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Claire Mack
Chief Executive
Scottish Renewables



Susie Lind

Head of Legal and Company Secretary
EDF Renewables

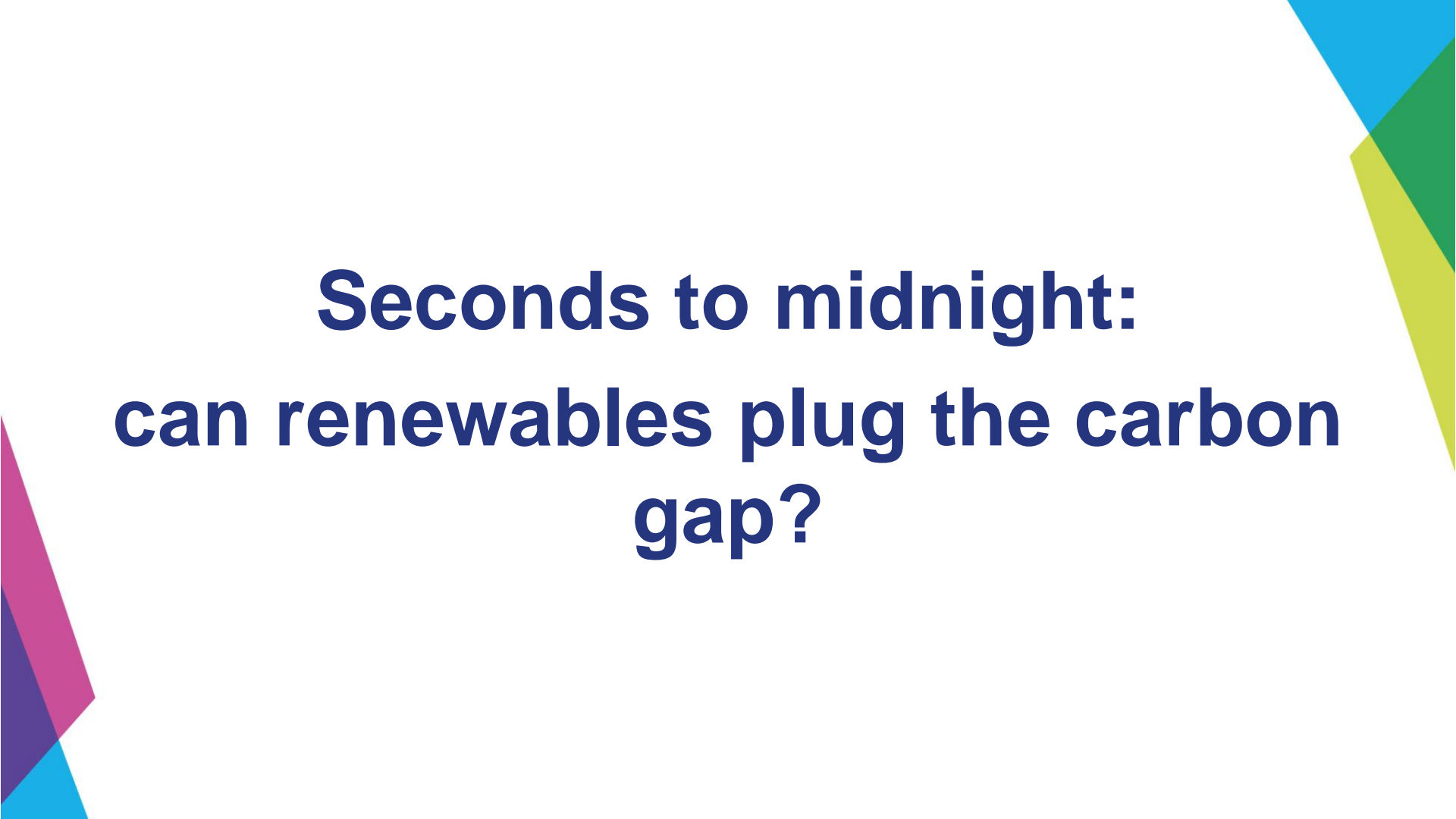


Paul Wheelhouse MSP

Minister for Energy, Connectivity and
the Islands

Scottish Government





**Seconds to midnight:
can renewables plug the carbon
gap?**




Chris Stark
Chief Executive
Committee on Climate Change

12 March 2019

Where do we stand?

Chris Stark
@ChiefExecCCC



Climate Change Act 2008

CHAPTER 27

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PART 1
CARBON TARGET AND BUDGETING

The target for 2050

- 1 The target for 2050
- 2 Amendment of 2050 target or baseline year
- 3 Consultation on order amending 2050 target or baseline year

Carbon budgeting

- 4 Carbon budgets
- 5 Level of carbon budgets
- 6 Amendment of target percentages
- 7 Consultation on order setting or amending target percentages
- 8 Setting of carbon budgets for budgetary periods
- 9 Consultation on carbon budgets
- 10 Matters to be taken into account in connection with carbon budgets

Limit on use of carbon units

- 11 Limit on use of carbon units


Indicative annual ranges

- 12 Duty to provide indicative annual ranges for net UK carbon account

Proposals and policies for meeting carbon budgets

- 13 Duty to prepare proposals and policies for meeting carbon budgets
- 14 Duty to report on proposals and policies for meeting carbon budgets
- 15 Duty to have regard to need for UK domestic action on climate change

Climate Change (Scotland) Act 2009 (asp 12)



Climate Change (Scotland) Act 2009

2009 asp 12

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- 8 The domestic effort target

Advice on progress

- 9 Progress towards targets

Greenhouse gases

- 10 Greenhouse gases

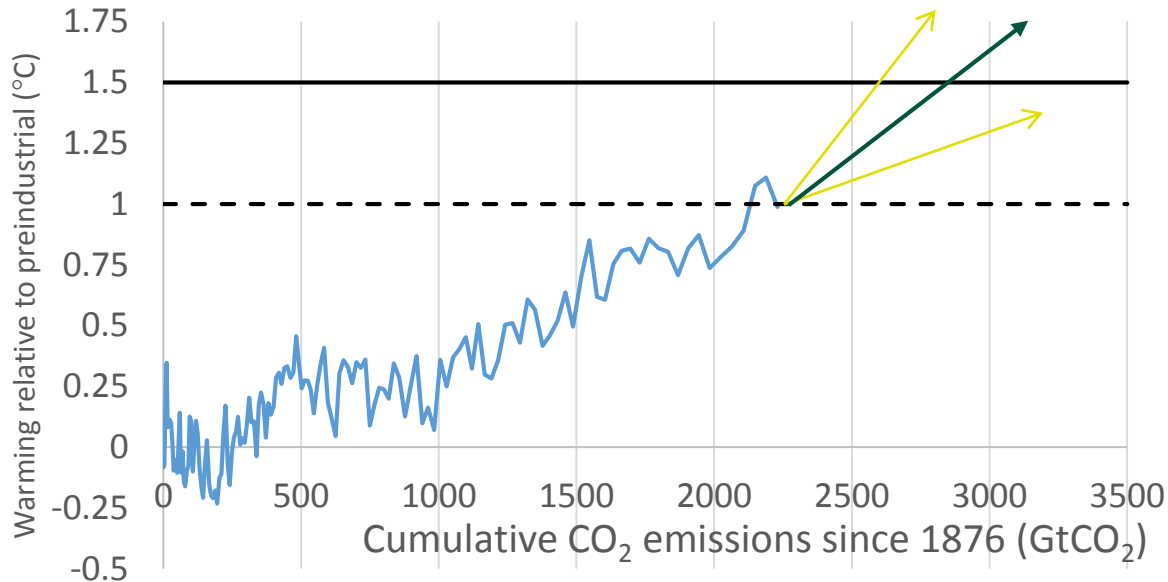
Baseline

- 11 The baseline
- 12 Baselines for additional greenhouses gases

Supplementary

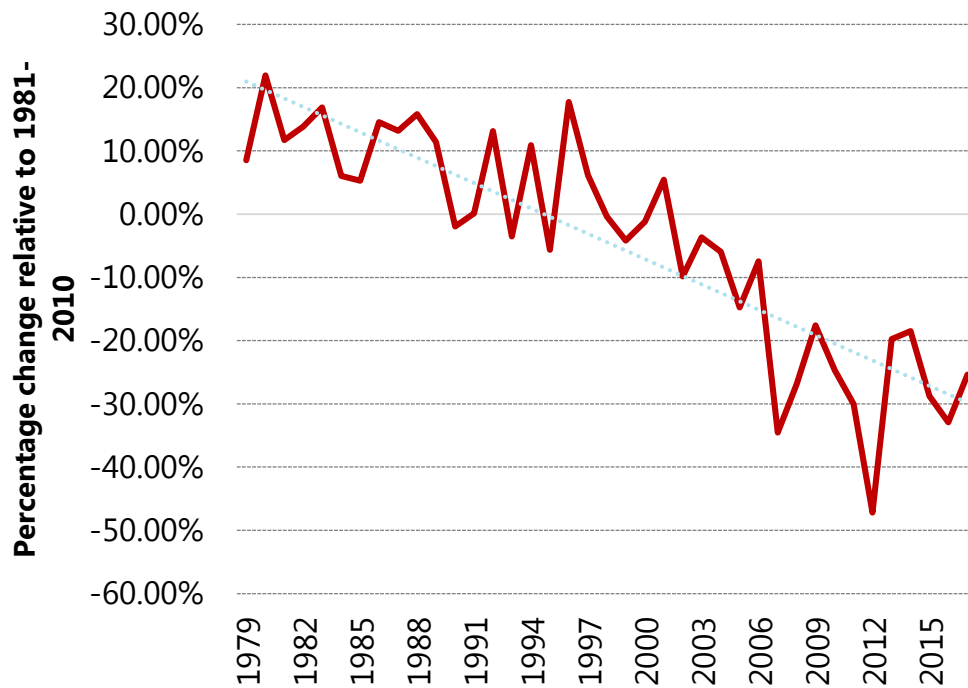
- 13 The net Scottish emissions account
- 14 Restriction on use in 2010-2017 of carbon units purchased by Scottish Ministers
- 15 Attribution of emissions to Scotland

