Scottish and Southern Electricity Networks Distribution Future Energy Scenarios 2021

North of Scotland regional webinar

Welcome and introduction

→ Ray Arrell - Head of Technical Development, Regen

Agenda for today

Time	Activity	Presenter
10:00 – 10:10	Welcome and agenda	Ray Arrell, Head of Technical Development, Regen
10:10 – 10:25	Introduction to SSEN	Steve Atkins – DSO Transition Manager, SSEN
10:25 – 11:30	Distribution Future Energy Scenarios – Technology engagement sessions (Interactive online polling)	Joel Venn, Head Analyst, Regen Tamsyn Lonsdale-Smith, Energy Analyst, Regen Ray Arrell, Head of Technical Development, Regen
11:30 – 12:00	Q&A session and close	Chaired by Ray Arrell – Head of Technical Development, Regen

A bit about Regen...

Not-for-profit centre of energy expertise and market insight based in Exeter, Devon

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We have a mission is to accelerate the transition to a net zero energy system

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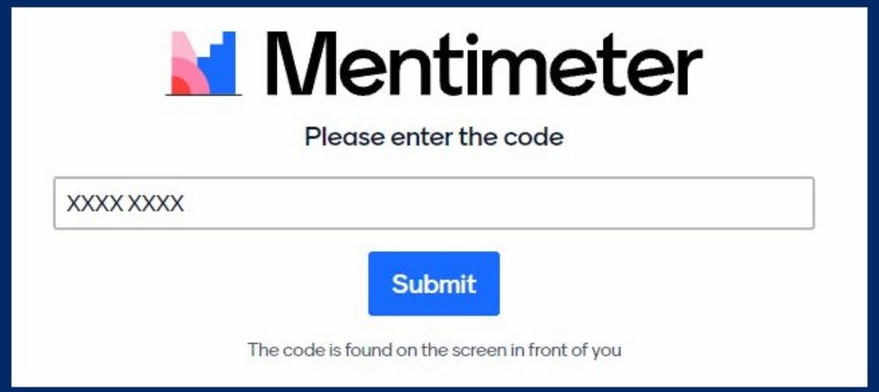
We have delivered Distribution Future Energy Scenarios (DFES) assessments for a electricity and gas distribution network operators since 2015



We are using Menti.com today for interactive voting

Go to www.menti.com on your phones!

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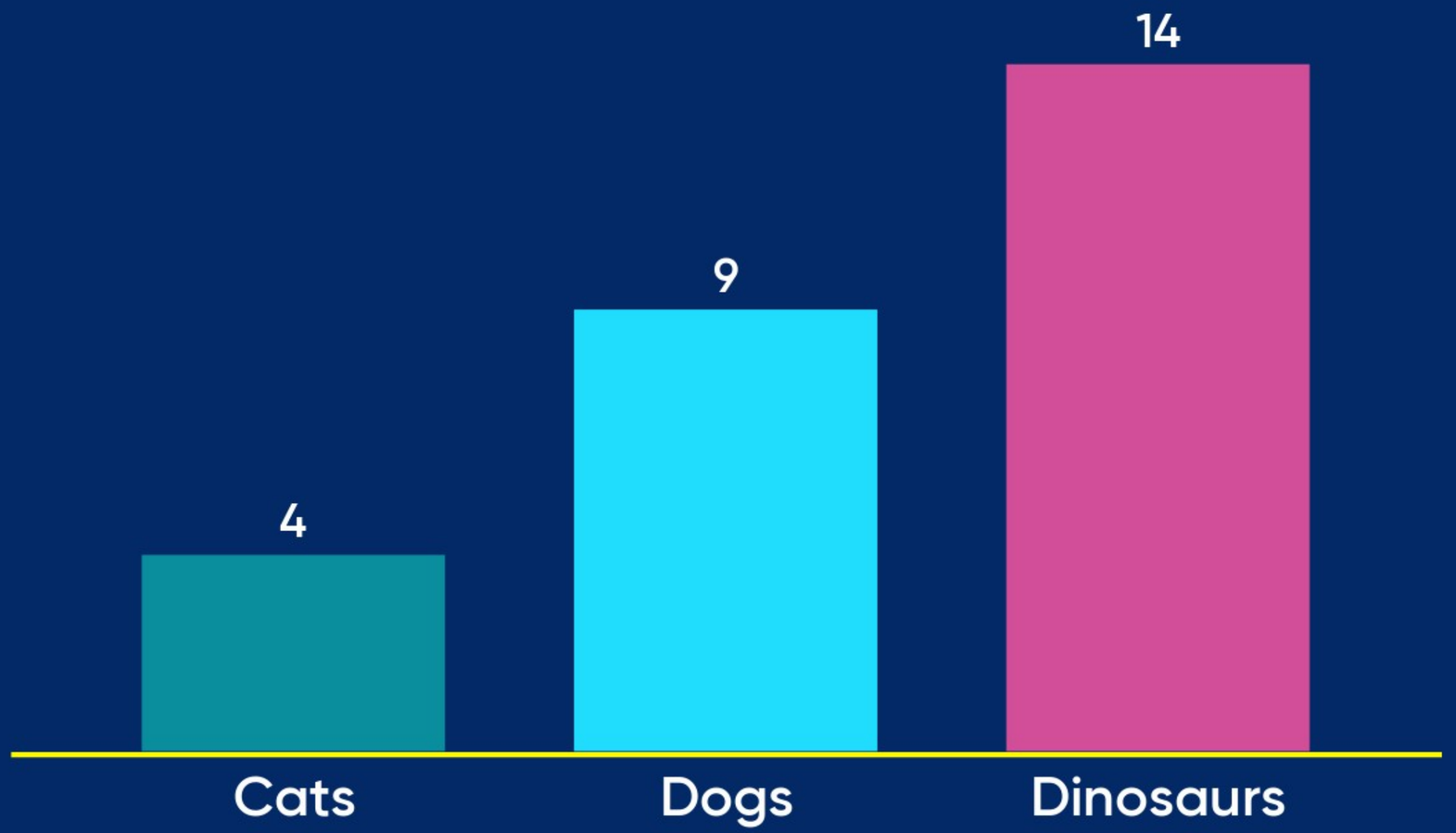
Test question! Which is your favourite?



Introduction to SSEN

→ Steve Atkins - DSO Transition Manager, SSEN

SSE's Seven business units

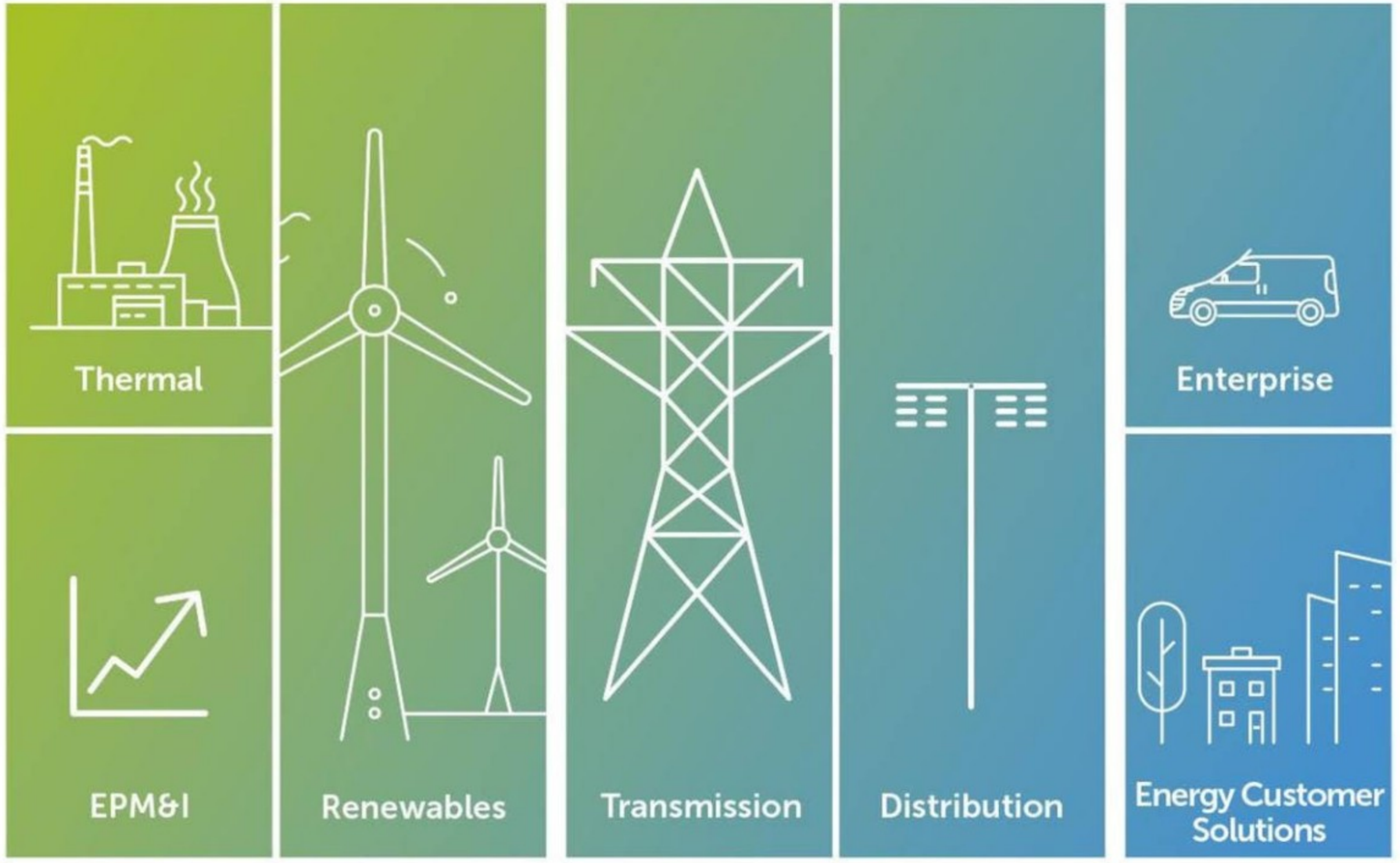
£8bn
NETWORKS RAV

4GW
RENEWABLE CAPACITY

COMBINED £1.5BN EBIT
FY19 EBIT SPLIT*

Renewables Networks Other

* Excluding Energy Portfolio Management



About SSEN

Our electricity distribution and transmission networks carry electricity to over 3.8 million homes and businesses across the north of the Central Belt of Scotland and Central Southern England.

Our skilled teams live and work in the communities they serve, supported by engineering and customer service teams based in major offices and depots in centres like Reading, Portsmouth, Perth and Inverness.

Our network at a glance

over **4,000** employees, working from 85 depots and offices in the heart if the community

130,000km of overhead lines and underground cables

106,000 substations

100+ subsea cables powering island communities

Power distributed to over **3.8m homes and businesses**

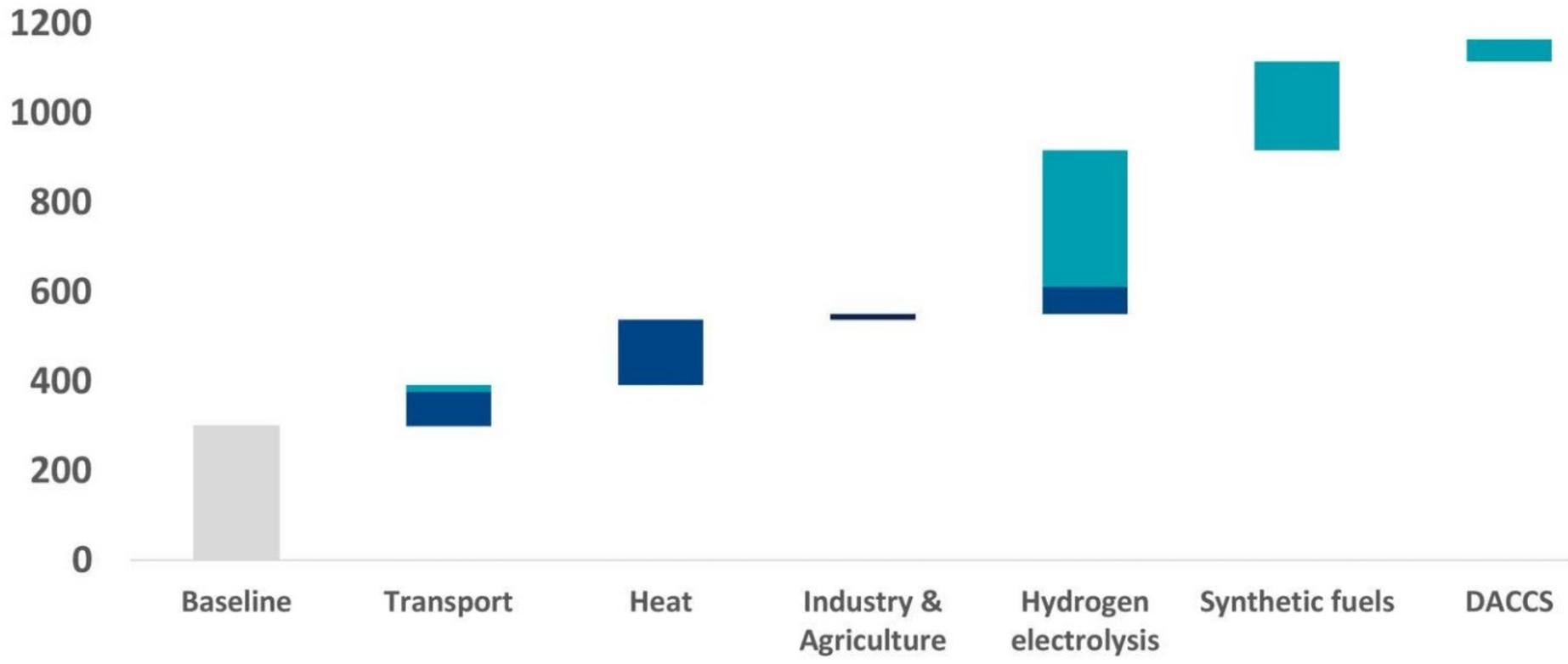
700,000+ vulnerable customers identified on our Priority Services Register

Scottish & Southern Electricity Networks

Net Zero will fundamentally reshape electricity demand

Government advisers, the Committee on Climate Change, predict an **electrification of the economy**

POTENTIAL NEW ELECTRICITY DEMANDS TO 2050 TO MEET NET ZERO (TWh/year)



Committee on Climate Change

Electricity demand could increase by 2 or 3 times by 2050

Hold the Front Page!

Oxford Mail

17th January

SSEN report estimates 70,000 electric vehicles in Oxford by 2050

By Liam Rice | @OxMailLiamRice
Reporter

Swindon Advertiser

Swindon will have more than 140,000 electric cars by 2050

By Daniel Angelini | Adver_Daniel
Reporter

John O'Groat Journal and Caithness Courier

New report forecasts rapid growth in electric vehicles in Highlands

islandecho the island's news source

ENERGY EFFICIENCY MEASURES SET TO RAPIDLY INCREASE ON THE ISLE OF WIGHT

DAILY ECHO

Charging points for electric cars in 8,000 Bournemouth driveways by 2035

By Darren Slade | @echodaz
Group business editor

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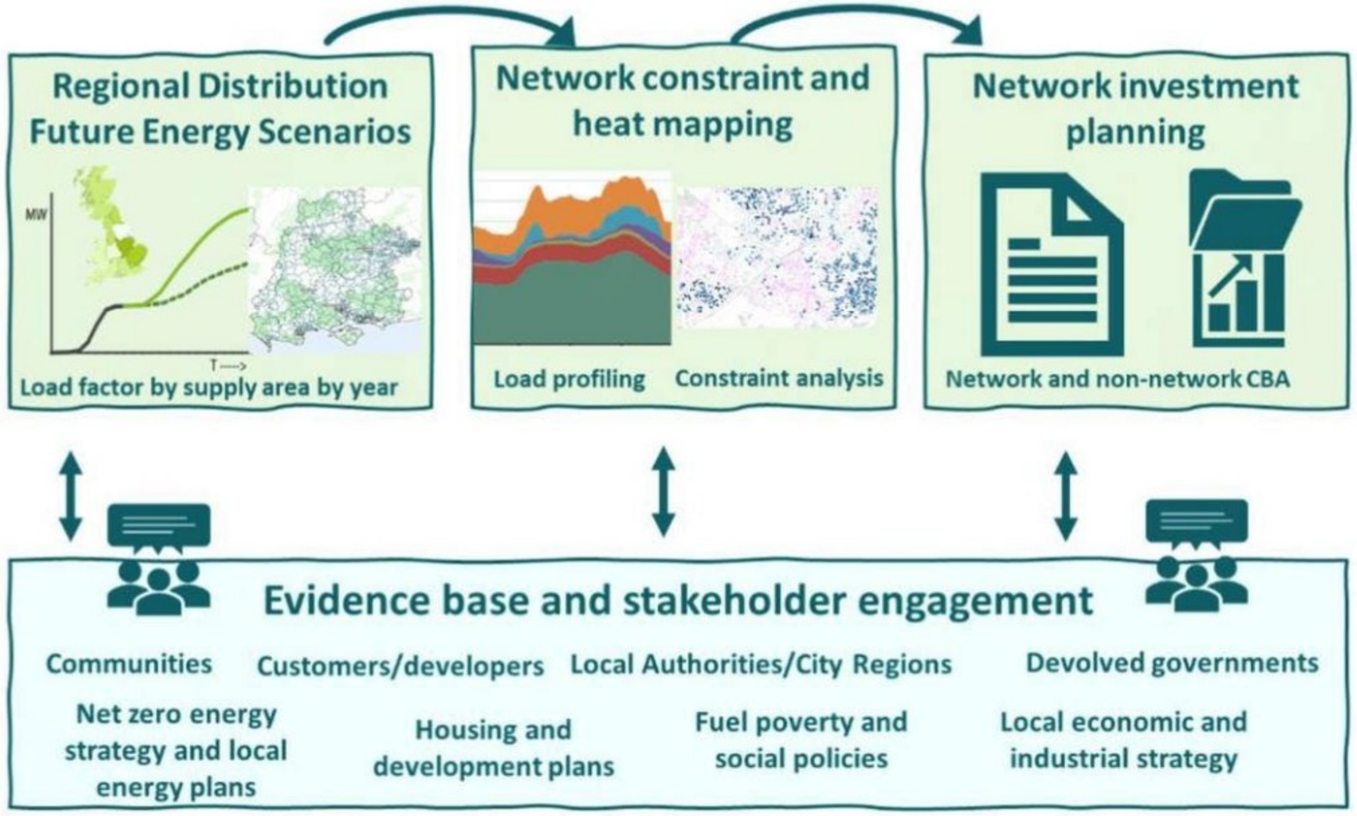
Distribution Future Energy Scenarios (DFES)

