Balancing centralised and decentralised powergen and storage to enable secure decarbonisation

UK Power Networks
Delivering your electricity

Sotiris Georgiopoulos – Head of Smart Grid Development

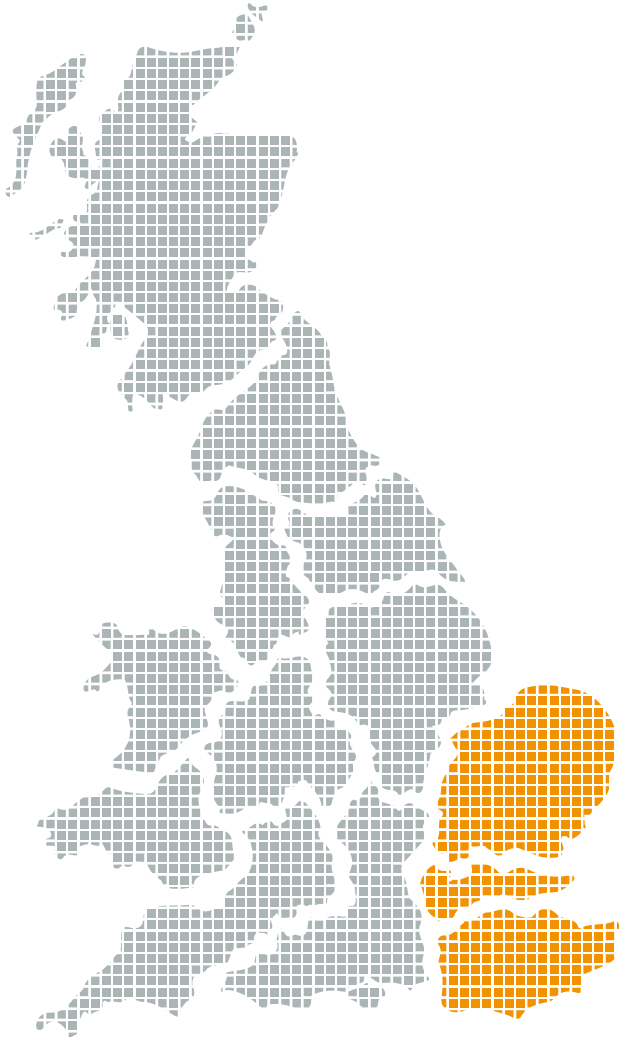
November 2021

INVESTORS IN PEOPLE™ We invest in people Platinum

NES NATIONAL EQUALITY STANDARD

THE UK'S 25 BEST BIG COMPANIES TO WORK FOR 2021

About UK Power Networks



8.3M homes and businesses

28% of UK total

180,000 connected EVs

36% of UK total

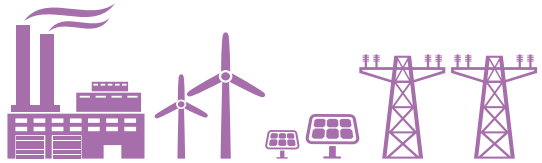
14GW Peak Demand

28% of UK total

9.8GW of Embedded Generation

UK Power Networks
Delivering your electricity

Key forces influencing our society and the future of our industry



- Distributed/Renewable Generation
- Energy Storage
- Local Energy

- Smart Meters and the connected home
- Micro generation / storage
- Electrification of heat and transport

Net Zero

- Legally binding targets by 2050
- Ban on the sale of petrol, diesel and hybrid cars by 2035
- 2025 New homes: low carbon heating
- Energy efficiency

Changing regulatory environment

- Market reflective returns
- Greater efficiency
- Managing uncertainty
- Greater focus on supporting customers in vulnerable circumstances
- The gas crisis

Digital revolution

- Digitalisation
- Internet of Things
- Connected homes
- Data : presumed open, standardised and visible

Evolving consumer expectations

- Affordability
- Vulnerability definition broadening
- Trust and purpose
- “Producers and consumers”

Covid-19

- Lives
- Livelihoods
- Re-imagining the “next normal” at work and in the home

Decarbonisation Journey

Growth in DG

- **9.8GW** of DG connected, doubled since 2011
- Over **170,000** distribution connected generators
- **8.8GW** of DG accepted to connect

Energy Storage

- 2.5GW accepted offers
- 320MW connected storage

Heat Electrification

- Heat counts for a third of total UK CO2 emissions
- 27,000 heat pumps across UKPN in 2021

EV Growth

- 180,000 electric vehicles on our networks

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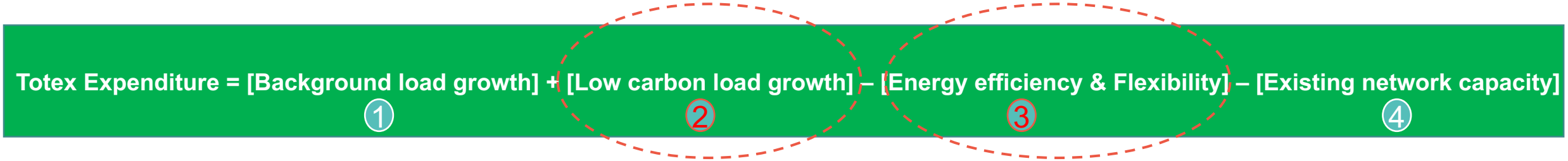
We are preparing for any possible scenario

Parameter	Steady Progression	System Transformation	Consumer Transformation	Leading the Way
Net-Zero by 2050?	No	Yes	Yes	Yes
Low-carbon gas grid?	No	Yes	No	Yes
Electric cars and vans in 2030	2.6 million	4.5 million	4.5 million	4 million[2]
Homes with heat pumps in 2030	320,000	445,000	712,000	1,245,000
Homes with solar panels in 2030	195,000	248,000	397,000	248,000
Battery capacity in 2030	1.3 GW	2.7 GW	4.8 GW	4.1 GW
Total renewable generation in 2030	6.1 GW	7.2 GW	8.1 GW	8.6 GW

UK Power Networks
Delivering your electricity

Adapting for the next phase of decarbonisation



We need to manage this uncertainty, whilst not losing sight of what is important:

- Avoid bring a barrier to low carbon connections
- Avoid unnecessary bill increases
- Maximise energy efficiency and flexibility potential
- Maintain public support with a just and fair transition

Transitioning our business to enable a smart, flexible energy system

Efficient deployment of capital – lowest cost to Net Zero

Undertake robust customer engagement	Collaborate beyond traditional silos to deliver joined up services for customers	Develop new markets and learn by doing	Embrace innovation, technology and data
-Strategic -Robust -Locally focused	-Whole electricity -Transport -Heat	-Co-design -MVP approach -Scale to value	-Faster -Cheaper -Greener
			
<u>Example:</u> Co-designing a local area framework	<u>Example:</u> Unlocking capacity in the South Coast collaborating with the ESO	<u>Example:</u> Developing LV flex products	<u>Example:</u> Advanced analytics to infer network utilisation

Thank you

Visit:
https://smartgrid.ukpowernetworks.co.uk/

Email:
sotiris.georgiopoulos@ukpowernetworks.co.uk

WEF: Annual UK Power & Networks review
– Strategic System transition Challenges

#EnergyTransition
#ETRI2021

23rd November 2021

THE ASSOCIATION FOR RENEWABLE ENERGY & CLEAN TECHNOLOGY

Renewable & Clean Tech Sector: value chain perspectives and opportunities

Dr Nina Skorupska CBE
@NinaSkorupska

About the REA

@reassociation

UK Gov said back in Dec 2020 *Build Back Better*

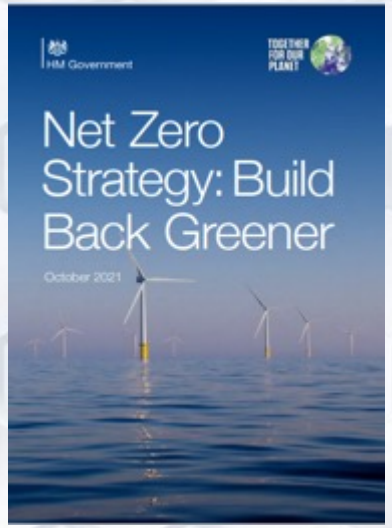
&

Nov 2021 Net Zero Strategy: *Build Back Greener*

Net Zero Strategy

- *building on the Energy White Paper & the 10 point plan (2020)*

- **40GW of Offshore Wind (1GW of floating offshore) by 2030**
- **5 GW of low carbon hydrogen by 2030**
- **Changes to how the Low Carbon power markets are supported (CfD)**
- **UK Emission Trading Scheme (UK ETS), started Jan 2021. Commitment to explore expansion to other areas of the economy.**
- **Governments 'Industrial Clusters Mission' - four low-carbon clusters by 2030 - Including carbon capture sector.**
- **Jet Zero and greener maritime: research for zero-emission planes and ships. As well as support to drive EVs.**
- **600,000 heat pumps/year by 2028.**
- **30,000 hectares of trees/ year.**

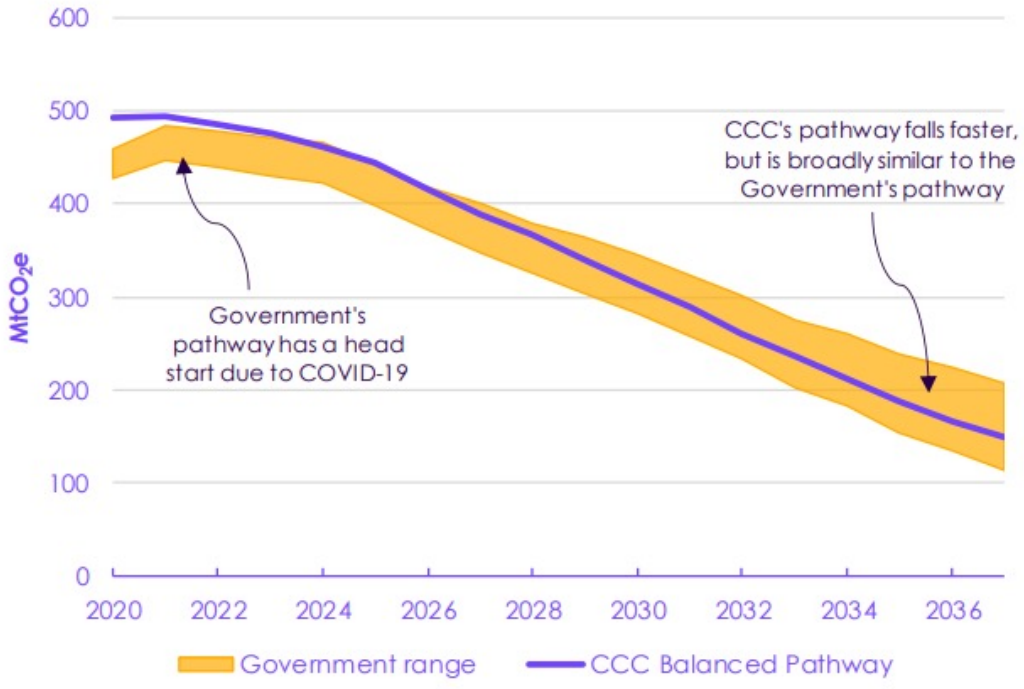


Net Zero Strategy - UK Electricity

*By 2035, all our electricity will need to come from low carbon sources, subject to security of supply, bringing forward the government's commitment to a **fully decarbonised power system** by 15 years, whilst meeting a 40-60% increase in demand.*

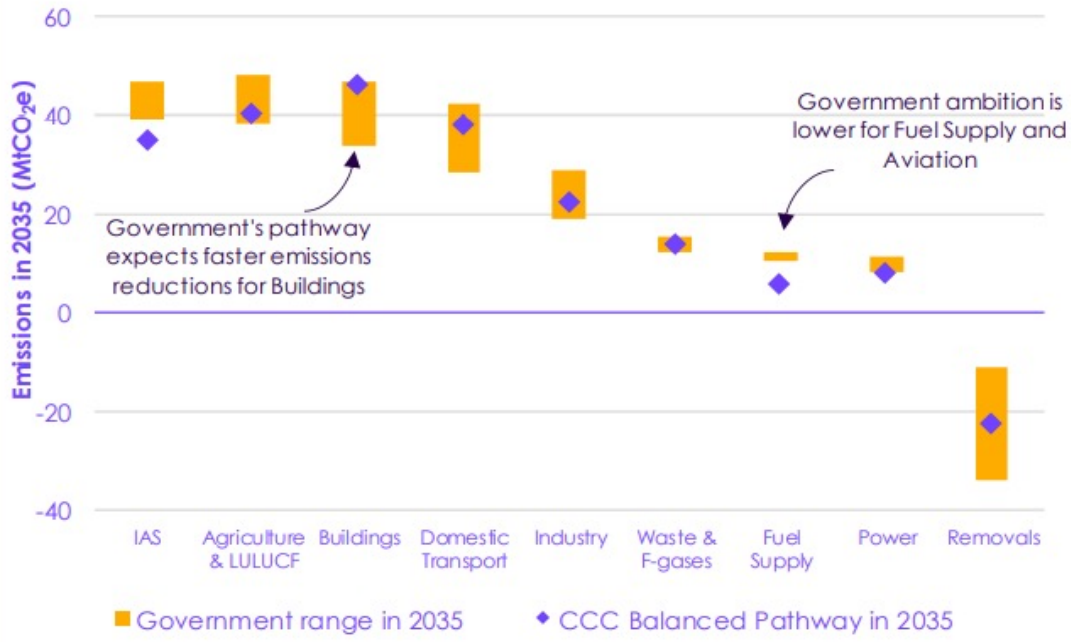
@reassociation

Figure 1 Overall ambition compared to the CCC Balanced Pathway (2020-2037)



Source: Net Zero Strategy (NZS); CCC analysis.
Note: The Balanced Pathway was the CCC scenario on which the Sixth Carbon Budget and the UK's NDC were based. 'Government range' refers to the Net Zero Strategy's Delivery Pathway.

Figure 2 Sectoral ambition compared to the CCC Balanced Pathway (2035)