Cumulative CO₂ and Global Temperature

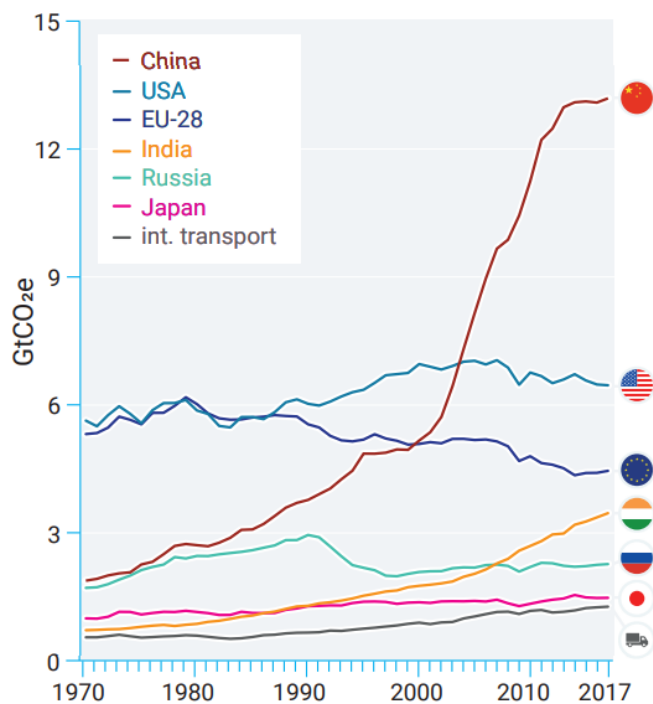
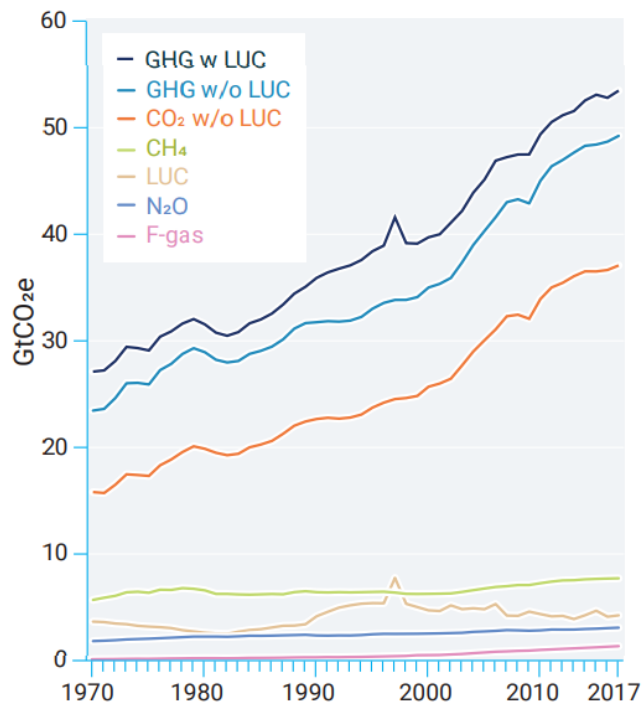


Estimated fossil fuel reserves: 3670 – 7100 GtCO₂
Estimated fossil fuel resources: 31300 – 50050 GtCO₂

