Scottish and Southern Electricity Networks Distribution Future Energy Scenarios 2021

Southern England regional webinar

Welcome and introduction

→ Ray Arrell - Head of Technical Services, 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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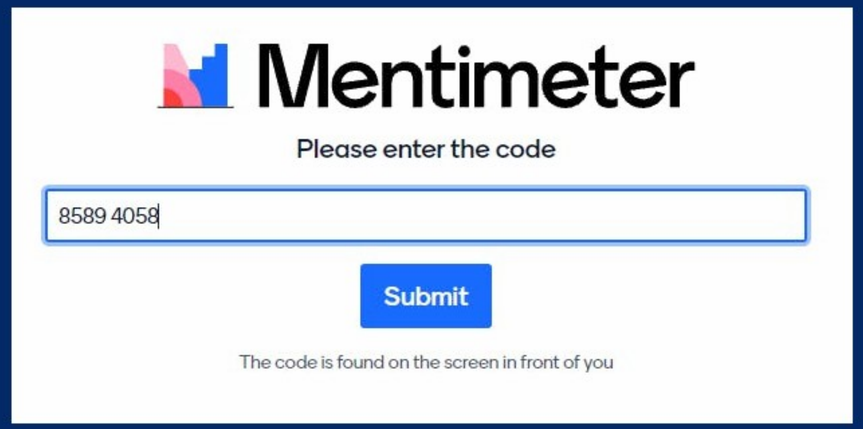
We have delivered Distribution Future Energy Scenarios (DFES) assessments for a electricity and gas distribution network operators since 2015



We are using Menti.com today for interactive voting

Go to www.menti.com on your phones!

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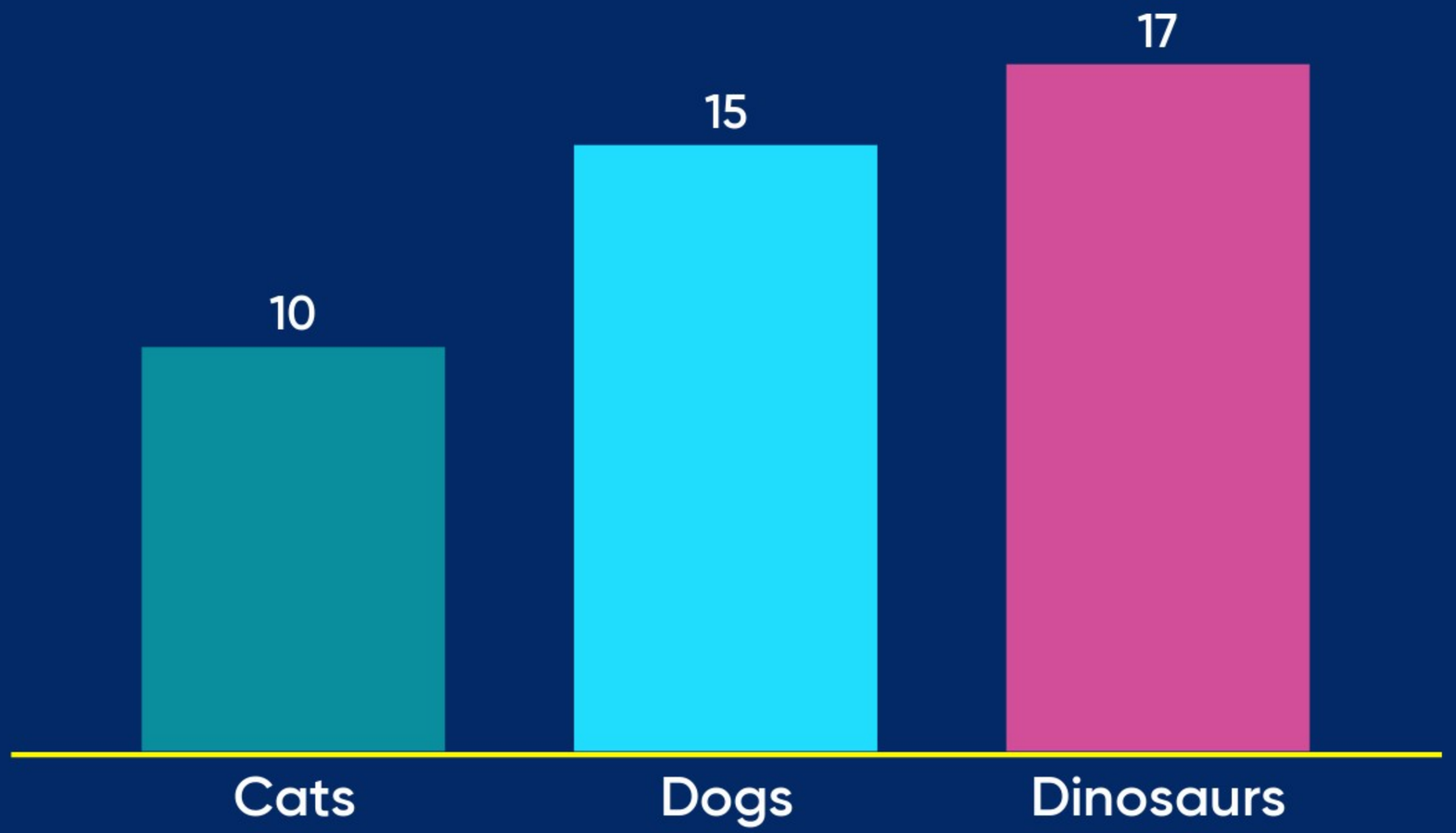
Test question! Which is your favourite?



Introduction to SSEN

→ Steve Atkins - DSO Transition Manager, SSEN

SSE's Seven business units

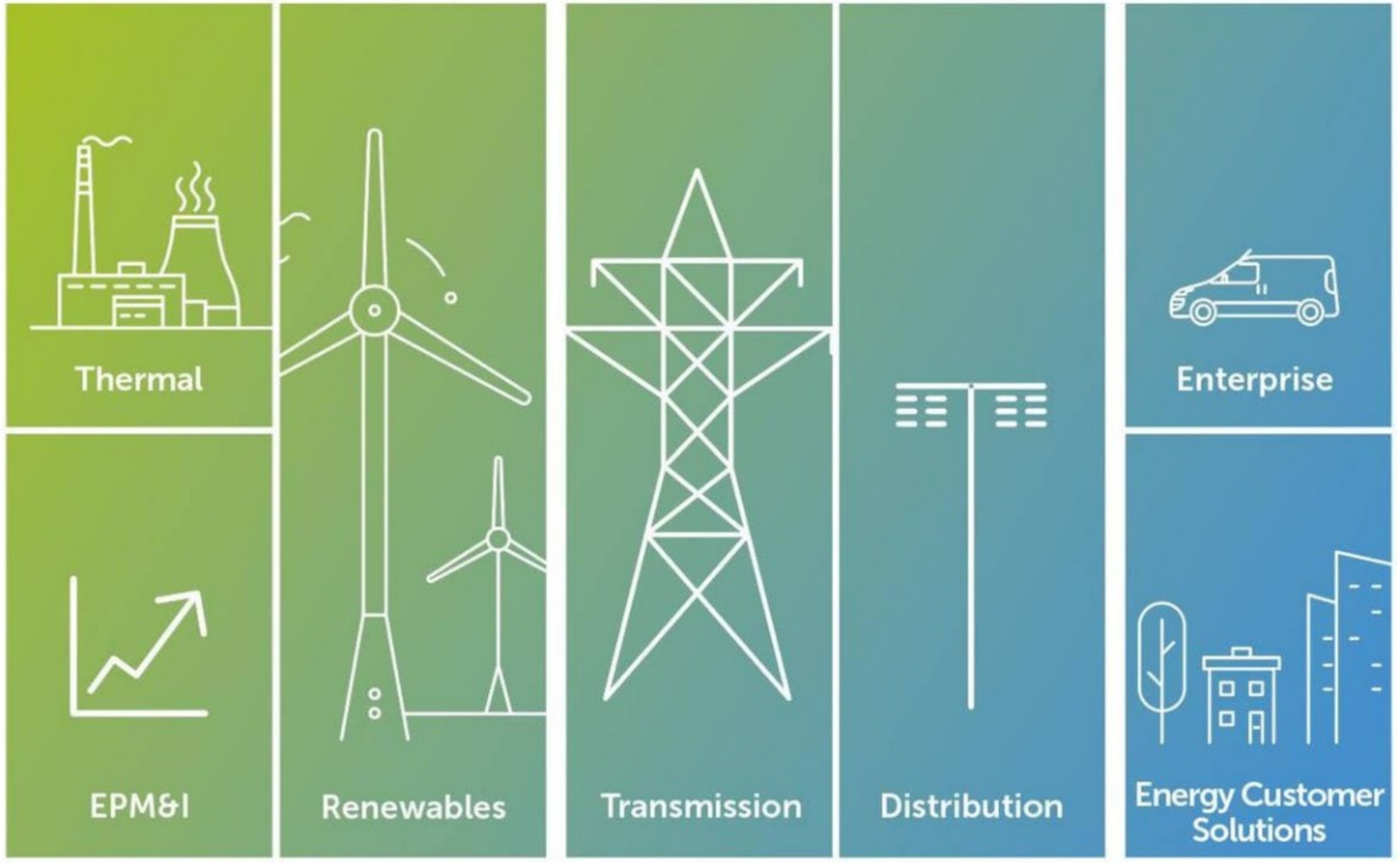
£8bn
NETWORKS RAV

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**

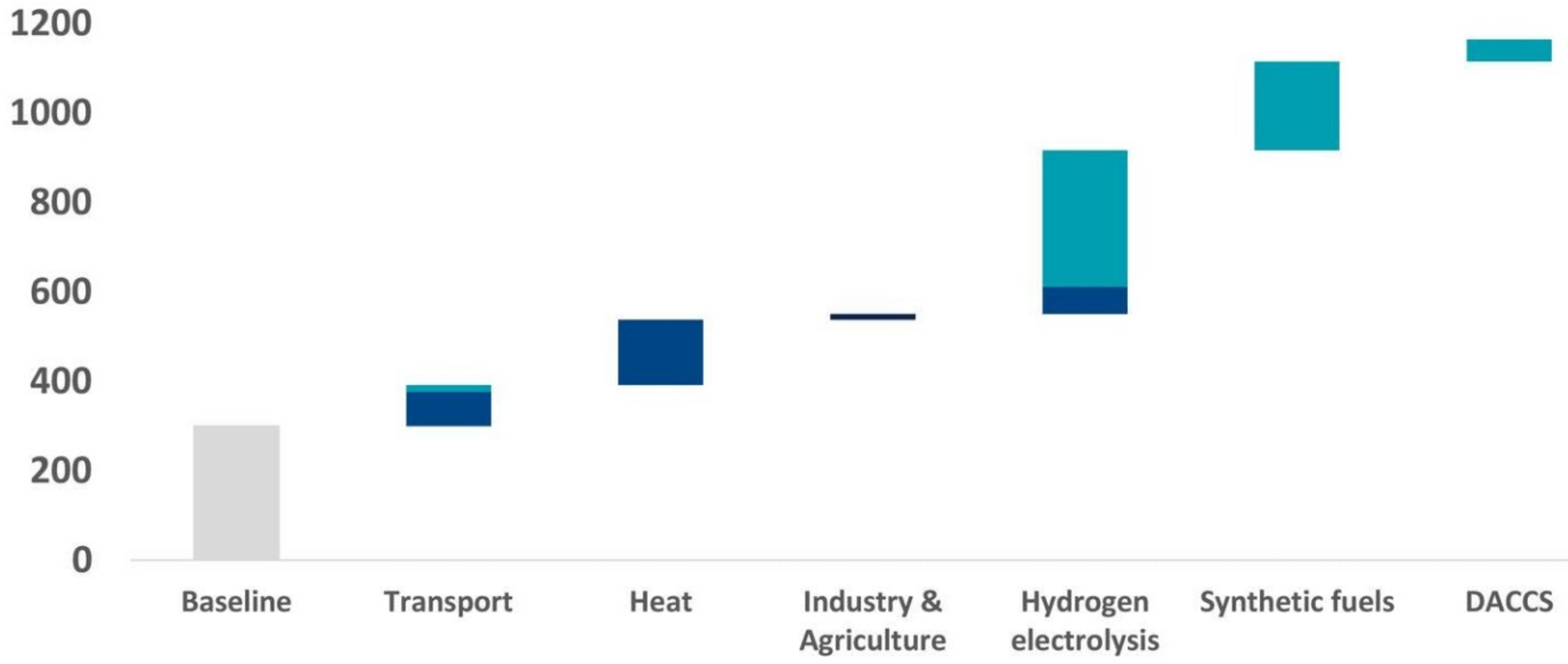
700,000+ vulnerable customers identified on our Priority Services Register

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

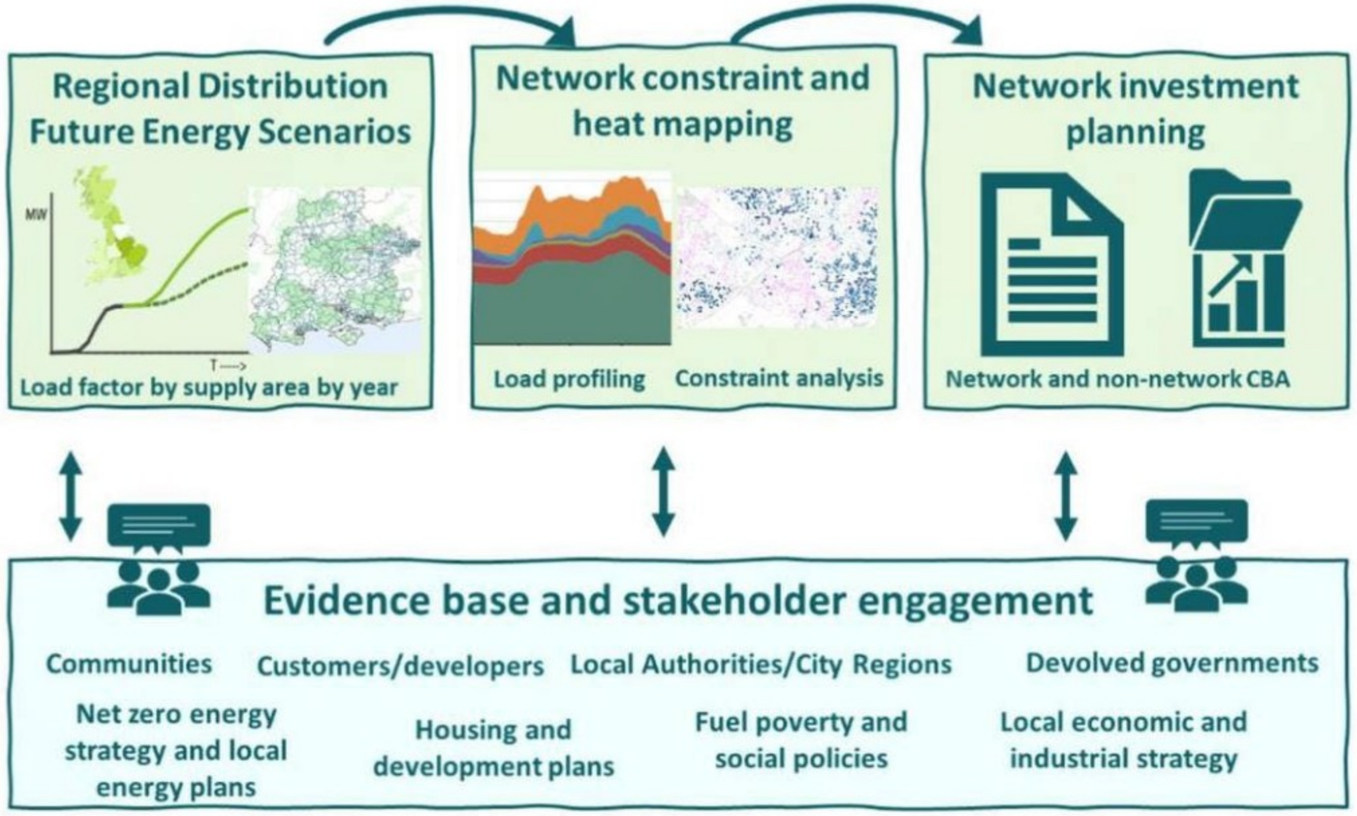
ENERGY EFFICIENCY MEASURES SET TO RAPIDLY INCREASE ON THE ISLE OF WIGHT

DAILY ECHO

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

By Darren Slade | @echodaz
Group business editor

Distribution Future Energy Scenarios (DFES)

