ORKNEY ISLANDS WHOLE SYSTEM UNCERTAINTY MECHANISM

29th February 2024

Scottish & Southern Electricity Networks

AGENDA

- Welcome and introductions
- Setting the scene
- Overview of the HOWSUM process
- Recent insights – DFES analysis
- Next steps
- Q&A

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

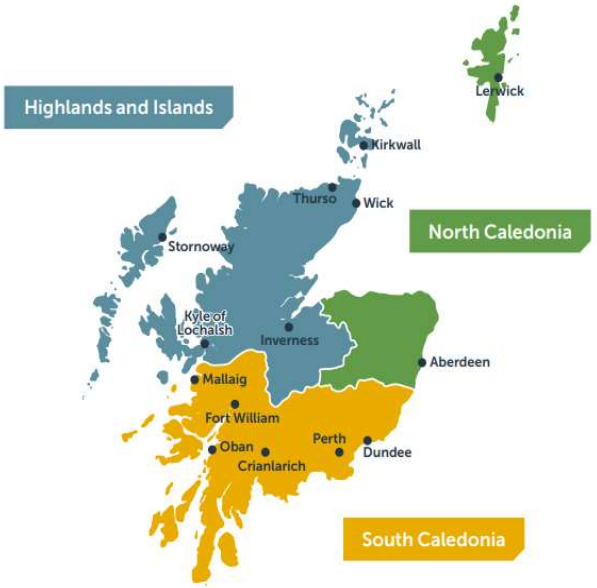
Underground cables
18,943km

Overhead lines
30,209km

Customers
782,787

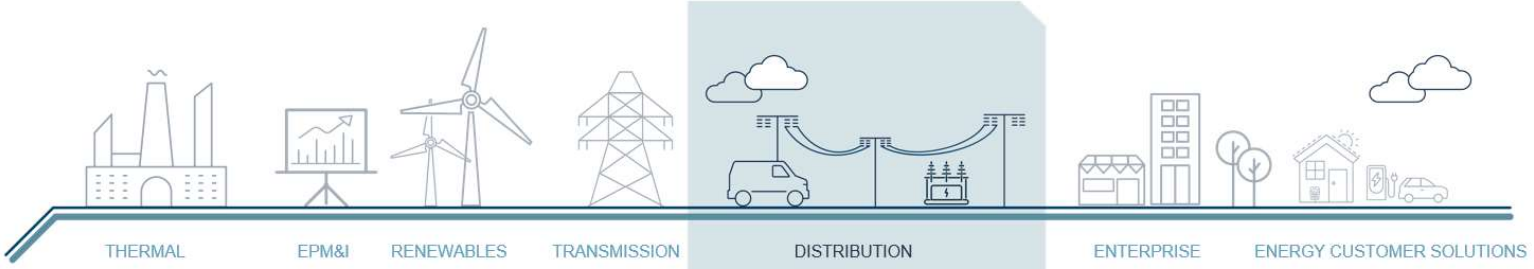
PSR customers
177,823

Island communities
60 islands served by 111 subsea cables



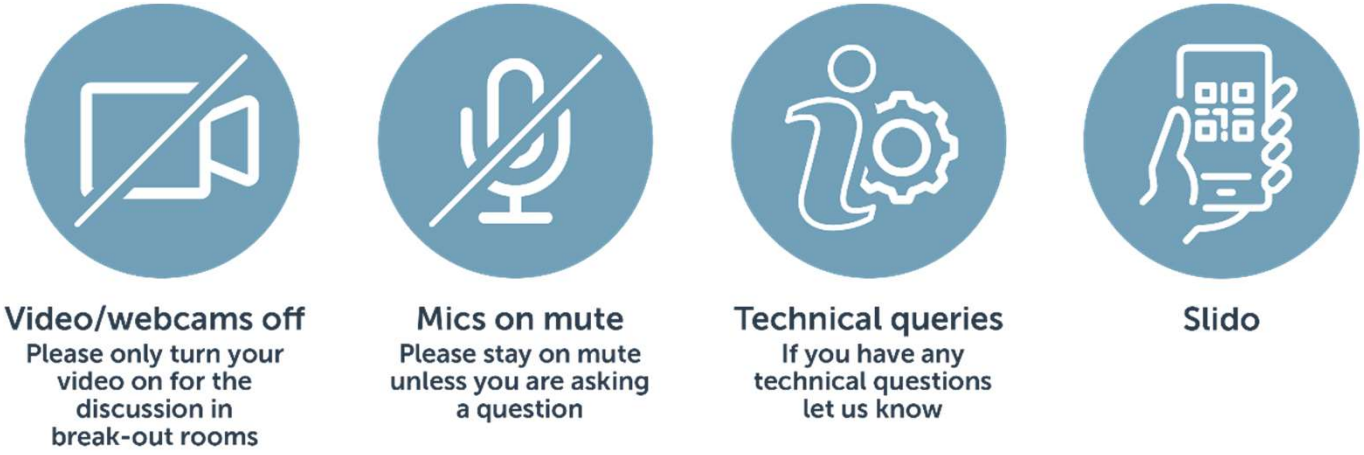
SHEPD
Scottish Hydro Electric Power Distribution Plc

SEPD
Southern Electric Power Distribution Plc



HOUSEKEEPING

- We're using Slido today to capture some of your thoughts and feedback.
- Please feel free to ask questions throughout the session in the Teams chat
- Today's session will be recorded



slido

What is your dream holiday destination?

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

SETTING THE SCENE

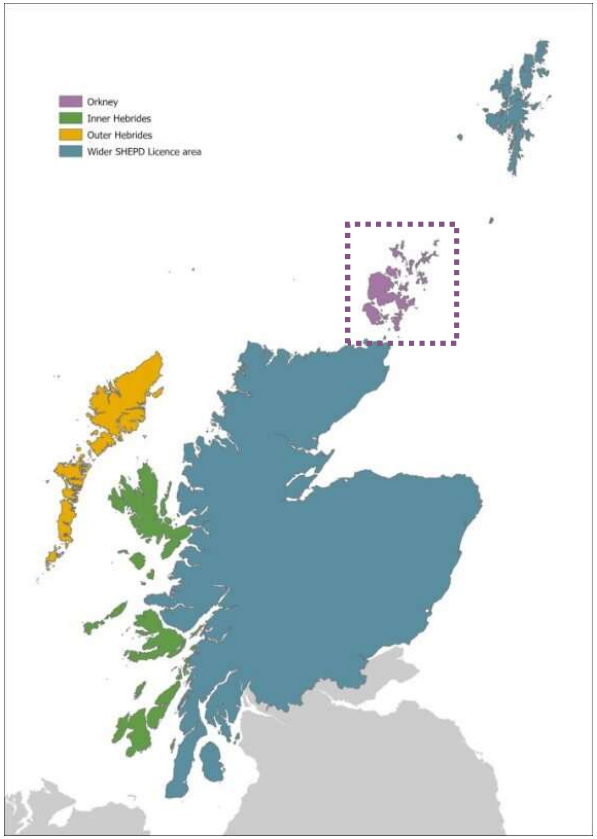
Landel Johnston, Head of RIIO-ED2 Non-Load, CBRM Lead

Scottish & Southern Electricity Networks

LJ0

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 and beyond.
- At our last webinar we introduced our work on Orkney, 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 Orkney.