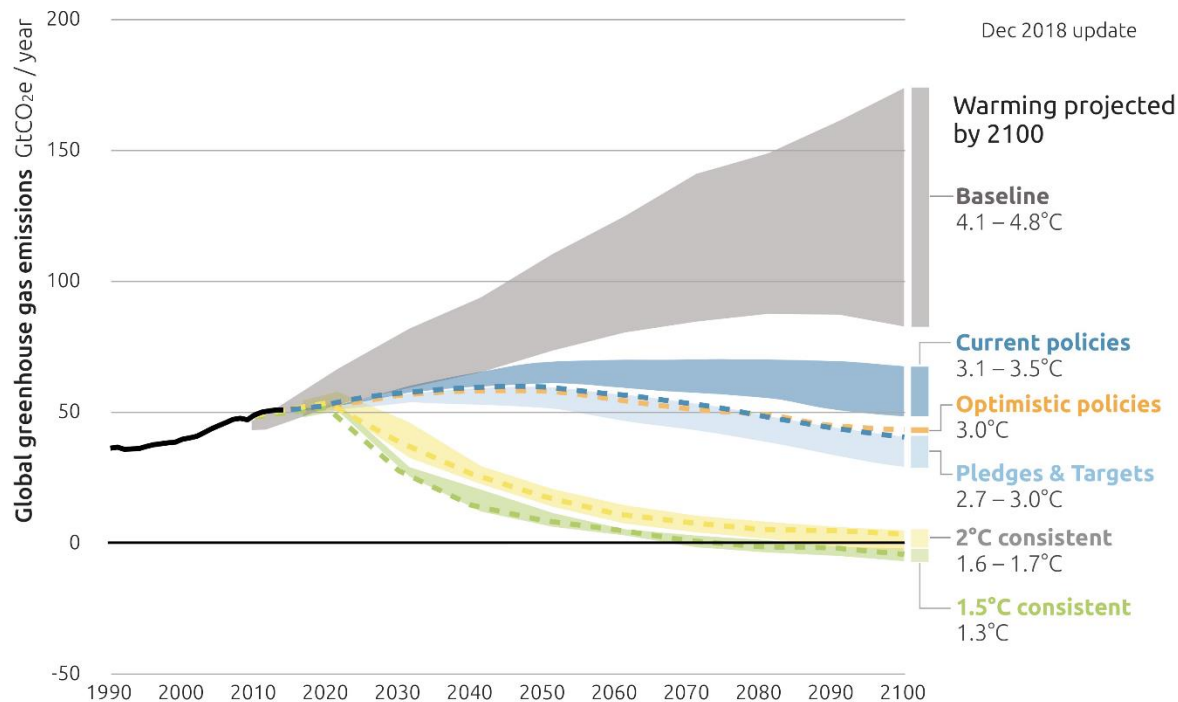
Arctic summer sea ice cover



Global greenhouse gas emissions UNEP 2018

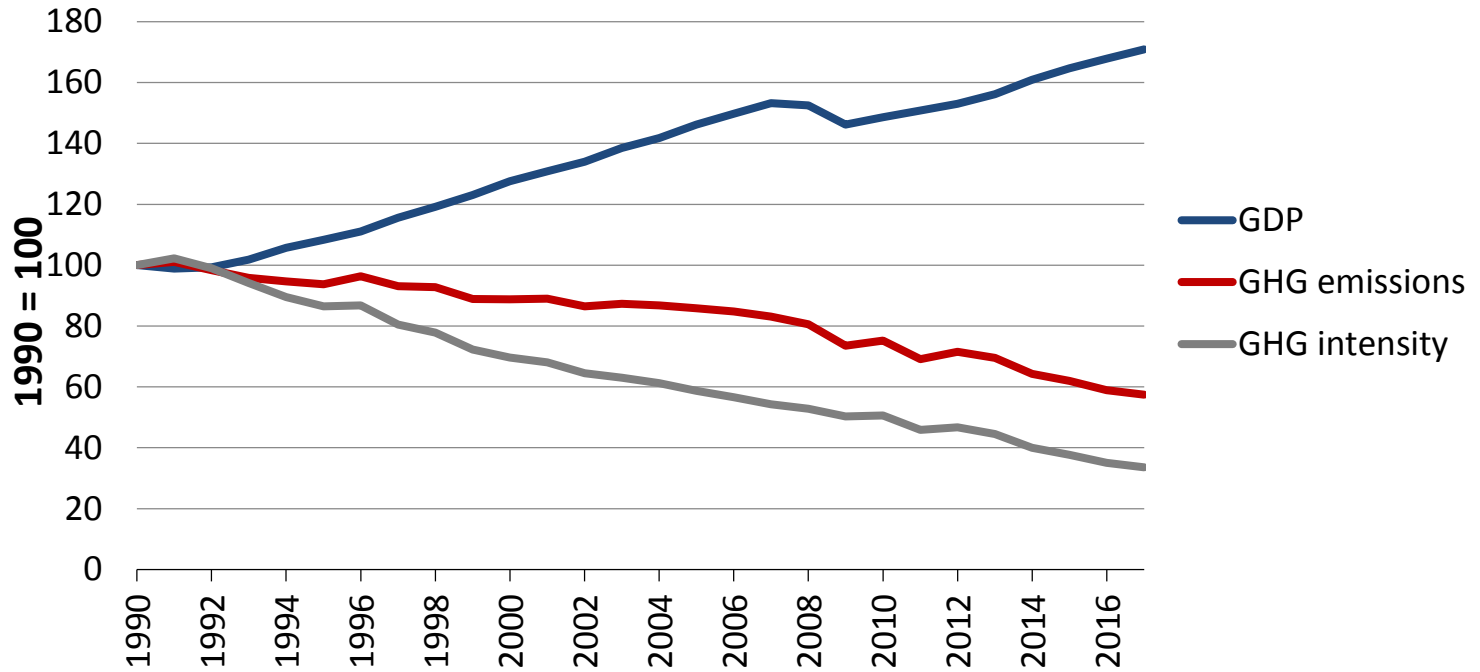


Global temperature scenarios

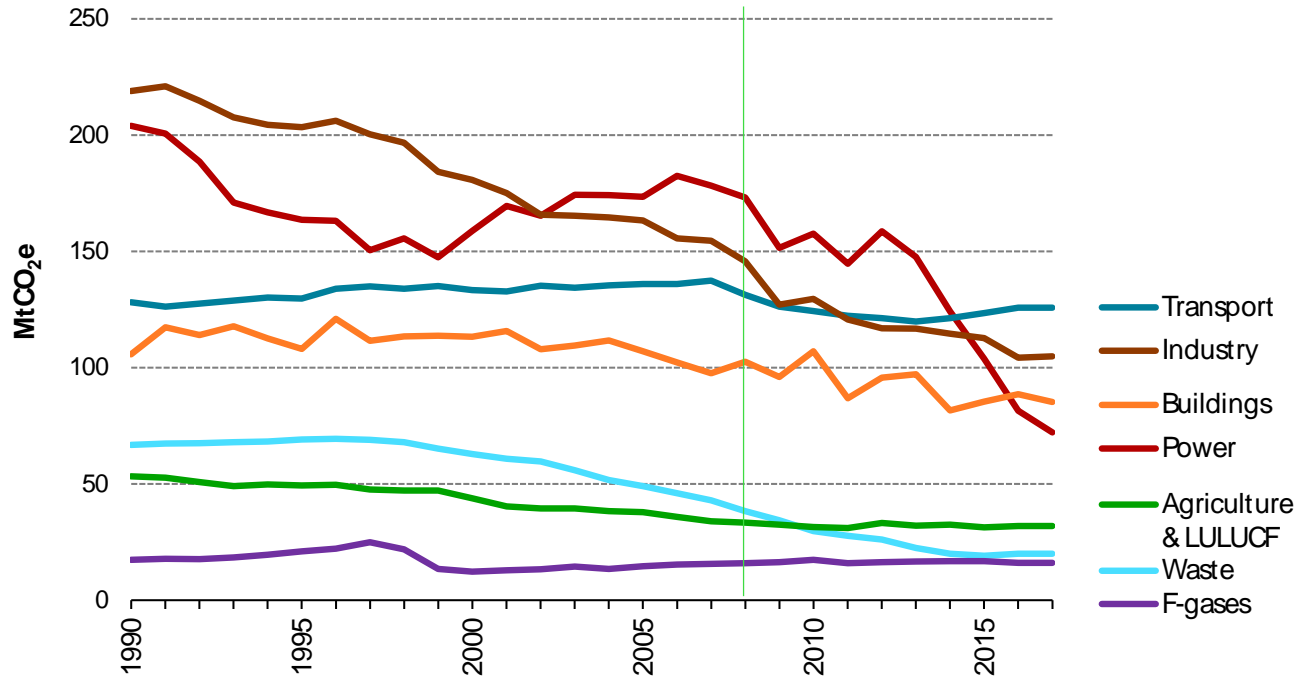


Source:
Climate Action Tracker

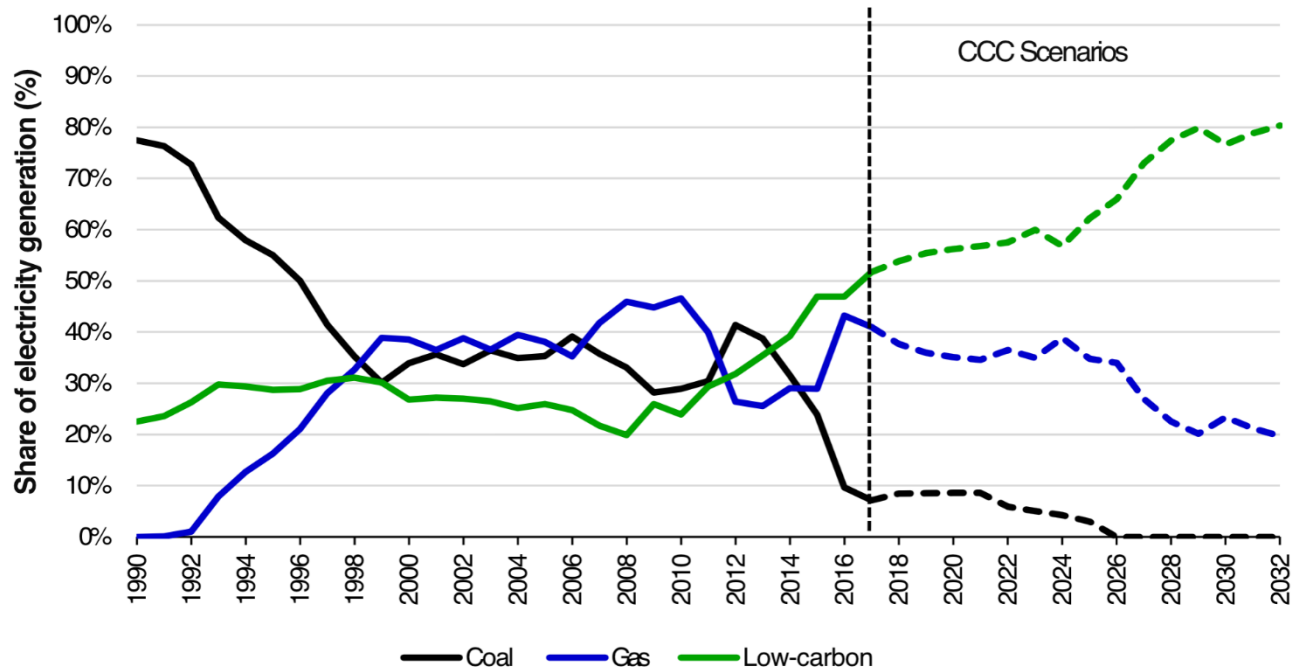
UK Greenhouse gas emissions (1990 – 2017)




UK Greenhouse gas emissions (1990 – 2017)



CCC Projections for electricity generation





Climate Change Act 2008

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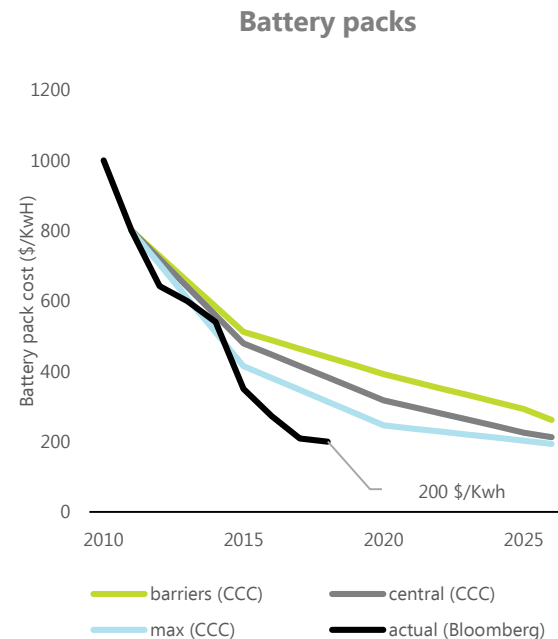
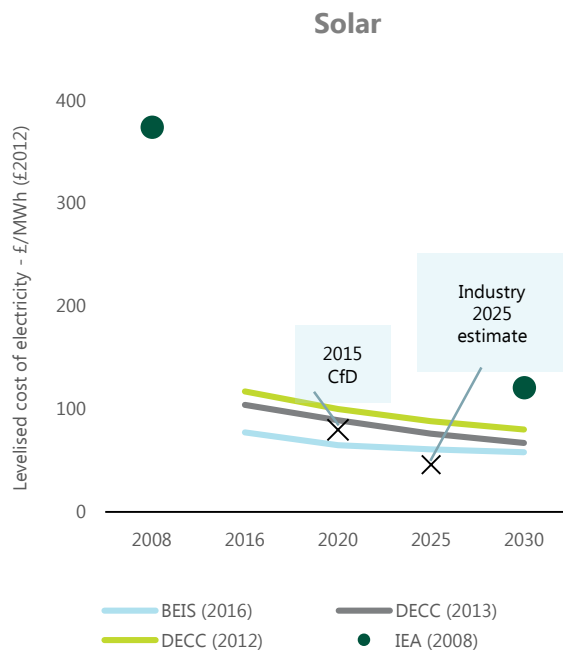
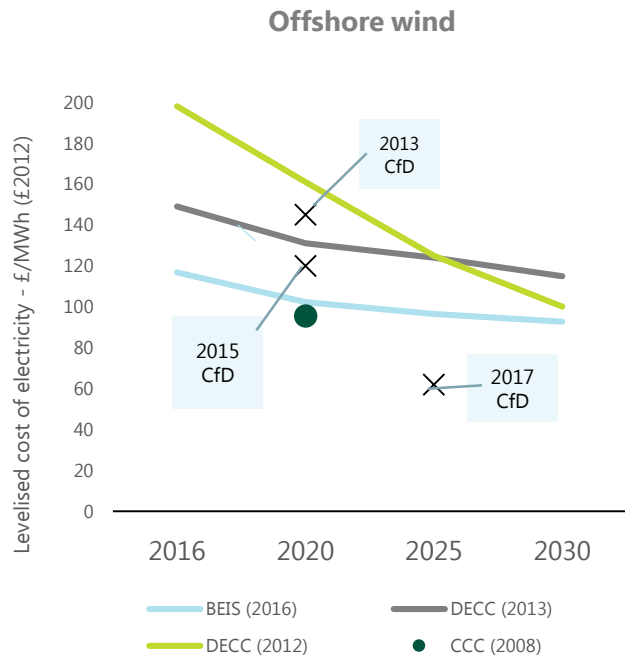
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- 15 Attribution of emissions to Scotland

Cost projections for key renewable technologies



chris.stark@theccc.gsi.gov.uk

@ChiefExecCCC



Anthony Legg

Director - Head of Power & Utilities
EY

[View presentation here](#)