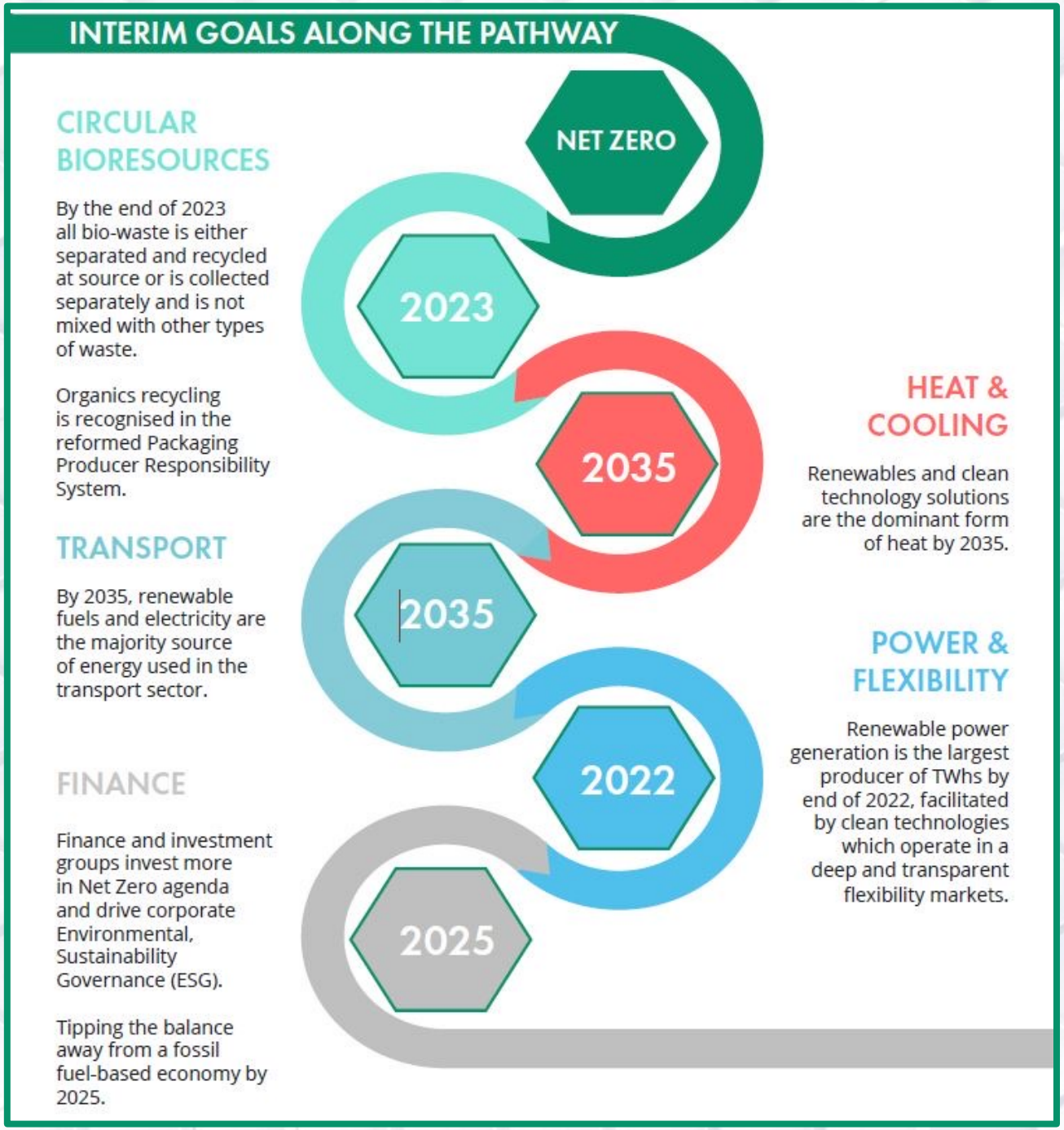


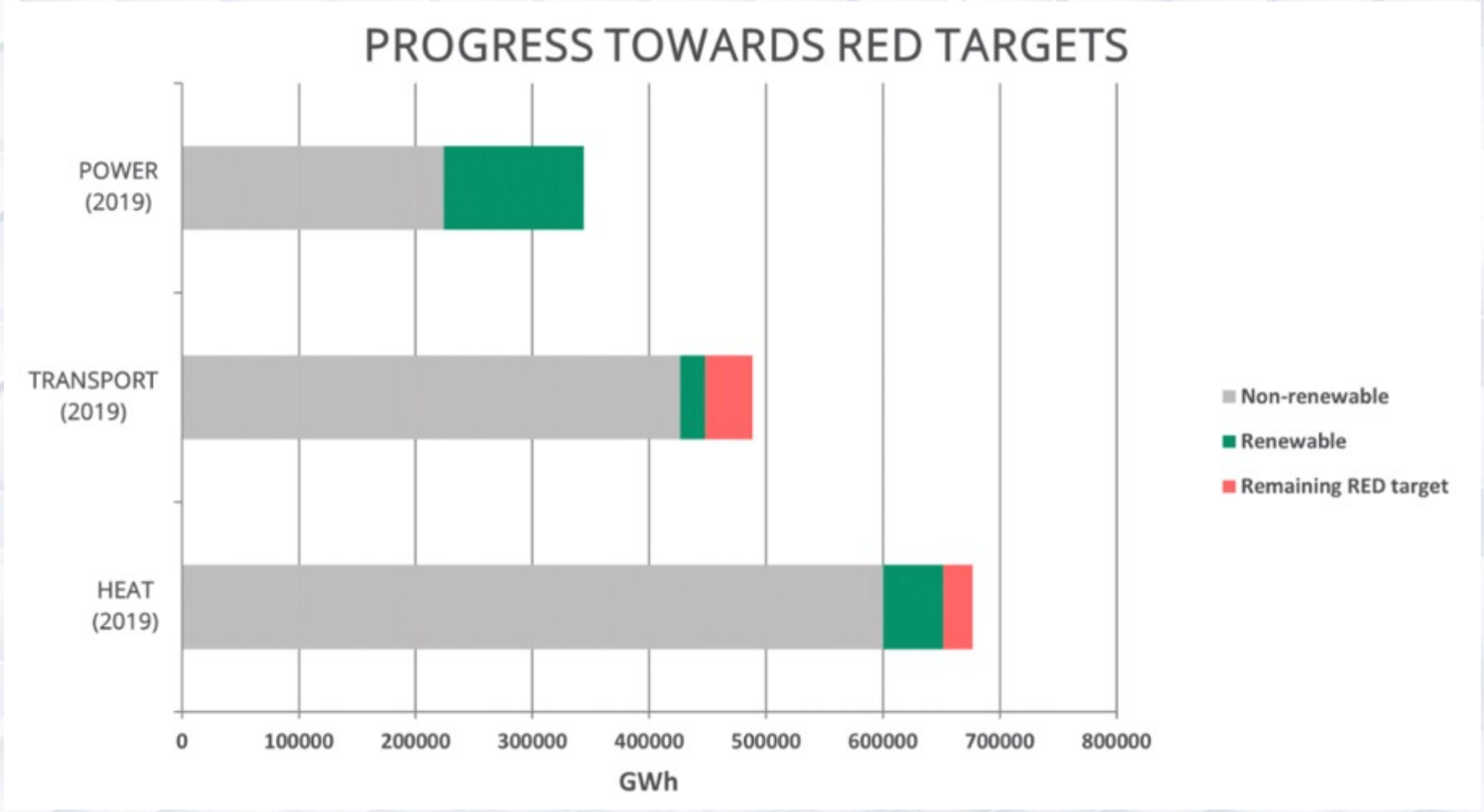
Source: Net Zero Strategy (NZS); CCC analysis.
Note: IAS = international aviation and shipping. CCC's sectoral pathways are translated to be comparable with the NZS's sector classification. 'Government range' refers to the Net Zero Strategy's Delivery Pathway. Fuel supply covers oil and gas production and processing, coal mining, leakage from the gas grid, and hydrogen production.

Transitioning to a Net-Zero Future

REA Strategy

@reassociation





REVIEW21
RENEWABLE ENERGY VIEW

octopus energy

REA

[REview-2021-.pdf (r-e-a.net)]

Power & Flexibility

Power & Flexibility - key findings:

- Progress of decarbonisation of energy in the UK continues to be driven by the power sector. In 2019, the power sector saw 34.85% of its energy come from renewable sources, up from 31.07% in 2018;
- Wind energy accounts for 53% of generation within the renewable power sector;
- A range of other technologies are making significant contributions, such as energy from waste and biomass power;
- Solar PV produces more than 10% - however, growth is slowing and, along with solar thermal, was the only technology which saw a dip in employment.

REVIEW21
RENEWABLE ENERGY VIEW

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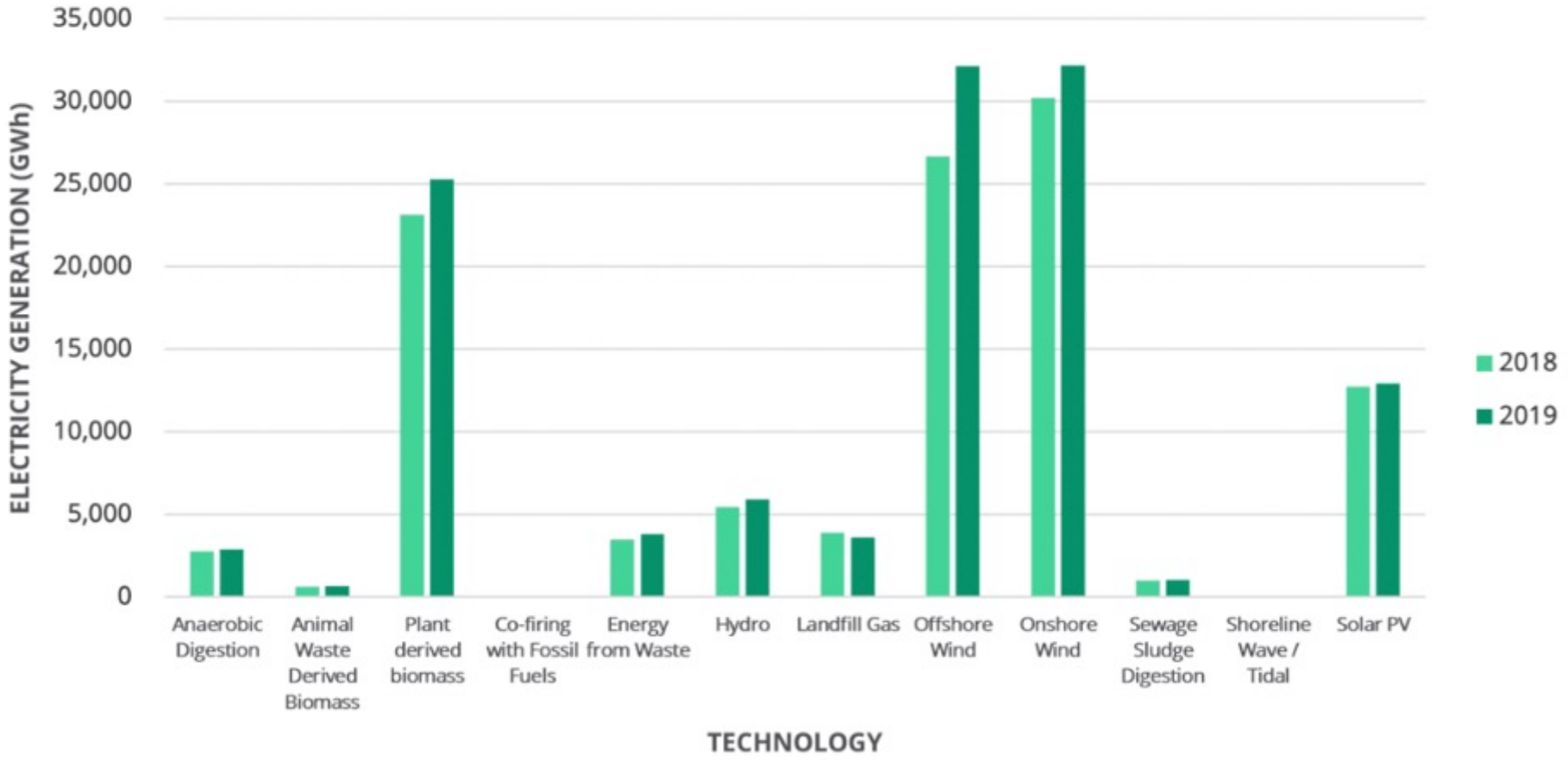
POWER GENERATION BY TECHNOLOGY, 2018 VS 2019



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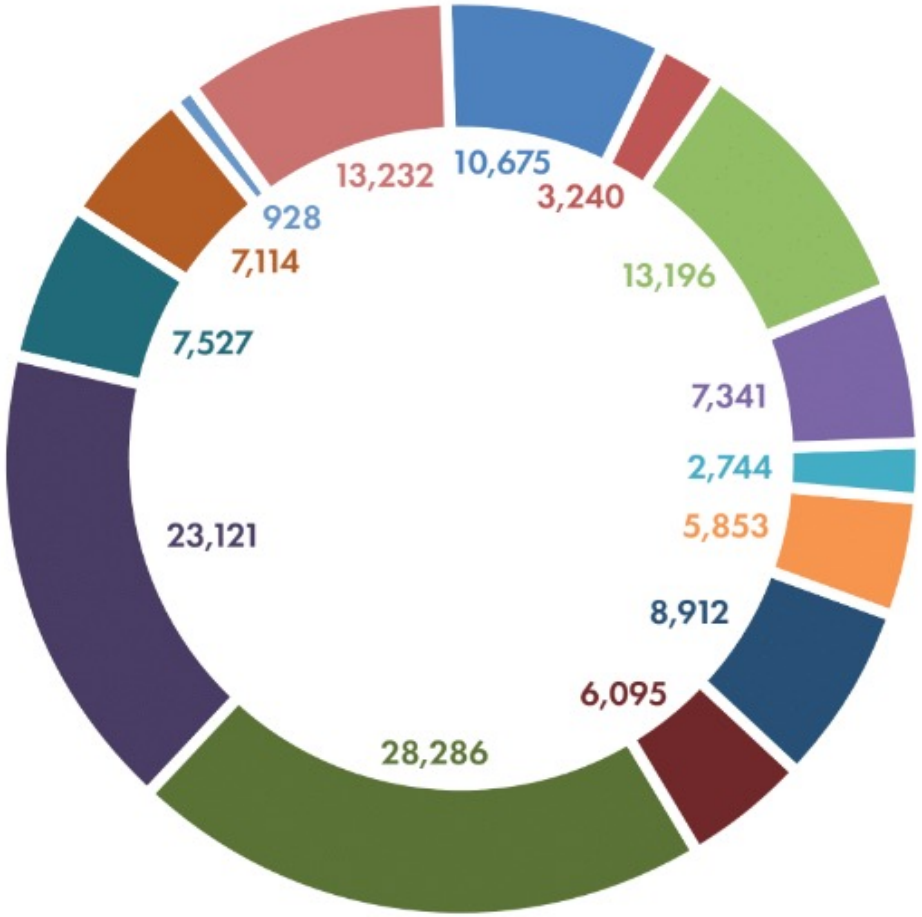
EMPLOYMENT IN 2019/20 BY SECTOR



- Air & Ground Source Heat Pumps
- Anerobic Digestion
- Biofuels
- Biomass Boilers
- Biomass
- Biomass Dedicated Power
- Energy from Waste
- Hydra
- Offshore Wind
- Onshore Wind
- Solar PV
- Solar Thermal
- Wave & Tidal
- Production of biomass including wood for fuel

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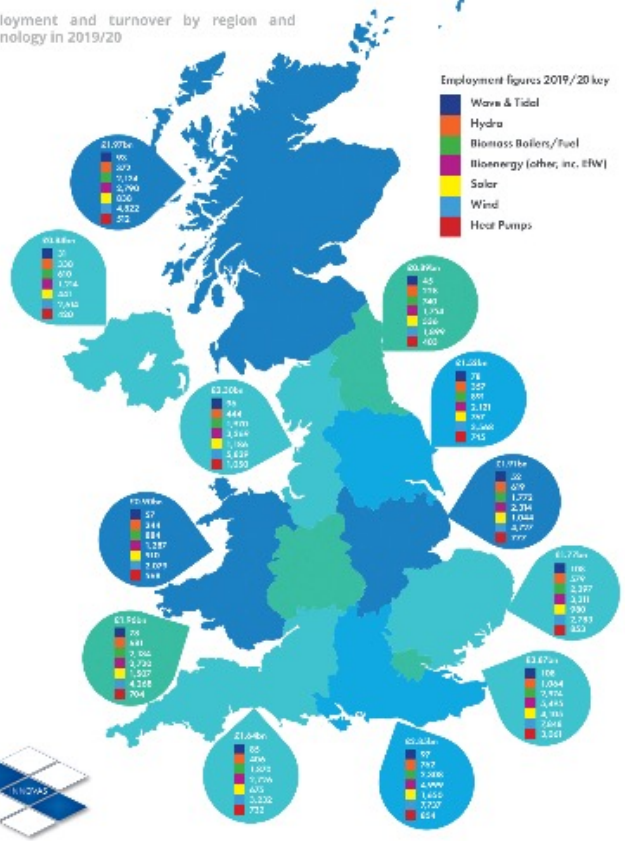
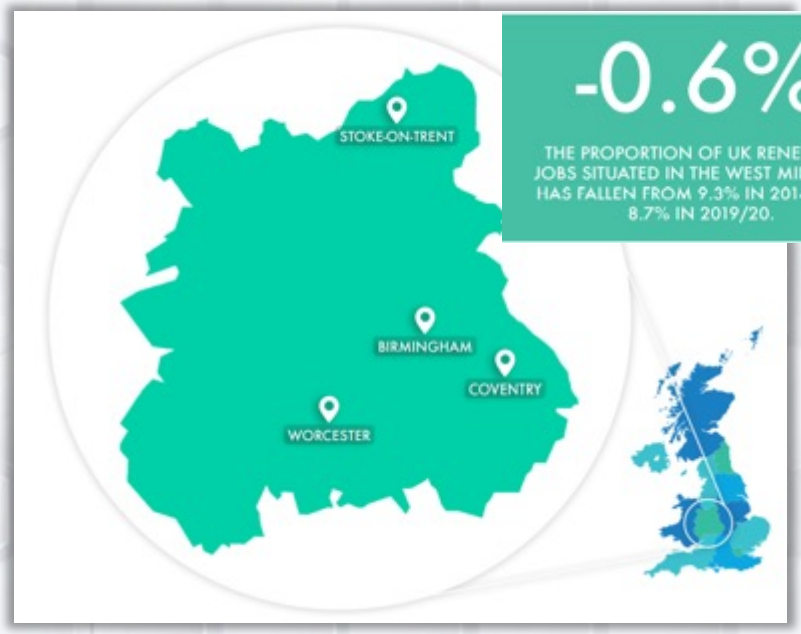
Made in Britain 2019/20

Renewable Energy & Clean Tech Jobs

Employment and turnover by region and technology in 2019/20





-0.6%

THE PROPORTION OF UK RENEWABLE JOBS SITUATED IN THE WEST MIDLANDS HAS FALLEN FROM 9.3% IN 2014/15 TO 8.7% IN 2019/20.

In 2019, the West Midlands renewable energy sector employed 12,092 FTEs. The REA projects that this could rise to 29,110 FTEs by 2035, an increase of 17,018.

WEST MIDLANDS 2035

EAST MIDLANDS 2035

In 2019, the East Midlands renewable energy sector employed 11,306 FTEs. The REA projects that this could rise to 27,217 FTEs by 2035, an increase of 15,912.

41.8%

OF EMPLOYMENT IN THE EAST MIDLANDS RENEWABLE ENERGY SECOR COMES FROM WIND ENERGY, COMPARED TO 37.2% IN THE UK AS A WHOLE.