Slide 7

LJ0 @Soucy, Kimberly (Distribution) - map updated and highlighted to reflect Orkney Islands focus

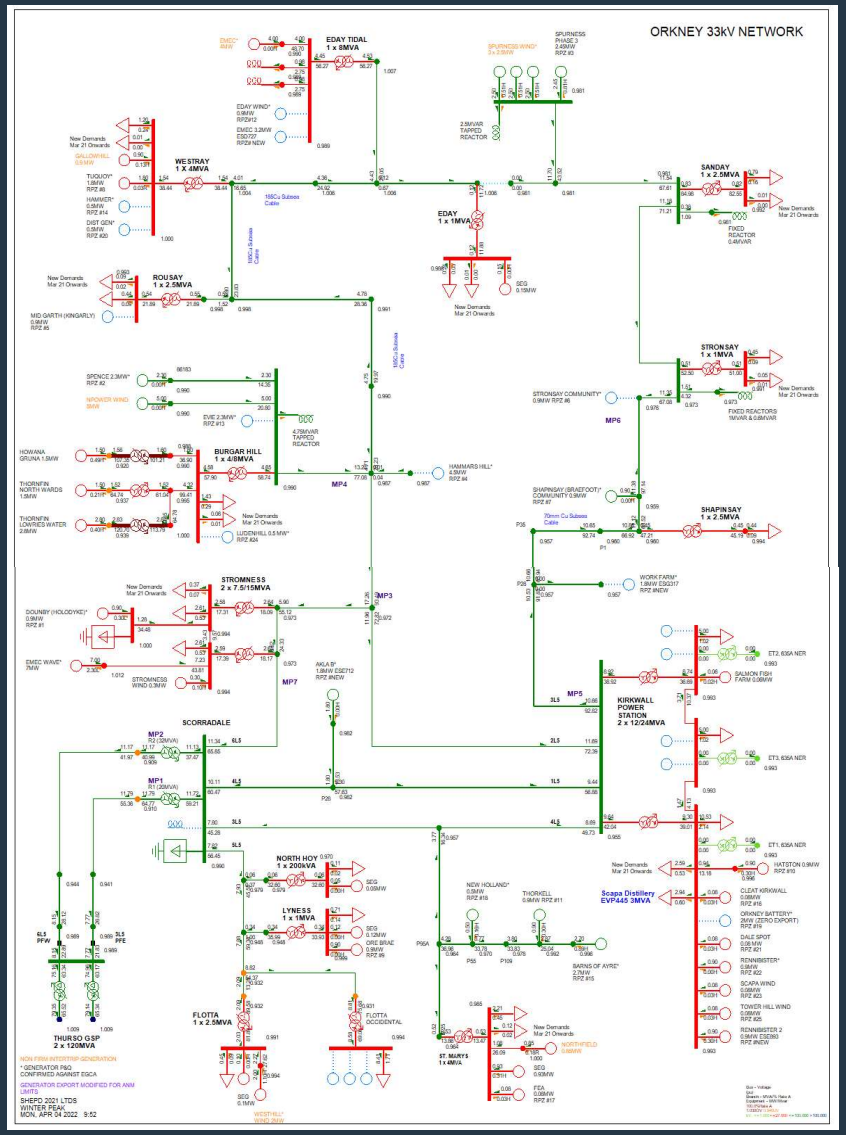
Johnston, Landel (Distribution), 2024-02-09T11:54:53.602

CURRENT NETWORK - ORKNEY

- The Orkney Islands are supplied by SSEN's Distribution network from Thurso South GSP via two 33kV circuits.
- The 33kV circuits consist of overhead lines, underground cables and subsea cables.
- The 33kV network on the Orkney islands is fed from Scorradale GSP, connecting the various islands through a mixture of ring and radial circuits.
- There is currently no Transmission network on the islands.

CURRENT NETWORK - ORKNEY

- To ensure security of supplies in the event of the loss of either of the 33kV circuits feeding the islands, SSEN Distribution owns and operates Kirkwall Diesel Power Station to manage the demand on the islands in fault scenarios.
- 24 local generators are currently distribution-connected via an Active Network Management (ANM) system to ensure that the network is kept within rated capacity.
- There are also a number of Primary substations on the islands that support the 11kV network.
- There are already transmission and distribution works in progress for the islands and these will be included in our HOWSUM work.