Claire Mack

Chief Executive, Scottish Renewables

Chris Stark

Chief Executive, Committee on Climate Change

Anthony Legg

Director - Head of Power & Utilities, EY

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**Breaking point:
making sense of Brexit**



Nick Sharpe



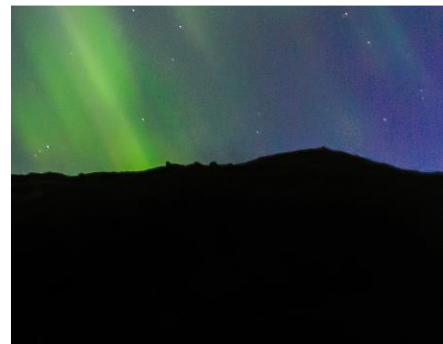
Director of Communications
Scottish Renewables



Michael Moore
Senior Advisor
PricewaterhouseCoopers

Scottish Renewables: *facing a blizzard?*

Presentation by **Michael Moore, PwC Senior Adviser**
12th March 2019



5

megatrends

1

financial crisis

?

political crises



Megatrend
TECHNOLOGY

700,000

Estimated 20 years ago

INDUSTRIAL
ROBOTS

1,800,000

Estimated this year

BIG

DATA

5 *tb/s*

Estimated in 2005

400 *tb/s*

Estimated in 2016

1,900 *tb/s*

Estimated by 2021

Sources: World Economic Forum, PwC

Megatrend

URBANISATION

55%

Estimated in 2017

WORLD POPULATION *LIVING IN CITIES*

68%

Estimated by 2050

Source: United Nations

Megatrend

DEMOGRAPHY

0.96

billion people
Estimated in 2017

PEOPLE aged over 60

2.1

billion people
Estimated by 2050

3.1

billion people
Estimated by 2100

Source: United Nations

Megatrend

ECONOMIC SHIFT

E7

*China, India, Indonesia, Brazil, Russia,
Mexico, Turkey*

G7

*USA, Canada, Germany, Japan, France,
UK and Italy*

**GROSS
DOMESTIC
PRODUCT**

$E7 = 50\% G7$

Estimated in 1995

$E7 \approx G7$

Estimated in 2015

$E7 = 2x G7$

Estimated by 2040

**GROSS
DOMESTIC
PRODUCT**

Sources: International Monetary Fund; PwC

Megatrend

ENERGY TRANSITION

35% FOOD

demand increase, estimated by 2030

40% WATER

demand increase, estimated by 2030

50% ENERGY

demand increase, estimated by 2030

7.3 becomes 8.8 billions

world population figures, estimated for 2017 and by 2030

8%

UK GDP increase estimated from 2008 to 2022

29%

UK GDP increase estimated from 1980 to 1994

33%

UK GDP increase estimated from 1990 to 2004

FINANCIAL CRISES

210 years

*Estimated length of time since previous
worst decade for real earnings growth*

*Source: Resolution Foundation using Office for
Budget Responsibility figures 2017*

52:48

Brexit

306:232

Trump

POLITICAL BACKLASH...

*208*_{days,} *4*_{parties}

Netherlands

32+18=50

Five Star/League

Sources: CNN, BBC, The Guardian

BREXIT

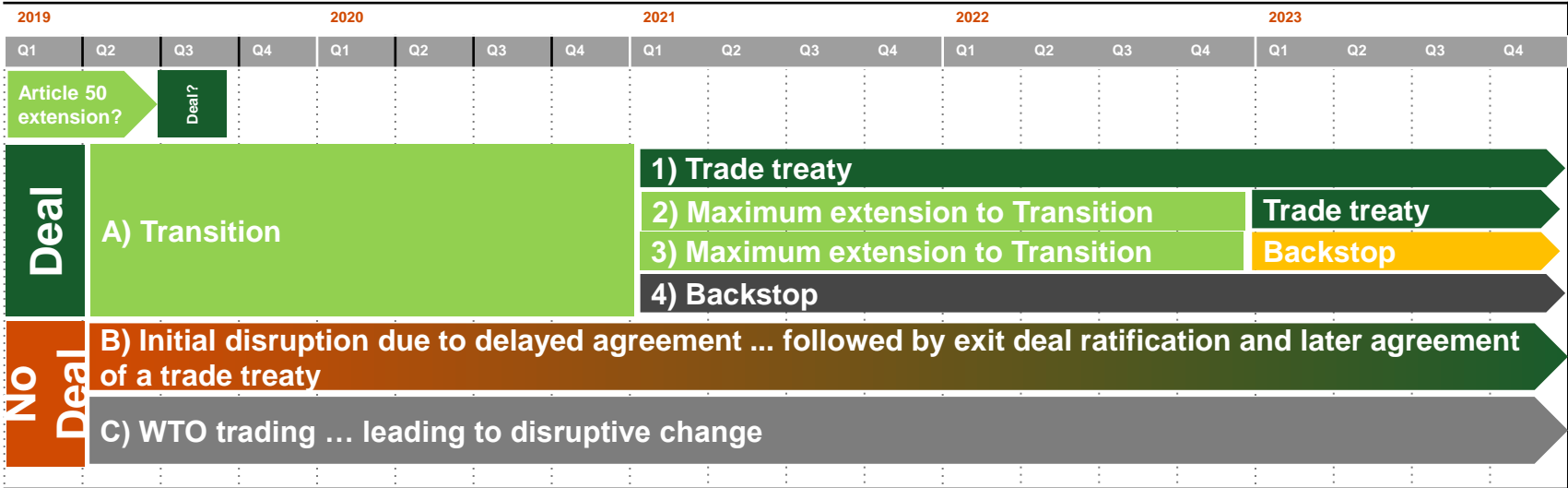
230

margin of January defeat in House of Commons

17

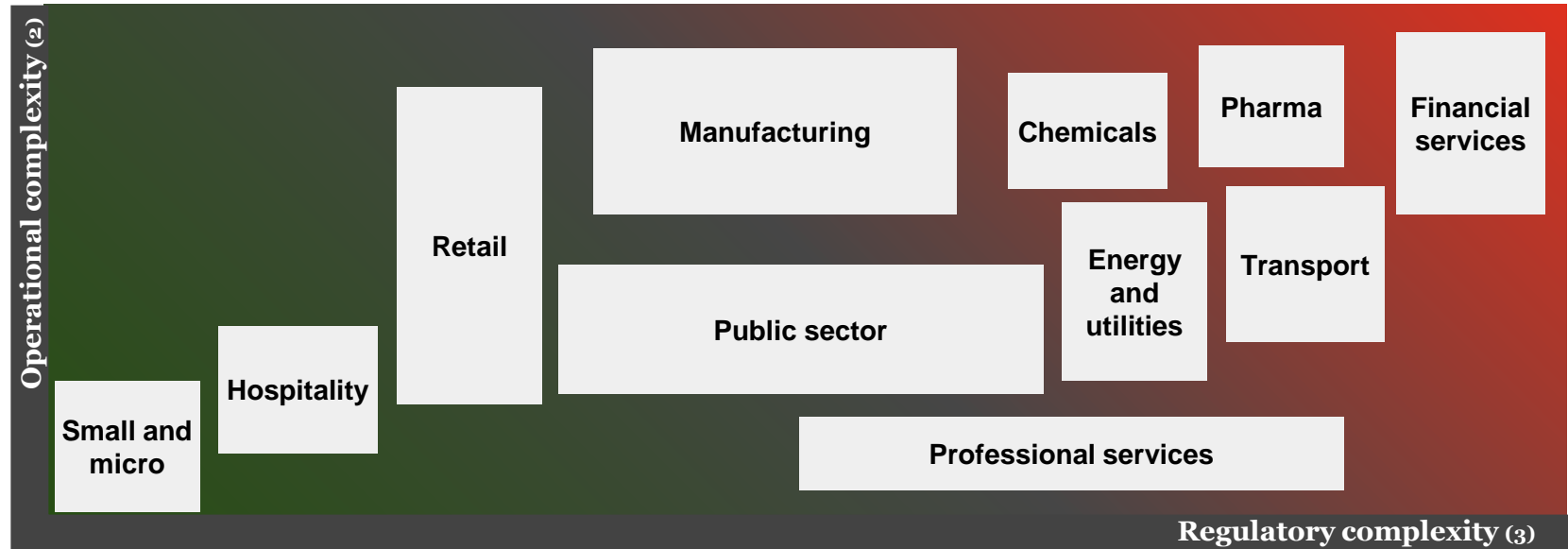
days until scheduled departure

BREXIT: *TIMELINE*



Under any likely scenario, the UK economy will experience change

BREXIT: *HEATMAP*



- 1) Heatmap for illustrative purposes only – within each sector there are big variations, so each business requires its own assessment
- 2) This covers the supply chain and the people mix in the business
- 3) New UK legislation will have an impact; statutory regulators are also setting out fresh requirements

BREXIT: *CONTINGENCIES*

Set up your **business continuity team** and heat map anticipated disruption

Engage **suppliers, customers** and **other key organisations** to share assumptions

Engage your **people** - support those affected and help them plan for new circumstances

Register for a **'EORI'** number and know how **HMRC's new processes** affect April

8 '*contingency*' considerations ahead of April

Check **business travel** plans to ensure valid work permissions and driving permits

Review **working capital exposure** for stock build up and delayed payments

Speak to your **banks** and other capital providers on facilities and payment services

Have a **plan** supported by front line staff, senior managers and the board

BREXIT: *NEW WORLD*

Energy

Industry

Taxation

*State aid and
procurement*

8 policy considerations under a '*future economic partnership*'

Competition

**National and
regional support
funding**

Employment law

**Consumer
protection**

Thank you

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Ayesha Hazarika MBE



Nick Sharpe

Director of Communications,
Scottish Renewables

Michael Moore

Senior Advisor, PricewaterhouseCoopers



Ayesha Hazarika MBE

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**Back to the Future:
How renewables can shape
energy's new normal**



Trisha McAuley OBE
Independent Consumer Expert



Mark Taylor

**Deputy Director of Innovation
Department for Business, Energy and
Industrial Strategy
UK Government**





Department for
Business, Energy
& Industrial Strategy

Back to the Future: How renewables can shape energy's new normal

Mark Taylor, Deputy Director Energy Innovation



My career before I joined the Civil Service...