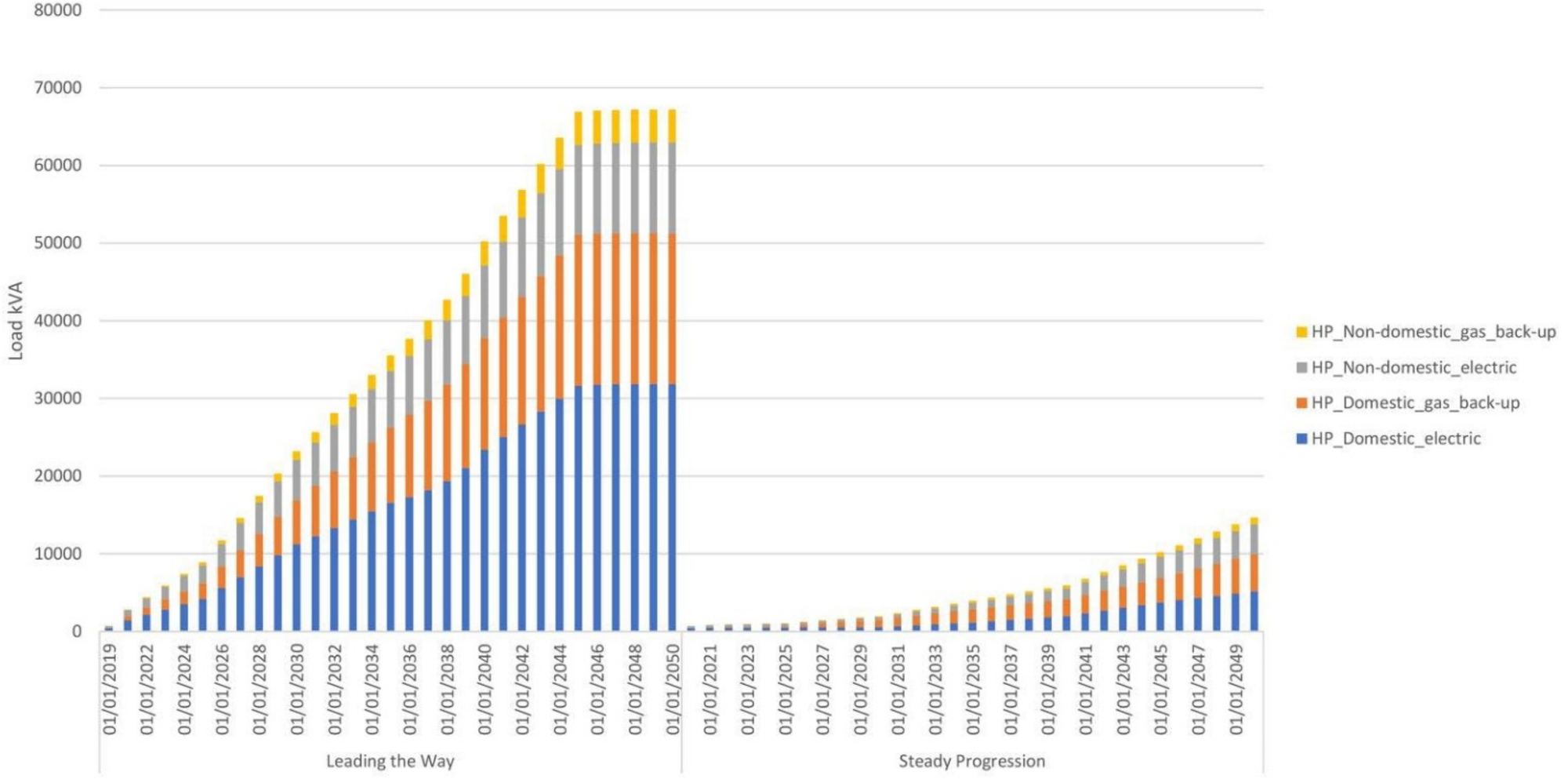


- The DFES **adopts the National Grid FES as its overarching framework**, but develops bottom-up local evidence driven projections.
- We **adjust the DFES as required**, to reflect **legally binding national/ devolved targets**, and reflecting that FES may have limitations.
- Where appropriate, **the scenarios are adjusted based on stakeholder engagement and an evidence base** to further reflect local ambitions and targets, and to reflect legally binding national/ devolved targets.
- The DFES recognise that there is no 'one-size fits all' approach to securing the net zero transition.

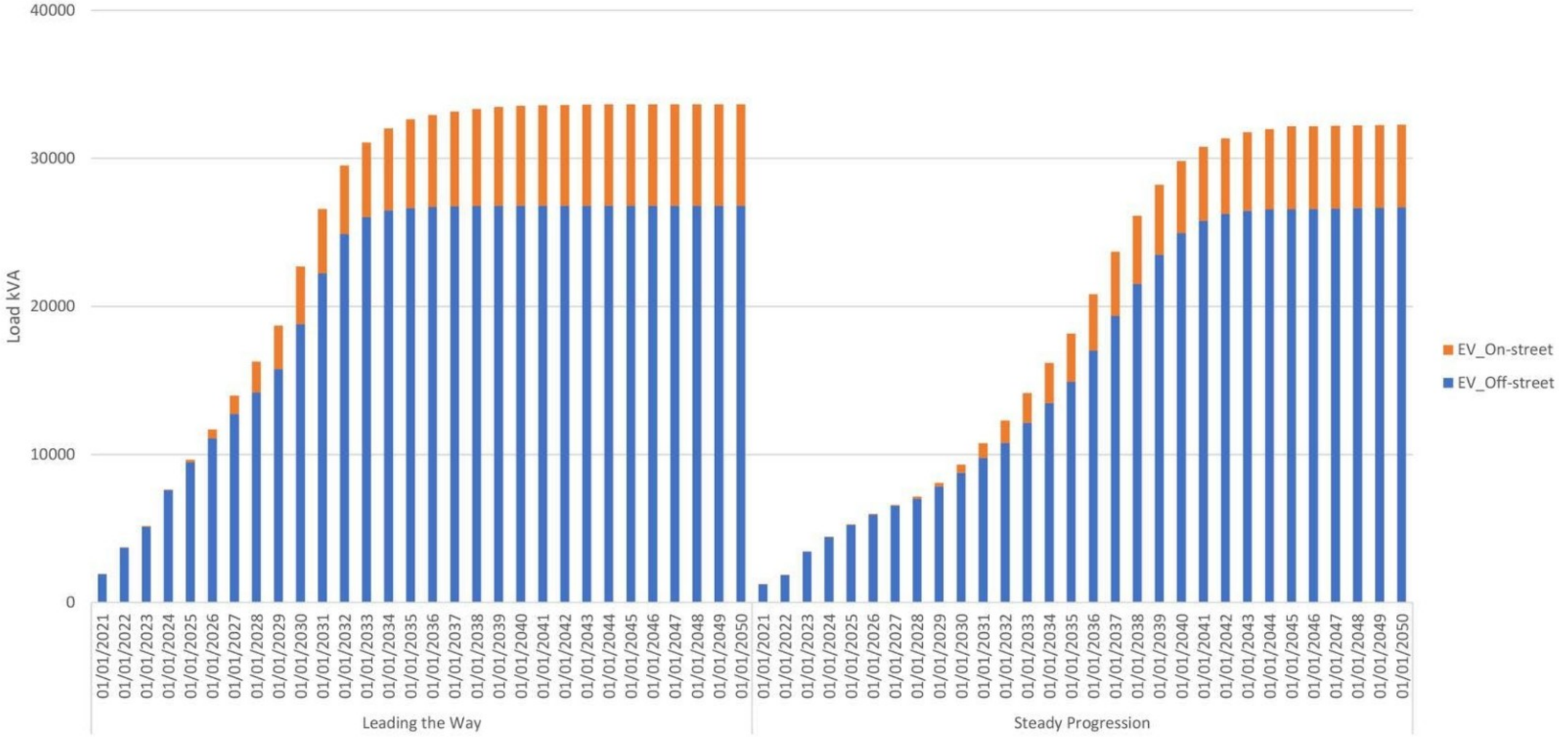
Local impact of the transition to net zero: Spelthorne

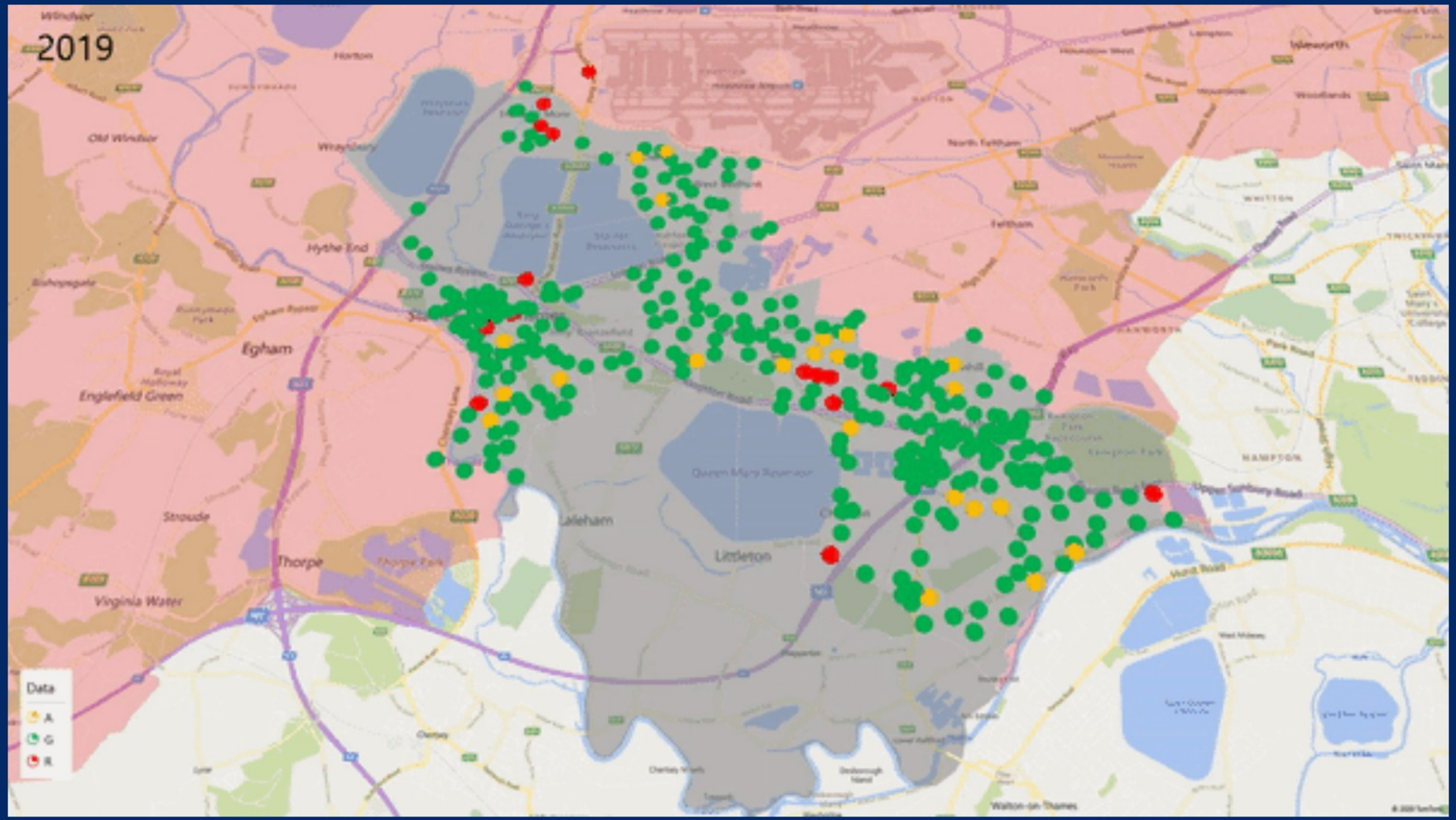
Scottish & Southern Electricity Networks

Heat pump (HP) uptake projections

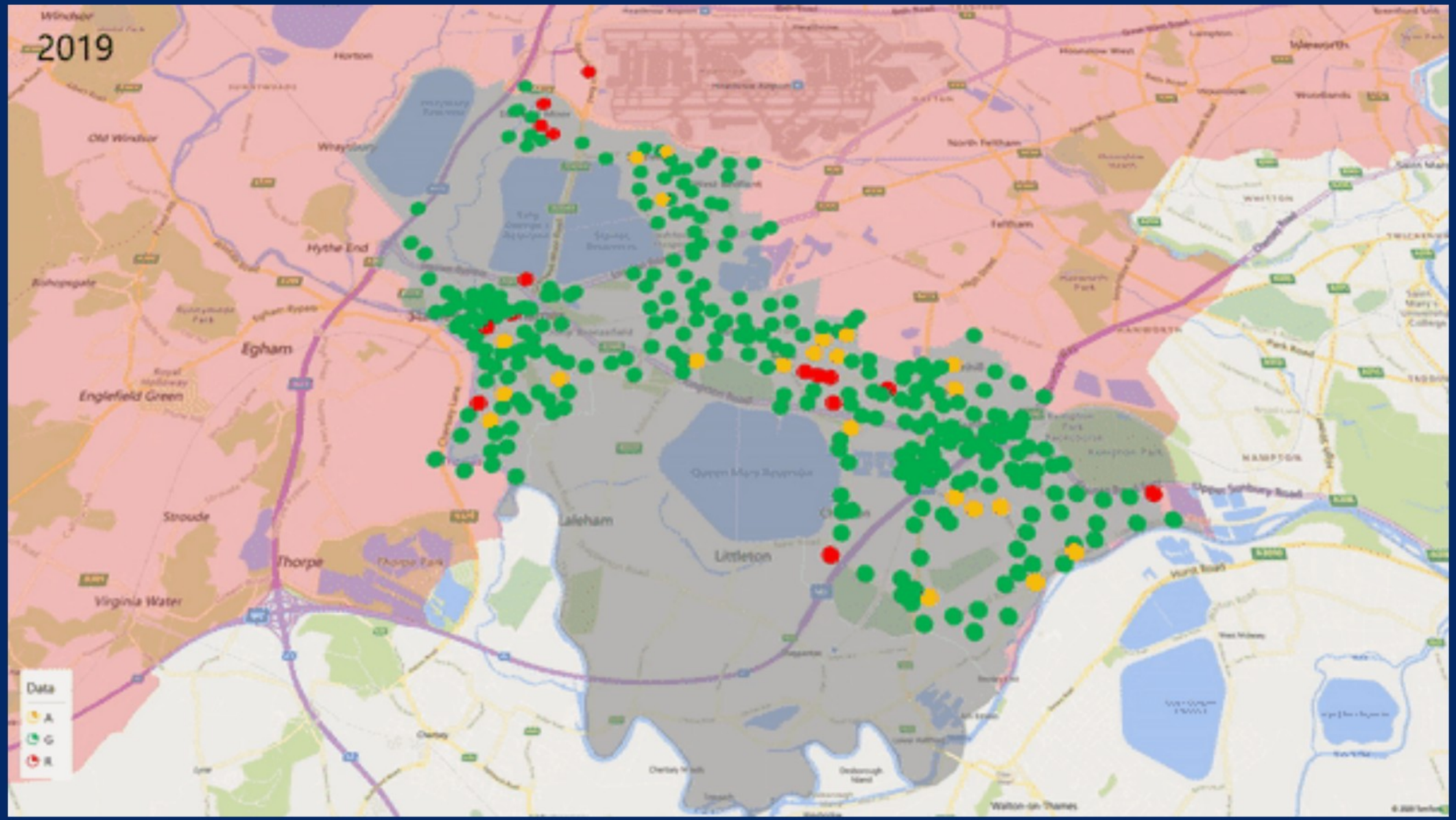


Domestic electric vehicle (EV) uptake projections





Network impact - Steady Progression scenario



Network impact – Leading the Way scenario

Overloaded network projections in numbers

Overloaded networks – Steady Progression								
Year	2023	2025	2028	2030	2035	2040	2045	2050
Total LV networks	18	20	27	32	55	84	94	106

Overloaded networks – Leading The Way								
Year	2023	2025	2028	2030	2035	2040	2045	2050
Total LV networks	30	41	72	99	147	176	193	193

* Note: RIIO-ED2 price control period runs from 2023-2028

Our Strategic Outcomes

Based on stakeholder feedback we have set out **four strategic outcomes** for our business plan, aligned to **three core principles**.

CORE PRINCIPLES

VALUE FOR MONEY

…focusing on efficiency and creating value for customers and communities

INNOVATION

…embracing new ways of doing things for the benefit of customers and communities

TRANSPARENCY

…being open and accessible in our activity and engagement

Overview of DFES

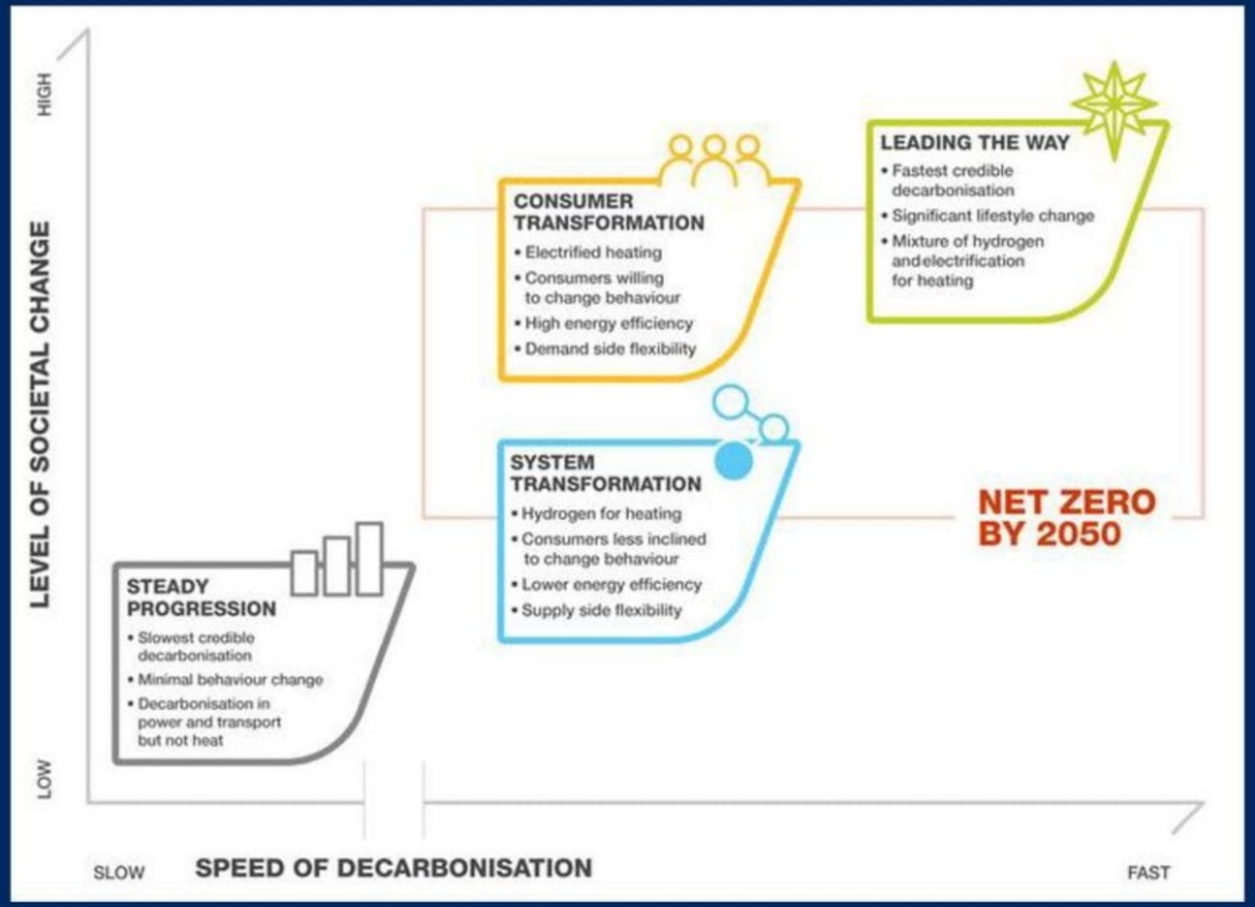
→ Ray Arrell - Head of Technical Development, Regen

In this session we will be...