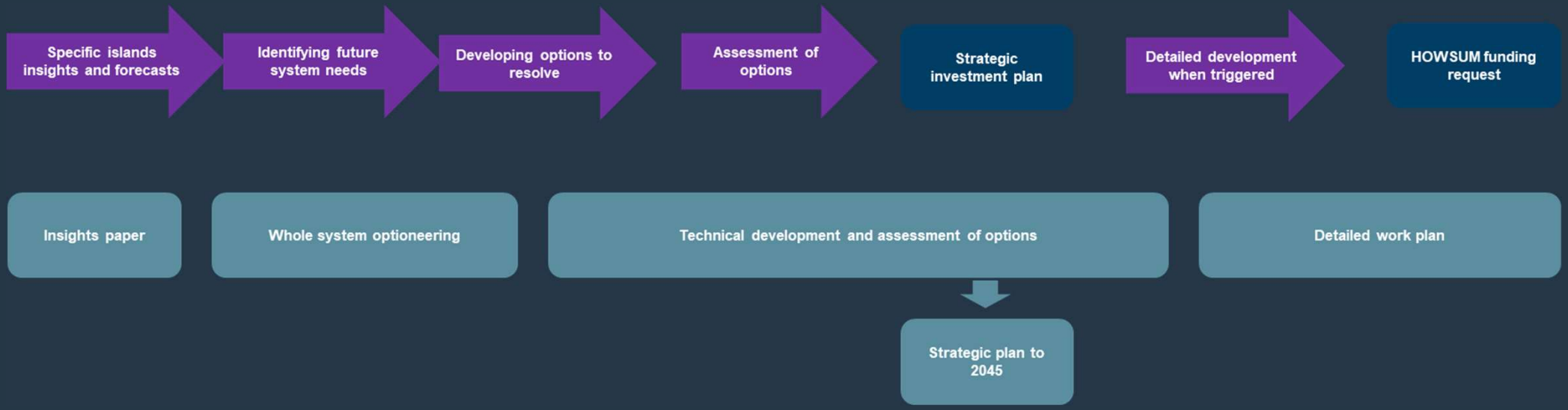


OVERVIEW OF THE HOWSUM PROCESS

Andy Wainwright, Whole System Manager

Scottish & Southern Electricity Networks

HOWSUM PLANNING PROCESS



LJ0

DRIVERS FOR CHANGE

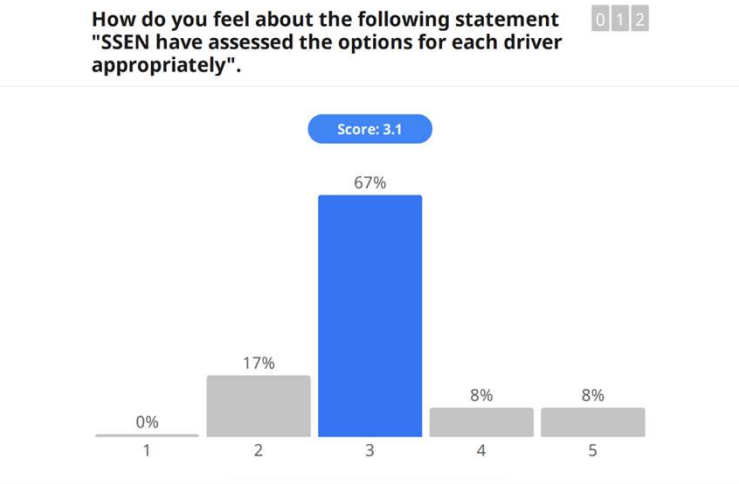
Future demand and generation requirements for the islands	*Subsea cable asset condition*	*Continued island resilience*	*Decarbonisation of our diesel generation fleet*
• We need to ensure our networks are appropriately sized to meet the requirements of parties who wish to connect to and use our assets. • We have assessed future needs against our DFES forecasts through to 2050 and worked with Regen to gain further specific insights.	• A key driver for our works is to maintain and, as needed, replace our submarine cables. • These cables exist in extreme environmental conditions and a cable that fails can take many months to locate and repair or in worst case scenarios completely replace.	• Resilience conditions for Scottish islands are unique given the geographies and potential lengthy system outages in the unlikely event of a subsea cable fault. • We have developed a specific net zero policy for the treatment of island groups fed by subsea cables recognising the impacts of decarbonisation on electrification of heat and transport.	• This is a significant source of carbon emissions for SHEPD when required to run for long periods of time. • Emissions reached 2238.49tCO_2-e in 2022/23 across the fleet, and we must reduce these to meet our 1.5^{o}C Science Based Target (SBT).

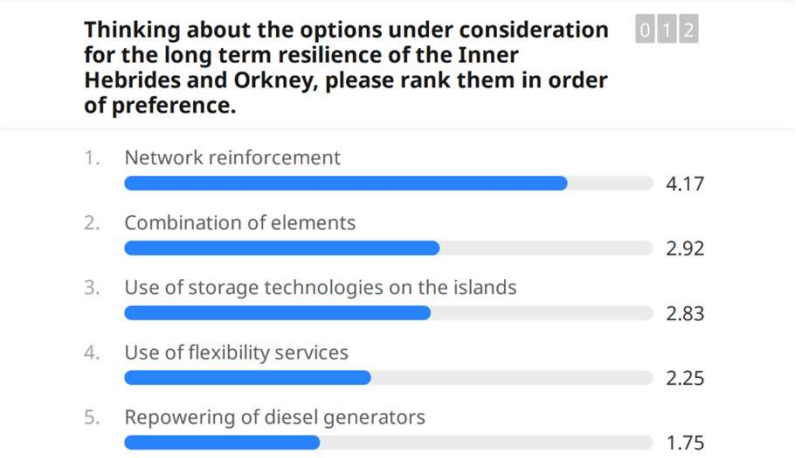
Slide 12

LJ0 [@Soucy, Kimberly (Distribution)] - updated slide to match submission drivers and detail
Johnston, Landel (Distribution), 2024-02-09T11:53:23.072

WEBINAR FEEDBACK

- You were broadly in agreement that we have assessed the options for each driver appropriately.
- The potential for both network reinforcement and storage technologies was supported, potentially in combination. We will be looking further into this option this year.





slido

Thinking about the feedback from the previous webinar, has anything changed since then? Are there any other drivers or factors we need to consider in the development of longer-term needs for Orkney?

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

CONTINUED ISLAND RESILIENCE AND DECARBONISATION OF OUR DIESEL GENERATION FLEET

Some drivers for change for Scottish islands are consistent with those that apply more widely on the mainland.

These include asset condition, load growth and the potential for additional generation connections. However, stakeholders have identified further drivers with material relevance for Scottish islands:

- *Diesel generator decarbonisation* – this is a significant source of carbon emissions for SHEPD and developing long term solutions to eliminate reliance on diesel-based DEG is crucial to remaining on the pathway to net zero to 2045.

- *System resilience* – repairs or replacements of cable faults can take a significant period of time and there is a need to ensure we are able to keep the lights on to island communities, particularly as diesel generators are phased out.

Island Group fed by subsea cable[21]	DFES (CT) Forecast 2050 island group demand	Relevant 2050 P2-8 Category	Net Zero Resilience Policy for island groups fed solely by subsea cables
Shetland	95MVA	D	Group demand secured for sustained long duration N-2 condition through a combination of network assets and local generation (including third party).
Orkney	61MVA	D	
Lewis & Harris	45MVA	C	
Uists, Benbecula, Eriskay & Barra	15MVA	C	
Mull, Coll & Tiree	13MVA	C	
Islay, Jura & Colonsay	13MVA	C	
Barra	3MVA	B	Group demand secured for sustained long duration N-1 condition through a combination of network assets and local generation (including third party). N-2 condition potentially managed through use of portable generation or use of existing generation on island if available.
Tiree & Coll	3MVA	B	
Colonsay	>1MVA	A	

Table 8: Summary of SHEPD Island Net Zero Resilience Policy

CONTINUED ISLAND RESILIENCE

- Resilience conditions for Scottish islands are unique given the geographies and potential lengthy system outages in the unlikely event of a subsea cable fault.
- We have developed a specific net zero policy for the treatment of island groups fed by subsea cables recognising the impacts of decarbonisation on electrification of heat and transport.
- Our policy aligns with the GB standard for network design requirements which is based on areas of demand (P2/8).
- Specifically we are interested in securing supplies for the ‘N-2’ condition which would occur in the unlikely event of the loss of two in feeding cables to the island group.
- For larger island groups this will be through a combination of network assets and local generation.
- For smaller island groups with peak demand less than 4MW the use of portable generation would also be considered.

Example - Proposed Future Resilience Outer Hebrides 2035 onwards

slido

On a scale of 1-5, where 1 is not at all and 5 is very, how supportive are you of SSEN Distributions Net Zero policy for island groups fed by subsea cables?

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

RECENT INSIGHTS

Becky Fowell, Energy Market Analyst, Regen

Scottish & Southern Electricity Networks

Future electricity load growth on Orkney:

Supporting SSEN's HOWSUM application

Becky Fowell – Energy Market Analyst

February 2024

SSEN Distribution Future Energy Scenarios

Regen has been supporting SSEN with their long-term load forecasting since 2017/18.

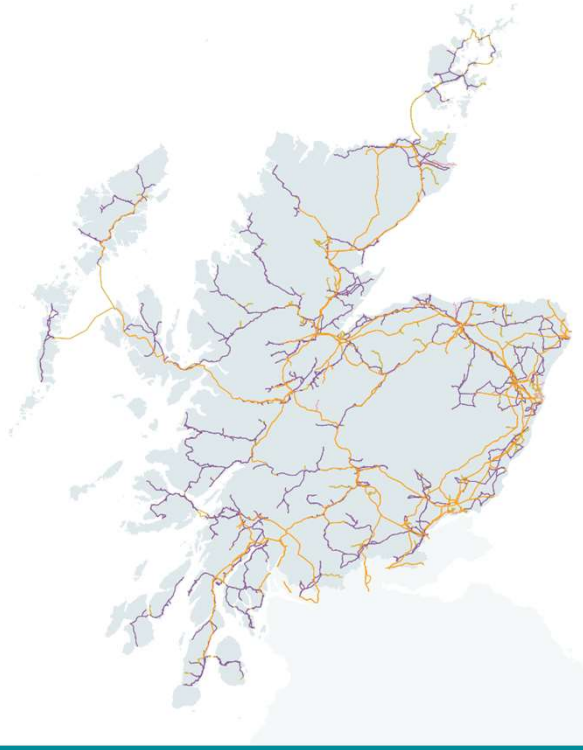
Load growth projections to 2050 are produced using:

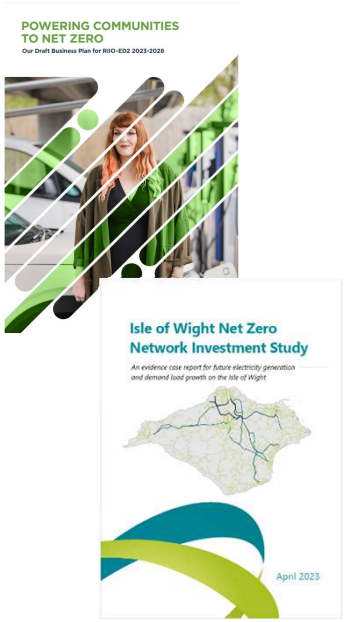
- **Online research**
- **Stakeholder engagement**
- **Analysis and modelling**

Annual projections and associated data for each licence area (North of Scotland and Southern England) are issued to the SSEN Network Planning team to aid future network planning, investment and reinforcement.