REVIEW21

RENEWABLE ENERGY VIEW

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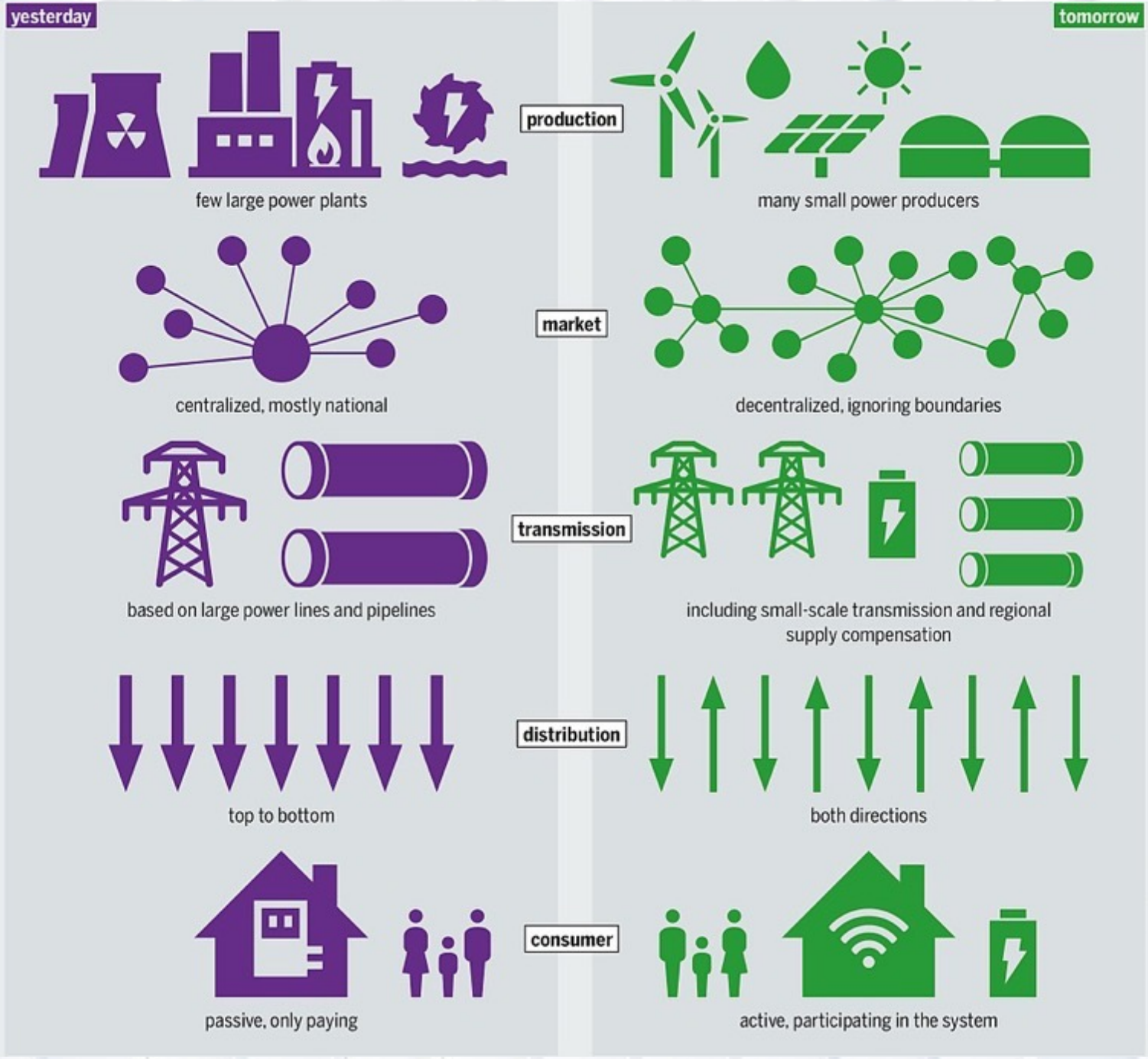
We have a *different* view today of how our power system must work in the future



- **Enabling net-zero**
- **Reduce energy waste and electricity cost**
- **Promote energy security**

"Flexibility is the key to stability"

- John Wooden

Energy Atlas: Graphics and license terms | Heinrich Böll Stiftung (boell.de)

Dr Nina Skorupska CBE

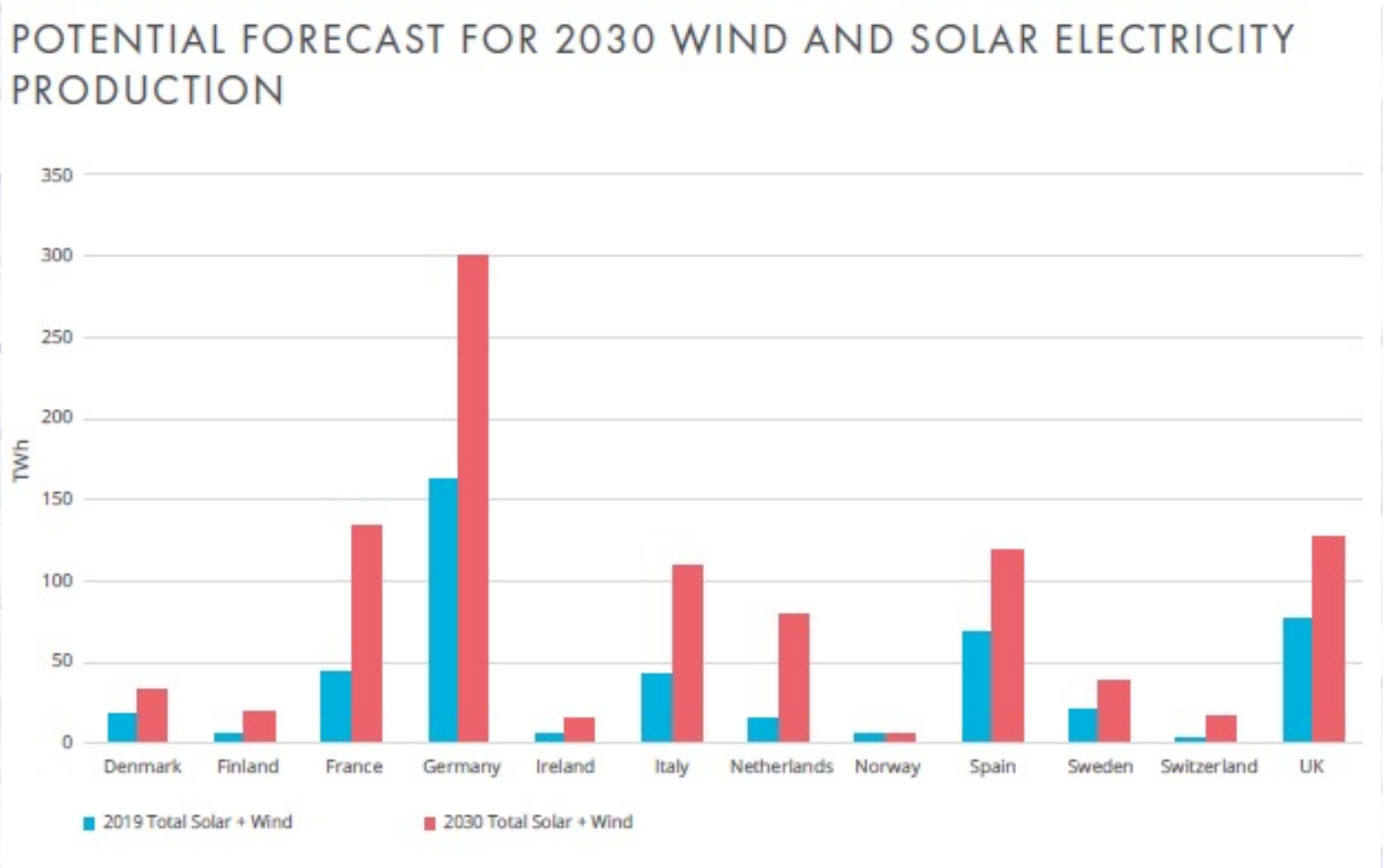
REA's work on flexibility

Each of the countries in our report has set emission reductions targets for 2030, together with associated targets for renewable electricity.

It is widely acknowledged that most of the new renewable resources will be *variable* wind and solar, which in turn will drive an increased need for flexible and dispatchable electricity resources to enable decarbonisation and security of supply.

Dr Nina Skorupska CBE

The 2030 decarbonisation challenge



If emission reductions targets for 2030 are met in the main by variable wind and solar *then* this will drive increased need for additional flexible electricity resources.

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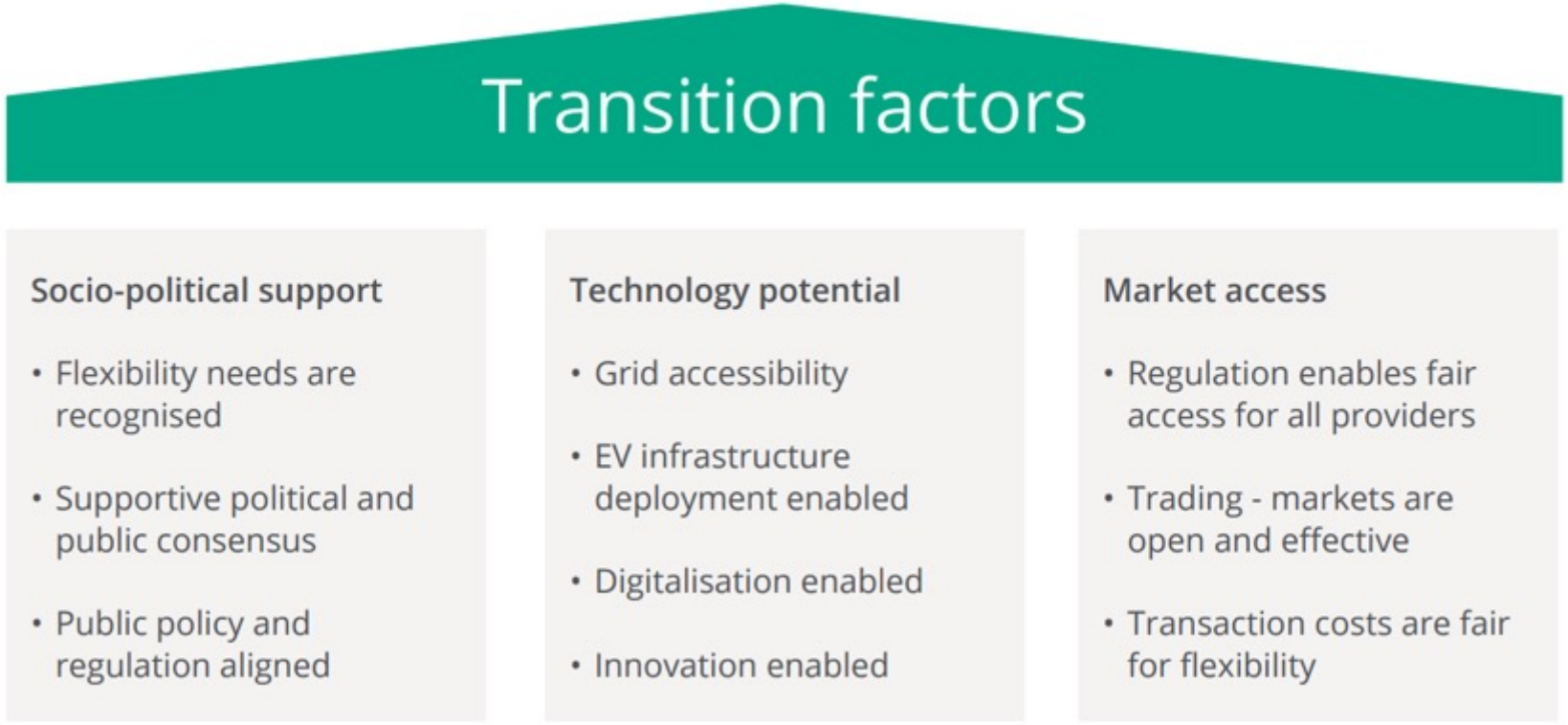
Transitioning to a Net-Zero Carbon Future

Approach to evaluation



Key questions asked were:

- ***Is the socio-political background supportive or an impediment to investment?***
- ***Are measures in place to help develop and deploy flexibility technologies?***
- ***Do the regulatory and market arrangements enable or restrict new investment in flexibility services?***

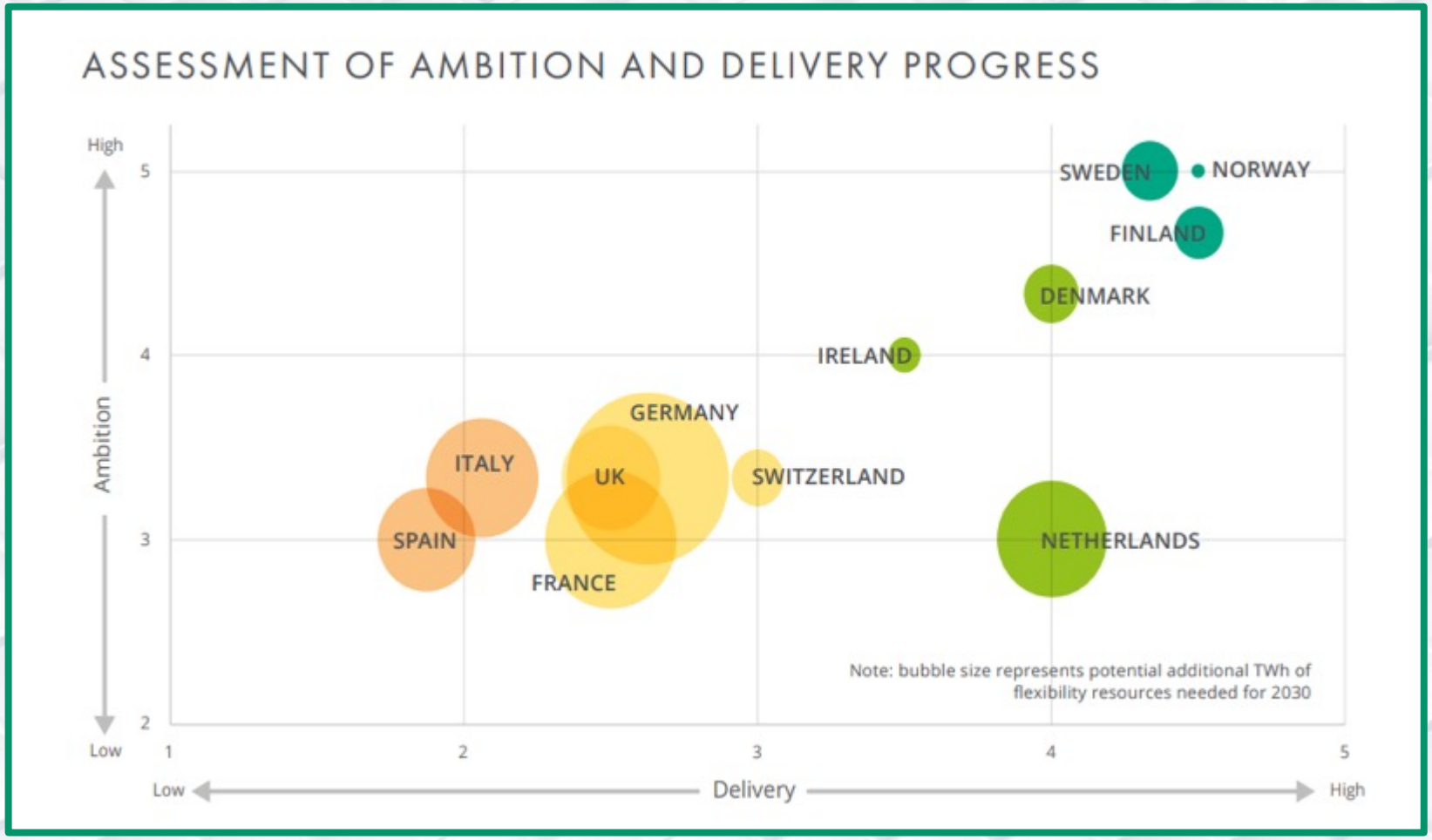
Dr Nina Skorupska CBE

Transitioning to a Net-Zero Carbon Future

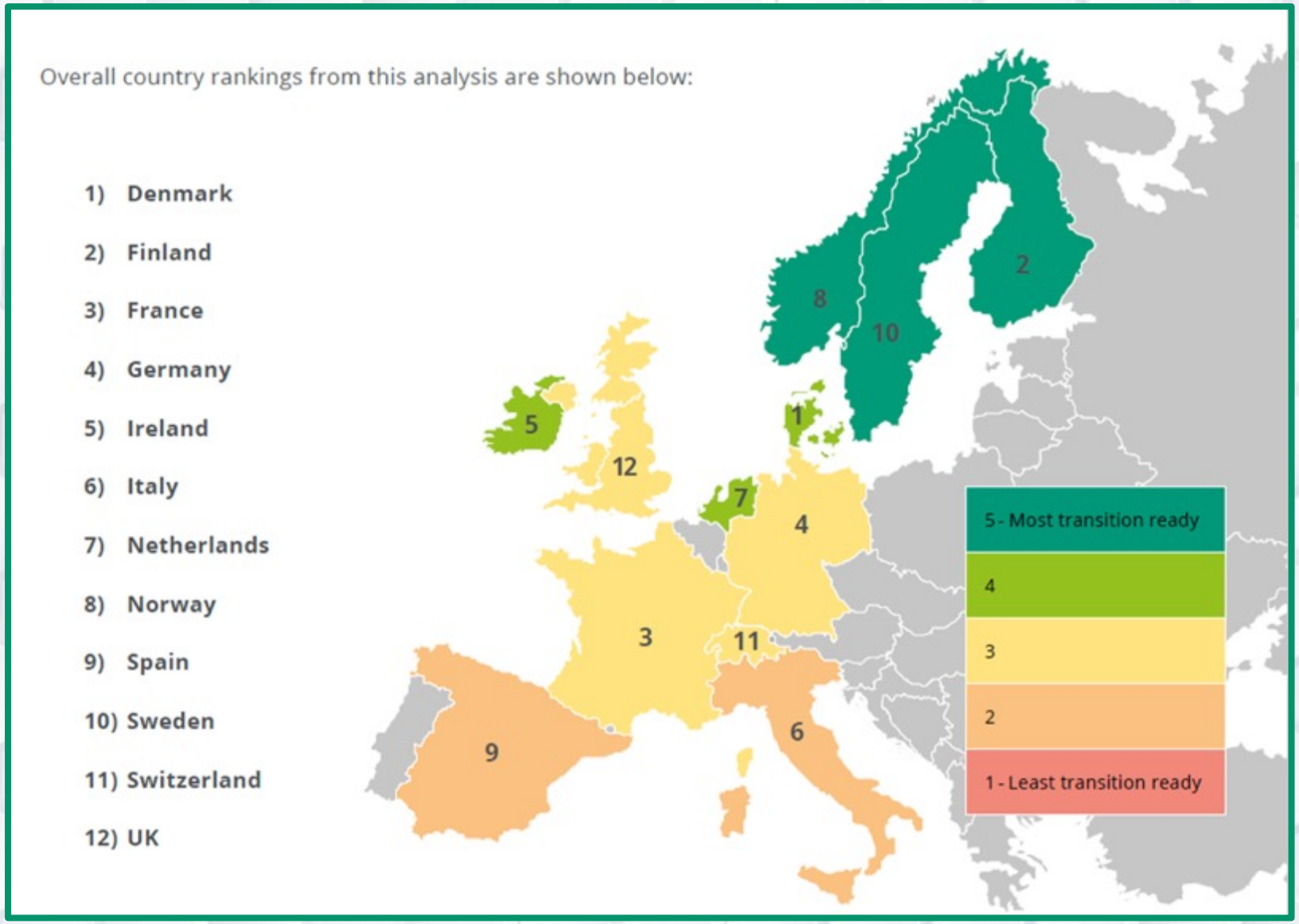
The scale of the flexibility challenge

Dr Nina Skorupska CBE

The evaluation data also allows us to assess the overall level of energy transition ambition for each country against the progress in delivering against this ambition.