Department for
Business, Energy
& Industrial Strategy



What is the Clean Growth Strategy?

The **Clean Growth Strategy** sets out government policies and proposals for decarbonising the UK economy:

1. **Accelerating clean growth**
2. **Improving Business and Industry Efficiency** (25% of UK Emissions)
3. **Improving Our Homes** (13% of UK Emissions);
4. **Accelerating the Shift to Low Carbon Transport** (24% of UK Emissions)
5. **Delivering Clean, Smart, Flexible Power** (21% of UK Emissions);
6. **Enhancing the Benefits and Value of Our Natural Resources** (15% of UK Emissions);
7. **Leading in the Public Sector** (2% of UK Emissions);
8. **Government Leadership in Driving Clean Growth**

The Strategy has a strong focus on innovation to bring down the cost of clean technologies



Make-up of the BEIS Energy Innovation Programme

Clean Growth Strategy set out expectation to invest £2.5bn in energy and clean growth innovation

The overall aim of the BEIS Energy Innovation Programme is to accelerate the commercialisation of innovation cheap, clean, and reliable energy technologies by the mid 2020s and 2030s.

Over £300m of the £505m already committed so far

£180m
Nuclear

Driving down costs and building new UK supply chains and skills

£15m
Renewables

Driving down the cost of low carbon electricity at scale

£100m
Industry

Low carbon options for industry, lowering energy costs

£90m Built Environment

More cost effective energy efficiency and low carbon heating

£70m Smart Systems

Scaling up flexibility and looking for new storage options

£50m Cross Cutting Supporting disruptive innovations (particularly for SMEs), including using innovative finance.



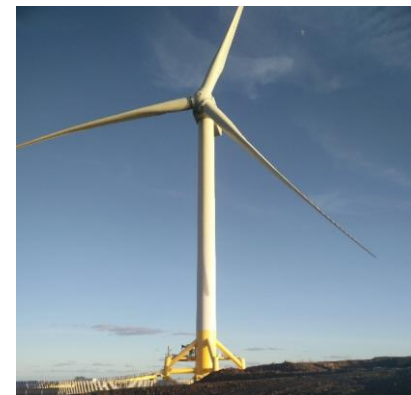
Accelerating cost reduction in Bioenergy- BESTF

- **Aim:** Enhance our ability to monitor and improve the sustainability of biomass and improving the efficiency and reducing the costs of biomass conversion technologies to allow us to use our available biomass effectively.
- **Scope:** Scope to enable new innovations relevant to syngas synthesis, clean up and gasification technology development that contributes towards cost reduction.
- **Technology Readiness Level (TRL):** Advance innovative technologies from Technology Readiness Levels 5 or 6 to Technology Readiness Levels 6 or 7
- **Timing:**
 - **BESTF 1:** Completed
 - **BESTF 2:** Completed – Final Report will submit soon
 - **BESTF 3:** Projects must be fully completed – including all reporting requirements - by 31 December 2019
- **Transnational collaboration:** Involve at least two separate private sector organisations from at least two of the BESTF partner countries/regions

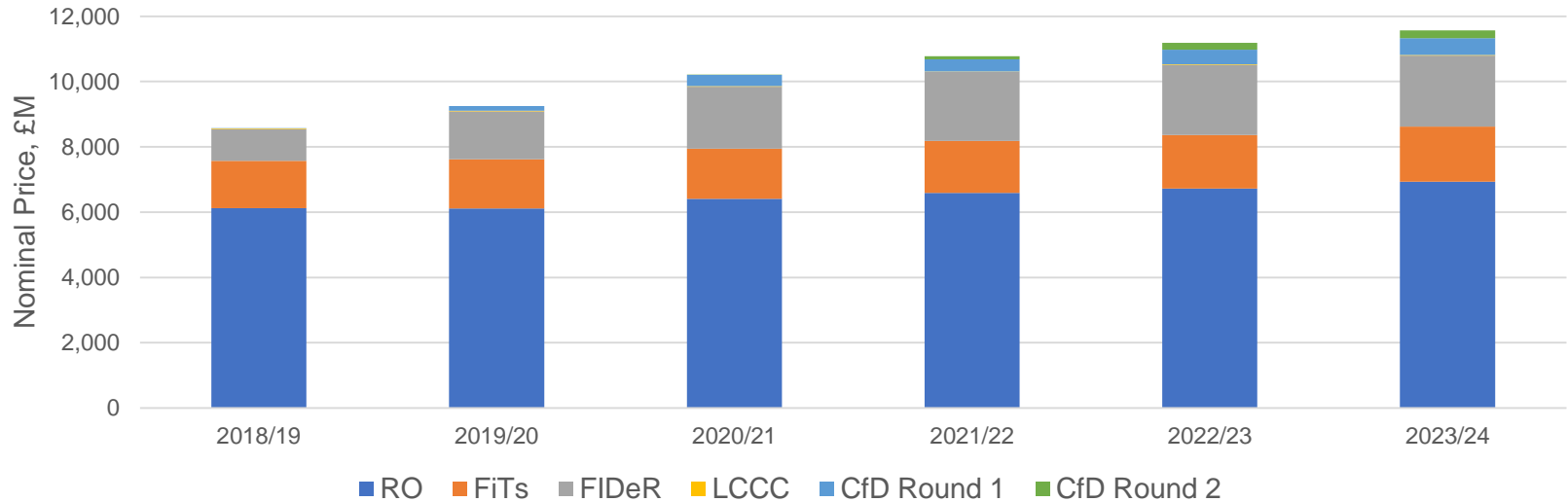


Accelerating cost reduction in offshore wind: DemoWind

- **Focus on cost reduction:** must provide evidence to show how the innovation to be developed and demonstrated will lead to reduction in the levelised cost of offshore wind energy
- **Technology area:** Technical priority area including turbine components, floating offshore turbines, foundation structures and electrical networks
- **Technology Readiness Level (TRL):** Advance innovative technologies from Technology Readiness Levels 5 or 6 to Technology Readiness Levels 6 or 7
- **Timing:**
 - **DemoWind 1:** Constructed and commissioned by 31 December 2018; and projects must be fully completed – including all reporting requirements - by 31 December 2019
 - **DemoWind 2:** Constructed and commissioned by 31 December 2019; and projects must be fully completed – including all reporting requirements - by 31 December 2020
- **Transnational collaboration:** Involve at least two separate private sector organisations from at least two of the DemoWind partner countries/regions



Support for Renewables: Levy Control Framework Projections



Hy4Heat



Value
chain:

Supply

Pipeline

Use: Transport, Buildings,
Industry

Energy
Storage

Objective: £25m To establish if it is technically possible and safe to replace natural gas with 100% hydrogen in commercial and residential buildings and gas appliances

Summary: The programme is made up of a number of related work packages.

From Summer 2018 (once partners are appointed) to Mar 2021

1. Definition of a hydrogen quality standard
2. Establishing an appliance and equipment testing capability
3. Development of domestic hydrogen appliances (fires, cookers and boilers)
4. Understanding commercial appliances
5. Understanding industrial appliances
6. Assessment of suitability of existing buildings
7. Trialling hydrogen appliances in unoccupied buildings
8. Preparations for a residential consumer trial

Partners:
Project Managers (contracted by BEIS):