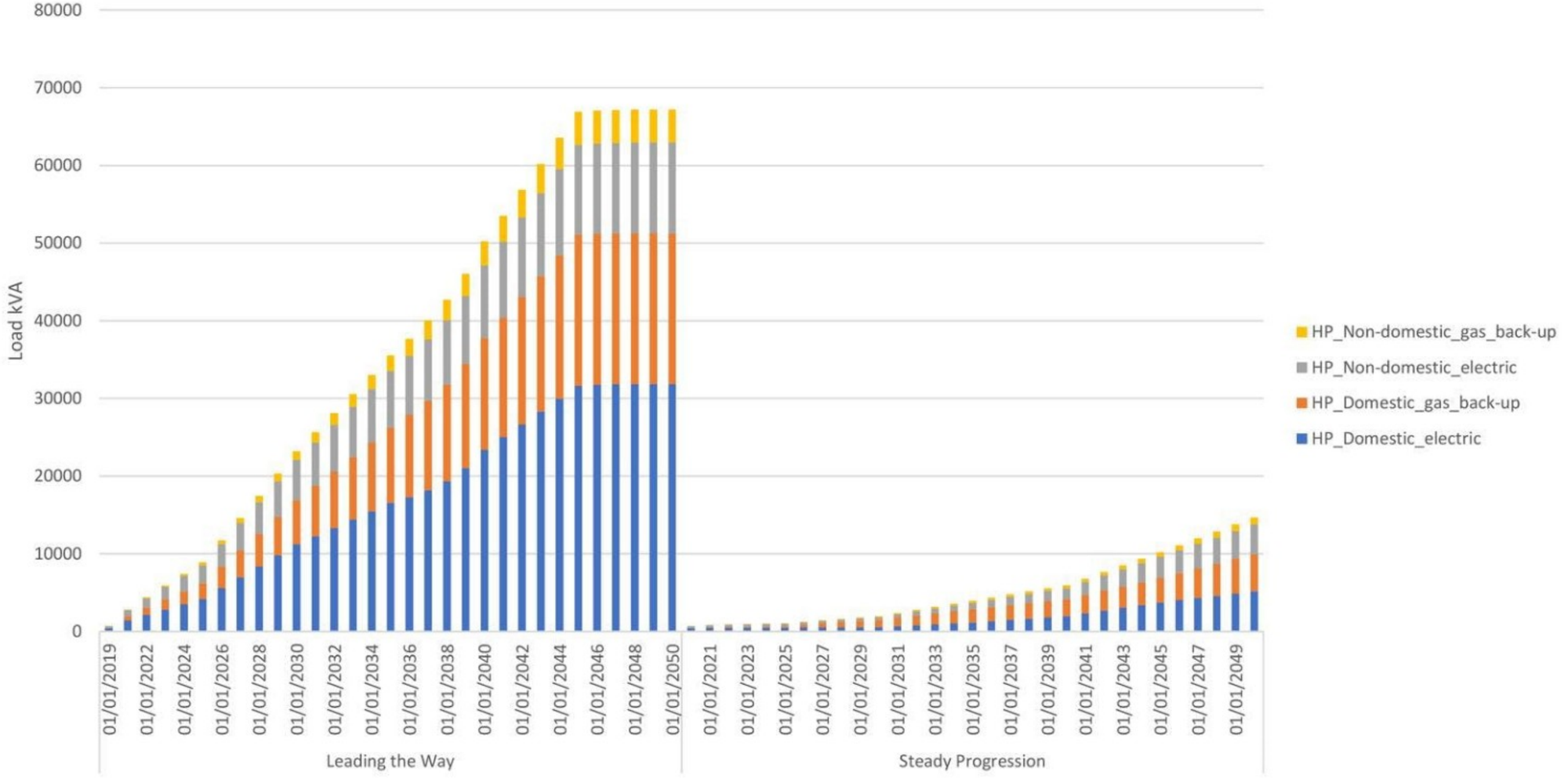


- The DFES **adopts the National Grid FES as its overarching framework**, but develops bottom-up local evidence driven projections.
- We **adjust the DFES as required**, to reflect **legally binding national/ devolved targets**, and reflecting that FES may have limitations.
- Where appropriate, **the 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.

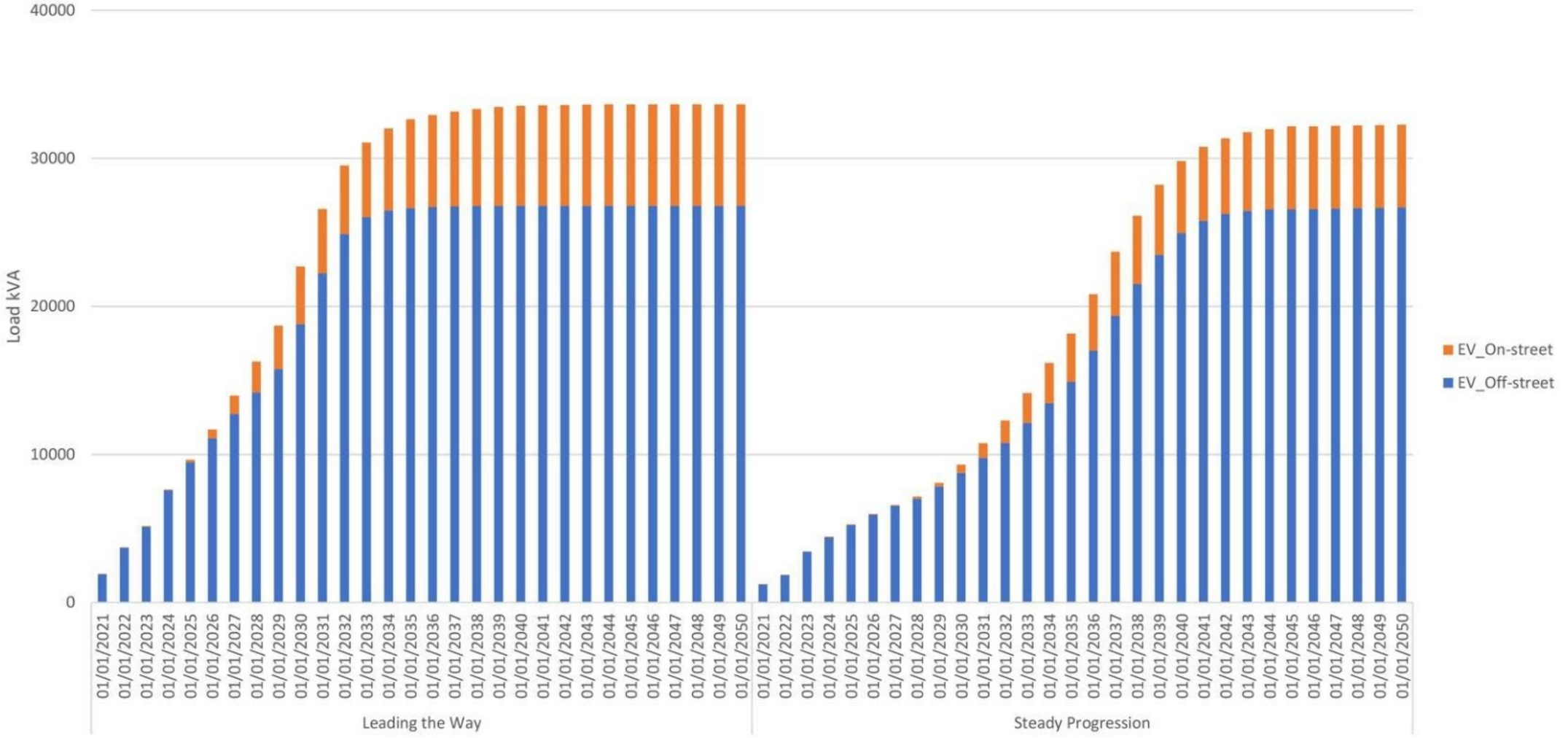
Local impact of the transition to net zero: Spelthorne