ETRI 2021 Overall Rankings



Each country has different market characteristics and decarbonisation challenges

The ranking is based on the comparative *attractiveness* to investors in flexibility resources

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ETRI 2021: UK *REPORT*

UK

Markets - In 2019, UK annual renewable electricity production represented 35% of annual consumption, with solar and wind representing 22% of annual electricity consumption. The UK Government's advisors have targeted 50% renewable energy output for 2030, which could increase wind and solar output by around 52TWh.

DER - The UK has less than 1% penetration of electric vehicles in 2020, and electric vehicles represent around 7% of all new vehicle registrations. Over 11GW of rooftop solar is installed. Smart meter rollout is 46% complete.

Survey - The individual survey scores and comments for the UK are shown right.

SOCIO-POLITICAL FACTORS

Transparency on system needs and policy direction	Socio-economic impact	Political and regulatory alignment
3	4	3

TECHNOLOGY FACTORS

Grid Reliability	EV Infrastructure and EV charging	Digital technology Enablers	Innovation
3	3	2	4

MARKET FACTORS

Regulations	Compensation structures	Transaction costs
2	2	2

Electricity markets	2019 actual	2030 estimate
Annual consumption (TWh)	342	342
Annual renewable production (TWh)	119	171
Renewable % of annual consumption	35%	50%
Annual solar and wind production (TWh)	76	128
Solar and wind % of annual consumption (TWh)	22%	37%

Distributed energy products and applications	2020 actual
Homes with electricity supply (million)	27.80
BTM rooftop solar (MW)	11,680
Domestic heat pumps ('000's)	260
Total Battery EV's ('000's)	206
% BEV penetration	0.5%
Physical and IT infrastructure (MW)	557

Enabling technologies	2020 actual
Smart meter penetration	46%

In summary:

+ Strong public and political support for energy transition

- Extensive consultation on policy decisions often leads to delays or changes

- Weak alignment across Gov. bodies leads to uncertainty of policy goals ..especially in the short term...making them complex and slow

- Grid visibility is low and connections slow and costly to realise

+ Positive environment for innovation but with many different trials and slow deployment of change

- Flexibility "markets" are nascent but stacked towards legacy fossil generators and grid scale batteries

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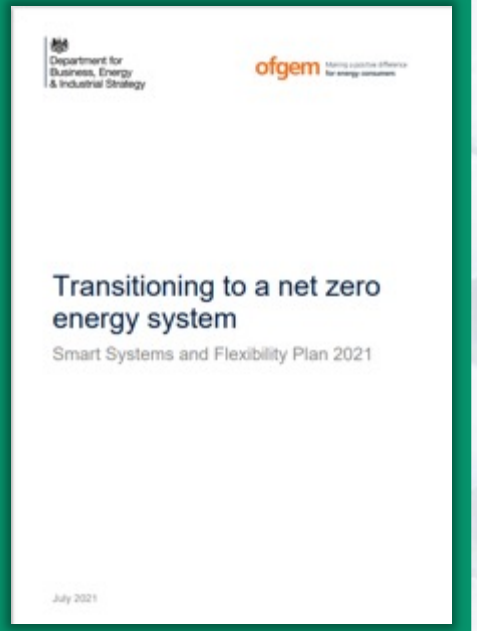
Smart Systems and Flexibility Plan 2021



Indicated the need for :

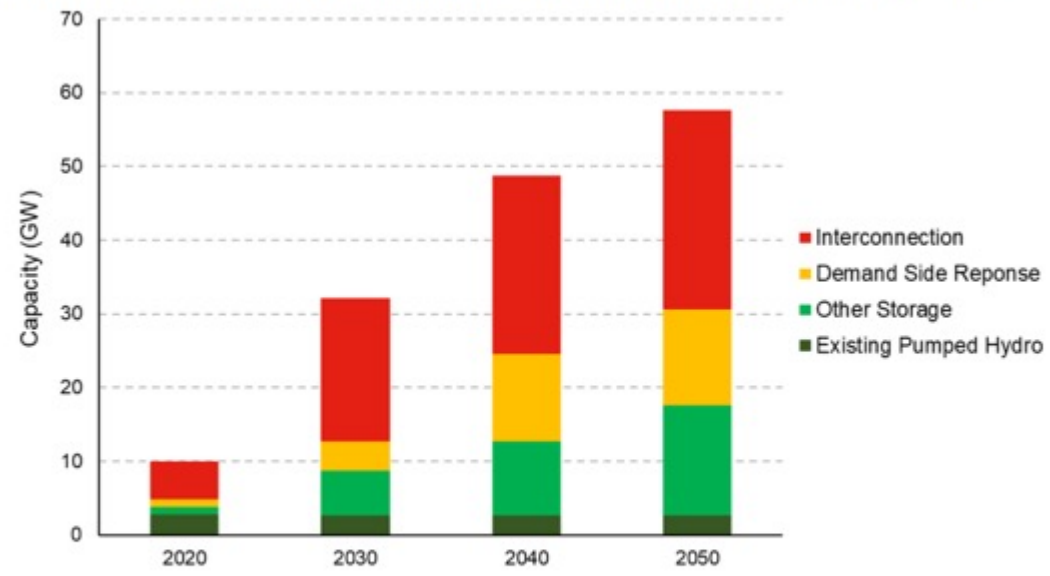
- **around 30 GW of new low carbon flexibility resources (a 20 GW increase) will be needed by 2030,**
- **and 60 GW (a 50 GW increase) by 2050 .**

Delivered by storage, flexible demand and generation, and interconnectors.

NOTE:
Does not yet consider Longer Duration Energy Storage, nor Vehicle to grid (with increasing EV deployment)

Nor the revised 2035 Net Zero Power ambition

Figure 8: Illustrative deployment of flexible technologies, high flexibility scenario[25]



[25] 'Other storage' includes existing battery projects and new deployments. All new storage assets are assumed to be 4-hour duration and could be a range of technologies including new battery and pumped hydro projects.

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THE ASSOCIATION FOR RENEWABLE ENERGY & CLEAN TECHNOLOGY

Thank you

&

Questions?

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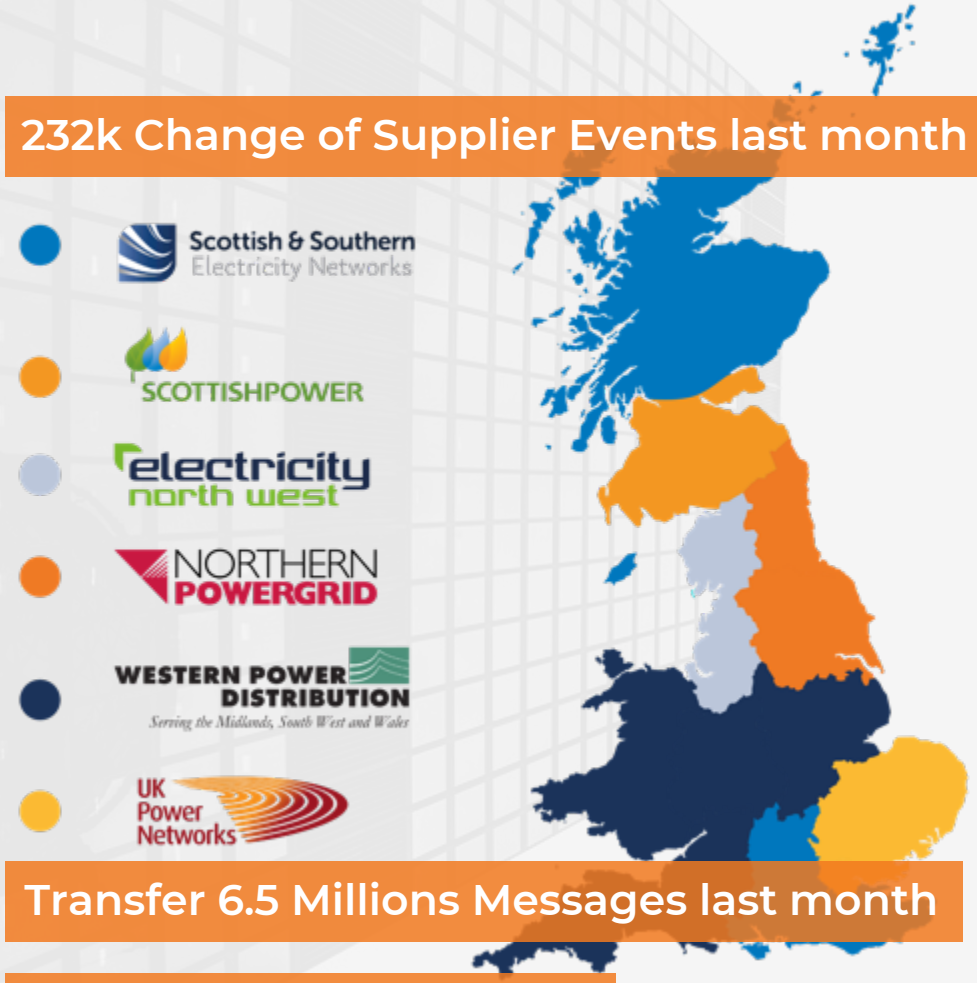
ElectraLink

WEF forum

Where is ElectraLink in 2021

ElectraLink

232k Change of Supplier Events last month



Transfer 6.5 Millions Messages last month

170 GB of data last month

Customers

DTS 297 Market Participant Connections
Customer NPS 8.2

71 EMI Customers
78 NS Customers

Code Administration
DCUSA
SPAA
SMICOP
TRAS

Other Services
NRPS
Advisory support

Centre of competency

Data infrastructure
Data services
Data governance / data stewardship
Industry process knowledge
Customer engagement management

Stakeholders

Innovation projects for SSEN
Data delivery for Ofgem and BEIS
Digitisation for DCUSA
PAF data for RECCo
Cost control for DTS users

Data transformation drivers in the GB data landscape

ElectraLink

Smart Metering

- Increased data
- **Half-hourly Settlement**
- Security
- Data privacy
- Dual fuel processes

Third Party Access to Data

- **Third party access to data**
- Increased requirements for speed and resilience
- High availability

Flexible Energy Market

- Industry process change
- Time of Use tariffs
- Domestic Demand Side Response

Smart Energy System

- DNO to DSO
- **Real time access to smart home**
- Electric vehicles
- Heat pumps
- De-carbonisation of heat.

Transformation of the data landscape

Key questions to answer

ElectraLink

What LCT is connected to the networks?

How will technologies drive behaviour change?

Where can I connect DER to maximise carbon reduction?

How fast are LCT proliferating?

What are the energy implications of de-carbonising heating and transport on a geography?

How can network companies efficiently plan ahead to connect LCTs?

How can I access granular LV data?

Where/when can I connect LCT?

Improving visibility of data publicly…

Home ▸ Open Data

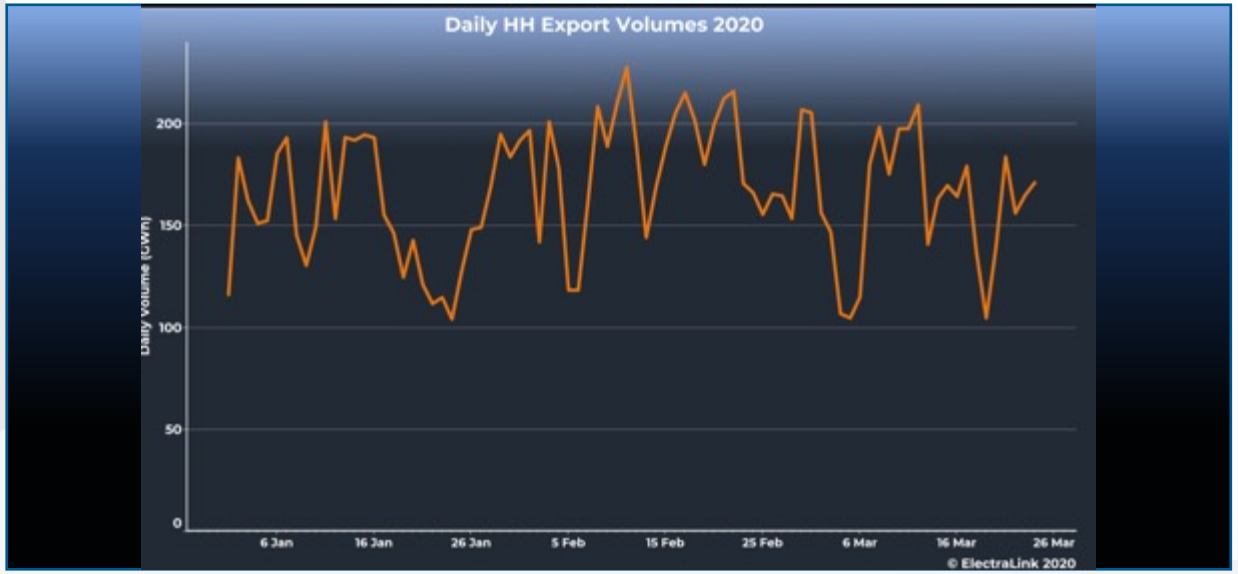
BACK TO ALL

OPEN DATA

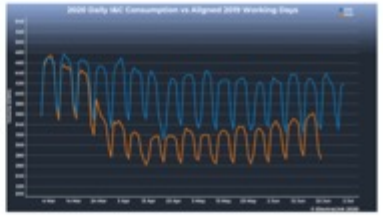
What is Open Data?

The Energy Market Data Hub (EMDH), managed by ElectraLink, transfers the data required to support the retail energy market (including electricity smart metering install and smart consumption data). Under the governance of the Data Transfer Service Agreement (DTSA), we are able to make this dataset available to market participants and regulators.

Since 2012, ElectraLink has had an established approach to data sharing – outlined in the DTSA, a well-defined data governance approach that enables us to manage a variety of data access requests from a wide range of utility industry parties.