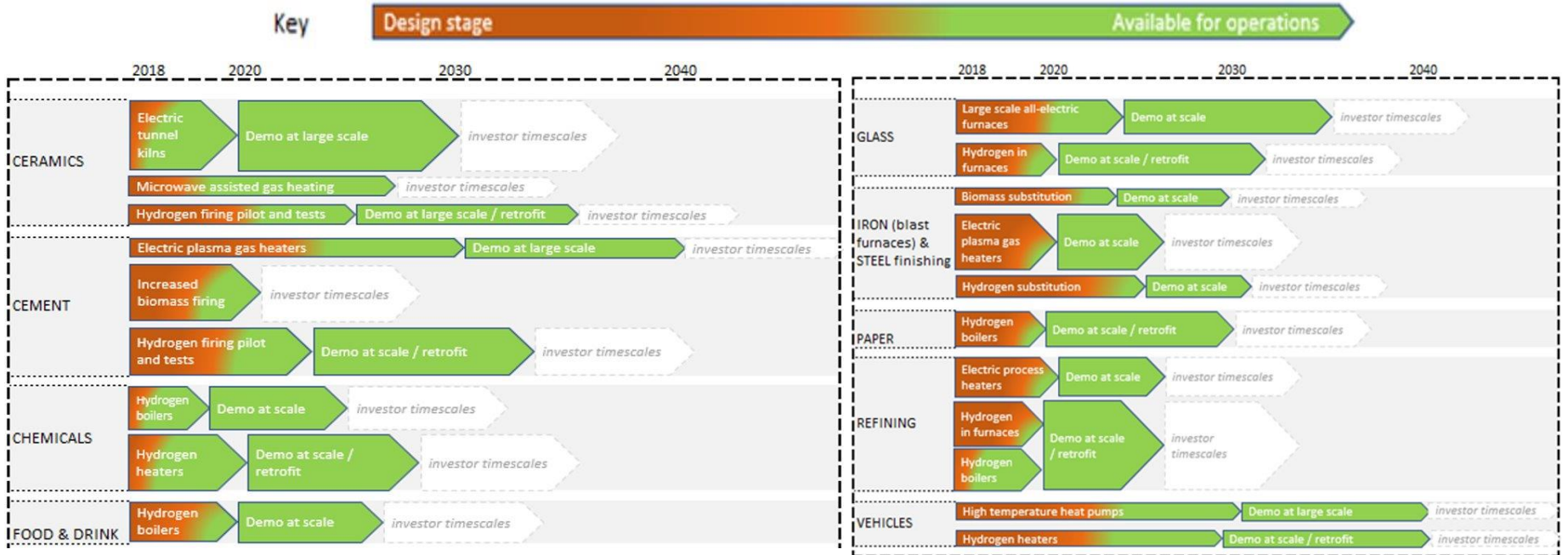
ARUP



Start: Mar 2018 - End: Mar 2021

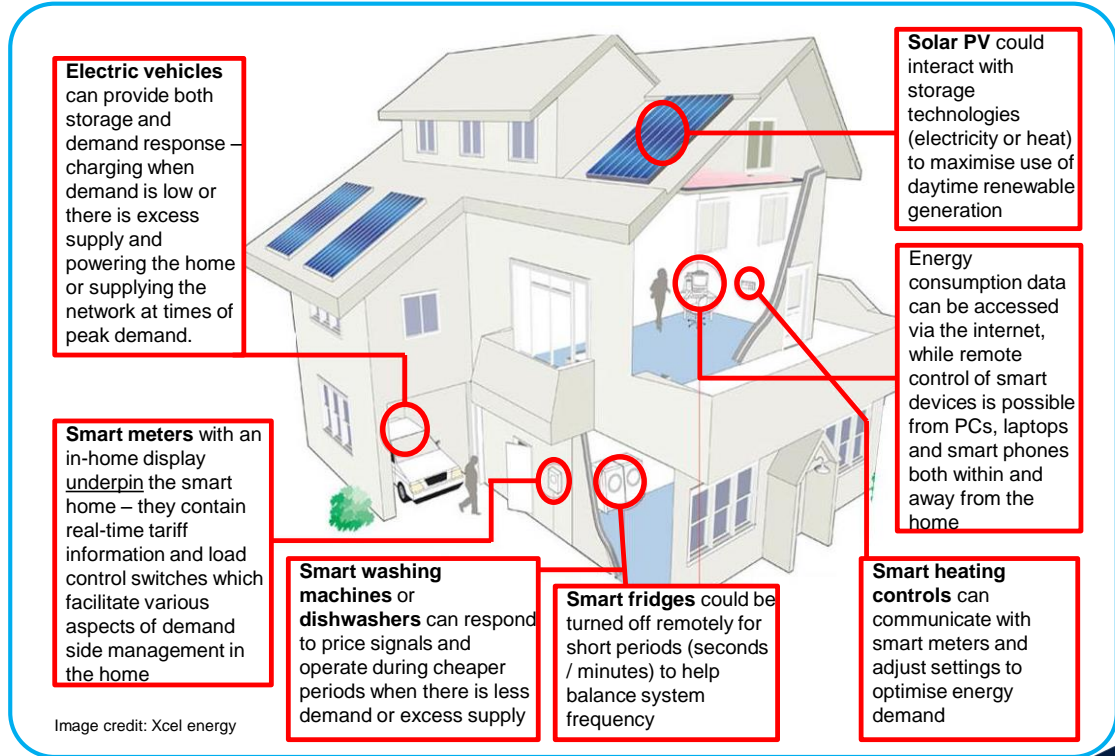


Industrial Fuel Switching



But what about intermittency costs in our decarbonisation strategy?

- We have a number of **potential** engineering solutions to the intermittency problem of renewables
- Battery storage costs have a learning rate of 8%, so may make a contribution
- We have demonstrated controlling demand is feasible and cost-effective using smart grid technology
- Interconnectors allow greater geographical spread and better diversity of generation and demand- the 'European Supergrid'
- GT back-up adds only marginally to carbon costs and generation costs
- We will be publishing for the first time in 2019 estimates of system costs of renewables due to intermittency using back-up generation- but they add on less than £10/MWh to generation costs





Dr Matthew Hannon

Senior Lecturer

Hunter Centre for Entrepreneurship



University of Strathclyde Business School



Trisha McAuley OBE
Independent Consumer Expert

Mark Taylor
Deputy Director of Innovation, Department for Business, Energy and Industrial Strategy,
UK Government

Dr Matthew Hannon
Senior Lecturer, Hunter Centre for Entrepreneurship, University of Strathclyde
Business School

Xavier Mamo
Research and Development Director, EDF Energy

Anita Breslin
Head of Commercial, Vattenfall Heat

Alan Gooding
Executive Director, Smarter Grid Solutions

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Claire Mack
Chief Executive
Scottish Renewables



The price of green: beyond subsidy



Fabrice Leveque
Senior Policy Manager
Scottish Renewables



Vicky Dawe

**Deputy Director – Renewable
Electricity Support Schemes**

**Department for Business, Energy and
Industrial Strategy**

UK Government

Scottish Renewables' Annual Conference

Vicky Dawe, BEIS

The Sheraton Grand Hotel, Edinburgh
13 March 2019


Department for
Business, Energy
& Industrial Strategy


Department for
Business, Energy
& Industrial Strategy

Renewables in the UK

- Renewables' share of electricity generation increased to a record 33.1 per cent (Q3 2018).
- Strong UK renewables sector:
 - around 40GW of installed renewable electricity capacity.
 - the CfD scheme is supporting around 10GW of that.
 - The UK is the world leader in Offshore wind, with over 7.1GW installed.
- We have seen substantial investment and significant cost reductions in some technologies.

Four Principles

Market Principle

“That we must wherever possible use market mechanisms that take full advantage of innovation and competition”

Insurance Principle

“Given intrinsic uncertainty about the future, government must be prepared to intervene to provide insurance and preserve optionality”

Energy
White
Paper

Agility Principle

“Energy regulation must be agile and responsive if it is to reap the great opportunities of the smart, digital economy”

No Free-Riding Principle

“All consumers should pay their fair share of system costs”

Department for Business, Energy & Industrial Strategy



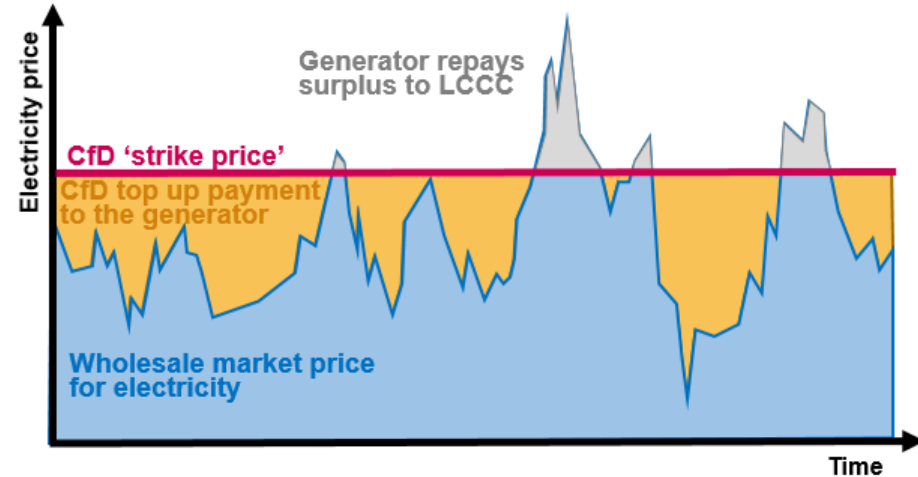
Department for
Business, Energy
& Industrial Strategy

Contracts for Difference (CfD) – AR 3

- Planned to open on 29 May 2019
- Pot 2 auction (less established technologies)
- Delivery years 23/24 and 24/25
- Budget of £60m (2011/12 prices)
- Administrative Strike Prices set at 25% of the supply curve
- No technology specific minima or maxima
- Whole auction capacity cap set at 6GW

Contracts for Difference (CfD)

- The CfD scheme is at the heart of the Industrial Strategy and Clean Growth Strategy, helping us to:
 - Deliver diverse, clean, secure and affordable power
 - Transition to a low carbon economy
- Income stabilisation for new projects
- 15-year private law contracts
- Awarded in competitive auctions



Contracts for Difference (CfD) – AR 4

- High bar to significant changes
- Importance of continuity and certainty

**AR4 in
2021**

- ▶ Subsequent auctions every 2 years after that
- ▶ 1-2GW of new offshore wind every year in the 2020s, subject to auction prices




Claire Perry, July 2018

Department for
Business, Energy
& Industrial Strategy



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Floating offshore, wind and tidal

Wave	Single prototype devices	
Tidal Stream	Early demonstration arrays in Scotland, other devices at prototype stage	
Floating wind	First windfarm in UK (Hywind), number of demonstrators installed or being planned worldwide	



Offshore wind sector deal

Smart Export Guarantee (SEG)

To support the transition to a cleaner, smarter and more flexible energy system our intention is to consider future arrangements that would facilitate:

- **A route to market** - which supports small-scale low-carbon generation of electricity.
- **Market innovation** - Government has identified innovation as a central tenet of its Industrial Strategy.
- **Lowering of costs for consumers** - by supporting the development of the electricity system to provide consumers with affordable, low carbon electricity.
- **The transition to a smart and flexible electricity system** - by promoting the efficient use of electricity through price signals, which incentivise consumer behaviour that enables the efficient management of the grid.





