

OUTER HEBRIDES WHOLE SYSTEM UNCERTAINTY MECHANISM

11th December 2023



Scottish & Southern
Electricity Networks



AGENDA

- Welcome and introductions
- Setting the Scene
- Recent insights – DFES Analysis
- Our proposed way forward
- Next steps





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What statement best describes your approach buying gifts for Christmas?

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SETTING THE SCENE

SSEN OVERVIEW

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

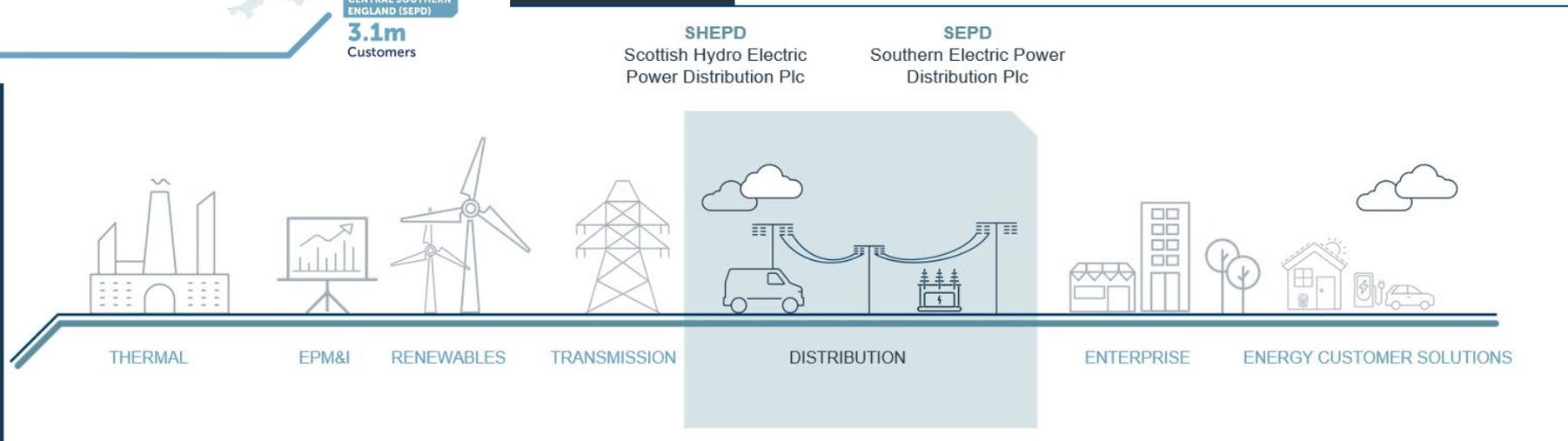
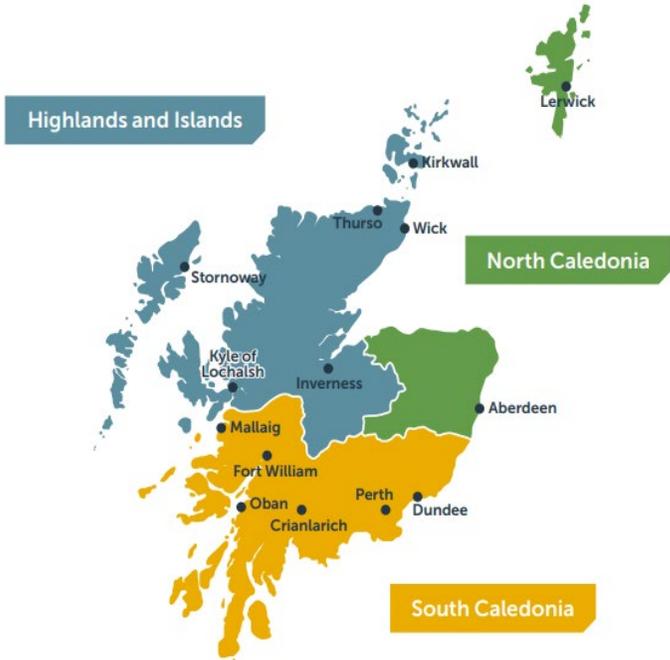
Over **4,100** employees across the country



Figures as at October 2023

SHEPD overview

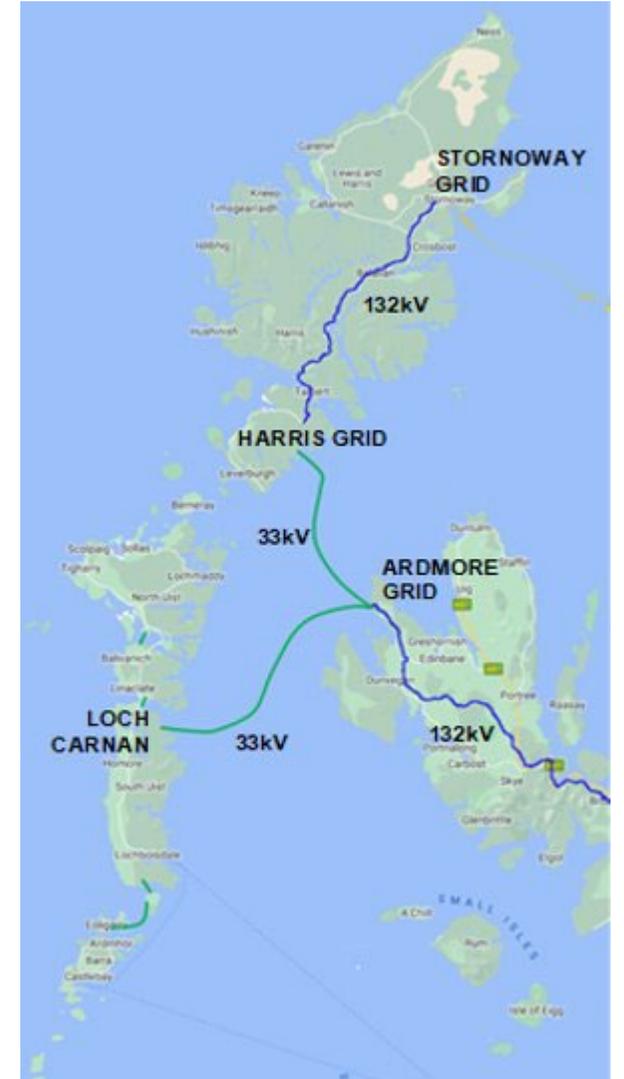
- Underground cables**
18,943km
- Overhead lines**
30,209km
- Customers**
782,787
- PSR customers**
177,823
- Island communities**
60 islands served by 111 subsea cables





HOWSUM RECAP

- The Hebrides and Orkney Whole System Uncertainty Mechanism (HOWSUM) provides SSEN with a funding route to improve the capacity, reliability and resilience of these key island routes.
- This needs to be supported by strategic analysis looking at future whole system requirements out to 2045.
- At our last webinar we introduced our work on the Outer Hebrides, the drivers for our work, and our proposed approach and next steps.
- We also offered the opportunity for bilateral conversations with either ourselves or Regen who are working with us to understand the future island needs for the Outer Hebrides.



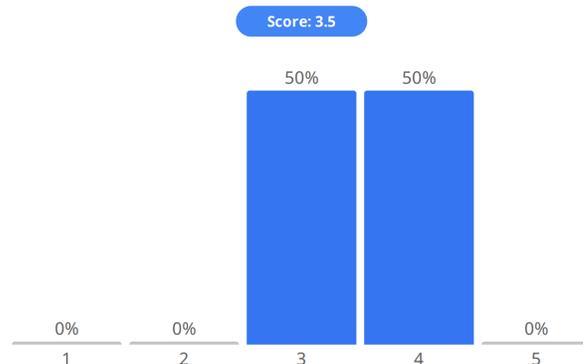


WEBINAR FEEDBACK

- You were broadly supportive of our intended approach to consider future long-term needs whilst delivering urgent requirements quickly.
- The potential for both network reinforcement and storage technologies was supported, potentially in combination. We will be looking further into this option in 2024. We will also explore the role of community options as part of this work.
- You also told us we need to consider the future plans for businesses and communities on the Outer Hebrides and we have held a number of bilateral discussions with key stakeholders.