Scottish & Southern Electricity Networks

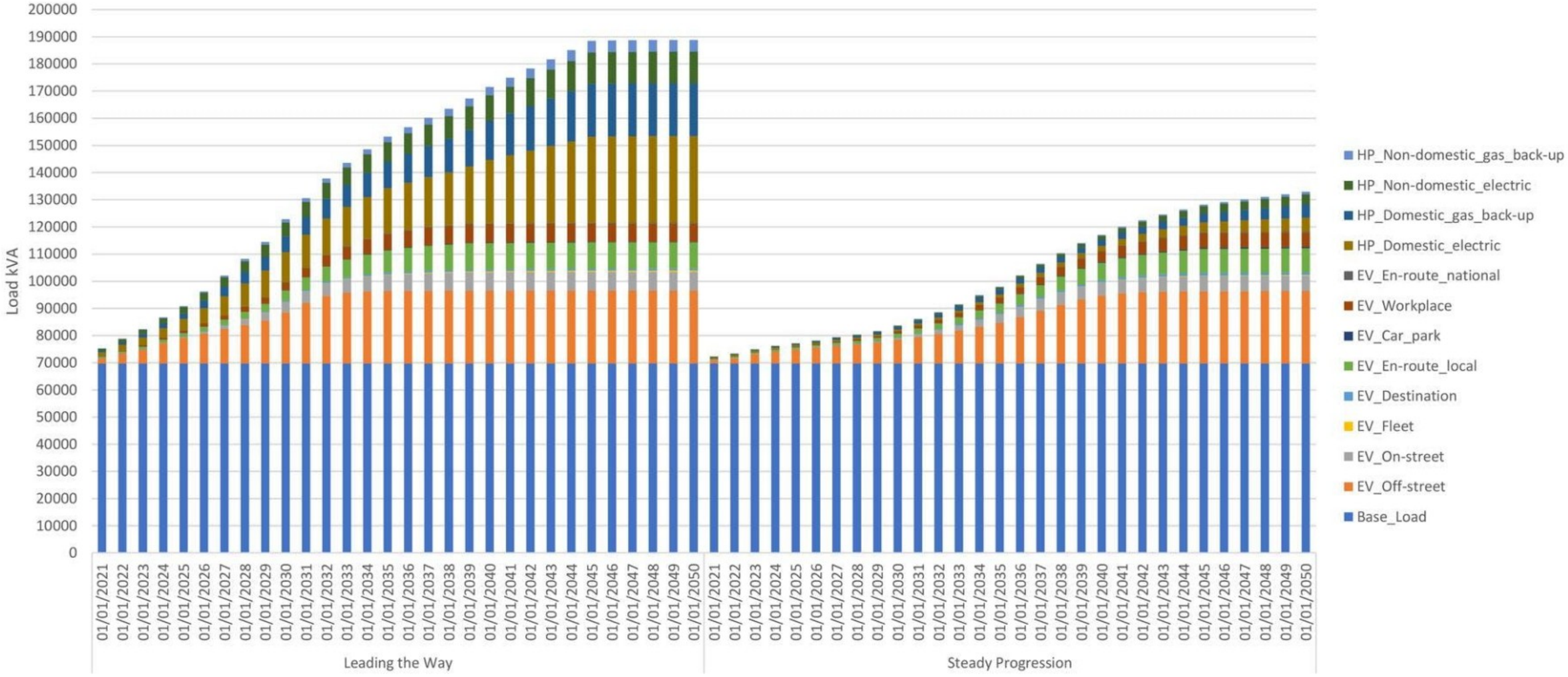
Heat pump (HP) uptake projections

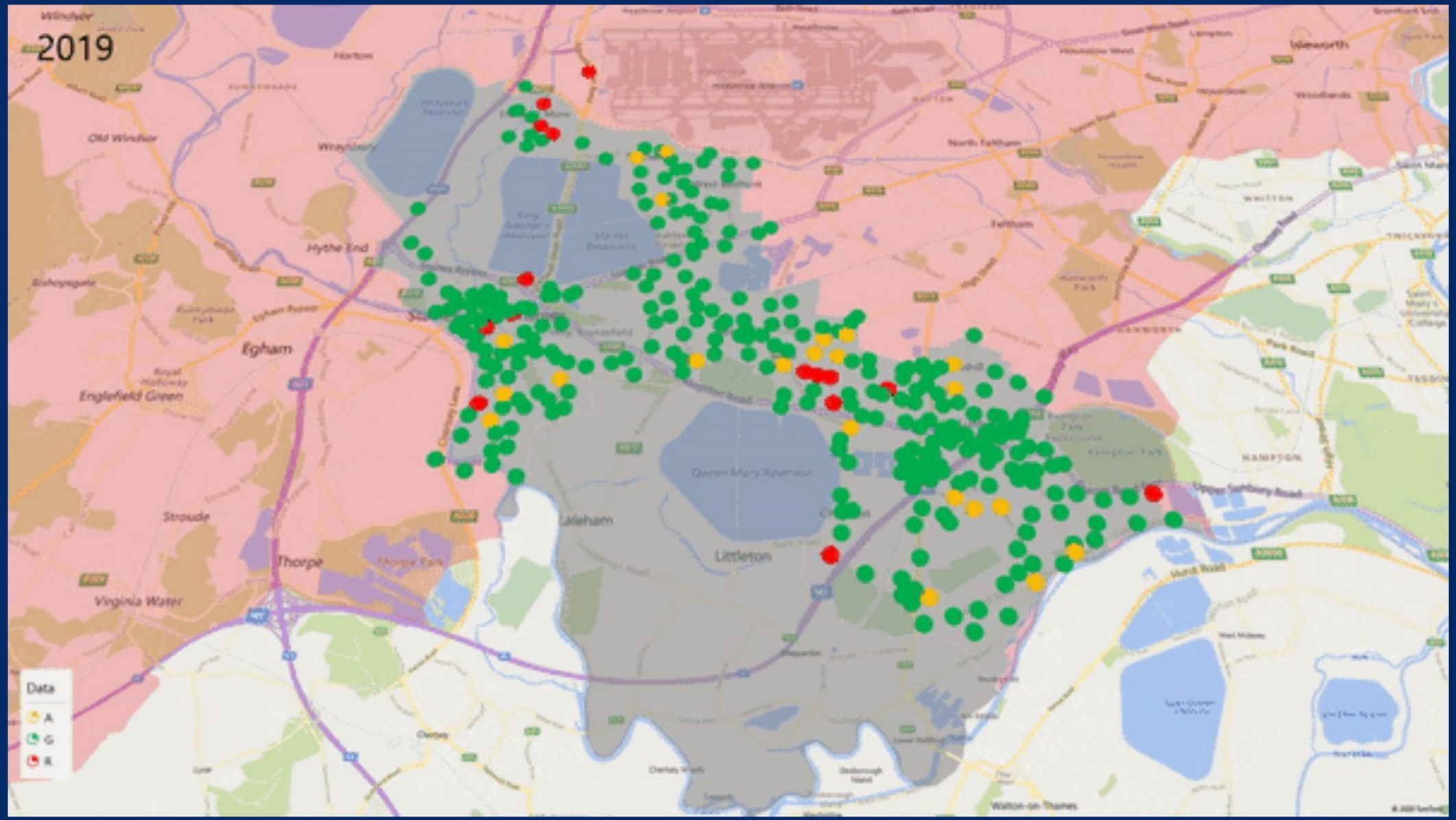


Domestic electric vehicle (EV) uptake projections

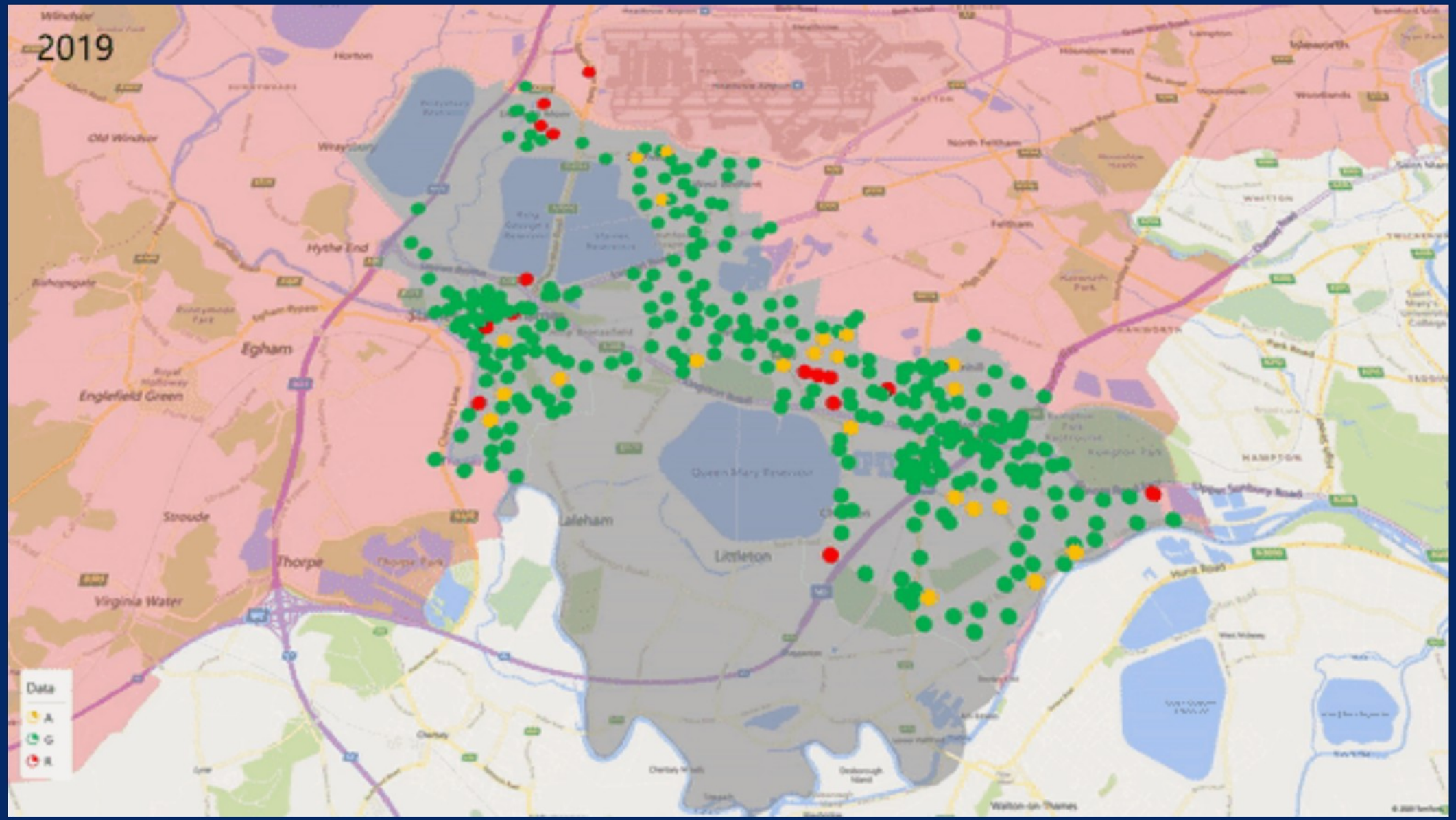


HP and EV uptake projections





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

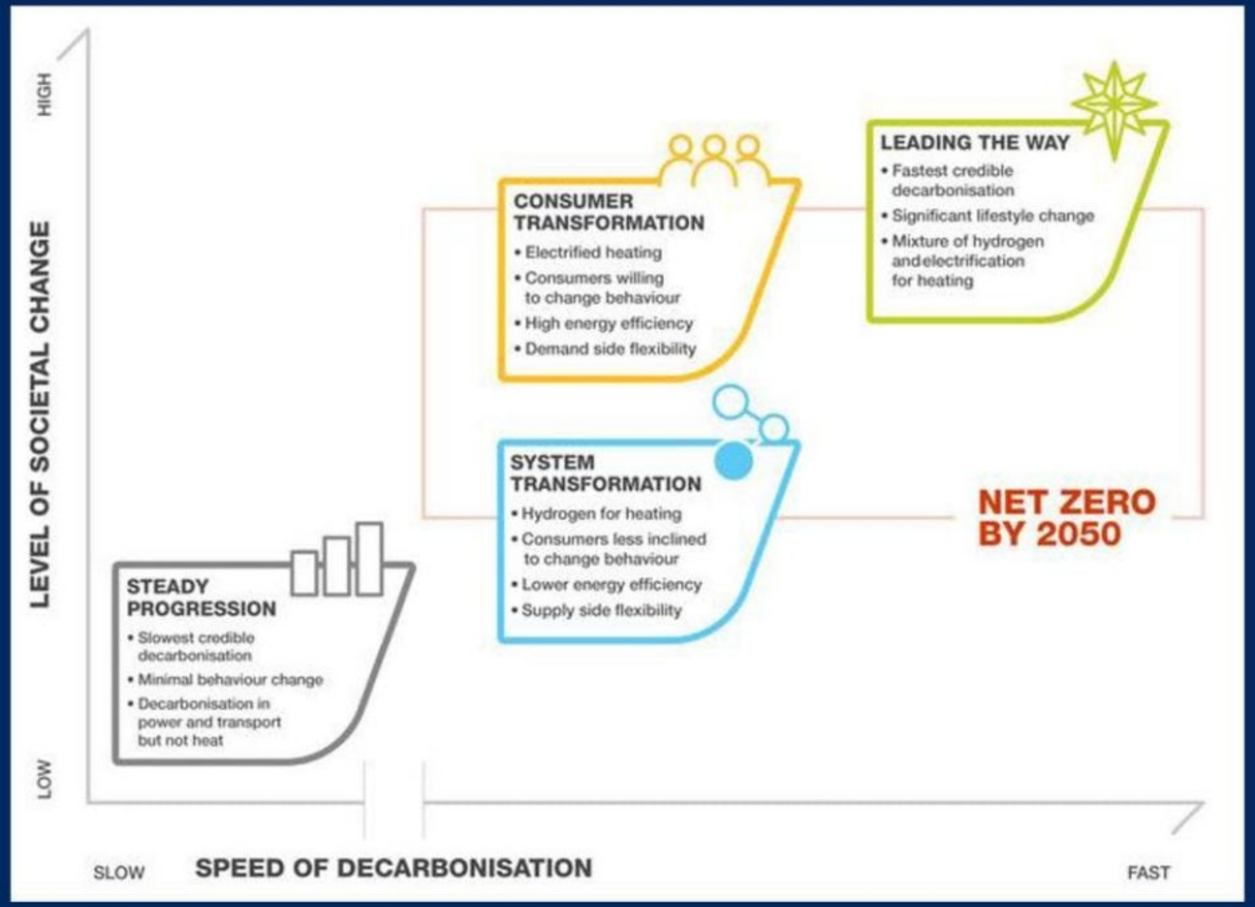
→ Ray Arrell - Head of Technical Development, Regen

In this session we will be...

- Briefly summarising what DFES is and how we do it
- Views on future energy technologies in the Southern 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

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:

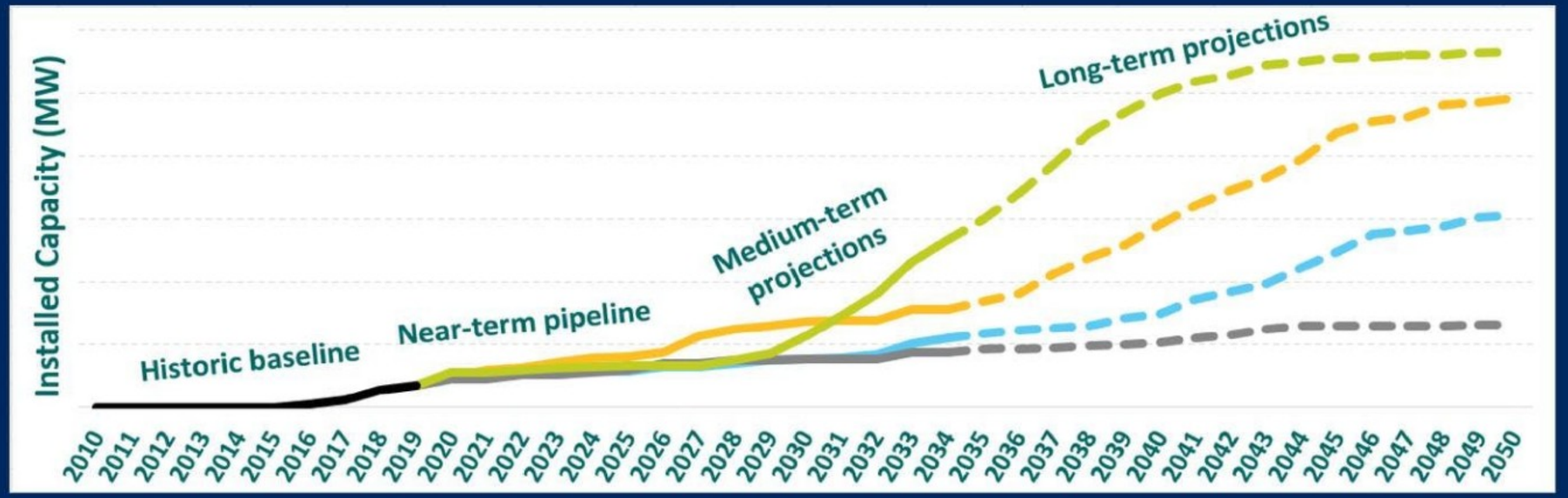
New homes / domestic developments

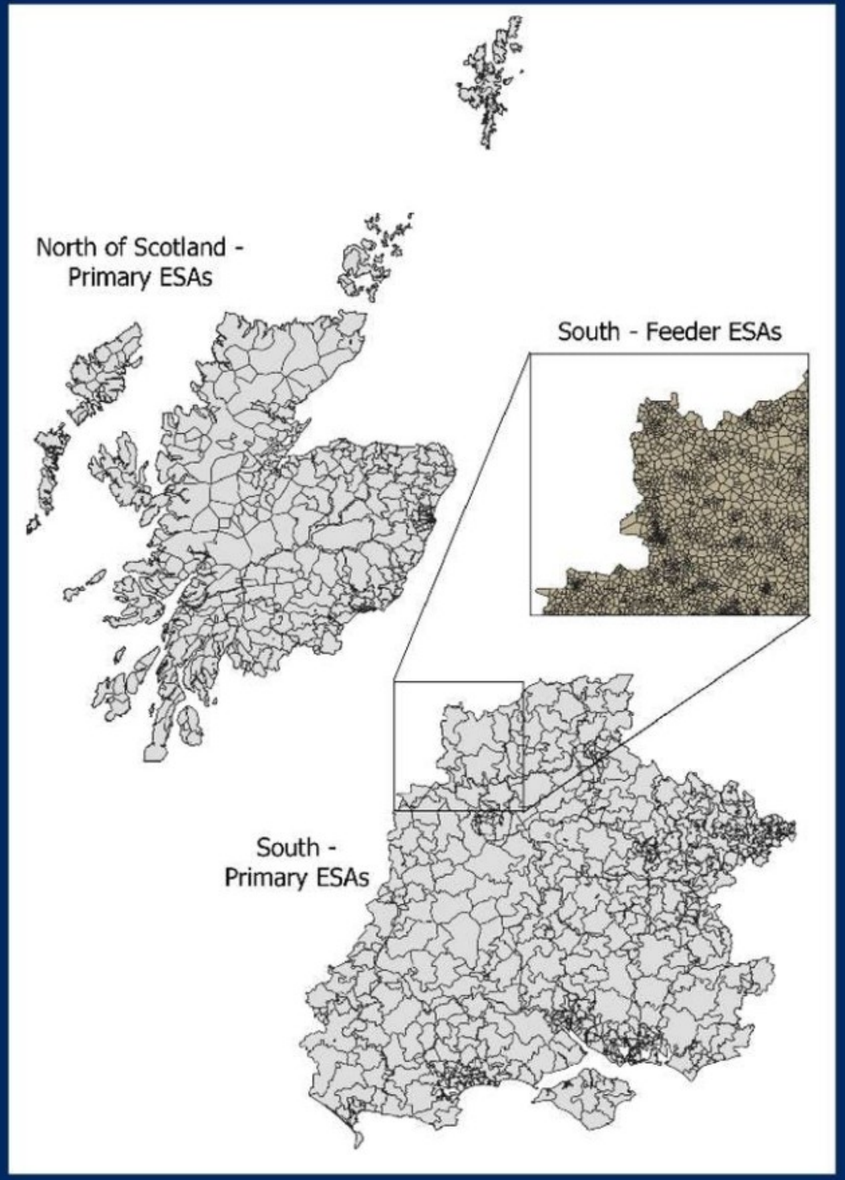
New non-domestic developments

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 & solar generation
- 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 =

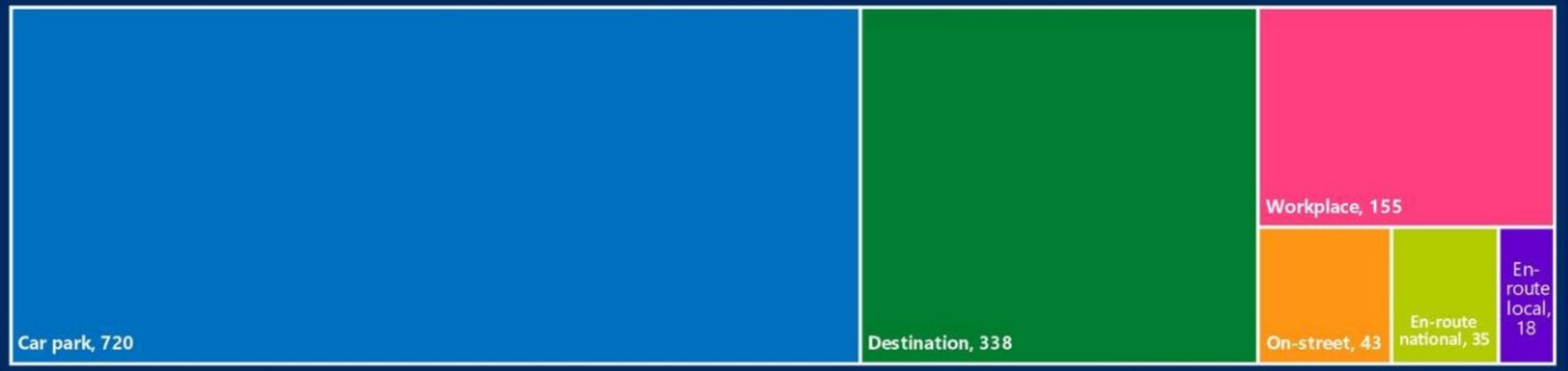
High granularity projections for low carbon technology uptake - EVs, EV chargers heat pumps and solar PV
SSEN, June 2020

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

When might the Southern England licence area's EV uptake align 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 are more centralised



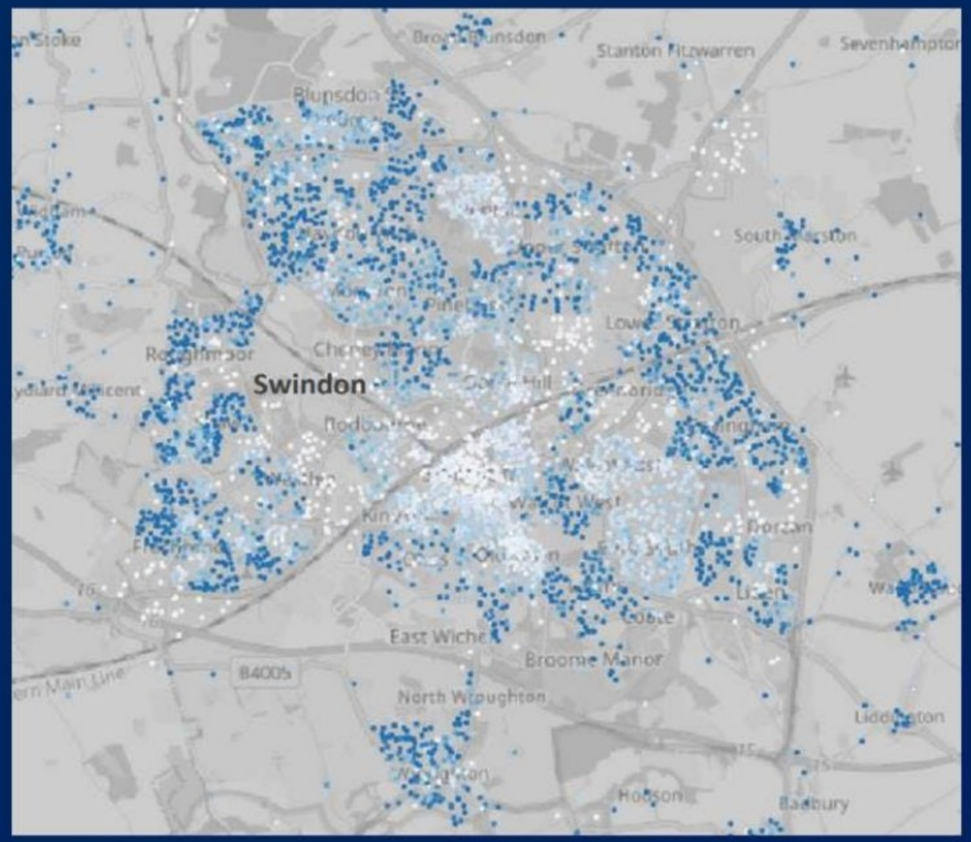
EV chargers in the Southern SSEN licence area are more decentralised

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

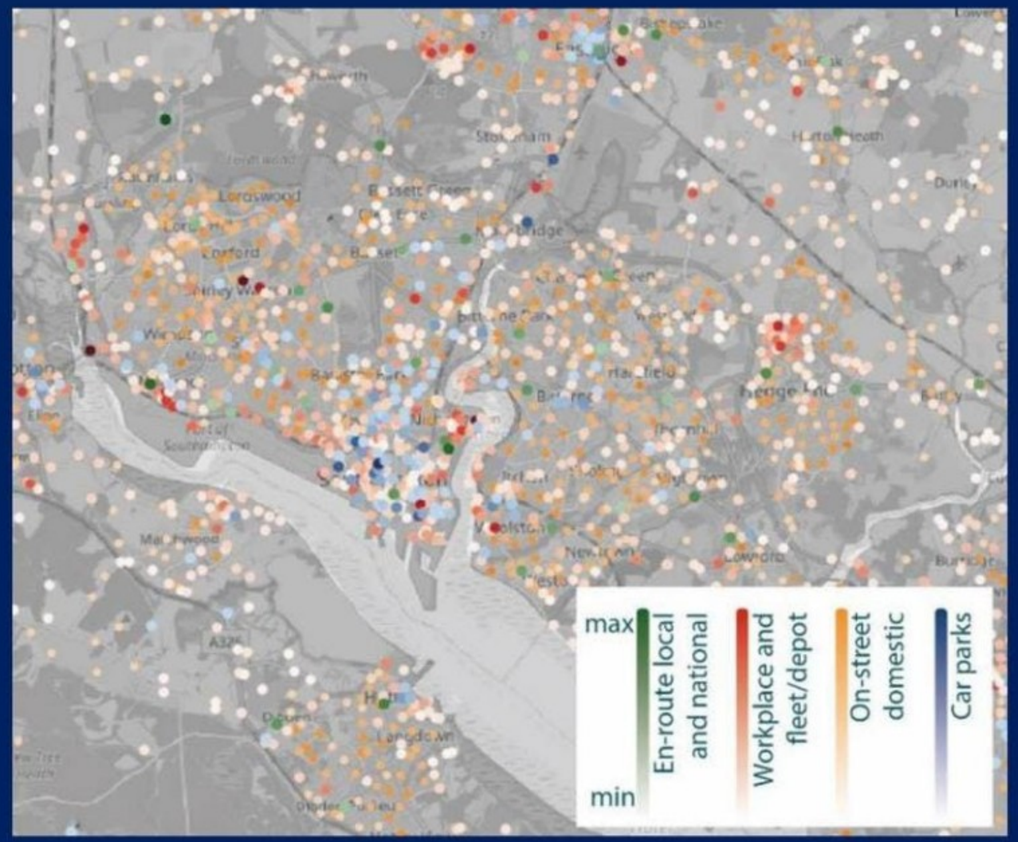
Data source:
National ChargePoint registry, Regen analysis

Existing EV charging infrastructure in SSEN's licence areas

Example off-street EV charging density in Swindon



Example non- domestic EV charging in Southampton



What is the future of EV charging infrastructure in the Southern licence area?