- Briefly summarising what DFES is and how we do it
- Views on future energy technologies in the North of Scotland licence area
- Giving you an opportunity to ask us some questions about DFES

DFES analysis is part of wider future forecasting and network planning processes

The DFES uses the National Grid ESO Future Energy Scenarios 2021 framework:



Credit & source: National Grid ESO, July 2021

- Underlying societal/economic framing of scenarios
- Future technology assumptions
- National UK trends
- Regional datasets (where available)

The DFES assesses:

1) Key distributed generation and electricity storage projects that are (or will) directly connect to SSEN's electricity distribution network – projected in electrical capacity (MW_e):

Renewable generation

Waste technologies

Electricity storage

Fossil fuel generation

H_2

Hydrogen electrolysers

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1) Key distributed generation and electricity storage projects that are (or will) directly connect to SSEN's electricity distribution network – projected in electrical capacity (MW_e):

Renewable generation

Waste technologies

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Fossil fuel generation

H_2

Hydrogen electrolysers

The DFES assesses:

2) Key low carbon technologies that might connect to SSEN's network at lower voltages:

Electric vehicles

Electric vehicle chargers

Heating technologies

Domestic rooftop PV

The DFES assesses:

3) Strategic new developments that local authorities are aware of within the licence areas:

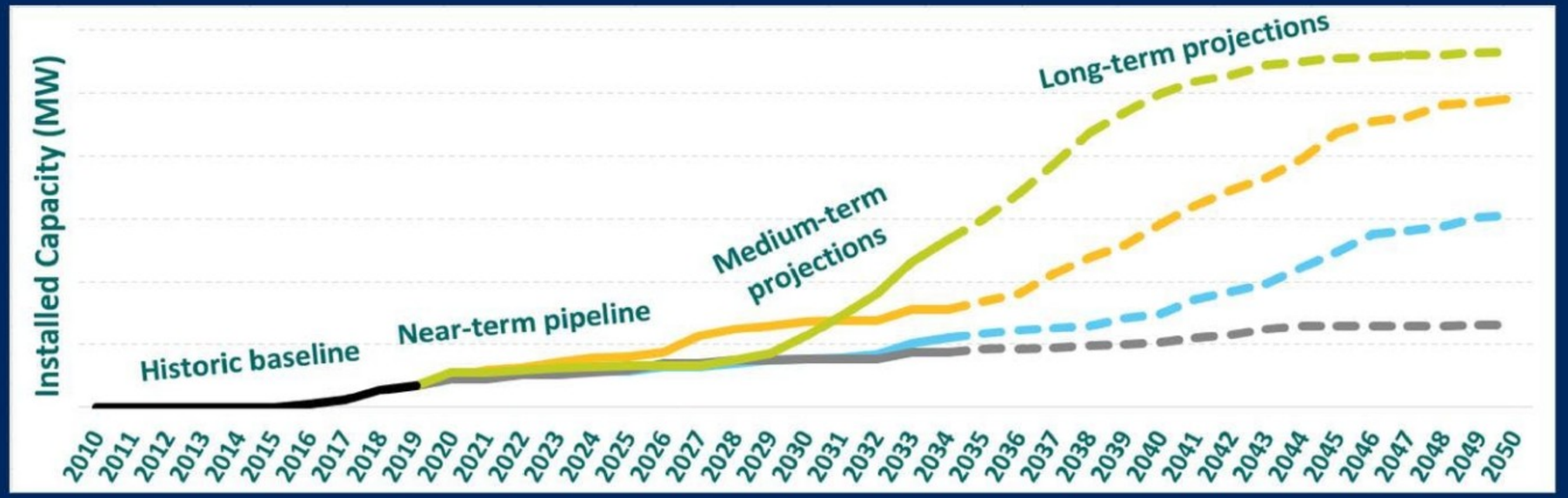
New homes / domestic developments

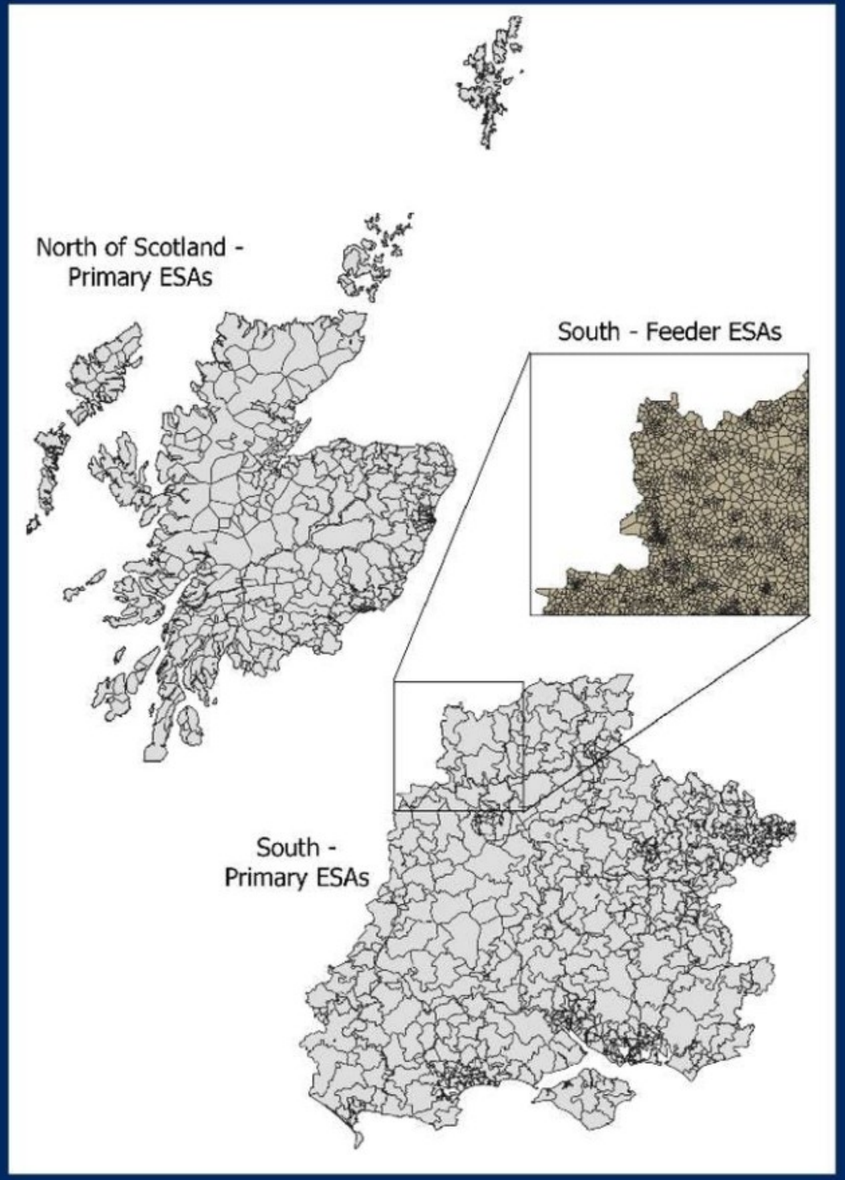
New non-domestic developments

Sharepoint data exchange (thankyou!)

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

1. Determines the **existing baseline**
2. Assesses the **near-term pipeline**
3. Develops **medium and long term projections** out to 2050
4. **Geographically distributes** these technologies/capacities within the licence areas





The DFES distributes its projections into **Electricity Supply Areas (ESAs)**

Using technology specific geographical factors

Generation & storage projections - 11kV substation level

LCT projections – feeder/secondary substation

DFES Technology Engagement Sessions

- Transport: Electric Vehicles & Electric Vehicle chargers
- Heat: Heat pumps and direct electric heaters
- Renewables: Onshore wind, large scale solar and hydropower
- Electricity storage: batteries and other technologies
- Fossil fuel generation: diesel and natural gas
- Hydrogen electrolysis

A bit more about you...

Transport

- EV uptake
- EV charger infrastructure

EV and EV charger uptake in SSEN's licence areas

For Battery Electric Vehicles (BEV)

Region	BEVs per 1,000 households	Public EV chargers per 1,000 households	Public EV chargers per 1,000 BEVs in region
SSEN Scotland	7 ↓	2.0 ↑	300 ↑
SSEN South	19 ↑	0.9 ↑	46 ↓
GB	9 =	0.7 =	80 =

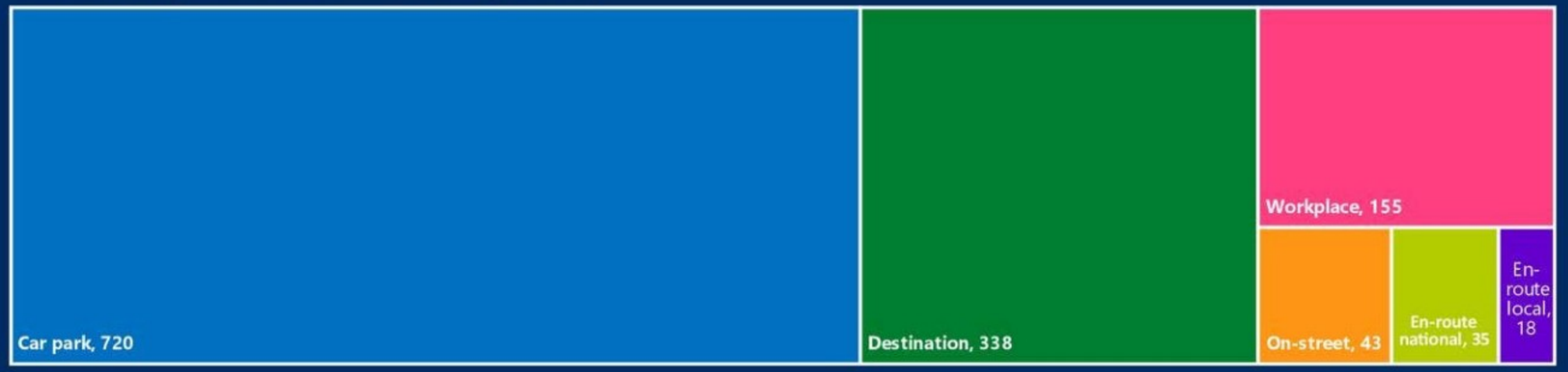
High granularity projections for low carbon technology uptake - EVs, EV chargers heat pumps and solar PV
SSEN, June 2020

Data sources: SSEN, Regen, DfT, NCR, ONS

When might Scotland's uptake of EVs catch up with the rest of the UK?

Existing EV charging infrastructure in SSEN's licence areas

EV chargers in the North of Scotland SSEN licence area tend to be publicly funded and located on public land such as car parks. ↓



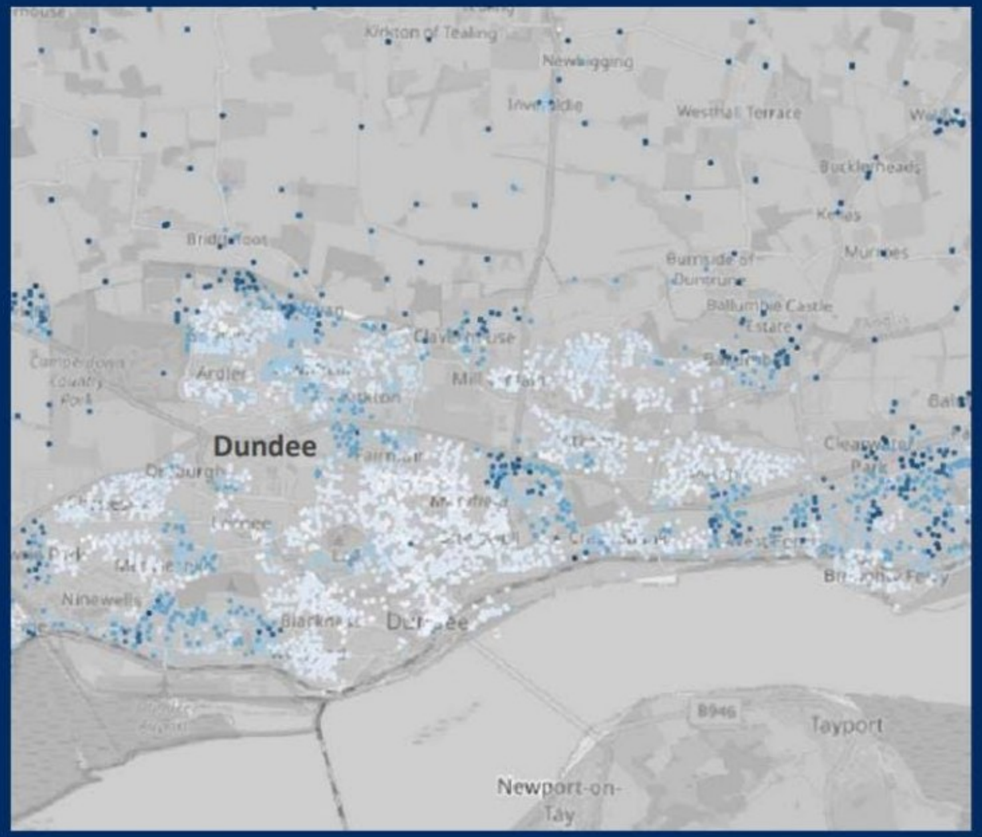
EV chargers in the Southern SSEN licence tend to be privately funded and so on private land and located in more dispersed locations such as on-street ↓

- Car park chargers
- Destination chargers
- On-street chargers
- Workplace chargers
- En-route (national)
- En-route (local)

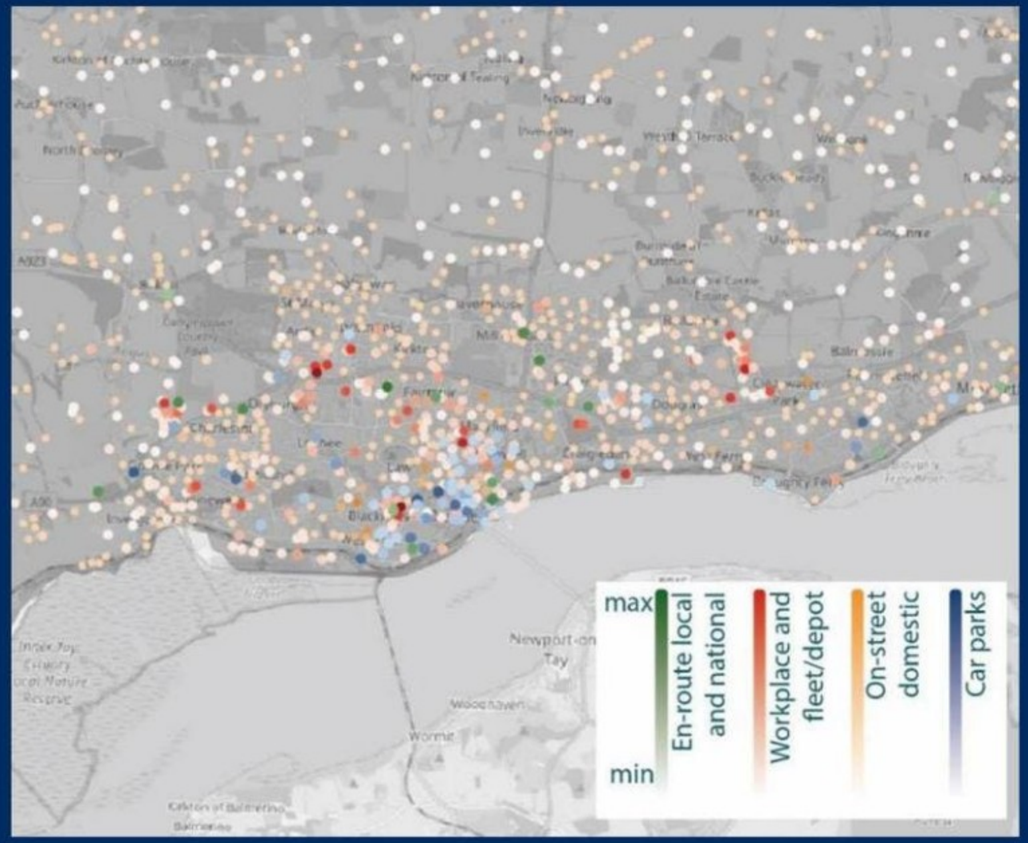
Data source:
National ChargePoint registry, Regen analysis

Existing EV charging infrastructure in SSEN's licence areas

Example off-street EV charging density in Dundee



Example non-domestic EV charging in Dundee



What is the future of on-street EV charging infrastructure in North Scotland?

Continued focus towards publicly owned charging infrastructure

Neighbourhood EV charging hubs

Widely distributed residential on-street charging

Heating technologies

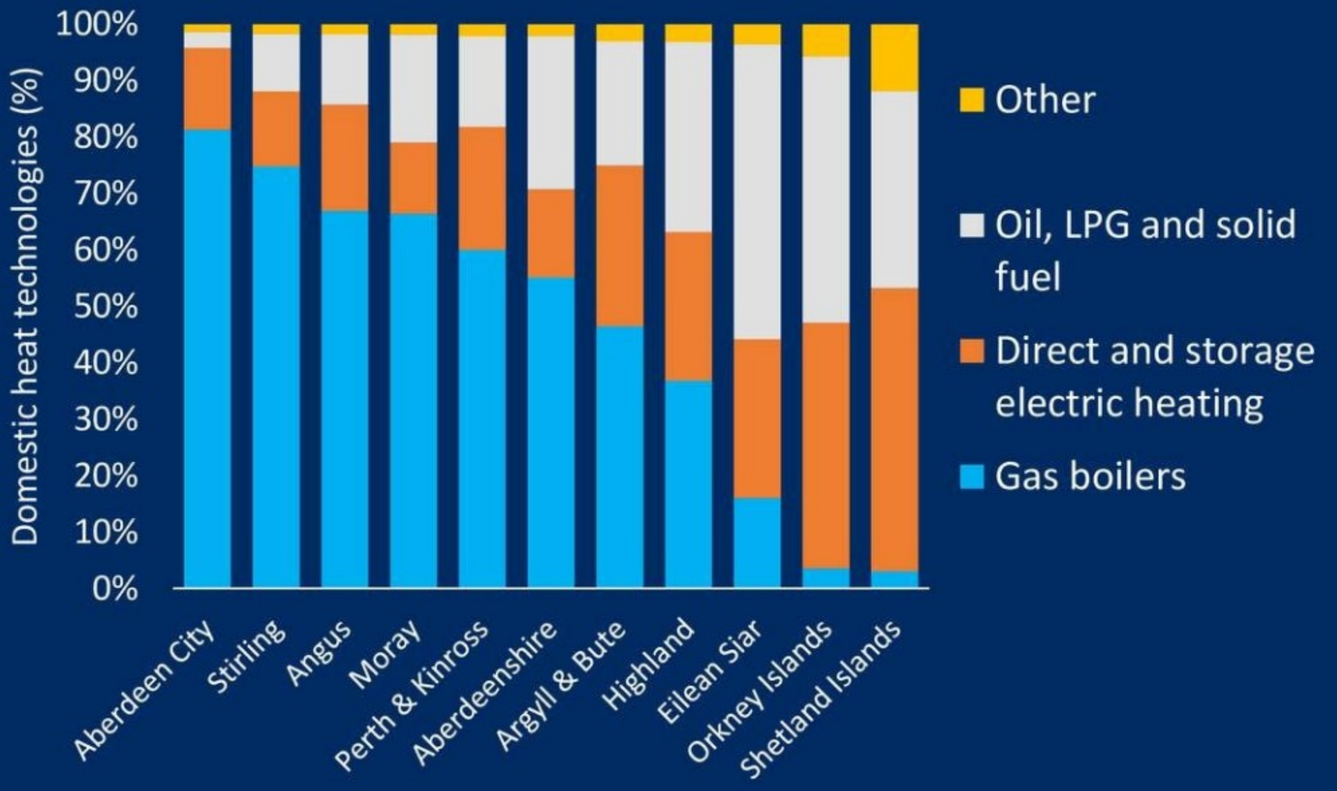
- Heat pumps
- Direct electric heating

Domestic heating in North Scotland

North Scotland has approximately triple the number of non-gas heated homes compared to GB