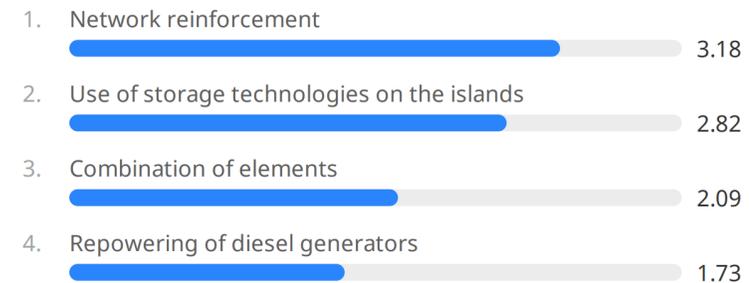
How do you feel about the following statement "SSEN has the right approach to delivering urgent requirements whilst taking a whole system view".

0 1 0



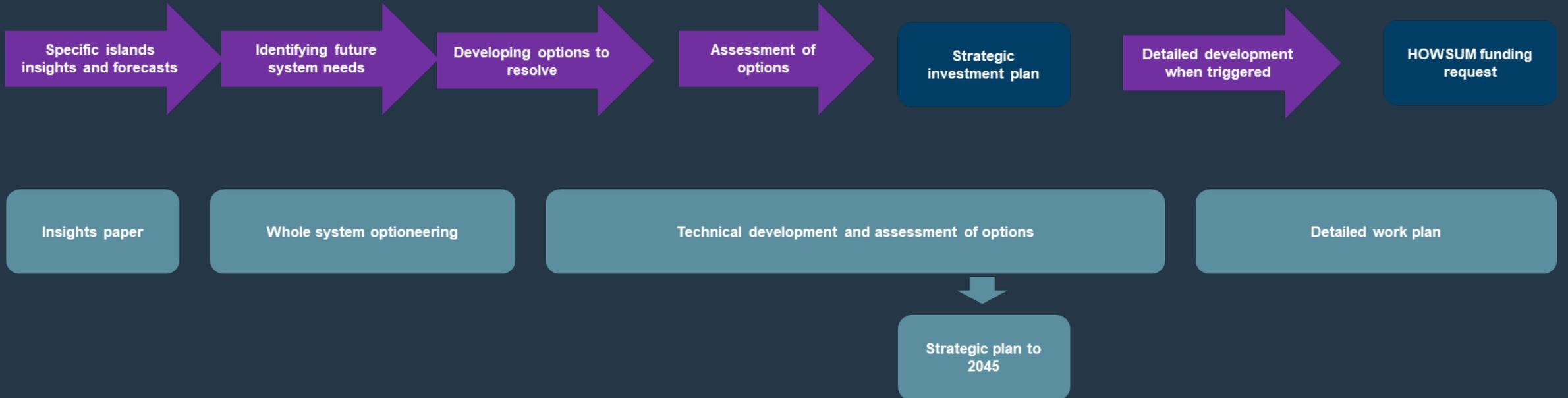
Thinking about the options under consideration for the long term resilience of the Western Isles, please rank them in order of preference.

0 1 1





HOWSUM PLANNING PROCESS





RECENT INSIGHTS

Future electricity load growth on the Outer Hebrides – analysis to support HOWSUM

Ray Arrell

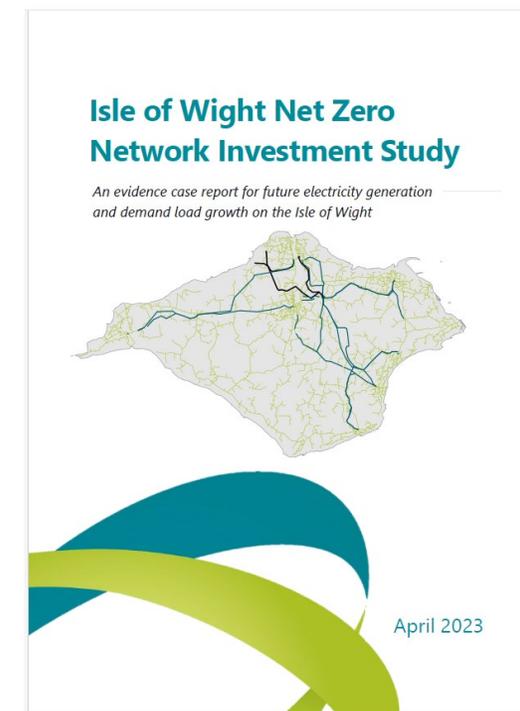
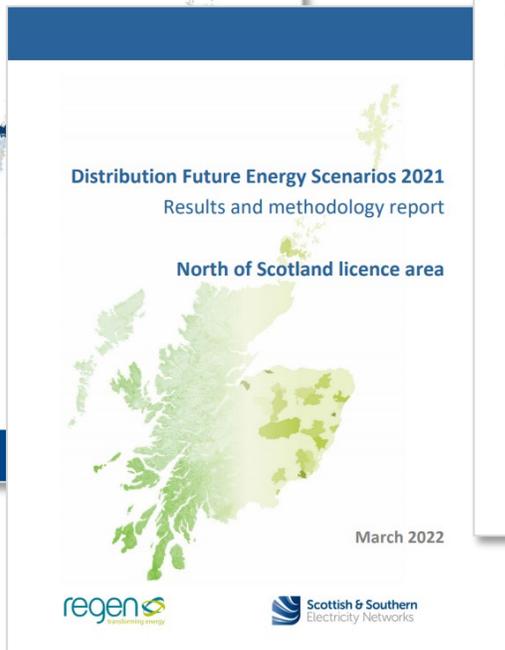
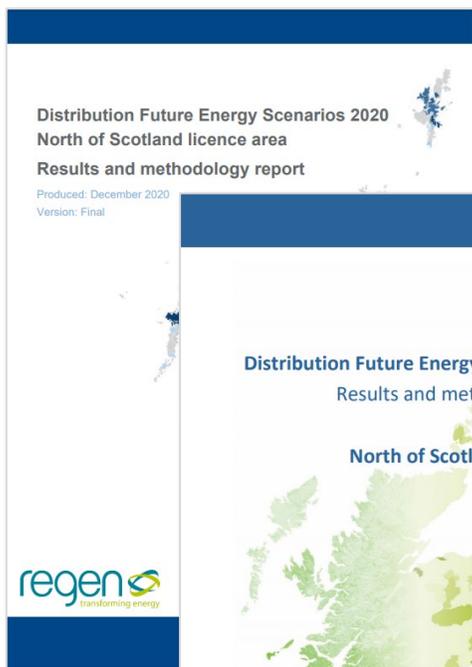
Head of Future Energy Systems, Regen

