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Climate response: the time is now

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Chief Executive

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Matthieu Hue

Chief Executive Officer

EDF Renewables

Chris Stark

Chief Executive

Committee on Climate Change

Committee on Climate Change

1 September 2020

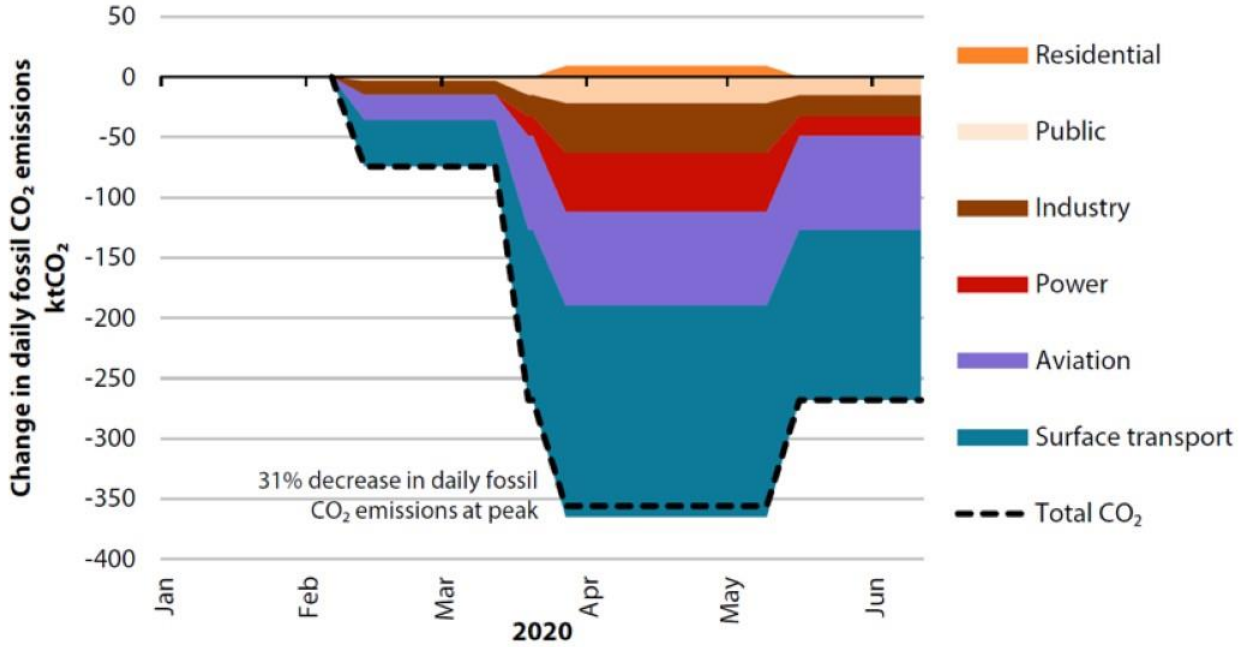
Scottish Renewables Conference 2020

Chris Stark

Committee on Climate Change

Impact of COVID-19

Change in daily UK Fossil CO2 emissions

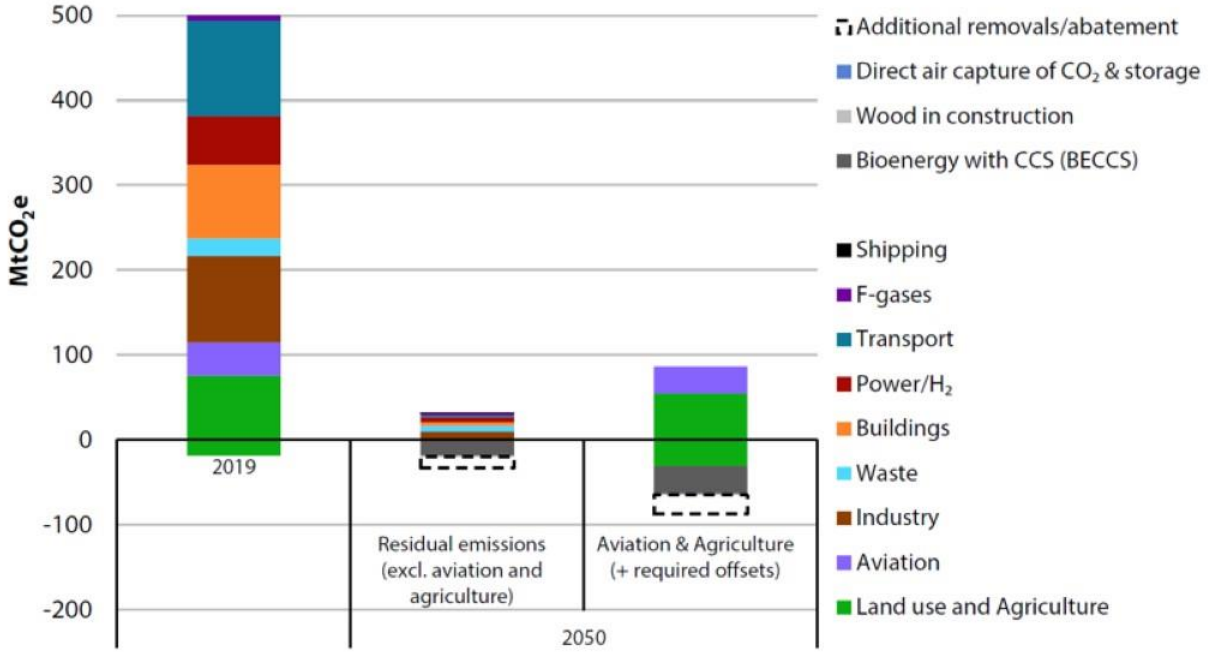


Source: Le Quéré, C. et al. (2020) Temporary reduction in daily global CO_2 emissions during the COVID-19 forced confinement.

Committee on Climate Change

Finding certainty in the long-term priorities

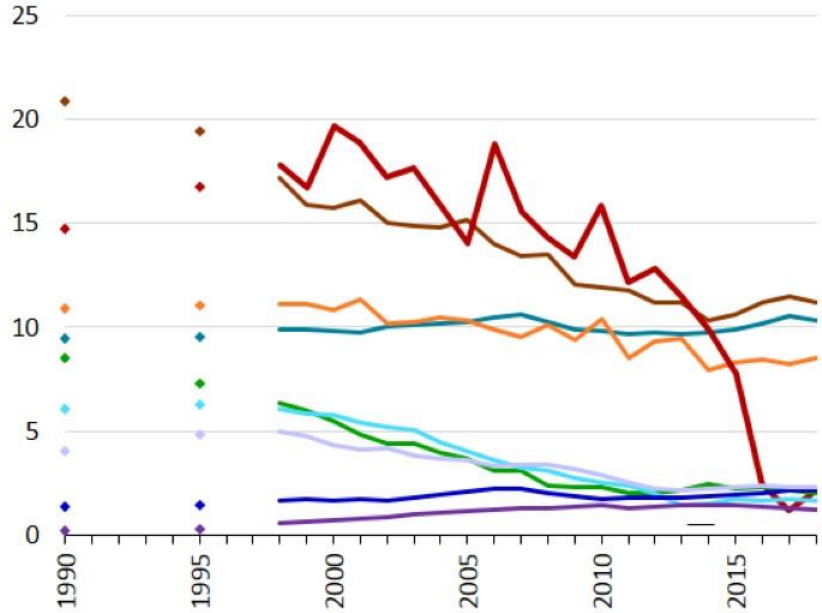
Implications of Net Zero



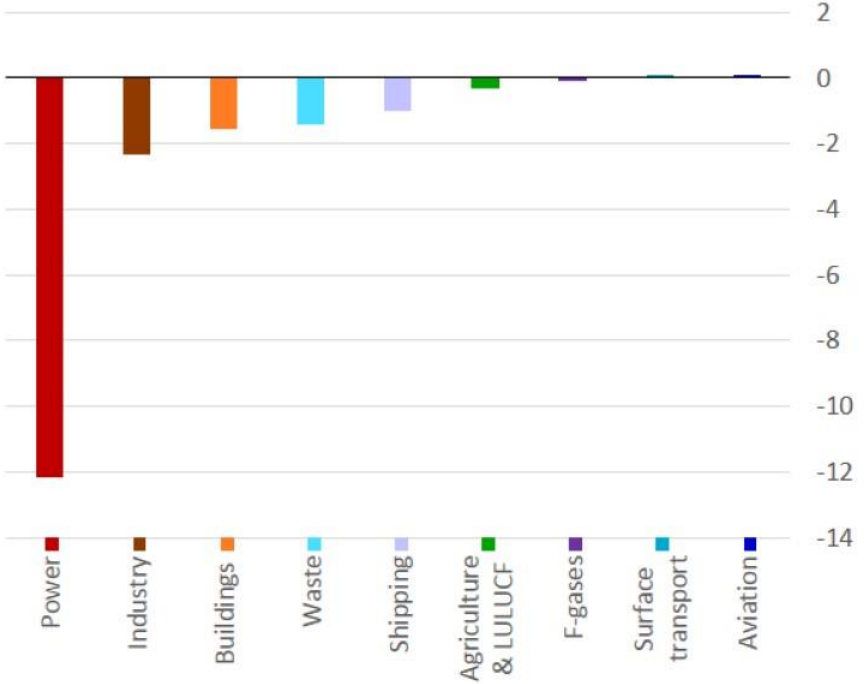
Source: CCC analysis

Scotland – a decade of (unbalanced) progress

Scotland emissions (MtCO2e)

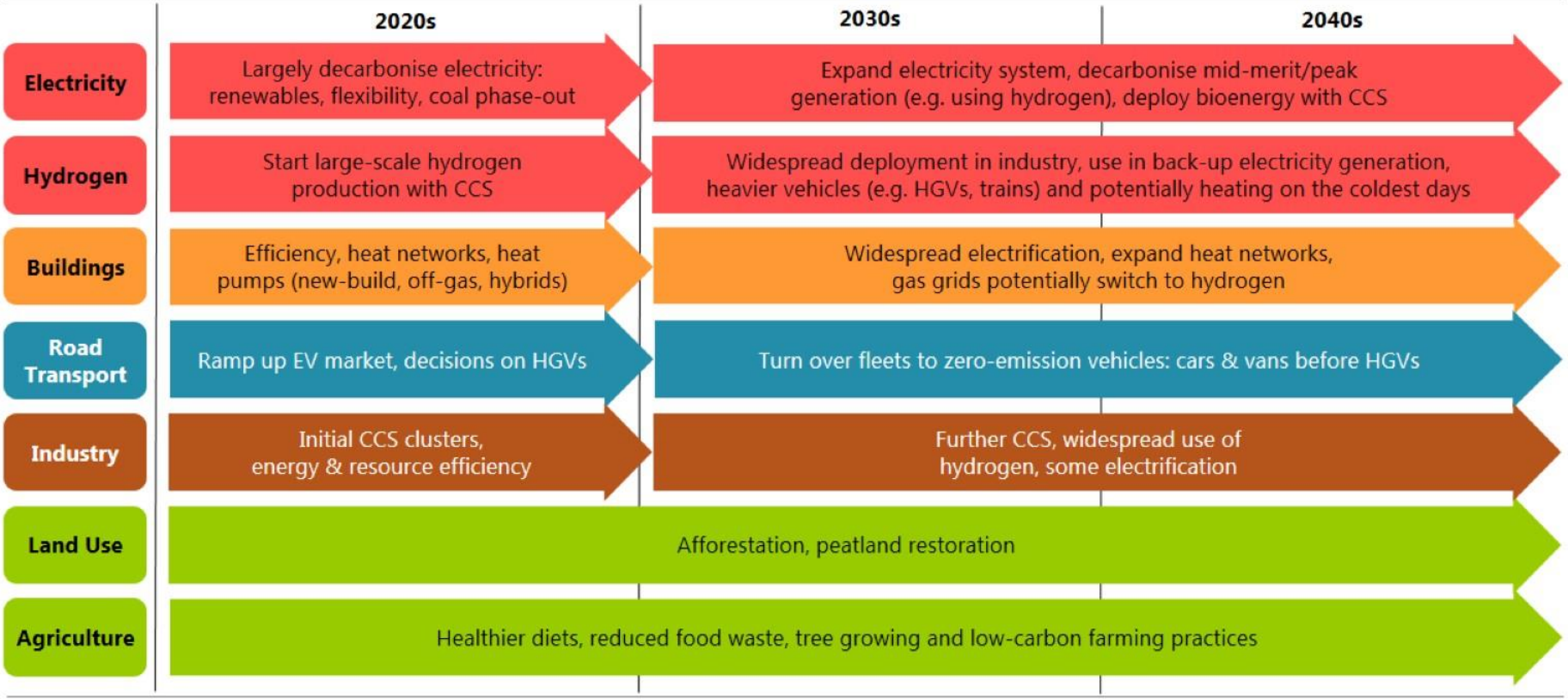


Change in emissions 2008-2018 ($MtCO_2e$)



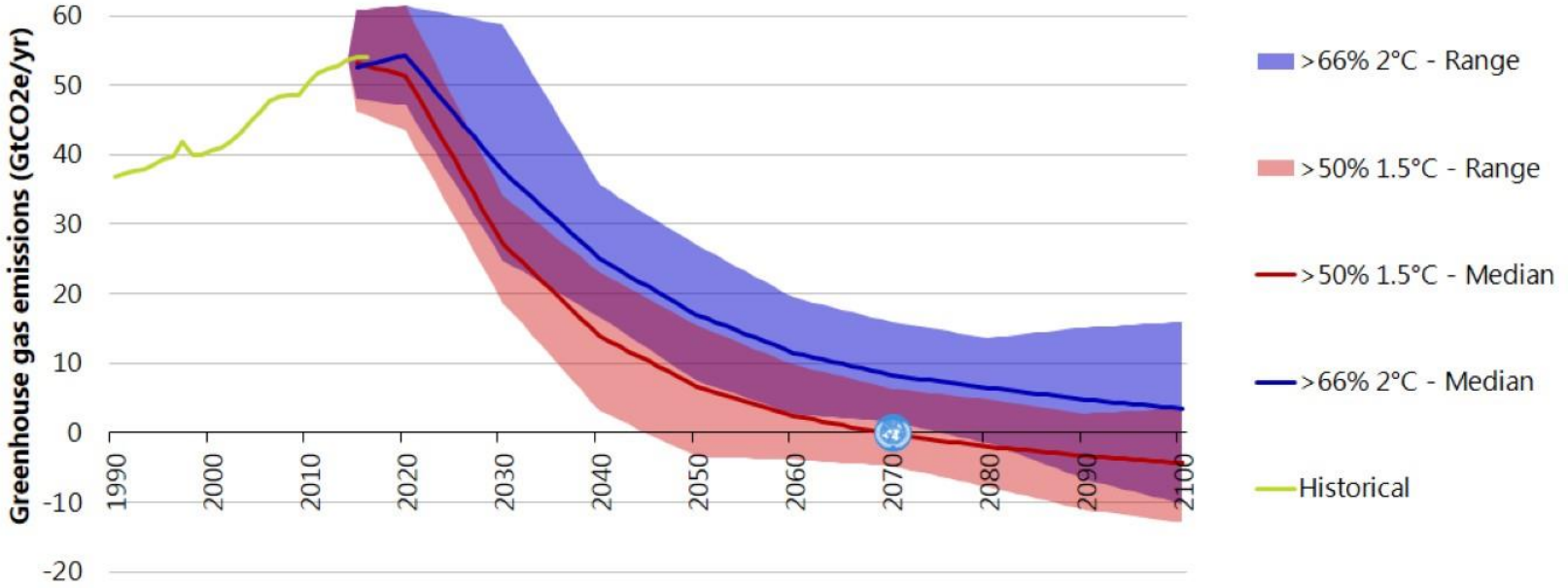
Committee on Climate Change

Delivering Net-Zero



COP26 – the Glasgow challenge

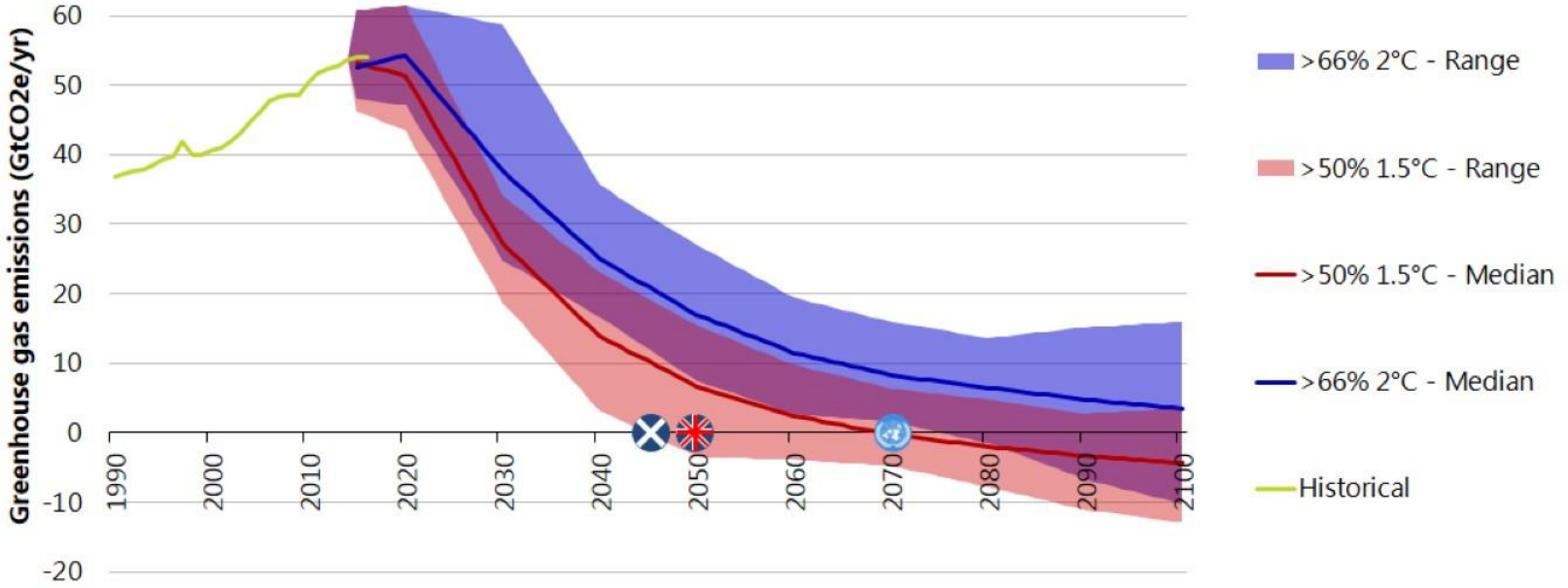
Global emissions pathways to deliver Paris Agreement



Source: Huppmann, D. et al. (2018) A new scenario resource for integrated 1.5°C research.

COP26 – the Glasgow challenge

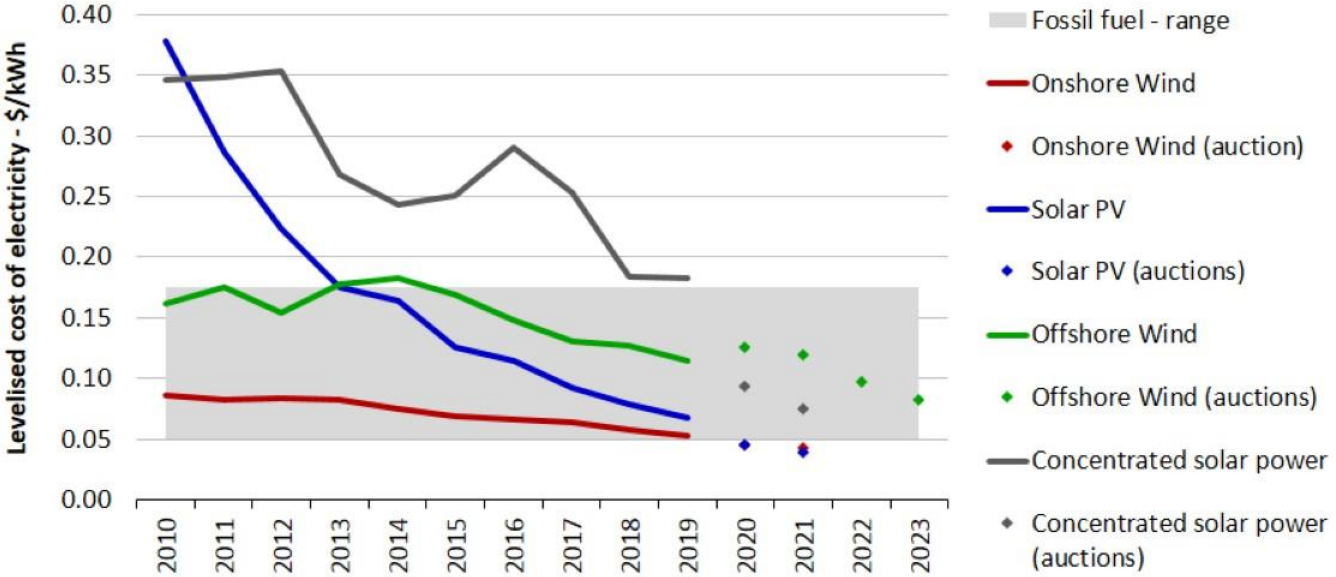
Global emissions pathways to deliver Paris Agreement



Source: Huppmann, D. et al. (2018) A new scenario resource for integrated 1.5°C research.

A global turning point – Glasgow 2021

Renewable power generation costs in 2019



Source: : IRENA (2020) Renewable Power Generation Costs in 2019

Jonathan Brearley
Chief Executive
Ofgem

Tweet @ScotRenew
#SRAC20

ofgem Making a positive difference for energy consumers

Scottish Renewables Annual Conference

Jonathan Brearley

The challenge

- Scotland’s net zero emissions target
- Trade-offs
- Synergies

For Ofgem, two challenges:

- Protecting today’s consumers
- Protecting consumers in the future

Pandemic

- Quickly adapted as a regulator
- Consumers protected
- Apply the lessons from pandemic to green recovery

Green recovery

- Huge opportunity
- Need to bring consumers with us
- Need to build trust

➢ Greener and fairer

Innovation

Essential for reaching Net Zero

Consumers

- People care about climate change
- Finances are important too
- ➢ Expectation to deliver value for money and avoid waste

Customers pay a fair price for vital infrastructure while it remains an attractive prospect for investors.

Any questions

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All change: energy in the new political era

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Director of Communications & Strategy

Scottish Renewables

Lord Ian Duncan

Former Parliamentary Under Secretary of State for Climate Change
UK Government

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Phil Henderson

Head of Government Affairs

ScottishPower

Alexandra Malone

Head of Corporate Affairs

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Cabinet Secretary Address

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Chief Executive

Scottish Renewables

Kate Forbes MSP

Cabinet Secretary for Finance

Scottish Government

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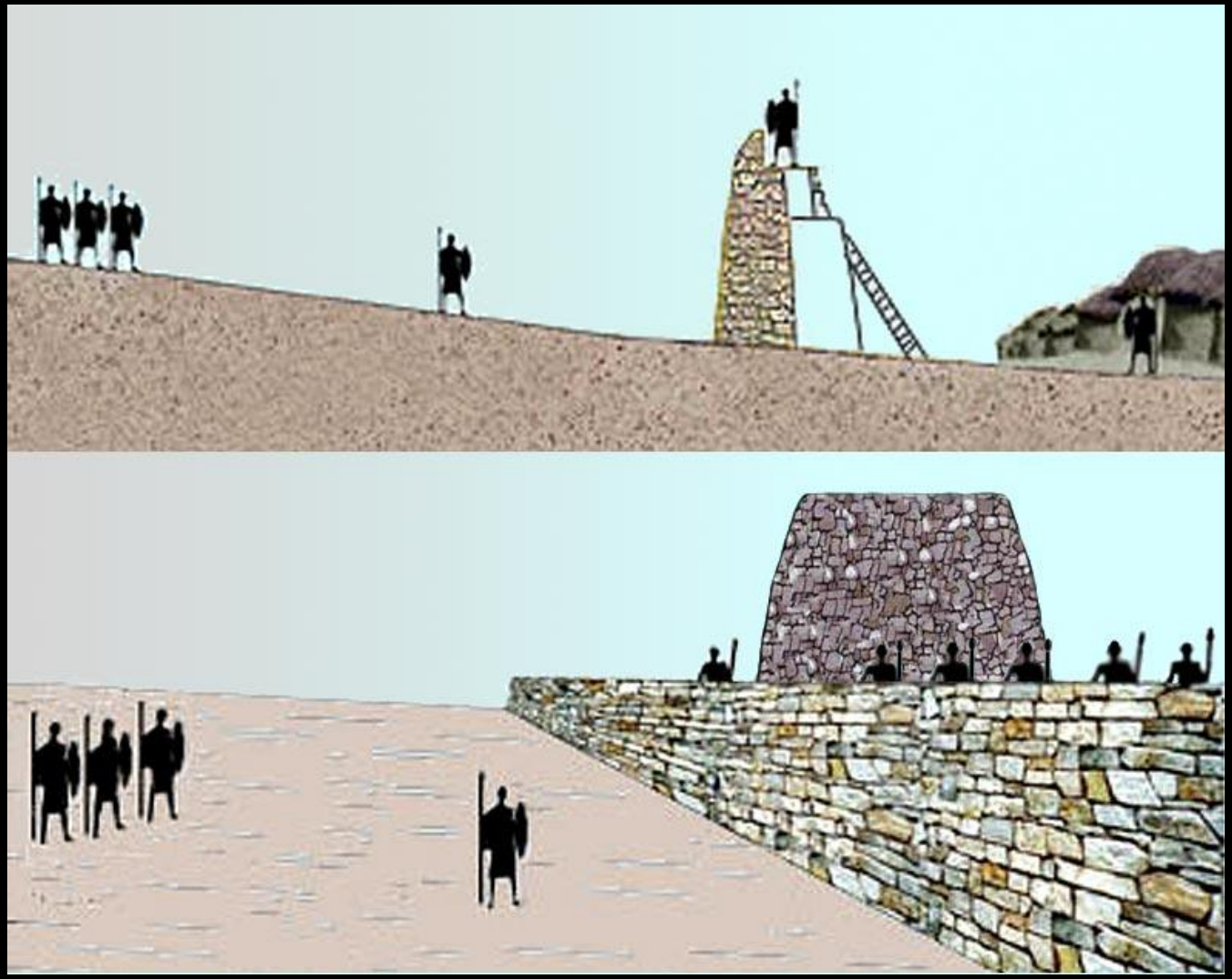
Renewables changing the world

@itwitius
Tim Marshall
@ScotRenew #SRAC20



Medieval fortress overlooking Ohrid, Republic of Macedonia

Derawar Fort, Punjab, Pakistan, 9th century AD

The "Walled City" of old Manila, Philippines late 16th Century

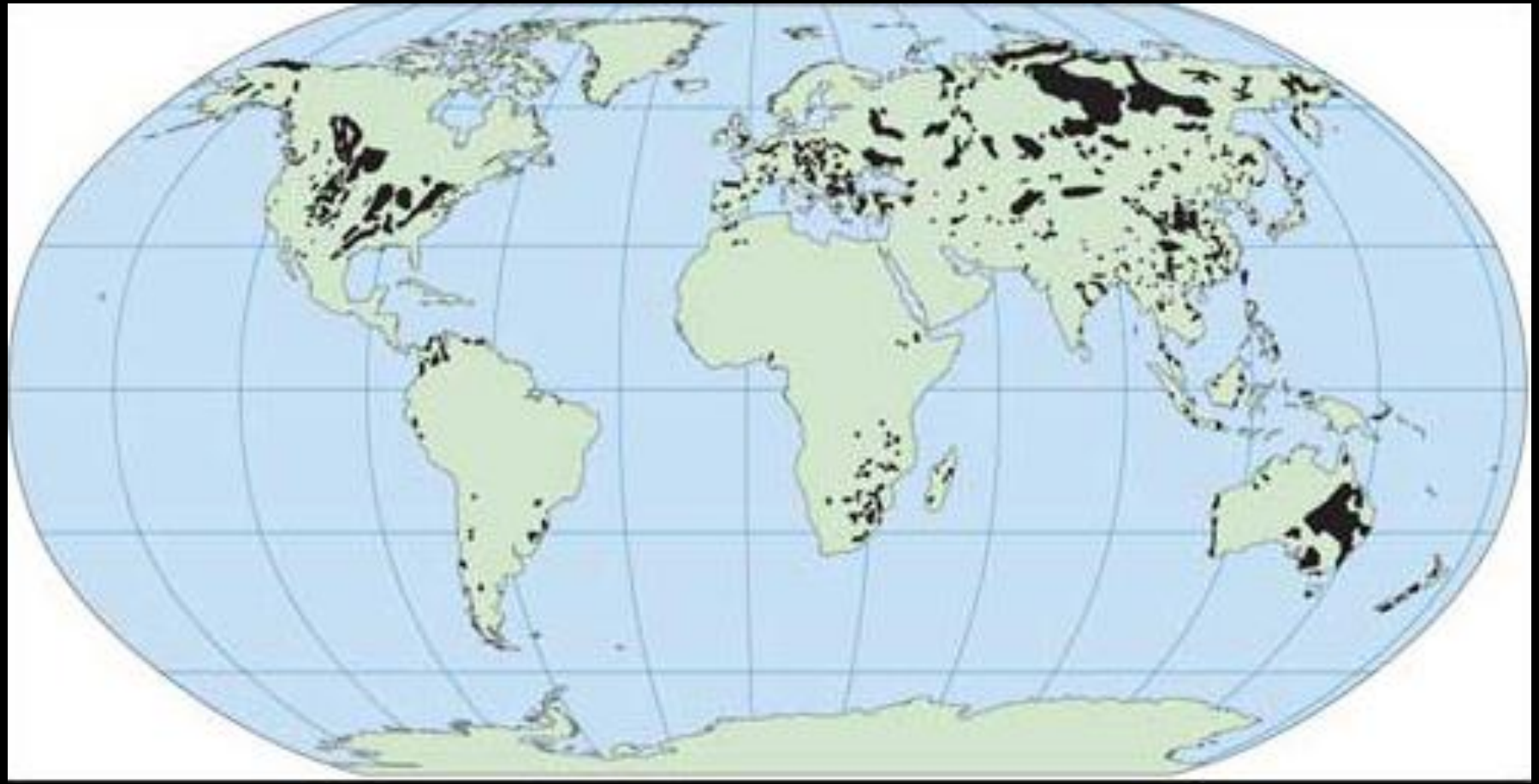
Walls of Constantinople, Istanbul, Turkey, built 5th/6th centuries AD

