast of Skye

Selection criteria:

- potential benefits of the solution for the local area
- suitability for meeting project objectives
- practicality of delivery and operation within project timeframes and budget
- technical design and integration

Chosen Trial Site - Drynoch

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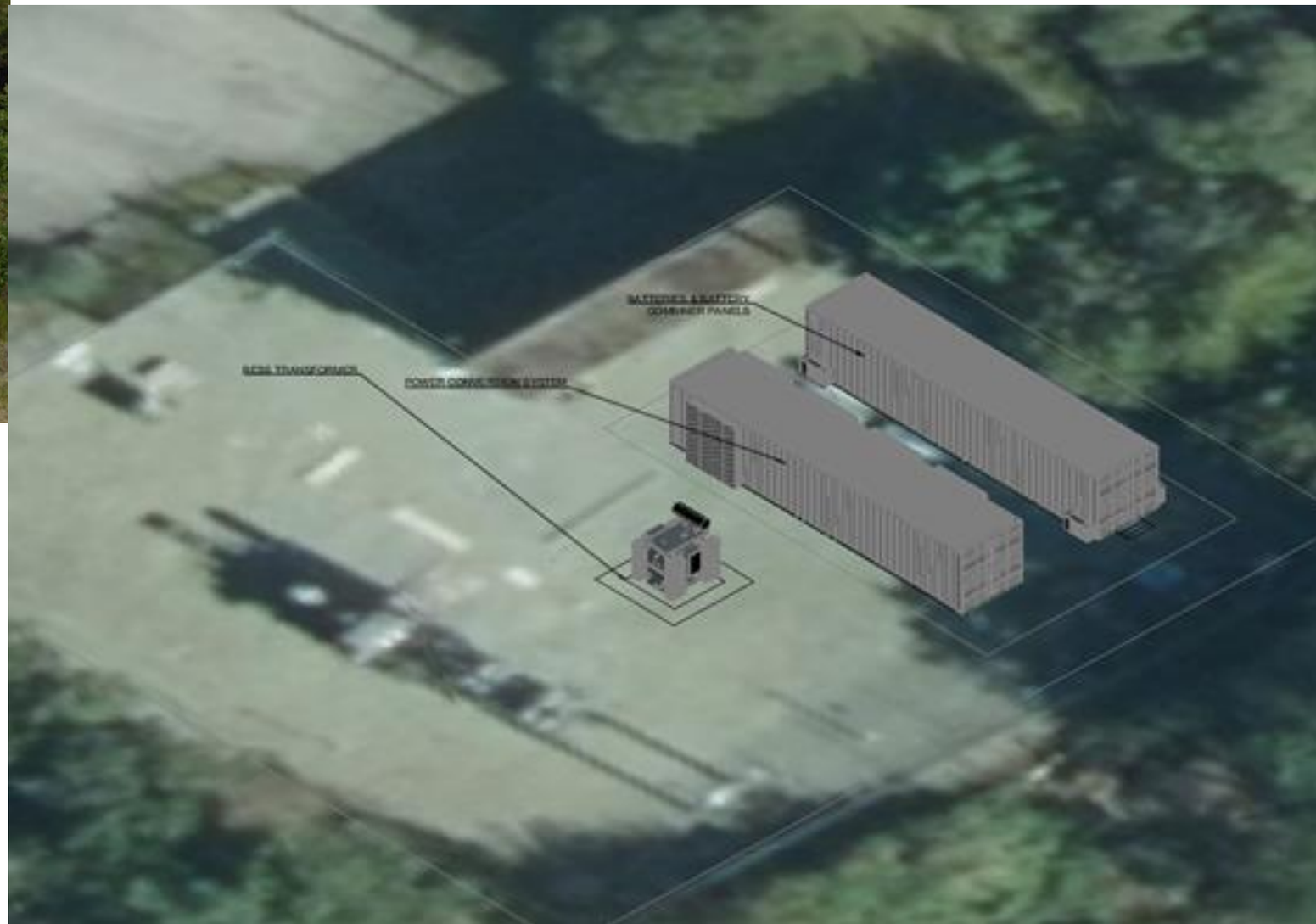
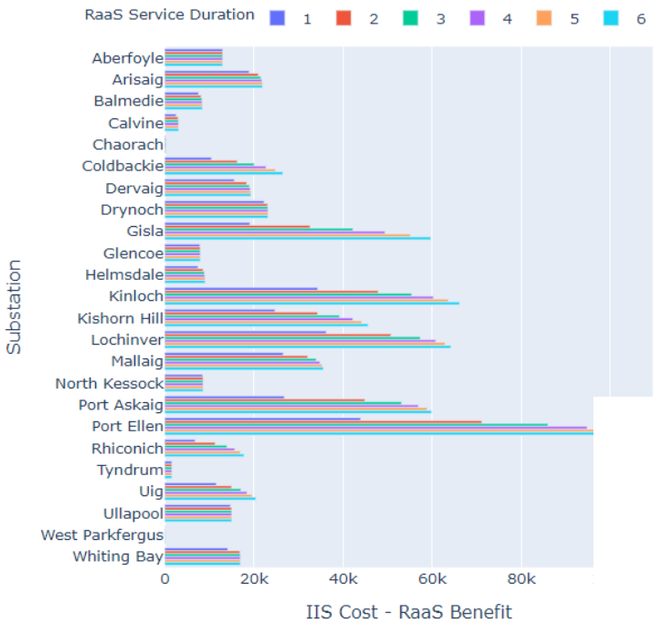
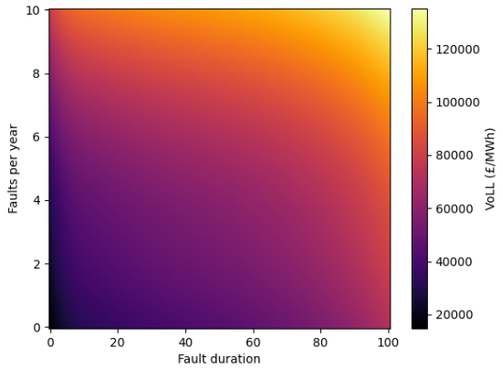
Chosen Trial Site - Drynoch