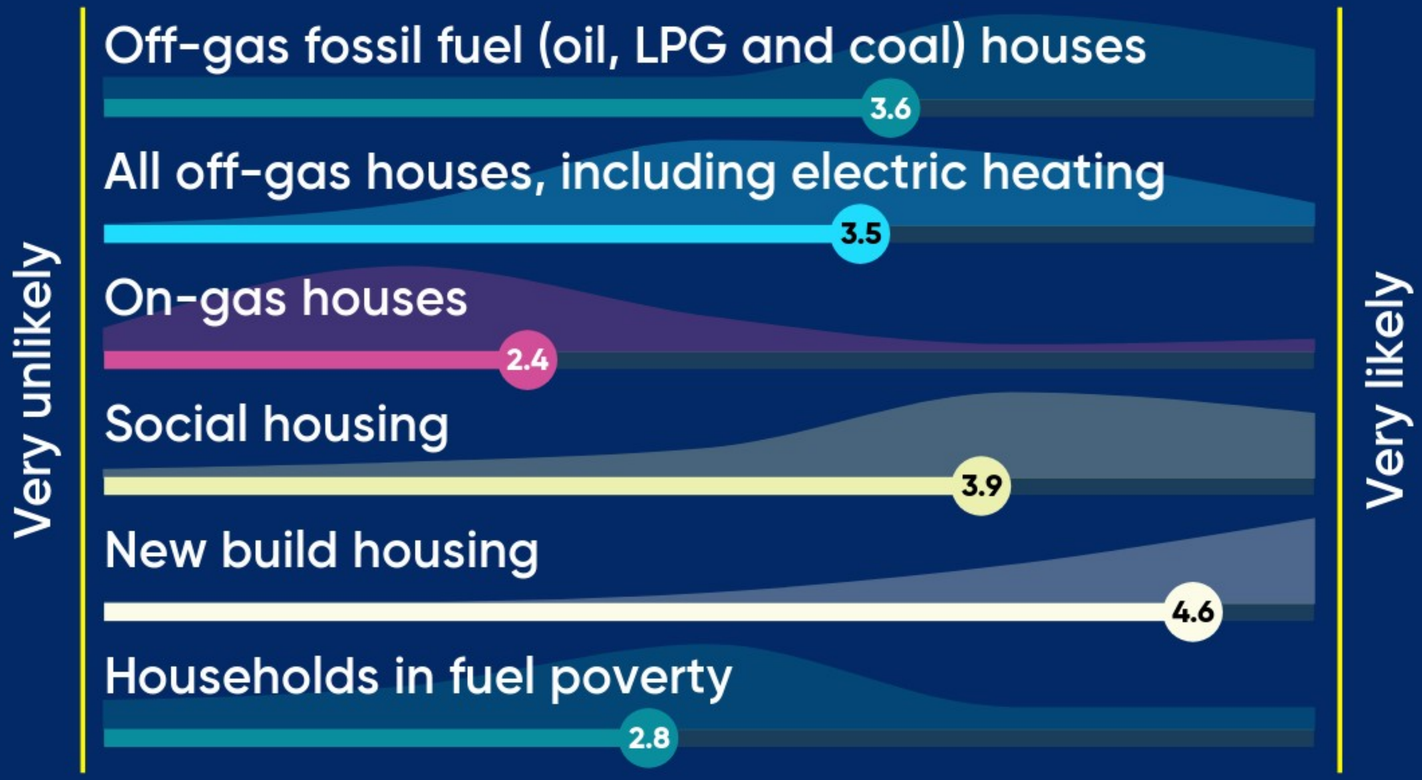
	Gas boilers	Direct and storage electric heating	Oli, LPG and solid fuel	Other	Heat pumps
SSEN Scotland	57%	20%	20%	2%	1%
SSEN South	79%	11%	8%	2%	1%
GB	85%	7%	5%	2%	1%

Gas heating is concentrated in local authorities that are predominantly urban, or in the east or south of the licence area

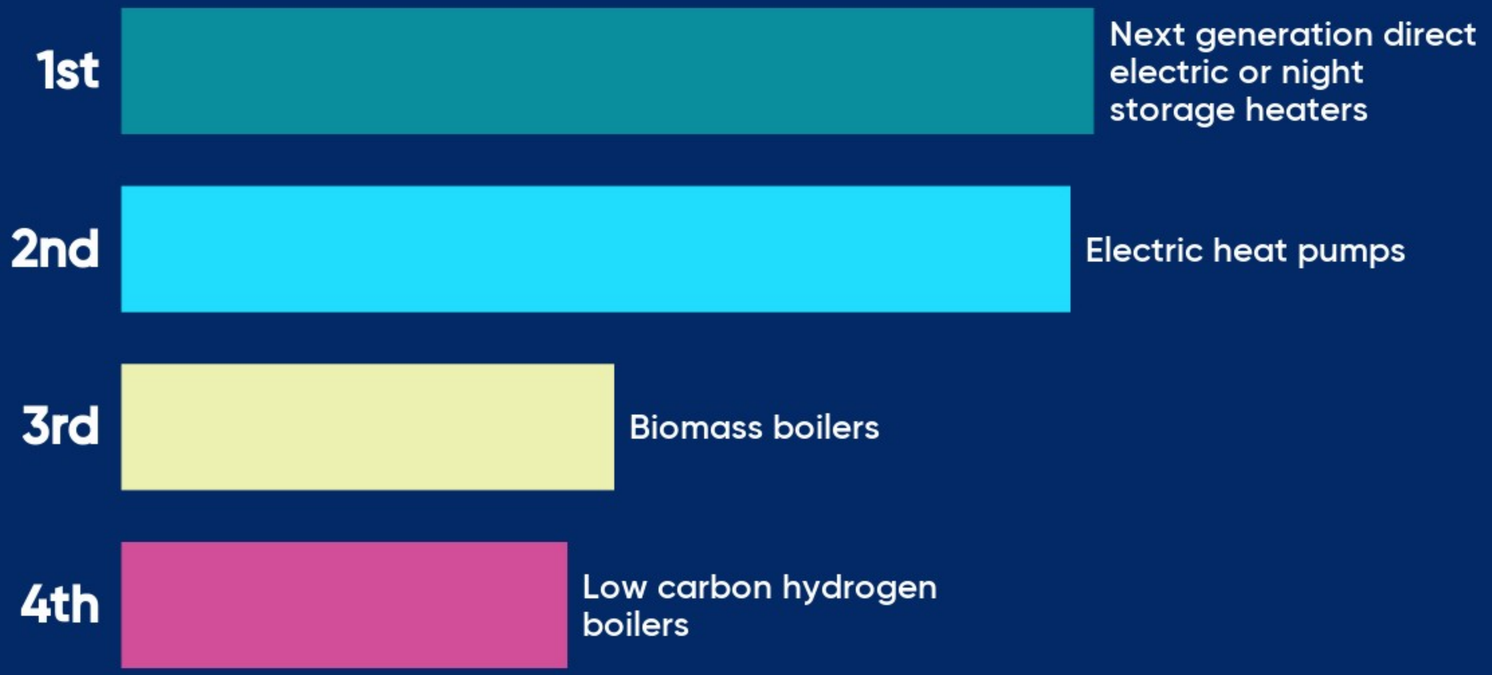


Data sources: Census, FES 2020, EPC

With Scottish Government's aims to ramp up zero carbon heating system installs to 200,000 pa by 2030, where could this be focussed in North Scotland?

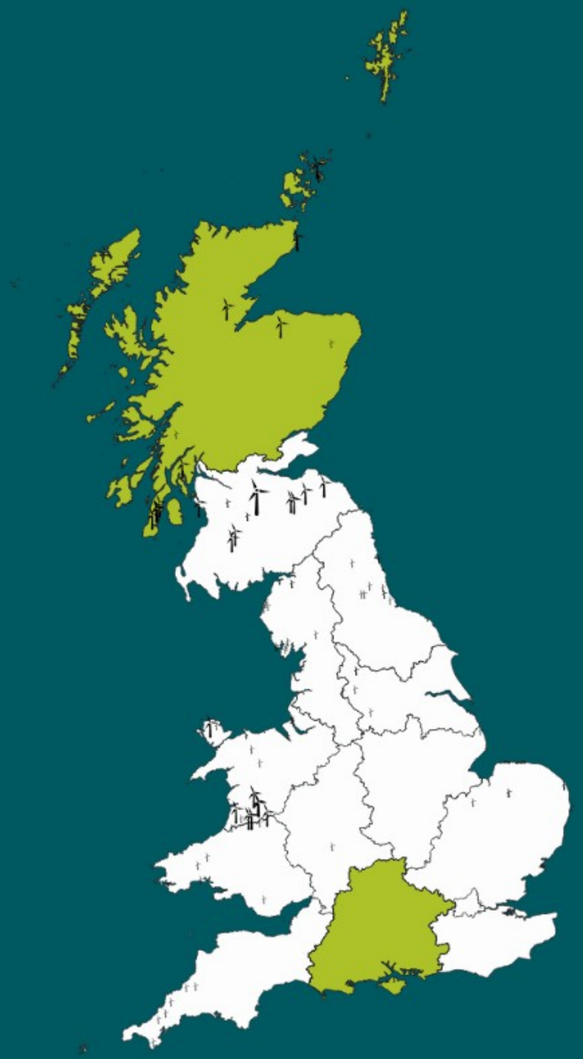


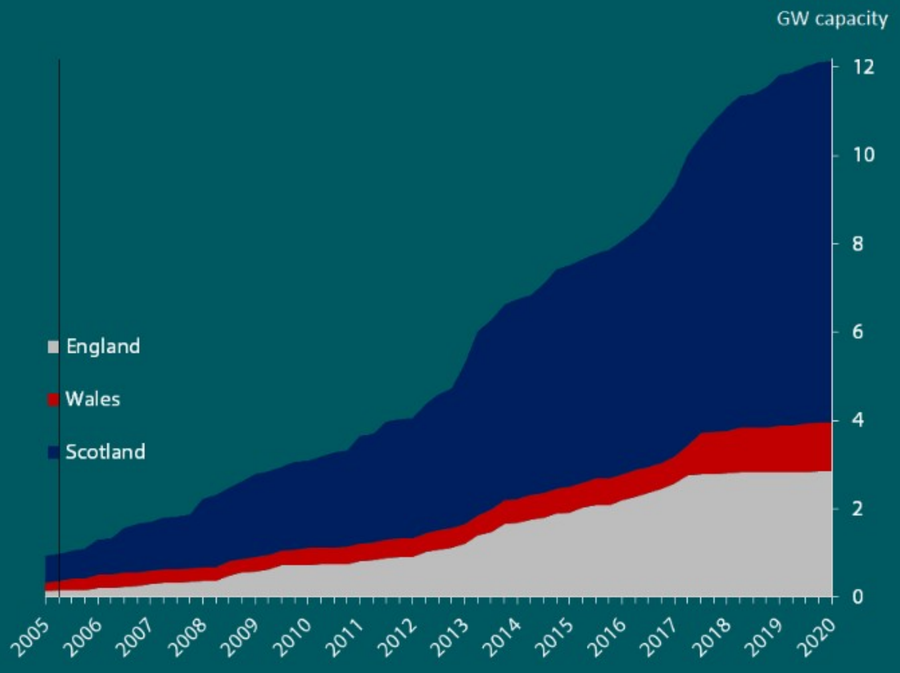
What do you think the future low carbon heating technology will predominantly be for the Scottish islands?



Electricity generation technologies

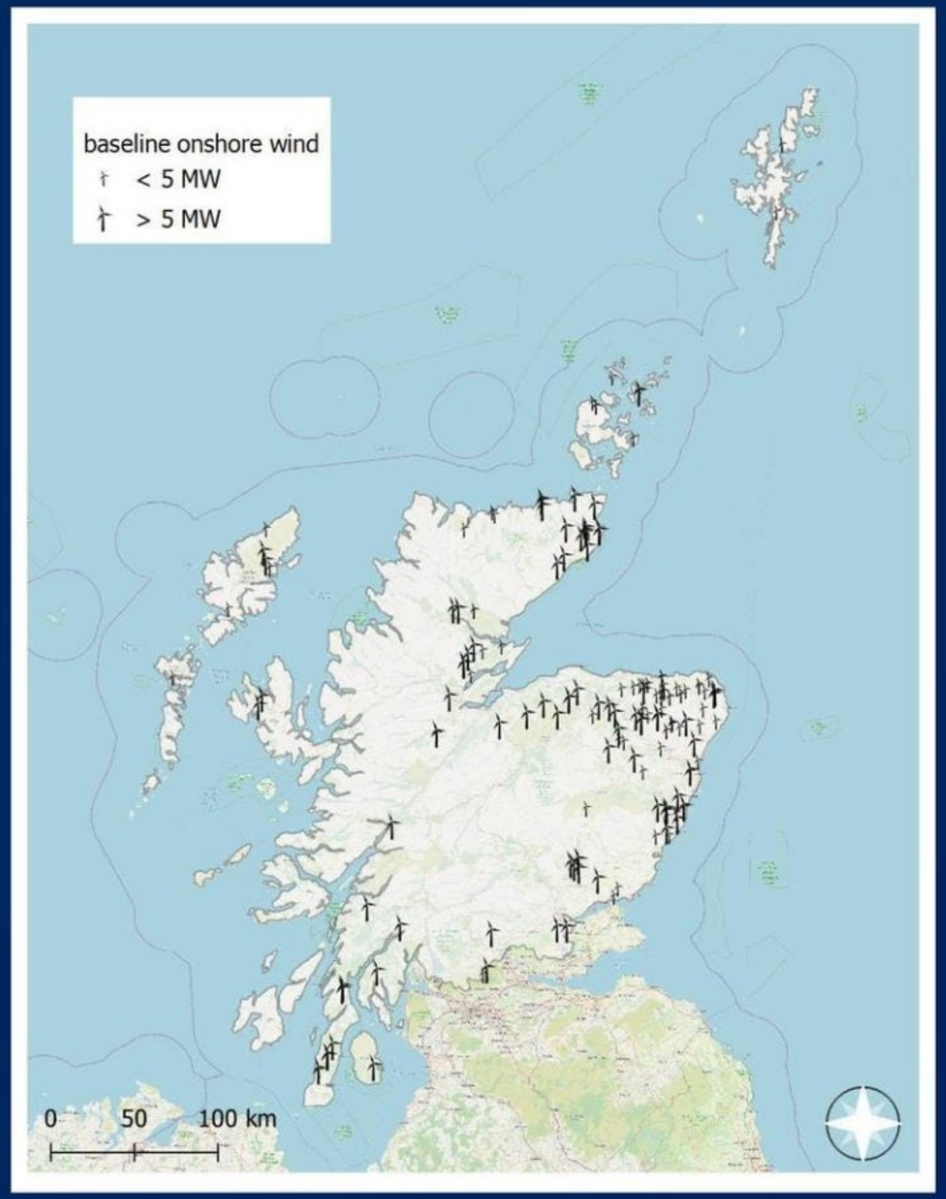
- Onshore wind
- Large scale solar PV
- Hydropower

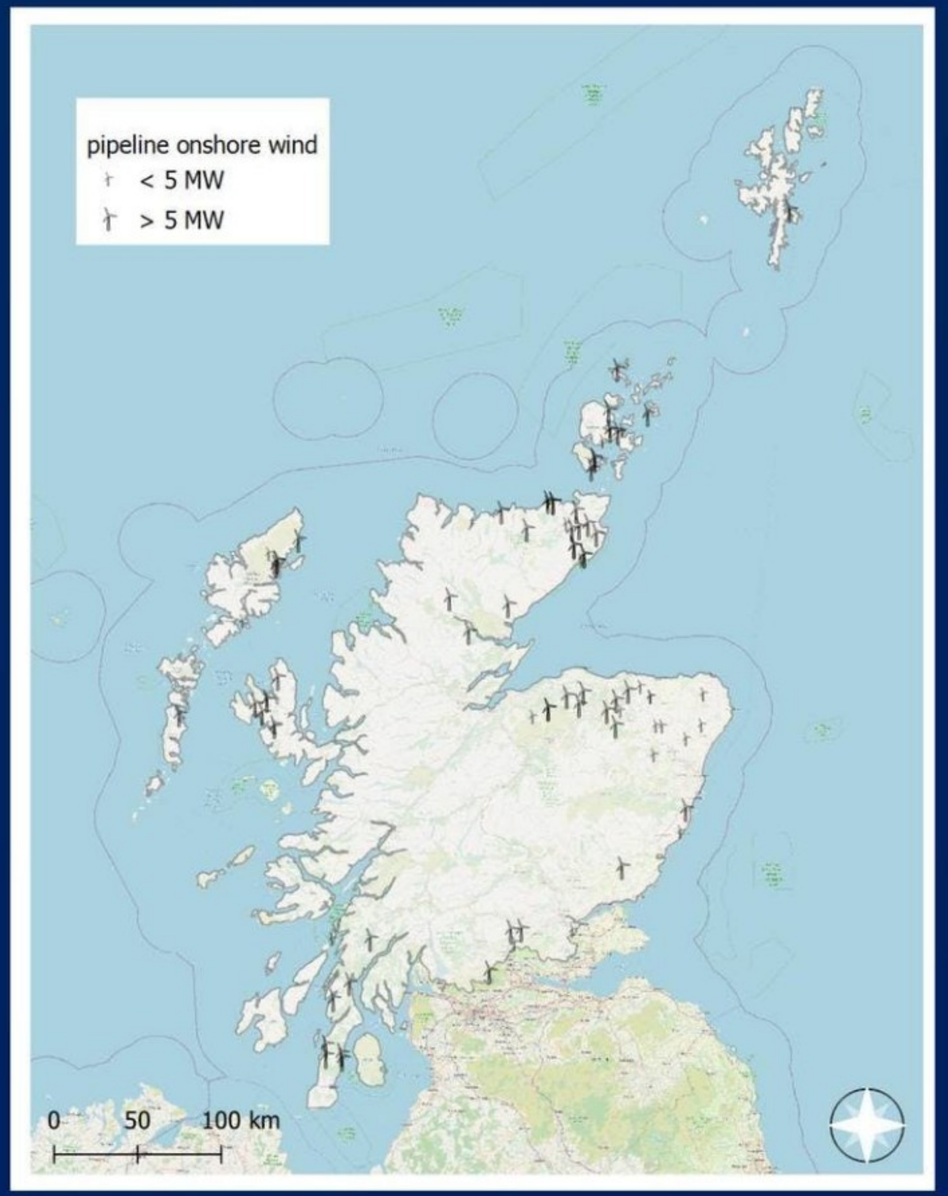




2005-04-01

Of the 3.9GW of onshore wind in North Scotland 1.8GW is transmission connected, 2.1GW is distribution connected, plus another 1.9GW is contracted