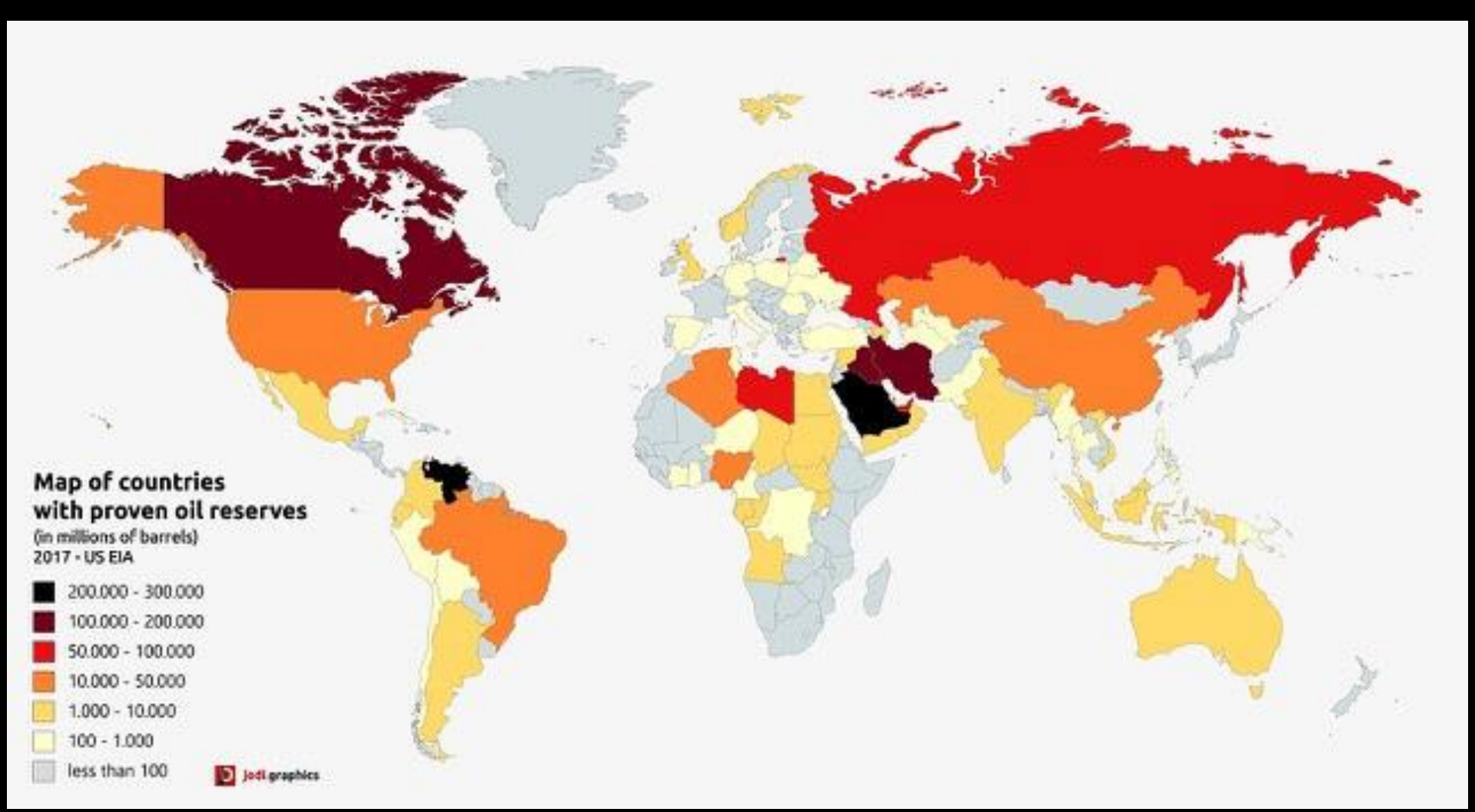
Turkish - Syria Border

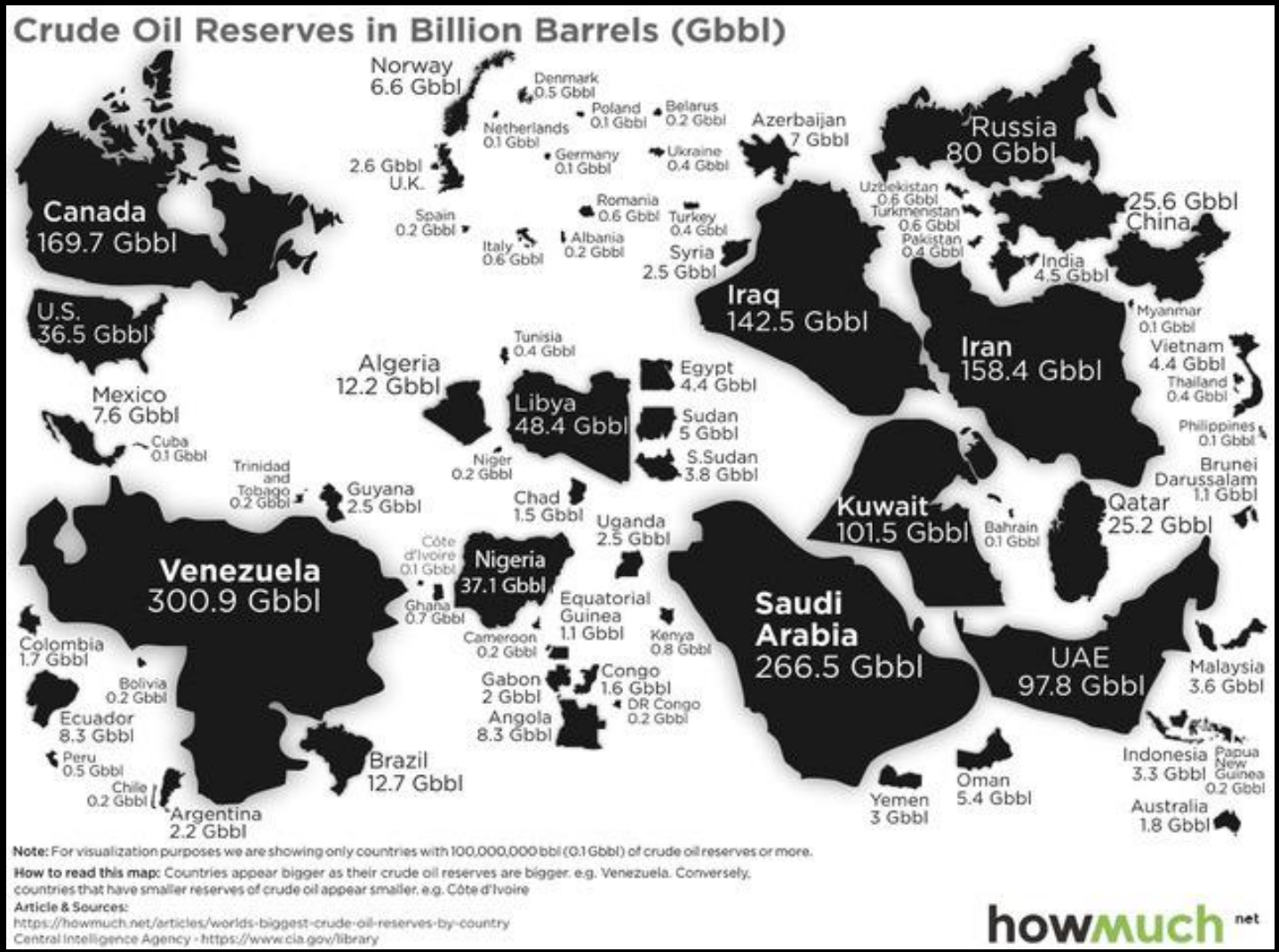

© Associated Press Photo


So he says...

Coal Deposits in the 19th Century




Map of countries
with proven oil reserves
(in millions of barrels)
2017 - US EIA
200.000 - 300.000
100.000 - 200.000
50.000 - 100.000
10.000 - 50.000
1.000 - 10.000
100 - 1.000
less than 100
Jodi graphics



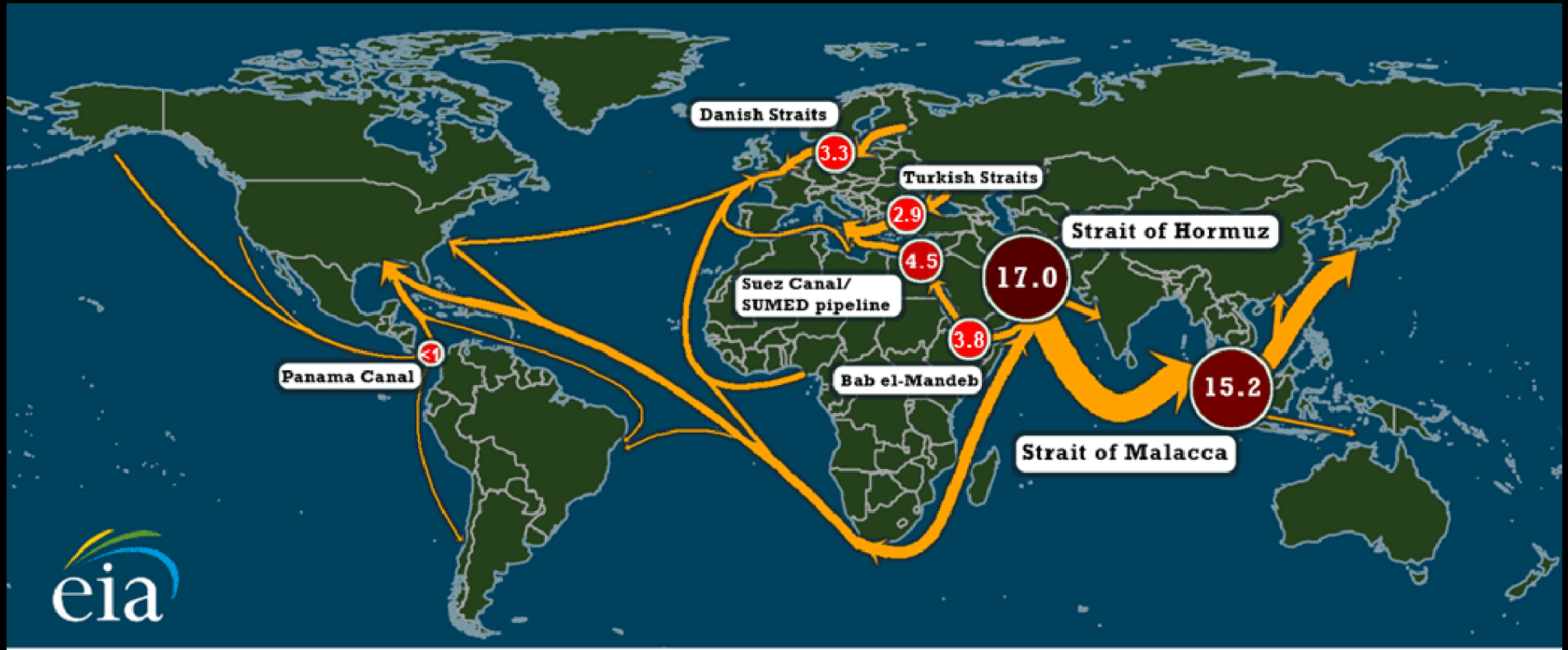
Note: For visualization purposes we are showing only countries with 100,000,000 bbl (0.1 Gbbl) of crude oil reserves or more.

How to read this map: Countries appear bigger as their crude oil reserves are bigger. e.g. Venezuela. Conversely, countries that have smaller reserves of crude oil appear smaller. e.g. Côte d'Ivoire

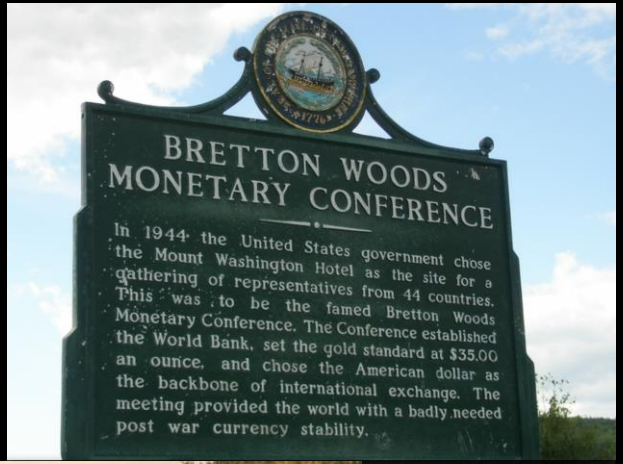
Article & Sources:
https://howmuch.net/articles/worlds-biggest-crude-oil-reserves-by-country
Central Intelligence Agency - https://www.cia.gov/library

howmuch.net

Choke Points



All estimates in million barrels per day. Includes crude oil and petroleum products. Based on 2013 data.


BRETTON WOODS
MONETARY CONFERENCE
In 1944 the United States government chose the Mount Washington Hotel as the site for a gathering of representatives from 44 countries. This was to be the famed Bretton Woods Monetary Conference. The Conference established the World Bank, set the gold standard at $35.00 an ounce, and chose the American dollar as the backbone of international exchange. The meeting provided the world with a badly needed post war currency stability.


WORLD BANK


INTERNATIONAL
MONETARY FUND

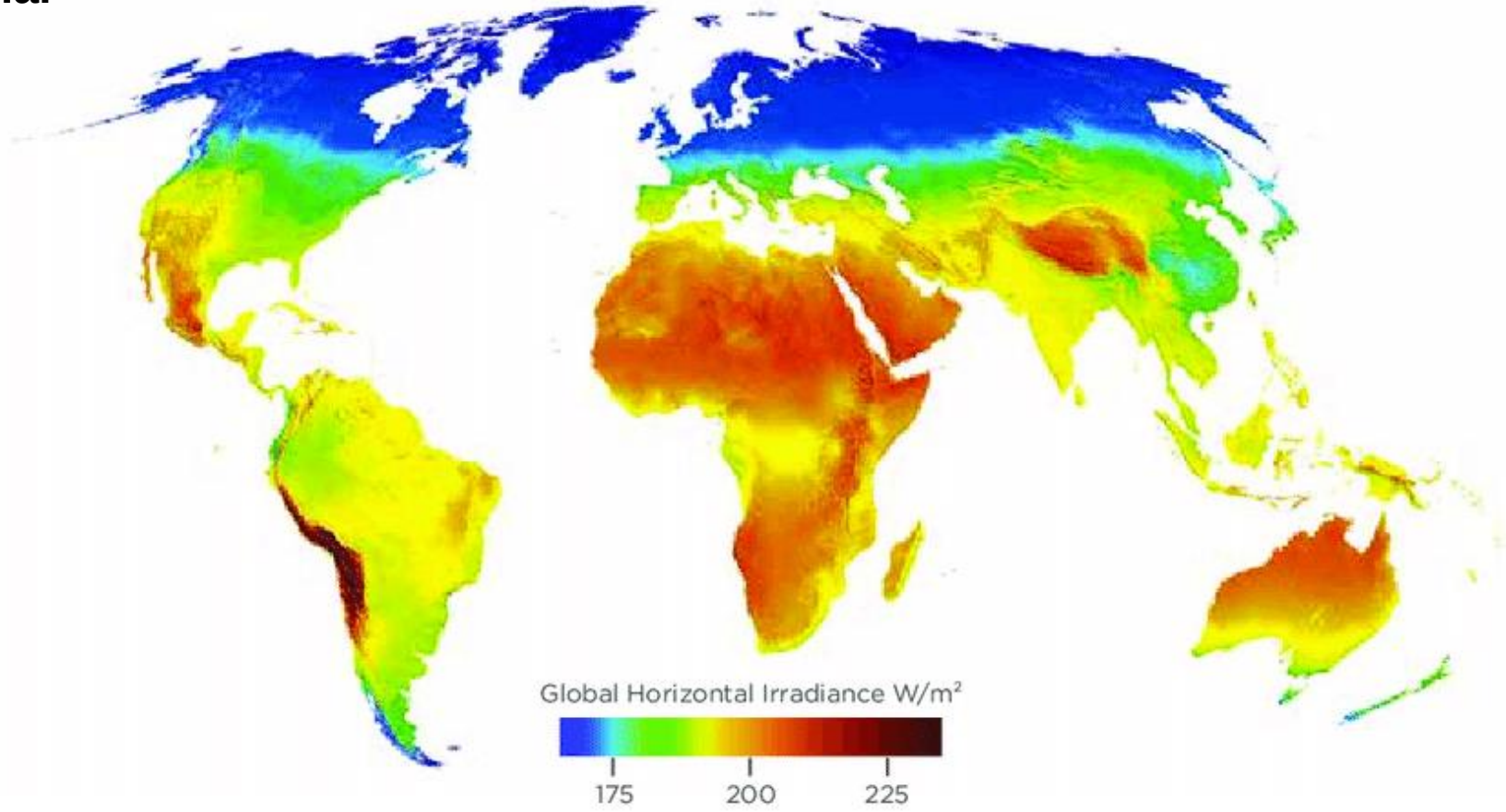
1945-1989 - A Bipolar World

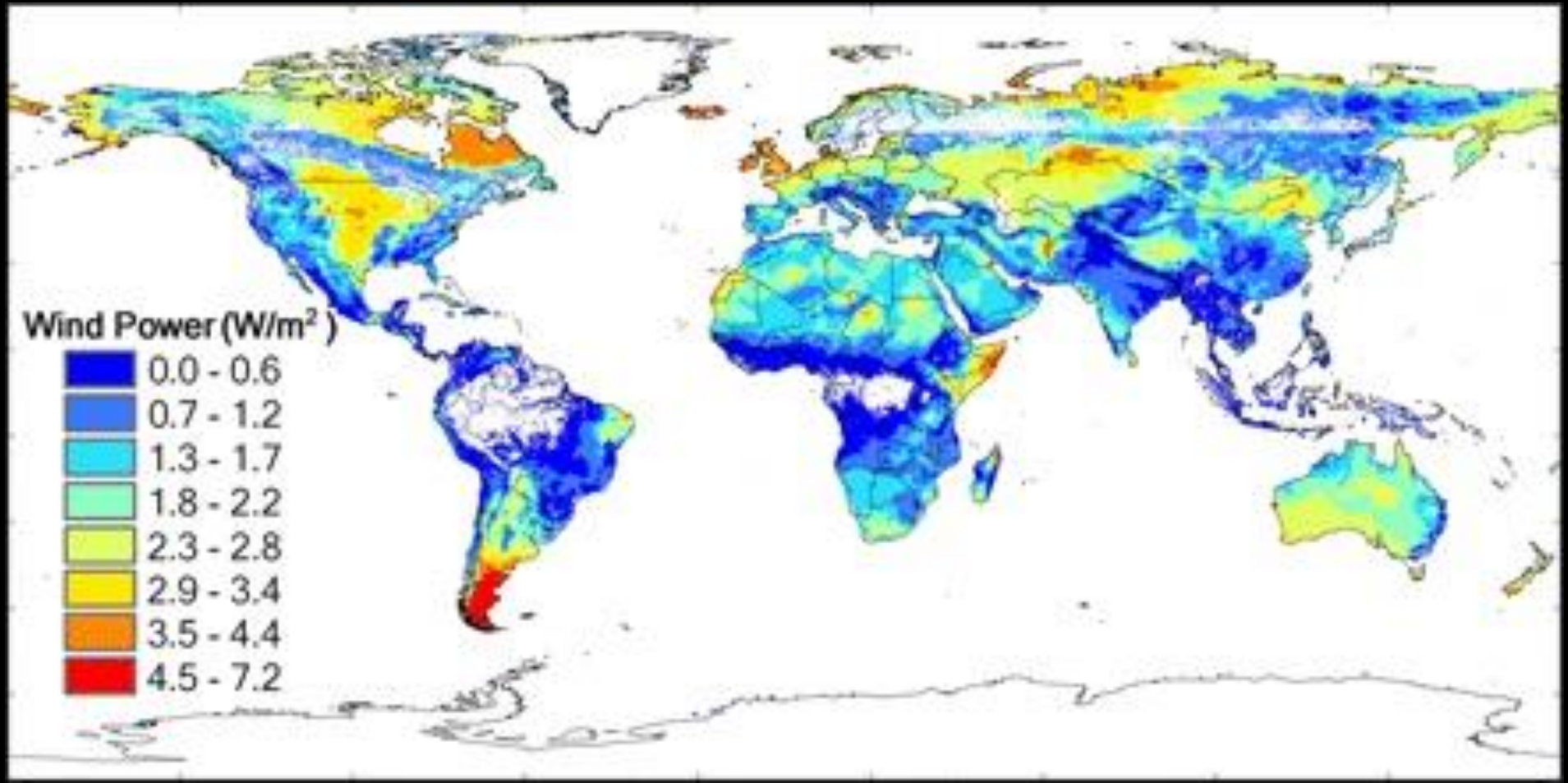
1989 - 2008 - A Unipolar World

2008 - present - A Multipolar World

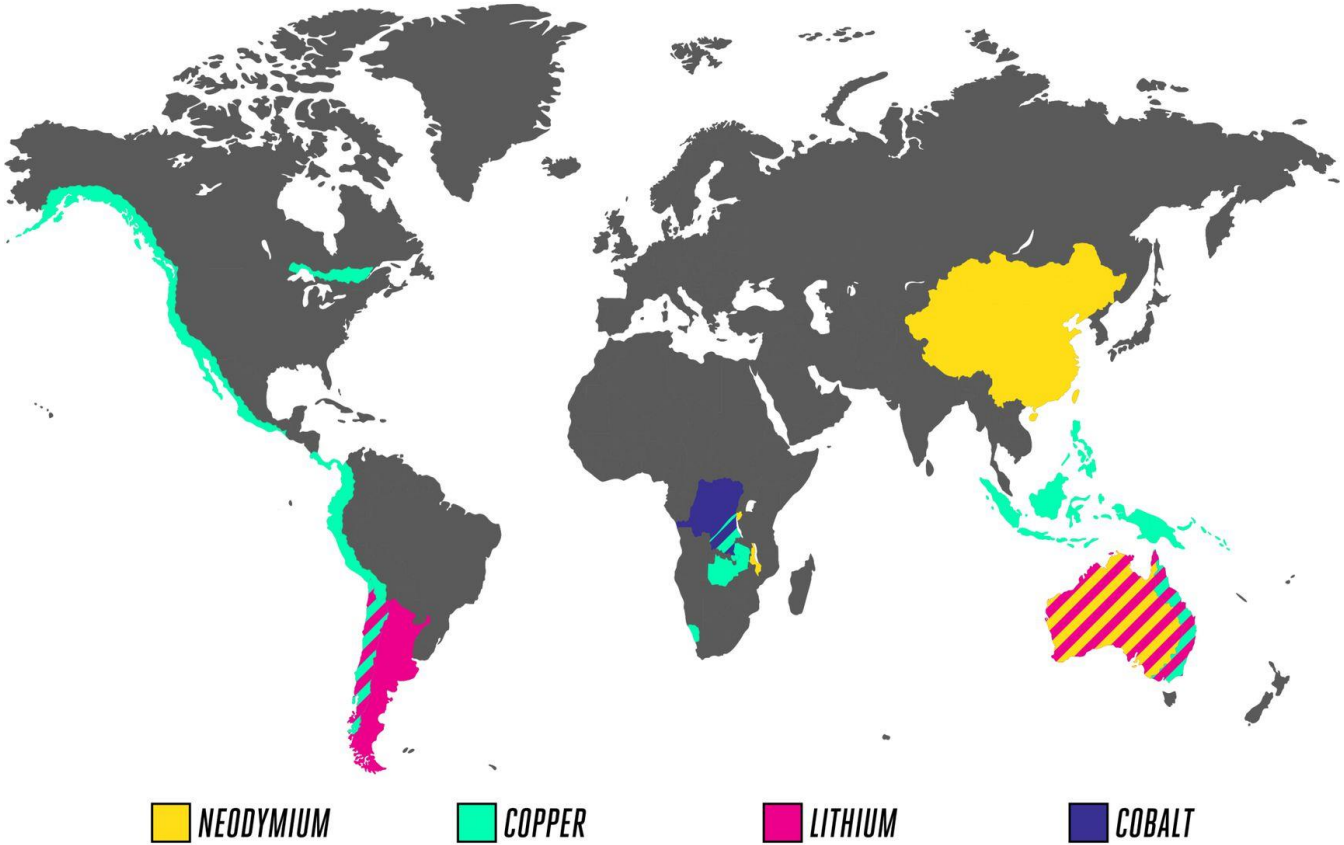
SUBSCRIBE

Solar

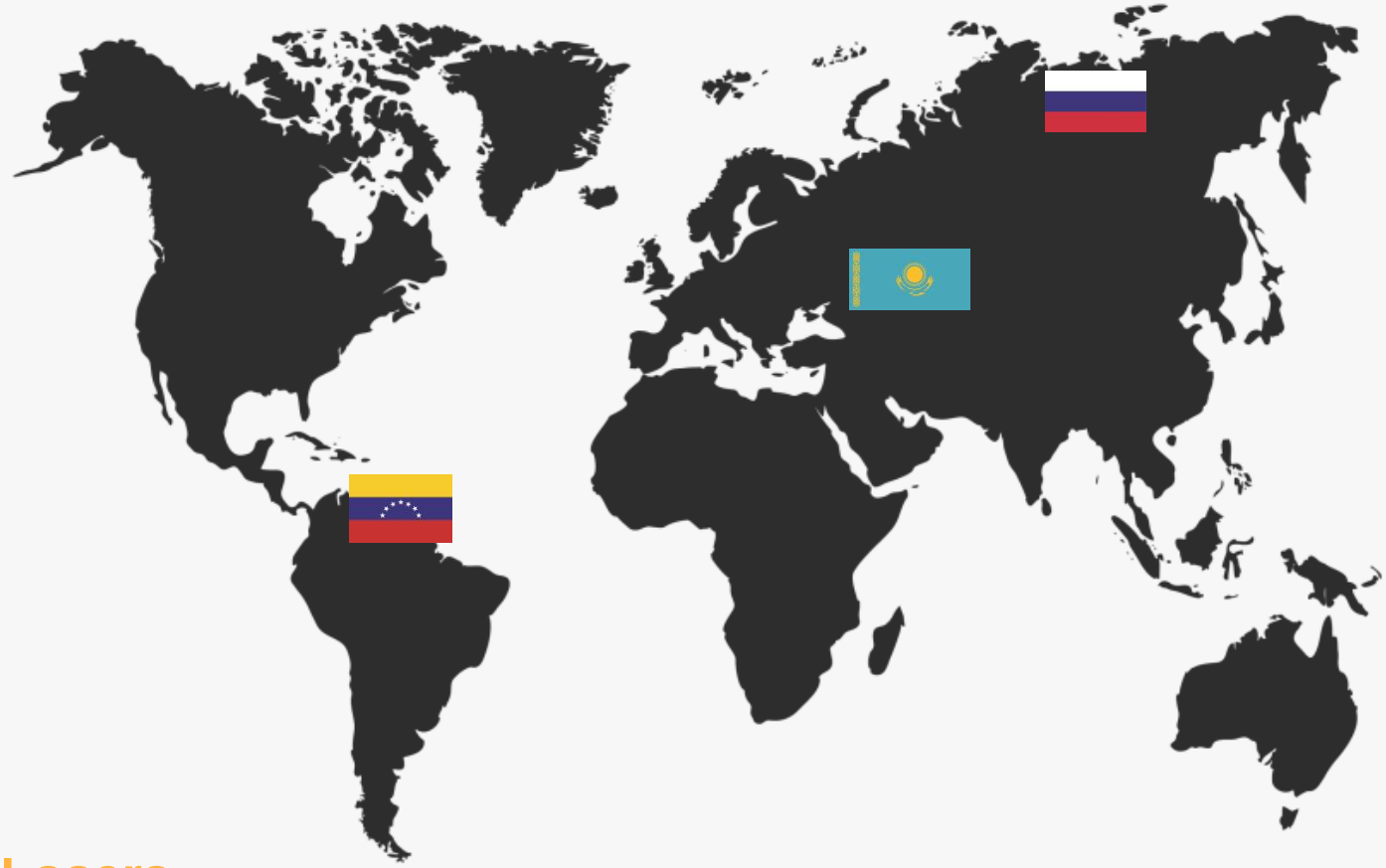



Wind Power (W/m²)
0.0 - 0.6
0.7 - 1.2
1.3 - 1.7
1.8 - 2.2
2.3 - 2.8
2.9 - 3.4
3.5 - 4.4
4.5 - 7.2