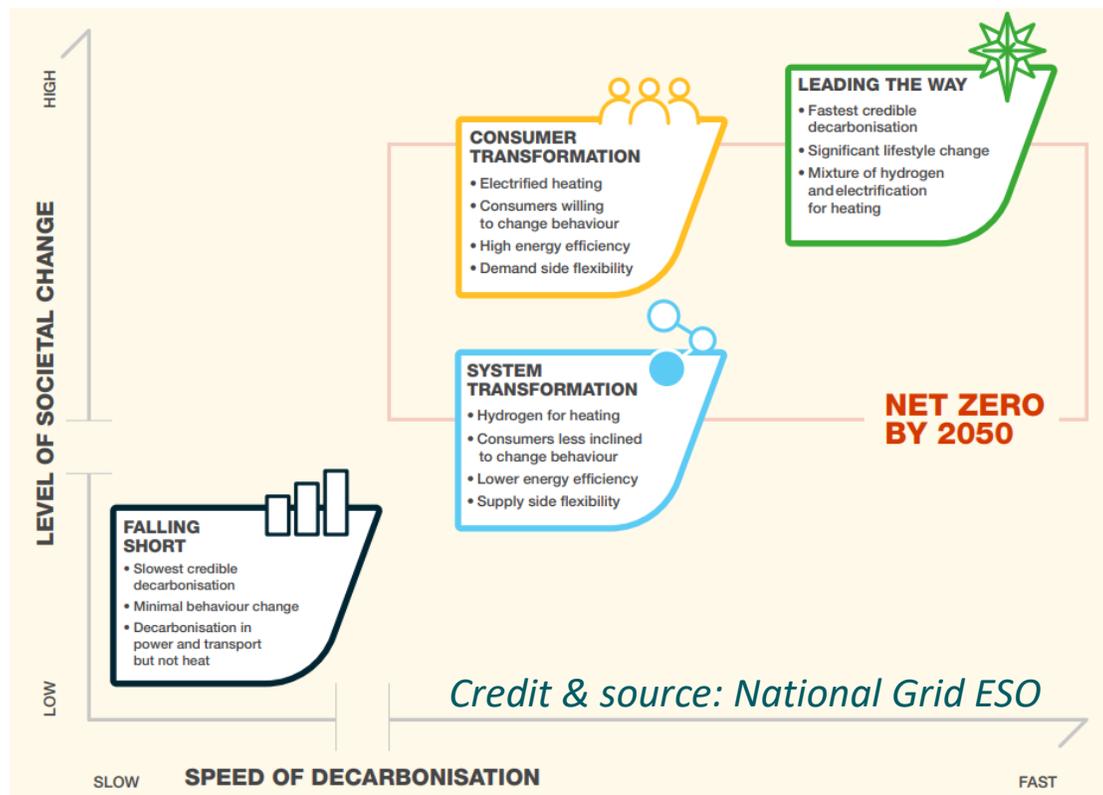
December 2023



SSEN Distribution Future Energy Scenarios

Regen has been supporting SSEN with their long-term load forecasting since 2017/18 through DFES Research, engagement, analysis and modelling to produce long-term load growth projections to 2050 For SHEPD and SEPD, annual DFES report and accompanying dataset issued to SSEN Network Planning Supported SSEN's wider work on ED2 business planning and uncertainty mechanism re-openers (Isle of Wight)





How does DFES use the FES?

- 1) DFES adopt the same scenario framework, building blocks and key assumptions
- 2) For some technologies DFES uses the FES regional view data for its top-down distribution
- 3) For other technologies DFES uses the FES to provide a benchmark for regional scenario projections
- 4) For all technologies Regen provides a reconciliation back to the FES highlighting differences
- 5) Feedback to the FES team which has helped to improve alignment over time.

The DFES adopts the **National Grid ESO annual FES** as its overarching framework and long-term projections.

But... Regen develops bottom-up local evidence driven projections for each technology and then reconciles these to the FES at GSP level.



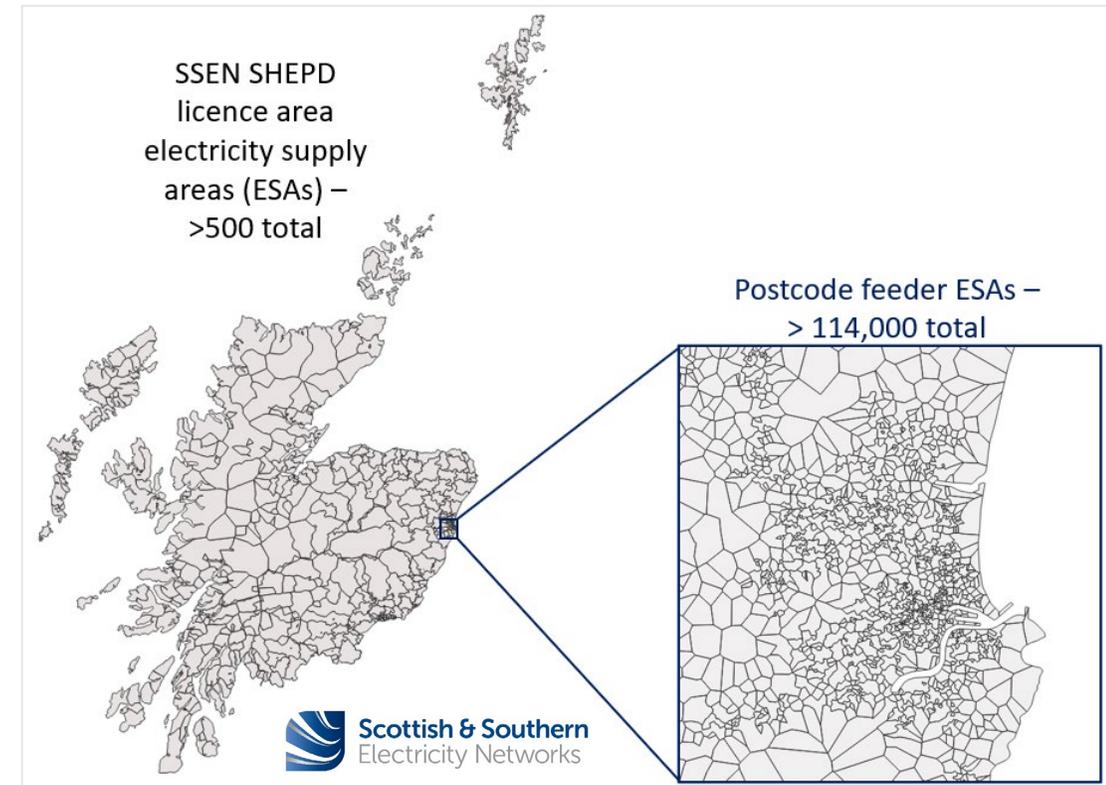
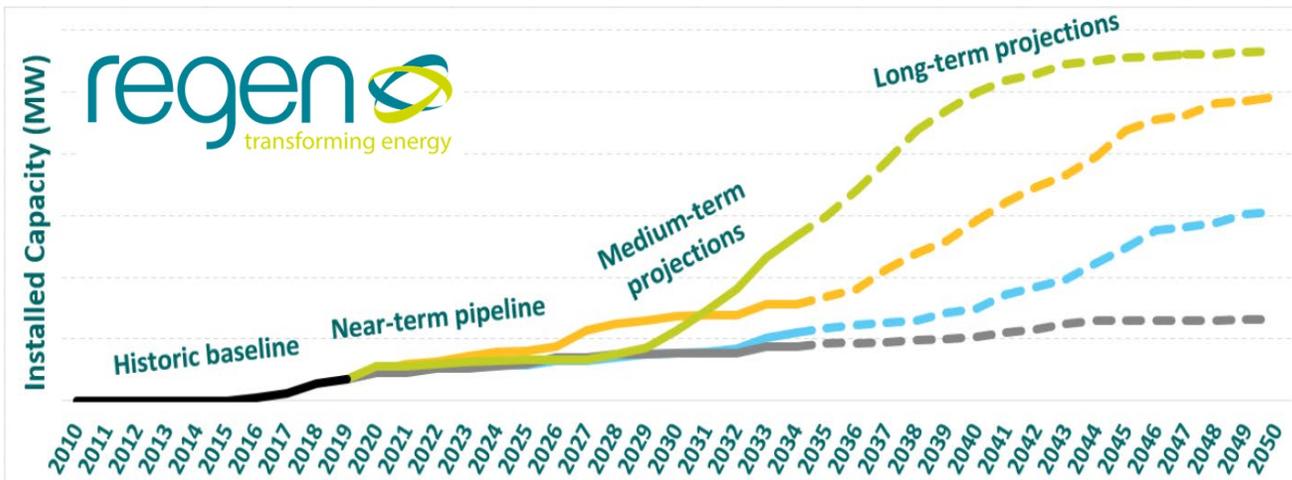
Credible net zero compliant scenario that has been adapted to most directly reflect Scottish policy ambition for SHEPD analysis

DFES modelling method at a high level

The **DFES** follows a four-stage process where, for each of the technologies in-scope, we:

1. Determine the historic, existing **baseline** (operational projects)
2. Assess the **near-term pipeline** (connection offers/planning applications)
3. Develop **medium and long term projections** out to 2050
4. Geographically **distribute** these technologies/capacities within the licence areas

MW capacity
No. of
m² floorspace



Technology building blocks – disruptive load growth

Distributed electricity generation and storage technologies connecting at/above 11kV



Renewable energy generation technologies

Fossil fuel generation technologies



Battery storage

Waste-driven energy generation technologies



Other electricity storage technology

Key low carbon technologies and new disruptive sources of future electricity demand