Sue Kearns

Deputy Director – Consumers and Low Carbon
Division

Scottish Government




Neal Rafferty

Head of Utilities, Markets and Network Policy Unit

Scottish Government

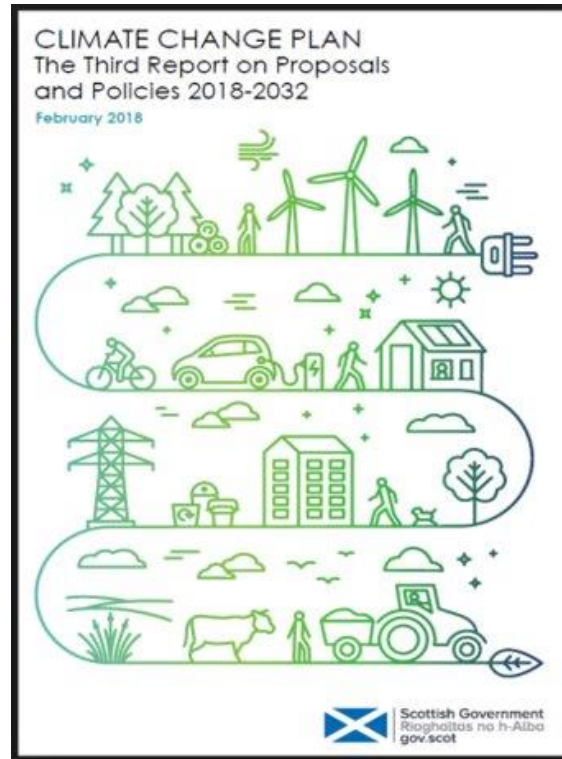
Low carbon legislation and policy



Climate Change (Scotland) Act 2009
2009 asp 12

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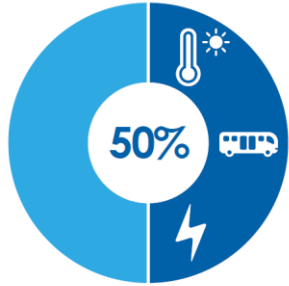
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Climate Change Bill proposes:

- **Updated 2020 target**
 - 42% -> 56%
- **New interim targets**
 - **2030:** 66%
 - **2040:** 78%
- **Updated 2050 target**
 - 80% -> 90%
- **Net zero emissions**
 - target date?

Scottish Government Energy Strategy



THE EQUIVALENT OF
50% OF THE ENERGY
FOR SCOTLAND'S
HEAT, TRANSPORT
AND ELECTRICITY
CONSUMPTION TO
BE SUPPLIED FROM
RENEWABLE SOURCES



A WHOLE-SYSTEM
VIEW



AN INCLUSIVE
ENERGY TRANSITION



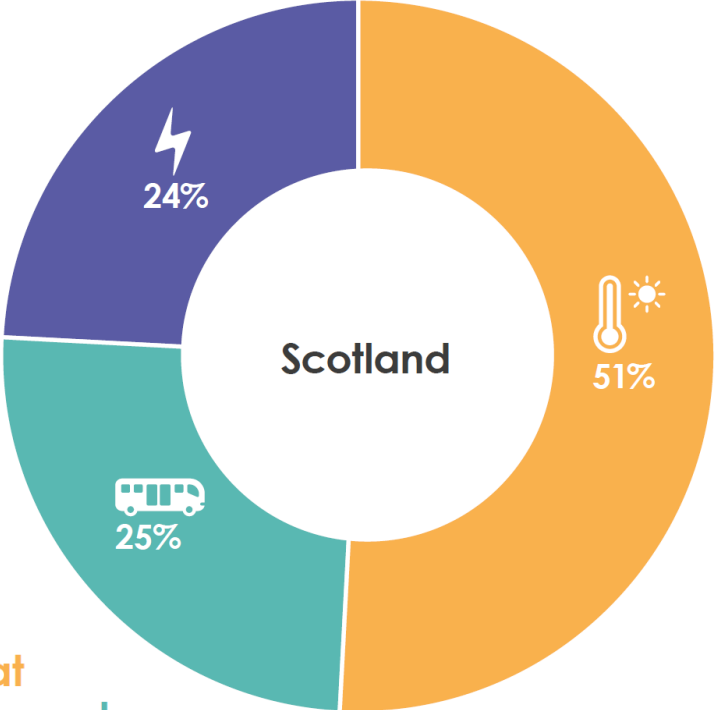
A SMARTER
LOCAL ENERGY MODEL



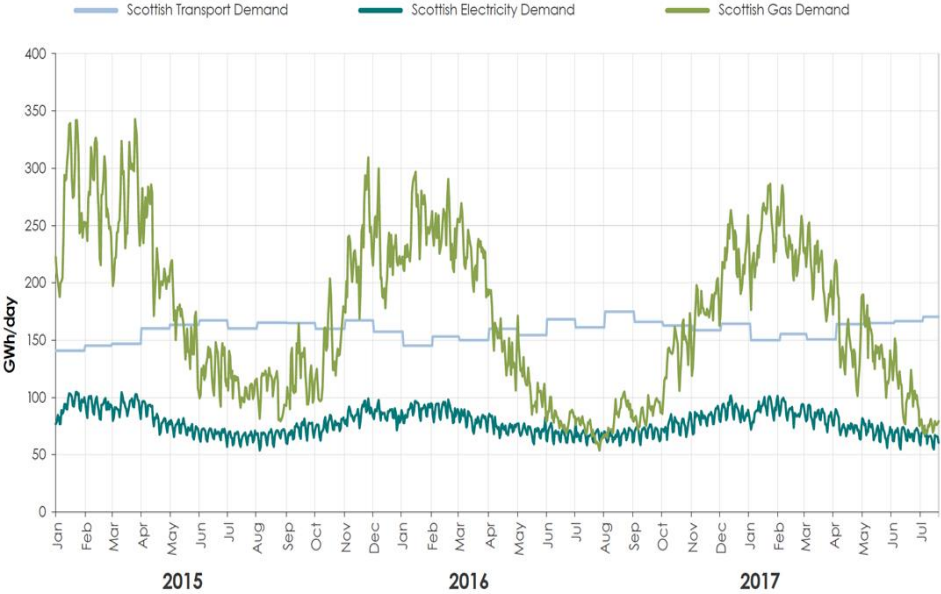
AN INCREASE BY **30%** IN THE PRODUCTIVITY
OF ENERGY USE ACROSS THE SCOTTISH
ECONOMY

by 2030

What does our energy use look like?

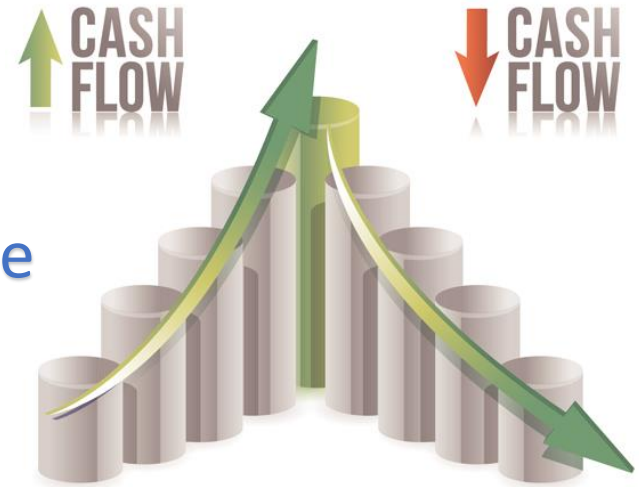


Heat
Transport
Electricity



The Challenge

- Need overall positive cashflow – cash inflows > capital spend & operating costs
- Subsidies under central UK Govt control.
- Limited levers available to overcome challenge
- Competing demands for capital

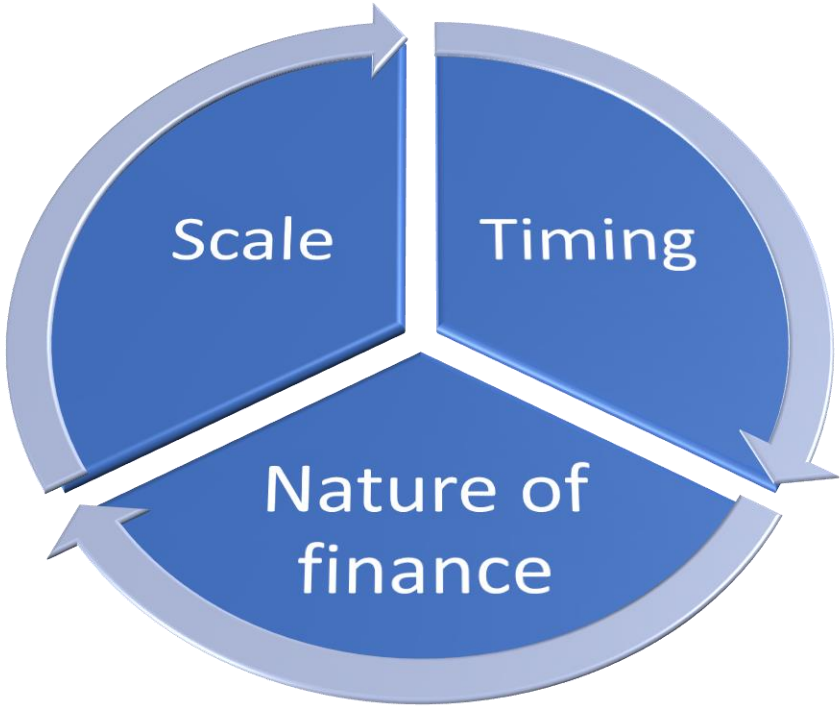


A difficult puzzle to solve

- Ring fence fiscal measures?
- Monetise social benefits?
- Increase the cost of the 'do nothing' option?
- Government bears risk eg SNIB?