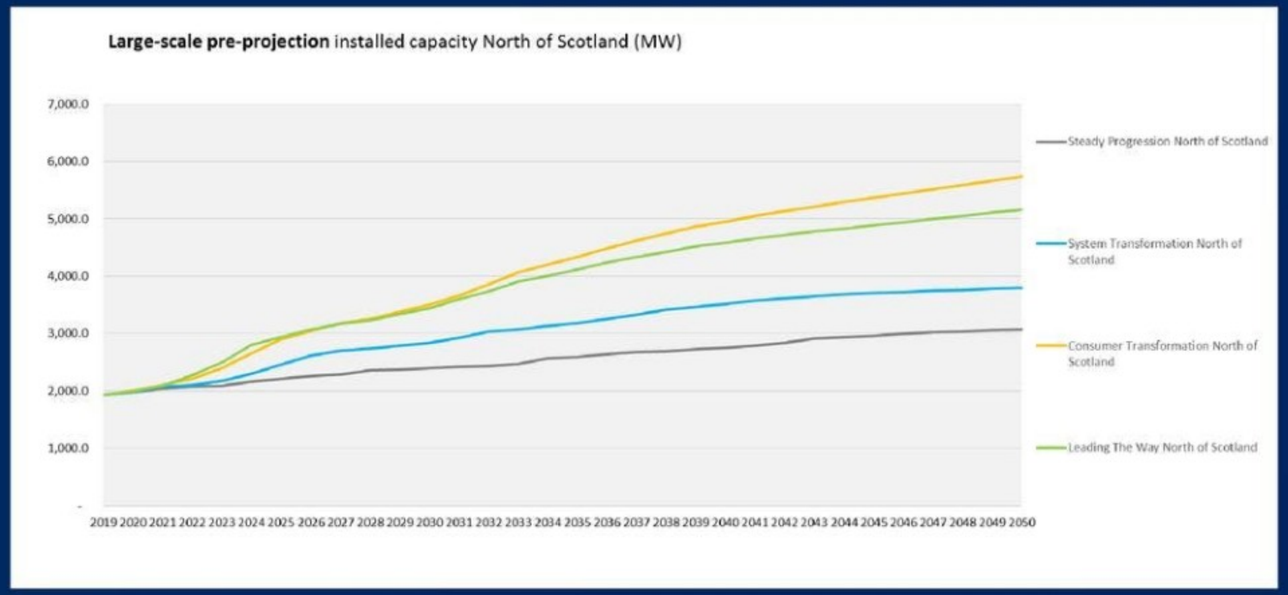


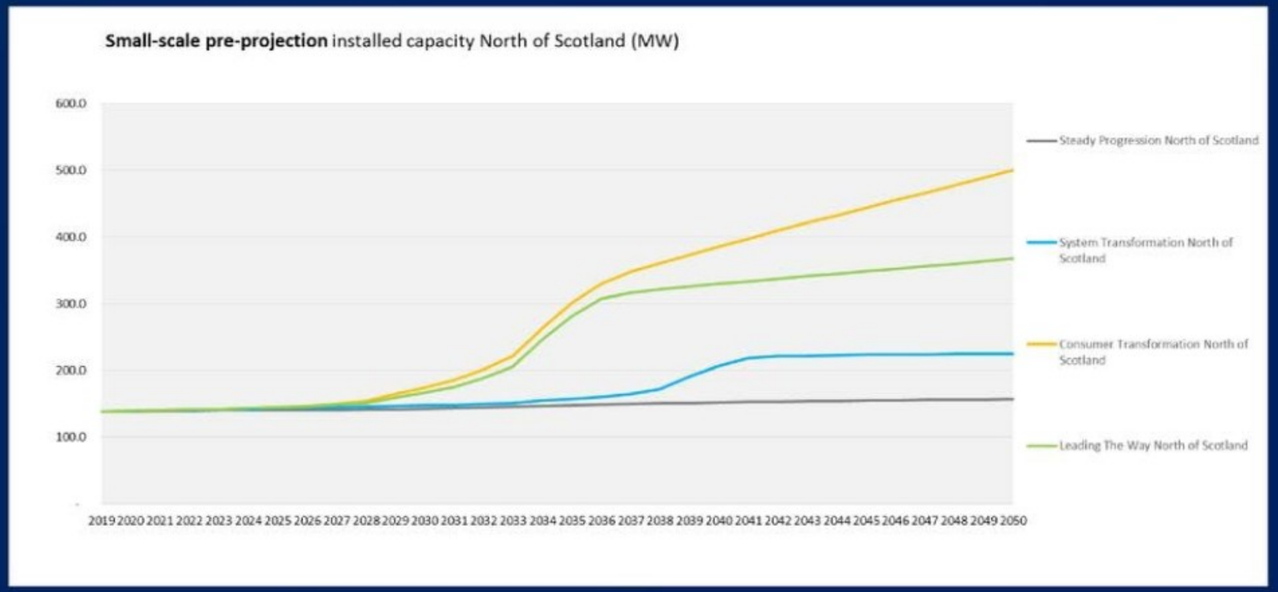


Onshore wind baseline and pipeline for the North of Scotland licence area are significant.

According to SSEN connections data:

- Pipeline: 1.9 MW from 89 sites
- Baseline: 2.1 GW from 491 sites



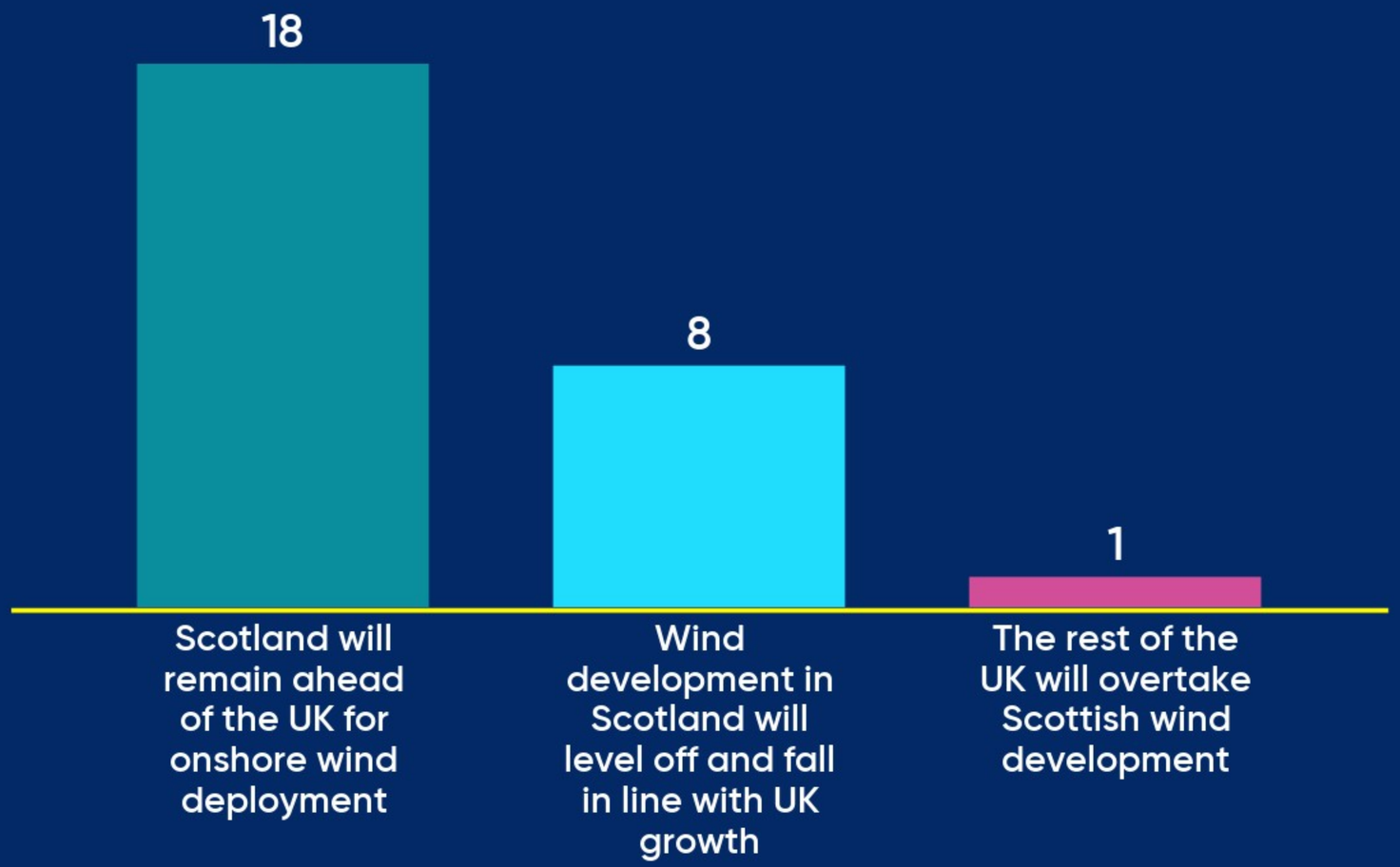


2020 Onshore wind projections

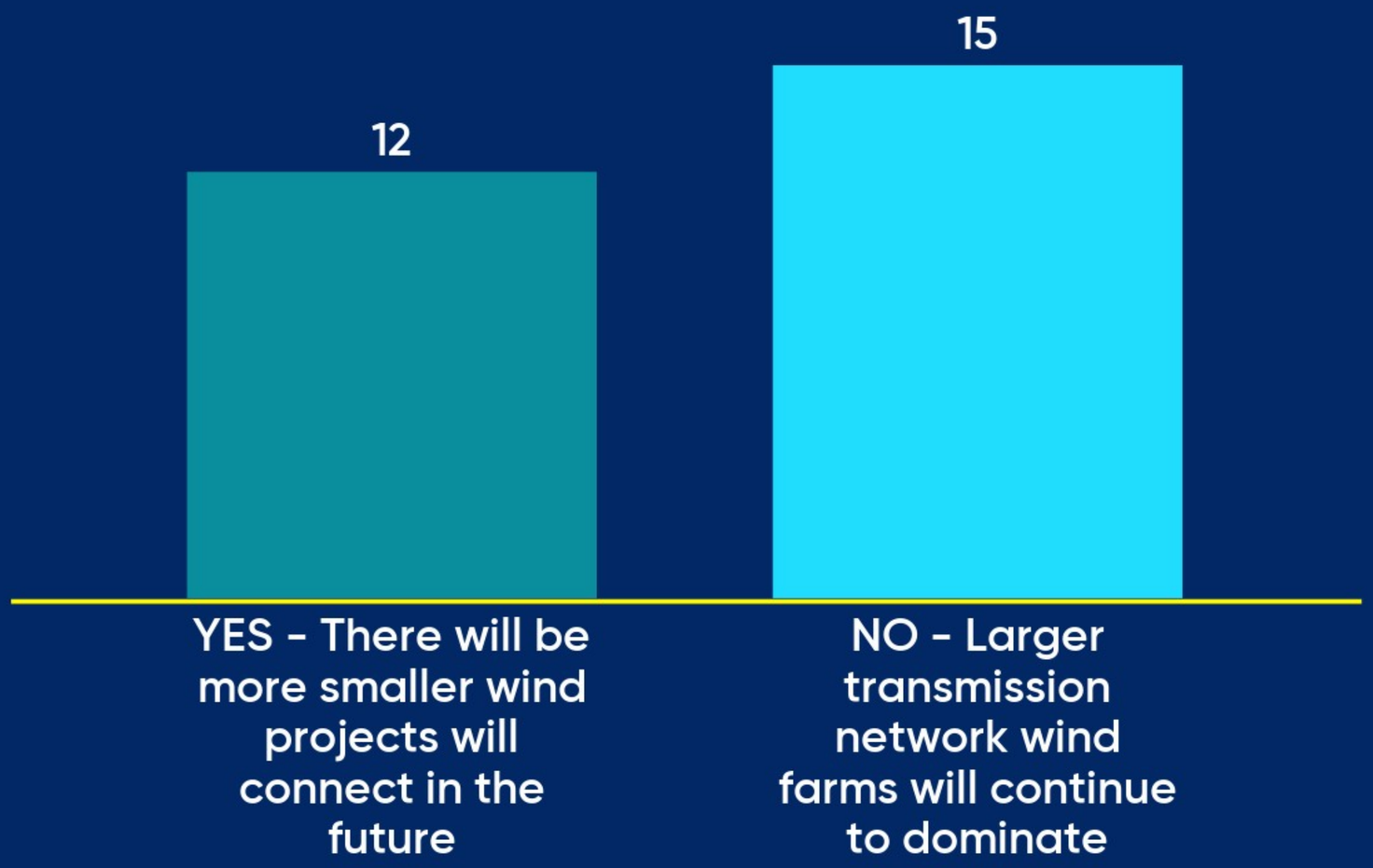
According last year's 2020 projections, installed capacity reaches 5.7 GW in Consumer Transformation and 5.1 GW in Leading the Way for projects exceeding 1 MW.

Projects with less than 1 MW reach as much as 500 MW in Consumer Transformation and 367 MW in leading the way.

How might onshore wind development in North Scotland compare to the rest of UK out to 2050?



...and will Scotland start to see more smaller wind projects connecting to the distribution network?



Large scale solar PV in the North of Scotland

- Solar deployment in the region and pipeline
- Distribution factors

SHEPD Solar Baseline

- 36 MW from 6 sites above 1 MW of capacity
- 55 MW from 351 sites under 1 MW of capacity

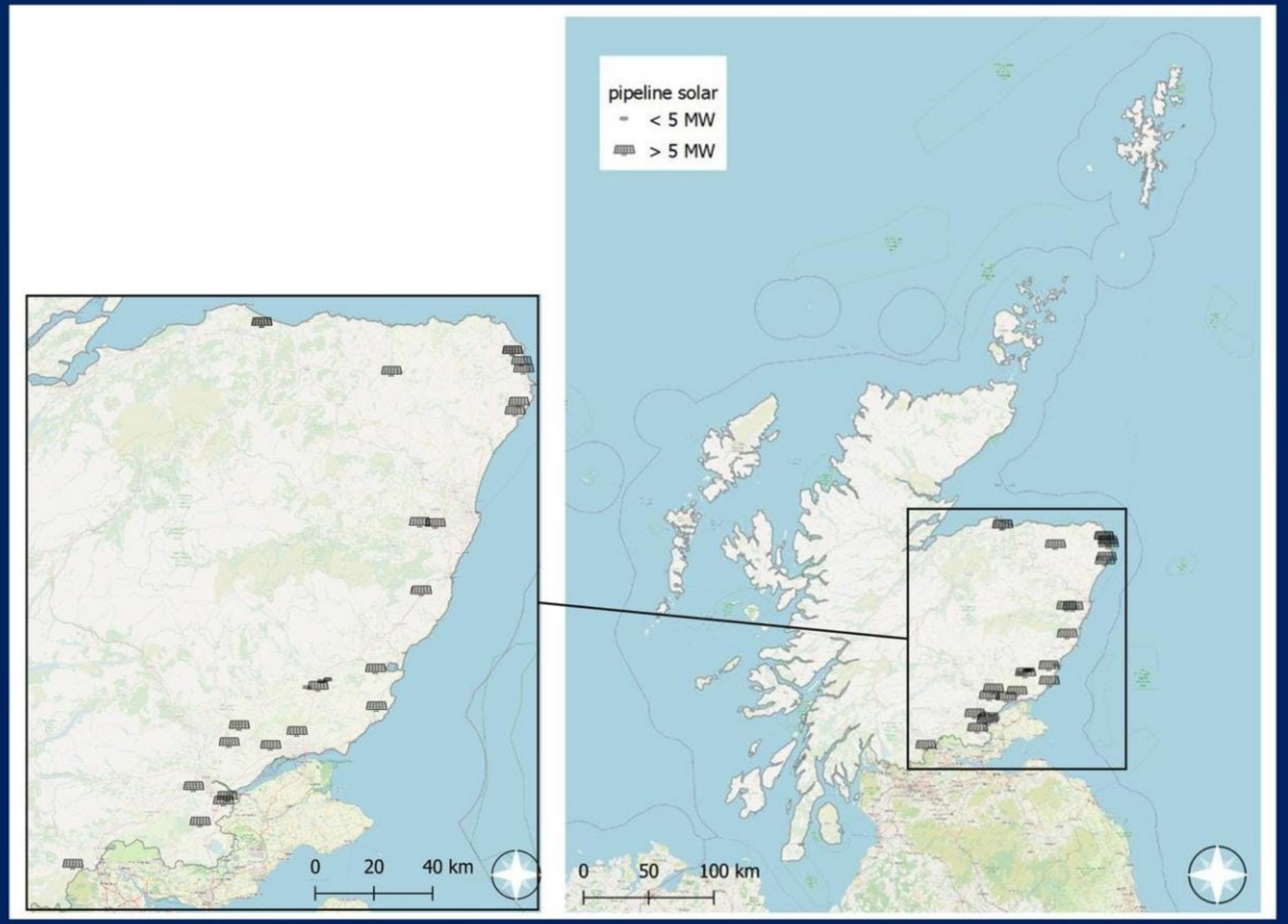
SHEPD Solar Pipeline

Below 1 MW:

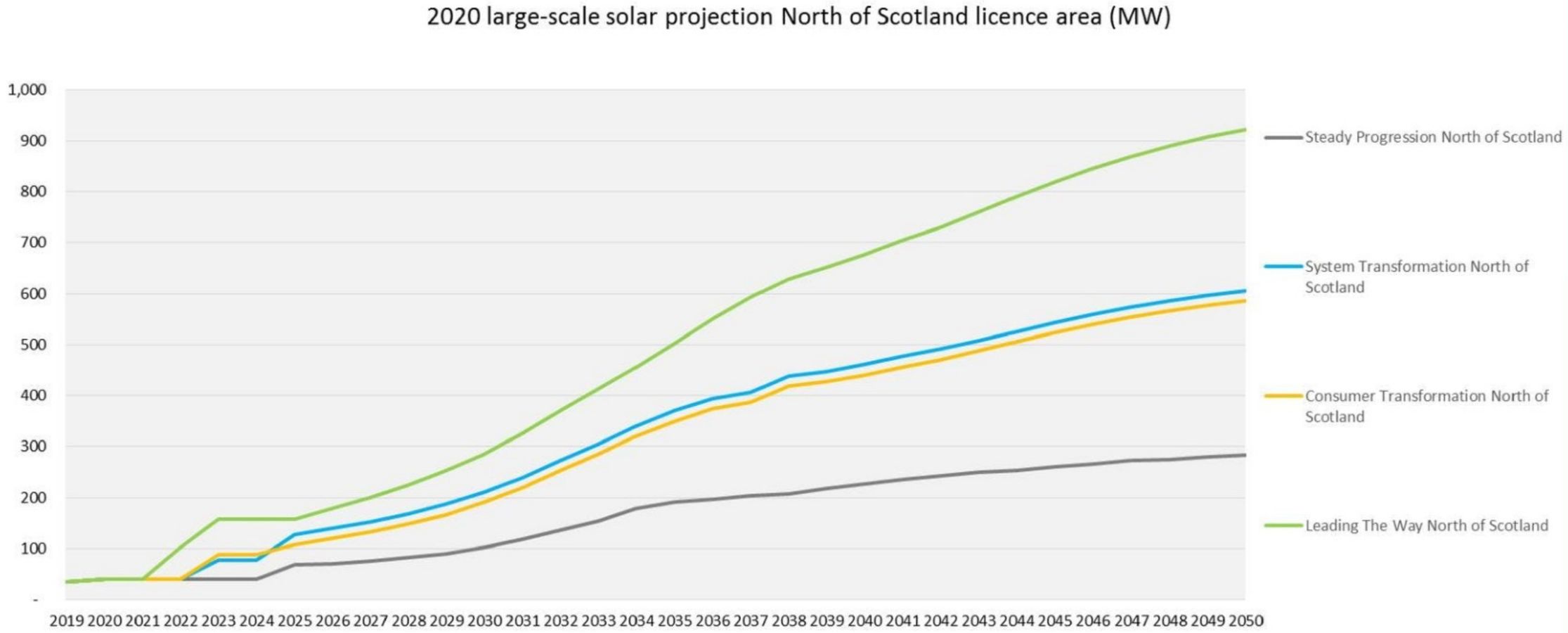
- 43 MW from 242 sites have a connection agreement
- 11 MW from 54 sites have been issued a quote