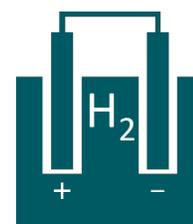
Electric vehicles



Electric vehicle chargers



Domestic rooftop solar



Hydrogen electrolysis



Electric heating and cooling technologies

New property developments

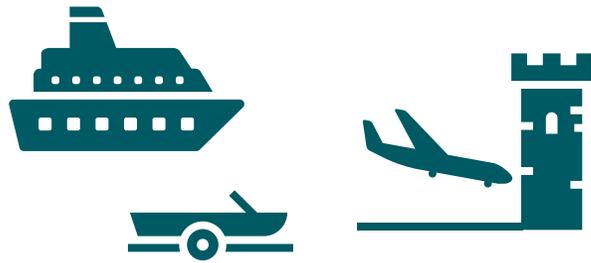


New homes / domestic developments

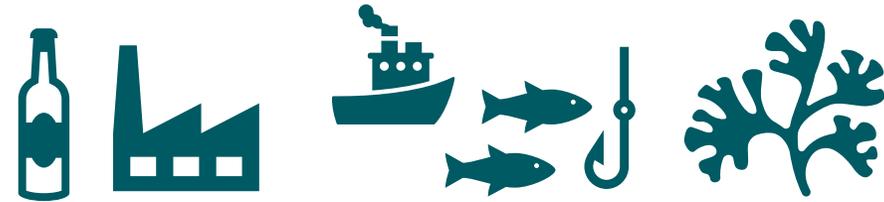


New non-domestic developments

Non-road transport



Local industry decarbonisation



Offshore wind industry



Local authority plans & developments



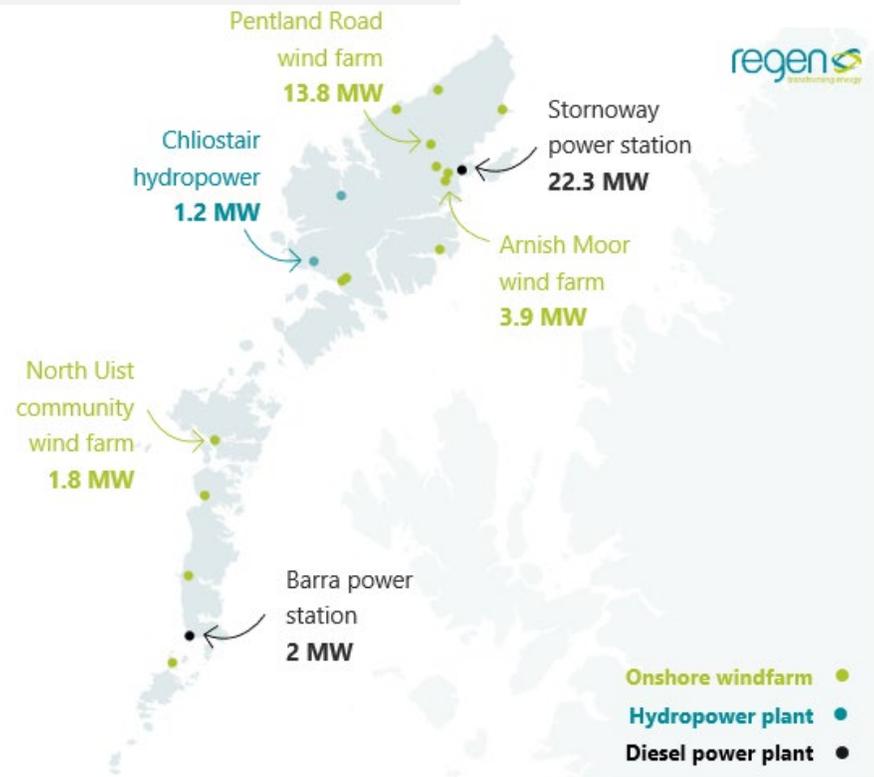


FUTURE ELECTRICITY LOAD GROWTH OUTER HEBRIDES – BY SECTOR

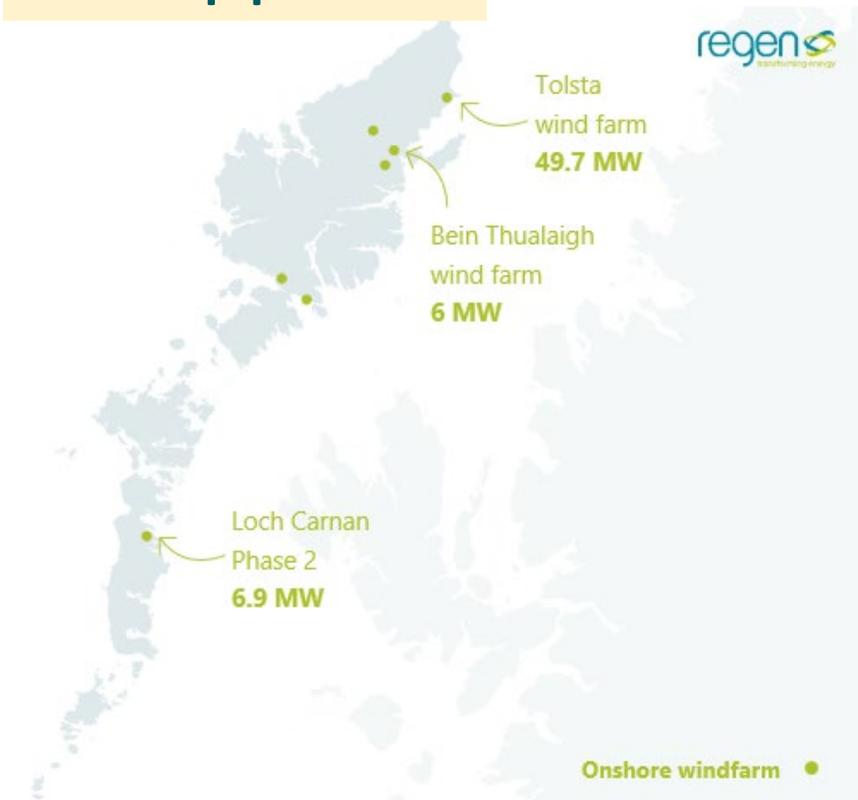
Distributed renewable generation – baseline & pipeline

Generation technology	Number of installed sites	Installed capacity (MW)	Number of pipeline sites	Pipeline capacity (MW)
Fossil fuel diesel backup	2	24.3	0	0
Hydropower	2	1.9	0	0
Onshore wind	15	40.1	7	76.2
Total	29	66.3	7	76.2