Major renewables - Cobalt, Lithium etc



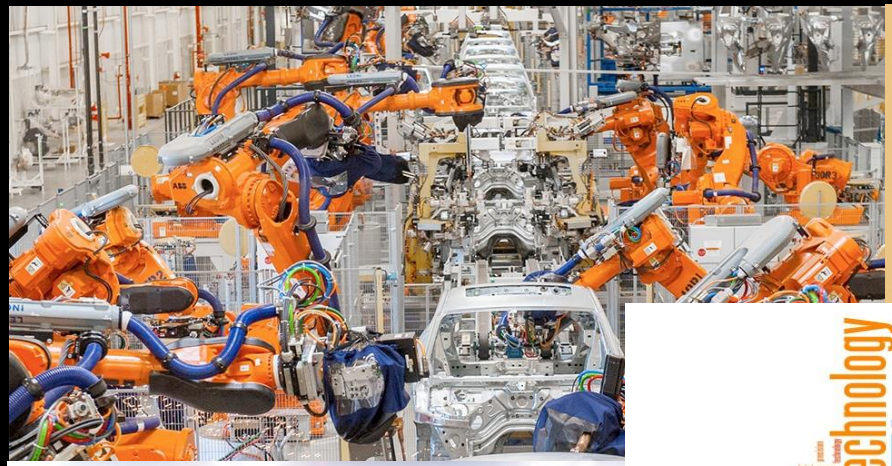
Winners

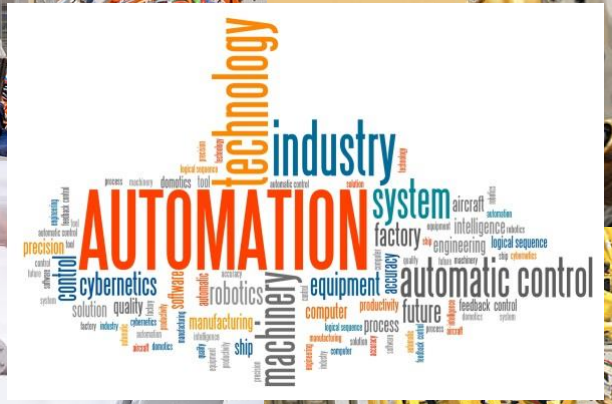


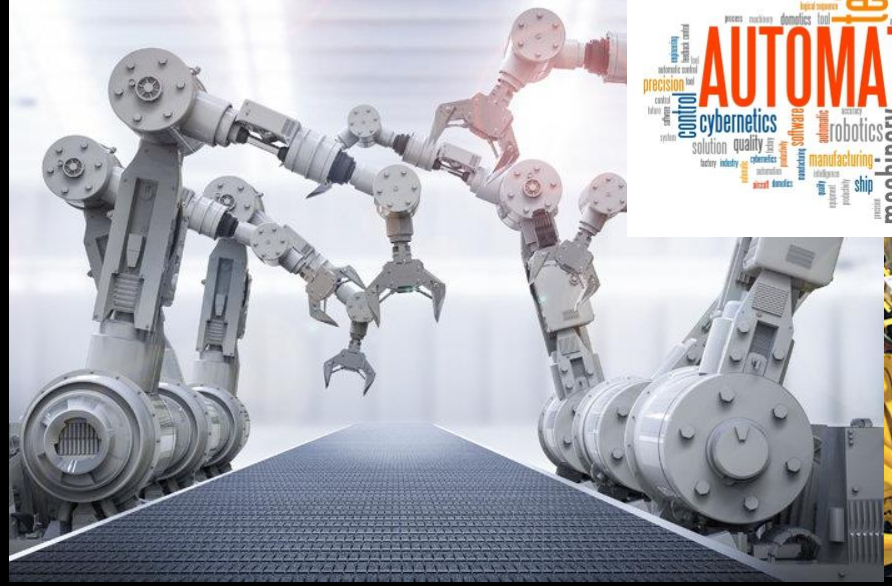
Losers


رؤية VISION 2030
المملكة العربية السعودية
KINGDOM OF SAUDI ARABIA

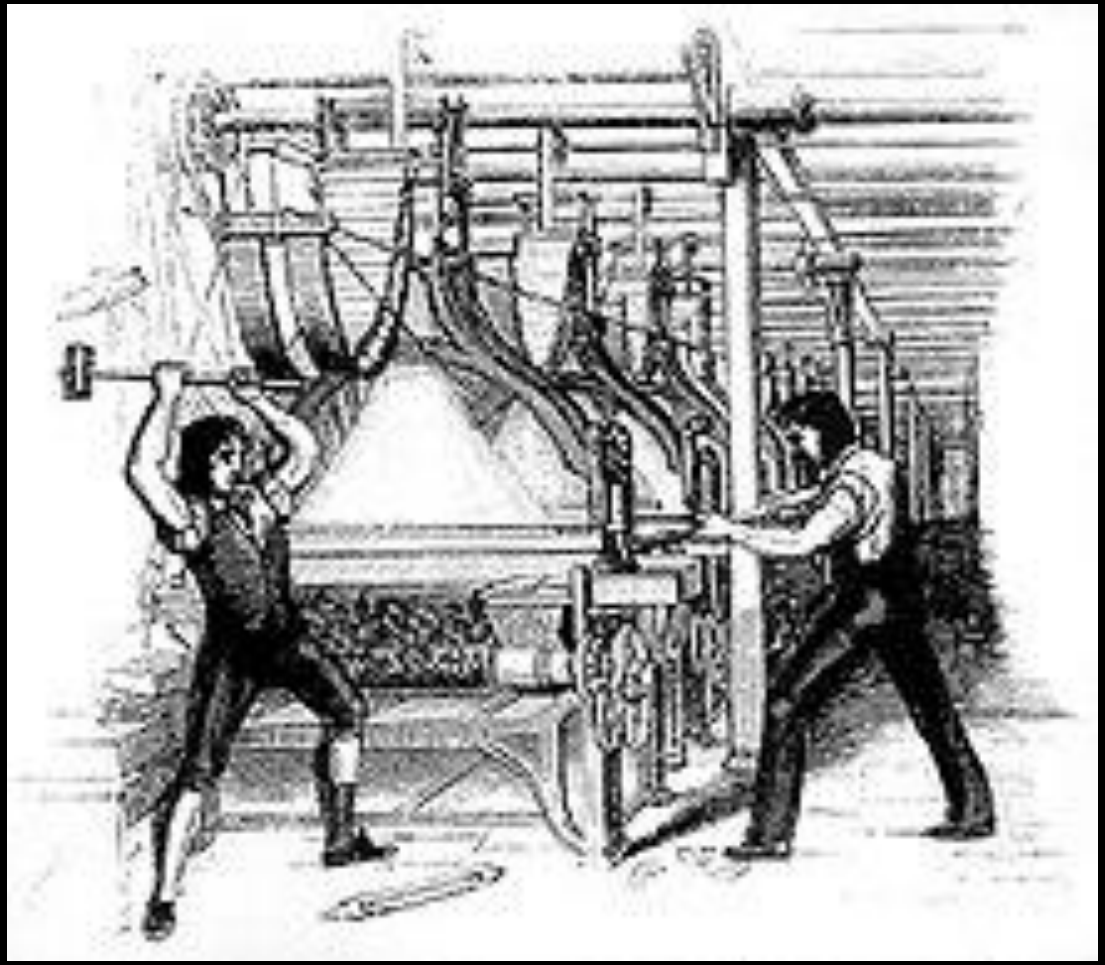

Enter
stephens.

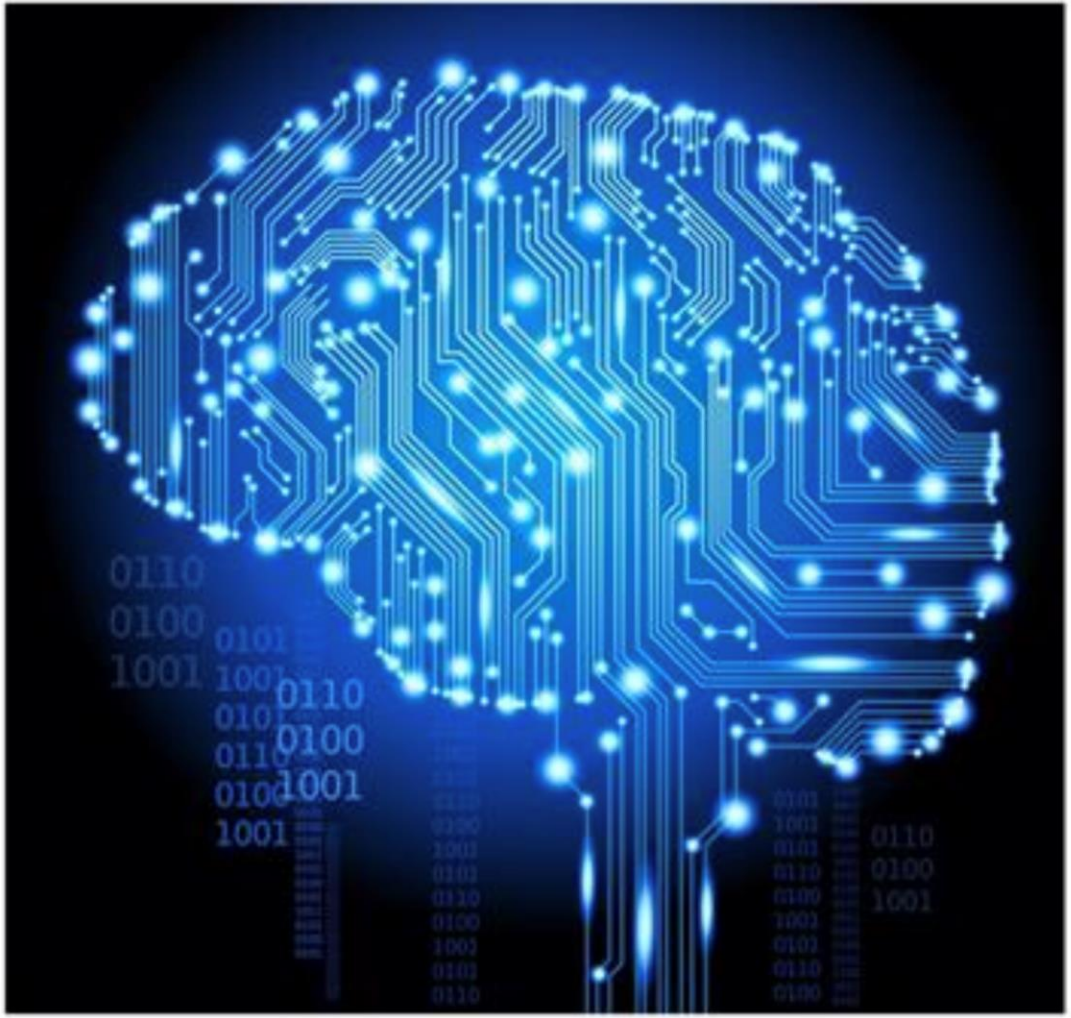



technology
industry
AUTOMATION
system
aircraft
factory
intelligence
engineering
logical sequence
precision
control
cybernetics
software
automatic
robotics
equipment
accuracy
automatic control
solution
quality
computer
productivity
future
feedback control
manufacturing
process
machinery
ship



Luddites

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THE END IS NEAR
gickr.com

@itwitius
Tim Marshall
@ScotRenew #SRAC20

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Industry Update with Crown Estate Scotland

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Chief Executive

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John Robertson

Head of Energy and Infrastructure

Crown Estate Scotland

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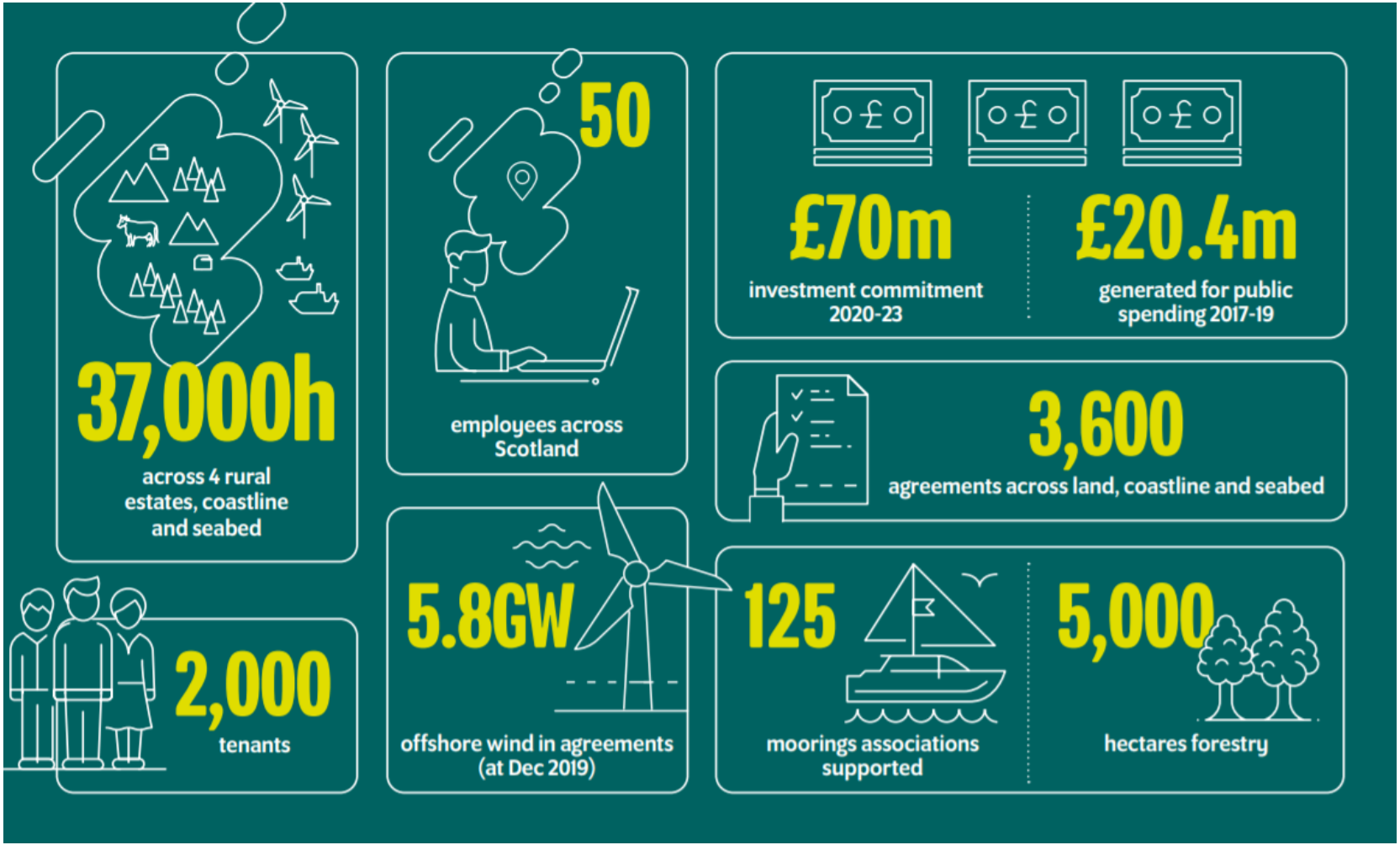
37,000h
across 4 rural estates, coastline and seabed
50
employees across Scotland
£70m
investment commitment 2020-23
£20.4m
generated for public spending 2017-19
3,600
agreements across land, coastline and seabed
2,000
tenants
5.8GW
offshore wind in agreements (at Dec 2019)
125
moorings associations supported
5,000
hectares forestry

Energy & Infrastructure

- Manage leasing for offshore renewable energy, cables and pipelines, and subsea gas storage
- Leasing processes designed to support project delivery - commercial-scale development or a test & demonstration project
- Funding and supporting strategic research to help sector development

Colin Maciver

Development Manager

Crown Estate Scotland

Tweet @ScotRenew

#SRAC20

ScotWind Leasing

- Offer successful applicants the chance to build Scotland's new generation of offshore wind farms
- Help us get to net zero by tapping into the potential of Scotland's marine resource
- Enough power every home in Scotland with clean, green electricity
- 6 million tonnes of CO2 removed

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Scottish context: Leasing and planning

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Crown Estate Scotland are the seabed manager

- Crown Estate Scotland grants a lease of the seabed only when the consents and other required permissions are in place

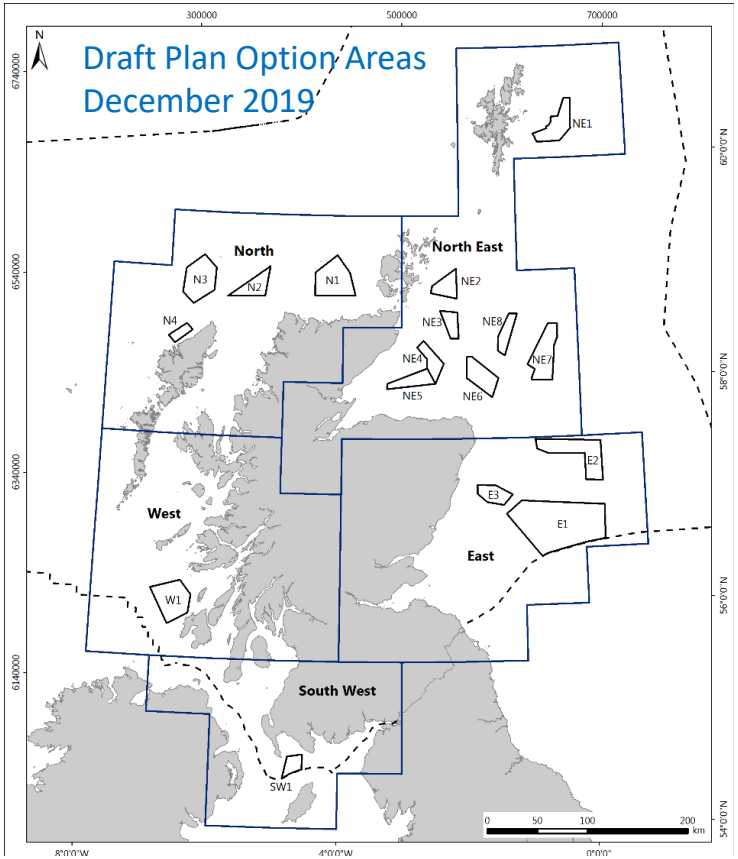
marinescotland

Marine Scotland are the regulator and responsible for strategic marine planning

- Marine Scotland grants consents for projects

Marine Scotland: Sectoral Marine Plan

- Defines the areas available for ScotWind Leasing
- Consultation on the Draft Plan closed in March 2020
- Launch documents are based on information in the draft plan
- Adopted plan expected Autumn 2020
- Final Leasing requirements will align with the adopted plan



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Award of Agreements

- Option Agreements will be awarded to the highest ranking applications:
  - within the limits set by the SMP for each Plan Option Area; and
  - in aggregate no more than 8,600 km^2 of seabed.
- Overall ranking determined by the four scoring inputs successively:
  - Coarse grading (Band 1, Band 2, Band 3).
  - Applicant Valuation (£2,000/km^2, £6,000/km^2, £10,000km^2).
  - Detailed numerical score (between 0 and 450).
  - Randomly allocated number (assigned at registration, used only in case of tie-breaker).

Timelines

Activity	Date or Duration
ScotWind Launched	10 June 2020 ✅
Engagement Event	7 July 2020 ✅
Registration Window for Applicants Closes	5 August 2020 ✅
Publication of Post-adoption Addendum to ScotWind Leasing	Soon after SMP is adopted by Scottish Ministers
Application Window Opens	Following Post-adoption Addendum publication
Deadline for applications to ScotWind	Late 2020 / early 2021

SCDS Objectives and Rationale

- The SCDS seeks to help maximise the opportunity from projects arising from ScotWind Leasing
- The long-term sustainability of offshore wind development in Scotland is linked to the capability and capacity of the supply chain.
- Volume and deployment rate of project pipeline are critical factors to supply chain development.
- Complete SCDS submissions will not be used in the assessment or detailed scoring of applications but will be available to government and agencies, and the public.
- It will be incorporated into Option Agreements and obligations will be ongoing during the option period.

Mark McKean

Development Manager

Crown Estate Scotland

Tweet @ScotRenew

#SRAC20

Our role

- Supporters and funders of strategic research
- Work in partnership to develop existing and emerging technologies that offer significant potential value to Scotland
- Recent key studies – floating wind, energy systems, ports for offshore wind

ENABLER

Empowering others by supporting local plans and projects, providing access to property and helping address barriers to sector growth.

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Macroeconomic benefits of floating offshore wind in the UK

The Scope of this work -

- Commissioned Offshore Renewable Energy Catapult to set out the potential macroeconomic early stages of UK floating wind deployment consequences of public policy support for FOSW;
- Different types and costs of government support that may be needed were investigated

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Macroeconomic benefits of floating offshore wind in the UK

- Represents a valuable economic opportunity for the UK
- Both public and private investment is required
- Estimated up to 17,000 jobs and £33.6bn of GVA could be generated by 2050

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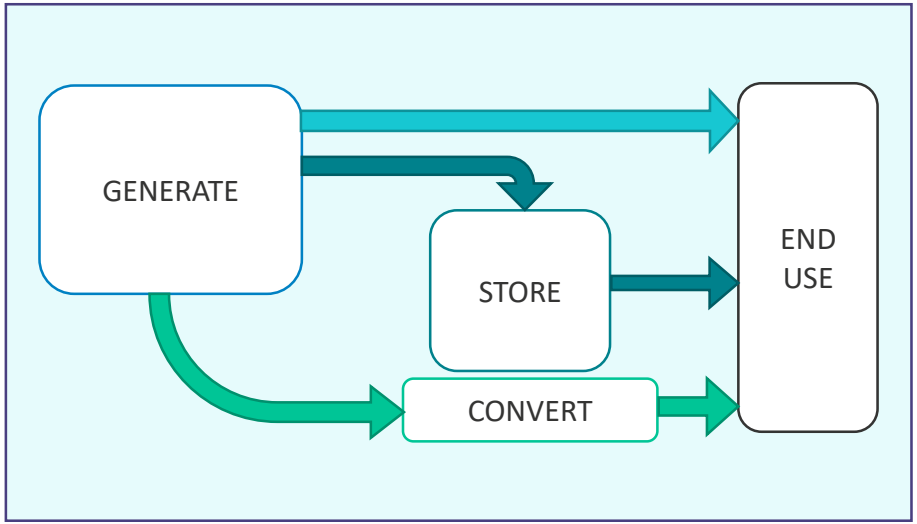
Energy systems work

- Commitment to a programme of energy systems work
- Exploring how energy systems might benefit and impact communities



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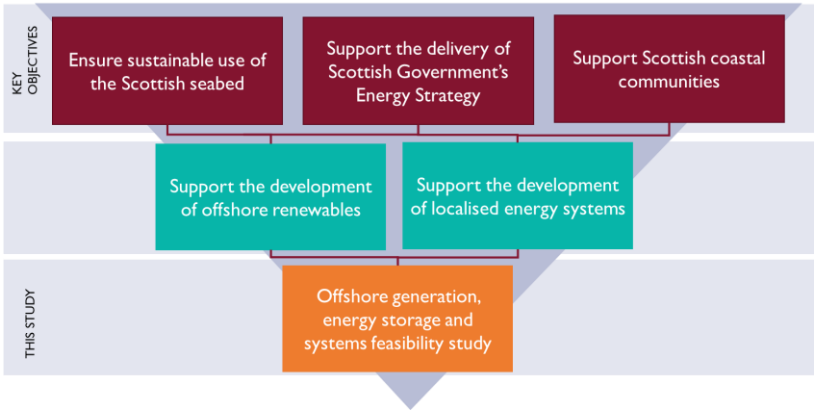
Offshore Generation, Energy Systems & Storage Feasibility

WHY IS CROWN ESTATE SCOTLAND INTERESTED IN A STUDY ON ENERGY SYSTEMS FOR OFFSHORE RENEWABLES?

This study draws together two delivery paths which could potentially deliver on three of Crown Estate Scotland's core aims:



AIM OF THIS STUDY

The aim of this study is to deliver an initial high-level investigation as to how integration of offshore renewables into a localised energy system can support the pathway to commercial viability of offshore renewable projects, whilst benefiting coastal communities through improved local energy solutions.

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Six Scenarios

1. FRAMING

Situation

Options

Selection

2. ASSESSMENT

Techno-economic modelling

Case studies

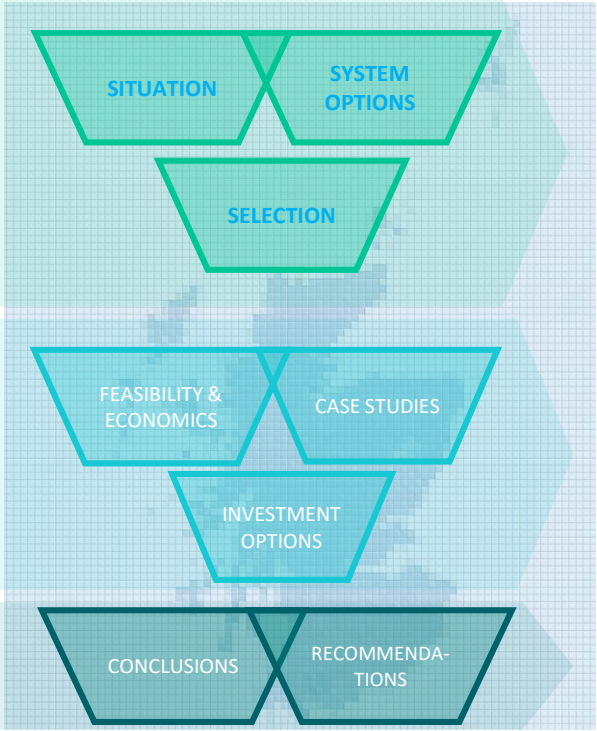
Regulatory issues

Investment options

Barriers & opportunities

3. RECOMMENDATIONS

Defining specific actions



SCENARIO 1a: SMALL WAVE CONNECTING TO REMOTE ISLAND WITH PRIVATE NETWORK

SCENARIO 1b: WAVE TO AQUACULTURE

SCENARIO 2: TIDAL CONNECTING INTO LARGE ISLAND WITH SIGNIFICANT INDUSTRIAL USERS

SCENARIO 3:TIDAL CONNECTING TO REMOTE MAINLAND PORT WITH MARITIME HYDROGEN SYSTEM

SCENARIO 4: TIDAL ARRAY WITH BATTERY STORAGE PROVIDING AN ALTERNATIVE GRID UPGRADE

SCENARIO 5: LARGE SCALE FLOATING WIND WITH OFFSHORE ELECTROLYSIS AND USE OF GAS PIPELINES

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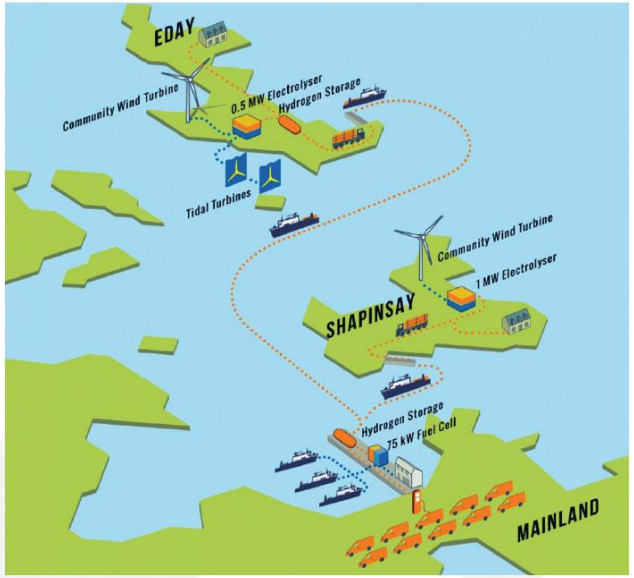
Energy systems Value Case Study

- This study investigated the wider value that adoption of a local energy system can bring to the community where both an offshore and onshore generation component is feeding in to an island based energy system;
- Case study investigated is Orkney's 'Surf & Turf' project (www.surfnturf.org.uk/);



Community Energy Scotland – Project lead, owner of 3 x 25kW fuel cells

Eday Development Trust – Owner of Enercon 900kW wind turbine, via subsidiary Eday Renewable Energy Ltd

European Marine Energy Centre (EMEC) – Site of tidal turbine, owner / operator of 500kW PEM elecrolyser

ITM Power – Supplier of 500kW PEM electrolyser, lead on SnT system's technical design and integration

Orbital – Owner and developer of the SR1-2000 2MW tidal turbine

Orkney Island Council – Purchase the electricity from the fuel cell

Scottish Government's Local Energy Challenge Fund – Provided £1.46 million in development funding

Crown Estate Scotland
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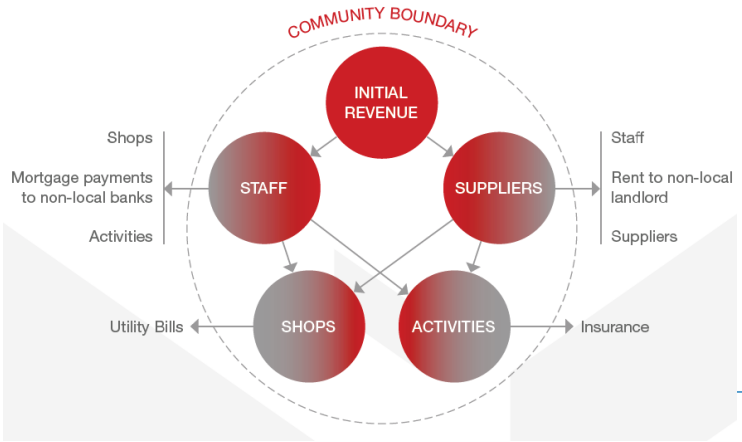
Energy systems Value Case Study

Energy Systems Value Case Study

- Study considered wider value to a community - the indirect and social benefit to the communities and wider benefits for other impacted parties;
- Modelling work (LM3 approach) and wellbeing analysis (stakeholder interviews) carried out;
- A number of insights provided by this work:



An illustration of monetary flows within and out of a community

- Some insights provided by this work:

1. Projects within island communities increase the likelihood of money remaining locally;
2. To achieve high LM3 score, projects should work to minimise economic leakage from local economy;
3. S&T project contributes to the vision and purpose of the local communities as a partner (island of Eday);
4. S&T Project has been a stimulus for training and development of local workforce; and
5. Replicability of this project's benefits needs to consider aspects such as constrained grid connections and the role of more mature onshore wind generation.