Above 1 MW:

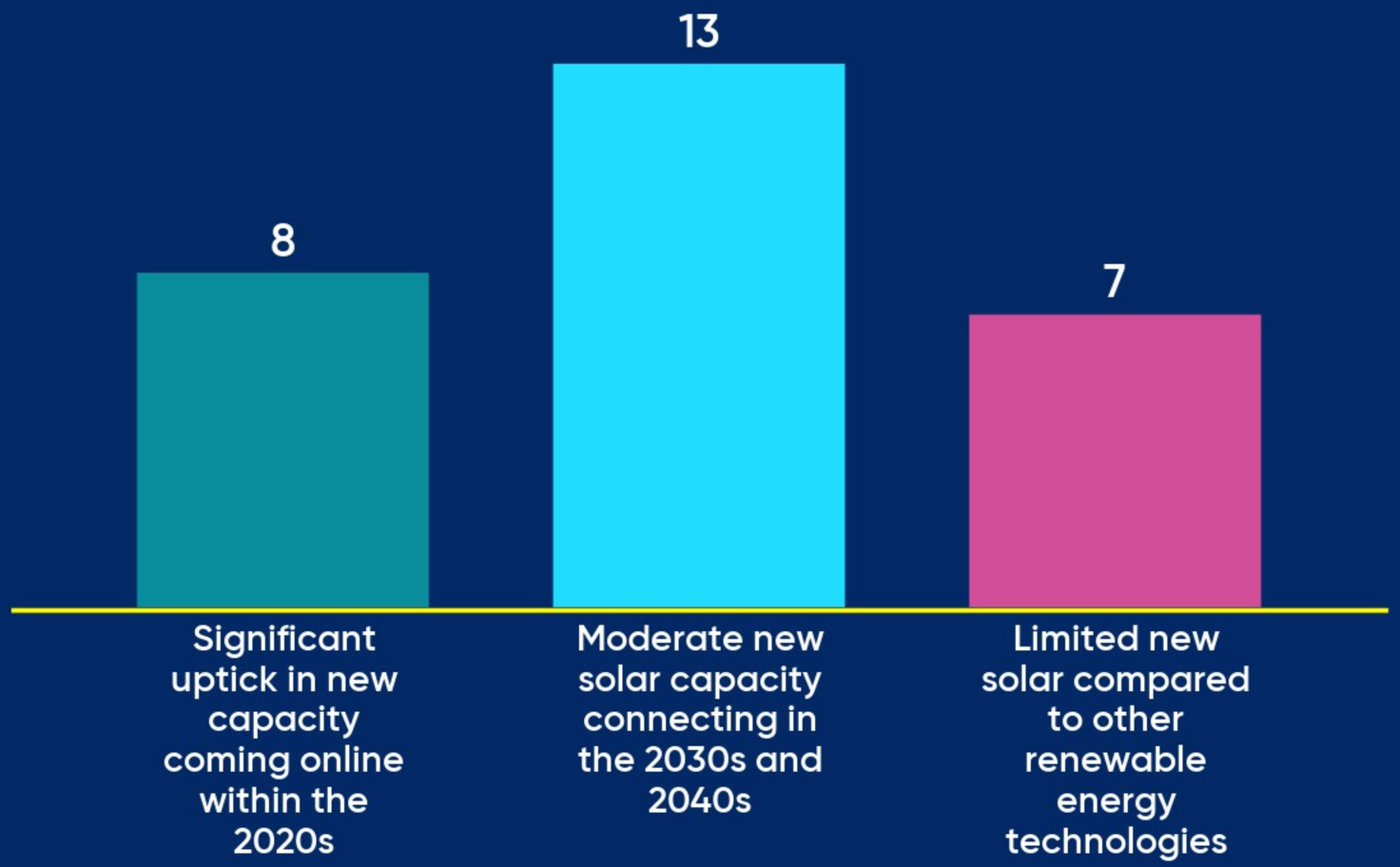
- 384 MW from 19 sites have a connection agreement
- 262 MW from 10 sites have been issued a quote



Large-Scale Solar Projections 2020



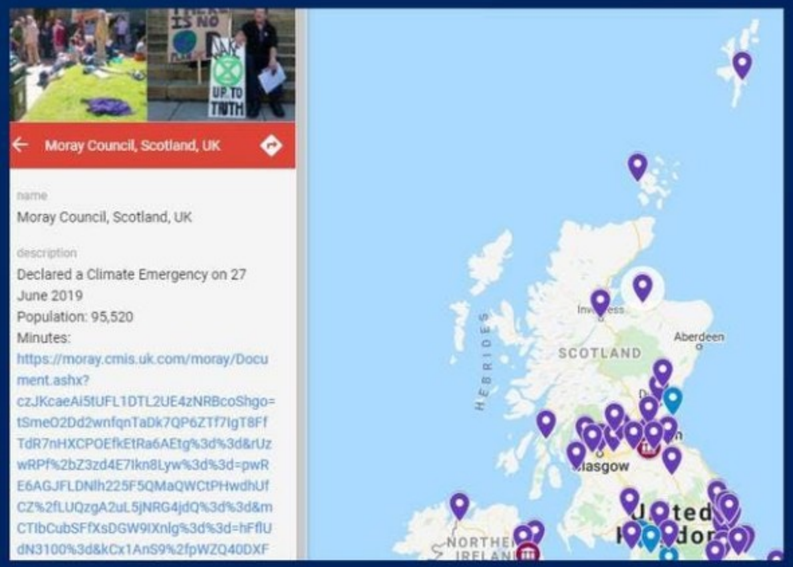
How do you see solar PV deployment developing in the future in the North of Scotland?



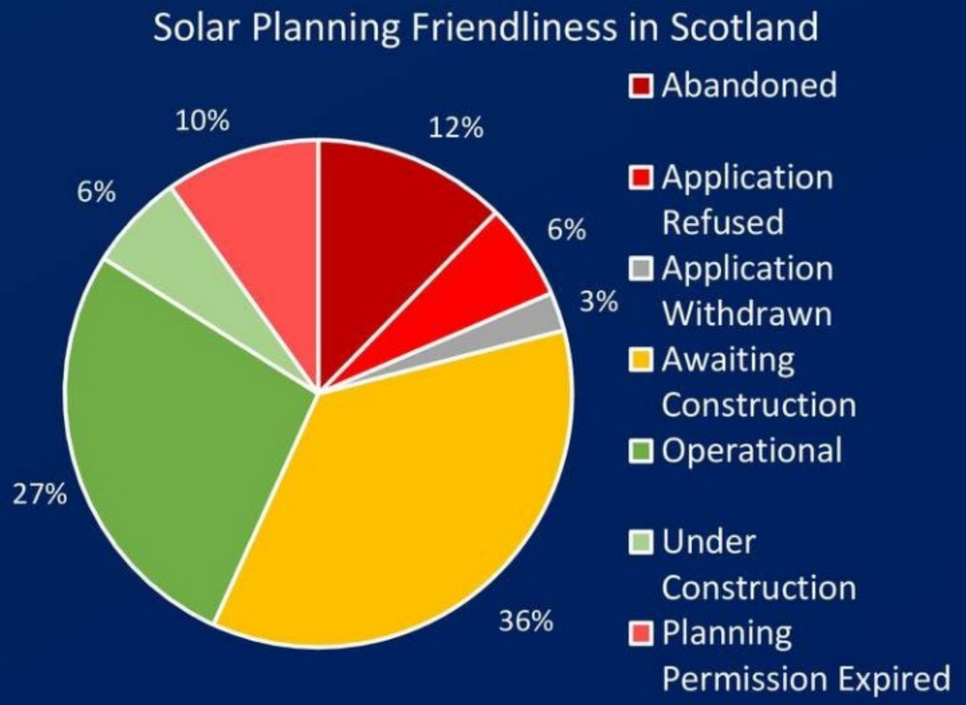
Solar Distribution Factors

The model determines where solar is likely to be located based on these constraints

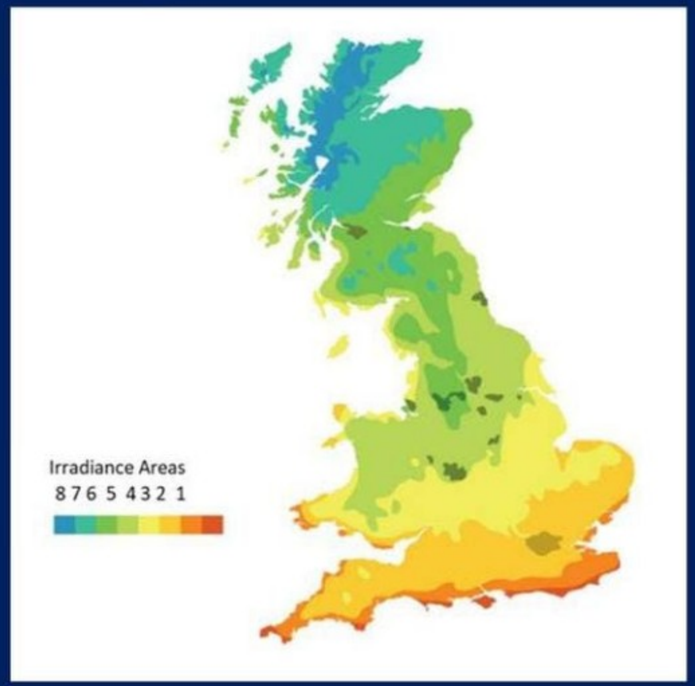
Declared Climate Emergencies and RE Targets



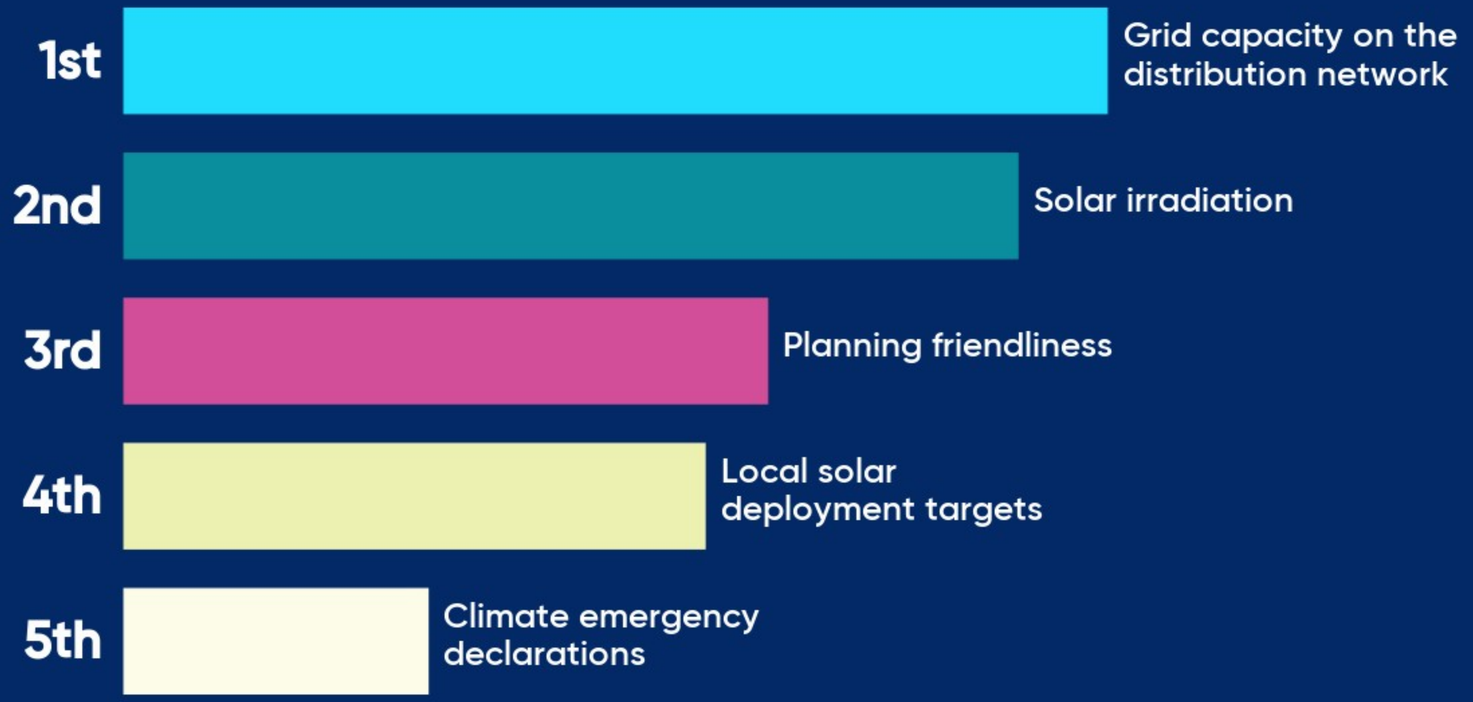
Planning Friendliness



Solar Irradiance

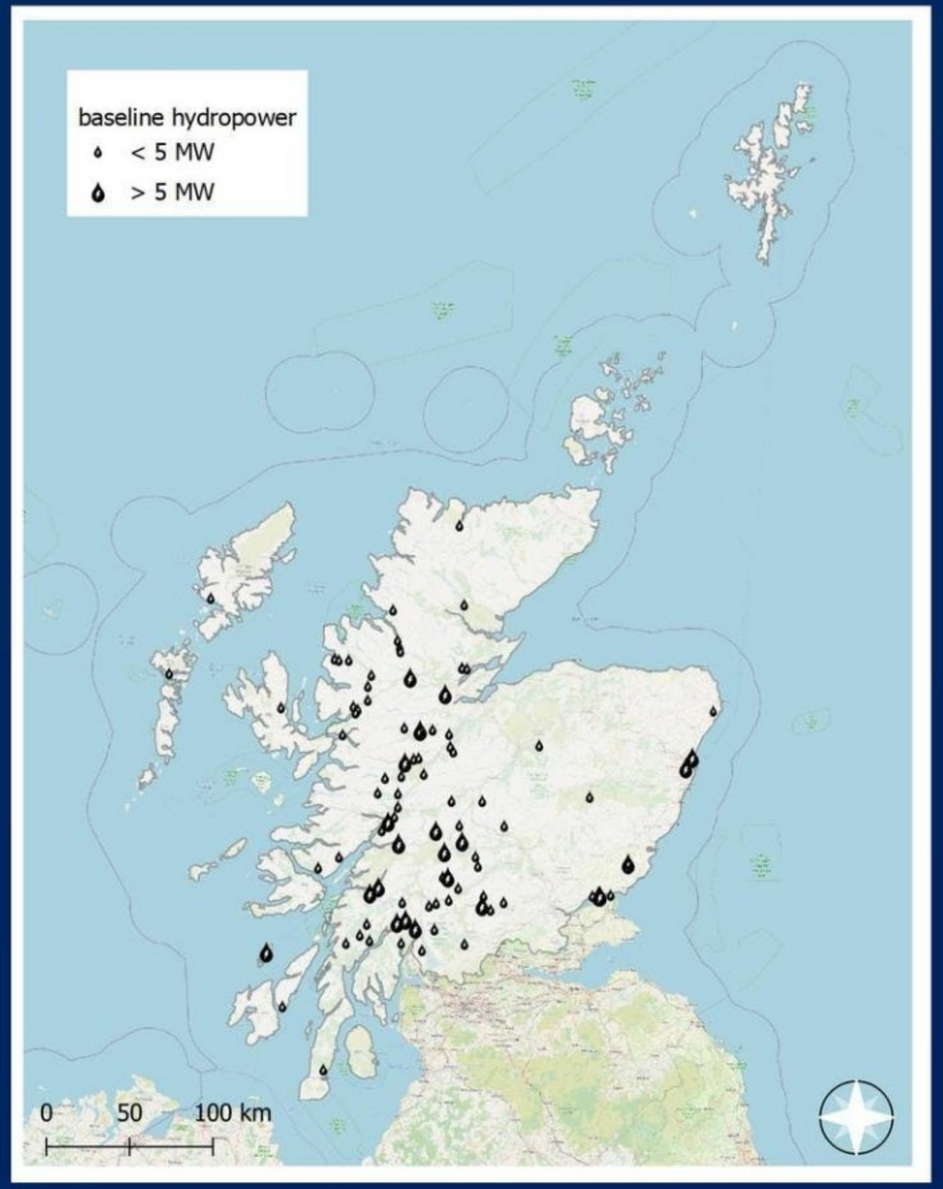


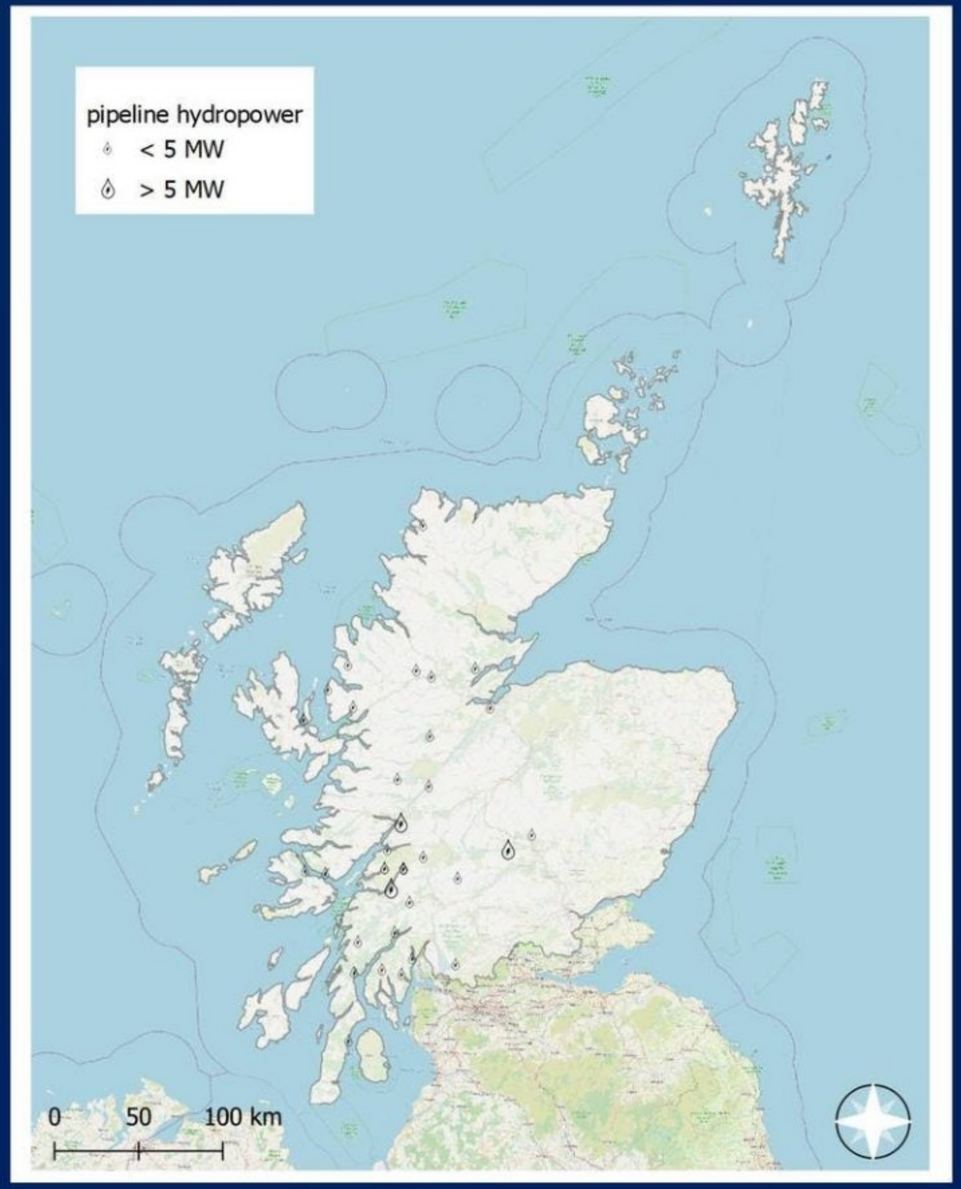
How would you rank the factors that determine the location of new solar capacity connecting in the North of Scotland licence area?