Regen is also supporting SSEN's wider work on ED2 business planning and uncertainty mechanism re-openers:

- Isle of Wight
- Outer Hebrides
- **Orkney**
- Inner Hebrides





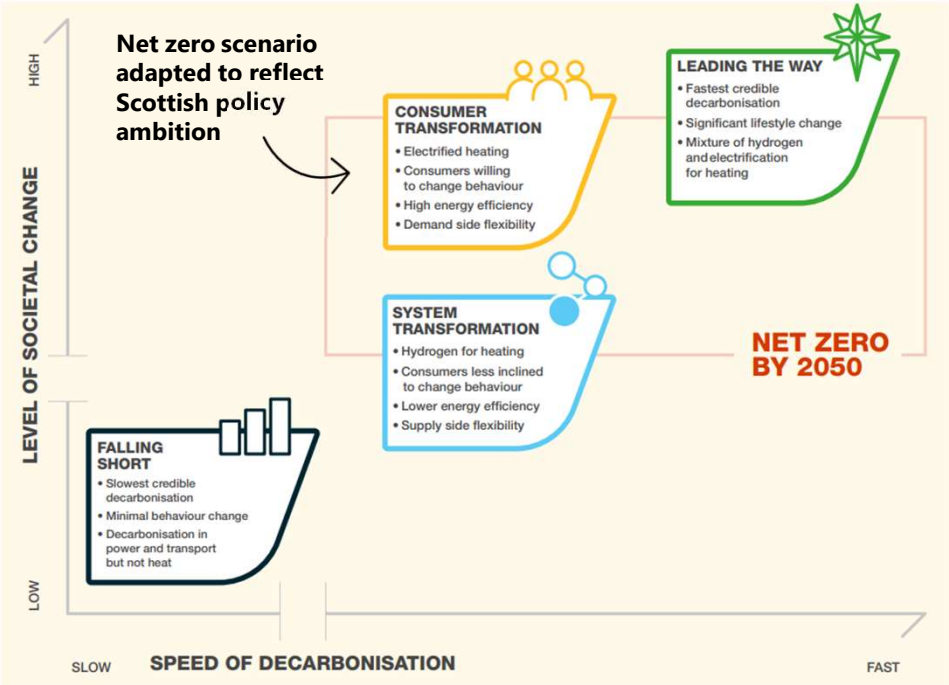
ESO Future Energy Scenarios (FES) Framework

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.

How does DFES use the FES?

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

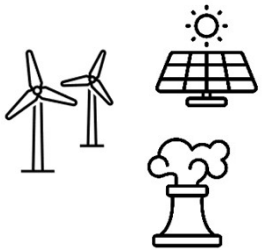


DFES modelling method

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

Stage 1

Determine the historic, existing baseline (operational projects).

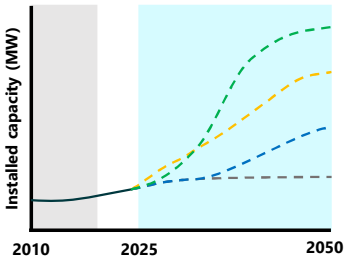


Stage 2

Assess the near-term pipeline (connection offers/planning applications).

Stage 3

Develop medium- and long-term projections out to 2050.



Stage 4

Geographically distribute these technologies/capacities within the licence areas

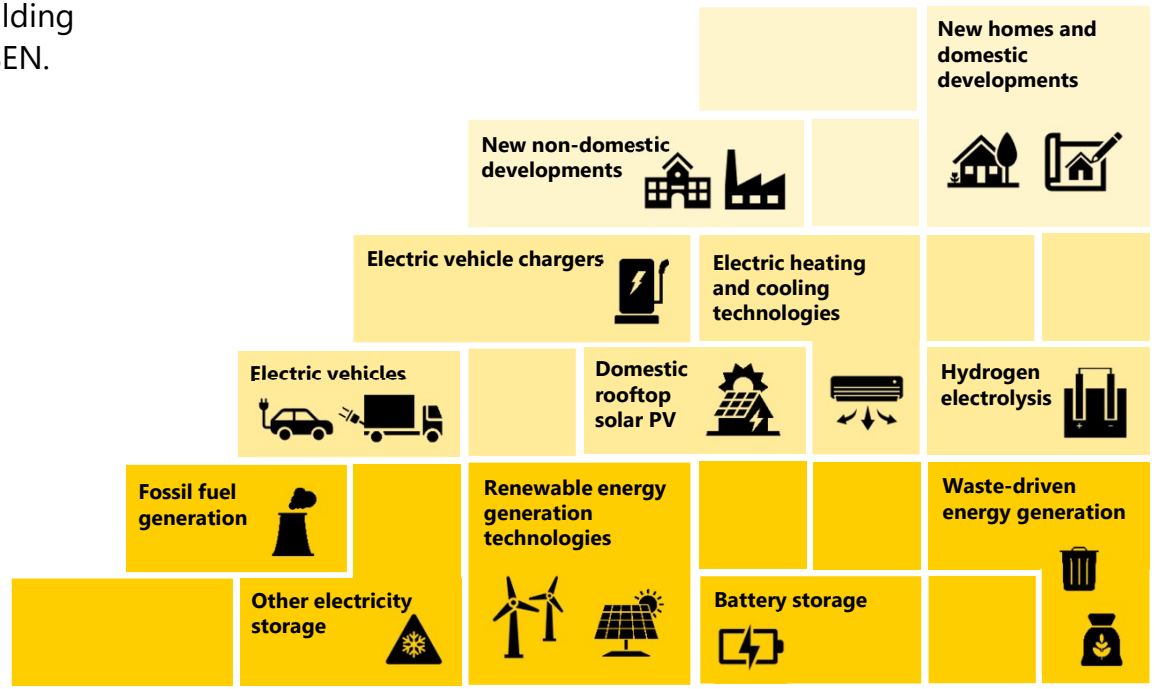
Disruptive load growth

The DFES includes an agreed set of technology building blocks. These are assessed by all DNOs, not just SSEN.

New property developments

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

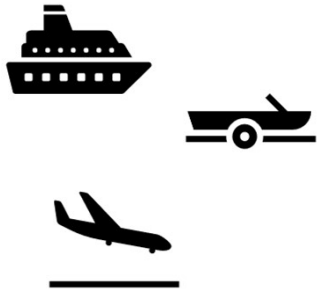
Distributed electricity generation and storage technologies connecting at/above 11 kV



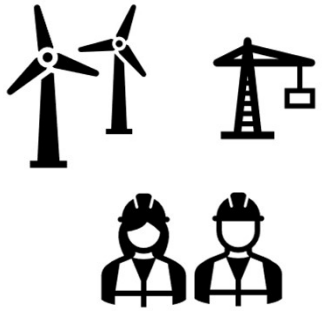
Additional sectors

Analysis into additional sectors established other significant future electricity load growth potential in the Scottish islands.