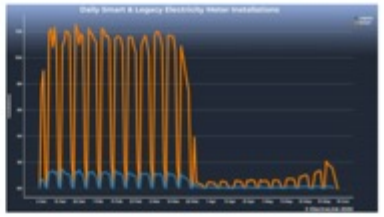


Half hourly I&C electricity consumption during COVID-19



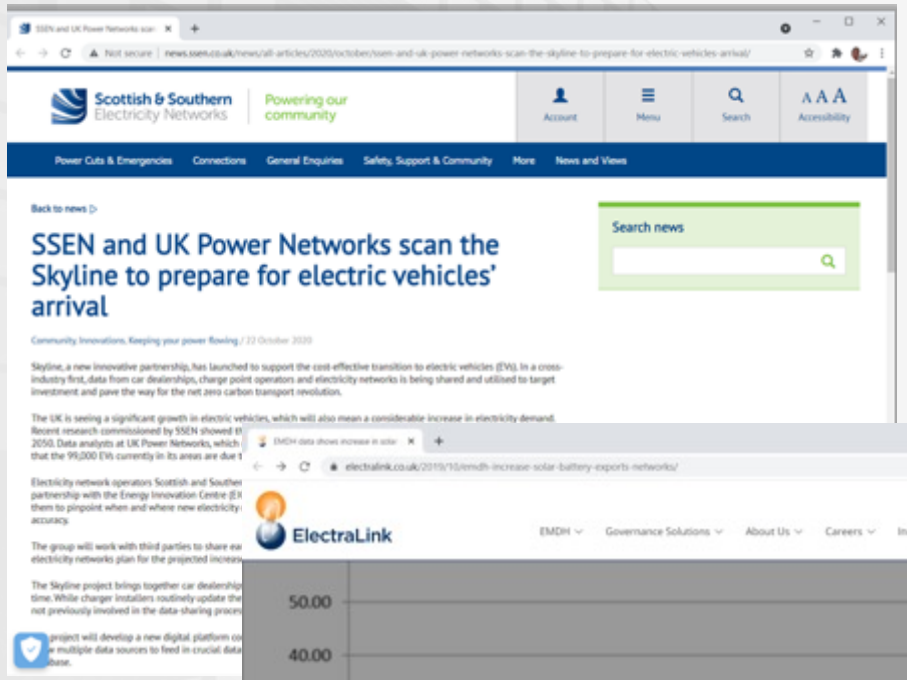
Half hourly embedded generation exports during COVID-19

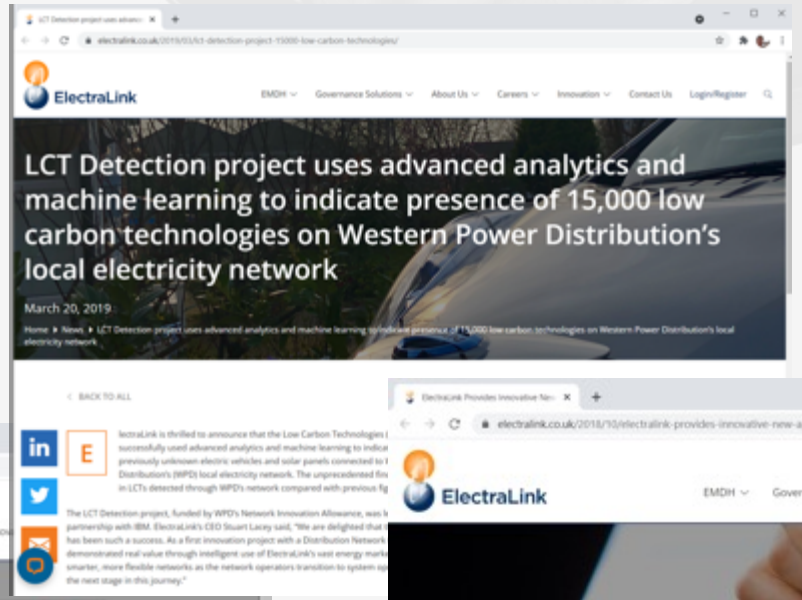
Daily meter installations

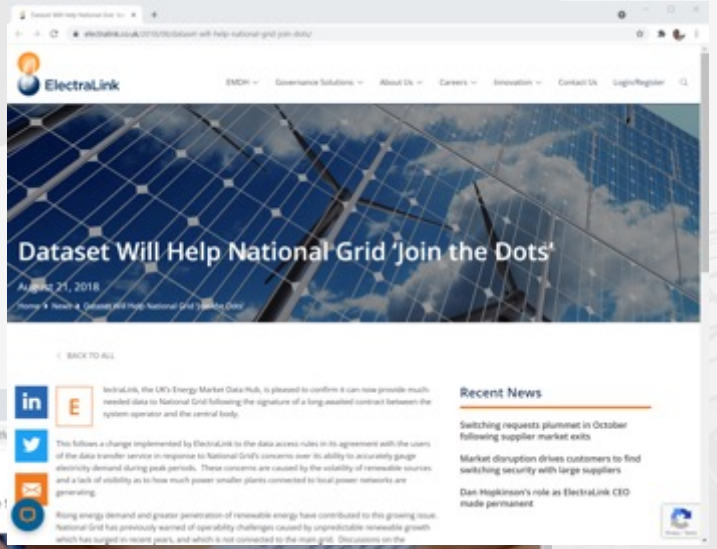


Daily meter readings during COVID-19

Innovation


Scottish & Southern Electricity Networks
Powering our community
SSEN and UK Power Networks scan the Skyline to prepare for electric vehicles' arrival
Search news


ElectraLink
LCT Detection project uses advanced analytics and machine learning to indicate presence of 15,000 low carbon technologies on Western Power Distribution's local electricity network
March 20, 2019


ElectraLink
Dataset Will Help National Grid 'Join the Dots'
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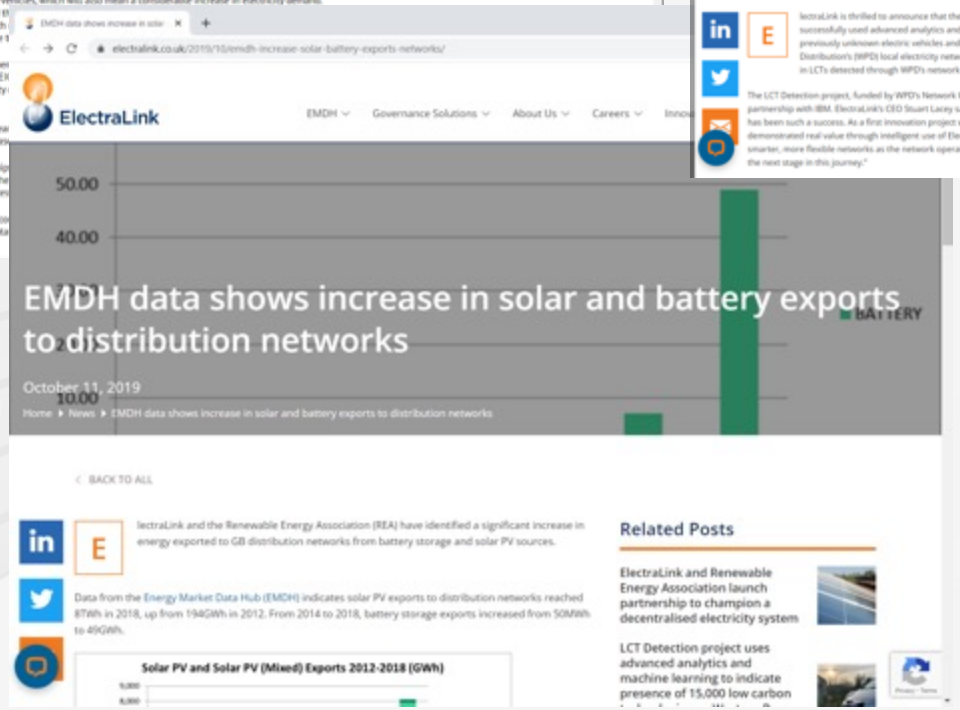
Switching requests plummet in October following supplier market exits
Market disruption drives customers to find switching security with large suppliers
Dan Hopkinson's role as ElectraLink CEO made permanent


ElectraLink
EMDH data shows increase in solar and battery exports to distribution networks
October 11, 2019
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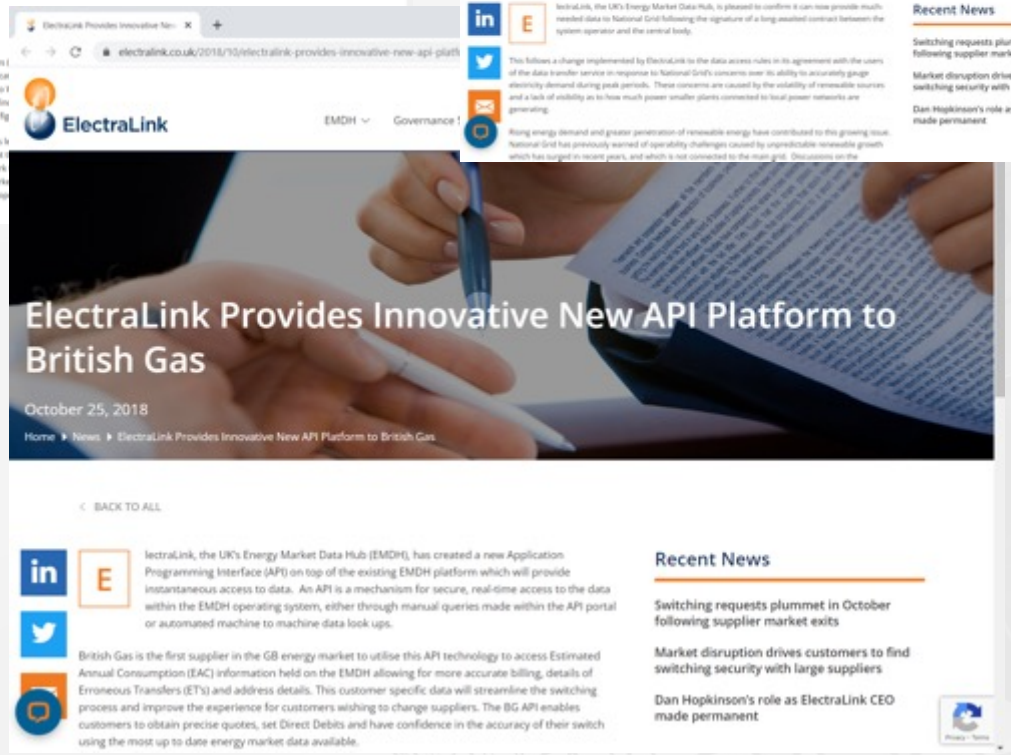
ElectraLink and Renewable Energy Association launch partnership to champion a decentralised electricity system
LCT Detection project uses advanced analytics and machine learning to indicate presence of 15,000 low carbon
Solar PV and Solar PV (Mixed) Exports 2012-2018 (GWh)


ElectraLink
ElectraLink Provides Innovative New API Platform to British Gas
October 25, 2018
Recent News
Switching requests plummet in October following supplier market exits
Market disruption drives customers to find switching security with large suppliers
Dan Hopkinson's role as ElectraLink CEO made permanent

Data can unlock barriers to Net Zero

ElectraLink

01 Creation of new, granular customer demand profiles

02 Uncovering and tracking fuel poverty

03 Impacts of societal events on energy consumption

04 Enabling DNO flexibility provision for LV customers

05 Merging address and metering datasets

06 Aggregation of metering data by substation

07 Virtual LV network monitoring

08 New LCT Detection techniques through machine learning

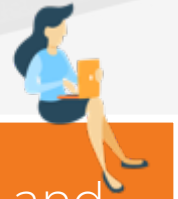
Lessons learnt

Through 20 years of experience ElectraLink has learnt:

- Access to data is constantly evolving
- Engagement is key to prioritising user needs
- Diverse technology options are needed for a diverse market
- Data governance is a challenge and needs tackling up front
- Data quality and standards should not be a barrier to getting started

Takeaways from today...

- ElectraLink has been focused on data and digitalisation for 20 years
- Managing data transfer for 290+ participants and **sharing billions of data points to third parties**



- The provision of data is evolving and central datahub providers must evolve with industry. Our key learnings have been:
  - No one-size fits all approach to data access
  - Access to data needs to be flexible and transform with industry needs

- We are all facing the same challenges so collaboration and coordination across states and industries is key

Contacts

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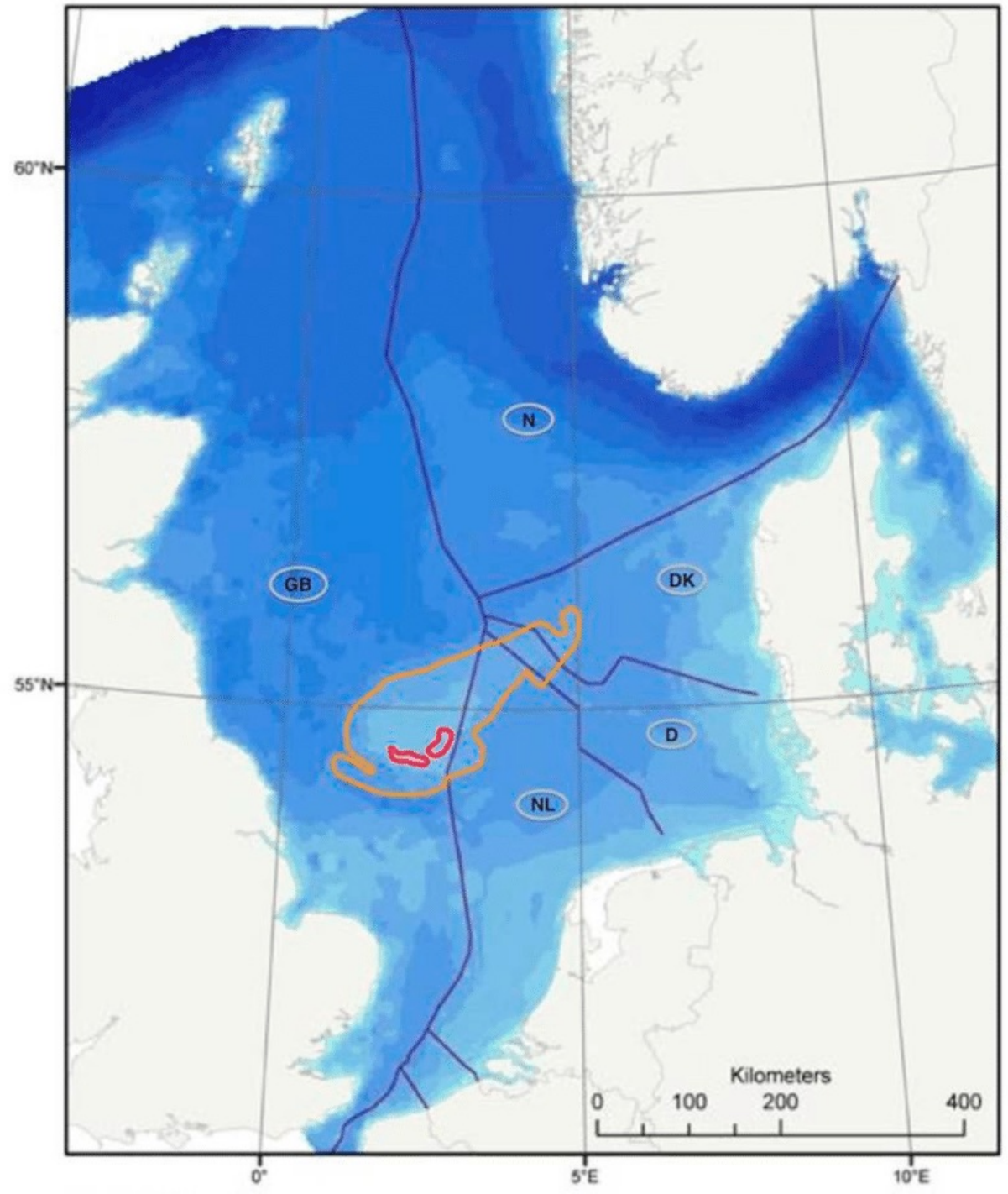
CERTIFIED LR ISO 9001 ISO 14001 ISO/IEC 27001 — UKAS MANAGEMENT SYSTEMS 001

Integrated Infrastructure Deployment

Jon Davies

nationalgrid Interconnectors



Resourceful North Sea

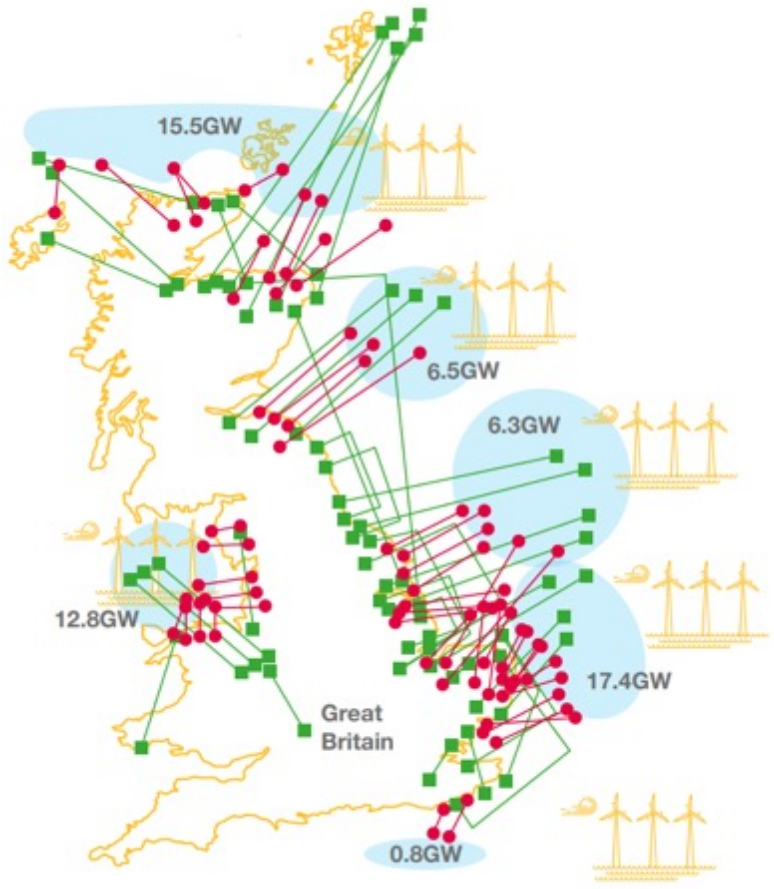
- The North Sea is 2.7 times the area of Great Britain
- Shallow, enclosed waters enable resource exploitation
- Nearly 90% of the UK & EU's offshore wind targets for 2030 (100GW) could come from the Dogger Bank area alone [1]
- **All** of UK & EU's offshore wind targets for 2050 (440GW) could come from ~16% of the North Sea