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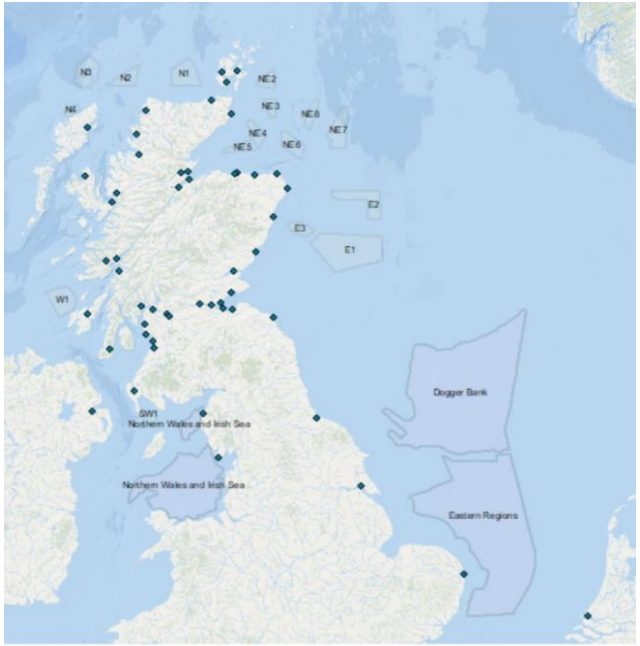
Ports for offshore wind: A review of the net-zero opportunity for ports in Scotland

- Launched today!
- Study a roadmap to ensure ports and offshore wind sectors collaborate and maximise potential
- Recommendations for how we can maximise the future potential of Scottish ports to host the major offshore wind projects set to come to Scotland



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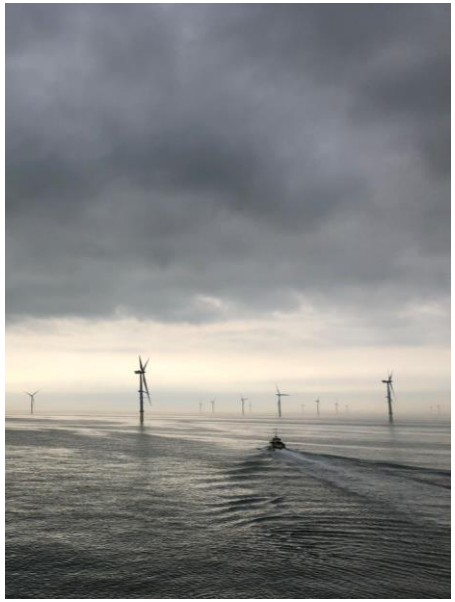
Purpose of the report



- Summary of the assessment of the capability of the ports sector to support the offshore wind industry to 2040, at a strategic Scotland-wide level;
- Identification of challenges and opportunities for port infrastructure provision in Scotland, to contribute to the decision-making processes of parties across the industry;
- Recommendations for consideration by Crown Estate Scotland and the wider public sector specifically.

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Key report recommendations

1. Taking steps to increase the port capacity that is suitable for large scale offshore wind developments

2. Establish a national strategic approach to how offshore wind port facilities are developed

3. Develop new optimal operation & maintenance facilities which open up the right opportunities for Scotland's ports

200km sailing distance perimeters from nine groupings of ports with marshalling/assembly potential.

Crown Estate Scotland
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Supporting tenants, the Sector and Scotland

Strong and open relationships with tenants and developers in support of our purpose:

We invest in property, natural resources and people to generate lasting value for Scotland

ORGANISED BY

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ANNUAL CONFERENCE

1-3 SEPTEMBER 2020 ONLINE

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2045: Getting to where we need to be

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#SRAC20

Rob Forrest

Chair

Scottish Renewables

Morag Watson
Director of Policy
Scottish Renewables

Tweet @ScotRenew
#SRAC20

Phil Steele

Future Technologies Evangelist

Octopus Energy


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Scottish Renewables

Philip Steele
Future Technologies Evangelist
September 2020

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Entech business launched in 2

Multi-award winning green energy technology

Operating in 3 countries

1.5m UK household customers
(5% market share)

£1.2bn annual revenue

6m customers in platform licencing contracts

Octopus Energy Group

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We use technology to bring lower and more transparent pricing, better service and more sustainable energy to customers

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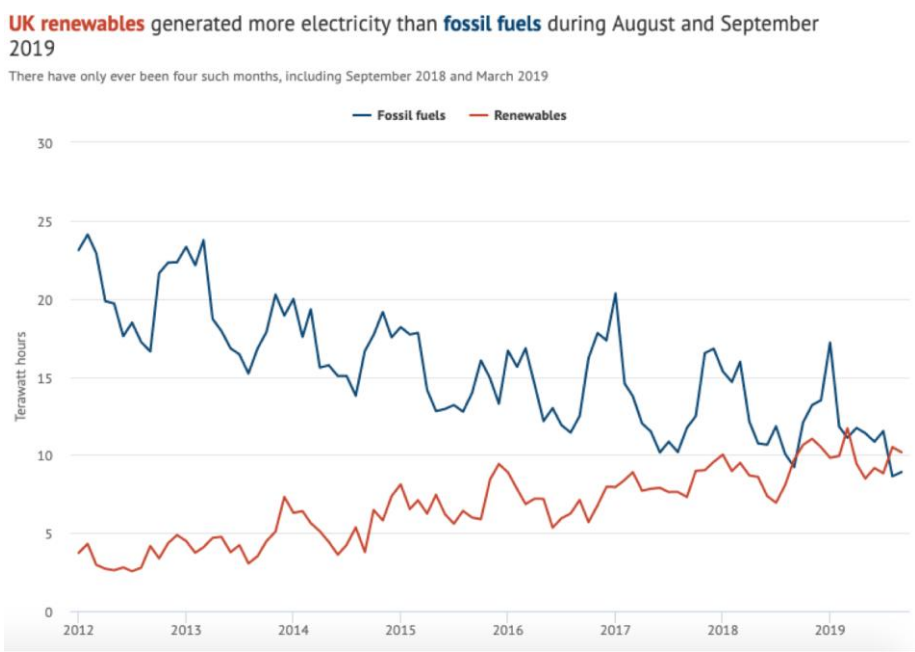
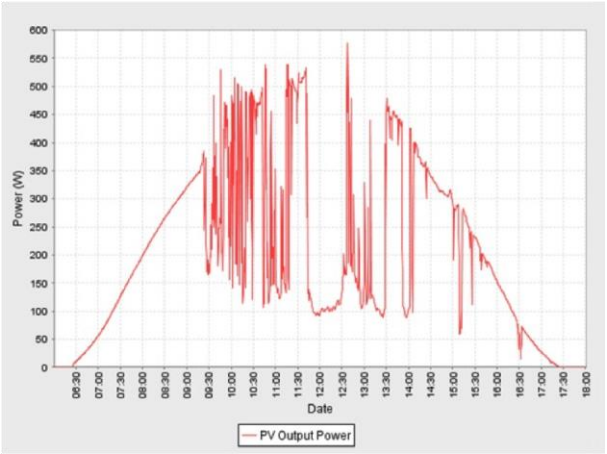
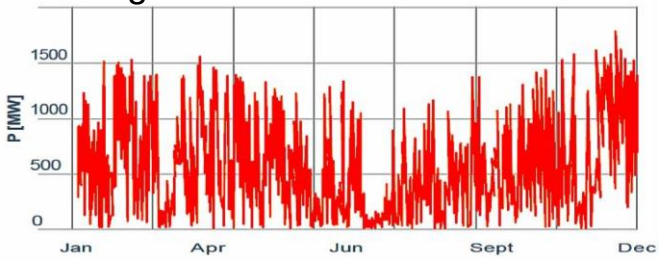
Renewable Growth: supply intermittency





Wind generation



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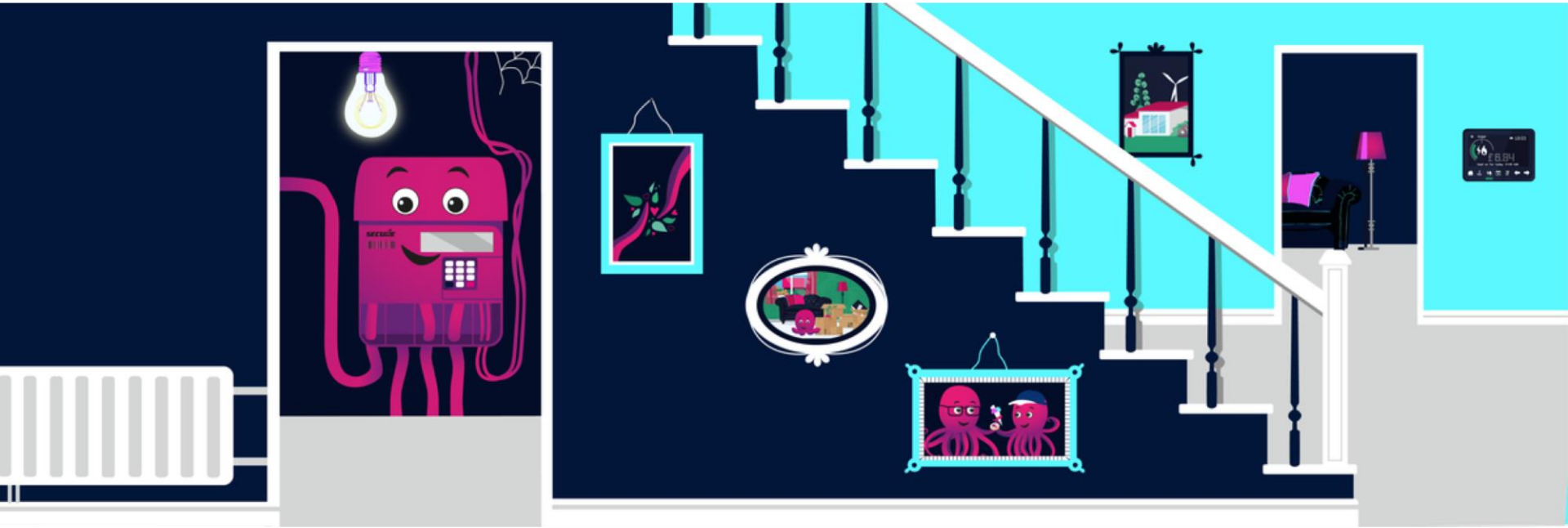
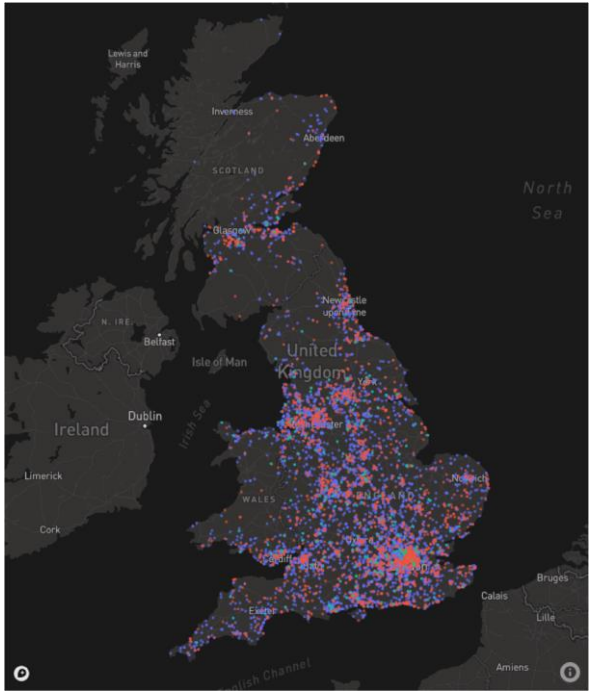
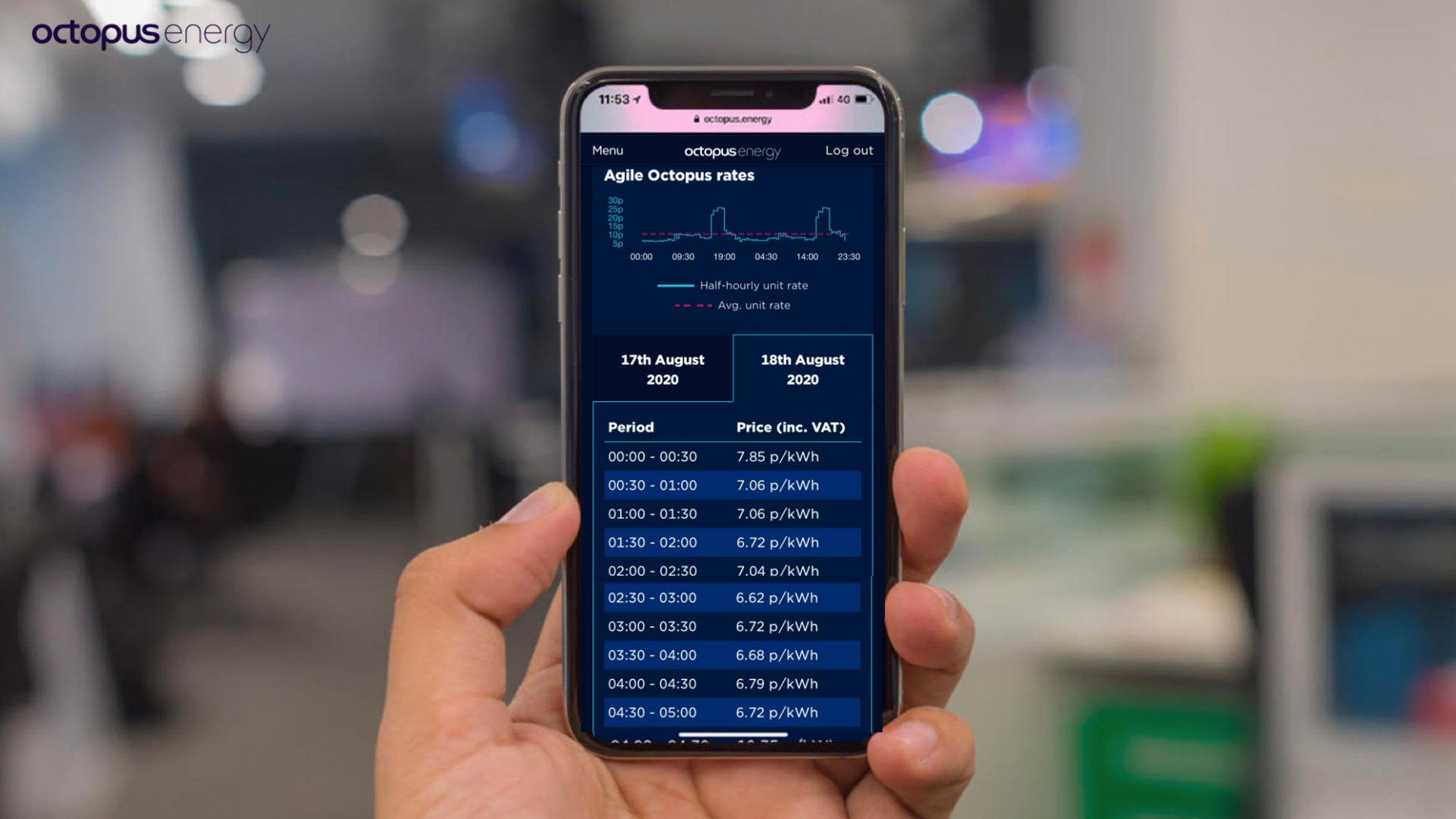
octopus energy



Behaviour Change

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4G
octopus.energy
Menu
octopusenergy
Log out
Agile Octopus rates
30p
25p
20p
15p
10p
5p
00:00
09:30
19:00
04:30
14:00
23:30
Half-hourly unit rate
Avg. unit rate
17th August 2020
18th August 2020
Period
Price (inc. VAT)
00:00 - 00:30
7.85 p/kWh
00:30 - 01:00
7.06 p/kWh
01:00 - 01:30
7.06 p/kWh
01:30 - 02:00
6.72 p/kWh
02:00 - 02:30
7.04 p/kWh
02:30 - 03:00
6.62 p/kWh
03:00 - 03:30
6.72 p/kWh
03:30 - 04:00
6.68 p/kWh
04:00 - 04:30
6.79 p/kWh
04:30 - 05:00
6.72 p/kWh

Incoming

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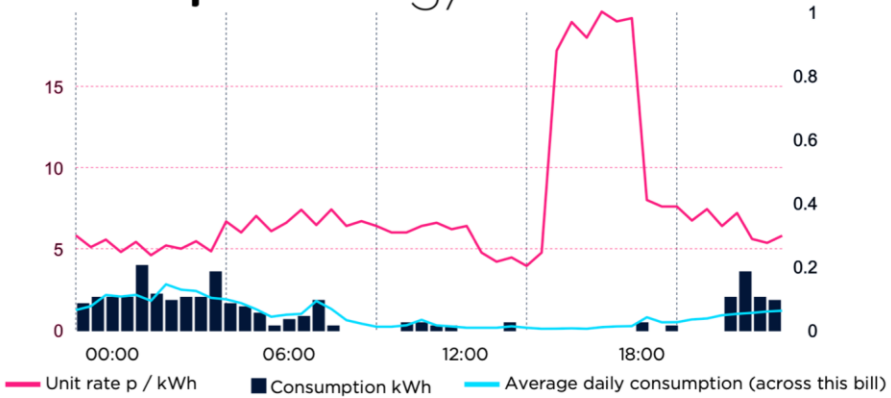
Monday
20th July 2020



Total cost

£ 0.12

Total consumption

2.12 kWh

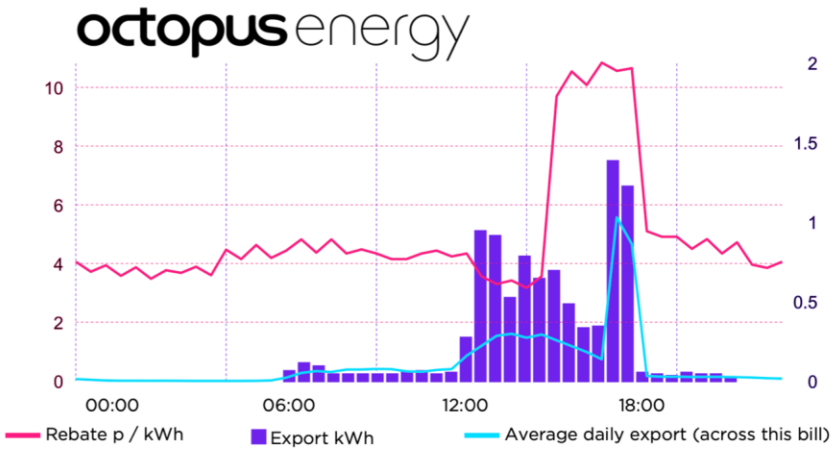
Weighted average unit rate

5.66 p / kWh

Period	Rate p / kWh	Consumption kWh	Cost p
00:00 - 00:30	5.82	0.08	0.466
00:30 - 01:00	5.10	0.10	0.510
01:00 - 01:30	5.56	0.10	0.556
01:30 - 02:00	4.80	0.10	0.480
02:00 - 02:30	5.42	0.20	1.084
02:30 - 03:00	4.60	0.11	0.506
03:00 - 03:30	5.20	0.09	0.468
03:30 - 04:00	5.00	0.10	0.500
04:00 - 04:30	5.46	0.10	0.546
04:30 - 05:00	4.84	0.18	0.871
05:00 - 05:30	6.68	0.08	0.534
05:30 - 06:00	6.00	0.07	0.420
06:00 - 06:30	7.02	0.05	0.351
06:30 - 07:00	6.08	0.01	0.061
07:00 - 07:30	6.60	0.03	0.198
07:30 - 08:00	7.40	0.04	0.296
08:00 - 08:30	6.46	0.09	0.581
08:30 - 09:00	7.42	0.01	0.074

Outgoing

Monday
20th July 2020



Total rebate

£ -0.65

Total export

9.43 kWh

Weighted average unit rebate

-6.85 p / kWh

Period	Rebate p / kWh	Export kWh	Rebate p
00:00 - 00:30	4.06	0.00	0.000
00:30 - 01:00	3.72	0.00	0.000
01:00 - 01:30	3.94	0.00	0.000
01:30 - 02:00	3.58	0.00	0.000
02:00 - 02:30	3.87	0.00	0.000
02:30 - 03:00	3.48	0.00	0.000
03:00 - 03:30	3.77	0.00	0.000
03:30 - 04:00	3.68	0.00	0.000
04:00 - 04:30	3.89	0.00	0.000
04:30 - 05:00	3.60	0.00	0.000
05:00 - 05:30	4.47	0.00	0.000
05:30 - 06:00	4.15	0.00	0.000
06:00 - 06:30	4.63	0.00	0.000
06:30 - 07:00	4.19	0.00	0.000
07:00 - 07:30	4.44	0.06	-0.266
07:30 - 08:00	4.82	0.11	-0.530
08:00 - 08:30	4.37	0.09	-0.393
08:30 - 09:00	4.82	0.04	-0.193

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Dave Dewson
@evsmiles

I'm impressed... the half hourly day by day data on my bill from Octopus energy is a joy to behold.

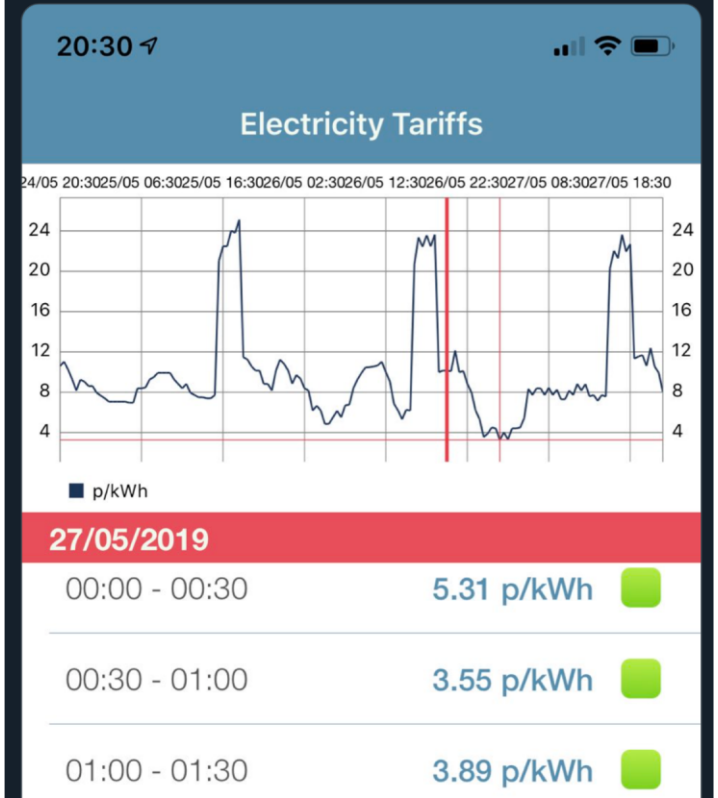
I've never been this excited to get an energy bill. Wow that sounds very sad!

Highly recommend the Octopus Go tariff for EV drivers... share.octopus.energy/ebon-dawn-607

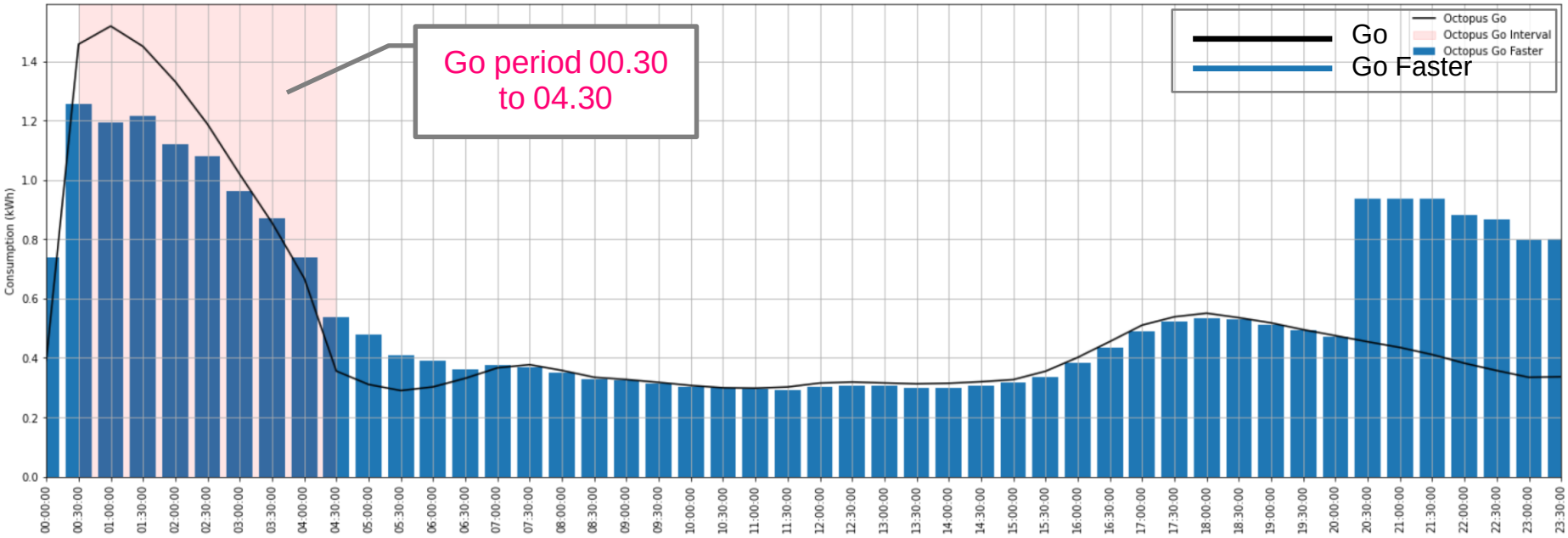
@octopus_energy

Justin
@lotsofbumper

Epic pricing on #OctopusAgile tonight...going to use the washing machine, dishwasher, charge the mower, laptop, iPad and the #IONIQ is nearly empty so @OhmeEV @raimonick you plugging in😉 @octopus_energy



Go Faster smooths out



UK Power Networks

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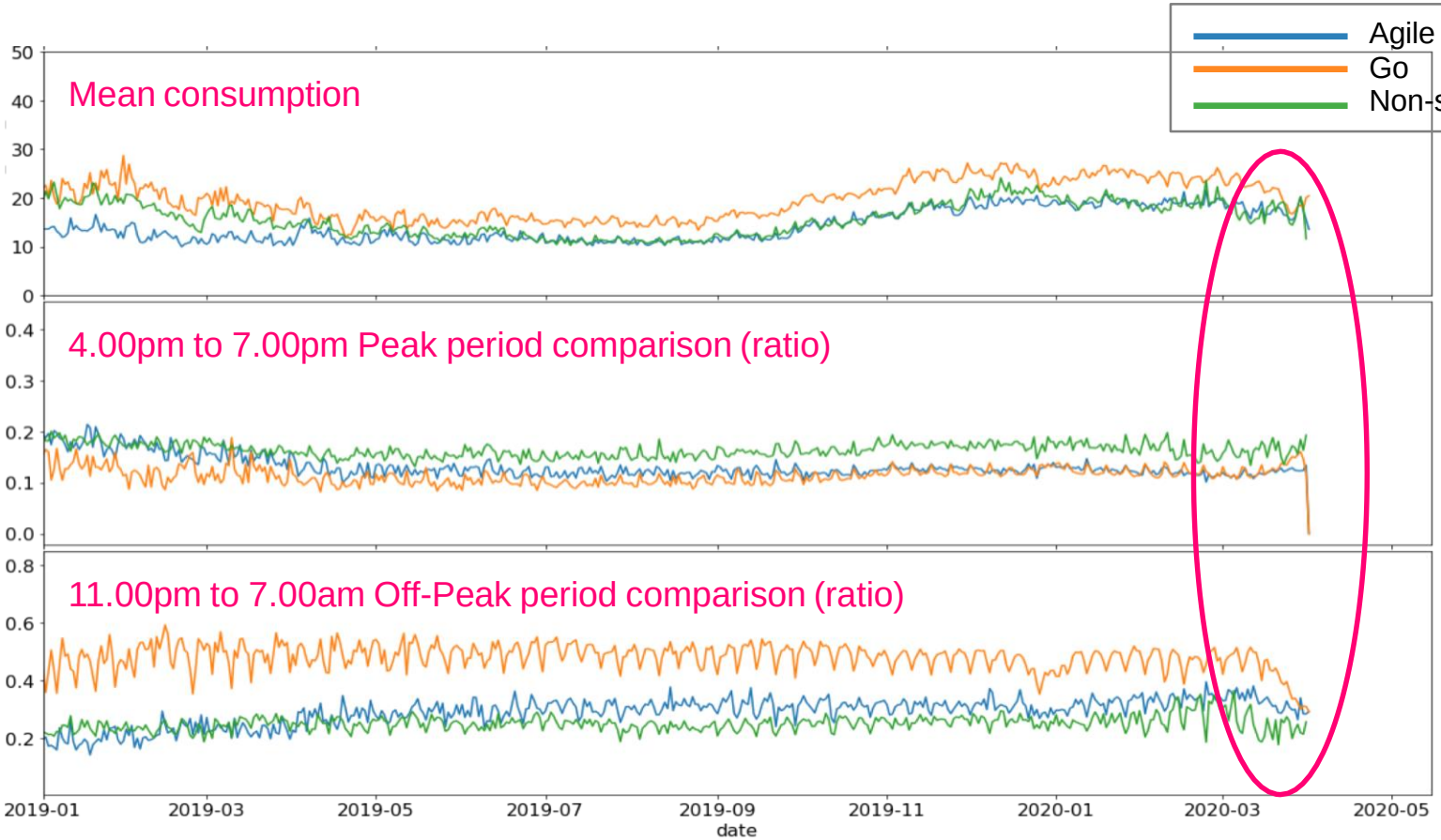
Consumption peak and off-peak (daily)



Consistently lower peak

Consistently higher off-peak

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May bank holidays

THE TIMES | Today's sections | Past six days | Times Radio

CORONAVIRUS

Blackout risk as low demand for power brings plea to switch off wind farms

Emily Gosden, Energy Editor

Saturday May 02 2020, 11.00am, The Times

There has been a huge fall in demand for power during the lockdown as factories and businesses close
ASHLEY COOPER/CONSTRUCTION PHOTOGRAPHY/AVALON/GETTY IMAGES

Britain could be at risk of blackouts as extremely low energy demand threatens to leave the electricity grid overwhelmed by surplus power.

National Grid asked the regulator yesterday for emergency powers to switch off solar and wind farms to prevent the grid from being swamped on the May 8 bank holiday, when demand is expected to be especially low.