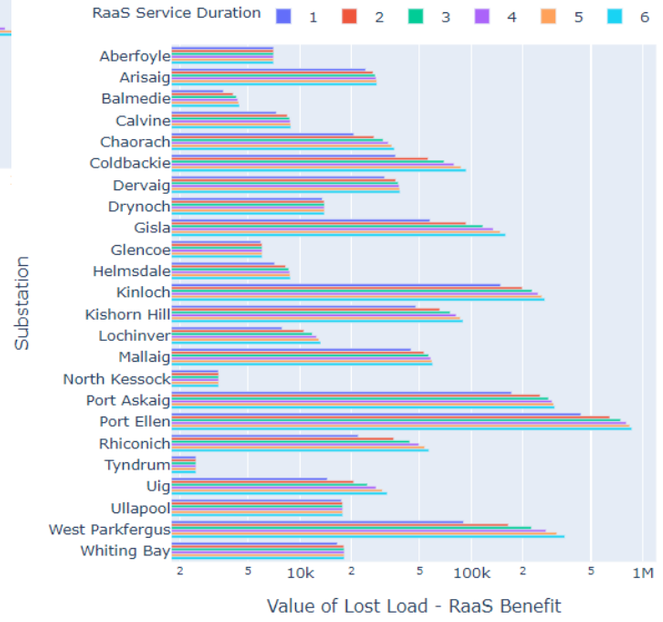
Chosen Trial Site - Drynoch



Business Case - DNO valuation







TNEI methodology

- derive probability distributions inferred from historic data for each site
  - no. faults, duration of faults
- use Monte Carlo simulation to sample randomly from the modelled distributions of frequencies and durations
- 'apply' the RaaS solution to reduce the duration
  - 1 to 6 hr service durations considered
- use the number and duration of faults to determine the associated cost with & without RaaS
  - both VoLL and CI/CML assessments
- repeat this process over a specified number of iterations (e.g. 10,000) to create output probability distribution curves for the potential cost of interruptions/RaaS saving at each site

Drynoch, 4 hr duration service	
CI (sim)	1,166
CML (sim)	284,000
IIS value	£23.15k p.a.
VoLL	£13.9k p.a.