Continued widely distributed residential on-street charging

Neighbourhood EV charging hubs

Shift towards centralised charging infrastructure

Heating technologies

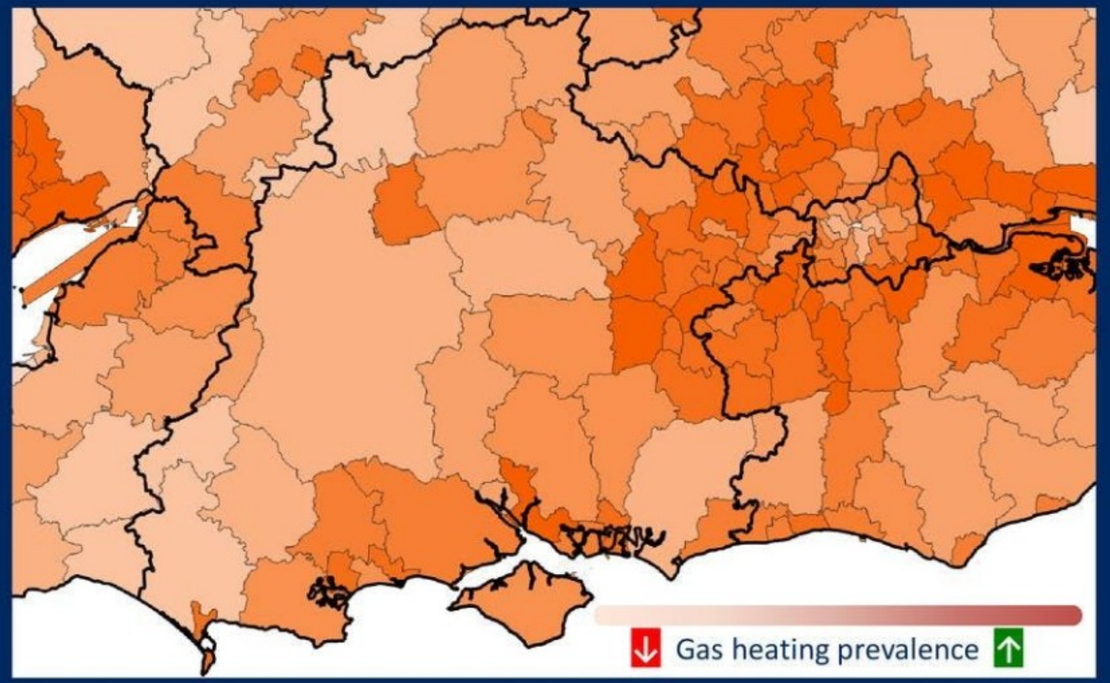
→ Heat pumps

Domestic heating in SSEN's licence areas

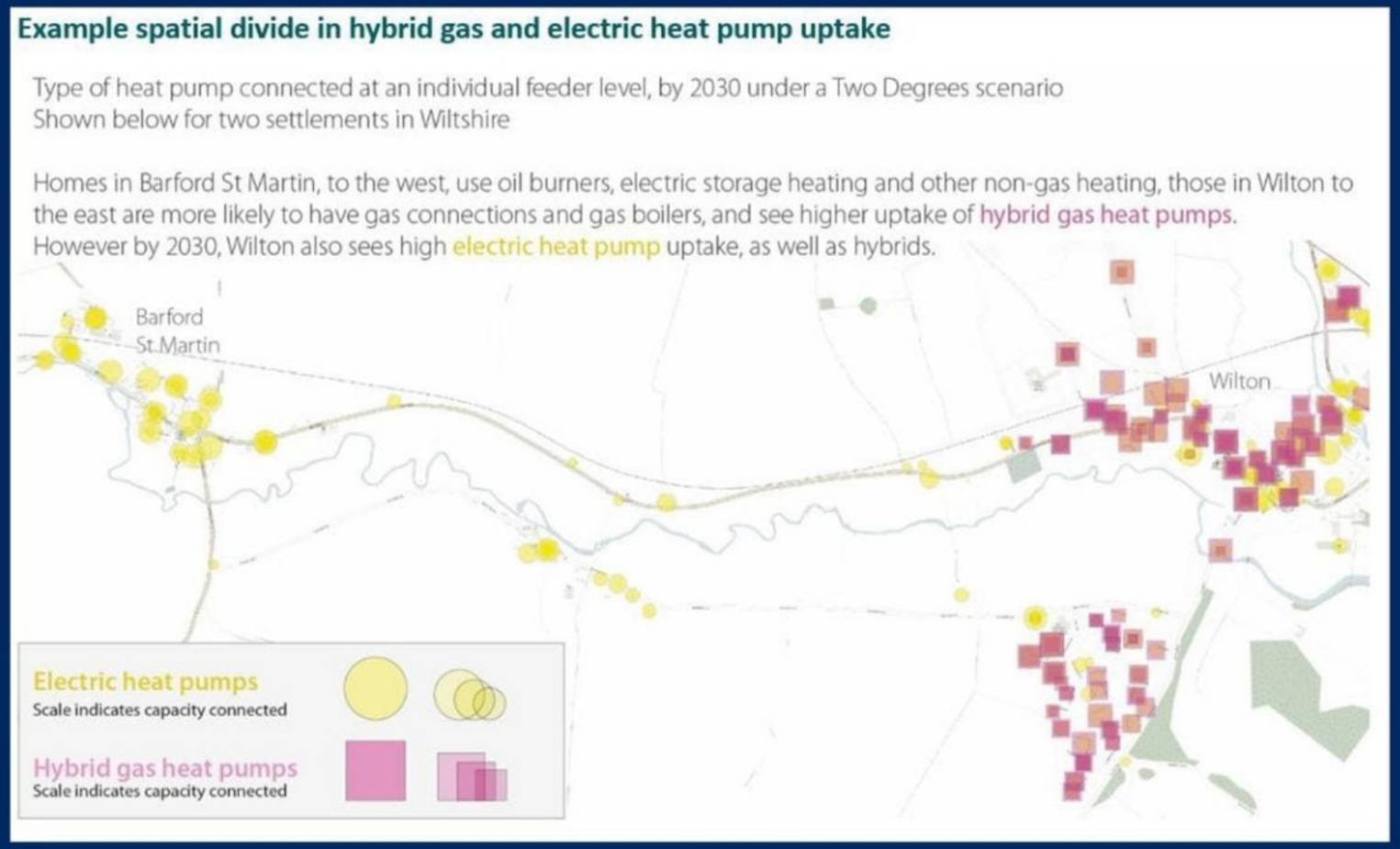
The Southern licence area has slightly below average proportion of gas heated homes compared to GB

Percentage of homes heated by different fuels/ technologies					
	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

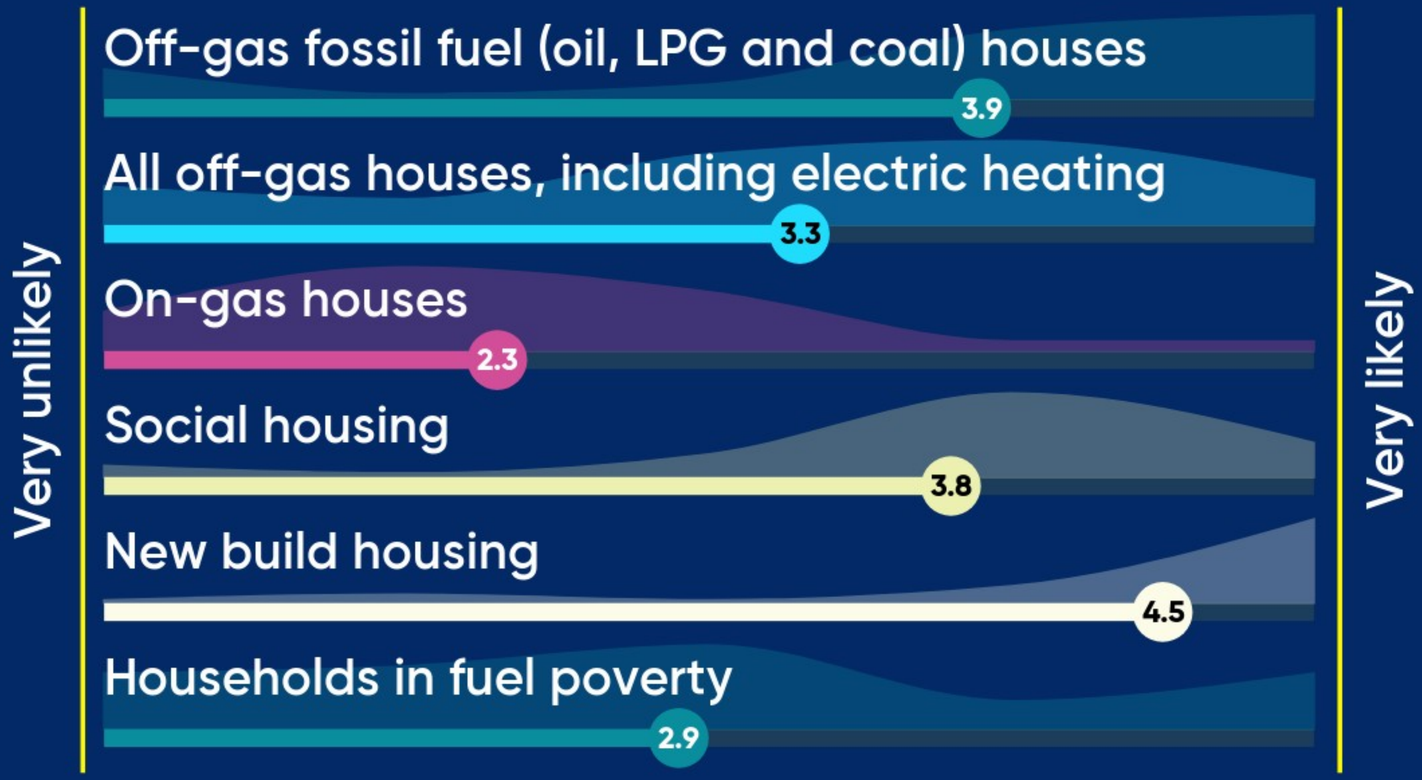


Example spatial divide in hybrid gas and electric heat pump uptake



High granularity projections for low carbon technology uptake - electric vehicle, heat pumps and solar PV
SSEN, June 2020

As the government looks to achieve its target of 600,000 heat pumps installed per year by 2028, which of these areas will be targeted?