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The Big Switch On

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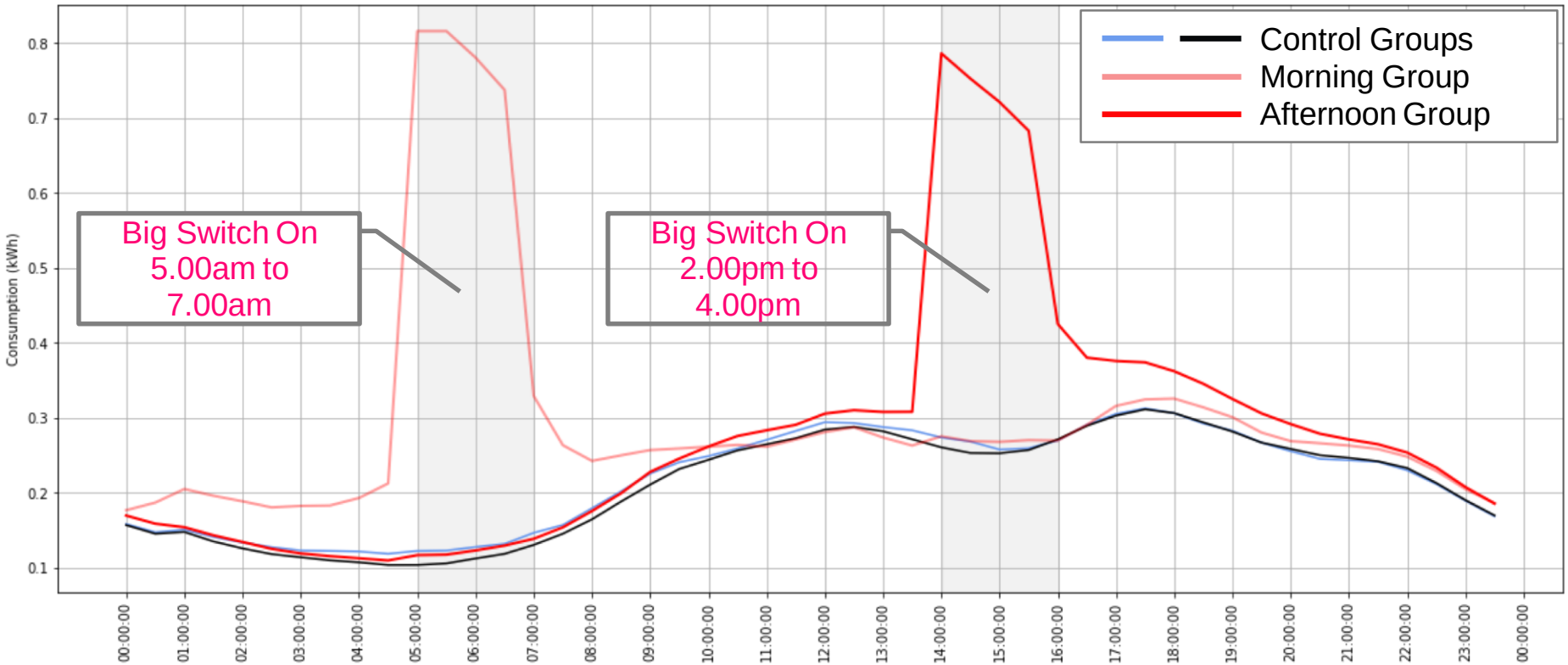
The Big Switch On



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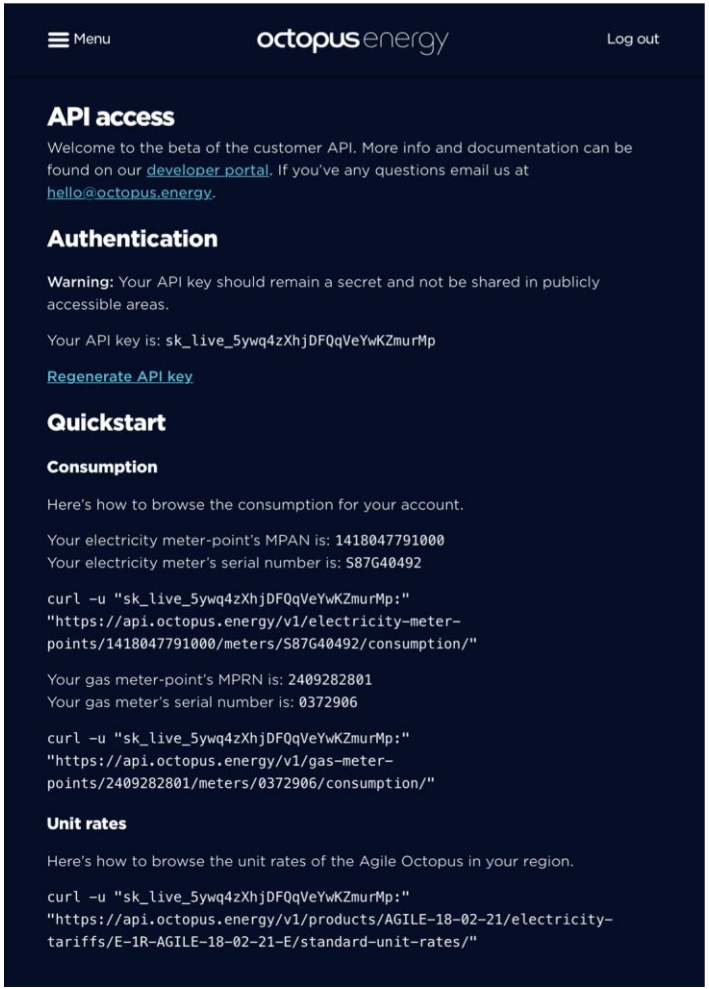
There's an API for that...



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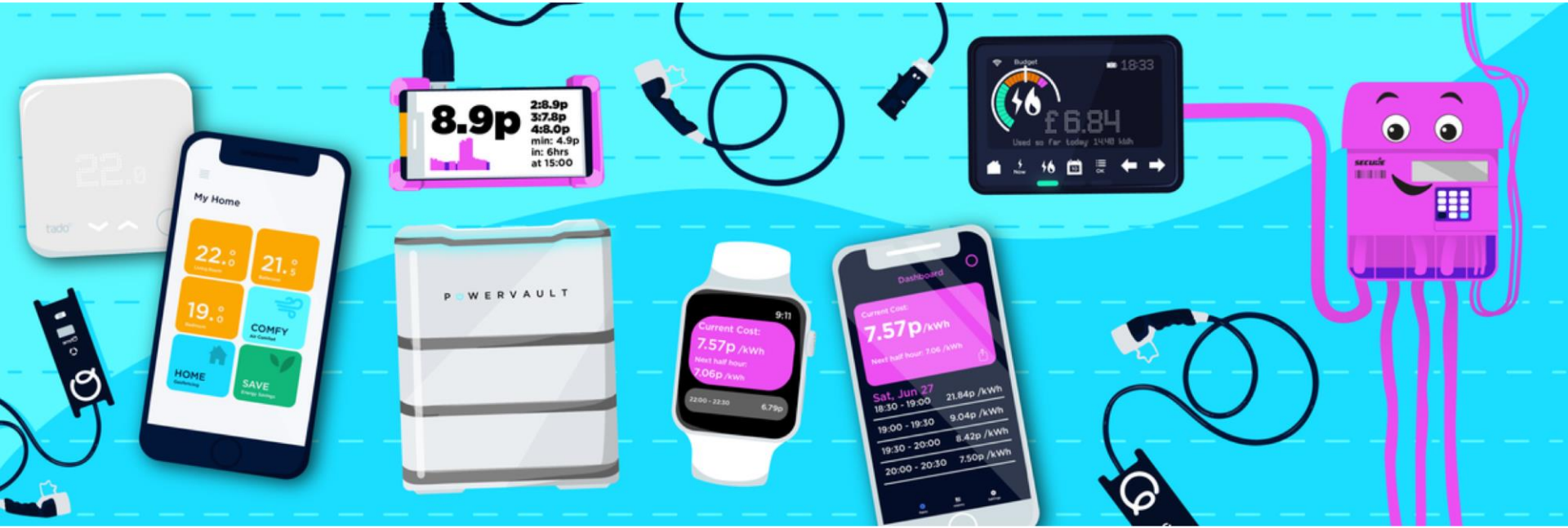
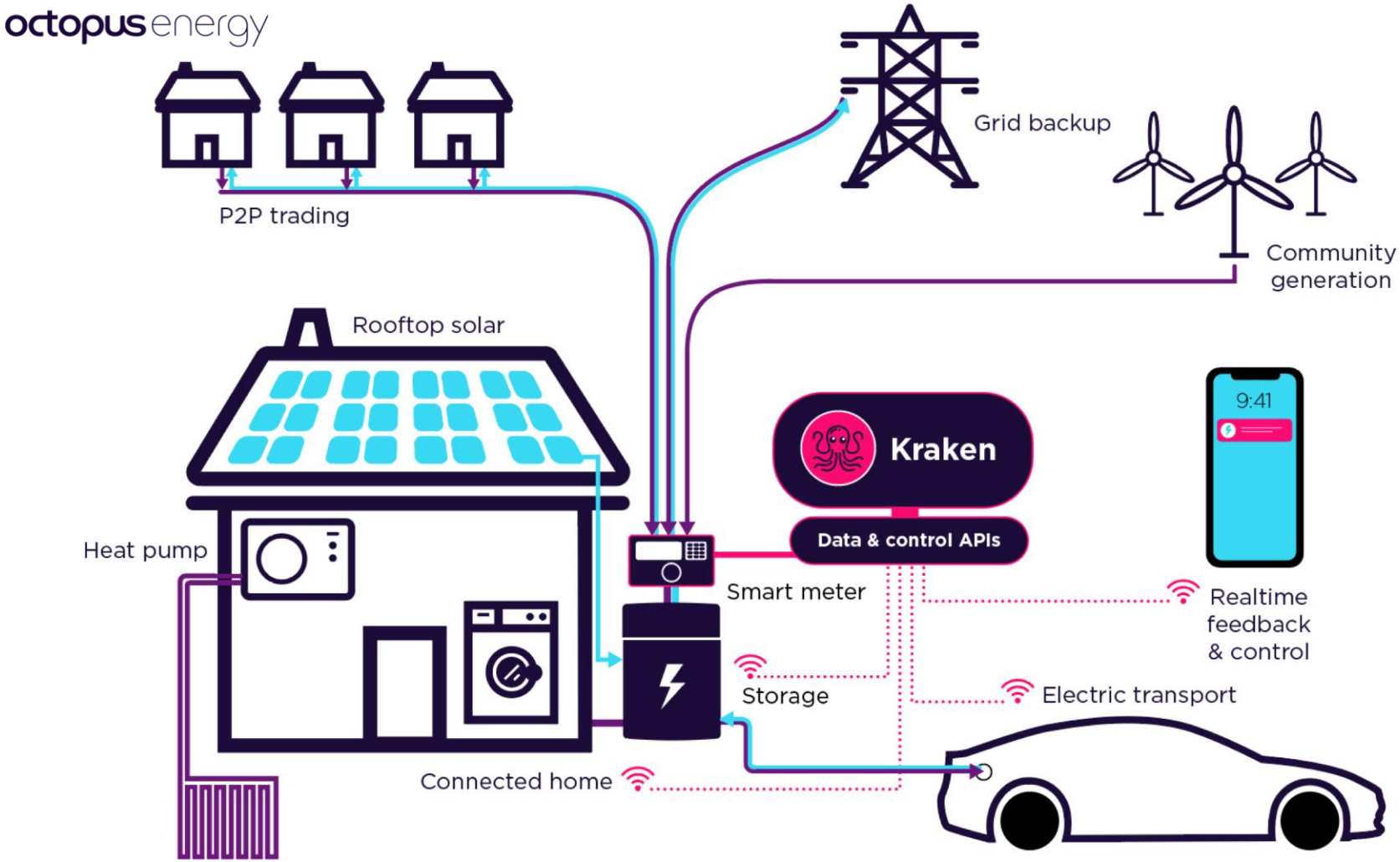


https://octopus.energy/blog/agile-smart-home-diy/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P2P trading
Grid backup
Community generation
Rooftop solar
Heat pump
Kraken
Data & control APIs
9:41
Smart meter
Realtime feedback & control
Storage
Electric transport
Connected home

Conclusion

- Renewable generation is growing fast and we've caught a glimpse of the future during lockdown
- We're able to use Smart Tariffs to drive Behaviour Change
- Connected systems and Smart Energy has potential


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Dr Jan Webb

Professor of Sociology
of Organisations
University of Edinburgh

Tweet @ScotRenew
#SRAC20

UKERC
UK Energy Research Centre

2045: Getting to Net Zero Emissions from Buildings

Janette Webb

University of Edinburgh

Scottish Renewables Annual Conference

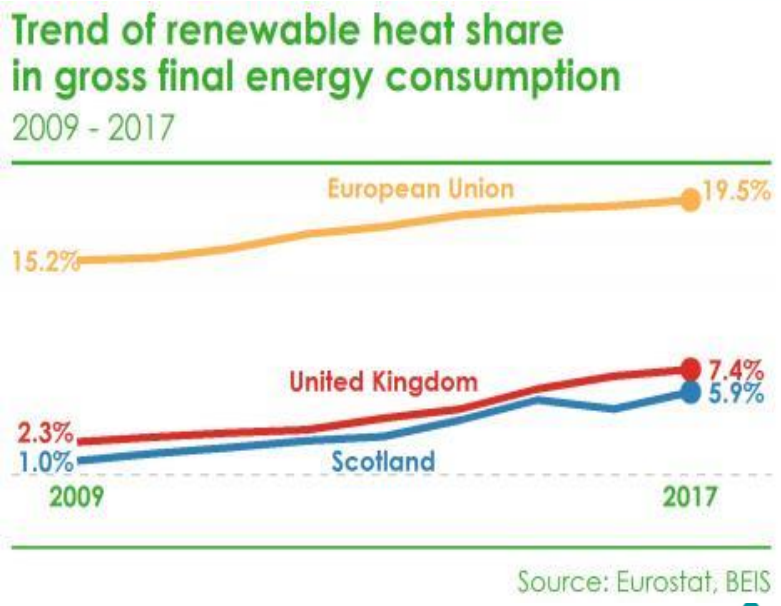
September 2020

@UKERCHQ

Why Focus on Buildings?

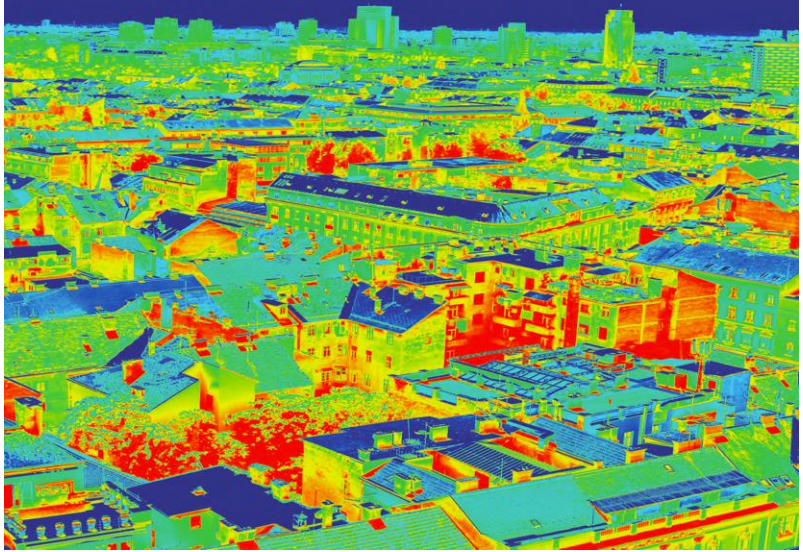
Over ten years after the Climate Change Act was passed, there is still no serious plan for decarbonising UK heating systems and no large-scale trials have begun for either heat pumps or hydrogen

UK CCC, 2019



Whole systems - technical, cultural, economic, political

Change of this scale and breadth will require a level of coordination beyond most public policy change programmes



Heat supply and heat demand, there are so many local considerations; it's about countries, locations, behaviours; it's a bigger beast. And you can't just build up a modelling tool and sell it, or build a new bit of kit and solve the problem

UK Gov Official

R&D Agenda – as much societal as technical

Institutions, political economy & policy innovation

- Governments, devolution and decentralisation
- International partners
- Market dynamics, skills and supply chains

Data & data sharing frameworks

Balance of technology innovation v application & improvement

Larger scale socio-technical demonstrators

- Infrastructures, markets, property owners, jobs, finance
- Open access evaluation

Scottish Opportunities - route to Net Zero

Whole systems thinking - Energy as economic strategy

Energy Efficient Scotland

Local Heat & Energy Efficiency Strategies

Work on finance solutions

Socio-economic value of options

HEAT AND THE CITY

UKERC
UK Energy Research Centre

@UKERCHQ

Image credits: Edinburgh Uni; Routledge; IPPR; Warwick Uni

James Johnston

CEO & Co-Founder

Piclo

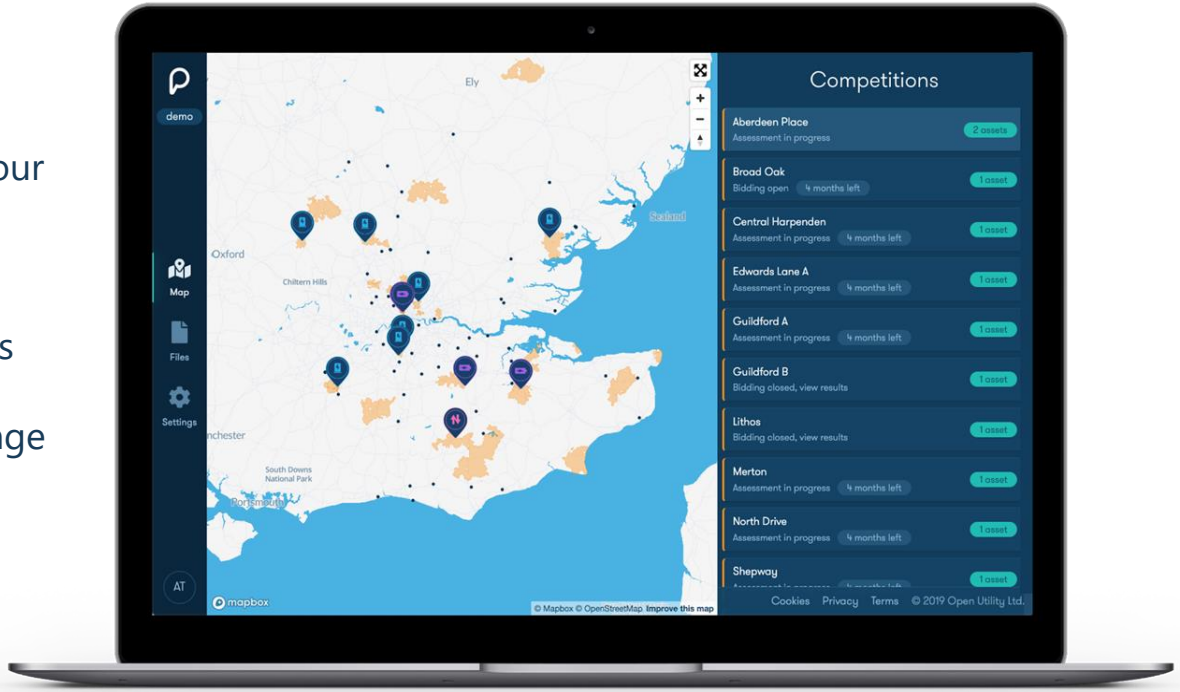
piclo®

Scottish Renewables' Annual Conference

2045: Getting to where we need to be

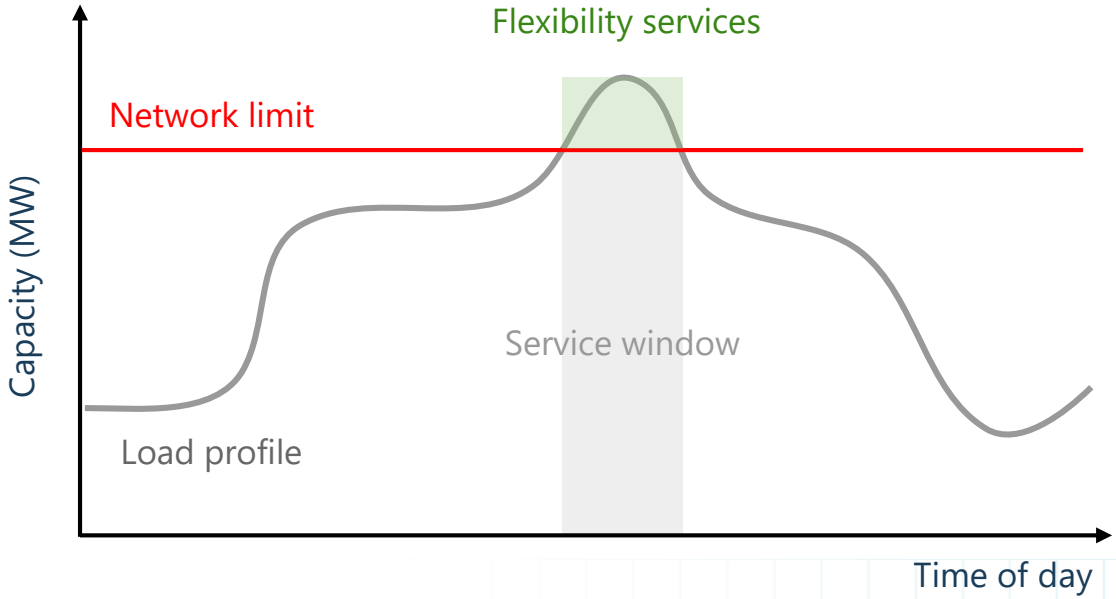
Introducing Piclo Flex

- ✓ GB's leading marketplace for DSO flexibility services
- ✓ £15m of DSO contract awards via our auctions since March 2019
- ✓ 7.2GW of distributed flex assets registered from market participants
- ✓ Establishing a multi-market exchange with National Grid ESO, all 6 DSOs and 300+ flex providers in GB.



piclo®

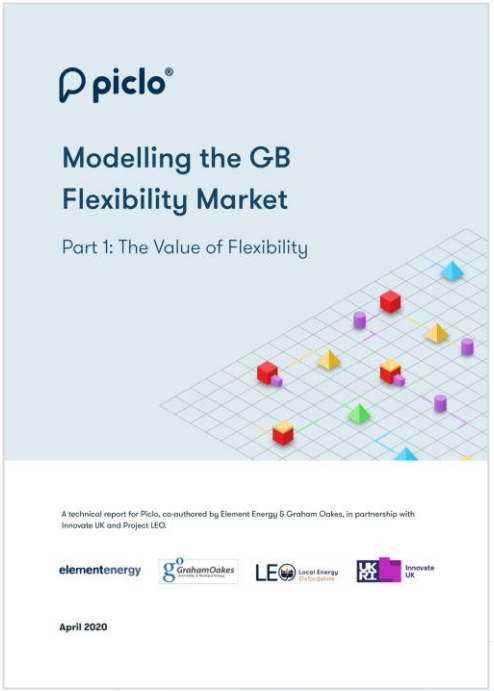
DSO flexibility in a nutshell

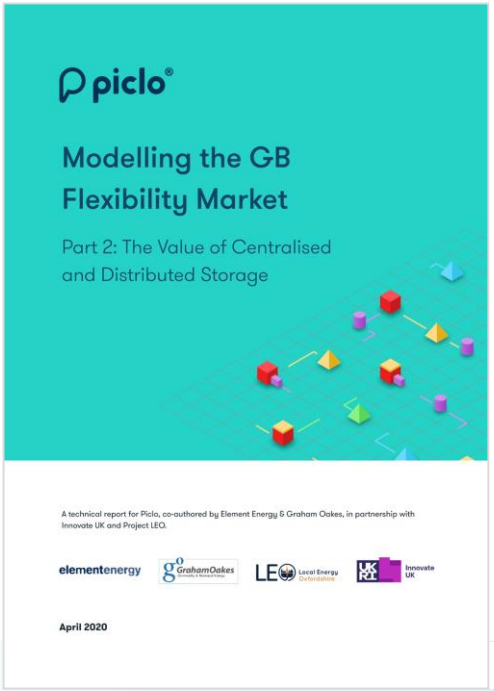


Household flex assets

Commercial & industrial flex assets

How much DSO flexibility will be required in 2045?



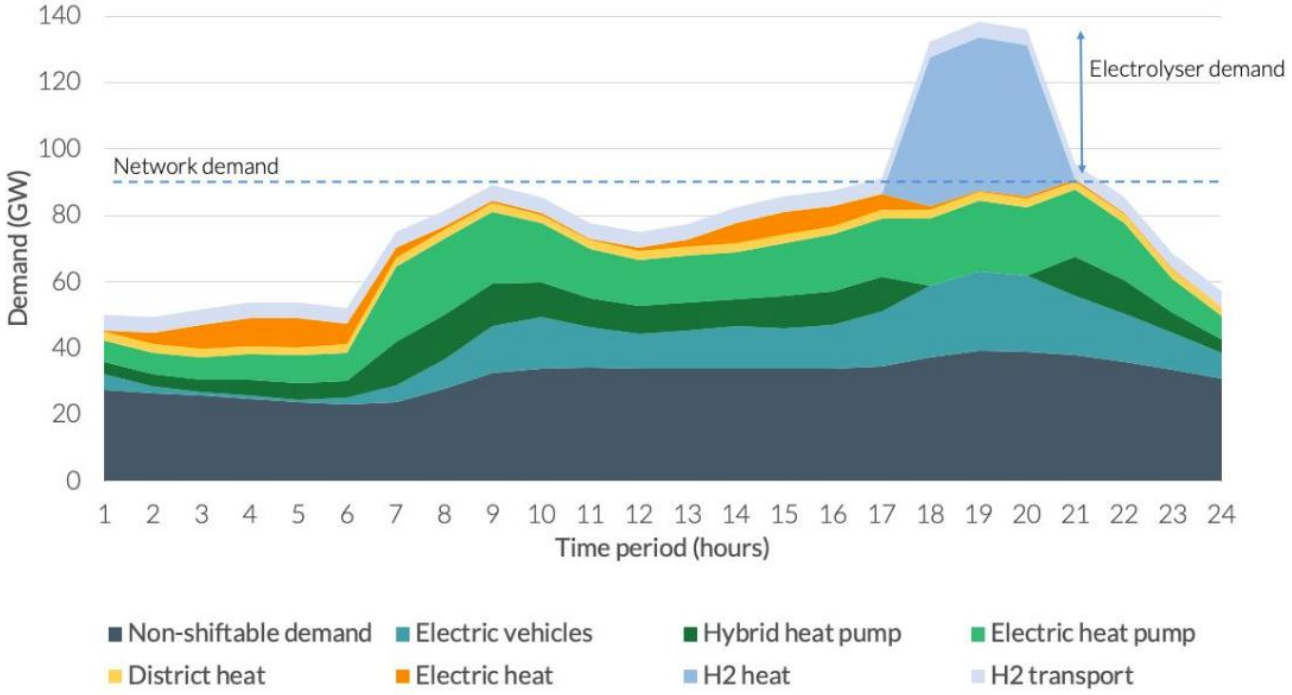


White Papers accessible here: https://piclo.energy/about#whitepaper

Heat and Transport infrastructure needed for net zero emissions in GB

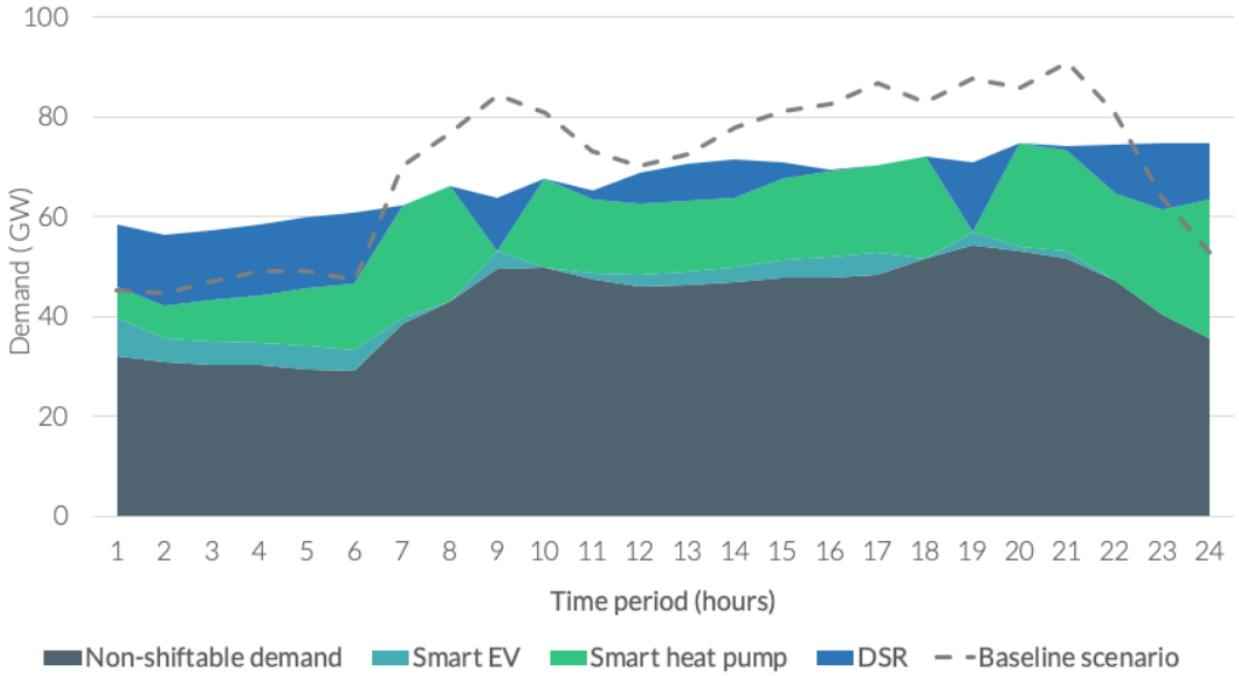
Technology	2020 estimates	Net Zero scenario	Swing
Heating			
Gas boilers	22 million	0	**-100%**
Electric heat pumps	240,000	14.5 million	**+5,942%**
Hybrid heat pumps	32,000	8.5 million	**+26,463%**
District heating	615,000	5 million	**+7,130%**
Other heating	5.5 million	2.8 million	**-49%**
Transport			
Petrol/diesel cars and vans	35.8 million	0	**-100%**
Battery electric cars and vans	350,000	35.8 million	**+10,129%**

The impact on the electrical network could be enormous



*Peak day profile from the **Baseline scenario**, in which demand reaches grows from 60GW to 91GW*