Kinloch, 4 hr duration service	
CI (sim)	1,593
CML (sim)	133,400
IIS value	£60.3k p.a.
VoLL	£244.97k p.a.

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Business Case - RSP revenue stacking

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4.2MW/4.2MWh BESS - Cornwall Insight ‘Central’ price scenario, 1.98MVA import/3.02MVA export limits

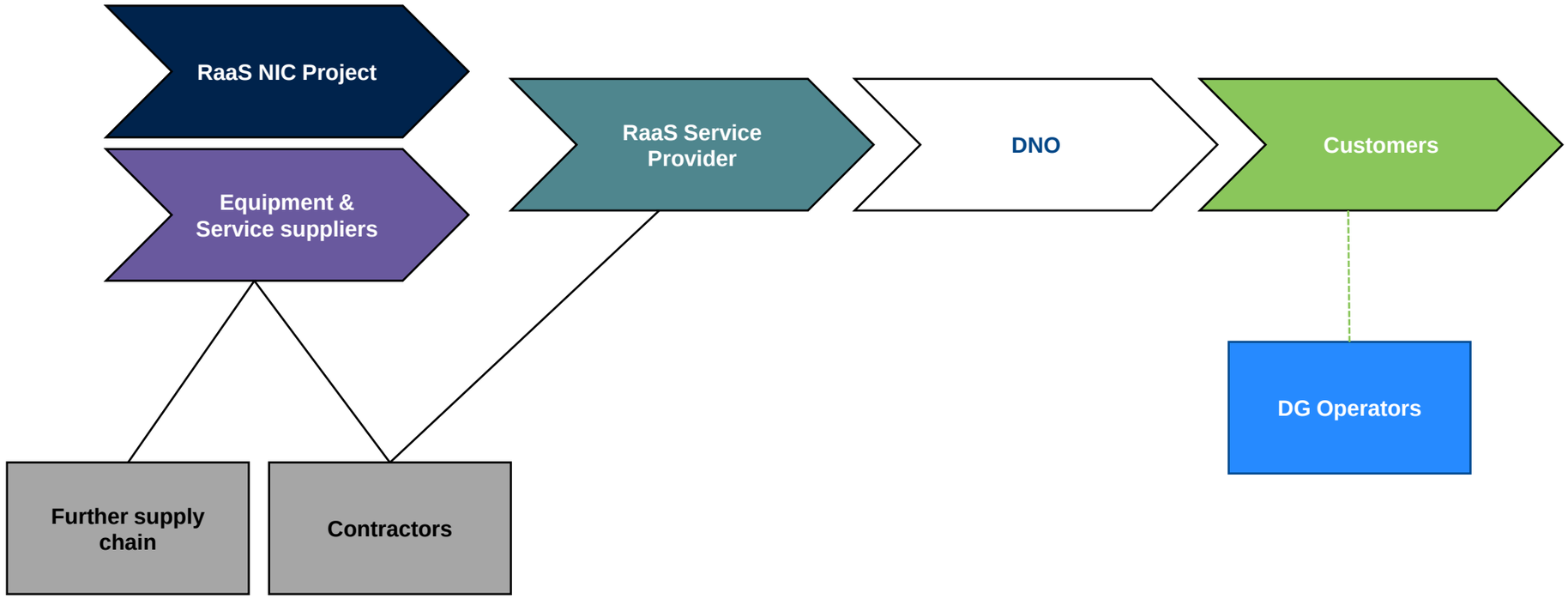
Scenario	No RaaS	1 (Seasons)	2 (EFA Blocks)	3 (Dynamic)
total - 10 yr	£ 1,579,019	£ 481,322	£ 453,760	£ 1,272,382
average p.a.	£ 157,902	£ 48,132	£ 45,376	£ 127,238