Non-road transport



Offshore wind sector



Local industry decarbonisation

Local authority plans and development

Future electricity load growth on Orkney:

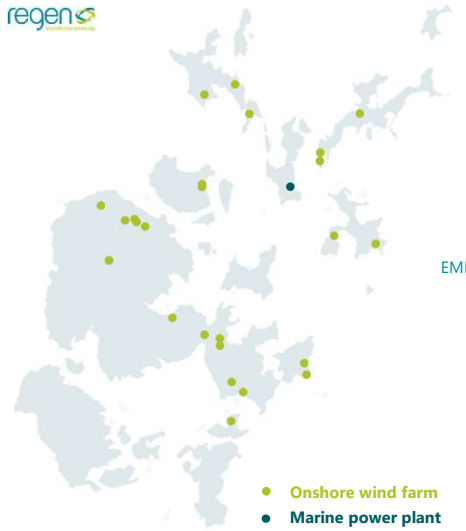
Sector analysis

Renewable electricity generation

Baseline and pipeline

Baseline and pipeline distributed electricity generation connected and expected to connect in Orkney
Source: SSEN 2023 connections data

Generation technology	Number of installed sites	Installed capacity (MW)	Number of pipeline sites	Pipeline capacity (MW)
Fossil fuel (gas)	-	-	1	0.1
Marine	2	11	5	91
Offshore wind	-	-	1	60
Onshore wind	31	47	9	164
Total	33	58	16	314



Distributed generation projects - 2023 baseline
Source: SSEN connections data

Distributed generation projects - 2023 pipeline
Source: SSEN connections data

Renewable electricity generation

Projected future scenarios

Strong renewable energy resources and future uptake:

273 MW
onshore wind
by 2050

114 MW
marine power
by 2050

Strong policy support from Scottish Government and Orkney Islands Council.

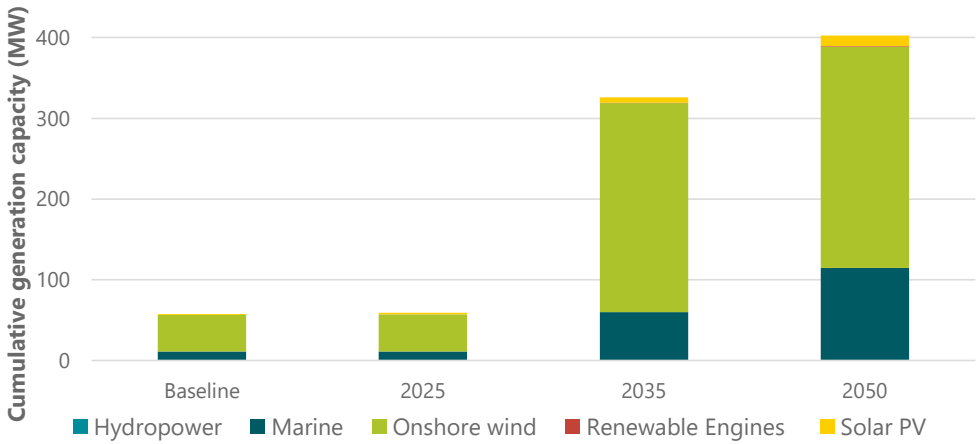
Potential and appetite to repower existing operational onshore wind farms (aged 6 – 18 years old).

Transmission HVAC link – point-to-point connection transmitting up to 220 MW of power between Finstown and Caithness.

Commissioning target: 2028

Supporting future development of offshore wind and marine power

DFES 2022 renewable generation projects for Orkney
Scenario: **Consumer Transformation**



Projected cumulative distributed generation and storage capacity in Orkney
Source: SSEN DFES 2022 projections – Consumer Transformation scenario

European Marine Energy Centre (EMEC)

EMEC will play a key role in energy generation Orkney:

- **30 MW Option Agreement** for new tidal stream capacity at Westray awarded to Orbital Marine Power.
- **Wave energy developers testing from 2025**
- **1 MW of wave energy** connected at EMEC by 2027 - Scottish Government target.
- **14.4 MW of future tidal stream capacity** awarded CfDs for delivery between 2026-2028.
- **80 MW grid-connected floating offshore wind test site** currently in design
- **Hydrogen research and development ecosystem**

Further generation and hydrogen projects may see electricity storage as a solution to increase on-island energy use.

New network infrastructure would support prospective future projects at EMEC.

Upfront build-out and ongoing maintenance of projects would also increase the electricity load.

Low carbon maritime vessels could influence shore power considerations at site.




Battery storage

Currently only one battery installed in Orkney:

1.8 MWh flow battery
currently at EMEC – does not export to the grid

Beyond this site, currently no battery storage projects holding accepting connection agreements in Orkney.

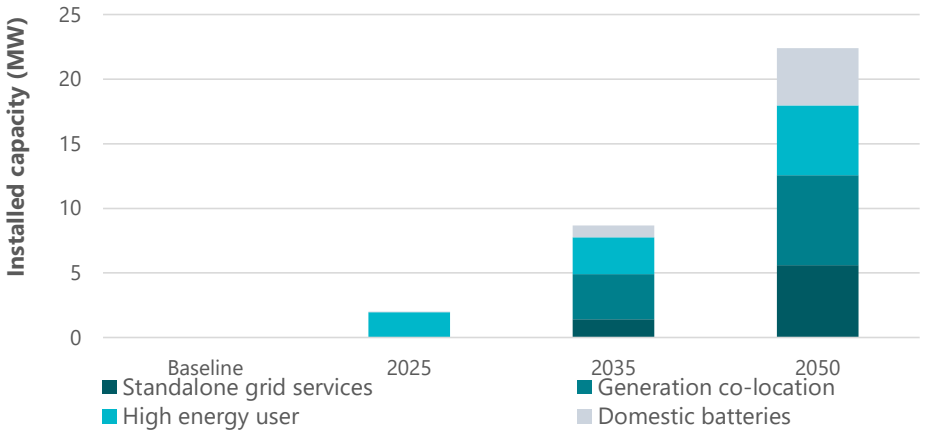
Very large regional and national pipeline elsewhere in Scotland and rest of UK. EMEC could be key player.

Flow batteries at EMEC
Photo credit: EMEC

DFES projections show:

- **Over 20 MW of battery storage capacity by 2050**

DFES 2022 battery storage capacity in Orkney
Scenario: **Consumer Transformation**



Projected cumulative battery storage capacity in Orkney
Source: SSEN DFES 2022 projections – Consumer Transformation scenario

Hydrogen

Orkney has been identified as a potential hub for future hydrogen development. Several projects looking at hydrogen as both storage medium and to supply local offtakers.

Two operational electrolysers in Orkney:

- **1 MW electrolyser at Shapinsay**
- **0.5 MW electrolyser as Eday**

No further projects currently seeking to connect to the distribution network, based on 2023 SSEN connection data.