Flexibility could **halve network reinforcement required** saving £2.7bn/yr



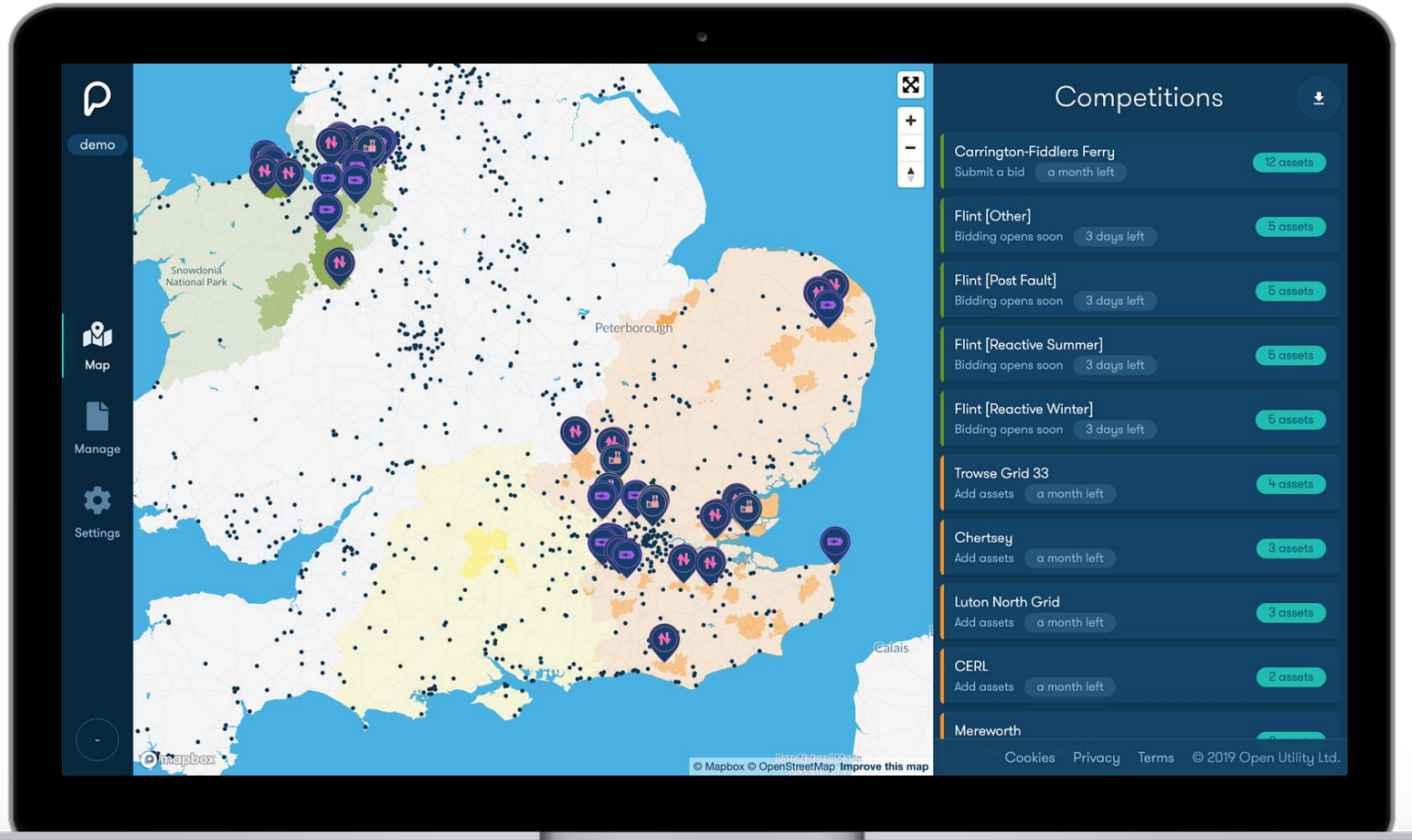
*Peak day profile from the **Basic Flexibility scenario**, in which peak demand is reduced from 91GW to 75GW*

DSOs will tackle Net Zero using a menu of options

<table>
<tr><th></th><th>Grid solutions</th><th>Flex procurement</th><th>Tariffs</th></tr>
<tr><td>Forecast bottlenecks (year(s) ahead)</td><td>Reinforcement</td><td rowspan="2">Scheduled flex contracts
+
Pre-fault flex contracts</td><td>Peak pricing</td></tr>
<tr><td>Forecast bottlenecks (week ahead)</td><td rowspan="2">Smart grid technology
+
Curtailment
+
Disconnection</td><td>Dynamic pricing?</td></tr>
<tr><td>Realtime faults</td><td>Post-Fault flex contracts</td><td rowspan="2">Pay-per-uptime?</td></tr>
<tr><td>Fault restoration</td><td>Reconnection</td><td>Restoration flex contracts</td></tr>
</table>

Flex Procurement is one of the three main pillars of the DSO model

	Grid solutions	Flex procurement	Tariffs
Forecast bottlenecks (year(s) ahead)	Reinforcement	Scheduled flex contracts + Pre-fault flex contracts	Peak pricing
Forecast bottlenecks (week ahead)	Smart grid technology + Curtailment + Disconnection		Dynamic pricing?
Realtime faults		Post-Fault flex contracts	Pay-per-uptime?
Fault restoration	Reconnection	Restoration flex contracts	


demo
Map
Manage
Settings
Snowdonia National Park
Peterborough
Calais
mapbox
© Mapbox © OpenStreetMap Improve this map
Competitions
Carrington-Fiddlers Ferry
Submit a bid
a month left
12 assets
Flint [Other]
Bidding opens soon
3 days left
5 assets
Flint [Post Fault]
Bidding opens soon
3 days left
5 assets
Flint [Reactive Summer]
Bidding opens soon
3 days left
5 assets
Flint [Reactive Winter]
Bidding opens soon
3 days left
5 assets
Trowse Grid 33
Add assets
a month left
4 assets
Chertsey
Add assets
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Luton North Grid
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3 assets
CERL
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a month left
2 assets
Mereworth
Cookies
Privacy
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picio

Thank you

James Johnston
CEO and co-founder

james@piclo.energy
+44 7880 603 378

piclo®

Colin Calder

CEO

PassivSystems


passivSYSTEMS
Grid-aware Controls &
Regulated Asset Base

Introduction

PassivSystems are a provider of predictive control, energy aggregation and demand flexibility services for efficient domestic asset management.

- Founded in 2008, employs 75 people, over half support R&D and software development
- Extensive experience in developing new energy services:
  - Distributed computing
  - Cloud based platform services
  - Radio technologies for LAN & WAN comms
  - Web and app-based consumer interfaces
  - Innovative predictive control algorithms

Core delivery areas:

- Comprehensive, aggregated high electrical load and heat demand control and monitoring
- Turnkey survey, installation, commissioning and lifetime O&M and asset management services
- Research and development projects and emerging flexibility energy services

Department for Business, Energy & Industrial Strategy

INDUSTRIAL STRATEGY

Freedom Project

Horizon 2020 Programme

Customers include:

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Changing Energy Market

- Government backed **Net Zero Carbon initiatives** are changing the energy system, consumer behaviour and consumer expectations
- Every MW of renewable generation capacity added to the energy system is creating a **supply side requirement** for Adequacy and Constraint capacity
- Domestic low carbon heating systems fitted with IOT **"grid-aware" control** technology can provide Adequacy and Constraint response capacity
- IOT Grid-aware control of energy demand can increase energy system asset utilisation rates, avoid capacity costs and reduce unit energy costs. In future **flexible consumers are expected to pay 50% less** for energy (see FREEDOM project report)
- Ofgem and BEIS are designing a more flexible energy system to provide consumers with **better value for money**. IOT Grid-aware controls need to be part of the solution
- Regulated Asset Base (RAB) could enable consumers to build out **small scale Adequacy and Constraint infrastructure capacity** while policy makers and regulators develop appropriate digital market mechanisms

Consumers realizing value from Adequacy and Constraint markets is one of the fastest way of making low carbon heat competitive

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Watch the MADE Video

Multi **A**sset **D**emand **E**xecution

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A National Infrastructure Project is Needed

- As a national infrastructure project the installation of 5 million hybrid heat pumps in homes by 2027 could:
  - Create tens of thousands of new jobs in the low carbon sector vital to the Green Economic Recovery
  - If UK manufactured, create a supply chain of economic value
  - Be a fast route to creating heat flexibility and enabling flexibility markets
  - Significantly reduce carbon emissions from domestic homes making Carbon Budget 4 outcomes much more achievable.
- The infrastructure is fuel-neutral – it reduces the amount of energy used but does not constrain the source of that energy
- The infrastructure is therefore capable of adapting to future technological developments (e.g. green hydrogen) but materially reduces the total future energy needs of the UK
- The RAB model would future-proof the energy system whilst enabling the creation of new, meaningful, manufacturing employment

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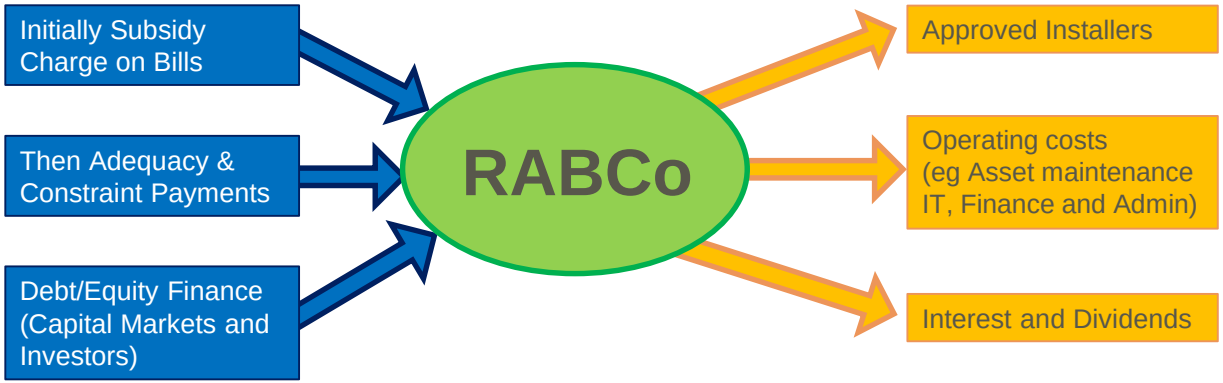
What RAB financing is for

- RAB financing is a method of socializing the cost of infrastructure over a period of time
- Under RAB financing, capital markets fund the construction of infrastructure
- The market financing is repaid, with a return,
  - initially by spreading the cost as a subsidy across all gas users; and
  - then as volumes increase charging energy system actors for using the Adequacy and Constraint capacity provided by the assets over their lifetime
- RAB financing requires regulation to ensure that there is no exploitation of the natural monopolies created by the infrastructure



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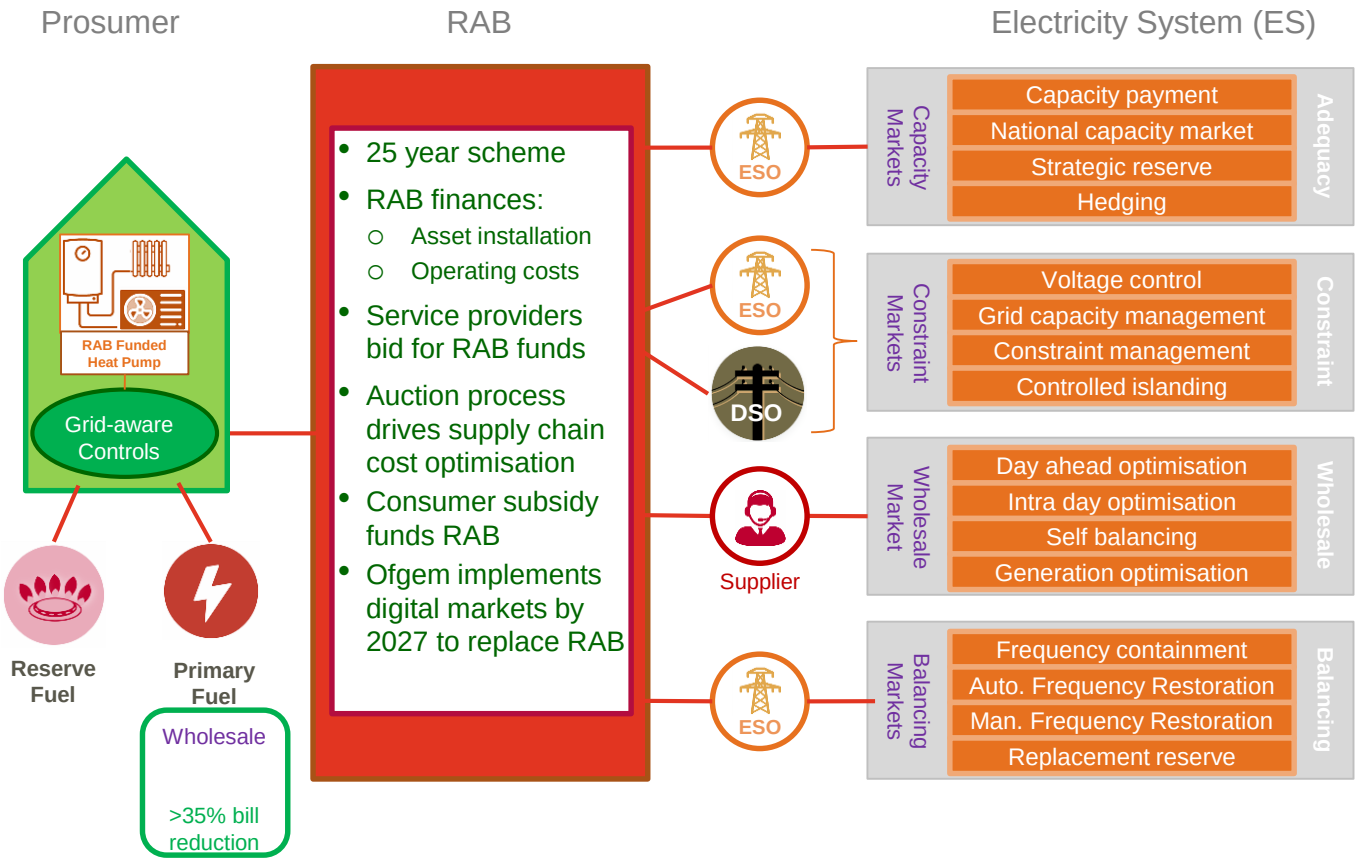
RAB Funded Market Creation



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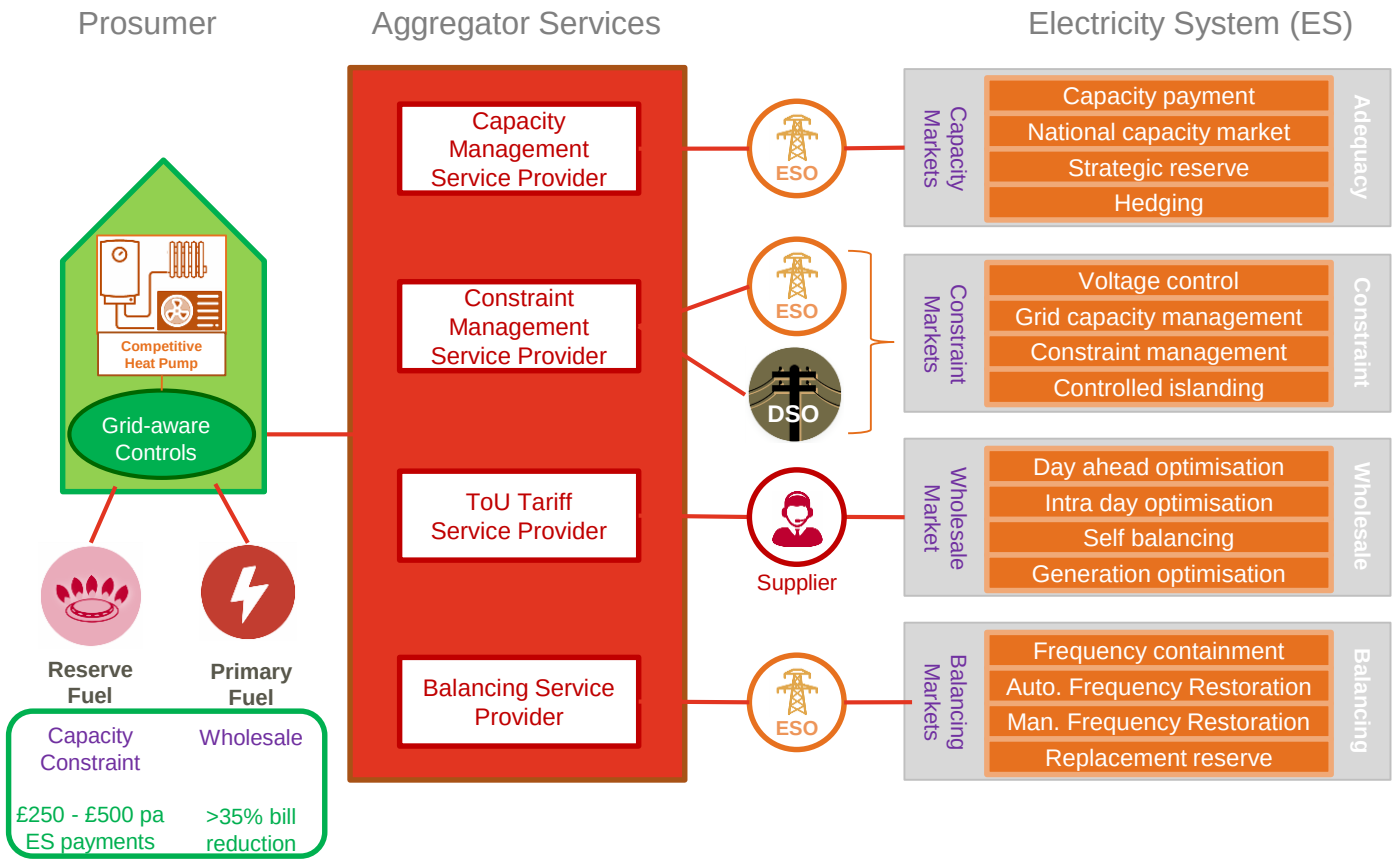
Post RAB Digital Markets



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Ofgem and BEIS Asks

- Agree an industry definition for “grid-aware” controls that support Adequacy and Constraint management & link the provision of subsidies to heating assets with grid aware controls.
- Encourage the industry to introduce “agile” tariffs.
- Encourage consumer adoption of “grid-aware” controls similar to switching as a bill saving measure.
- Work with the industry to support rapid deployment of hybrid/HP heating systems while designing competitive markets.
- Support the initial high cost of hybrids / heat pumps through socialising costs but use an auction mechanism to drive supply chain efficiency
- Make mandatory electricity and heat metering of hybrids / HPs
- Use data from “early adopters” to inform market design and future regulation – “Learn by doing”

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Katrine Feldinger

Head of International Capital Investment

Scottish Government

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Going Greener. Faster.
We can’t afford not to
#SCOTLANDISNOW

Perspectives on a moment in history

The burning platform: a moral imperative and a defining decade

“What was once slow and imperceptible, is now remorseless and dramatic”

“The silver bullet is not around the corner, we already know the solutions”

“Investing in green isn’t as risky as we’d like to tell ourselves”

The Gap Government Fills

Consistency, certainty and coherence: creating the conditions

Market failure interventions

Innovation

#SCOTLANDISNOW

Opportunity and Recovery

Renewables and energy transition

Decarbonisation of transport

Data, space and sensors

Innovative food and drink

Built environment

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A Green New Deal

Climate Change Plan: Net Zero by 2045

Scottish National Investment Bank

Climate Emergency skills action plan

Low Carbon Challenge Fund

Green Jobs Fund

National Planning Framework

Land Reform

Green Growth Accelerator

Green Investment Portfolio

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Tracy Black
Director
CBI Scotland

Morag Watson
Director of Policy
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Nick Sharpe

Director of Communications & Strategy

Scottish Renewables

Nicola Percival

Senior Regulatory Affairs Manager – Grid

RWE Renewables

Audrey Ramsay

Head of GB Network Access Planning

National Grid ESO

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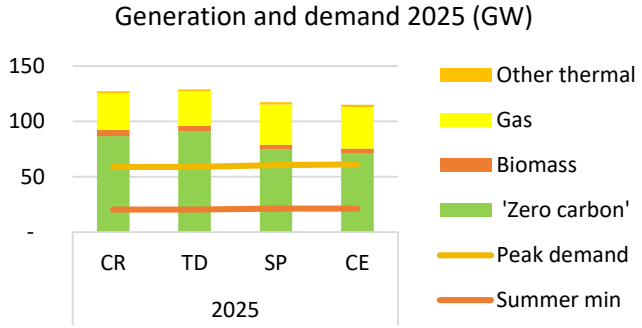
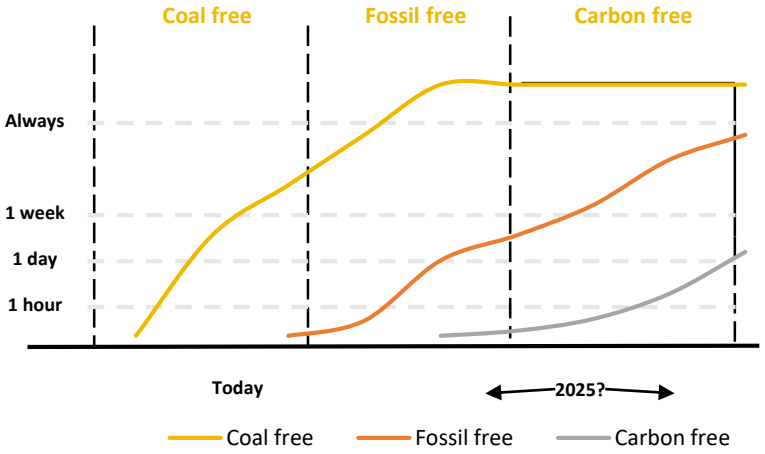
Zero Carbon Operation by 2025

Audrey Ramsay
Head Of GB Network Access Planning - ESO

nationalgridESO

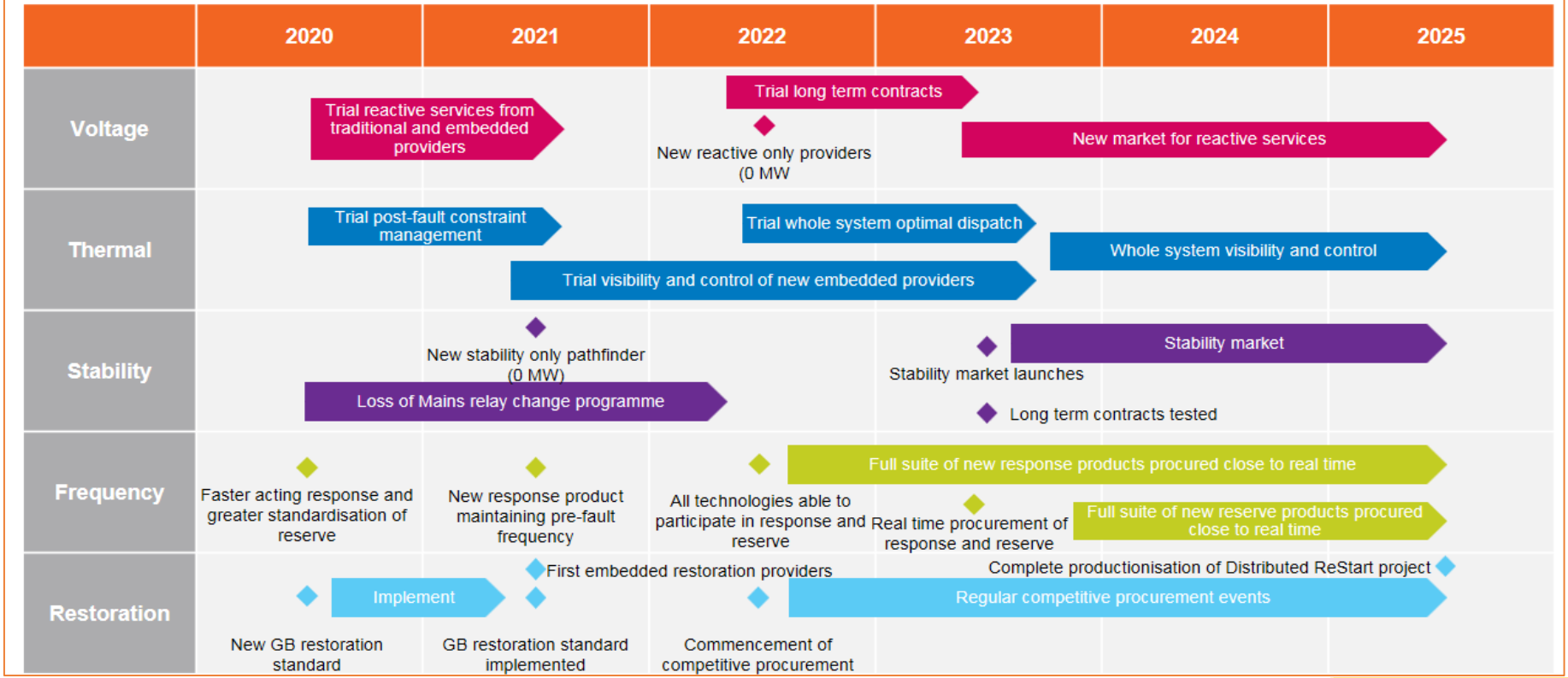
When will we see zero carbon?



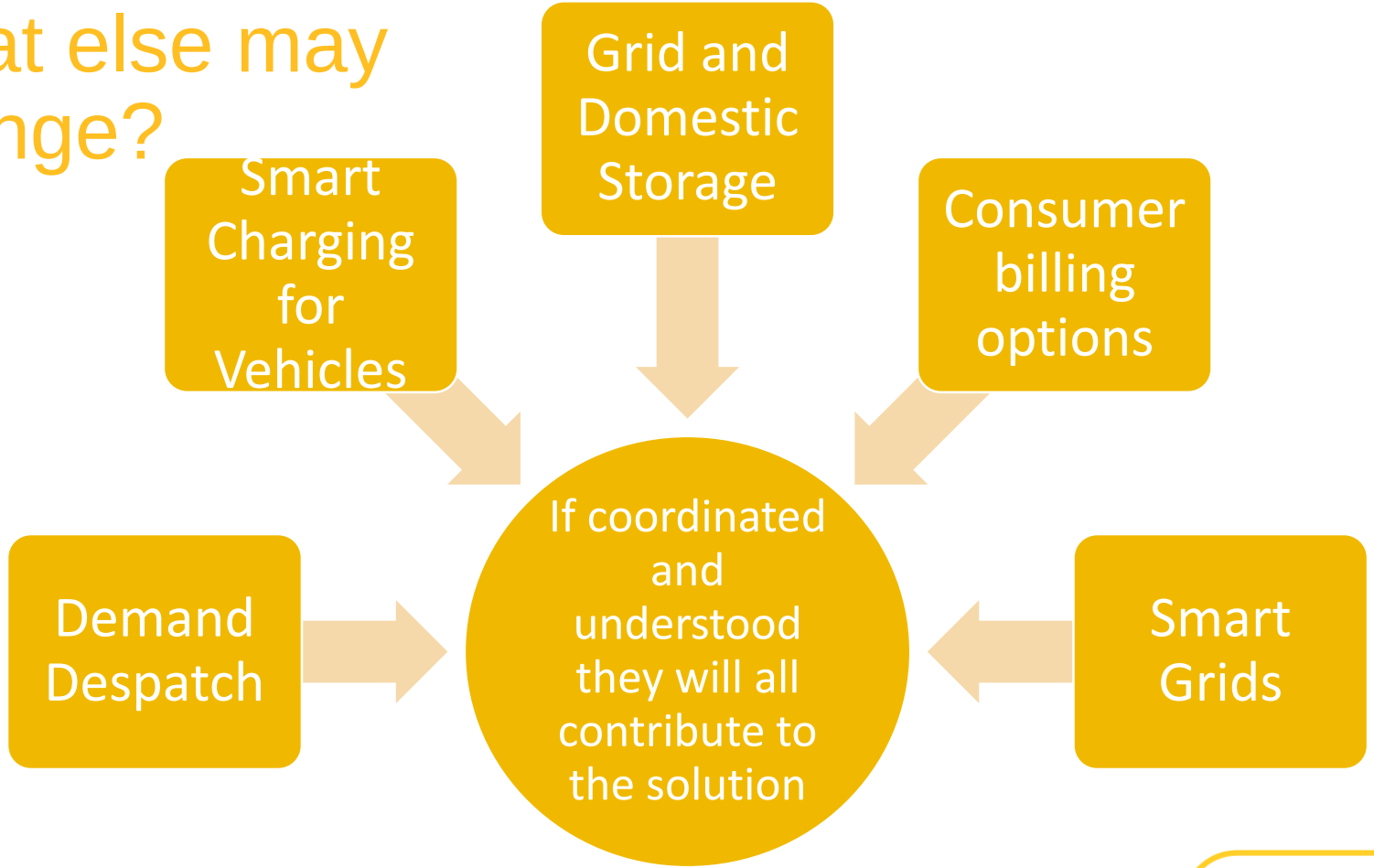


- We are now frequently seeing coal-free days and have experienced a 2 month coal-free period
- In the coming years, we will start to see the first hours without gas generation. This will progress to days and weeks as it has for coal
- We will then see the first hours of zero carbon, i.e. no fossil fuel or biomass generation
- When this will happen remains to be seen – by 2025 all FES scenarios show peak and min demand met by ‘zero carbon’ generation.
- **The market will determine when we see instances of zero carbon – our ambition is to be ready by 2025.**

Technical roadmap for zero-carbon operation



What else may change?