4.2MW/5.8MWh BESS - additional capacity for use in Flexibility Markets

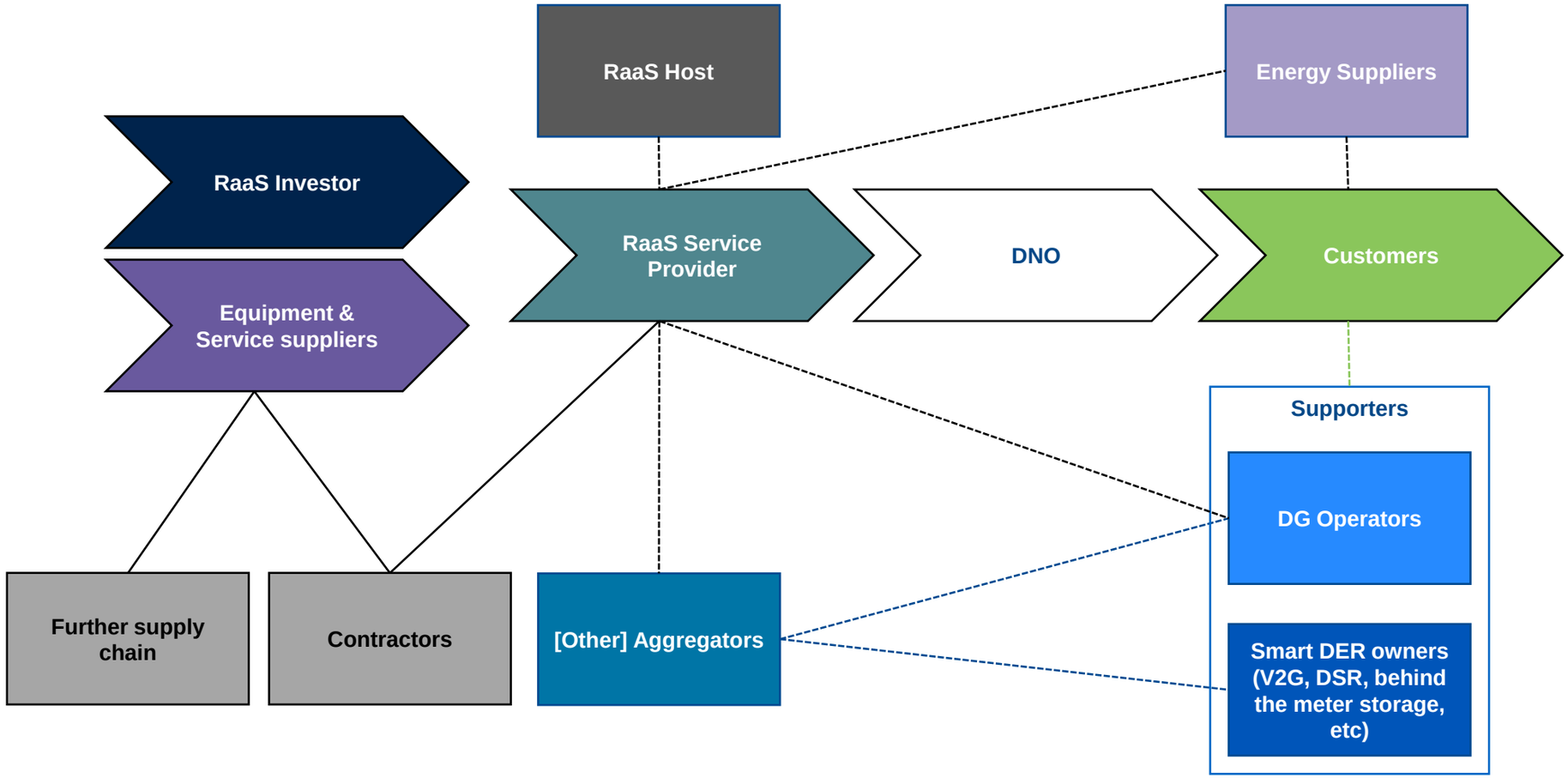
Scenario	No RaaS	1 (Seasons)	2 (EFA Blocks)	3 (Dynamic)
total - 10 yr	£ 1,988,347	£ 1,320,157	£ 1,301,208	£ 1,615,738
average p.a.	£ 198,835	£ 132,016	£ 130,121	£ 161,574