Current baseline

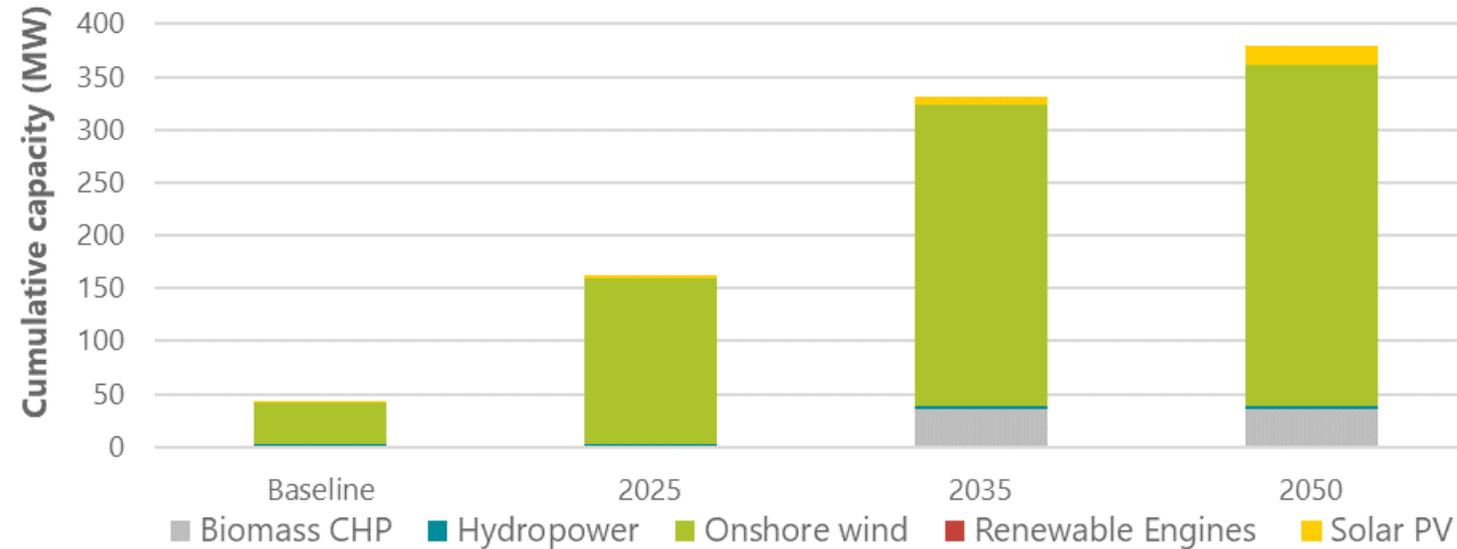


Known pipeline



DFES 2022 renewable generation projects for the Outer Hebrides

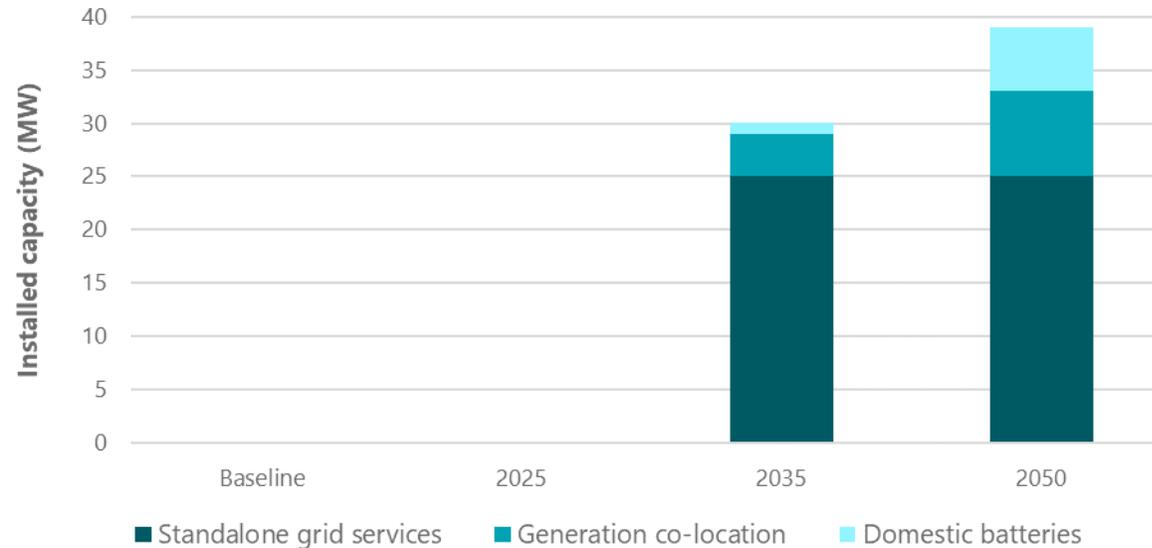
Scenario: **Consumer Transformation**



- Strong renewable energy resources
- Strong policy support from Scottish Government and Comhairle nan Eilean Siar
- Potential repowering of existing operational wind farms (5-16 yrs old)
- *Transmission HVDC link – 300 MW Stornoway Wind Farm and offshore wind*

DFES 2022 battery storage assets on the Outer Hebrides

Scenario: **Consumer Transformation**

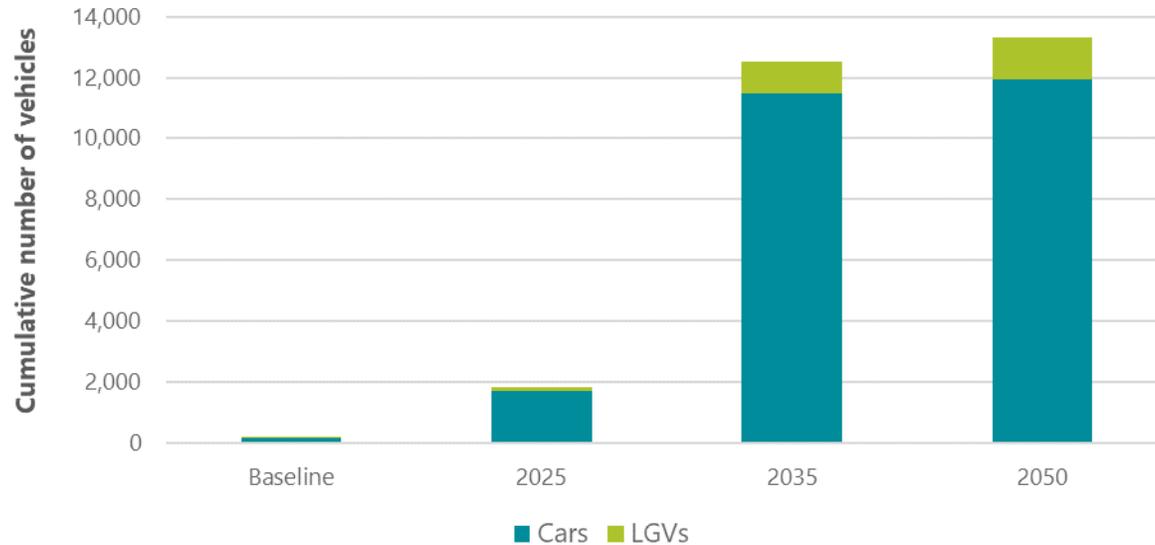


- No commercial-scale batteries currently installed on Outer Hebrides to date
- 1 x 25 MW battery with an accepted connection agreement - located at Battery Point
- Very large regional and national pipeline elsewhere in Scotland and rest of the UK
- DFES projections show 35-50 MW of capacity on Outer Hebrides by 2050
- Potential for longer duration batteries to be part of alternative to diesel back-up