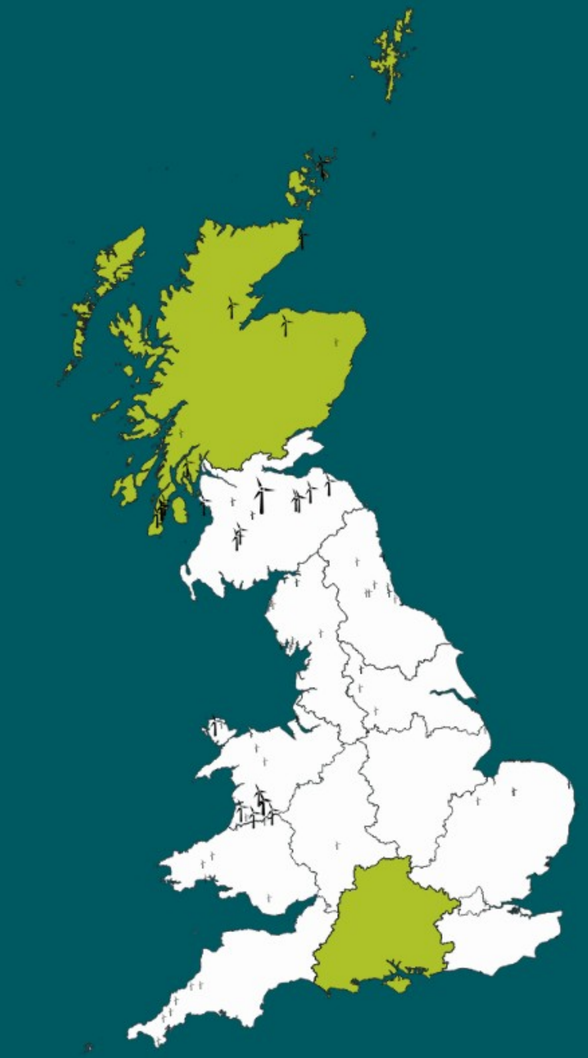


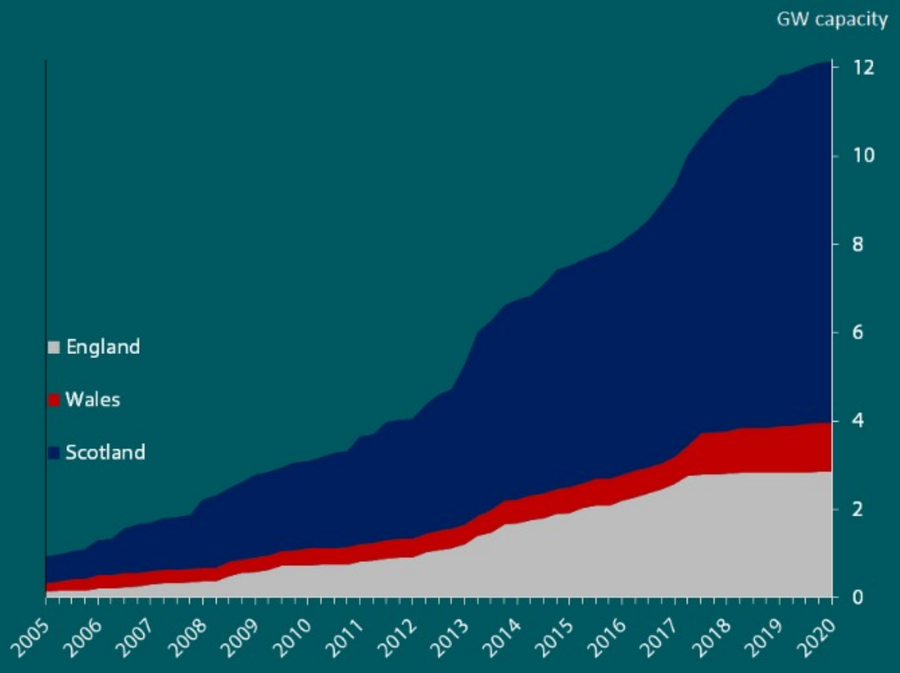
Electricity generation technologies

- Onshore wind
- Ground mount solar PV

Onshore Wind in the South of England

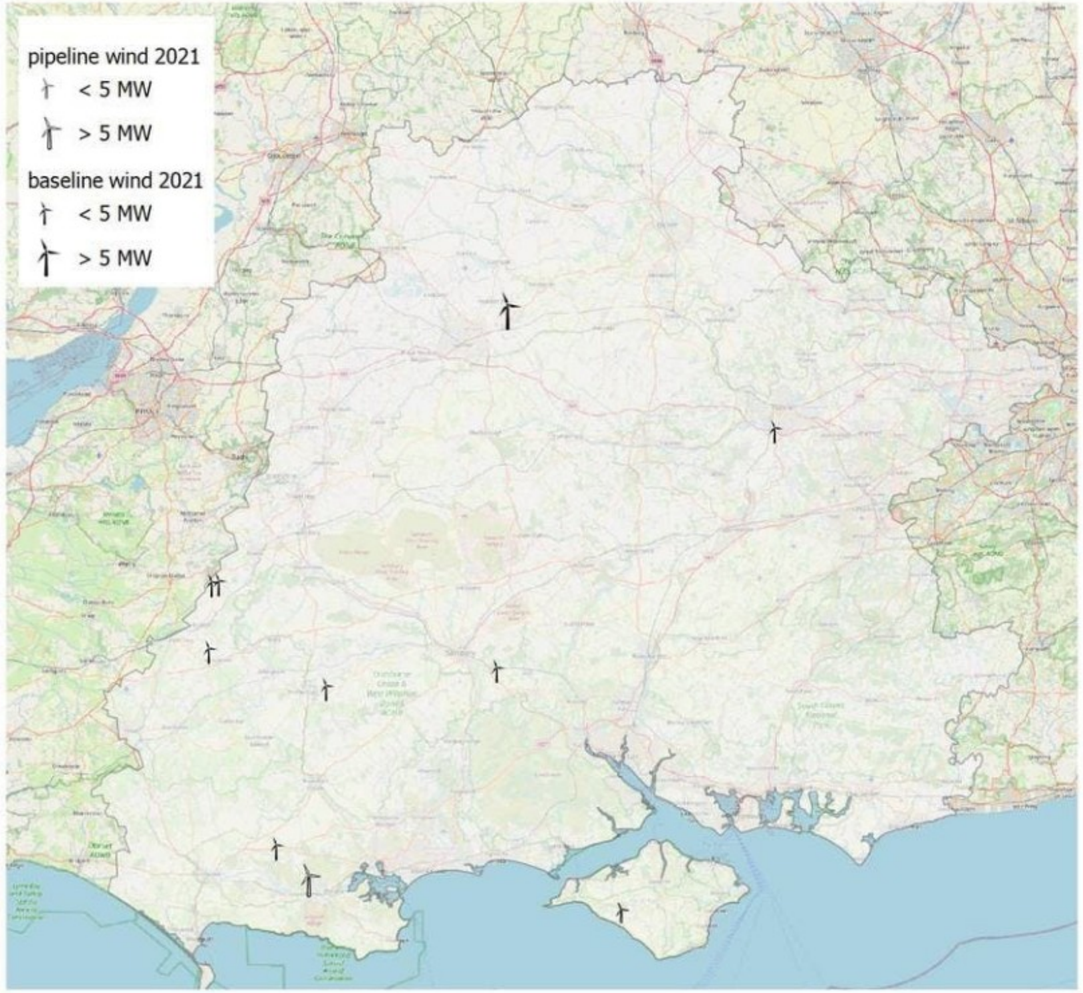
- Status of onshore wind development
- Storage co-location





2005-03-01

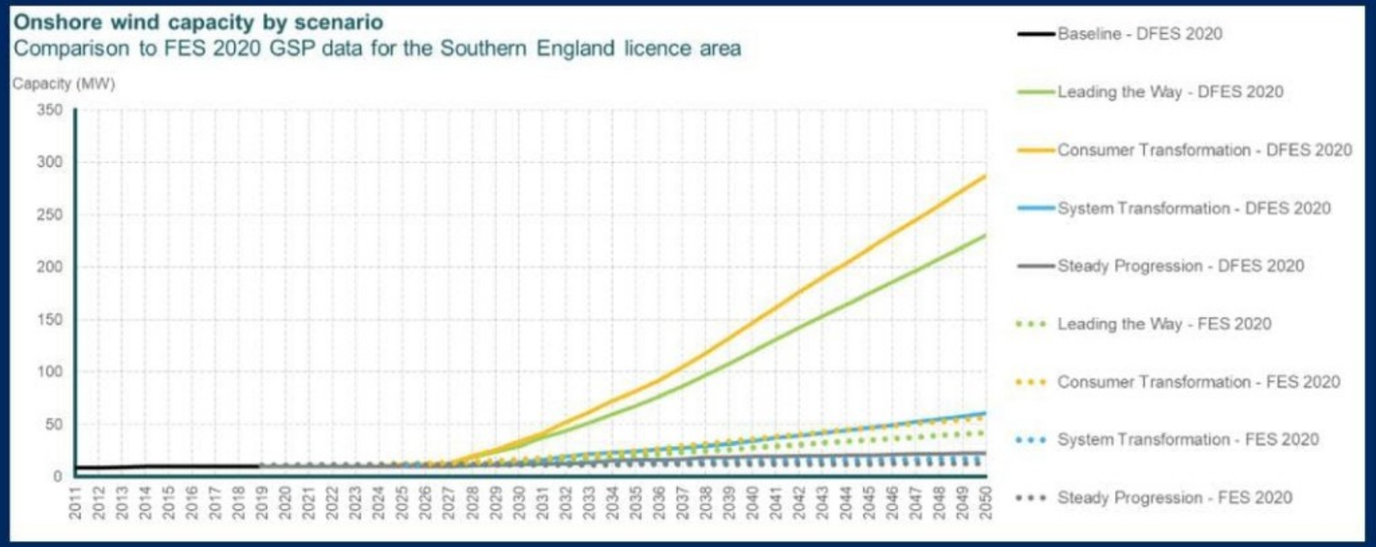
According to last years' analysis, wind has limited uptake in south of England



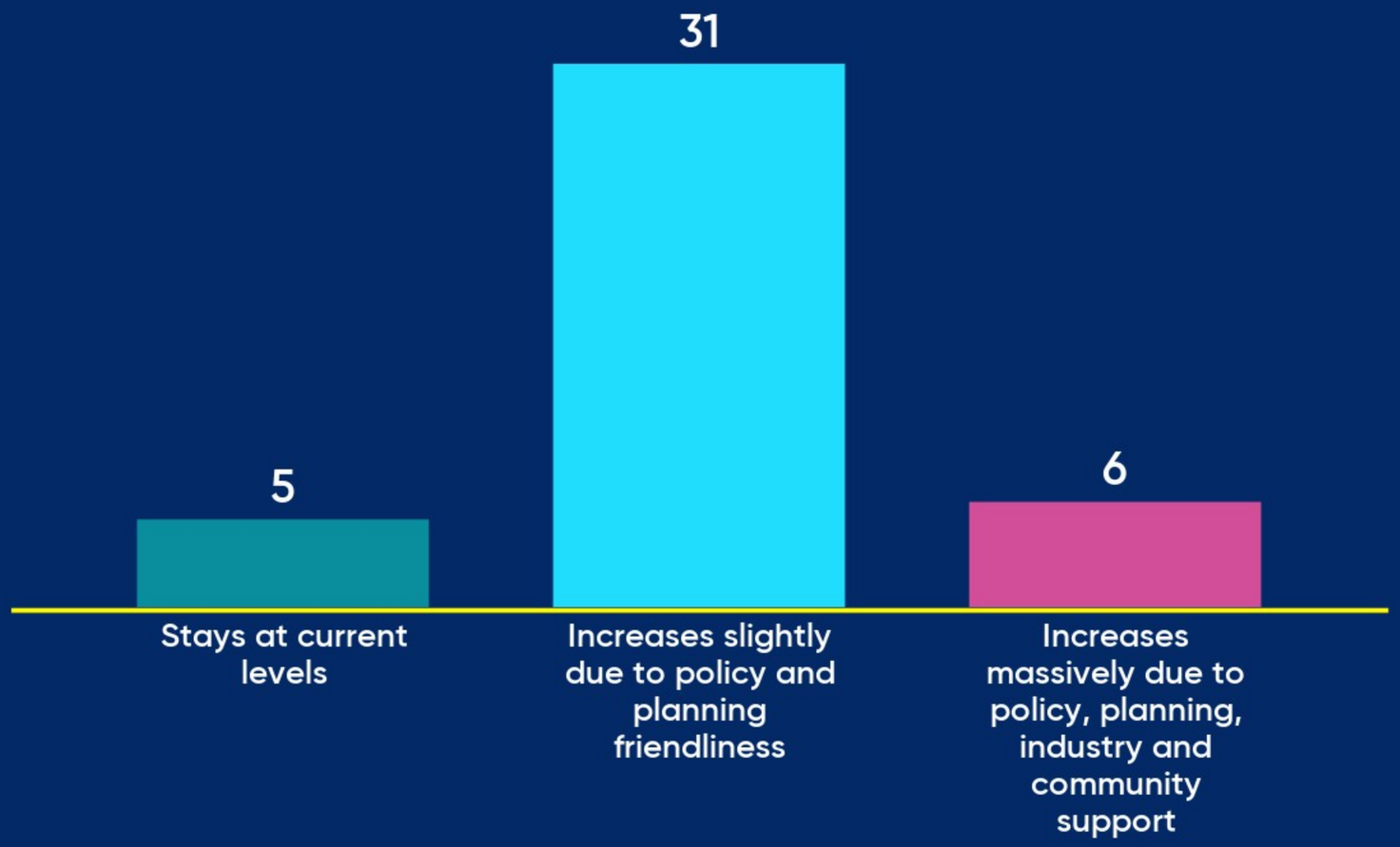
Onshore wind baseline and pipeline for the Southern licence area are negligible.

According to SSEN connections data:

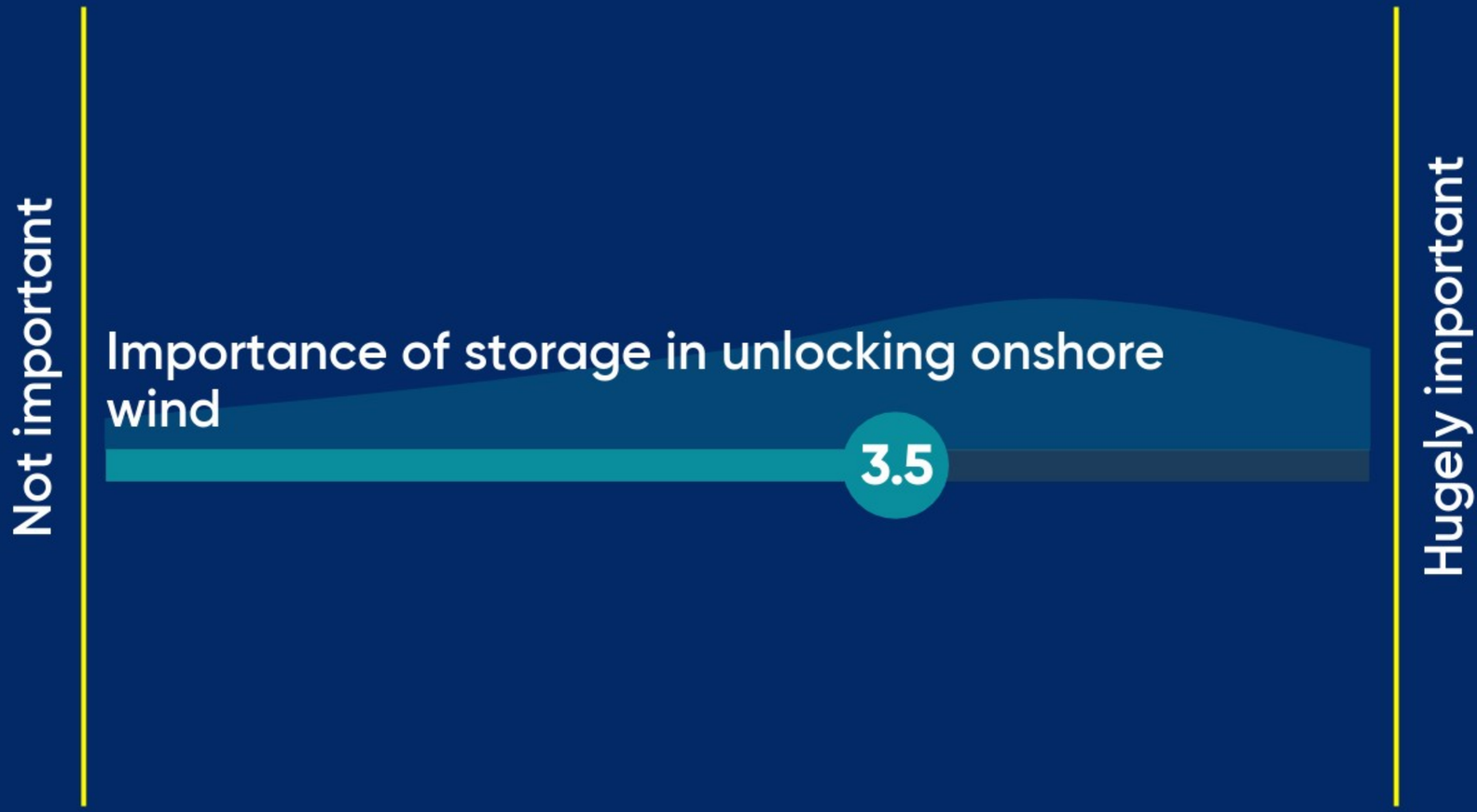
- Pipeline: 0.5 MW from 2 sites
- Baseline: 11 MW from 8 sites



Do you see distribution-connected wind continuing along the same trend, or increasing in the region?



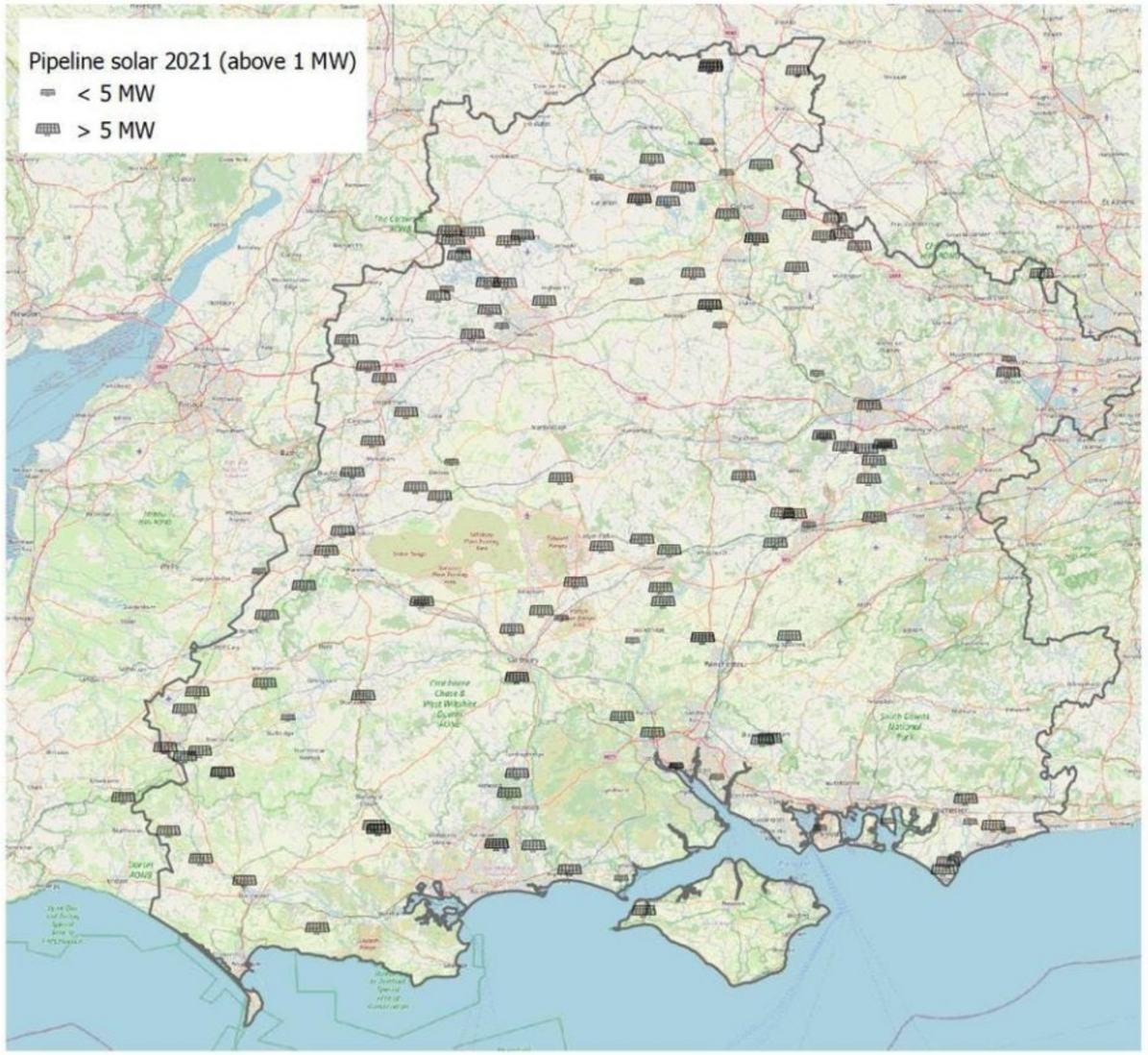
How important is co-located storage for unlocking future uptake of onshore wind in Southern England?