1 Assumes offshore wind power density ~ 5MW/km^2 Dogger Bank area ~ 17600km^2

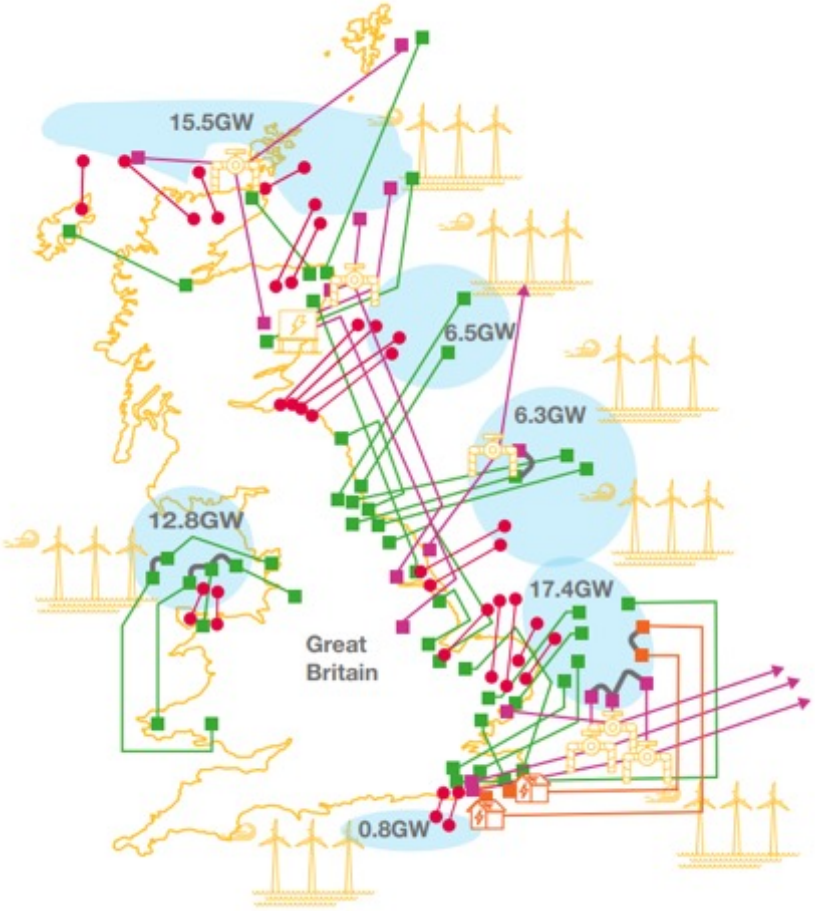
Challenge 1 – coordination in design

nationalgrid ventures

CURRENT APPROACH



INTEGRATED APPROACH



BENEFITS*

Landing points
105 to 30

Onshore & offshore cable
11,585km to 6735km

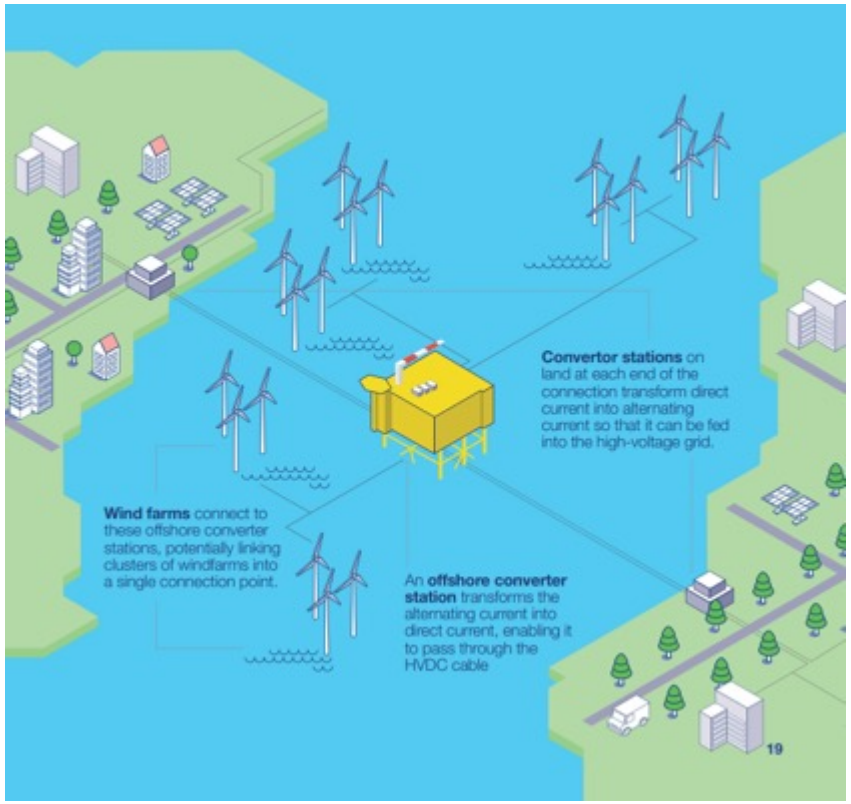
HVDC substations
57 to 20

* National Grid ESO *Offshore Coordination Project Report*, December 2020

Challenge 2 – cooperation across the industry and across borders

nationalgrid ventures

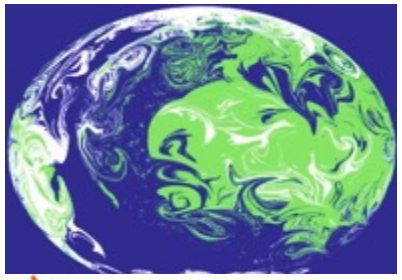
Cooperation developing solutions…



… and cooperation across borders

TCA

FRAMEWORK FOR EU-UK COOPERATION



COP26

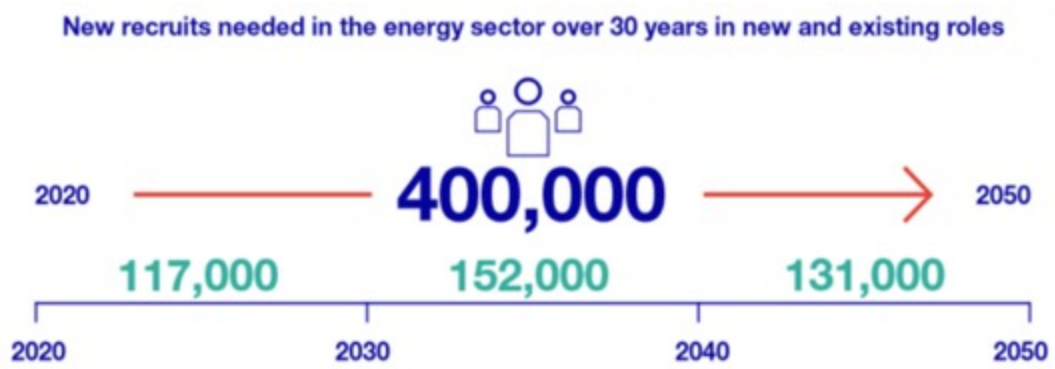
GLOBAL LEADERSHIP

Challenge 3 – Policy will set the pace

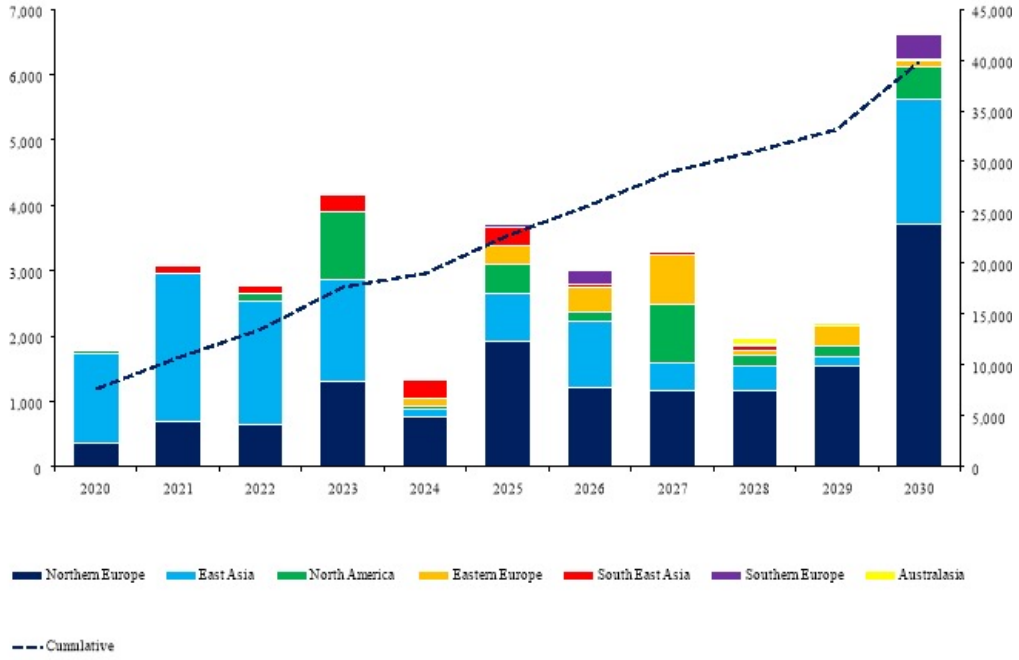
- Legislation, policy and regulation are needed to encourage development and investment
  - **UK:** OTNR will shape this for offshore wind and transmission
  - **EU:** ORES is already clear and will shape the EU market that we need to interface with
- Regulation balances risks and benefits for investors & consumers
  - £ billions of benefits to be shared appropriately
  - Commercial arrangements between MPI investors will be crucial

Challenge 4 – identifying and addressing supply chain constraints

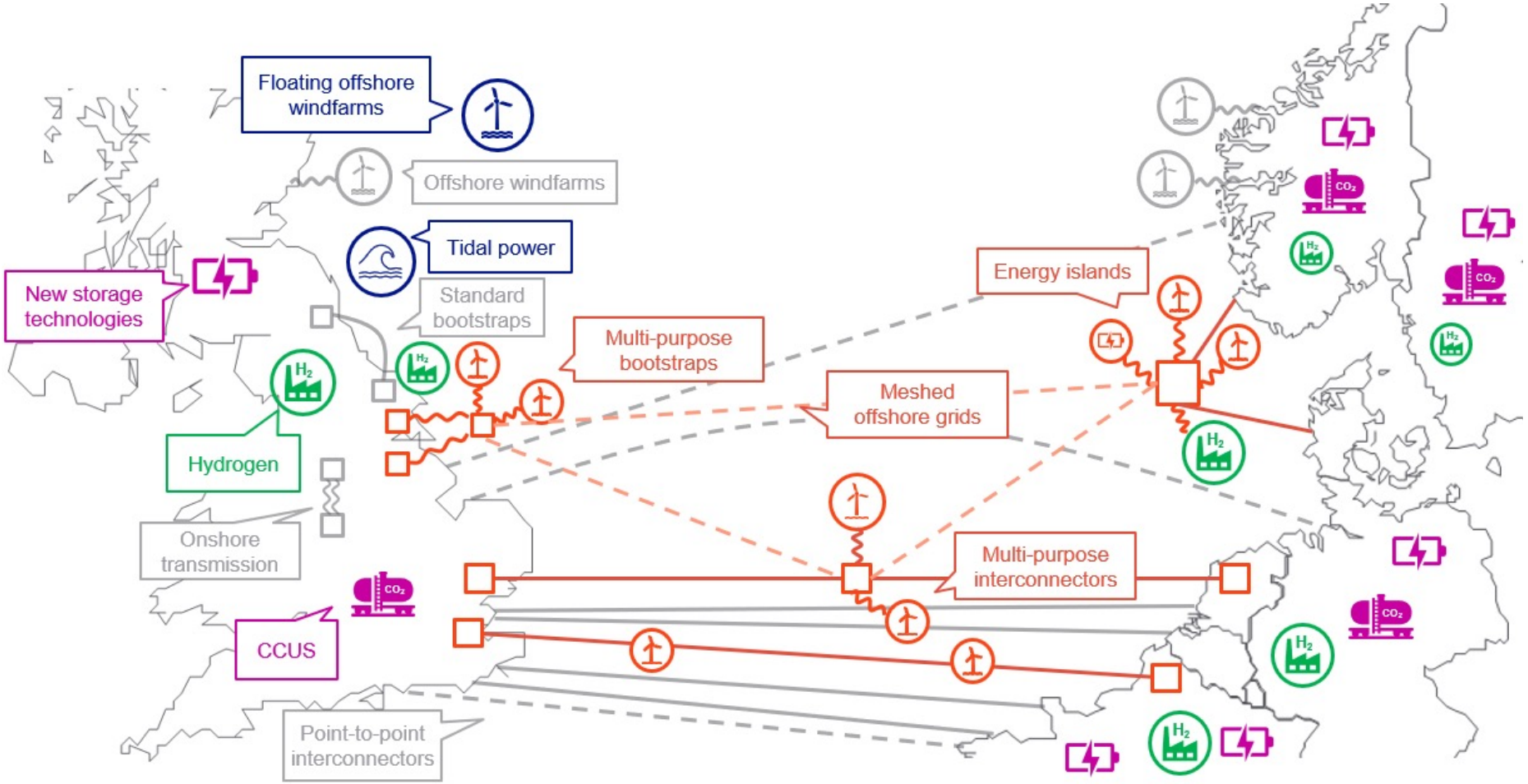
Over 100,000 green energy jobs…



… and a cable market set to grow six-fold



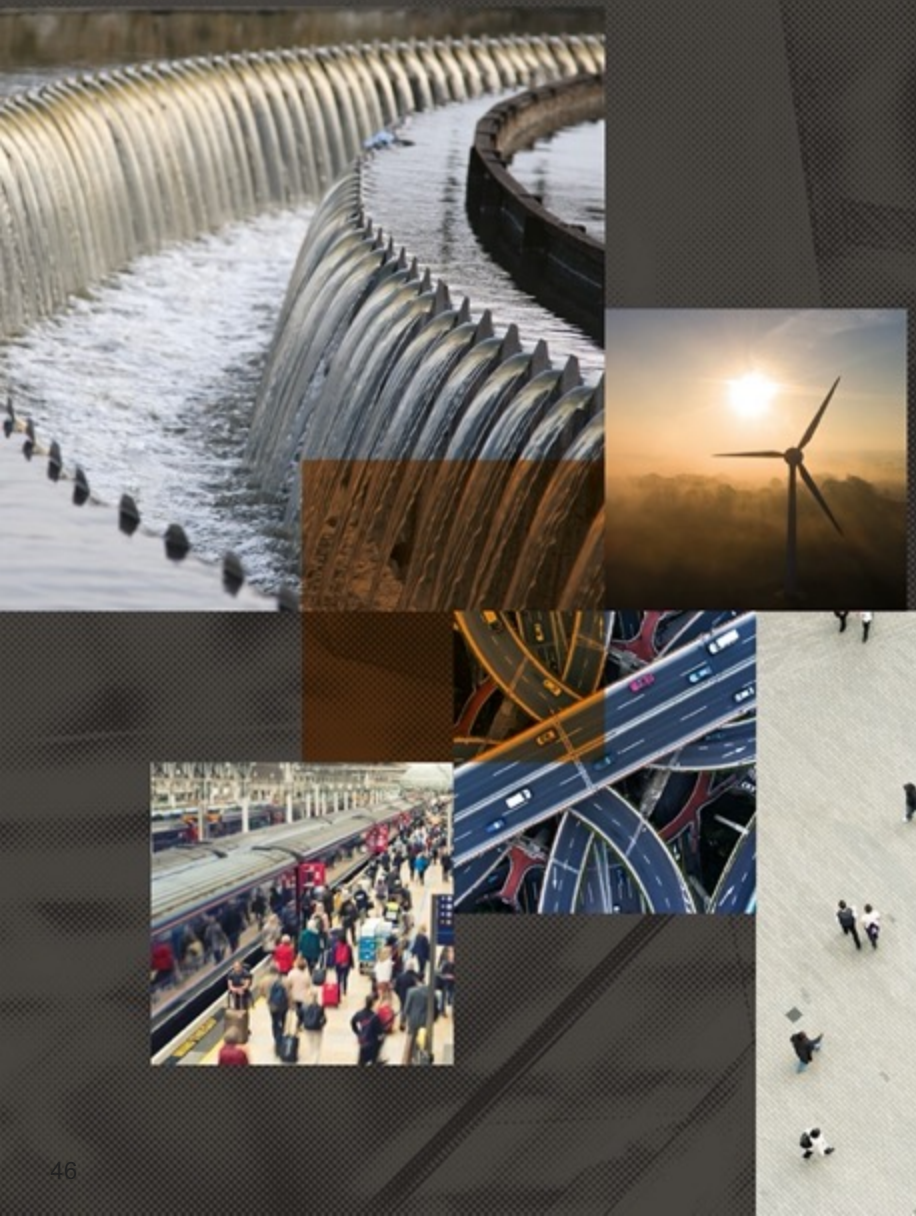
Challenge 5 – breaking the problem down to make progress



To close…

We **have the technology and the ambition** to meet our targets.

Addressing these challenges is **critical for unlocking the renewable resources** in the North Sea. **2030 starts today**.