Electrification of road transport

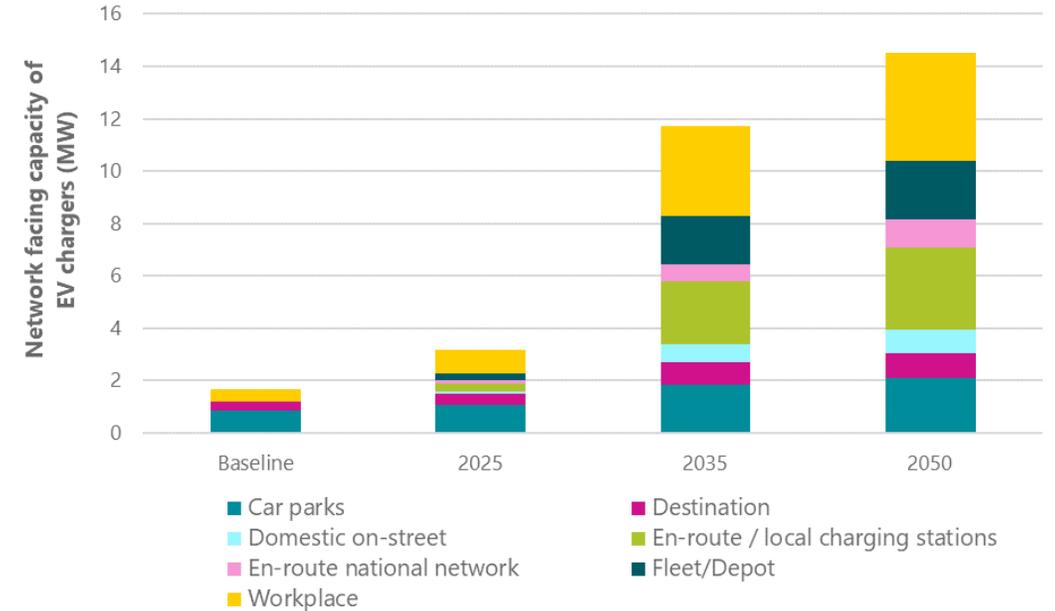
DFES 2022 EVs for the Inner Hebrides

Scenario: **Consumer Transformation**

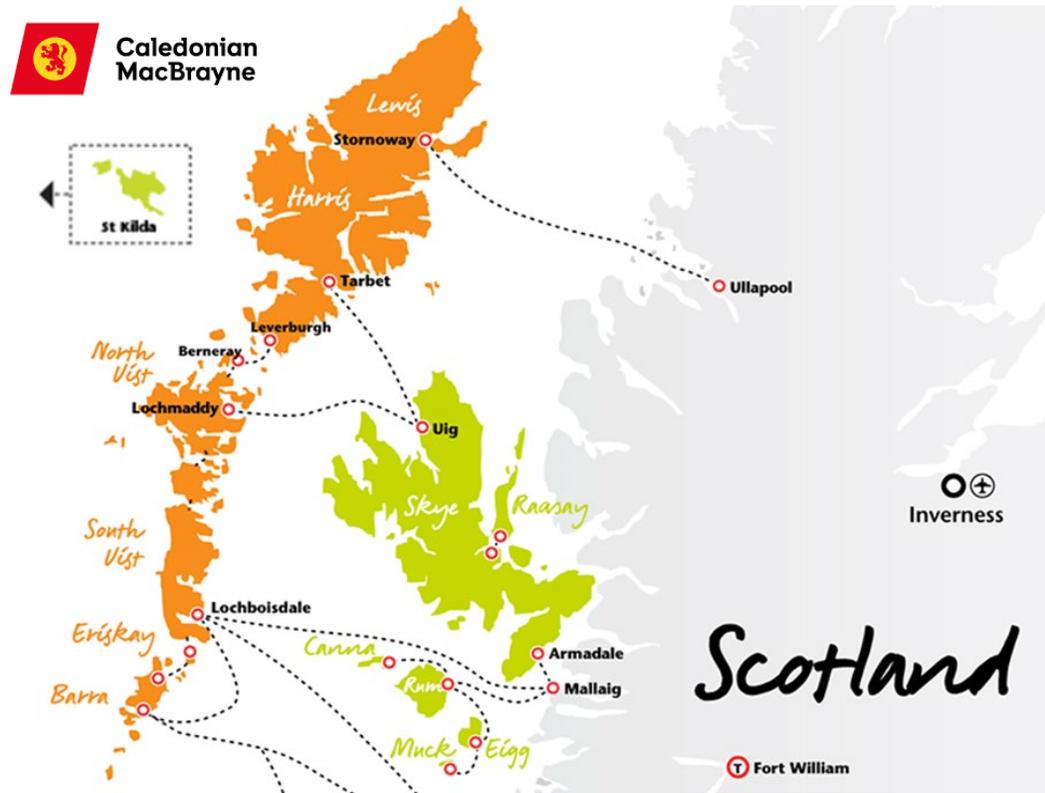


DFES 2022 non-domestic EV charger projections - Outer Hebrides

Scenario: **Consumer Transformation**



- <200 EV cars and LGVs currently registered on Outer Hebrides
- Potential for this to significantly increase to >12,000 by 2030s
- Island bus fleet, refuse collection vehicles – potential for EVs or hydrogen in future
- Future EV charging capacity for resident and visitors could reach >14 MW by 2050

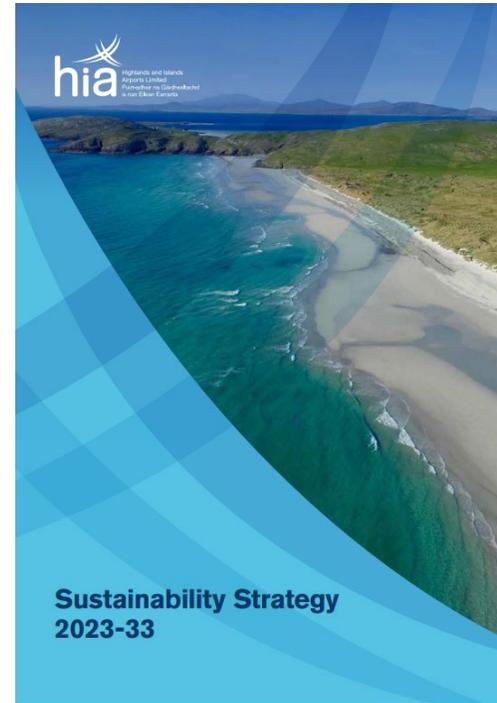


Small Vessel Replacement Programme



The Small Vessel Replacement Programme aims to achieve a very substantial renewal of the small vessel fleet during the next 10 years.

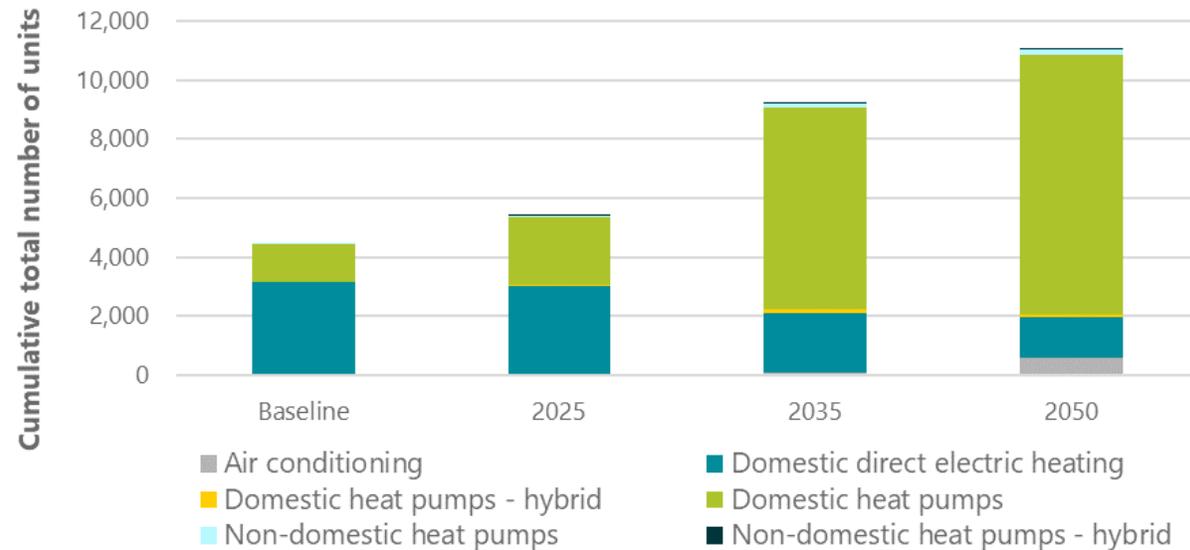
- CalMac currently operate 33 ferries spanning 30 routes across west Scotland region
- CMAL currently looking at future decarbonisation of ferry fleet
- Engaged with SSEN around specific port locations for potential shore power assets



- Scottish Government and Highlands and Islands Airports Limited have committed to creating the world's first zero emission aviation region
- Loganair launched GreenSkies initiative in 2021, targeting to be carbon neutral by 2040
- Shift to all-electric ground equipment for aircraft turnaround across island airports
- Electrification of aircraft thrust/drive systems a longer-term consideration – by 2045

DFES 2022 heating demand for the Outer Hebrides

Scenario - **Consumer Transformation**

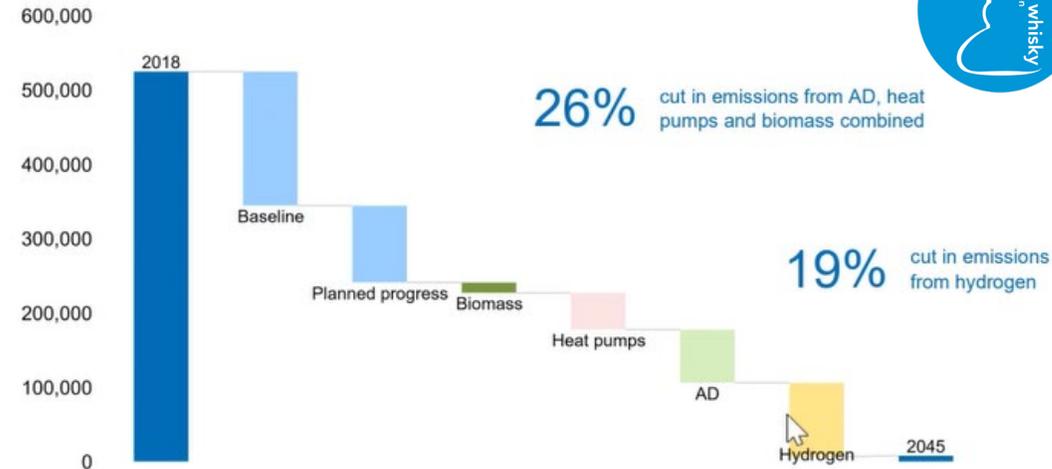


- c.15,000 houses across the Outer Hebrides, housing c.26,000 residents
- All except 1,600 houses in Stornoway are off-gas, largely fossil fuel boilers and stoves as well as direct electric radiant heaters, night storage heaters and some heat pumps
- Under the CT scenario, air source heat pumps and direct electric heaters could supply space heating to c.75% of all Outer Hebrides properties by 2050.
- SGN currently pursuing 100% hydrogen conversion of Stornoway town propane network