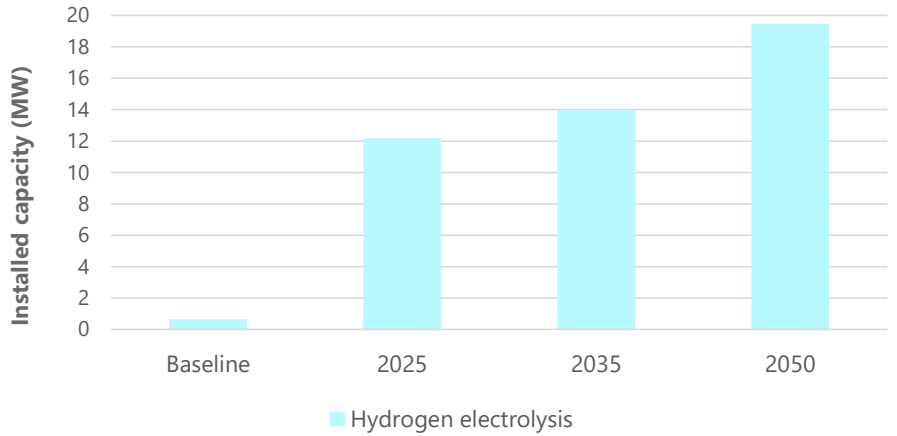
However, a number of initiatives are being pursued:

- **West of Orkney Windfarm** could deliver renewable power to proposed green hydrogen production facility at Flotta Oil Terminal.
- **HySpirits programme** will test hydrogen-fuelled technologies to decarbonise the distilling process.
- **MoU between Loganair and Cranfield Aerospace Solutions (CAeS)** to develop operational hydrogen-electric aircraft.

DFES projections show:

- **c.20 MW of distributed electrolyser capacity by 2050**

DFES 2022 hydrogen electrolysis capacity in Orkney
Scenario: **Consumer Transformation**



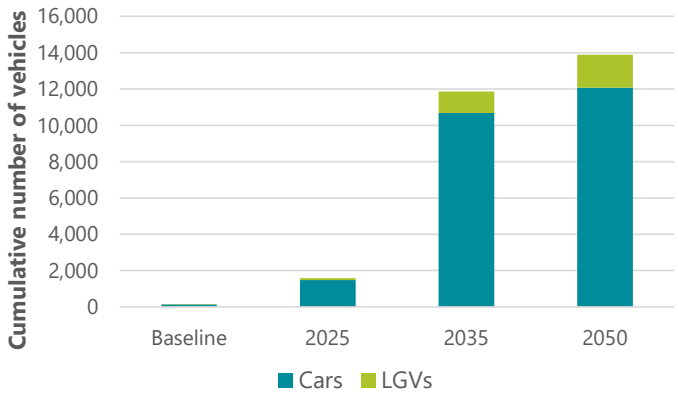
Projected cumulative hydrogen electrolysis electricity demand capacity in Orkney
Source: SSEN DFES 2022 projections – Consumer Transformation scenario

Electrification of road transport

c.150
EVs currently registered

14,000
EVs by 2050

DFES 2022 EVs for the Orkney Islands
Scenario: **Consumer Transformation**

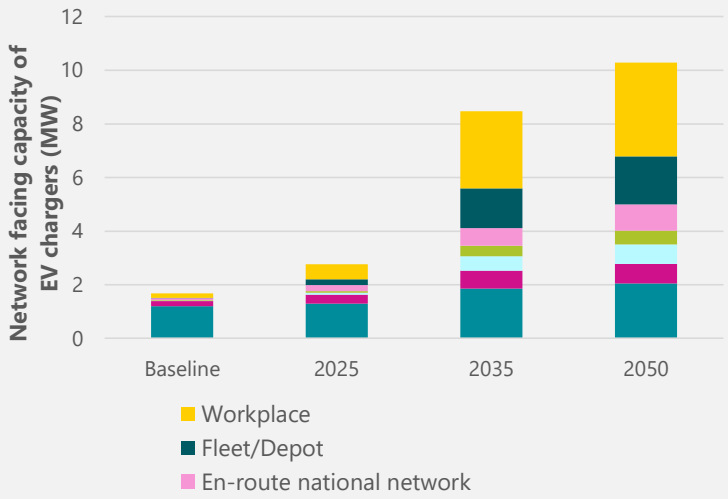


Projected cumulative number of EV cars and LGVs in Orkney
Source: SSEN DFES 2022 projections – Consumer Transformation scenario

10 MW
non-domestic EV charging capacity by 2050

13,500
off-street domestic EV chargers by 2050

DFES 2022 non-domestic EV charger projections for Orkney
Scenario: **Consumer Transformation**



Projected cumulative non-domestic EV charger capacity in Orkney
Source: SSEN DFES 2022 projections – Consumer Transformation scenario

Ambitions are already in place for decarbonising road transport:
ReFLEX Orkney, OIC bus fleet and public EV chargers.

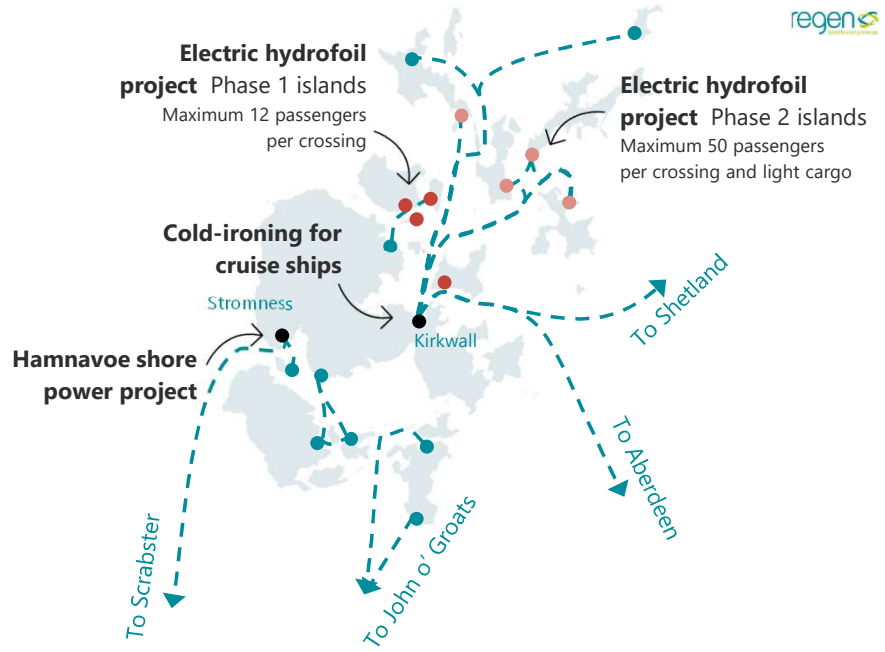
Electrification of maritime vessels

Three main ferry operators in Orkney committed to decarbonising maritime travel:

- **NorthLink Ferries**
- **Pentland Ferries**
- **Orkney Ferries**

Current projects:

- **Hamnavoe shore power project –** MV Hamnavoe 'plugged in to the grid' overnight at Stromness since 2019.
- **Electric hydrofoil passenger vessels –** first of two vessels to be delivered in 2024. Charging infrastructure also installed.
- **Cold-ironing solution at Kirkwall port** – recent UK Government funding to support hotel loads of cruise ships.