Integrated Infrastructure Deployment

Planning challenges across generation, transmission, microgrid deployment, storage and interconnection

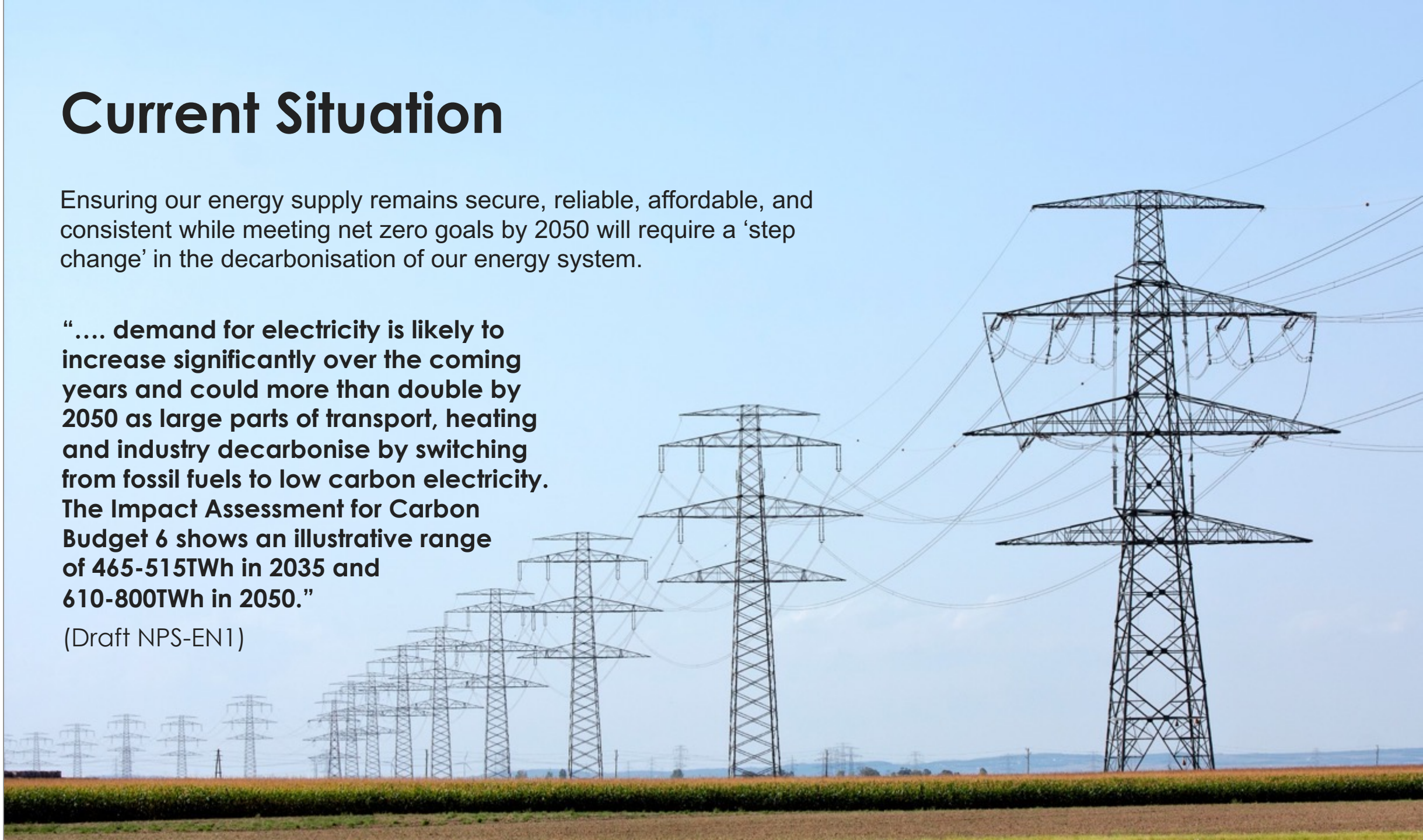
Chris Leach 23/11/21

Current Situation

Ensuring our energy supply remains secure, reliable, affordable, and consistent while meeting net zero goals by 2050 will require a ‘step change’ in the decarbonisation of our energy system.

“…. demand for electricity is likely to increase significantly over the coming years and could more than double by 2050 as large parts of transport, heating and industry decarbonise by switching from fossil fuels to low carbon electricity. The Impact Assessment for Carbon Budget 6 shows an illustrative range of 465-515TWh in 2035 and 610-800TWh in 2050.”

(Draft NPS-EN1)



Planning Framework

Number of different, and often competing planning frameworks for developing energy infrastructure in the UK.

Two main planning regimes (in England) for developing energy infrastructure are DCO and TCPA – depending on size of project. Each have their own advantages and disadvantages.

Delivering aims of the NPS and Net Zero will require a mix of different technologies, across different scales, different planning regimes, and will all need to tie together

Main Challenges to delivery through planning

- Timescales
- Public perception – e.g. Delivering SMR
- Additional land and Biodiversity net Gain
- Competing land uses
- Changing Policy
- Resources of LPA / Statutory bodies / competing planning policies

How to overcome these challenges

- Planning ahead – incorporating energy infrastructure into Net Zero Plans, Local Plans and Land Use Strategy
- Recognising that energy infrastructure can't be developed in isolation – Developers working closely with e.g. Utilities
- Planning energy infrastructure with housing / industrial
- Co-locating energy projects
- Increasing powers of LDOs / PD rights?
- Another tier of 'Major Infrastructure Projects'?
- Where electricity, gas, petroleum, hydrogen, and road infrastructure have been conceived independently, it is likely that these will increasingly merge into one system with critical interdependencies.

Design with
community in mind

The Growing Strategic role and Delivery of the Microgrid

Westminster Energy Forum Panel Discussion

Andy McKenzie

Microgrid Commercial Lead UK&I

se/microgrids

Life Is On | Schneider Electric

The **most local** of global companies

Key figures for 2020

5% of revenues devoted to R&D

€25.2 billion
2020 revenues

41%
of revenues in new economies

128,500+
Employees in over 100 countries

We partner in everything we do

650k service providers & partners

45k+ system integrators & developers

3k electricity companies

Deep Domain Expertise

Home
Building
Industry
Data Centre
Infrastructure
Cities

Taking Sustainability to the next level

Over **300 microgrid** projects delivered globally

Over **900 electrification** projects delivered globally

#1 Corporate Knights - 2021's most sustainable company on the Global 100 index

#2 in Microgrid control technology by Navigant Research (2018)

Pioneer in innovative digital and IoT solutions for MV equipment and SF6 free switchgear.

Life Is On | Schneider Electric

Sustainability is no longer a nice-to-have.
It's business critical

Boards face **increasing pressure** to become ESG competent and prepare for climate change challenges

2021 S&P Corporate Governance TreGlobalnds

Companies are increasingly using digital to build **resilience** and take on **innovation**

2020 Corporate Energy & Sustainability Progress Report

Government and business **net zero commitments doubled** in less than a year in 2020

2020 United Nations Press Release

COVID-19 has updated the definition of critical infrastructure

Now more than ever, we have to re-think who requires energy resilience.

Large electro-intensive Infrastructure

- Hospitals
- Water and Wastewater Facilities
- Data Centers
- Military Bases

Critical to local well-being

- Grocery Stores
- Distribution Centers
- Gas Stations
- Cell Phone Towers
- Banks/Co-ops

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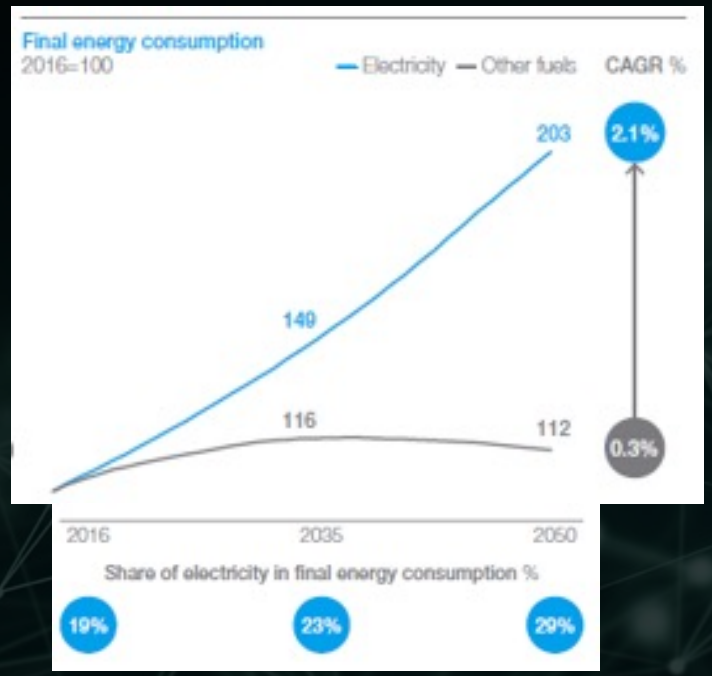
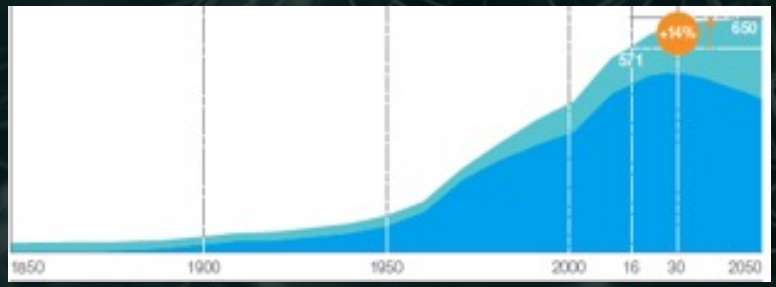
A New Energy Landscape

Electrification *across key end uses, particularly in buildings and road transport, drives a doubling of electricity demand by 2050*



Decarbonization *of generation while global primary energy plateaus around 2030, and distributed renewable energy sources get highest share*



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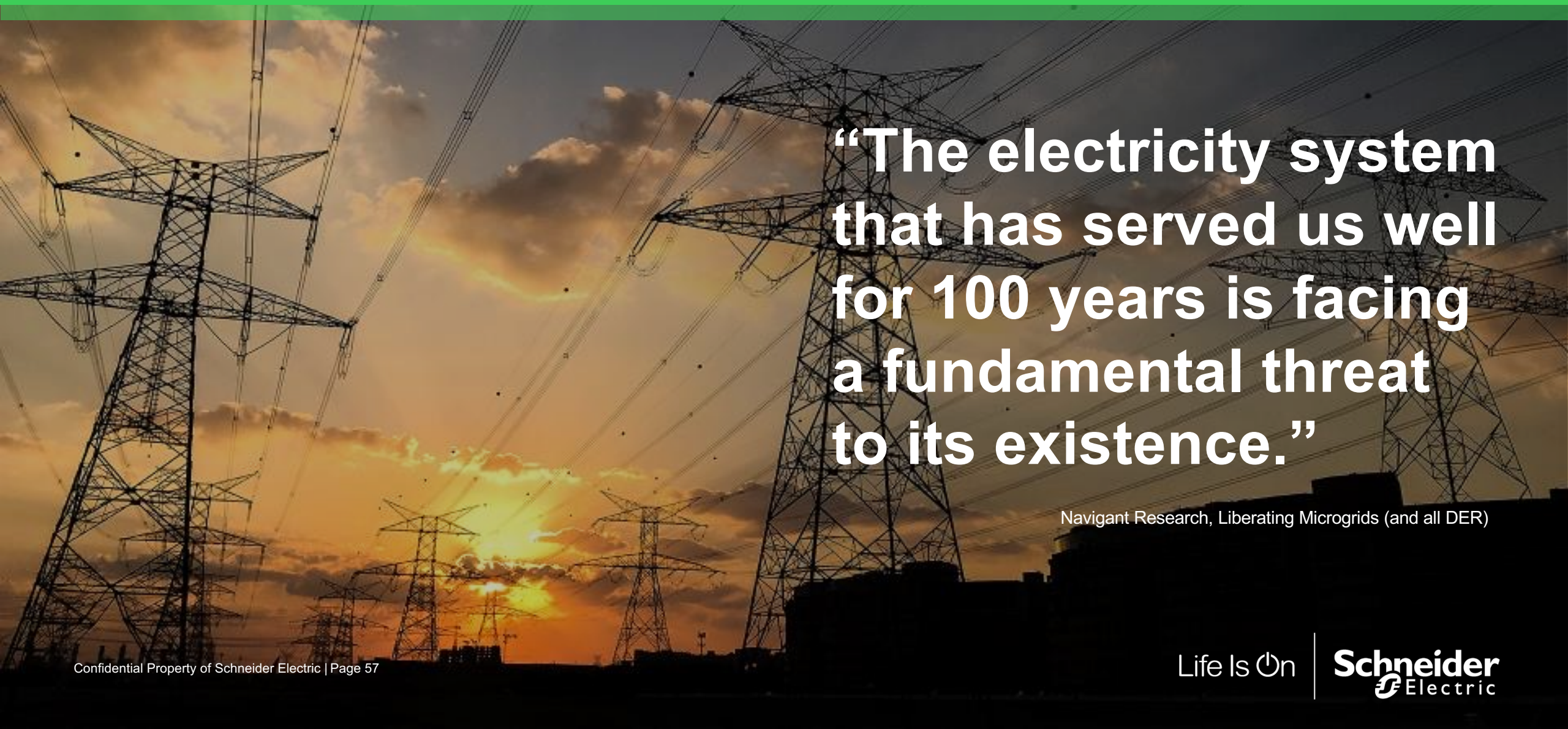
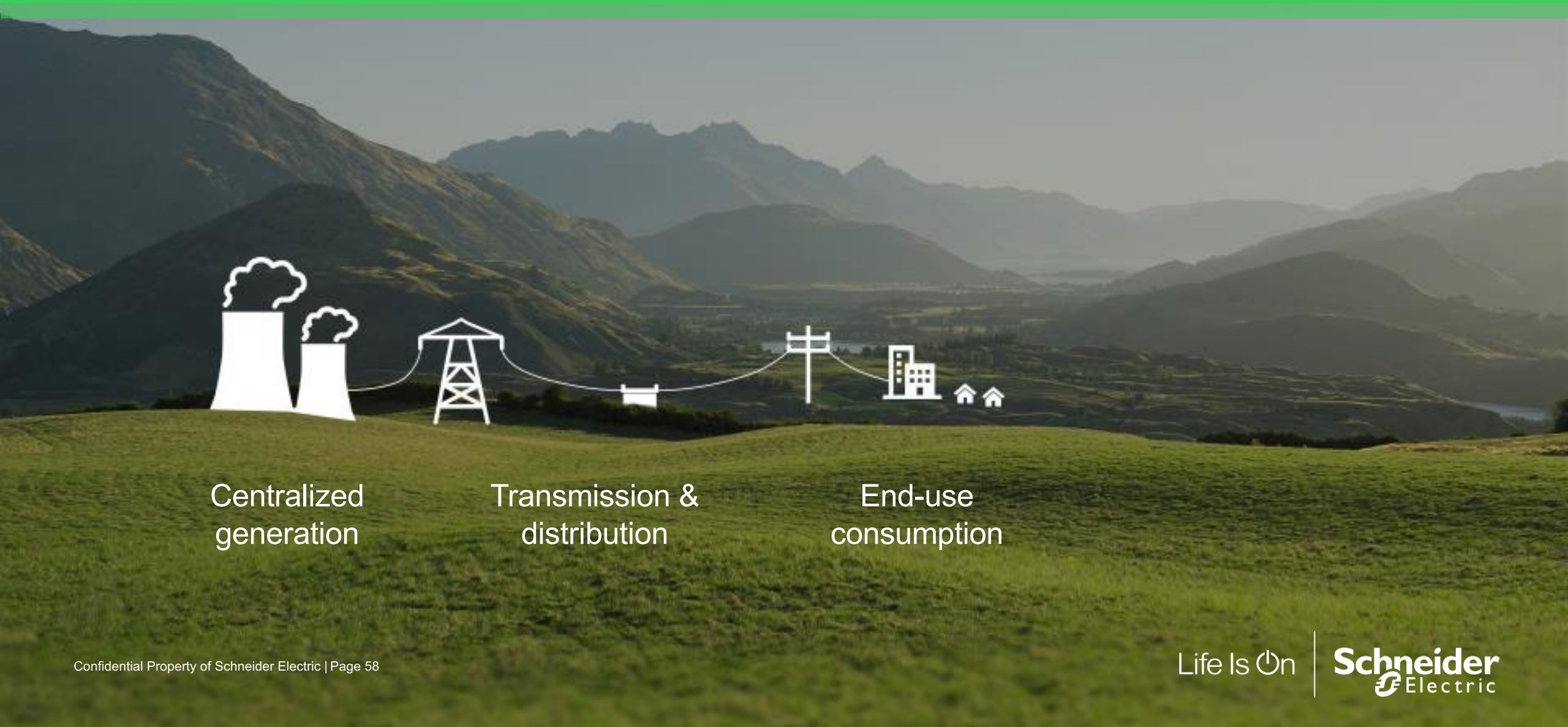
On the brink of disruption