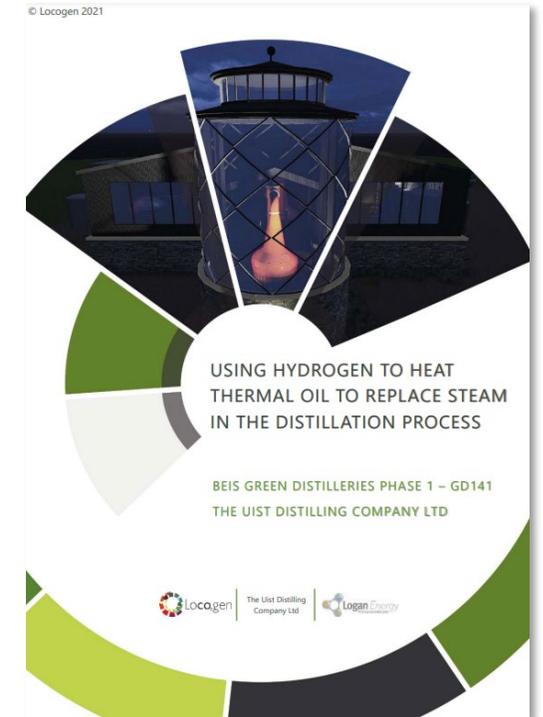
C&I decarbonisation – whisky distilleries



Balanced scenario - emissions reduction by measure



Source & credit: Scotch whisky pathway to net zero, Riccardo, 2019



- High energy consumers, largely from distilling process heat requirements
- Alternative fuels being explored by a number of distillery organisations and the SWA
- North Uist Distilling Company using Green Distilleries Fund to use hydrogen in the process
- Decarbonisation of associated operations and distribution also being explored (EVs, solar)



- Outer Hebrides account for fifth of all Scottish fish farming. Potential for electrification or alternative fuels requiring electricity (fuel cells) for fishing vessels and fish farming operation.
- In addition to this, significant seaweed drying loads, currently using fossil fuels/kerosine.
- Scottish growth strategy to double the sector's economic contribution to £3.6 billion and supported job growth to 18,000 by 2030. Growth is currently limited by grid constraints.

- **Renewable energy** generation (especially onshore wind) will remain a significant area of future load growth on the Outer Hebrides. Potential for some solar PV to be installed.
- **Battery storage** is currently limited, but use cases and business models are evolving and the replacement of existing diesel engines may include battery storage as part of the solution.
- **Green hydrogen** as both a source of electricity demand from electrolysis plants and as an offtaker of local wind generation, may see notable development on the Outer Hebrides.
- **The electrification of transport** could be a significant source of future electricity demand, from road, ferry and aviation sectors. Tourism and commercial freight distribution (i.e. whisky/fishing) could be a significant contributor for transport charging infrastructure.
- **The electrification of heat** could create significant new electricity load in some parts of the islands, with the adoption of heat pumps and next generation night storage, alongside some hydrogen in Stornoway.
- **Industrial decarbonisation pathways** in key island industries including whisky distilling, fishing and seaweed farming, could drive further electricity demand for bespoke processes and vessels.



OUR PROPOSED WAY FORWARD

●●●● DEVELOPING A PLAN TO DELIVER URGENT REQUIREMENTS WHILST TAKING A WHOLE SYSTEM VIEW

Our work on the future requirements for the Western Isles is comprised of two elements. This allows us to proceed with least regrets work quickly ensuring continued security of supply, whilst also taking a broader view of whole system needs.

Delivering a core spine to the Western Isles

- Undertake technical assessment of future system demands and generation on Western Isles to 2045.
- Assess the appropriate solution to replace all cables whilst meeting future demand and generation requirements.
- Key benefits;
 - Replacing age expired assets improving security of supply to islands
 - Sizing future requirements to meet demand and generation requirements.

Taking a broader view of whole system needs

- Take a broader view of future resilience on the Western Isles post diesel generators
- Consider innovative non-build alternatives
- Key benefits;
 - Allows future resilience to the islands to be managed at lowest cost.
 - Potentially creates additional capacity for the islands for both demand and generation. This mitigates forecast uncertainty.

●●●● DELIVERING A CORE SPINE – DEVELOPING AND ASSESSING OPTIONS

Stage 1 of Jacobs Scope – Initial Optioneering & Power System Studies

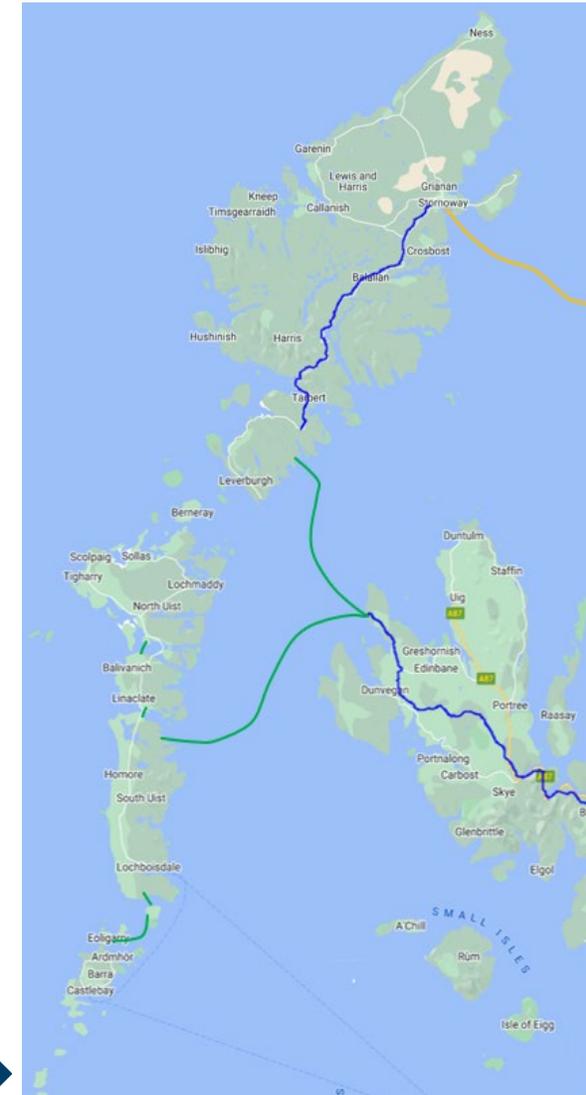
- *Identify & review alternative options to support the health index improvement of the existing subsea cable connection to Uist considering N-1 licence obligations, DFES projections and SHET proposals to inform a Whole System solution for the island group.*

Stage 2 of Jacobs Scope – Cost Benefit Analysis & Engineering Justification

- *Assess the stand-alone solutions for the proactive replacement of the current Skye to South Uist subsea cable through cost benefit analysis to establish least worst regret and enable decision making based on the preferred investment.*