Known maritime electrification initiatives in Orkney

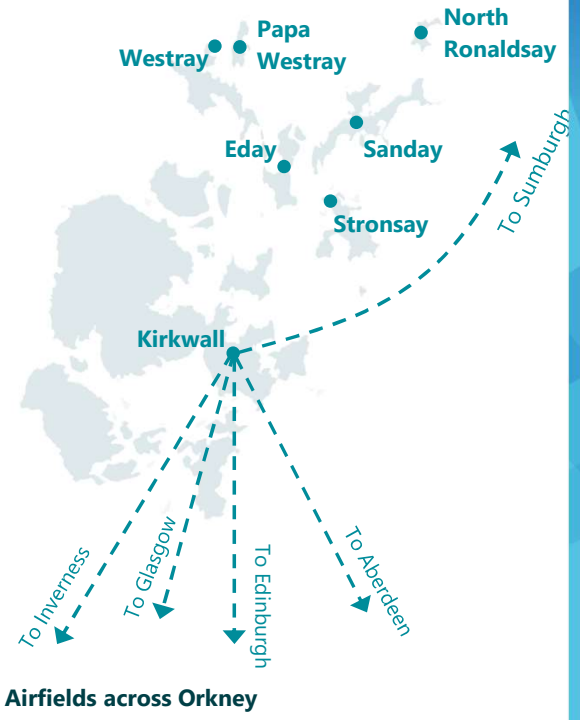
Electrification of aviation

Scottish Government and Highlands and Islands Airports Limited (HIAL) have committed to creating the world's first zero emission aviation region.

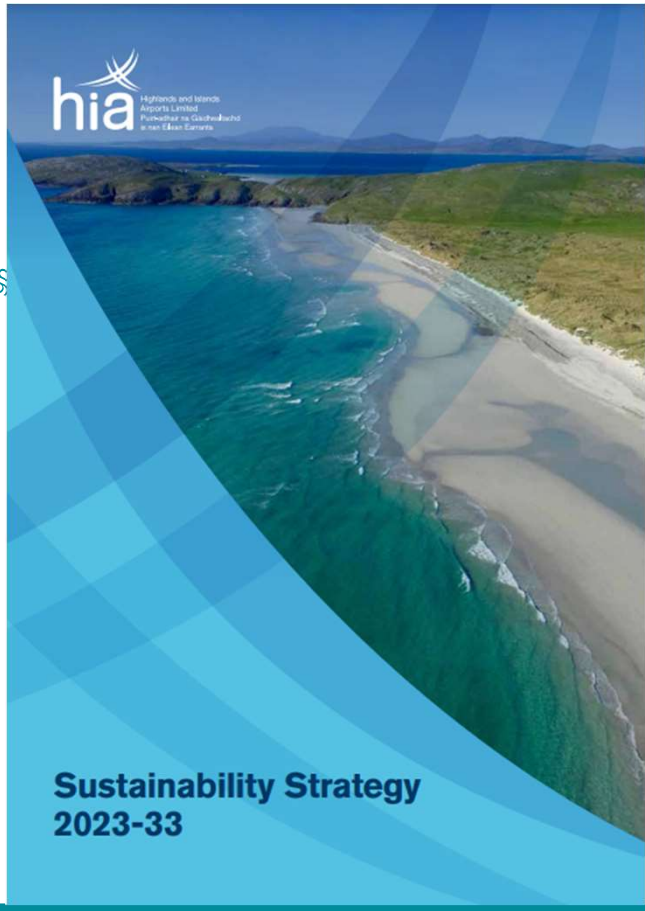
Current projects

- **Sustainable Aviation Test Environment (SATE) –** tests 'low carbon aviation technologies and infrastructure at Kirkwall Airport.
- **Loganair and CAes MoU** – developing short-haul hydrogen-electric aircraft operational by 2027.
- **Greenskies** – initiative by Loganair to implement electric ground equipment for aircraft turnaround at Kirkwall Airport.

Electrification of thrust/drive systems, particularly for long-haul flights will be a longer-term consideration – closer to 2045.



Airfields across Orkney



Heat decarbonisation

As of the 2022 census, there are c. 10,600 residential properties, housing c. 22,000 residents.

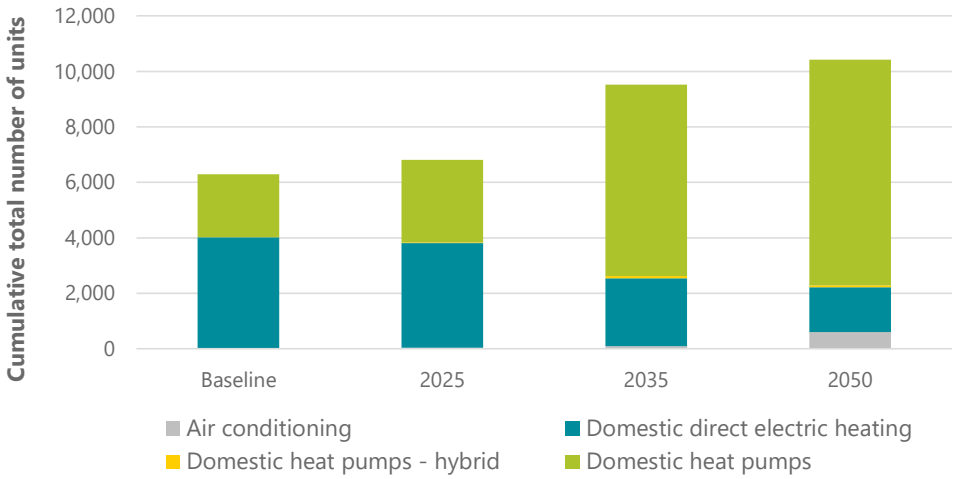
No mains gas connection in Orkney, so houses are currently heated using electricity, oil and solid fuels.

The consumer transformation scenario projects:

8,150
domestic heat pumps
by 2050

87 %
properties with heat pumps and
direct electric heaters by 2050

DFES 2022 heating demand for the Orkney Islands
Scenario: **Consumer Transformation**



Projected cumulative number of heat pumps in Orkney
Source: SSEN DFES 2022 projections – Consumer Transformation scenario

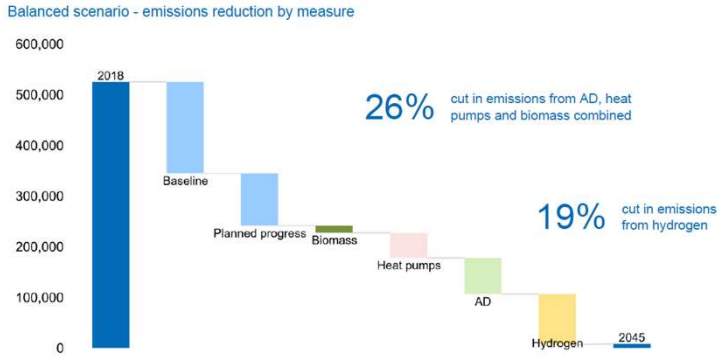
Commercial and industrial decarbonisation:

Distilleries

Distilleries are high-energy consumers, largely from the heat requirements needed for distilling.

Engagement with industry shows that decarbonisation methods are already being explored:

- **Alternative fuels –** seeking transition away from kerosene. Ongoing demonstration project assessing green hydrogen as a primary fuel and natural gas as a backup. Biofuels also being considered.
- **Electrification of smaller distilleries** – electric boilers are deemed suitable for smaller distilleries. Electrification could include solar PV or wind farm connection as no gas on Orkney.
- **Associated operations –** includes electrification of associated operations also being explored by distilleries, such as bottling plants, distribution and export and onsite decarbonisation for shops and staff. Decarbonisation of vehicle fleets already in place.