Barry Carruthers

Head of Innovation & Sustainability

ScottishPower

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Electrify Everything First…

Barry Carruthers
Head of Innovation, Sustainability & Quality

ScottishPower today…

100% 1st integrated energy company generating **100% green energy**

Part of the Iberdrola group, **leader in renewable energies**

£6 billion
Investing £6 billion in the UK between 2018 and 2022

2000 MW
Over **2,000 MW** of wind capacity

5600
5,600 employees, supporting over **72,000 UK jobs**

5M
5M electricity and gas retail customers spread all over the UK

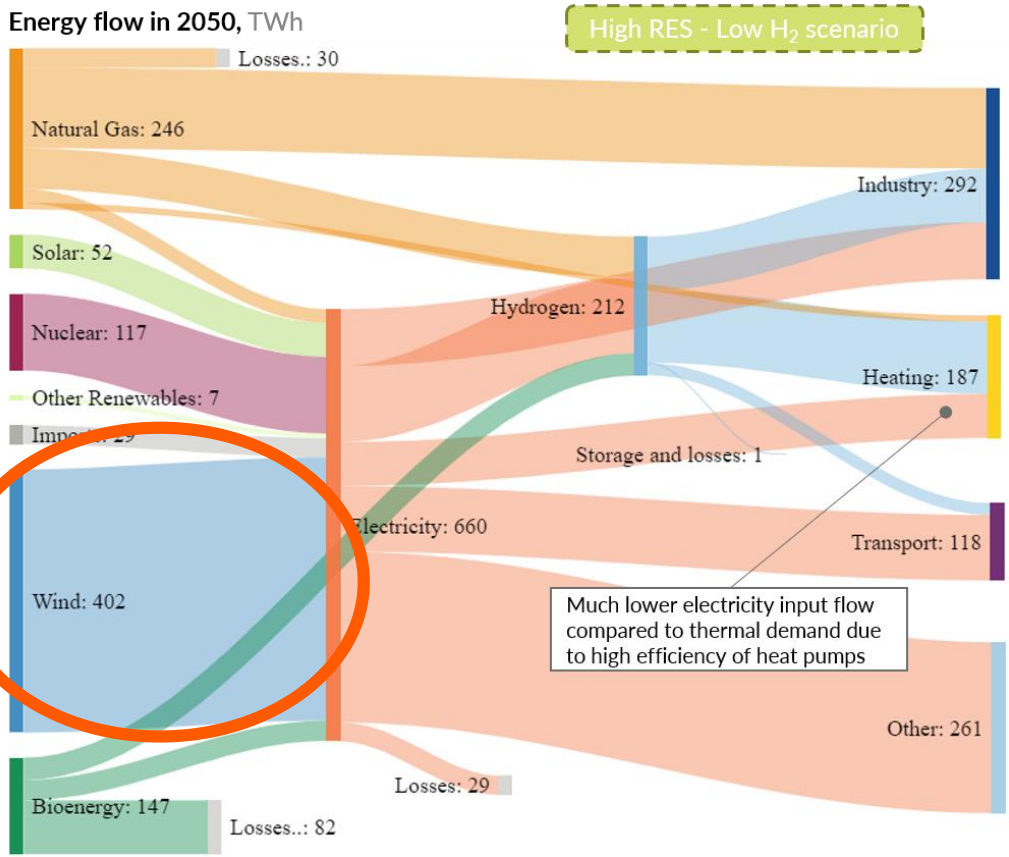
3.5M
Networks: **3.5M** points of supply and **110,000 km** of power lines

SCOTTISHPOWER

Better future, quicker

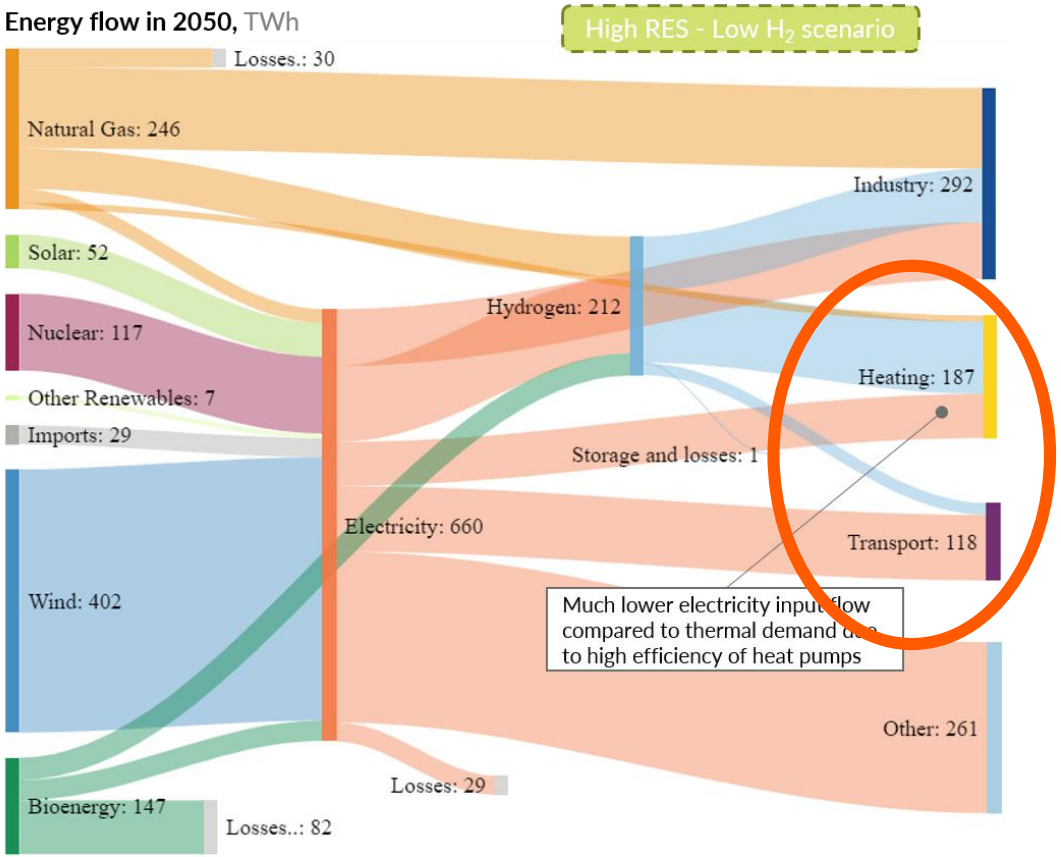
Electrification for Everything…

Enormous growth in renewables capacity required



*Aurora Energy Research: "**Hydrogen for a Net Zero GB: An integrated energy market perspective**" – June 2020*

Electrification for Everything…



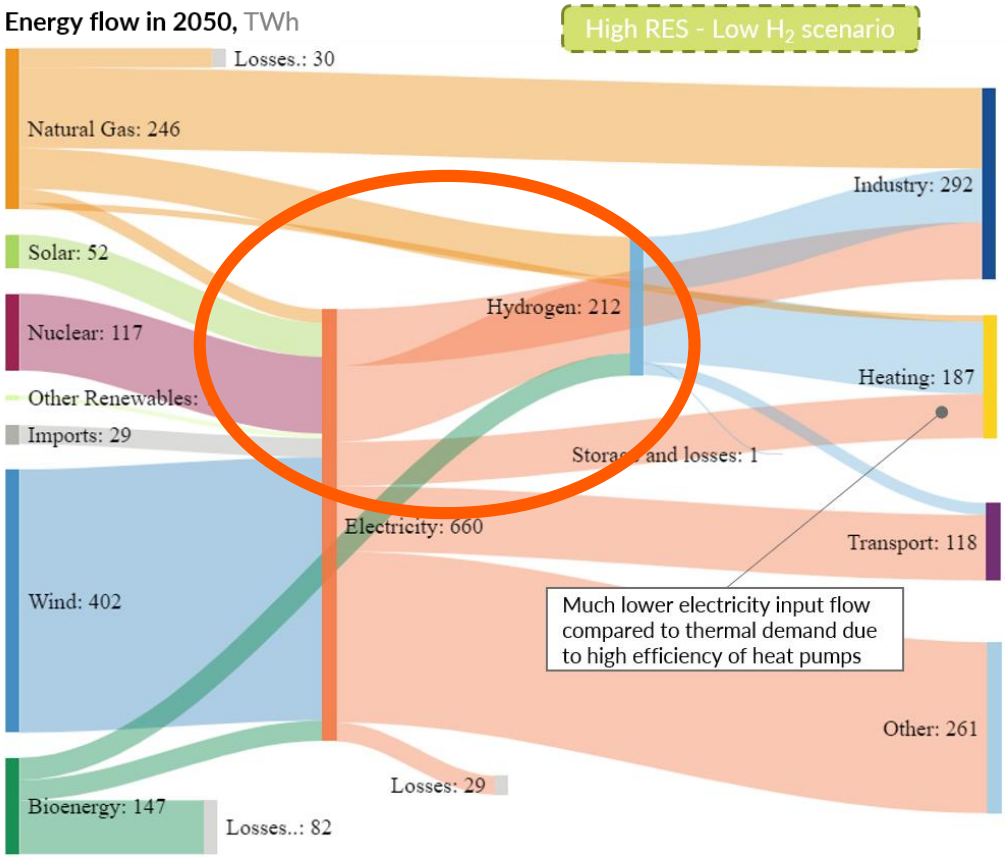
Electric heating more efficient

Electric transport more efficient

*Aurora Energy Research: "**Hydrogen for a Net Zero GB: An integrated energy market perspective**" – June 2020*

Electrification for Everything…

Relative proportion of Hydrogen to Electricity & reliance for Green Hydrogen



*Aurora Energy Research: "**Hydrogen for a Net Zero GB: An integrated energy market perspective**" – June 2020*

Electrify Everything First…

To achieve a Net Zero future:

- Need to reduce reliance on natural gas
- Need to dramatically increase renewable generation capacity
- Need to accelerate electrification of transport
- Need to accelerate electrification of heating

Therefore…

- Green Hydrogen can build upon supporting electrification as critical enabler
- **Significant investment in electricity networks, both transmission and distribution, is fundamental to all Net Zero achievements**

Neil Kermode

Managing Director

European Marine Energy Centre

ReFLEX ORKNEY

INDUSTRIAL STRATEGY

UK Research and Innovation

SMART LOCAL ENERGY SYSTEMS: DEMONSTRATOR

ReFLEX: The Energy System of the Future

EMEC

solo energy

aquatera environmental services and products

Heriot Watt University

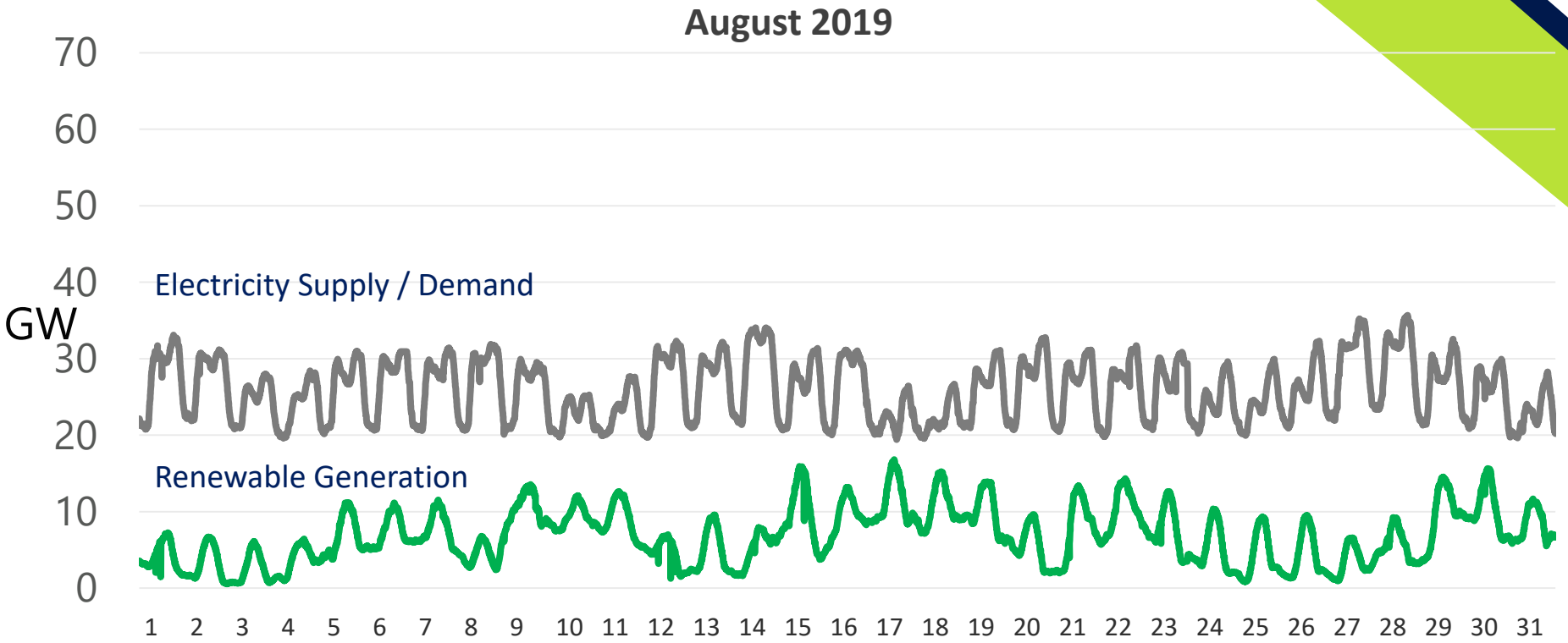
Community Energy Scotland Empowering Communities

Orkney Islands Council

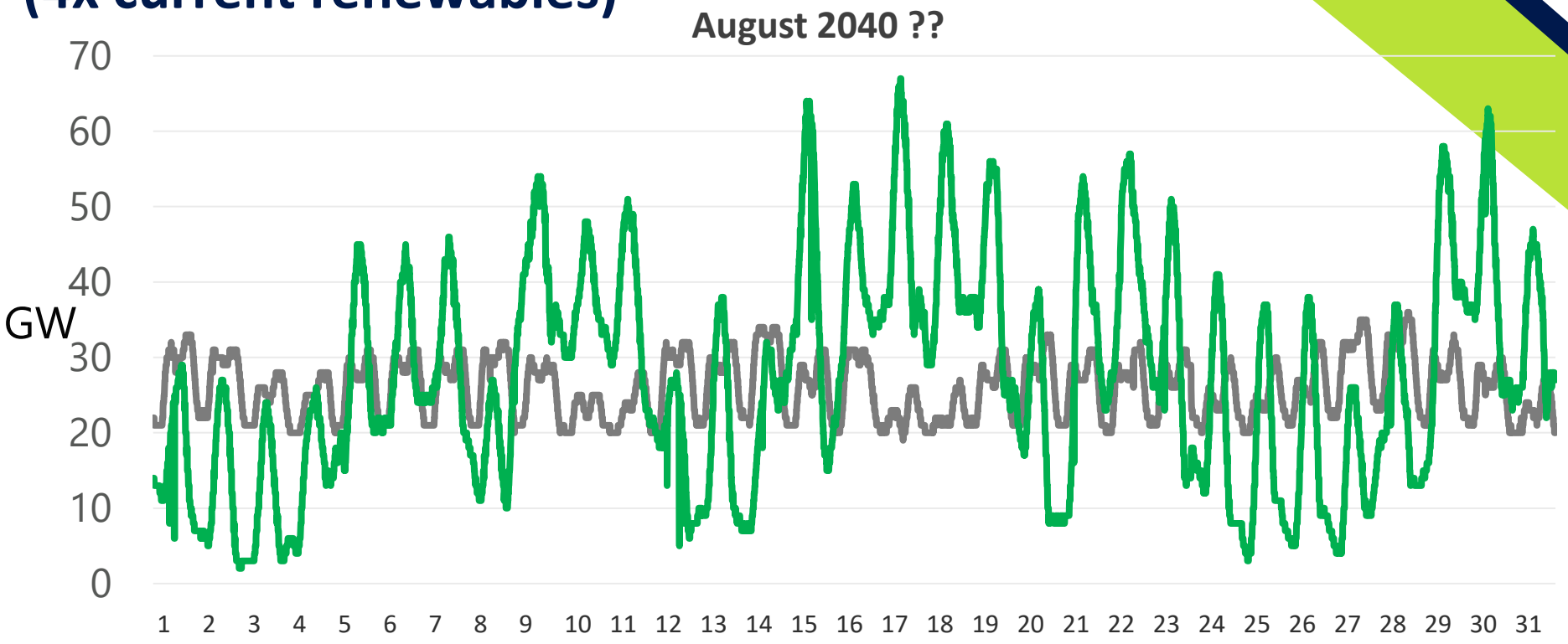
ReFlex Overview

- Inspired by, built by and will applied by **Orkney**
- Developing the **local energy system** of the future
- Aggregating flexible power, heat, transport assets with local renewables; creates an **Integrated Energy System**
- **£28.5 million** project, 50% from UKRI, started April ’19
- Delivering decarbonisation **without asking the consumer to pay up front** for technology, through **private sector asset-financing** within a UK and globally replicable business model
- Consortium of **leading industry and academic experts**
- Goal – accelerate towards **carbon neutrality by 2027**

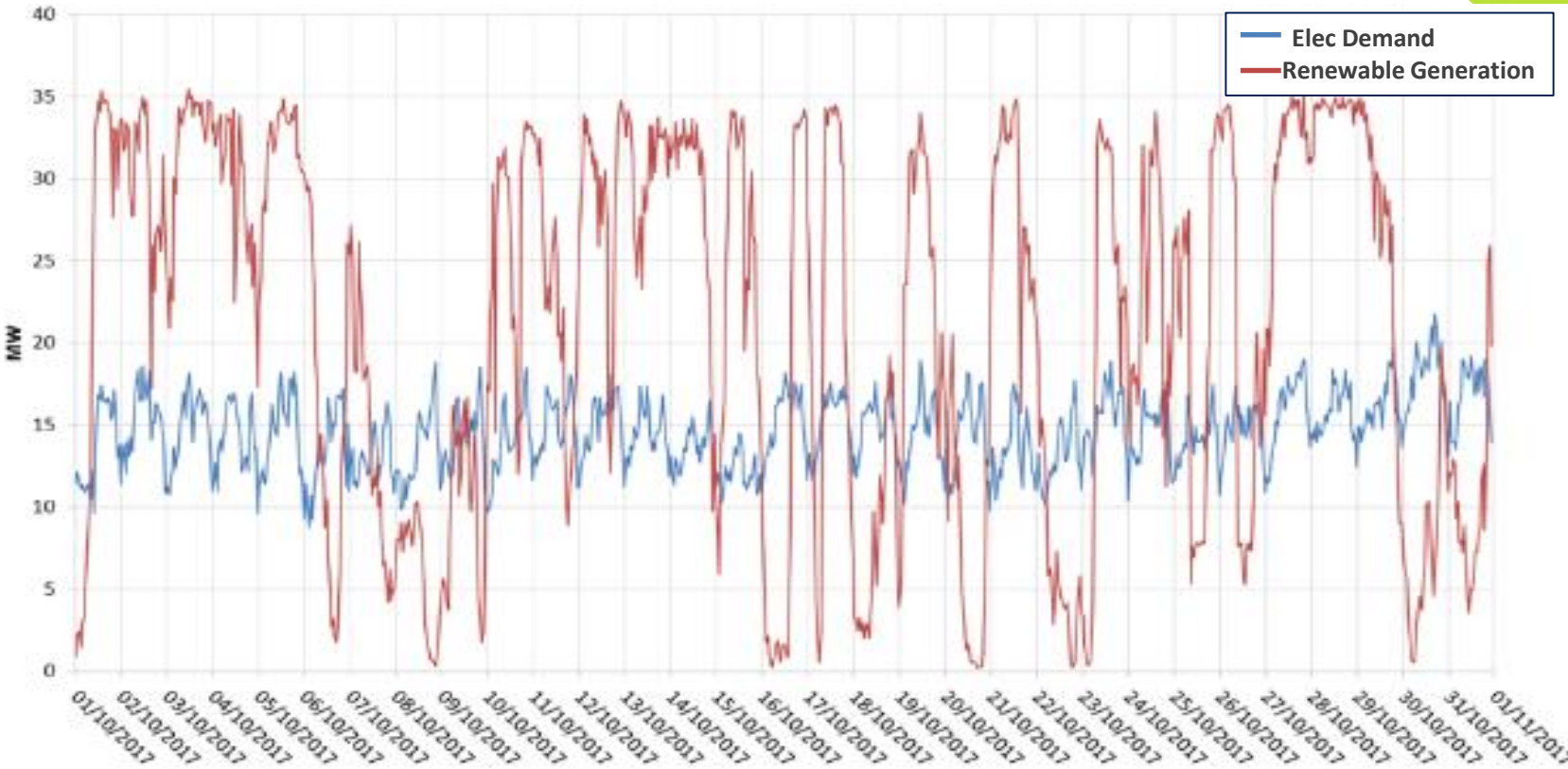
UK electricity system - today



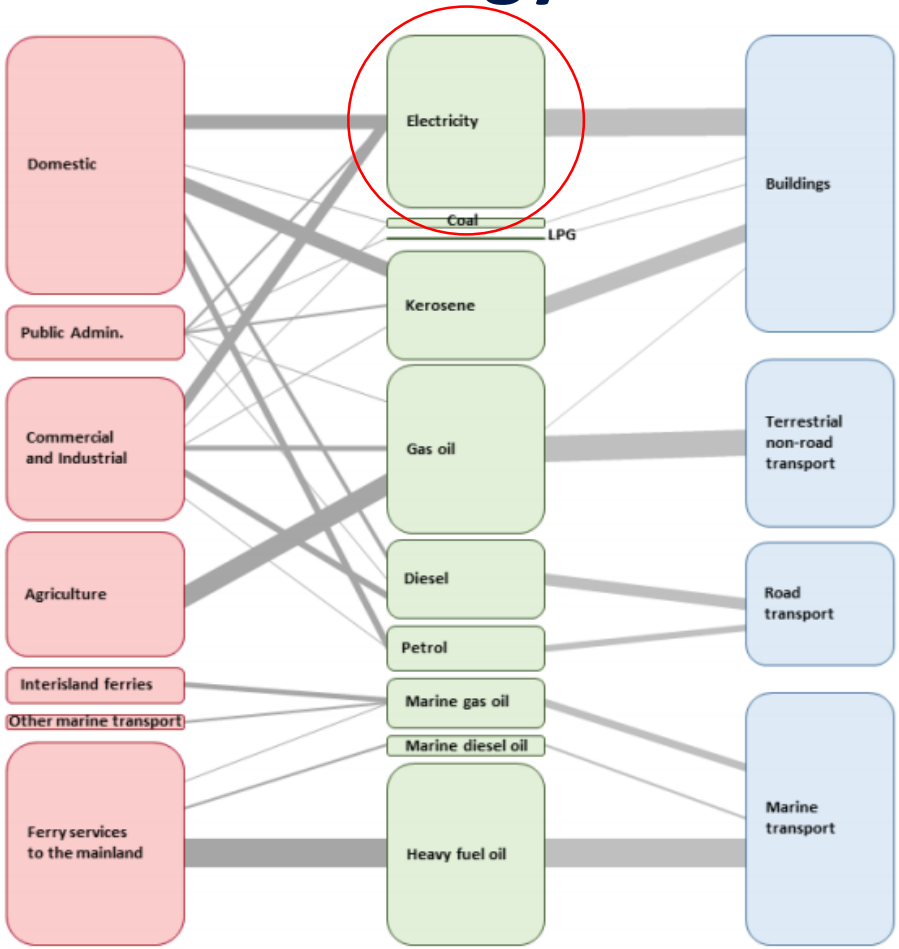
UK electricity system – 2040
(4x current renewables)



Orkney electricity system – today



How we use energy now



Source: OREF 2015 Energy Audit by Aquatera

Note: Excludes peat and air travel

ReFlex customer offer

Power

- Free battery install
- Affordable 100%-renewable local tariff
- Local customer support
- **500+ domestic batteries**
- **20 commercial batteries**
- **1 MW scale industrial battery**

Transport

- Affordable EV leasing
- Try before you buy & no deposit
- Free charging miles through ReFlex tariff
- **500+ EVs**
- **50 new mobility solutions**
- **5 HGEVs**

Heat

- Financed heat pump offer
- Flexible storage heating control
- Affordable renewable heating
- **300+ flexible heating systems (storage heating + heat pumps)**
- **1 hydrogen CHP system**

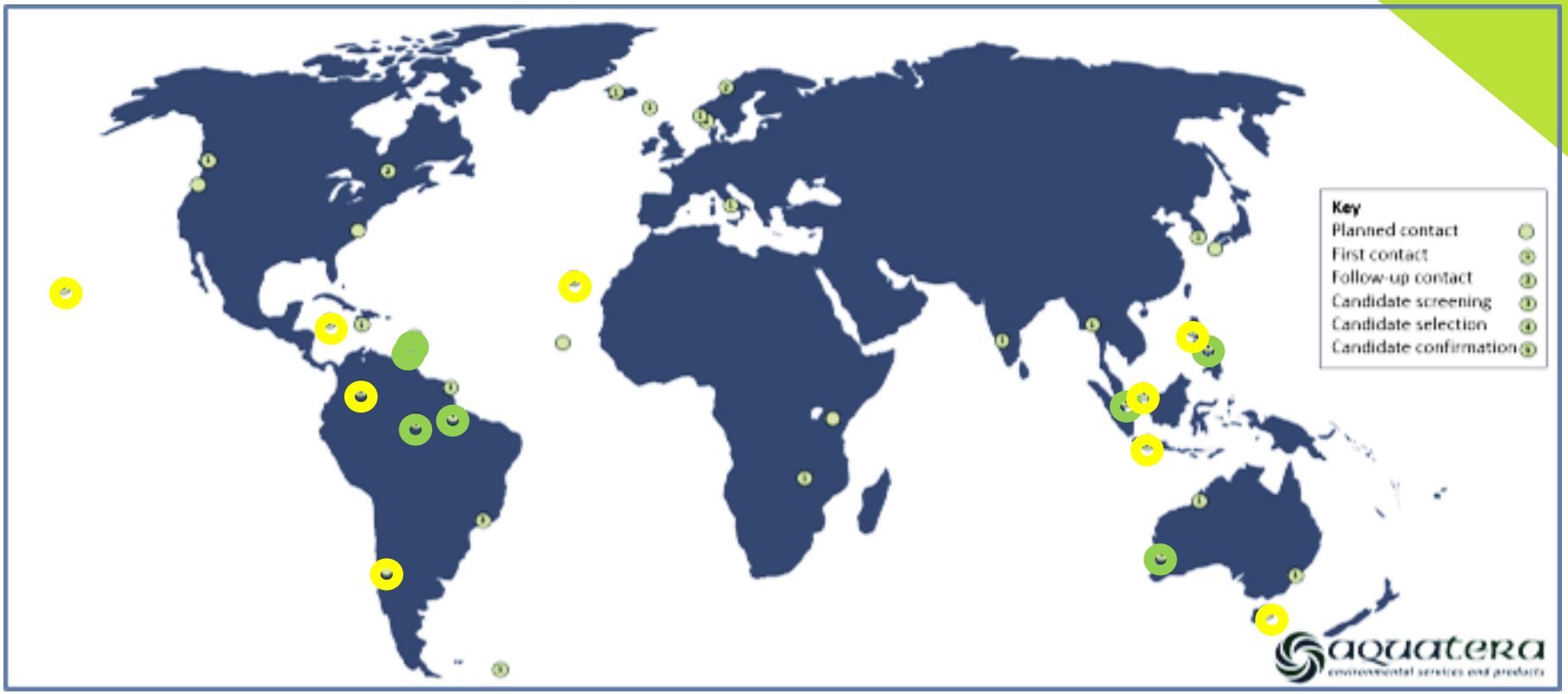
National replication

Key

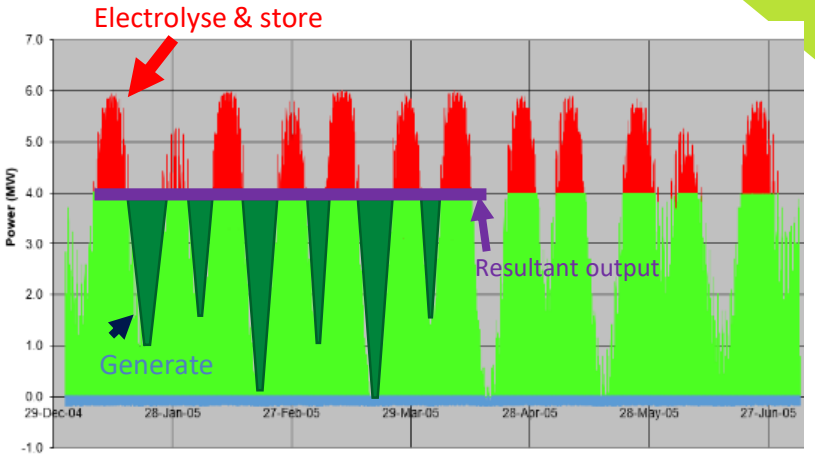
- Planned contact
- First contact (1)
- Follow-up contact (2)
- Candidate screening (3)
- Candidate selection (4)
- Candidate confirmation (5)

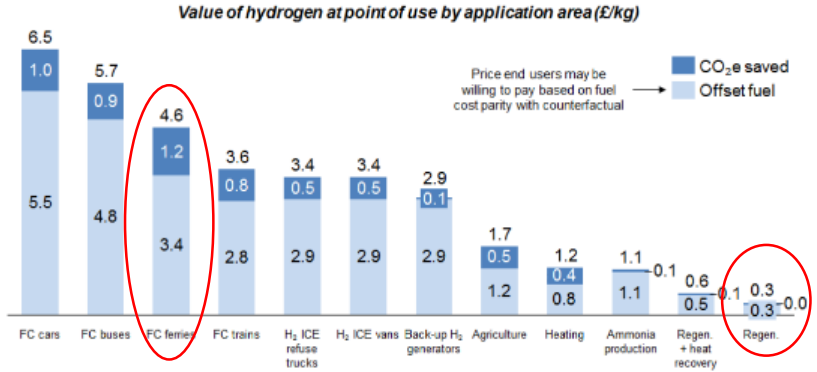
aquatera
environmental services and products

International replication



Locality shapes solutions





Source: Xodus/Element Energy study, 2016

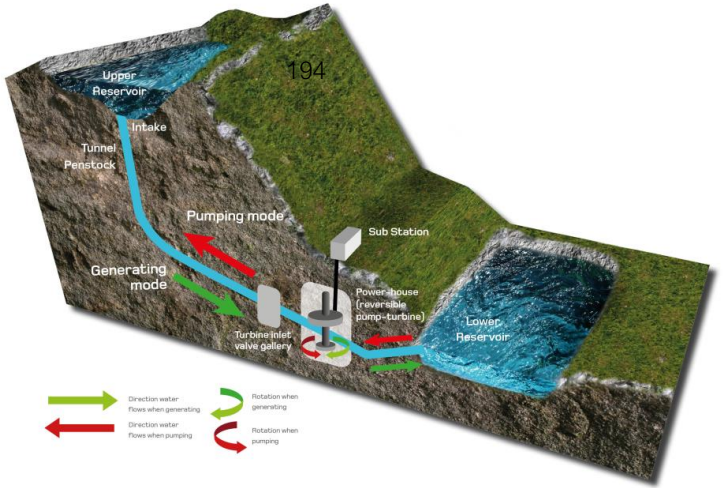
Innovation opens doors

Mark Wilson

Chief Executive Officer

Intelligent Land Investments Group Plc

Pumped Storage Hydro – enabling the energy transition



Mark Wilson

CEO

Presenting to

Scottish Renewables Annual Conference

September 2020

The need for flexible electricity storage

- Recent performance of electricity systems under Covid with lower demand, higher renewables and limited long duration storage has given us a glimpse of the future.
- In the UK, this has resulted in high balancing costs; in the US, rolling blackouts.