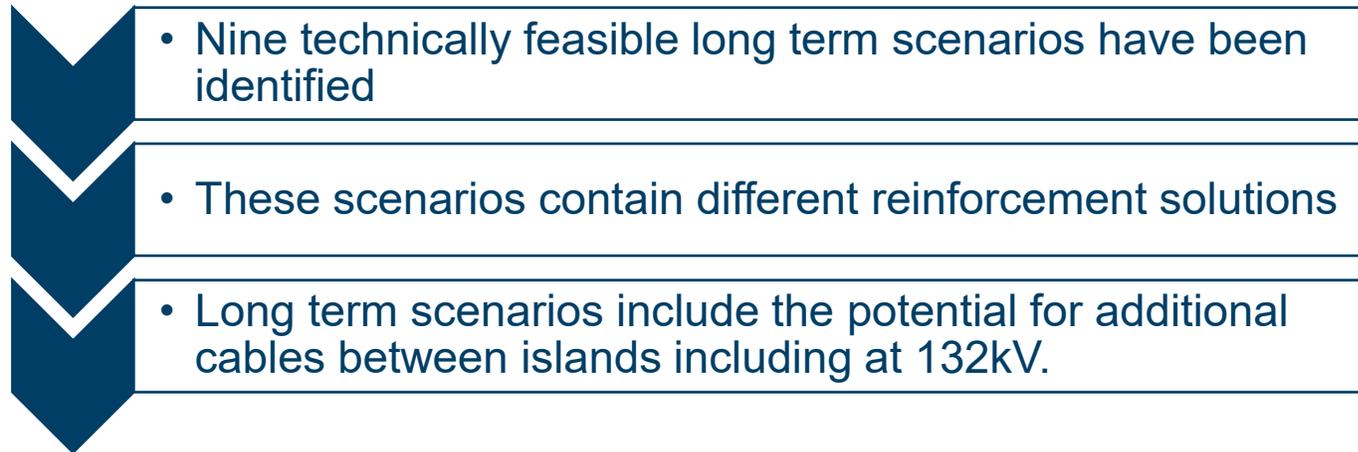
Stage 3 of Jacobs Scope – Ofgem Re-opener Submission Support

- *Continued support in the form of drafting the HOWS (Outer Hebrides) report as the re-opener submission to Ofgem, confirming the long-term view of the proposed strategies and alignment with the Whole System approach through the final report*



●●●● OUTCOME OF OPTIONEERING ON LONGER TERM NEEDS

Jacobs optioneering has been completed, identifying future scenarios that meet our Net Zero commitments and are being assessed through cost-benefit analysis;



These scenarios represent the longer term needs of the island groups. These are informing our plans through;

- Understanding of least worst regrets elements that need to be delivered in the short term but form key components of long term scenarios.
- Base cases to allow deeper whole system explorations in 2024 on future resilience and decarbonisation for the islands and their reserve power sources.



ELEMENTS THAT NEED TO BE DELIVERED IN THE SHORT TERM

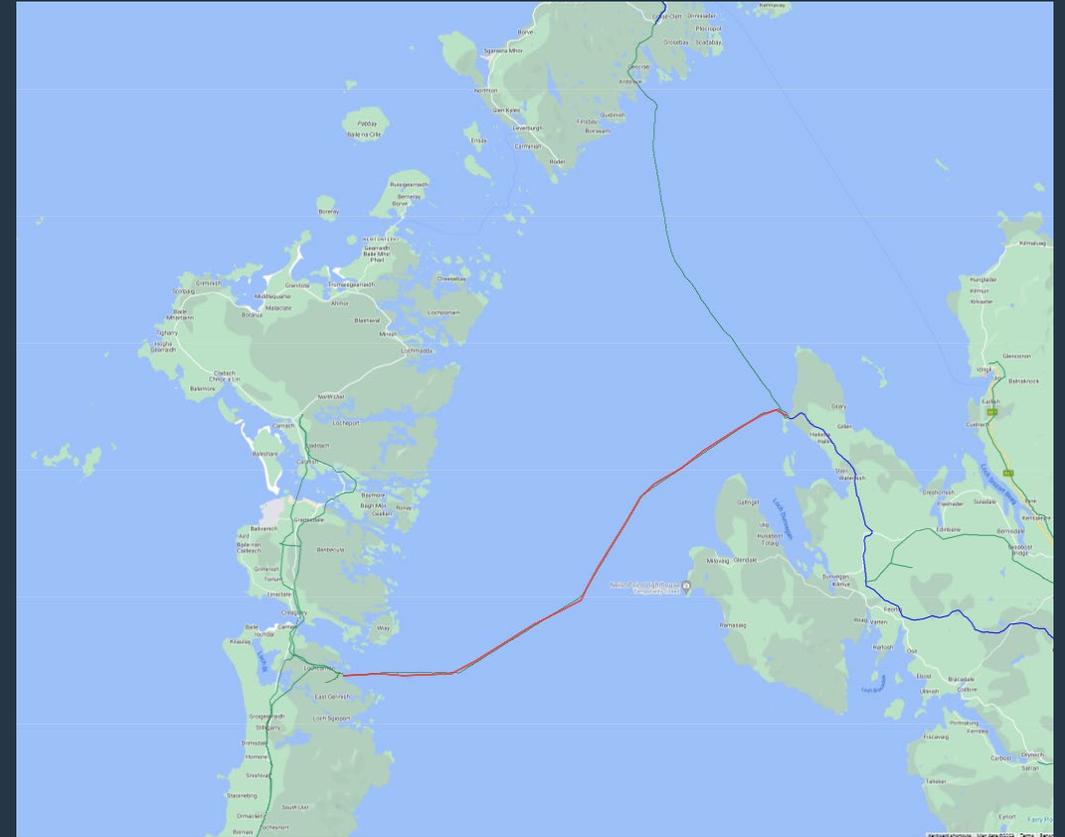
- Analysis indicates an immediate need to replace the existing Ardmore to Loch Carnan circuit with a 300mm subsea cable from Skye to Loch Carnan*. This supports the **core spine** of the Uist archipelago network.

Needs Case for work

- ⑩ *Monitoring of the existing 33kV subsea cable from Skye to Uist, and analysis of similar assets on our network, indicates that the cable is nearing the end of its operational life*
- ⑩ *DFES data has been used to confirm that the proposed cable will meet the needs of the projected demand growth on the islands out to 2045*
- ⑩ *The option is consistently required across all long-term scenarios identified, ensuring least regret investment*

Additional short-term elements

- ⑩ *We will also be taking forward two additional network interventions. Replacing the two 11kV subsea cables to Barra and replacing the existing 11kV subsea cable to Eriskay with an overland cable.*





FUTURE REOPENER SUBMISSIONS

- Following conclusion of the CBA, the optioneering assessment will present us with an optimum scenario for the islands based on projected demand and generation growth to 2045.
- However we recognise there is considerable uncertainty in realising this scenario in the future.
- We are therefore taking a staged approach to investment to meet the demands of the islands into the future.
- We will continue to review these assumptions as new information becomes available.
- We will also take a deeper view of future resilience on the Western Isles post diesel generators and consider innovative non-build alternatives to traditional investment.

Recommended solutions		Decision sought at January 2024 re-opener		Decision sought in later 2024		Decision sought at January 2025 re-opener		Potential ED3
		Needs case, technical solution	Costs	Needs case, technical solution	Costs	Needs case, technical solution	Cost	
Outer Hebrides	Uist-Eriskay solution (overland solution proposed)	✓	✓	-	-	-	-	
	Eriskay-Barra solution (cable solution proposed)	✓	✓	-	-	-	-	
	Skye-Uist solution – Phase 1 (cable solution proposed)	✓	-	-	✓	-	-	
	Skye-Harris solution – Phase 2 (potential cable, flexibility, storage solutions)	Outline information	-	-	-	✓	✓	
	Outer Hebrides solutions – Phase 3 (potential cable, flexibility, storage, wider solutions)	Outline information	-	-	-	-	Outline information	✓



YOUR FEEDBACK

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What other areas would you like us to consider in the development of longer-term needs for the Outer Hebrides?

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

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Where 1 is strongly disagree and 5 is strongly agree, how do you feel about the following statement - “I am supportive of SSEN’s approach to progress immediate needs now whilst continuing to develop the future requirements for the islands in parallel”?

① Start presenting to display the poll results on this slide.

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Where 1 is strongly disagree and 5 is strongly agree, how do you feel about the following statement - “I feel more informed about the whole system energy options for the Outer Hebrides after attending this webinar”?

① Start presenting to display the poll results on this slide.



Q&A



NEXT STEPS



NEXT STEPS; DEVELOPING THE 2024 WORK PROGRAMME

Least worst regrets elements will form part of the 2024 HOWSUM submission for Ofgem in January.

Beyond this we will continue to develop our thinking on the longer-term scenarios we have discussed today.

Part of this will be building on the insights gained from Regen's work over the last few months.

We will also be looking more deeply into;

- future resilience needs and the impacts of different options
- options for decarbonisation of diesel generation fleet



THANK YOU

Stakeholder.Engagement@sse.com