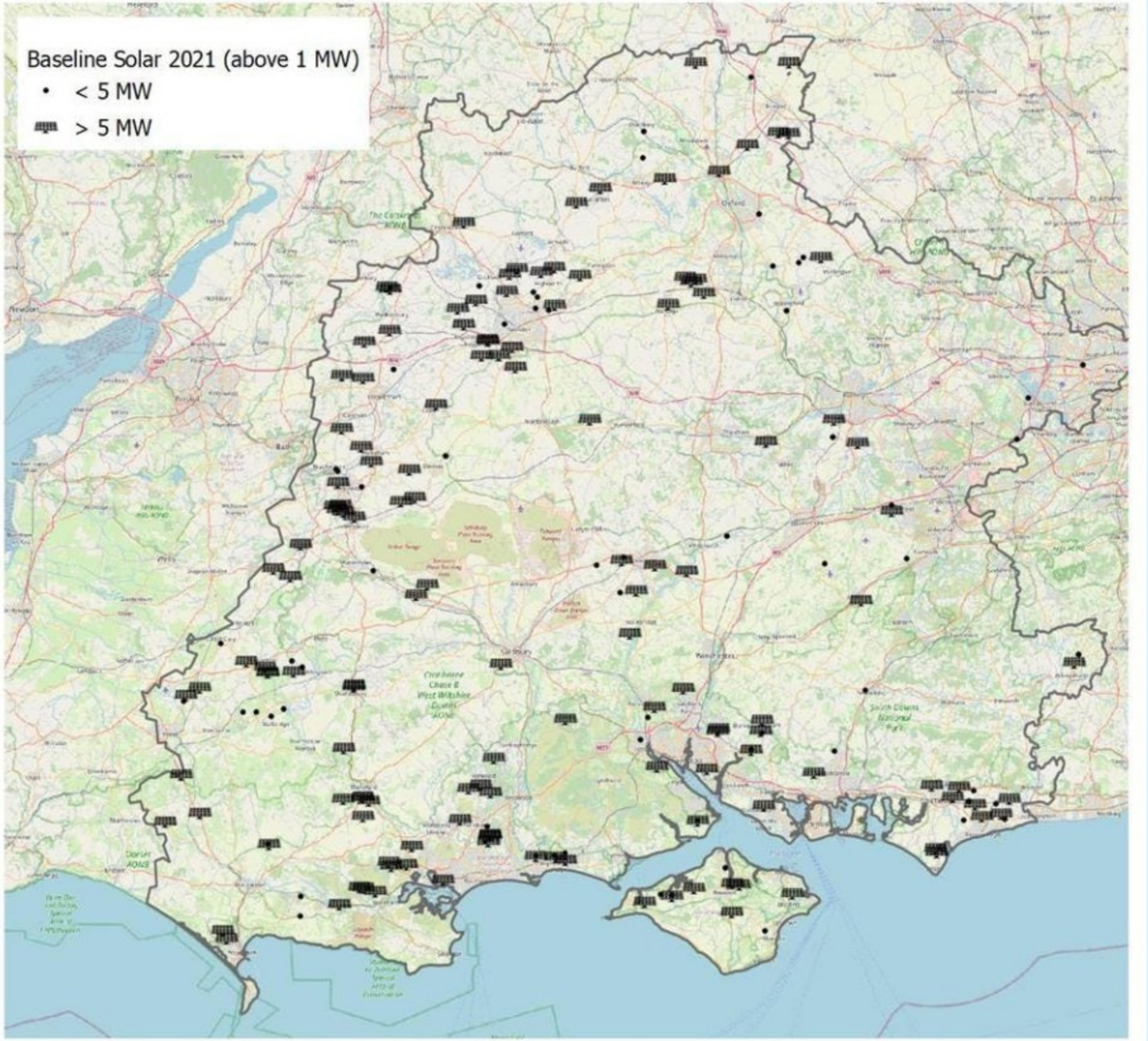


Large scale solar PV in the Southern England

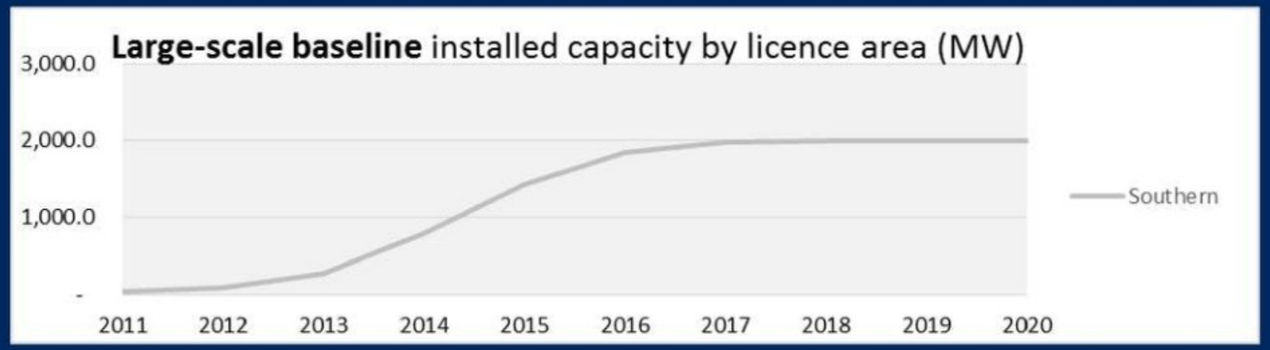
- Status of solar and trends
- Peak growth per business model
- Distribution factors
- Emerging technologies and repowering

2021 Solar Pipeline and Baseline in the SEPA Licence Area





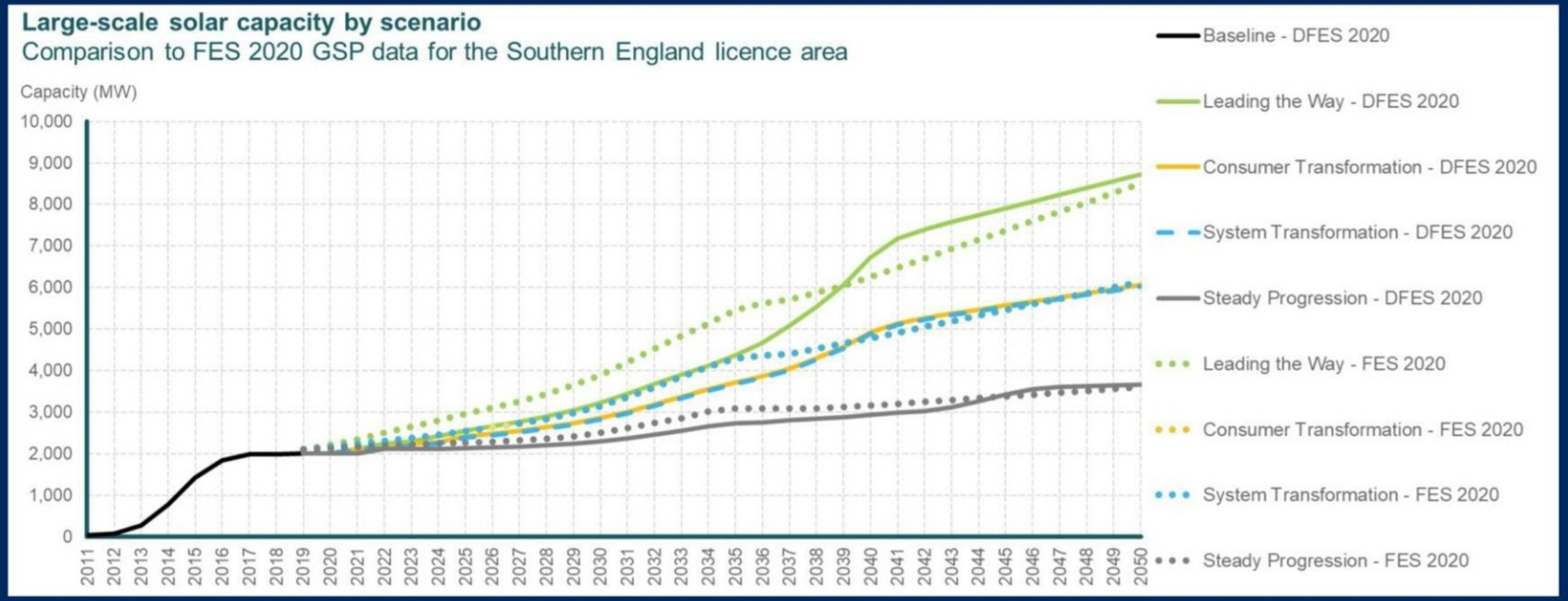
Installed solar[1] capacity has increased, but less rapidly post-2016:



Size	2011		2021	
	MW	sites	MW	sites
Below 1 MW	0	0	43	232
Above 1 MW	41	9	1,991	209
Total	**41**	**10**	**2,034**	**442**

[1] Excluding FIT data on solar

2020 Solar Projections



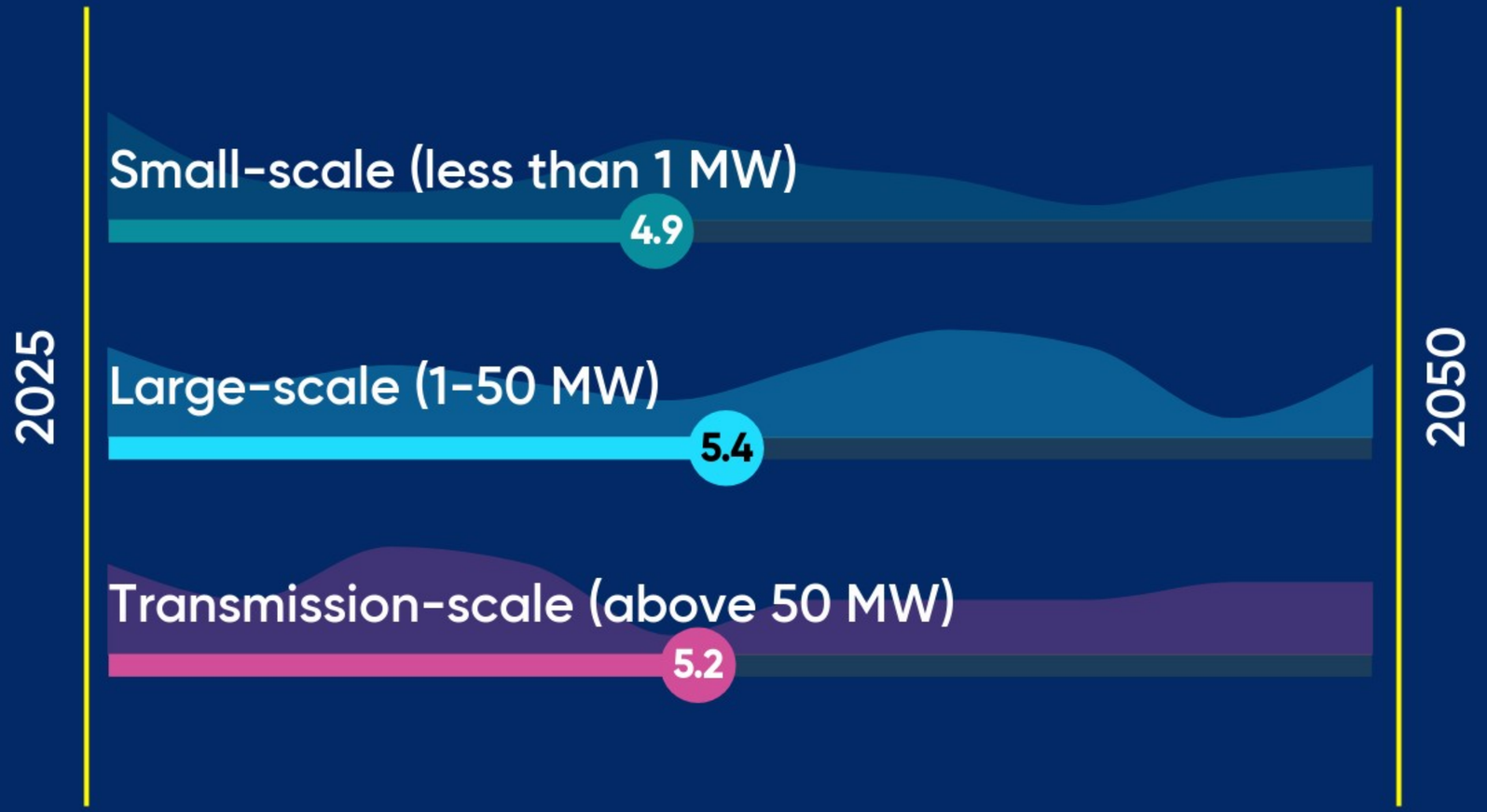
How do you see solar deployment going in the future in Southern England?

Pick up again with exponential growth in the near-term

Continuing the current trend, tapering off in the near term, then taking off in the long term

Continuing the current trend, slowing down and aligning to current levels

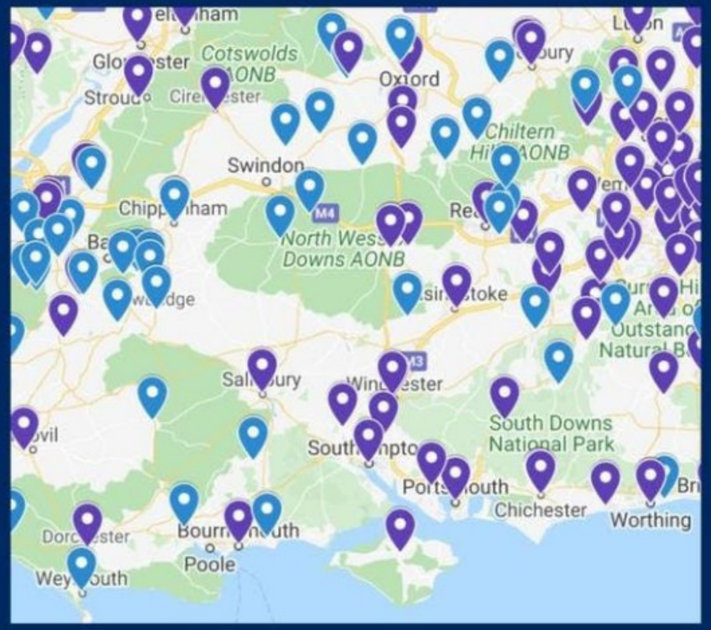
When do you see the most growth occuring in each of the following solar business models?