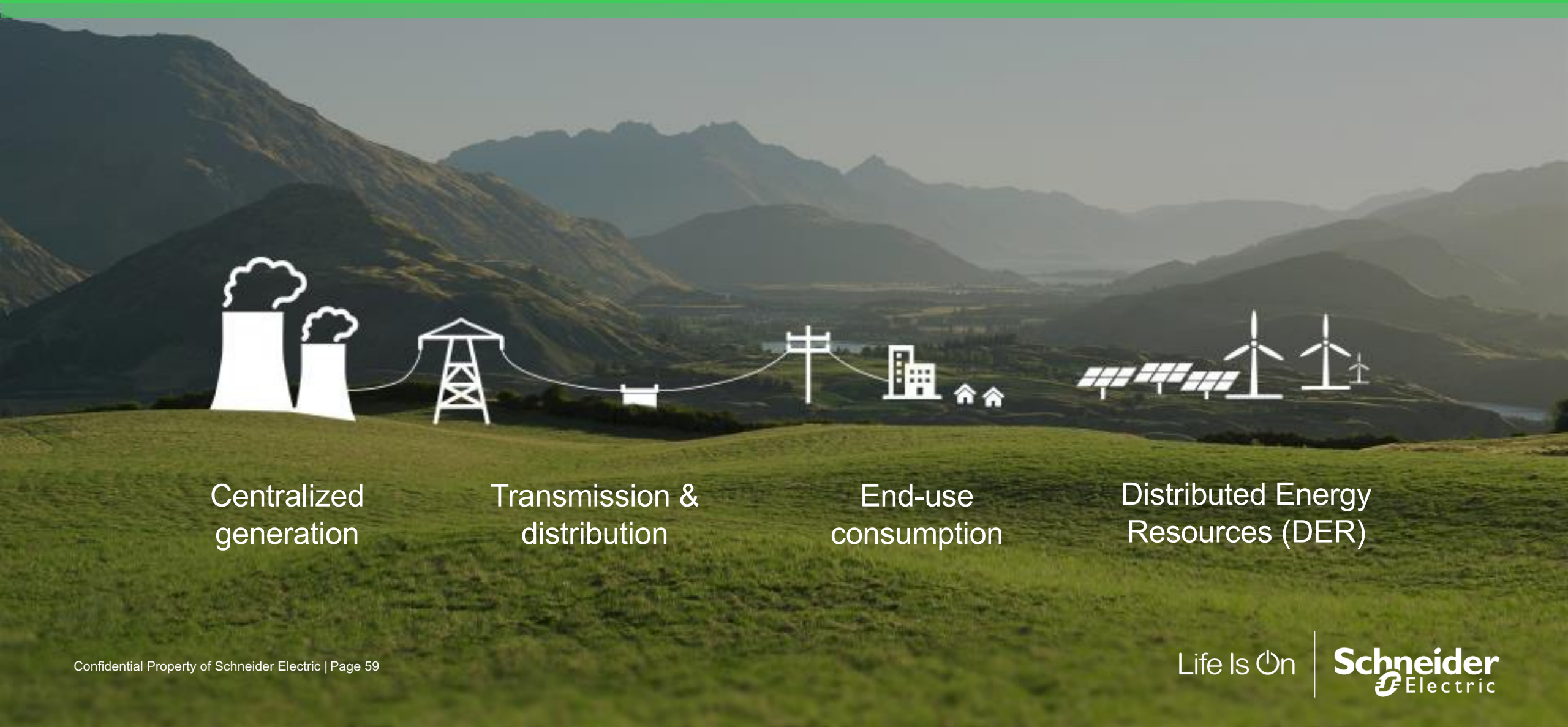
“The electricity system that has served us well for 100 years is facing a fundamental threat to its existence.”

Navigant Research, Liberating Microgrids (and all DER)

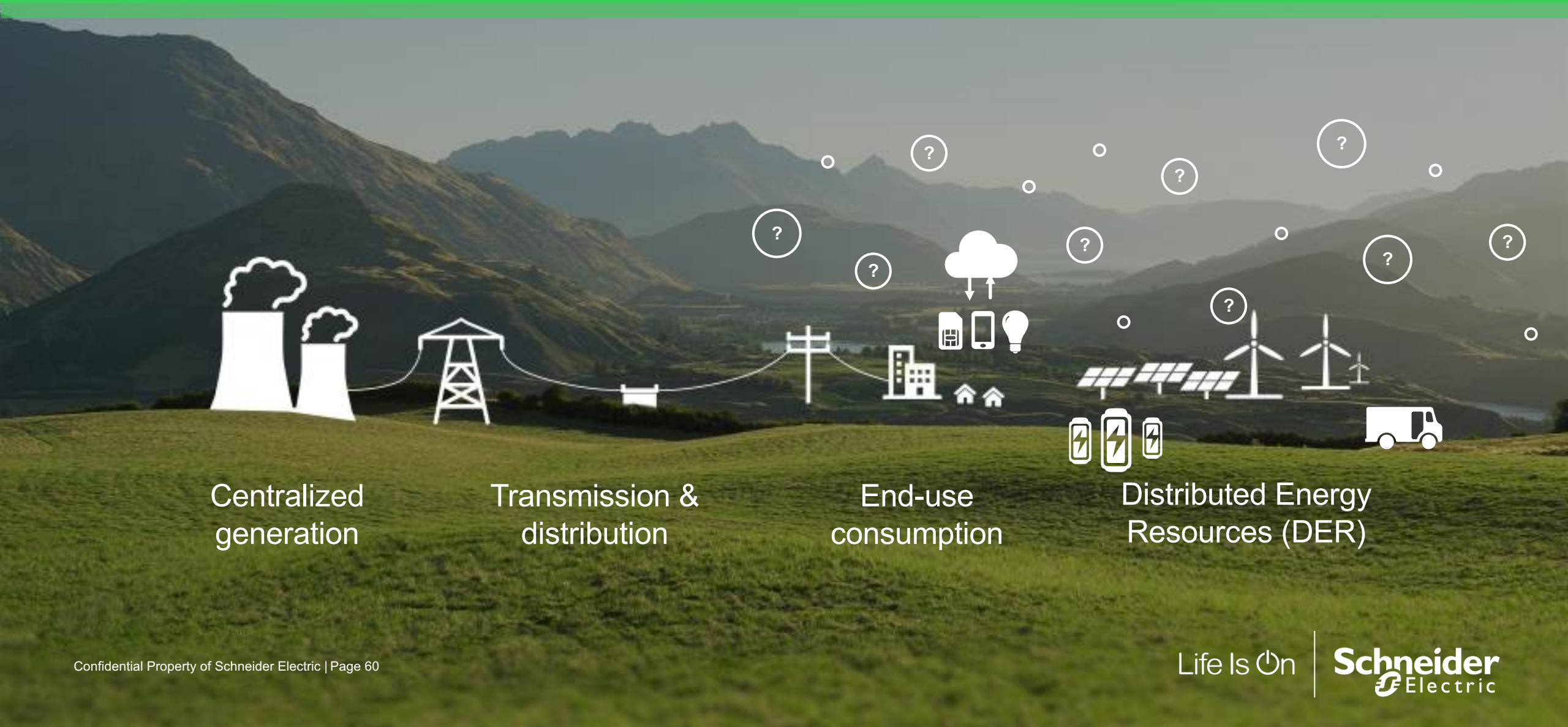
From simple and linear



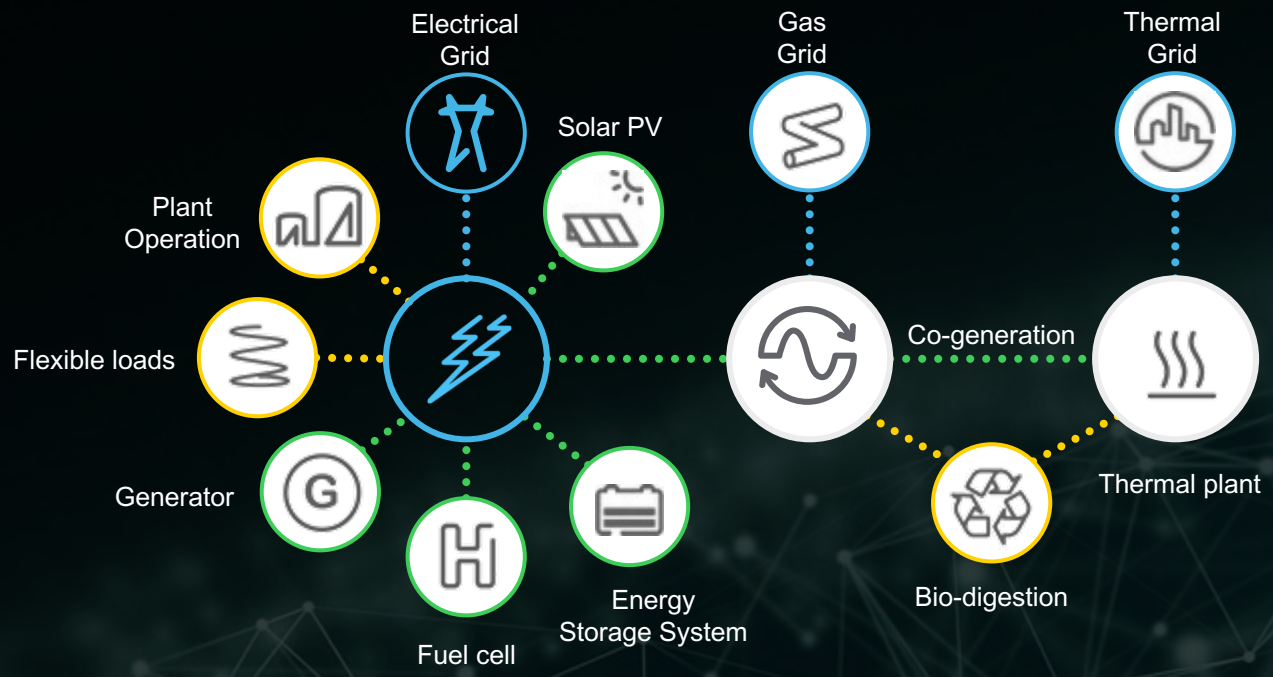
Added distributed energy resources



To increasingly complex and multidirectional



Technologies… Art of the possible



Grid-tied

Island-able

Off-grid

Sustainable | Resilience | Cost Efficient

Life Is On Schneider Electric

Microgrid end-customers

A Grid of Grid(s) interconnecting new usage and generation with Decentralized control enabled by Digital technologies

Large & XL MG
2MW to 20MW – and above
Custom & Engineered solutions

Large sites

- Hospitals
- Consumer Goods
- MMM
- Oil & gas
- Data Centers

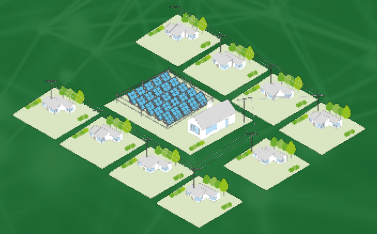
Infrastructures

- Eco-District
- Electrical companies (grid operators)
- Green Ports
- Airports

Small & Medium MG
50kW to 1MW
Standard & Repetitive solutions

Buildings

- Hotels
- Retail
- Real estate



Access to Energy

- Rural electrification

Prosumers
Local energy resources implemented at end-user site
require local or virtual “orchestrator”

Communities
Local energy resources shared among different users
require local or virtual “operator”

Case study – SAPM Microgrid in Sydney, Australia

SYDNEY, Australia – November, 2019

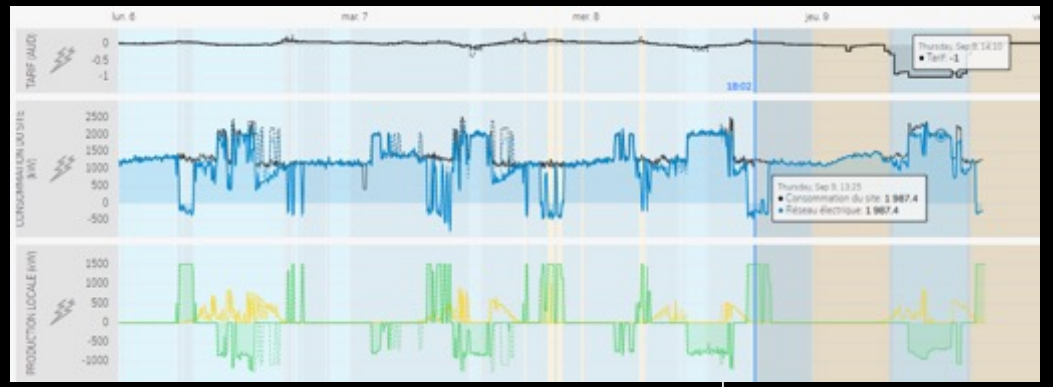
Schneider Electric has been chosen by The South Australian Produce Market Limited (SAPML) as a major supplier to achieve Australia's first energy **microgrid connected to the spot market**, that will not only supply the site's entire energy demand but also export power to the National Electricity Market (NEM).

The **$10.5M Microgrid** which includes more than 6,400 solar panels and 25 Tesla power pack batteries energy storage systems, uses Schneider Electric's *EcoStruxure Microgrid Advisor* technology in its control system, which allows them to forecast demand and electricity spot market pricing 24 hours ahead of time.

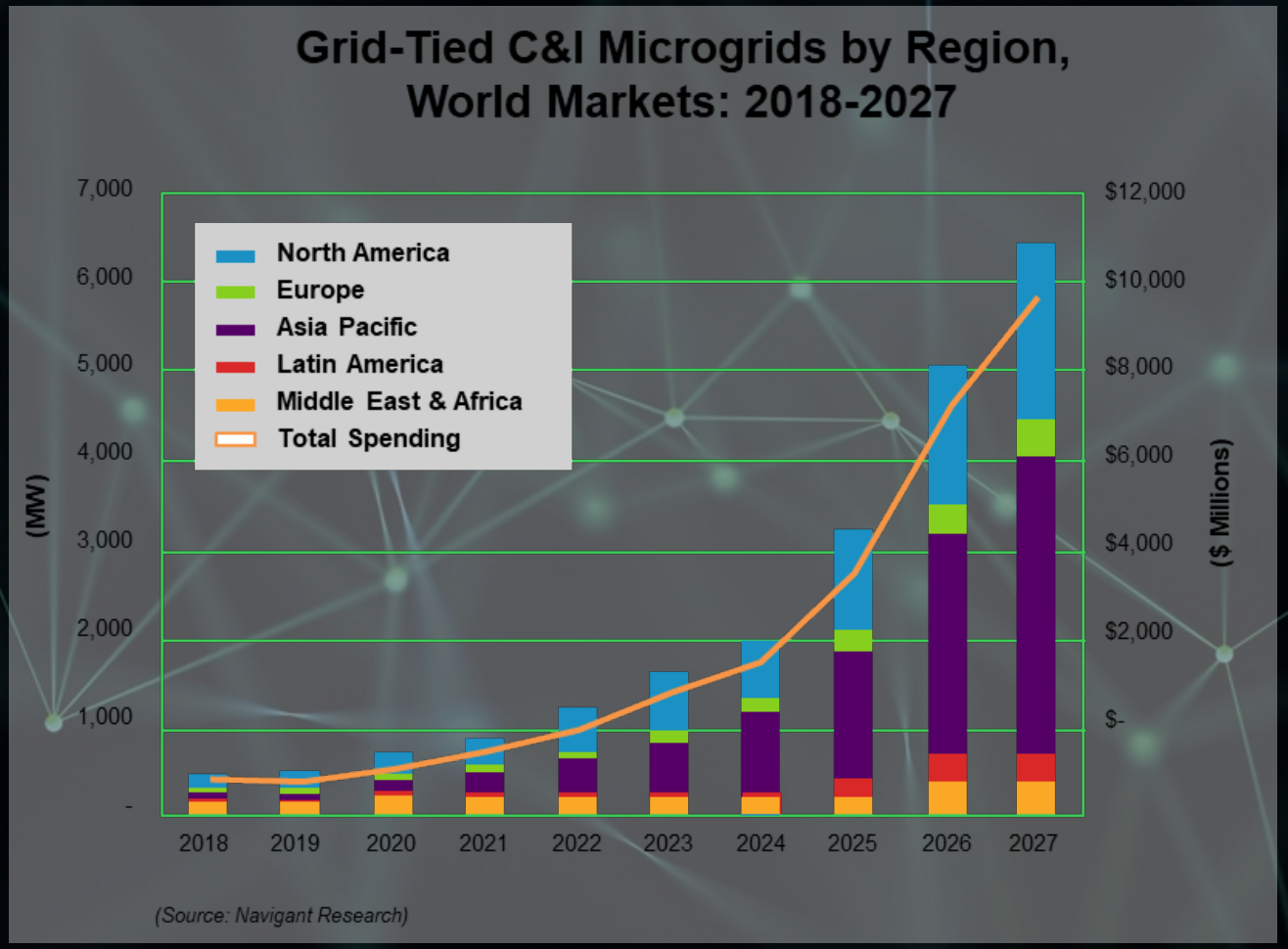
Using date analytics from the software, South Australia Produce Market can determine the most economically beneficial times to charge or discharge the battery.

The microgrid will have notable environmental benefits by:
- cutting annual greenhouse gas emissions by 32%
- reducing the maximum demand on grid by 3.8MWh per annum
- having a net savings of $4.3M over 10 years.

At full capacity, the system is capable of powering approximately 4,500 homes..



Drivers for Growth & Adoption



Maximize Value creation across ecosystem

- Capability to combine use cases

Ensure Value sharing for all stakeholders

- Monetization (Implicit & Explicit)
- Value of resilience
- Investment models (CAPEX, EAAS, …)

Ease of adoption

- No impact on comfort / production
- Friendly regulation (Relationship with utility, grid code)

Local skiils & support

- Upskill of Electrical channel (contractor, system integrator)
- Integration of new usages (EV)

Life Is On Schneider Electric