Hydropower

- Historic growth of the sector
- Impact of climate change





Hydropower Baseline & Pipeline

According to SSEN connections data:

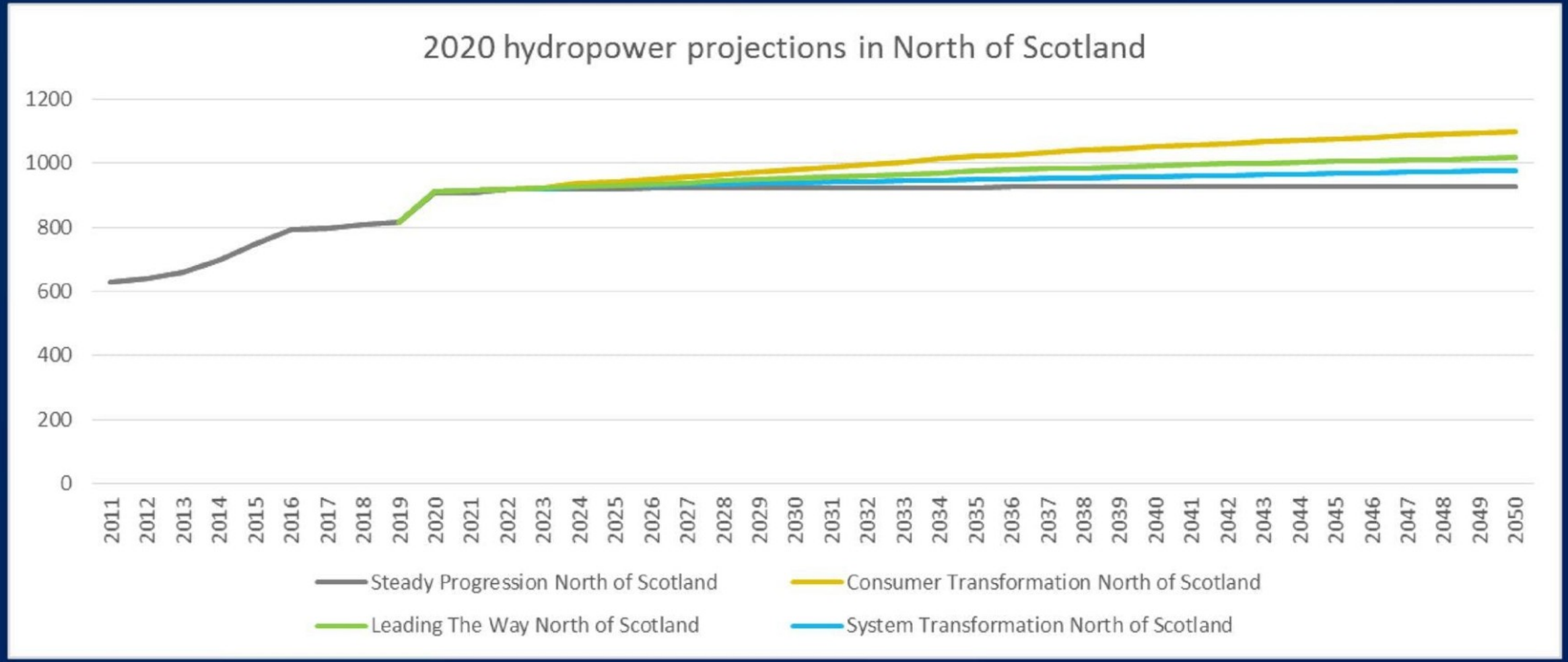
Baseline:

- 815 MW from 452 sites

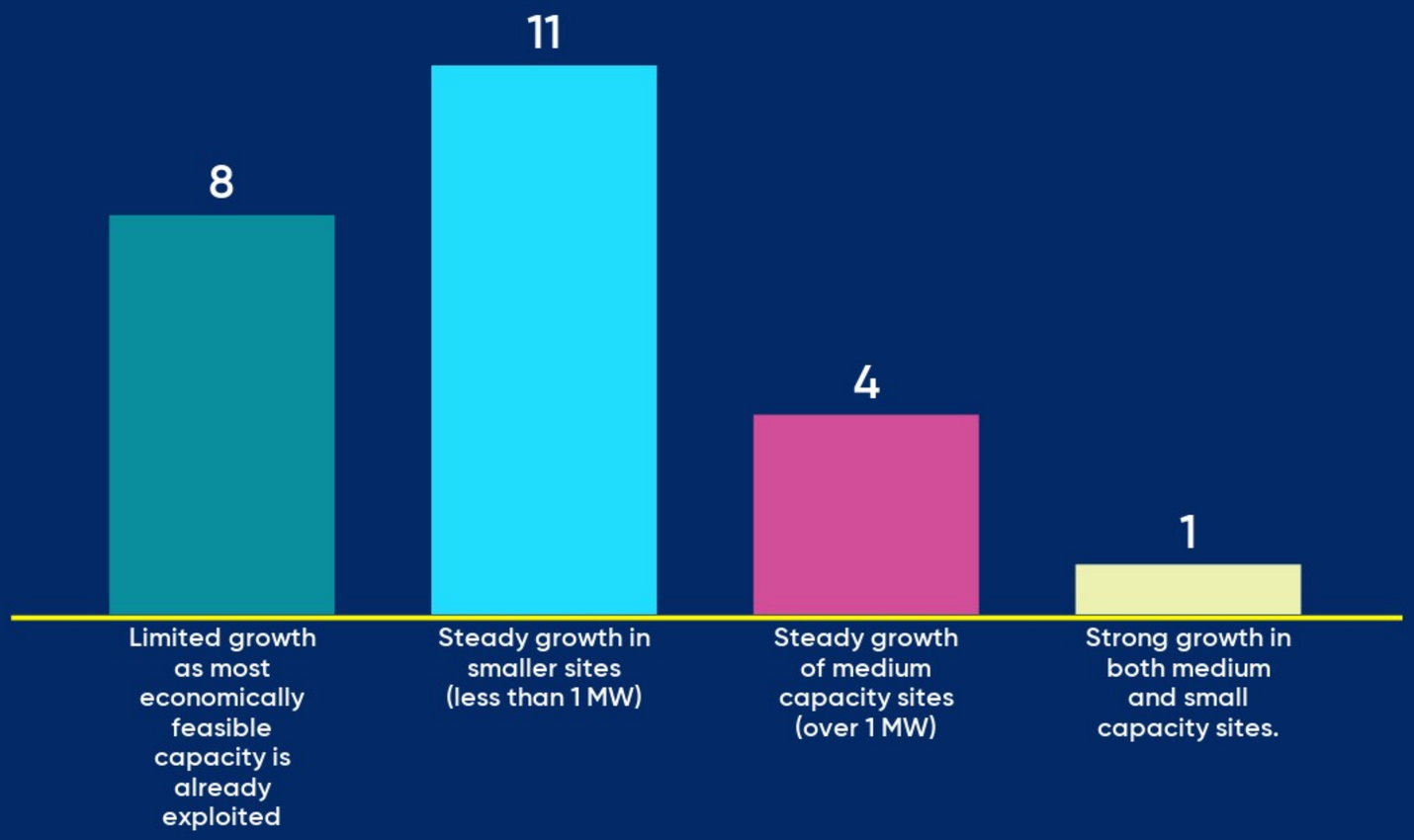
Pipeline:

- 90 MW from 41 projects with a connection offer

Hydropower Projections 2020



In which direction is the small hydropower sector in North of Scotland headed?



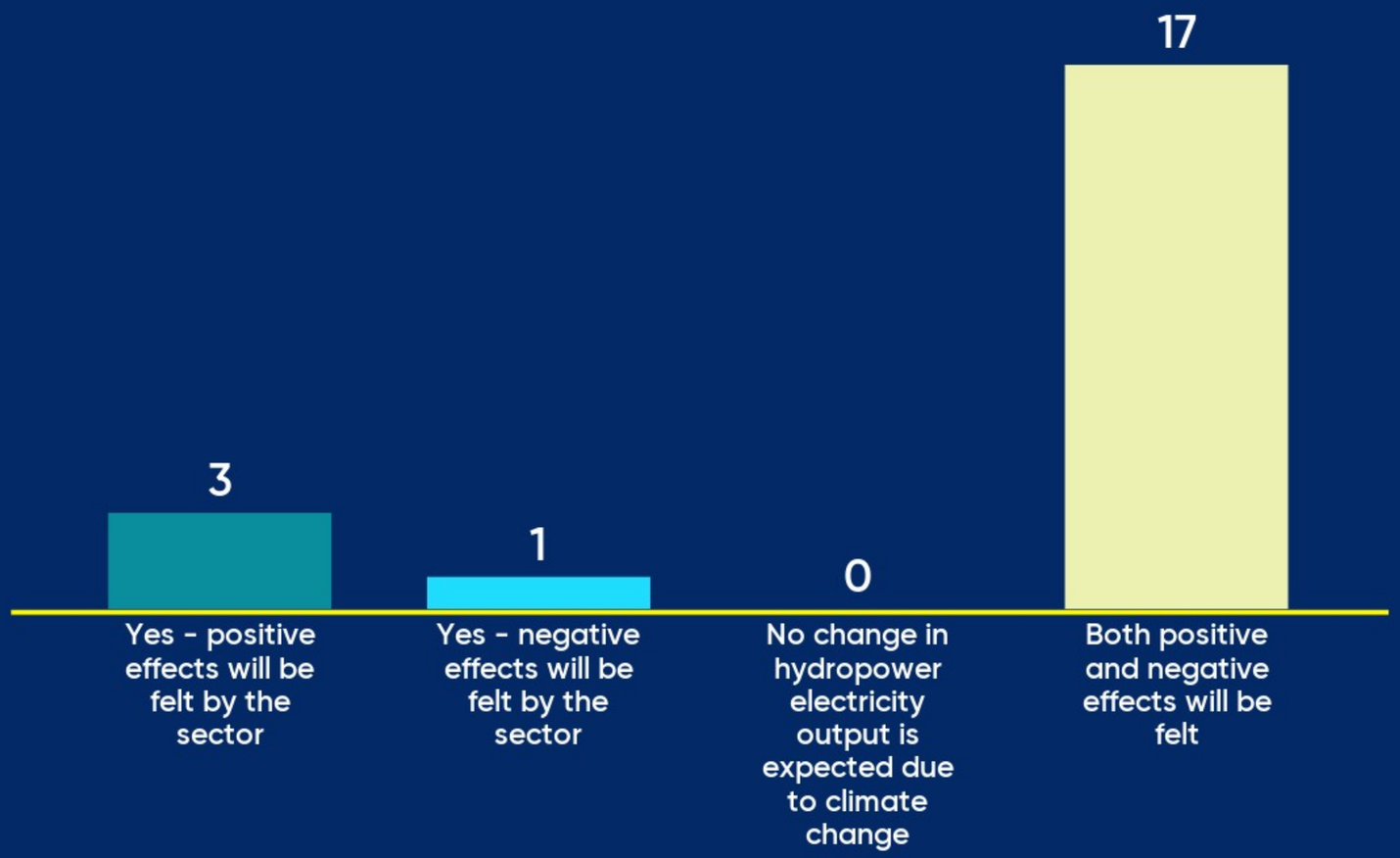
Climate Change in Scotland

Historic average rainfall change (2010-2019) was 9% ***wetter*** than the 1961-1990 average.

Projections predict ***warmer, wetter winters***, with 8% wetter by 2050 under 1 degree of warming, and 19% wetter by 2080 under 2.7 degrees warming.

Projections predict ***hotter, drier summers***, with 7% drier by 2050 under 1.2 degrees of warming and 18% drier with 3 degrees of warming by 2080.

Will hydropower be affected by climate change impacts in Scotland by 2050?



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Energy flexibility

- Electricity storage
- Fossil fuel generation
- Hydrogen electrolysis

Electricity storage

- Battery storage business models
- Other electricity storage technologies

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DFES analysis categorises electricity storage into four main business models

Standalone network services

Typically multiple MW scale projects providing balancing, response and reserve services to the system

Generation co-location

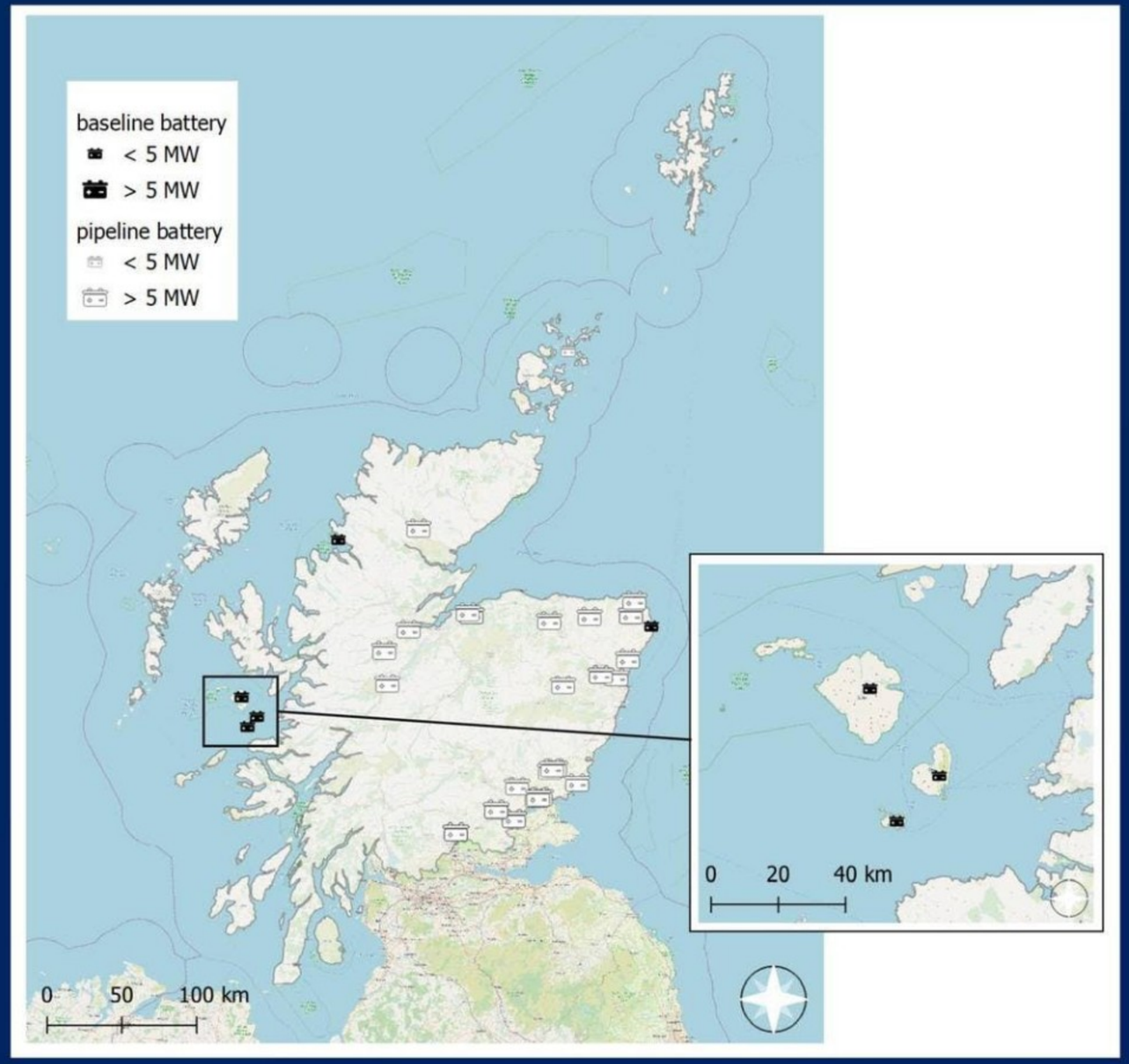
Typically multiple MW scale projects sited alongside renewable energy generation projects

High energy user

Typically low MW scale projects located onsite at large energy user sites (usually behind-the-meter) to support onsite energy management

Domestic storage

Typically 5-20kW scale batteries installed in households alongside rooftop solar PV or provide short-duration backup services



Electricity storage in the Northern licence area

Baseline (up to end of 2020)

- 5 battery projects currently connected
- Total capacity of 1.1MW
- Including some small island batteries

Pipeline (known projects 2021-2030)

- 46 new projects in the pipeline
- Total capacity of c. 1.6GW (all batteries)
- Mixture of business models and scales
- Notable number of projects with planning approval or activity in UK Capacity Market.

Which battery storage business model do you think will see the most connected capacity (MW) by 2050?

Standalone battery projects

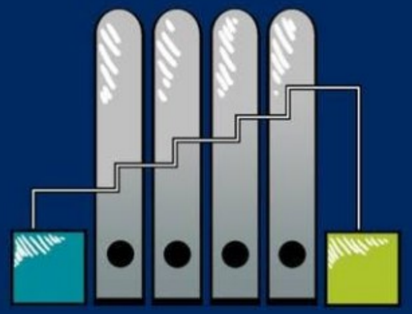
Generation co-location projects

Behind-the-meter large energy users

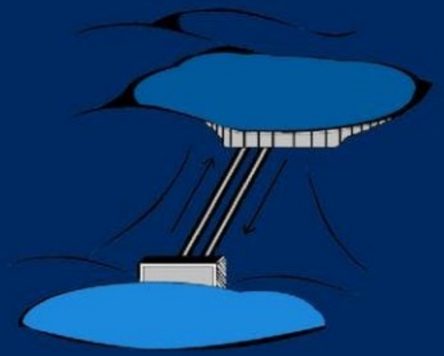
Domestic batteries

Standalone batteries are the dominant technology today and this is likely to continue into the future.