Los Angeles Times

August 2020: In their first public comments since the blackouts began Friday evening, officials at the California Independent System Operator described a “perfect storm” of conditions that caused demand to exceed available supply: scorching temperatures in California and across the western United States, diminished output from renewable sources and fossil-fueled power plants affected by the weather, and in some cases plants going offline unexpectedly when electricity was needed most.

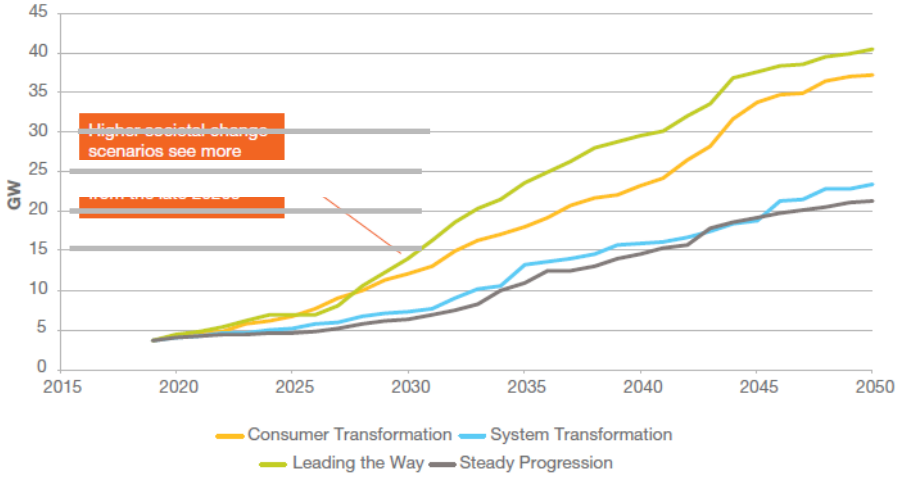
ofgem
Making a positive difference for energy consumers

Review of high balancing costs during spring and summer 2020

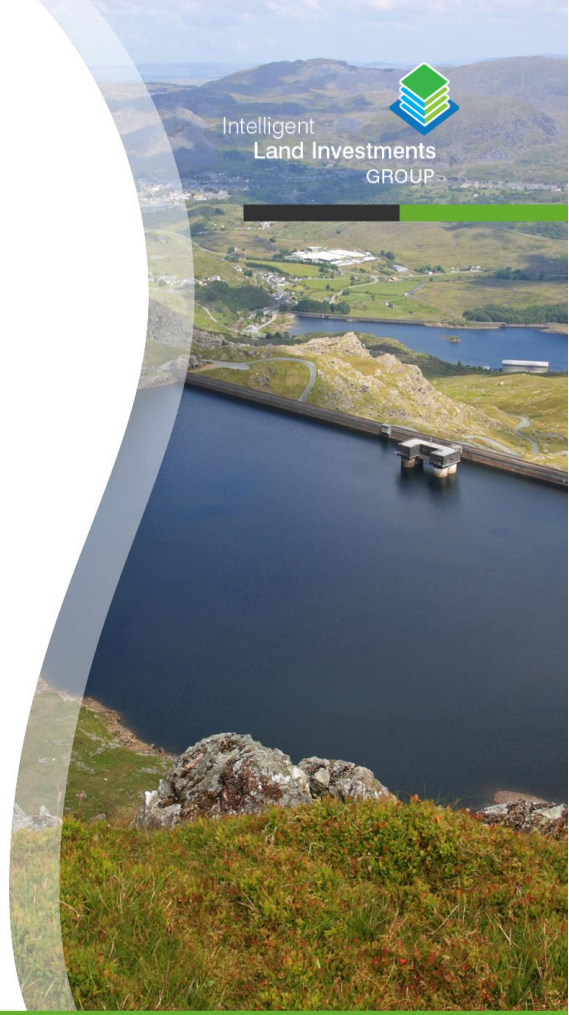
August 2020: The GB electricity system has seen an increase in balancing costs this spring and summer 2020, coinciding with the onset of the COVID-19 pandemic. Specifically, the period from March to July 2020 has seen balancing costs of £718 million, which is 39% higher than the ESO expected costs would look like in this period. These costs increased at the same time as nationwide lockdowns changed consumer electricity consumption behaviour and reduced industrial activity. Moreover, some of this period saw high level of renewables output, which required the ESO to take a large number of actions to balance the system and ensure system operability.

The need for flexible electricity storage

- The recent 2020 Future Energy Scenarios identify the need for rapid growth in storage, from some 4GW today to over 40GW by 2050
- About 4GW of additional Pumped Storage Hydro (PSH) capacity is in the UK planning and development pipeline (ILI has around 2GW of projects underway).

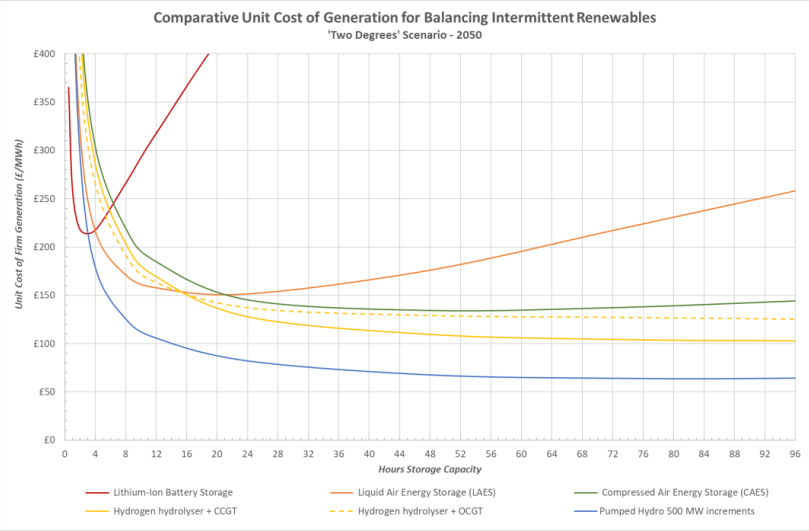


The ‘Leading the Way’ scenario has the highest renewable energy growth.



Why Pumped Storage Hydro?

- Proven technology - 95% of the world's grid scale electricity storage is provided by PSH
- PSH is large scale, long duration storage which provides flexibility to enable renewables
- Recent analysis by Jacobs shows that PSH has the lowest unit cost of all longer duration storage technologies



Benefits

- PSH will enable NetZero and rapid growth of renewables by providing flexibility and system balancing services.
- Savings – Carbon Trust/Imperial report estimates annual savings from storage of up to £2.4 billion, or £100 per consumer per year.
- It will provide long-term energy security for the UK and reduce reliance on interconnectors.
- Jobs - 70% of PSH Capex is construction. Several hundred jobs created. Money stays in the UK economy

Intelligent Land Investments GROUP

Addressing barriers to pumped storage development

PSH developments need certainty about future revenues to secure lower cost financing

- Merchant PSH projects can access revenues from wholesale electricity, balancing services and capacity markets.
- But wholesale and balancing markets do not provide longer price term signals or revenue certainty needed for large scale new infrastructure.

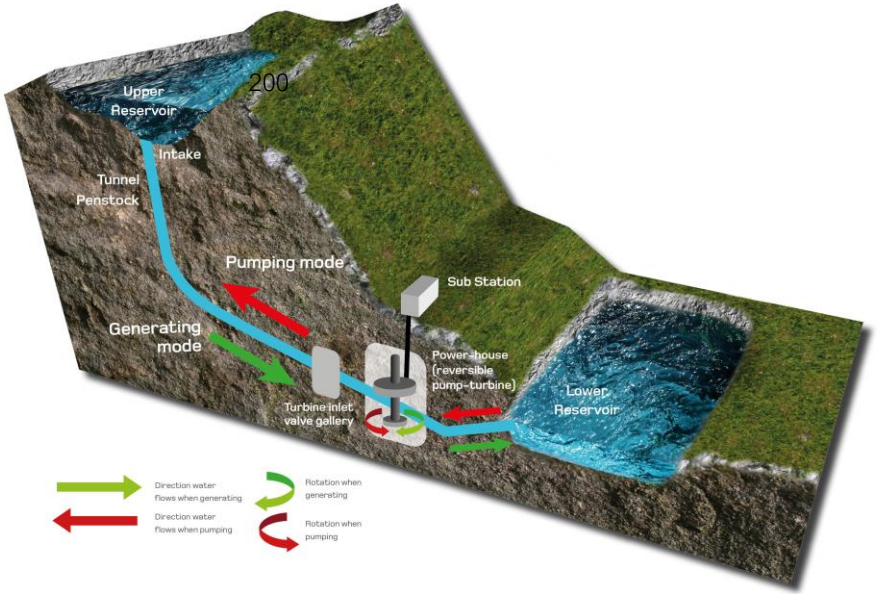
Policy reform will be needed, but not direct subsidies

- Revenue certainty could be provided through a Regulated Asset Base or a Contract for Difference (CfD). But PSH is different to renewable CfD's in that it imports and exports, and also provides a range of system services.
- For interconnector projects, a cap and floor revenue model is available. This could be similarly applied to long term storage projects like PSH.

What next?

- Covid and low electricity demand is giving us a **glimpse into the future**, where electricity production is dominated by renewables:
  - Carbon emissions from electricity have fallen to record low, but
  - Balancing costs have increased significantly, and security of supply is at greater risk.
- Additional **flexible pumped storage** generation would have allowed more renewable generation to run, reduced the costs of balancing, and enhanced security of supply.
- There is strong evidence to show that **more storage is needed**, and that PSH can deliver the lowest cost, large scale, long-duration storage.
- But **policy reform is needed** to give confidence to investors in these high capital cost projects. Extending the interconnector cap and floor regulation to long duration storage would be a great start.
- As well as decarbonisation, security of supply, and cost benefits, PSH construction projects can provide a well-needed **economic boost** to help recover from Covid.

Thank you



Mark Wilson

CEO

Intelligent Land Investments Group Plc

The Shires, 33 Bothwell Rd, Hamilton, ML3 OAS

t : 01698 891 352

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Neil Collar

Partner/ Head of Planning Law

Brodies LLP

Alasdair Sutherland

Partner

Burness Paull

3 SEPTEMBER 2020

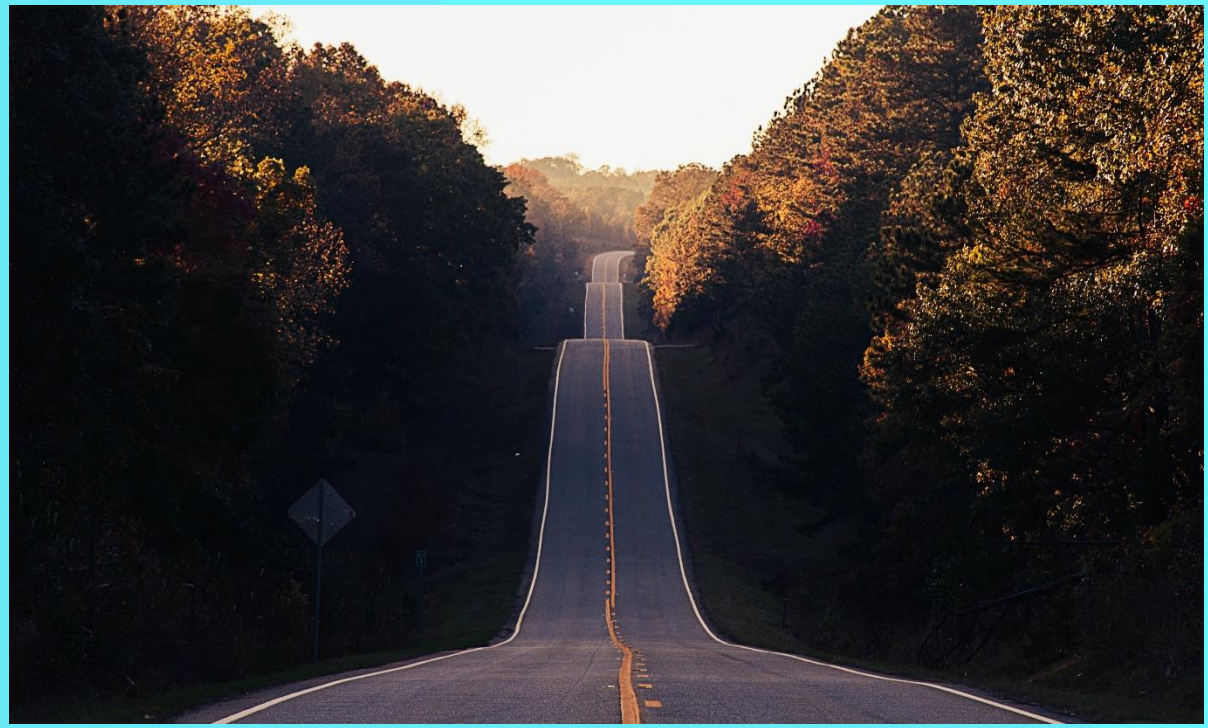
Burness Paull

Planning for Net Zero: A Step Change to tackle Climate Change

ALASDAIR SUTHERLAND – PARTNER, BURNESS PAULL LLP

E-mail: Alasdair.Sutherland@burnesspaull.com

The journey towards a ‘step change’…



Where are we on the journey?

- Climate Change Legislation
  - *Legal commitment to net zero*

- Planning Act
  - *Purpose of planning*
  - *NPF4*
    - STATEMENT ON CONTRIBUTION TO CLIMATE CHANGE TARGETS
    - INCORPORATE SCOTTISH PLANNING POLICY
    - PART OF THE DEVELOPMENT PLAN

- NPF4 Call for Ideas.

The Impact of Covid-19

The Impact of Covid-19

- Positives & Negatives
  - *Delay to NPF4*
  - *Green recovery*
  - *'Can do' culture*
- What can we learn?
  - *What radical response to an emergency looks like*
  - *The importance of leadership (and resource)*

Burness Paull

Signs of a ‘step change’?...

What next?

Mary Fisher

Associate Director – Landscape & EIA

Stephenson Halliday

STEPHENSON HALLIDAY

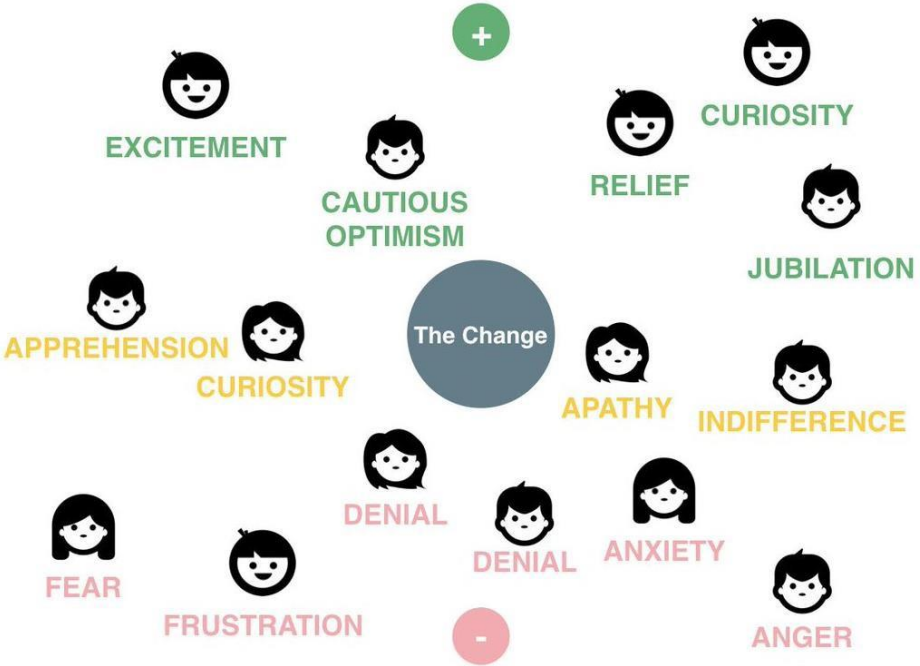
Planning, Landscape & Environment

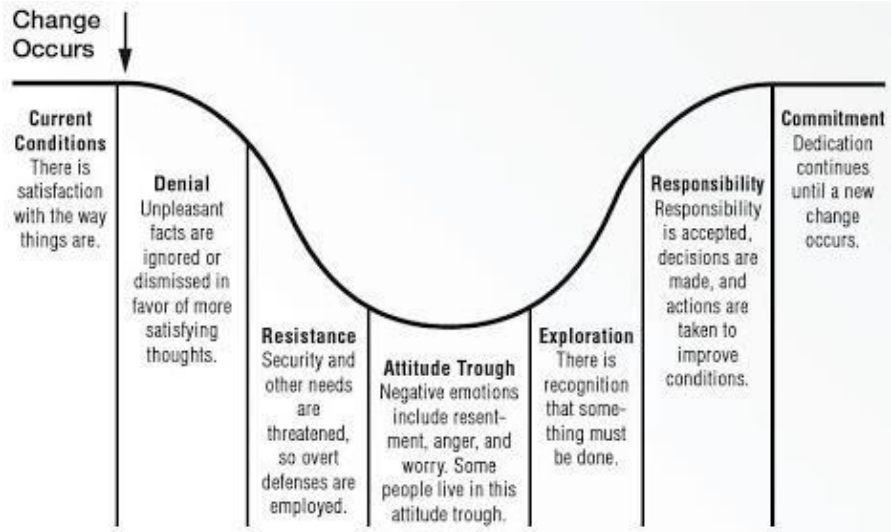
Planning for Net Zero: A Step Change to tackle Climate Change

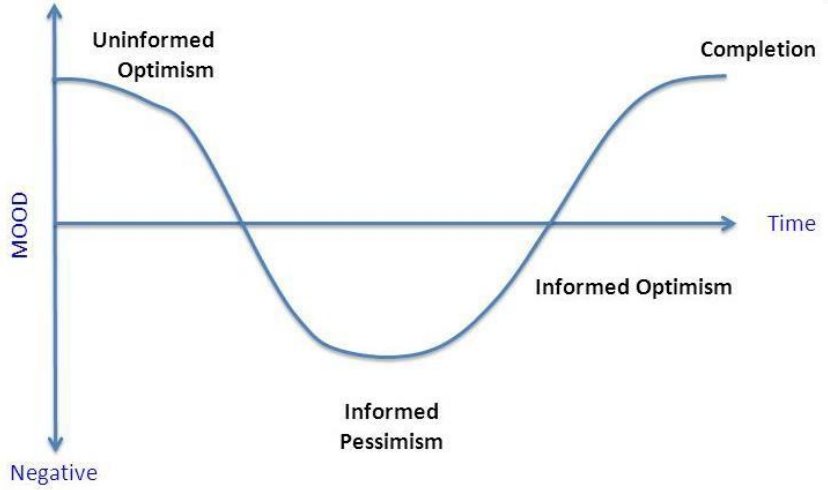
Landscape

A Changing Landscape

People and Change



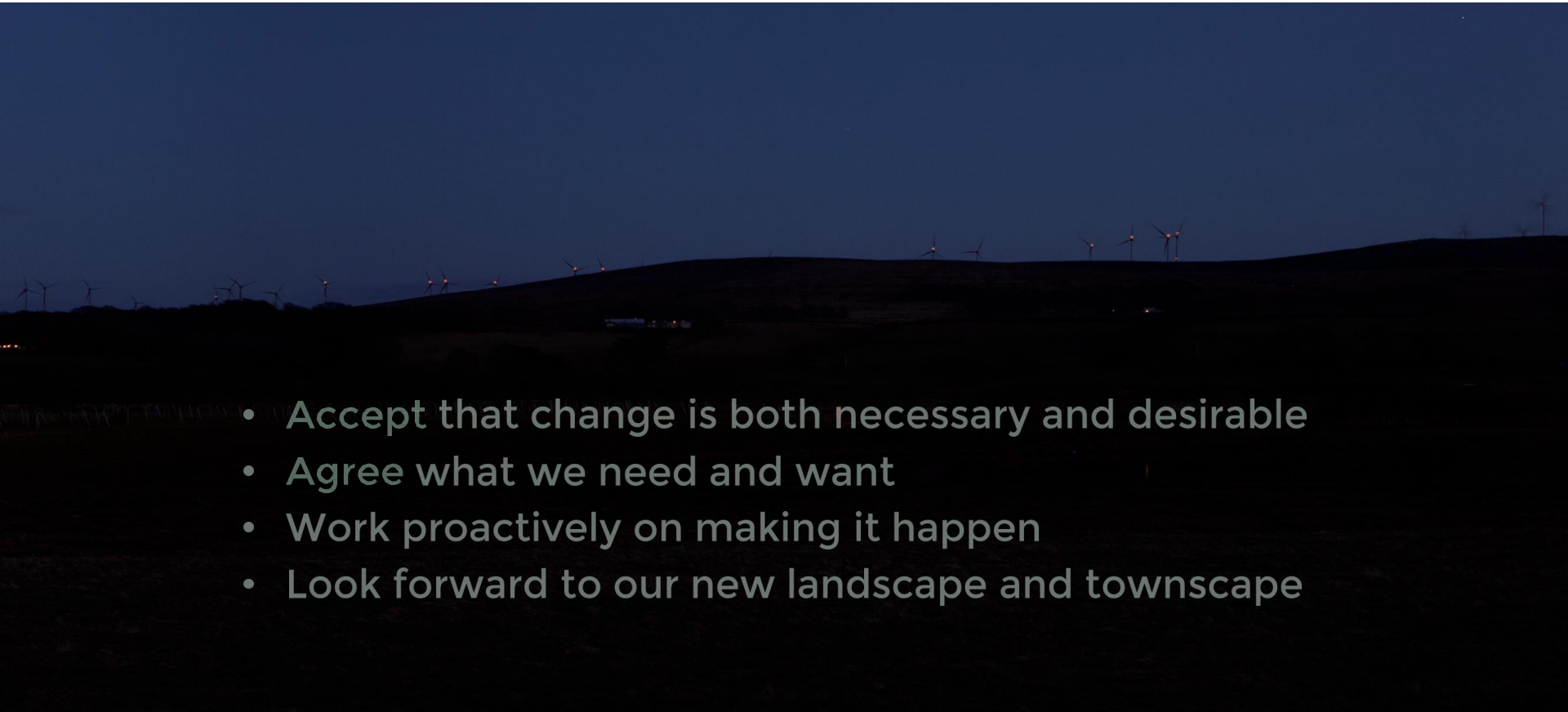




Natural or man-made?

- Landscape is a human concept
- We accept older ‘intrusions’ (towns, roads, railways, enclosure) as part of our landscape
- Beauty is in the eye of the beholder
- We shape our world through action and inaction

A new conversation



- Accept that change is both necessary and desirable
- Agree what we need and want
- Work proactively on making it happen
- Look forward to our new landscape and townscape

Ragne Low

Head of Heat Planning and Delivery
Scottish Government

Local Heat and Energy Efficiency Strategies

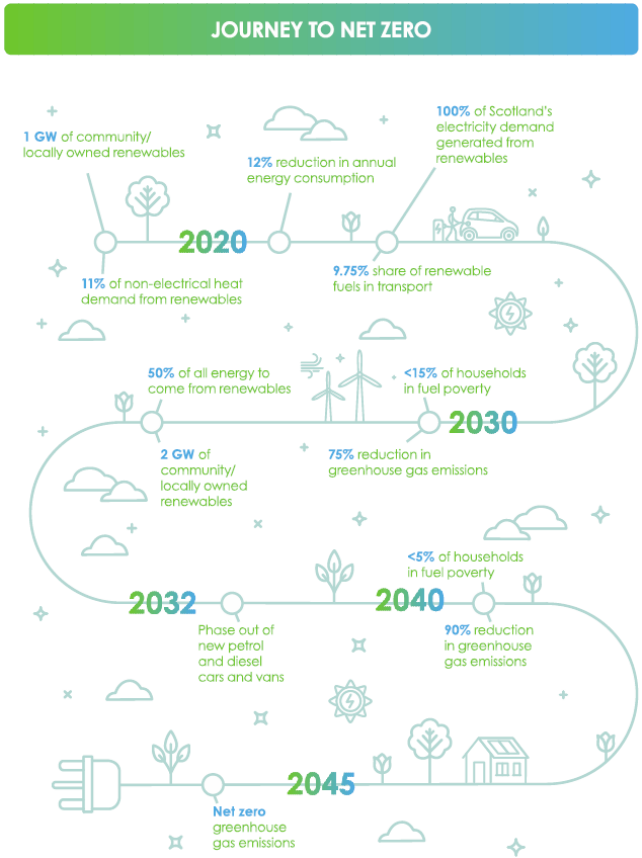
Ragne Low
Scottish Government

3 September 2020

Scottish Government
Riaghaltas na h-Alba
gov.scot

High-level objectives

- Energy efficiency is a **National Infrastructure Priority**
- The Climate Change (Scotland) Act 2019 requires a 75% reduction in greenhouse gas emissions by 2030 and **net zero by 2045**
- **Fuel Poverty** (Scotland) Act 2019: "*in the year 2040, no more than 5% of households in Scotland are in fuel poverty.*"
- **Energy Strategy** target: 50% of demand met from renewables by 2030



Context

Building on 2017 consultation and LHEES Pilot Programme with local authorities:

- The function of LHEES will be to define and drive action on heat decarbonisation and energy efficiency improvement at local level

LHEES will do this by:

- undertaking an assessment of different pathways towards decarbonising the building stock
- identifying the most suitable solution for local areas
- assessing energy efficiency needs at a local level

Proposed LHEES structure

In order to do the above, we envisage a two-part structure for LHEES.

Strategies will:

- identify the changes needed for heat in buildings over the next 15-20 years, based on an assessment of the building stock
- take into account local and national factors, such as the timing of planned infrastructure upgrades, access to resources, major projects, decisions over the gas grid, community engagement.
- reflect local priorities, policies and wider strategies

Delivery Plans will:

- clarify roles and responsibilities in delivering the strategies
- build on existing plans and policies, such as HEEPS:ABS Plans, as far as possible.
- coordinate across local partners and provide a mechanism for identifying new delivery actions

Piloting LHEES

LHEES phase 1 pilots

- 12 local authorities
- Completed March 2019
- Evaluation reports September 2019

LHEES phase 2 pilots

- 11 local authorities
- Completed January 2020

Phase 3 - ongoing

Angus Council

Comhairle nan Eilean Siar

East Ayrshire Council
Comhairle Siorrachd Àir an Ear

East Dunbartonshire Council

East Renfrewshire Council

the Moray Council

North Ayrshire Council

South Ayrshire Council

West Dunbartonshire Council

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What's Next?

- Putting Local Heat & Energy Efficiency Strategies on a statutory footing
- Engaging with wider local energy planning initiatives
- Evaluating and learning from the full Pilot Programme
- Developing the methodology for LHEES – a step by step guide

Eleri Davies

Head of Consents UK – Onshore Wind

RWE Renewables

Planning for Net Zero: A Step Change to tackle Climate Change

Eleri Davies

Head of Consents UK (Onshore Wind)

3rd September 2020

Context

Two-thirds of Britons favour new onshore wind power

Nicola Sturgeon declares 'climate emergency' at SNP conference

28 April 2019

SNP Conference

The Drone Hill Wind Farm in the Scottish Borders.

Onshore wind has hit its "highest ever" level of public support, a

Committee on Climate Change

Independent advice to governmen
preparing for climate change

Home | About | News & insights | Publications | The climate chal

Home > News stories > New ambitious actions needed for a Net Zero Scotland

New ambitious actions needed for a Net Zero Scotland

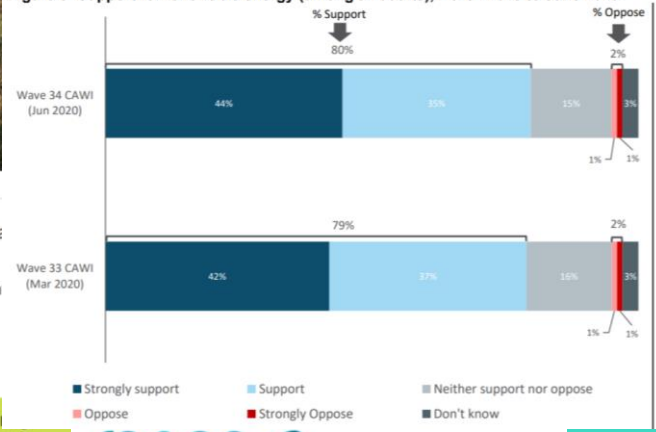
17 December 2019

Scotland must match the ambition of its world-leading Net Zero 2045 target
decisive action to strengthen climate change policy in all parts of the econo
Decisions over the next 12 months are likely to determine the direction of th
next 25 years.

Renewables

In June 2020, 80% of the public expressed support for renewable energy, with 44% strongly supporting it. Only 2% said they opposed renewable energy (Figure 5).

Figure 5: Support for renewable energy (among all adults), March 2020 to June 2020*



regen
transforming energy

Government to re-open Contracts for Difference for onshore wind and solar

Onshore Wind

Opportunity	Risk
Climate Emergency & 2045 Net Zero Targets	National planning policy: • delay to publication of NPF4 • consultation on the removal of the ‘presumption in favour’ • Scottish Government interim position

Onshore Wind

Opportunity	Risk
Contracts for Difference Round 4 Eligibility	Speed of decision-making • lack of certainty for developers on timescales

Onshore Wind

Opportunity	Risk
Technological advancements / taller tip heights	Landscape and visual impacts, including visible aviation lighting • Disproportionate weight in decision-making?

Claire Mack

Chief Executive

Scottish Renewables

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