‘Optimisation Assessment for RaaS Battery Operation’ report (E4.2 and E4.3)

Market Structure



Market Structure



Potential Evolution

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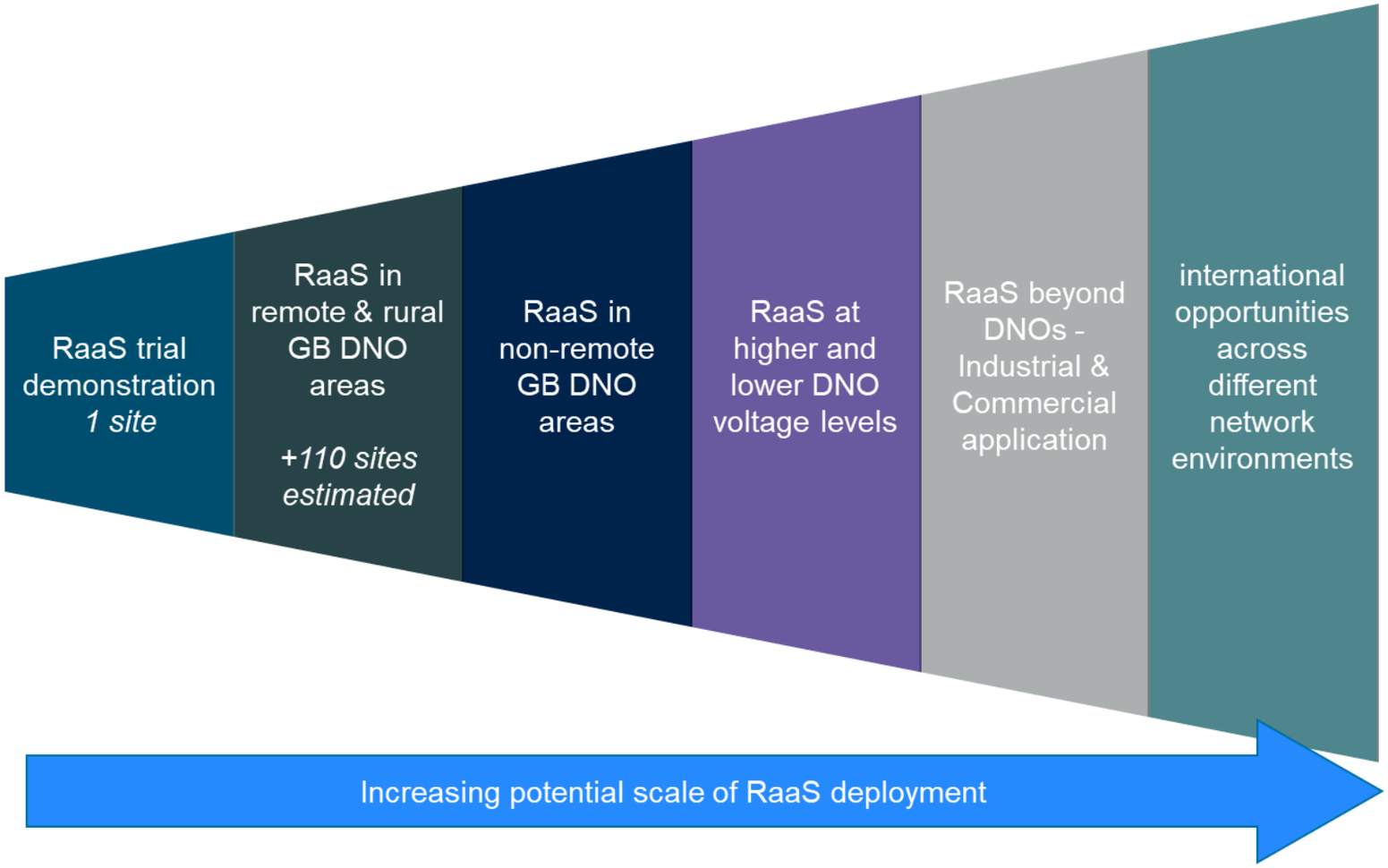