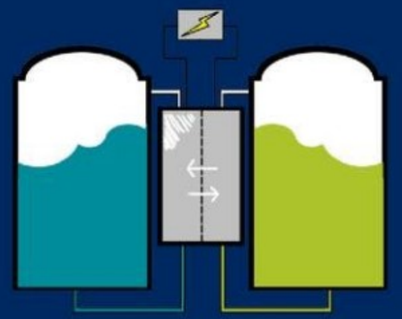
DFES does consider other technologies that could connect to the distribution network out to 2050



Liquid Air Energy Storage (LAES)



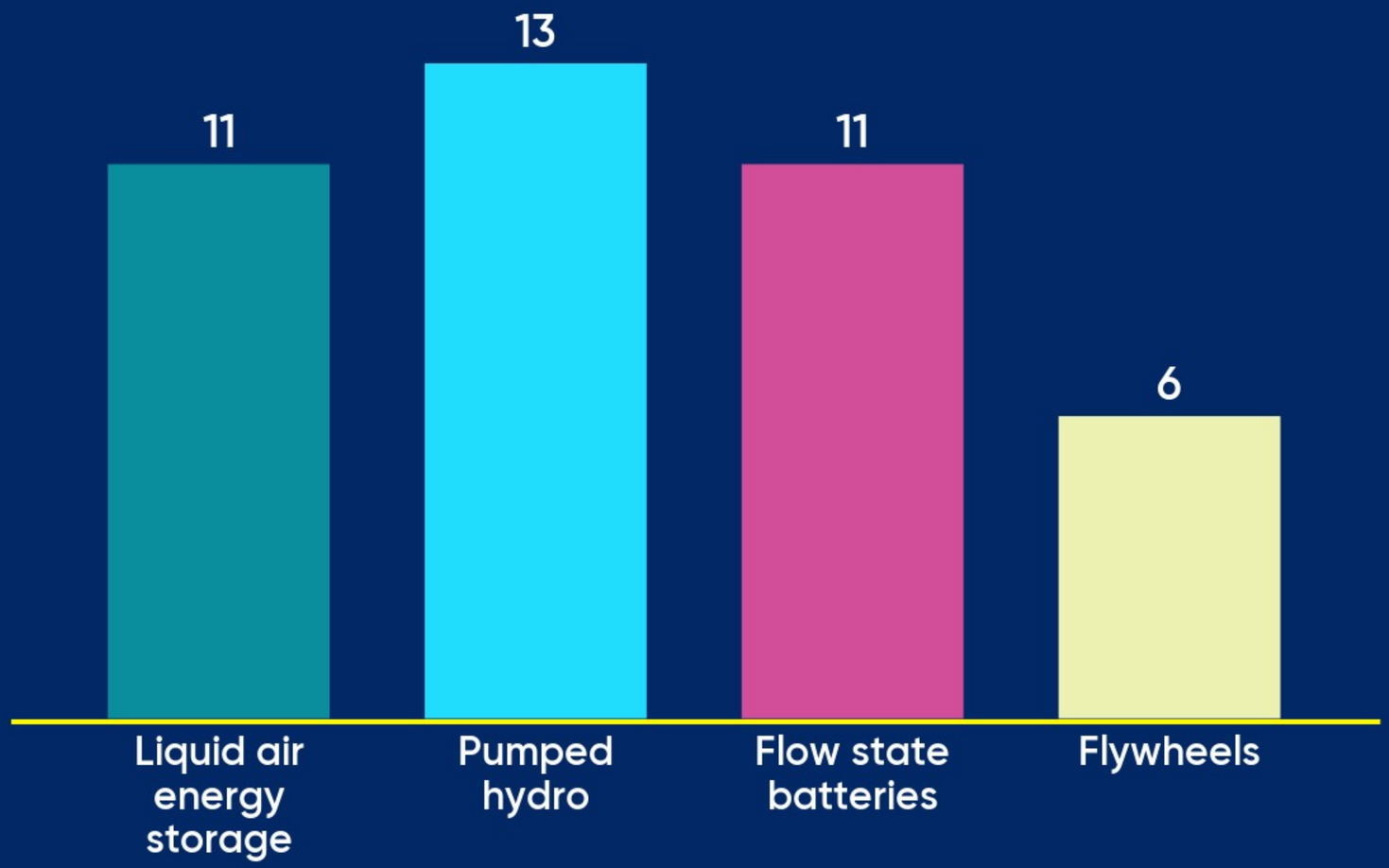
Small-scale pumped hydro



Flow-state batteries

Flywheels

What other electricity storage technologies might we see connecting in the North of Scotland by 2050?



Fossil fuel generation

- Diesel generation
- Natural gas (methane) generation

DFES looks at fossil fuel generation connecting to the distribution network

Diesel fuelled generation

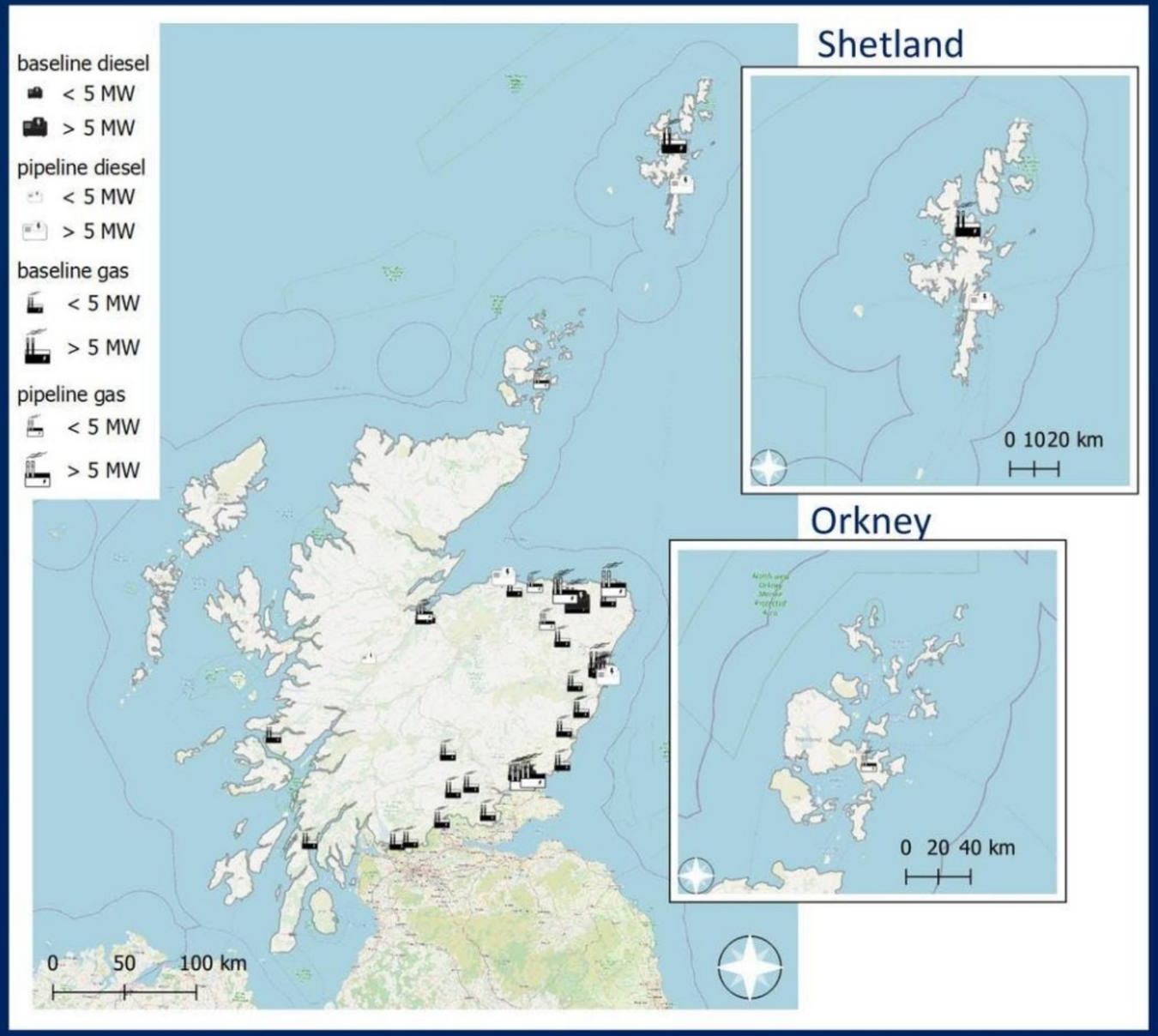
- Standalone commercial diesel power sites
- Back-up diesel generators that can export to the network

Fossil gas (methane) fuelled generation

- Closed-cycle gas turbines (CCGTs)
- Open-cycle gas turbines (OCGTs)
- Gas reciprocating engines
- Gas Combined Heat & Power installations (gas CHPs)

Policy considerations

- Legally binding UK net zero targets
- Medium Combustion Plant Directive
- Fully decarbonised electricity system by 2035



Fossil fuel generation in the Northern licence area

Diesel

Baseline (up to end of 2020)

- 8 sites currently connected
- Total capacity of **126 MW**
- All island diesel back-up generators

Pipeline (known projects 2021-2030)

- **4** new projects in the pipeline
- Total capacity of c.34 **MW** (mostly new back-up)

Fossil gas

Baseline (up to end of 2020)

- 18 sites currently connected
- Total capacity of c.52 **MW**
- Almost all small-scale onsite gas CHPs

Pipeline (known projects 2021-2030)

- **8** new projects in the pipeline
- Total capacity of c.99 **MW** (mostly recip engines)
- **56 MW** (4 sites) have secured planning approval or a Capacity Agreement in the Capacity Market

What do you see taking on the role of unabated diesel back-up generation on the Scottish Islands?

Bioenergy fired generation

Longer duration battery storage

Diesel but with exhaust abatement technology

Hydrogen fuel cells

Something else - none of these!

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What will happen to fossil gas generation in the North of Scotland?

Net zero obligations and gas prices will prevent new sites from connecting beyond 2025

Surge of interest in the 2020s then a steady decline from 2030-2040

Continue to see deployment 2035, until it is not permitted to operate

Many existing/pipeline sites will convert to hydrogen peaking plants in 2030s/2040s

Low Carbon Hydrogen in the North of Scotland

- New fuel sector - Scottish Government ambition
- Future use cases for hydrogen
- Green hydrogen production

Low carbon hydrogen could play a role in decarbonisation as a new fuel sector

The production, storage, transportation and use of low carbon hydrogen are areas that still remain nationally unclear.

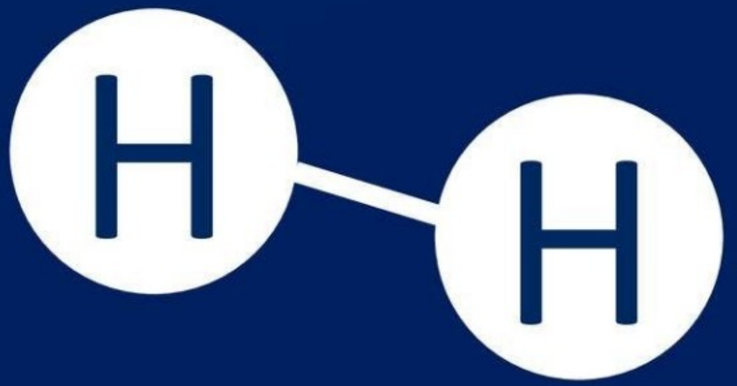
Electrolytic hydrogen (aka green hydrogen) could potentially be a significant source of future electricity demand for the distribution network.

Scottish Government Hydrogen Policy Statement (Dec 2020), high ambition for Scotland

The Scottish Government
Riaghaltas na h-Alba

Our vision is for Scotland to become a leading Hydrogen Nation in the production of reliable, competitive, sustainable hydrogen and secure Scotland's future as a centre of international excellence as we establish the innovation, skills and supply chain that will underpin our energy transition.

There are multiple potential end sector uses for low carbon hydrogen



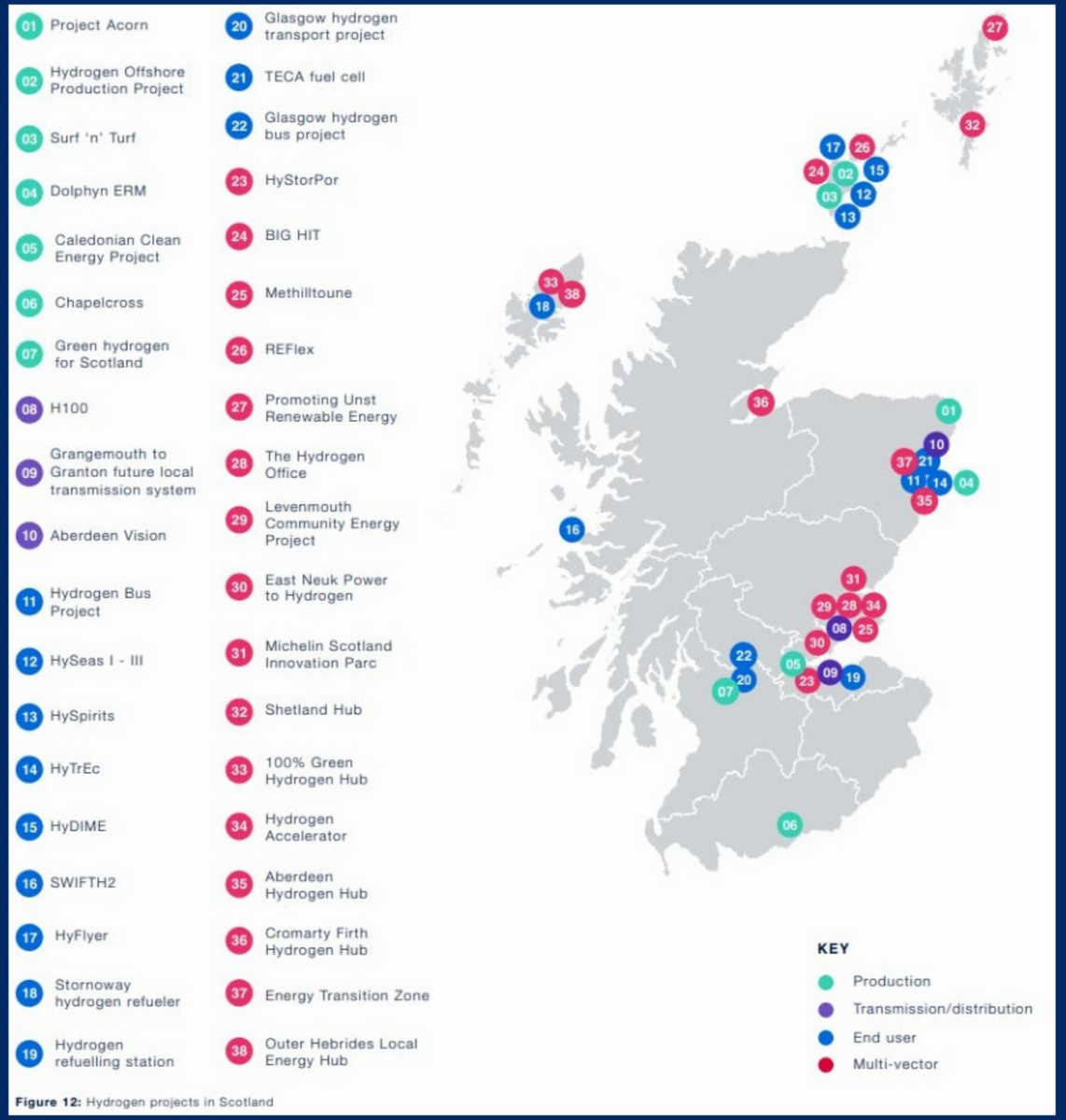


Figure 12: Hydrogen projects in Scotland

There are a notable number of hydrogen innovation projects across Scotland

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Decarbonising Existing hydrogen manufacturing

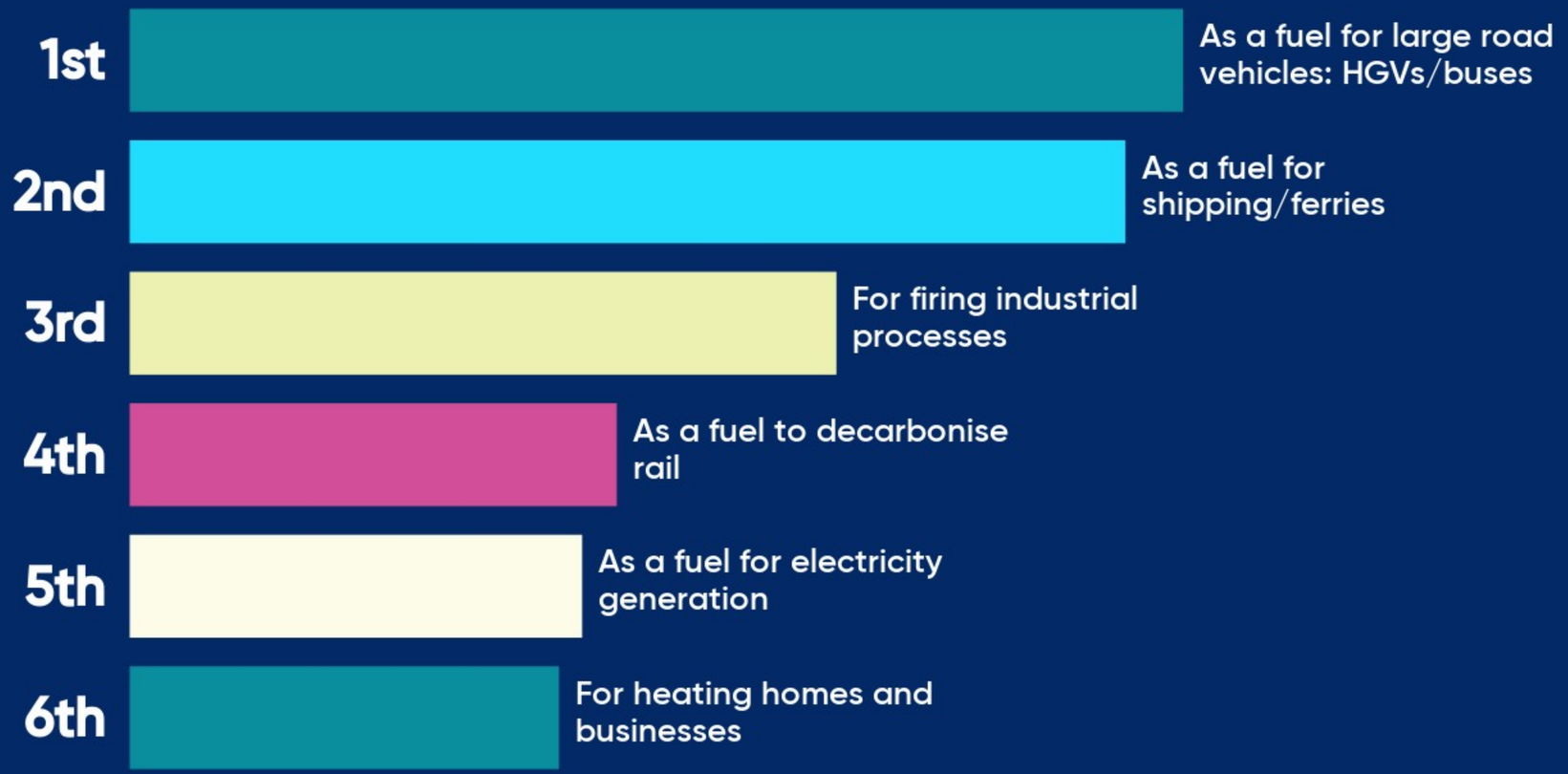
A number of transport sector applications

High temperature industrial processes

Low carbon thermal electricity generation

Space heating for homes and businesses

How would you rank these potential uses of hydrogen in the North of Scotland in the future?



Could the North of Scotland become a significant producer of green hydrogen by 2050?

Q&A panel session

Euan Norrington - Lead Account Manager, Connections, SSEN

Joel Venn - Head Analyst, Regen

Tamsyn Lonsdale-Smith - Energy Analyst, Regen

Thank you for joining us today