Emissions reductions in the Scotch Whisky industry by measure
Source: Scotch Whisky Association

Engaged stakeholders:

Pernod Ricard · EDRINGTON · DIAGEO · Islay Energy Trust · scotch whisky association

Commercial and industrial decarbonisation:

Aquaculture

Fishing and aquaculture in Orkney directly supports around 90 local businesses and equates c.5% of the local economy.

Salmon Scotland, the representing organisation, have set a net zero target of 2045, which includes 100% renewable electricity use across production and transport.

Potential for electrification or alternative fuels requiring electricity (e.g. hydrogen fuel cells) for fishing vessels.

Scottish Aquaculture Growth Strategy aim to double the sector's economic contribution to £3.6 billion by 2030, supported by a job growth to 18,000.

Sector growth is currently limited by grid constraints.

Aquaculture Growth to 2030
Source: Highland and Islands Enterprise

Load growth in Orkney: Key points

Renewable electricity generation – to remain significant source of future generation load growth on Orkney (particularly onshore wind and marine energy). There is potential for some solar PV to be installed.

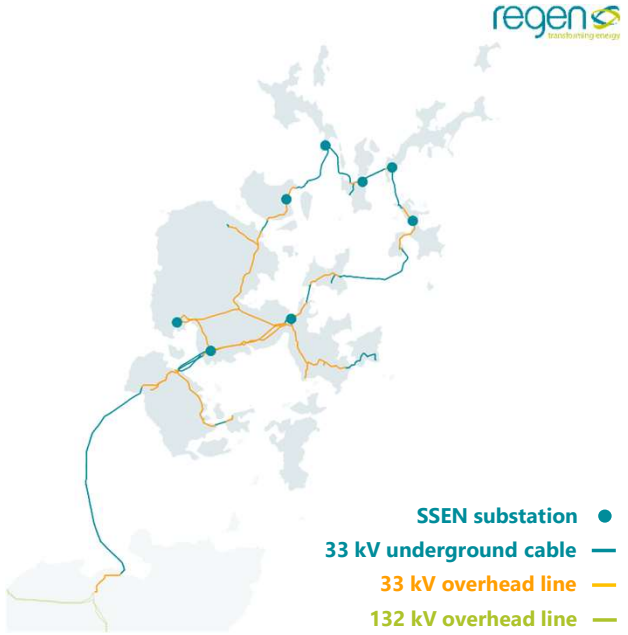
Battery storage – currently limited development in Orkney; however, use cases and business models are evolving. Further renewable electricity generation and hydrogen development – spearheaded by EMEC – could see storage as a component.

Hydrogen – as source of demand from electrolysis and as a potential offtake of local wind generation, green hydrogen may see notable development in Orkney.

Transport – potentially significant source of future electricity demand from road, maritime and aviation. Tourism and commercial freight distribution (i.e. whisky/ fishing) could be a significant contributor for transport charging infrastructure.

Heat – space heating could create notable new electricity load across Orkney as heat pumps are adopted to replace some fossil fuel heating systems, alongside existing night storage and direct electric heating.

Commercial and industrial decarbonisation – decarbonisation of key island industries (e.g., whisky distilleries and fish farming) and broader industries (e.g., agriculture and other commercial businesses) could drive a range of potential electrification outcomes.



Existing network infrastructure in Orkney
Source: SSEN distribution network mapping data

slido

Are there any further energy insights we need to consider?

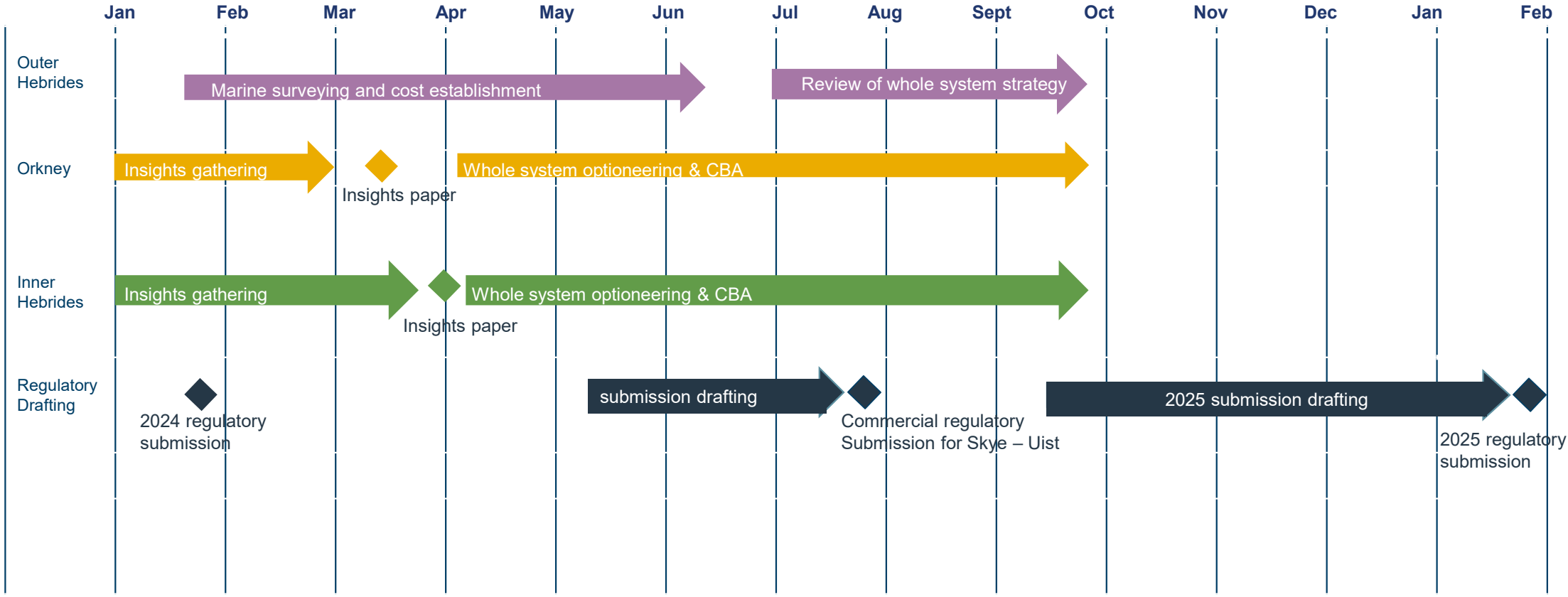
ⓘ Start presenting to display the poll results on this slide.

NEXT STEPS

Andy Wainwright, Whole System Manager

Scottish & Southern Electricity Networks

2024 DRAFT PROGRAMME OF WORKS



Q&A

Scottish & Southern Electricity Networks

YOUR FEEDBACK

Scottish & Southern Electricity Networks

slido

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 Orkney after attending this webinar”?

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

slido

How frequently would you like to be updated on the whole system energy solutions for Orkney?

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

slido

How would you like us to keep you informed?

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

ENGAGE WITH US

For any queries or to request further information, please contact us on:

stakeholder.engagement@sse.com

www.ssen.co.uk

twitter.com/ssencommunity

facebook.com/ssencommunity

linkedin.com/company/ssencommunity

Sign up for our Local Authority Roadshows

- Perth – 16th April
- Inverness – 17th April

Scottish & Southern Electricity Networks

THANK YOU

Scottish & Southern Electricity Networks