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Wider Policy Context

The RaaS concept is well placed to support wider policy aims

- Scottish Government's recently published Local Energy Policy Statement - key principles and values to inform decisions of those participating in or developing local energy schemes, these support an inclusive energy transition centred on individuals and supported by strong collaboration at local community level www.gov.scot/publications/local-energy-policy-statement

- Electricity Engineering Standards Review - Independent Panel Report (for BEIS/Ofgem) - recommendations include a customer focused resilience standard, and a methodology to use distributed resources to supply customers in power islands under outage conditions https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/943685/Electricity_Engineering_Standards_Review.pdf

- National Infrastructure Commission report on infrastructure resilience - recommendations include using flexibility services to keep options open as energy demands change, and applying managed approaches to proactively and incrementally adapt https://nic.org.uk/app/uploads/Anticipate-React-Recover-28-May-2020.pdf

Progression to Phase 2

Factors that will provide additional drivers for RaaS and/or influence future costs

- SSEN ED2 WSC aspirations, similarly Ofgem expectations for service to vulnerable consumers (beyond consideration of VoLL or CIs/CMLs)
- external impact - avoiding the visual impact of an OHL (alternatively accepting the high cost of undergrounding)
- battery costs reducing - economies of scale, potential reuse of former EV batteries, etc.
- implementing RaaS using BESS assets installed for other purposes

acknowledging

- potential uncertainty over future ESO and/or DNO flexibility markets & associated values
- conventional reinforcement is permanent

2.5 OUR OVERALL RELIABILITY REGULATORY OUTPUTS

Table 9 below outlines the key Reliability outputs in our RIIO-ED2 business plan submission.

Table 9 – Our RIIO-ED2 Reliability Outputs

Output	Output type	RIIO-ED2 target	Costs
Reliability – Interruptions Incentive Scheme (IIS)	ODI-F	Reduce the frequency and duration of power interruptions by 20%.	£23.5m
Guaranteed Standards of Performance (quality of supply)	LC	We will minimise the number of customers experiencing an outage greater than 12 hours.	N/A
Reliability – Reduce number of Worst Served Customers	PCD	By 2028 we will improve the network performance for at least 75% of customers that are deemed worst served.[1]	£37.8m

LC - licence condition; PCD - price control deliverable; ODI – output delivery incentive (F – Financial, R = Reputational), SSE Networks (SSEN) Goal – company goal

Progression to Phase 2

Key points to explore during Phase 2

- proving the technical solution for fault response and local resilience
- approach to DNO requirements specification for procurement/tendering
  - inc. moving from the original concept of e.g. ‘meeting 90% of 4 hr faults’ to the concept of RaaS being a ‘locational signal’ for a battery, still cost effectively bringing benefits to customers
- 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
  - income from other flex. markets - to inform RSP battery sizing decisions (also RaaS fees), and ‘opt out’ decisions
- the implications of different RaaS fee structures - e.g. fixed / availability / utilisation payments
- developing our understanding of the supply chain for RaaS / other flexible solutions, and how this can be grown
- the potential for technical & flexibility market learning for other use cases

Next Steps

Stage Gate consultation activities

- stakeholder engagement - industry and community
- review of feedback
- discussion with the Stakeholder Advisory Board
- decision by the Project Steering Board
- detail the decision process & conclusions in ‘PD4 Stage Gate Evaluation’

Subject to a positive stage gate decision - Phase 2

- installation & operation of RaaS at the trial site
- further engagement to refine the concept

@10.30am

Wed 3 Nov	The RaaS Technical Solution
Thu 4 Nov	Business Case for DNOs & RaaS Service Providers
Fri 5 Nov	Market Structure & Procurement


Q & A
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Do you have suggestions for other things that may be of interest from Phase 2 ?

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Do you have any challenges to the RaaS concept or project plans ?

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Are you supportive of the proposal to proceed to the trial phase ?

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What word/s come to mind regarding the RaaS concept ?

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Q & A
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thank you

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Questions & comments welcome - RaaS@costain.com

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