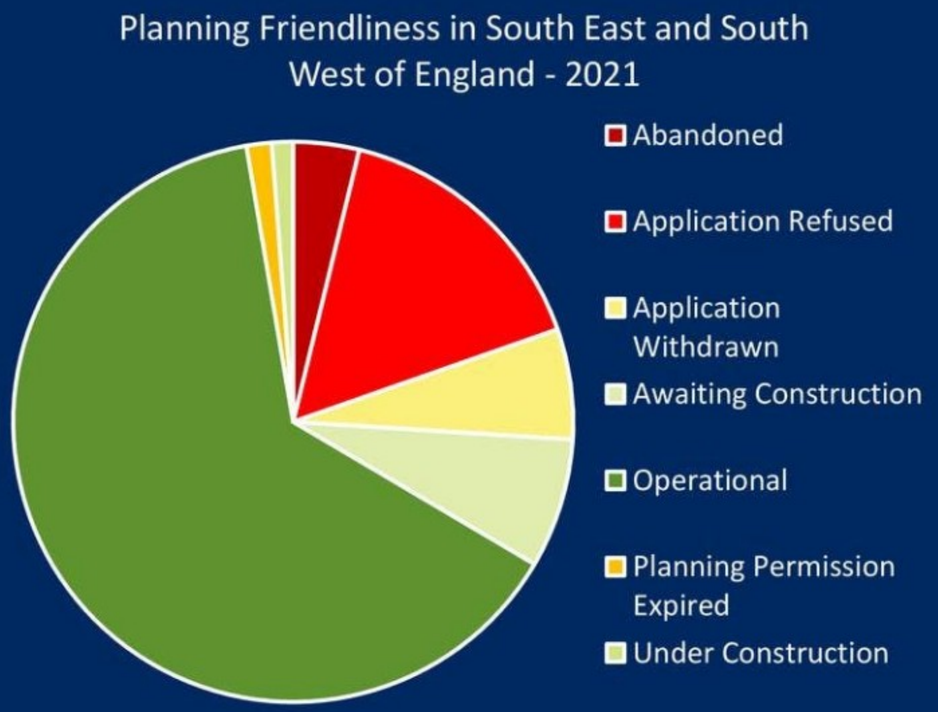
Solar Distribution Factors

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

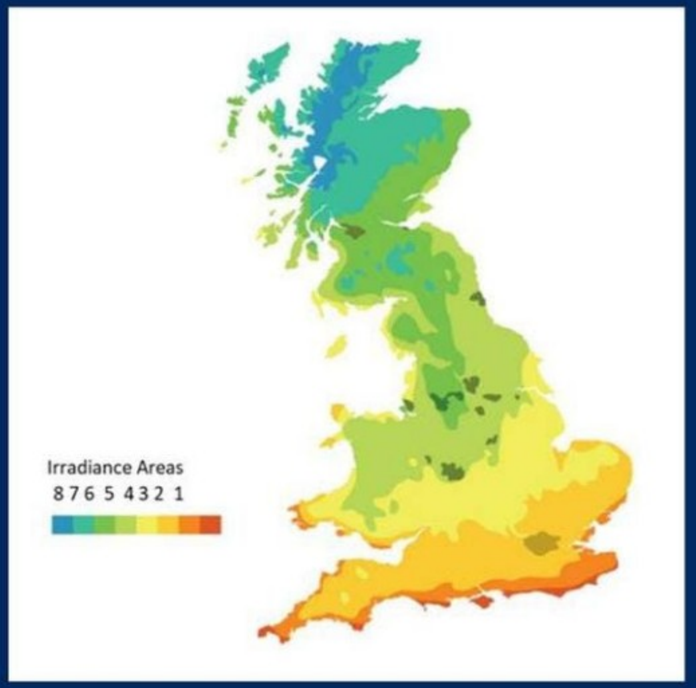
Declared Climate Emergencies and RE Targets



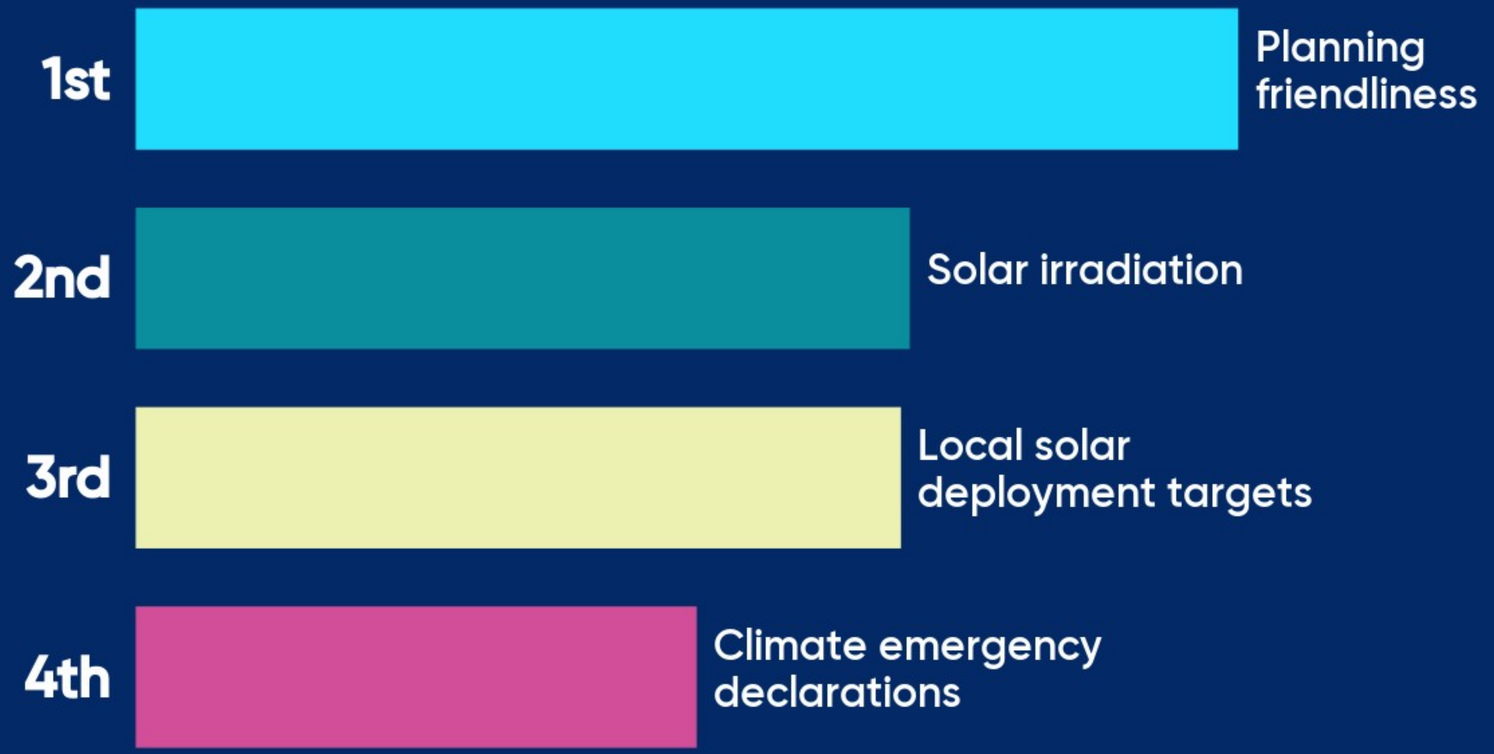
Planning Friendliness



Solar Irradiance



What factors are most important in determining the location of new solar capacity?



Repowering Model

As part of the projections, we take into account uptake of new solar technologies with improved efficiencies at existing solar sites, thereby improving installed capacity of those sites.

Repowering	Year delay < 5 MW	Percent increase
Steady Progression	30	+ 25%
System Transformation	25	+ 50%
Consumer Transformation	25	+ 50%
Leading the Way	25	+ 100%

Solar Cell Type	Efficiency Rate
Monocrystalline Solar Panels (Mono-SI)	~20%
Polycrystalline Solar Panels (p-Si)	~15%
Thin-Film: Amorphous Silicon Solar Panels (A-SI)	~7-10%
Concentrated PV Cell (CVP)	~41%

Based on emerging technologies in the market, what is the maximum increase in repowering of pre-existing solar panels?

regen
transforming energy

Scottish & Southern
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Energy flexibility

- Electricity storage
- Gas peaking generation
- Hydrogen electrolysis

regen transforming energy

Scottish & Southern Electricity Networks

Electricity storage

- Battery storage business models
- Other electricity storage technologies

regen transforming energy

Scottish & Southern Electricity Networks

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

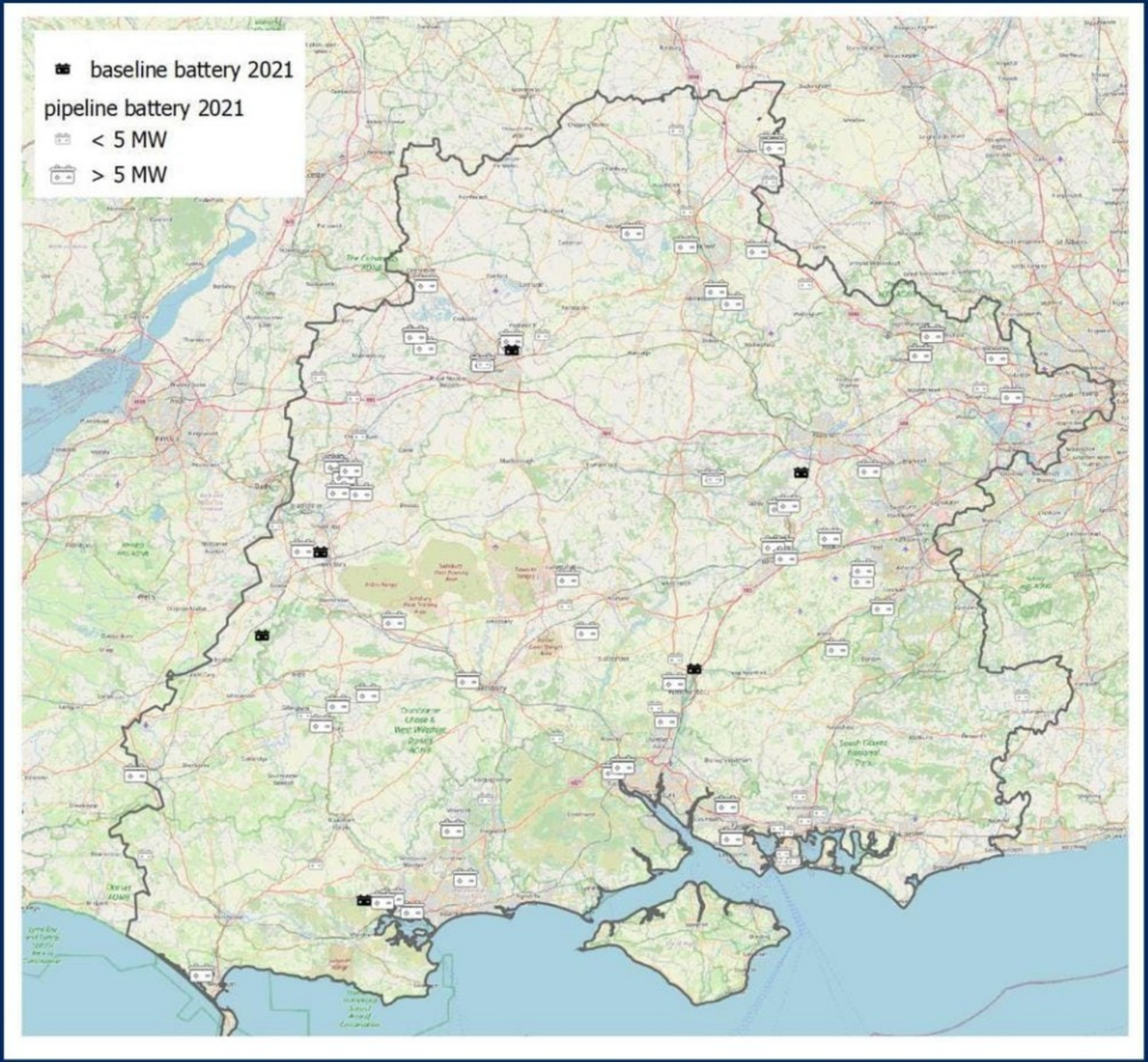
Typically multiple MW scale projects sited alongside renewable energy generation projects

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 Southern licence area

Baseline (up to end of 2020)

- **6** projects currently connected
- Total capacity of c.**6MW**
- Mostly small-scale batteries co-located with solar farms or high energy users

Pipeline (known projects 2021-2030)

- **104** new projects in the pipeline
- Total capacity of c.**2.5GW** (all batteries)
- Mixture of business models and scales
- Significant number of projects with planning approval or activity in UK Capacity Market. (potentially up to 1GW)

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

Standalone storage projects

Generation co-location projects

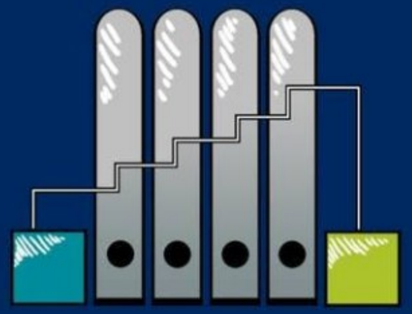
Behind-the-meter large energy users

0

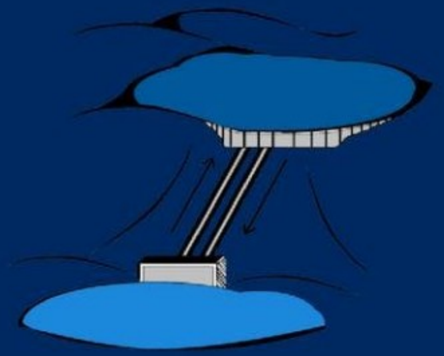
Domestic batteries

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

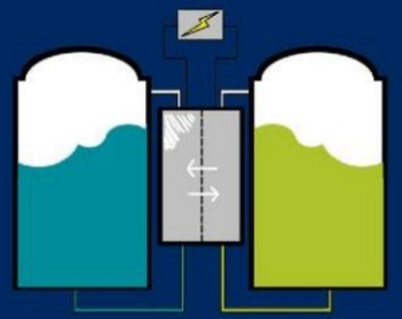
DFES does consider other technologies that could connect to the distribution network out to 2050



Liquid Air Energy Storage (LAES)



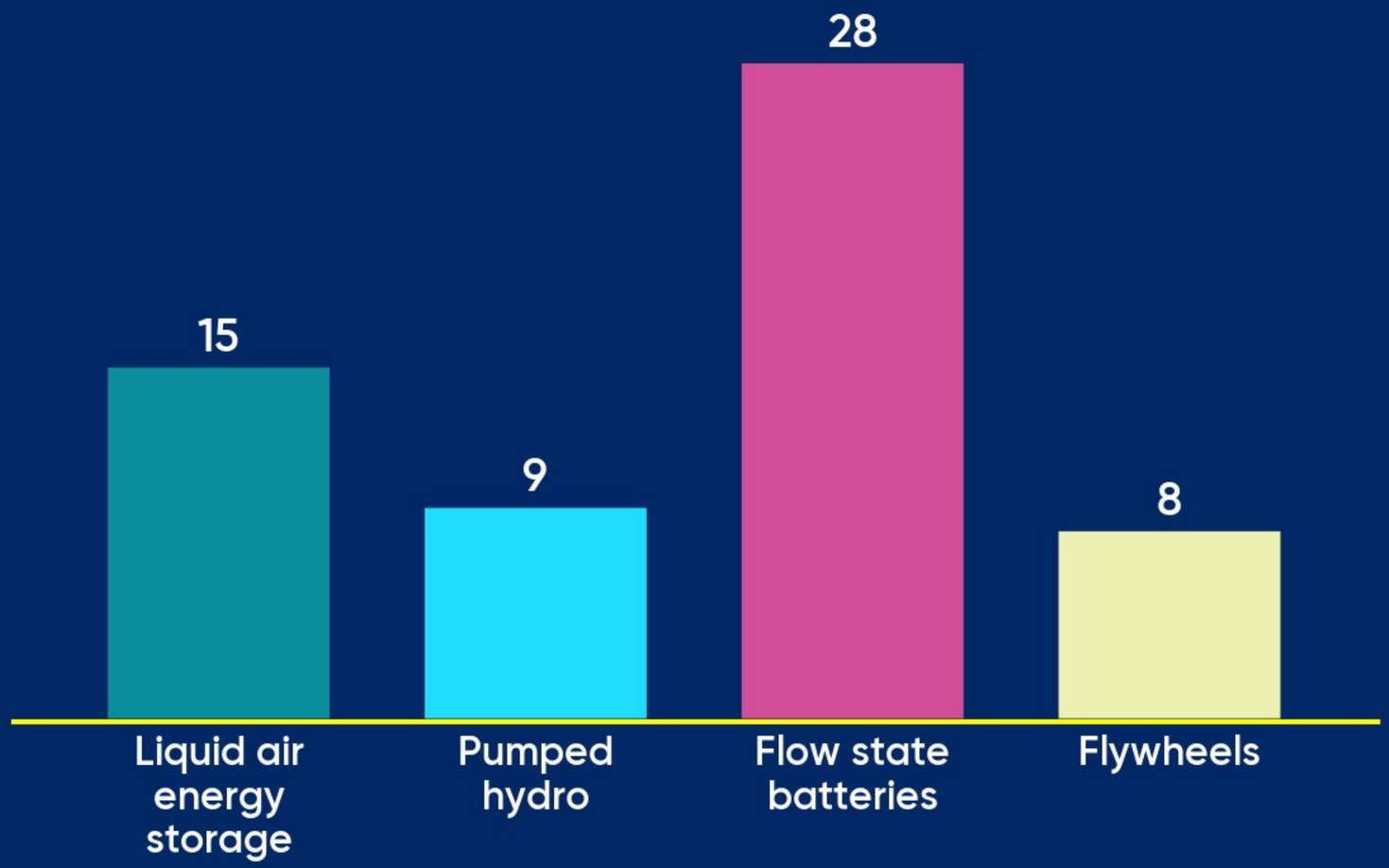
Small-scale pumped hydro



Flow-state batteries

Flywheels

What other electricity storage technologies might we see connecting in Southern England 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

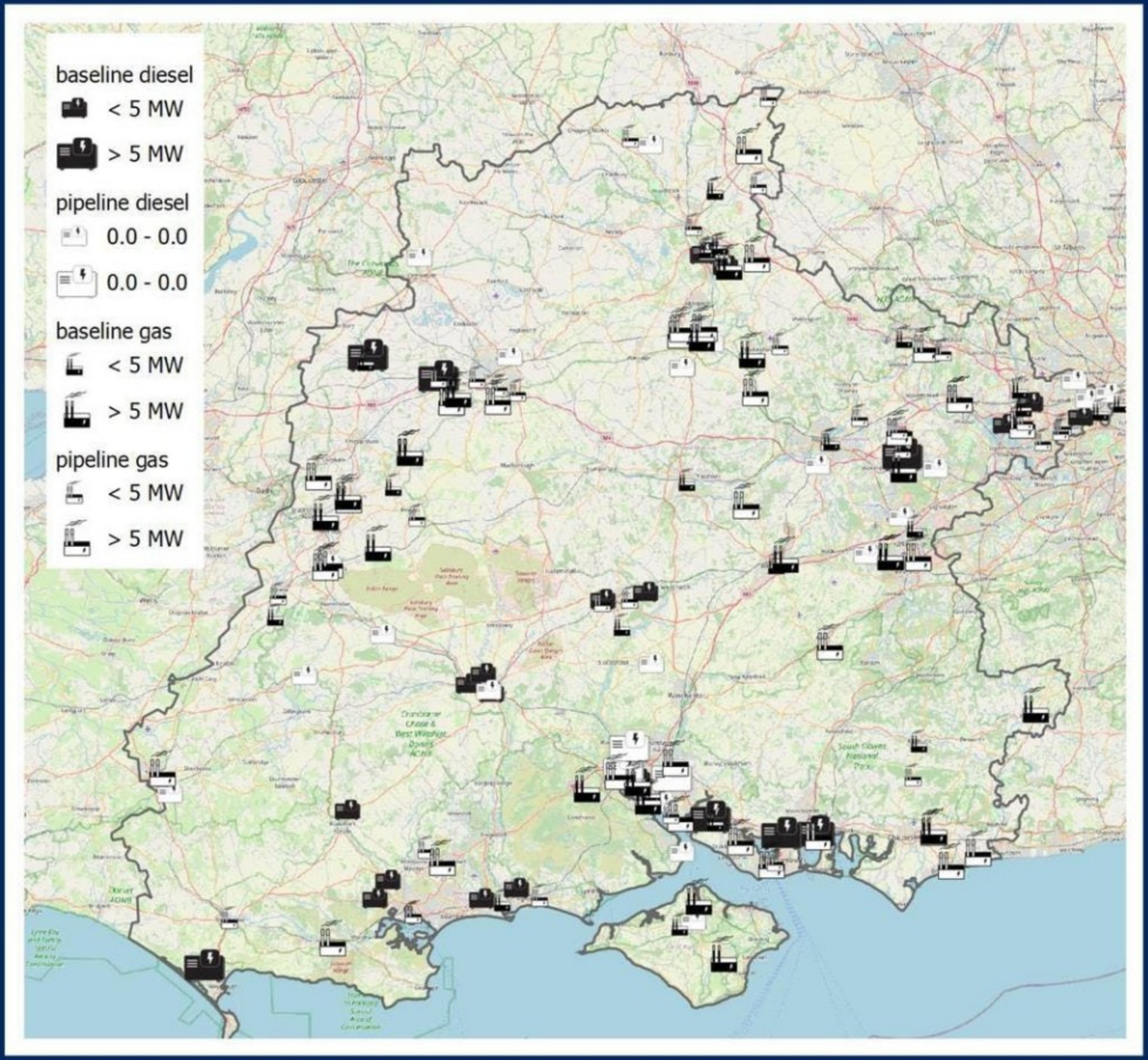
- Standalone commercial diesel power sites
- Back-up diesel generators that can export to the network

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 Southern licence area

Diesel

Baseline (up to end of 2020)

- **27** sites currently connected
- Total capacity of **171 MW**
- Mix of standalone plant and back-up gensets

Pipeline (known projects 2021-2030)

- **26** new projects in the pipeline
- Total capacity of c.**89 MW** (mostly back-up)

Fossil gas

Baseline (up to end of 2020)

- **47** sites currently connected
- Total capacity of c.**500 MW**
- Mix of OCGT, reciprocating engines and CHPs

Pipeline (known projects 2021-2030)

- **67** new projects in the pipeline
- Total capacity of c.**132 MW** (mostly recips)
- **78 MW** (11 sites) have secured planning

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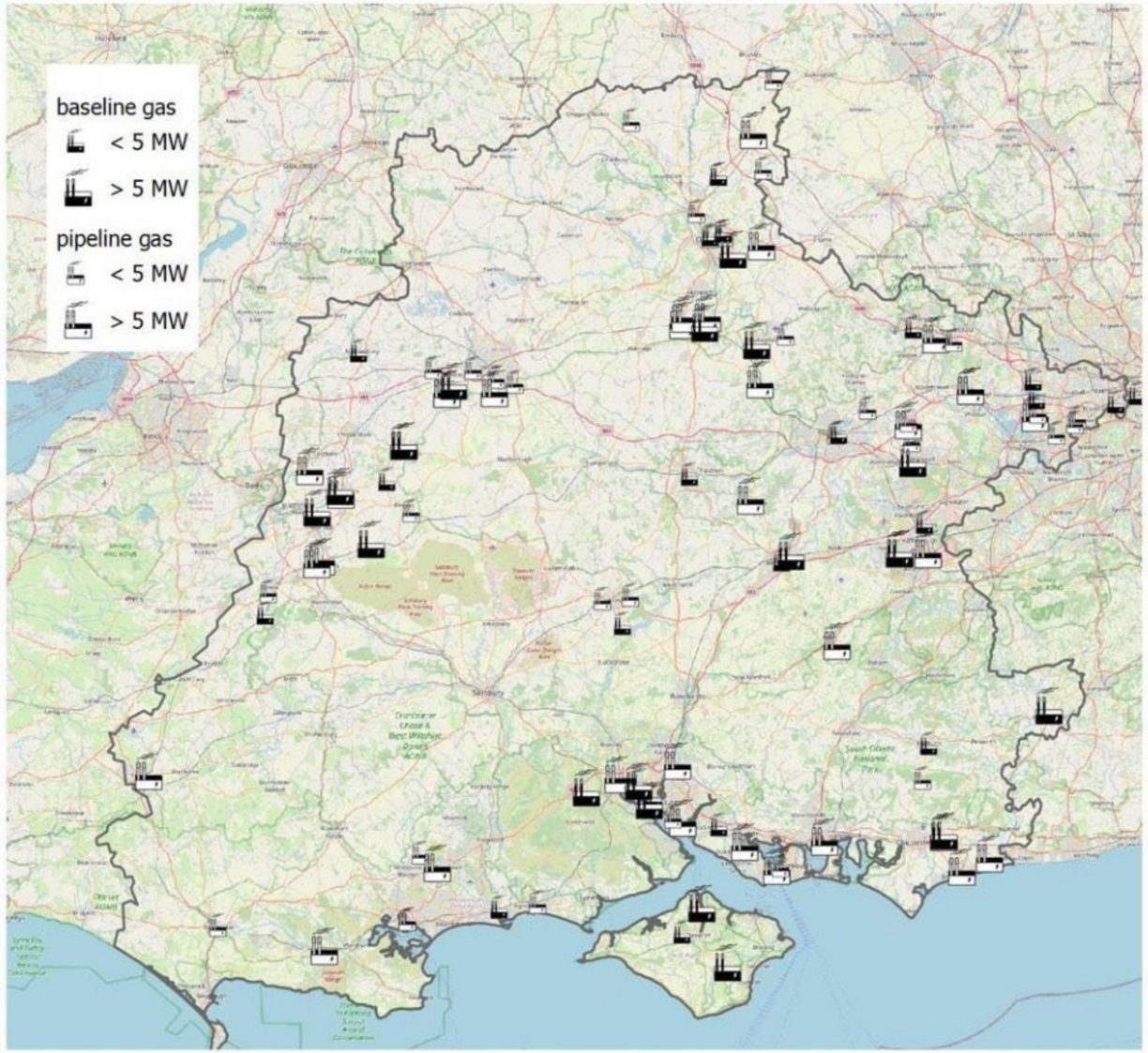

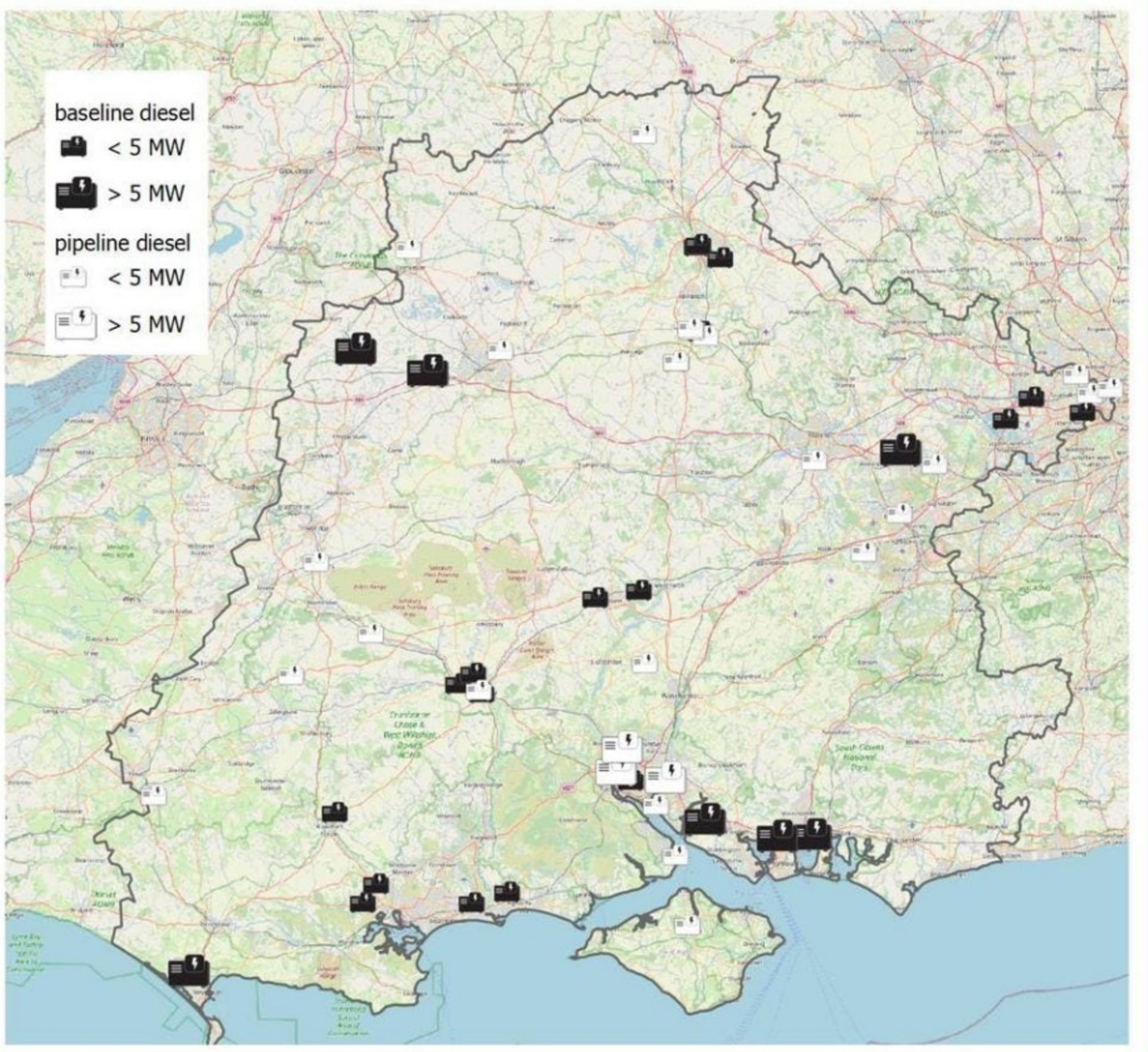

What do you see taking on the role of unabated diesel back-up generation?

Bioenergy fired generation

Longer duration battery storage

0

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 Southern licence area?

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

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Hydrogen in Southern England

- Future use cases for hydrogen
- Green hydrogen production

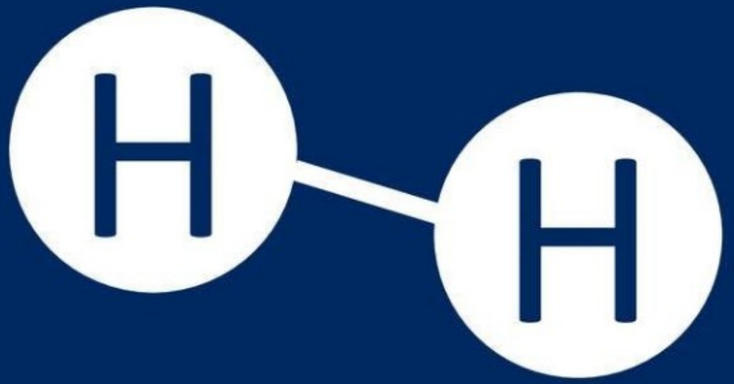
Low carbon hydrogen could play a role in decarbonisation as a new fuel sector

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.

UK Government target for **5GW** of low carbon production capacity by 2030.

There are multiple potential end sector uses for low carbon hydrogen



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Decarbonising Existing hydrogen manufacturing

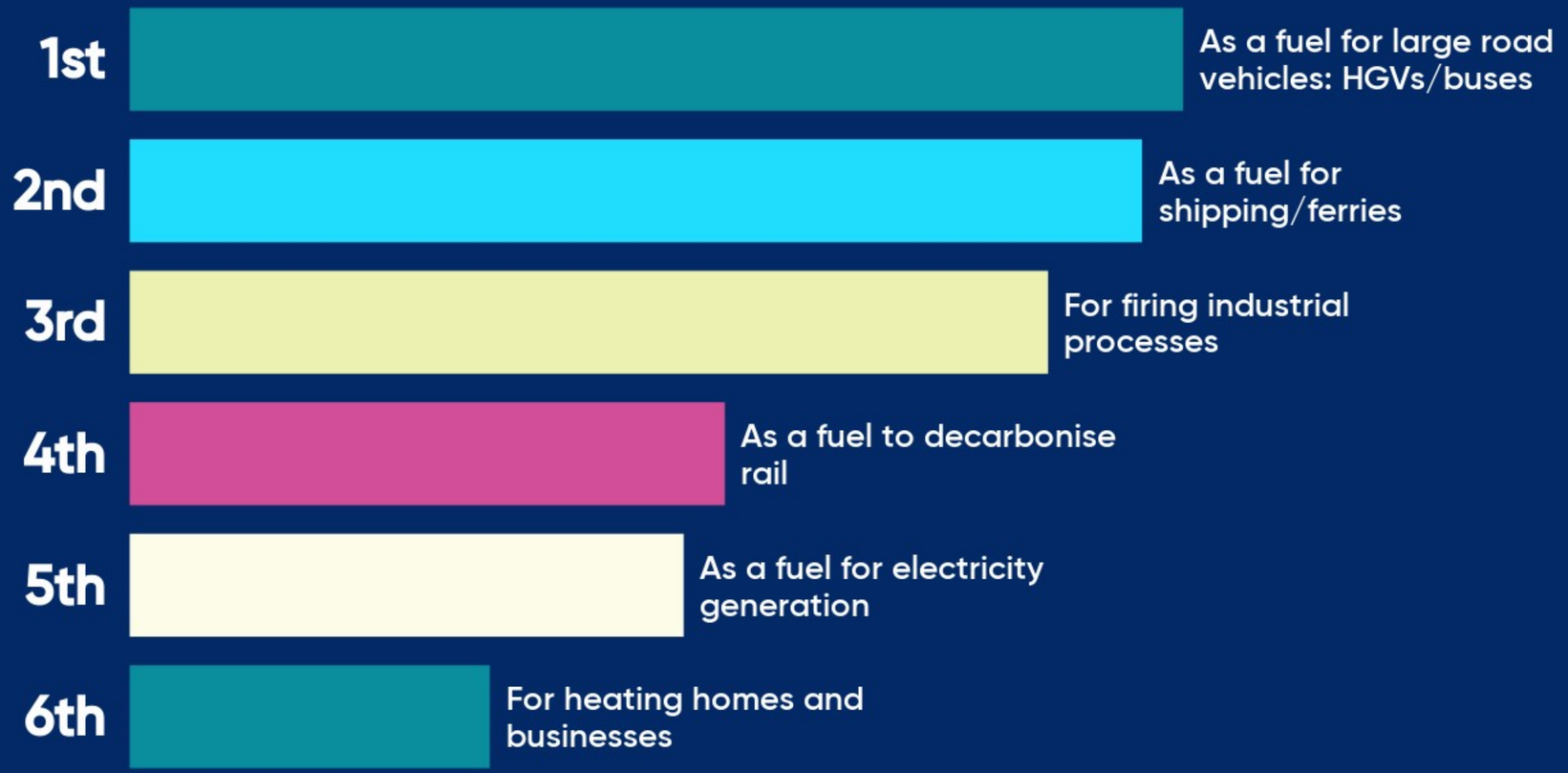
A number of transport sector applications

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 Southern England in the future?



Could Southern England become a significant producer of green hydrogen by 2050?

Q&A panel session

Steve Atkins - DSO Transition Manager, SSEN
Joel Venn - Head Analyst, Regen
Tamsyn Lonsdale-Smith - Energy Analyst, Regen

Thank you for joining us today