Financing Considerations





Graham Meeks

Head of Policy

Green Investment Group





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Making it Work

The price of green: beyond subsidy

Graham Meeks
Head of Policy
Green Investment Group

Scottish Renewables Annual Conference

13 March 2019

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01

Green Investment Group

Green Investment Group: Global Platform



Green Investment Group

270+ green energy specialists operating in 29 offices across the globe; Macquarie and GIG have backed >100 green energy projects requiring more than £15bn investment

Globally
50+
technical staff



Americas
16 staff
ii



EMEA
114 staff
iiiiiiii



ASIA
127 staff
iiiiiiiiiiiiii
(including 34 MacPro)

+88 Conergy

ANZ
15 staff
ii
plus support from EMEA

£15bn+ Invested or arranged in green projects

7GW Global pipeline

One of Europe's largest specialist green energy investors, capital provider, asset manager and adviser, backed by the world's largest infrastructure investor

Green Investment Group: Subsidy-Free Renewables



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GIG is a leader in subsidy-free renewables, having funded c.1.5GW in subsidy-free or PPA-enabled projects in the past 18 months, and pursuing a global pipeline of 4+ GW



c.1.5^{GW}
PPA-enabled or
subsidy-free projects
in the past 24 months



Global subsidy-free presence

Transactions completed in Europe, the Americas, and Australasia



GIG Dedicated PPA team

Longest corporate PPA in EU

Largest single site wind corp. PPA in EU

Largest PPA in Australia – club solution



4+^{GW}
Global subsidy-free renewables pipeline



#1

Leading infrastructure advisor globally¹



Macquarie CGM

200+ gas and power experts globally
60TWh European power traded annually

1) 2018 – Global Best Investment Bank in Infrastructure sector (Global Finance Awards) and 2018 – Most innovative Investment Bank for Infrastructure and Project Finance (The Banker Investment Banking Awards)



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02

Making It Work

Turning industry green with Scotland's waste resources



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Development and investment in a 21 MW_e Energy from Waste CHP facility in Grangemouth

Opportunity

A ban on waste to landfill and a goal to improve productivity in industry mean Scotland's Climate Change Plan is creating demand for a new generation of energy from waste infrastructure

Actions

Three year partnership with Brockwell Energy to develop and fund the Earls Gate project in Grangemouth

Bespoke Energy Supply Agreement to meet chemical manufacturer CalaChem's needs for long-term supply of green heat and power

Outcomes

Construction of a **£210 million** facility, expected to create **500** construction and **30** long-term jobs

Will prevent **216,000 tonnes** of waste from entering landfill each year, instead turning it into **79GWh of power and 81GWh of heat**

Supply of steam through a local heat network will enhance energy efficiency and improve productivity of industrial customers

Expected to **decarbonise CalaChem's energy consumption by 39 ktCO₂ p.a.** - equivalent of taking 17,000 cars off the road



Subsidy-Free Renewables Drivers



Four trends are driving the growth of subsidy-free renewables around the globe

REDUCING COSTS



Wind LCOE down by c.40%, solar PV LCOE down by c.80% since 2010

BNEF

RISE OF AUCTIONS



Globally, 180GW of renewables capacity auctioned in 2018 vs 4GW in 2010

BNEF

GROWING CORPORATE DEMAND

RE100 demand >150TWh/yr, with an estimated 100TWh/yr left to procure (c.€45bn of renewable investment)



BNEF

INVESTOR APPETITE

\$343bn invested in renewables in 2017 (24% increase vs. 2010), with many global investors looking to increase renewables allocation



Preqin

Subsidy-Free Partnerships



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Delivering subsidy-free renewables requires deep collaboration between key project participants



Technology Supplier/ Developer Success Factors



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Technology suppliers and developers play a vital role in developing competitive projects



Key considerations

- Developers focus on the most competitive projects with strong resource and low cost
- Suppliers drive down LCOE through performance – technology advances reduce costs and increase yield/capacity factors
- Technology upgrades ease market integration (e.g. smart inverters, hybrid power plants)
- Bankable technologies reduce cost of debt and risk for sponsors in subsidy-free markets
- Benefits from broad and deep global supply partnerships



Case study: Project Cloud

- GIG and SCA Energy - 235MW Overturingen wind farm
- Norsk Hydro PPA with NEAS energy management
- Siemens provided 56 wind turbines rated at 4.2MW each and a full-scope long-term operations and maintenance contract
- Innovative Siemens technology solution – next generation turbine technology, high onshore hub height, and de-icing capabilities for extreme cold weather conditions on site



Off-taker Success Factors



Off-take structures are evolving and becoming more advanced, these enable success in a range of subsidy-free projects, but also require new partners and approaches



Key considerations

- Replacing government in a subsidy-free world, while allowing for project finance investment
- Off-takers include utilities, traders & corporates
- Various PPA structure combinations (e.g. pay-as-produced volume and profile, fixed volume and profile, fixed price, floor price, collar pricing, etc.)
- Key issues to negotiating PPAs include tenor, price, and volume and profile
- Potential to work with parties such as energy managers to optimise PPA structure



Case study: Project North Pole

- GIG, GE & Svewind – 650MW Markbygden project
- 19 year corporate PPA with Norsk Hydro - physically delivered fixed volume, fixed profile PPA
- NEAS Energy provided physical energy management and portfolio management (guarantees of origin) services
- Innovative floor structure to hedge the Nordic electricity certificates (Elcerts) exposure

Lenders Success Factors



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International lenders are rapidly gaining experience in subsidy-free renewable assets, and are a key partner in delivering new projects



Key considerations

- Detailed understanding of subsidy-free renewables risk profile, including deep power market expertise
- Flexibility to optimize PPA and debt structure
- Facilitate the integration of off-taker's requirements
- Knowledgeable and decisive credit committees with subsidy-free experience

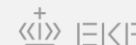


Case study: Project Cloud

- GIG negotiated one of the longest known corporate wind PPAs – 0.3TWh/yr from 2021-2030 and 0.55TWh/yr from 2031-2049
- Unique lending structure, involving EKF, with long-term maturity, and ancillary facilities such as a CPI and FX swap
- Long-tenor PPA allowed for longer-term 22 year debt, lowering the cost of capital and enabling GIG to deliver a competitive PPA price



KFW



DANMARKS
EKSPORTKREDIT

Equity Sponsor Success Factors



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Increasingly, equity sponsors can be the catalyst in global partnerships that meet the goals of the other key players in the equation



Key considerations

- Driving force in global partnerships, delivering mutually beneficial solutions for technology providers, off-takers and lenders
- Need to optimize the risk/return profile vs FiT, ROCs, etc.
- Flexibility to co-sponsor with developers, strategic, or financial partners to deliver value in transactions
- Active trading strategy and mitigation measures for electricity price cannibalisation risk
- Appropriate risk allocation and partnership with technology providers



Equity sponsor commitment

- GIG has developed c.1.5GW of PPA-enabled or subsidy-free renewables projects in the last 18 months
- Identified deep and broad partner appetite across North America, Europe, and Australasia based on improved risk/return dynamics
- Example of sponsor appetite – InfraRed and Partners Group have come in as long term investment partners in GIG subsidy-free renewables projects





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03

Emerging Themes

Club PPAs



Corporates are increasingly looking to benefit from the advantages of forming consortia to contract for the capacity of a single renewable energy generation project

The benefits and challenges of the consortium model



- Economies of scale lead to more favourable pricing
- Reduced costs
- Portfolio diversification and risk management
- Replicable structure



- Risk of partners being misaligned
- Complexity transaction structure
- Challenging corporate governance
- Ongoing coordination needs

Murra Warra, Australia – 429MW wind farm

Largest corporate PPA in Australia finalised by Macquarie Capital and RES

- Multi-buyer PPA with five off-takers: Telstra, ANZ, Coca-Cola Amatil, Melbourne University and Monash University
- PPA term >10 years with run of plant, pay as produced structure
- Expected COD in Q3 2019 with c.A\$500m expected construction costs
- Partners Group identified as long-term partner for asset in September 2018



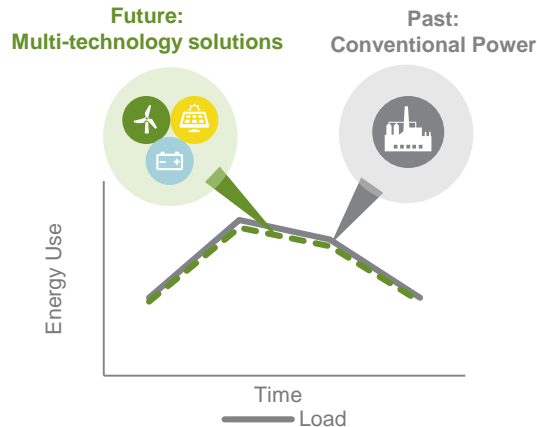
Multi-Technology Solutions

Global corporate off-takers are beginning to explore matching their loads 24/7 with renewable energy, helping to enable multi-technology solutions in subsidy-free markets

Multi-Technology Solutions

Off-takers are beginning to explore 24/7 renewable procurement for their loads.

Wind + solar enabled by battery storage can deliver tailored services to off-takers to meet this complex need.



Leading Examples

Google



- 100% renewable off-take, 24/7 goal
- Multi-technology leader with 38 PPAs signed (solar, wind, batteries)
- Globally active (c.70% US sourced)

BNEF

Microsoft



- 1.3GW offsetting 96% of demand
- Use of data centre batteries for frequency regulation
- Proxy Generation PPA and Volume Firming Agreement pioneer

BNEF

Fabrice Leveque

Senior Policy Manager, Scottish Renewables

Vicky Dawe

Deputy Director – Renewable Electricity Support Schemes, Department for Business, Energy and Industrial Strategy, UK Government

Sue Kearns

Deputy Director – Consumers and Low Carbon Division, Scottish Government

Neal Rafferty

Head of Utilities, Markets and Network Policy Unit, Scottish Government

Graham Meeks

Head of Policy, Green Investment Group

Chris Milne

Chief Financial Officer, Orbital Marine Power

Andy Yuill

Senior Renewable Heat Manager, Natural Power

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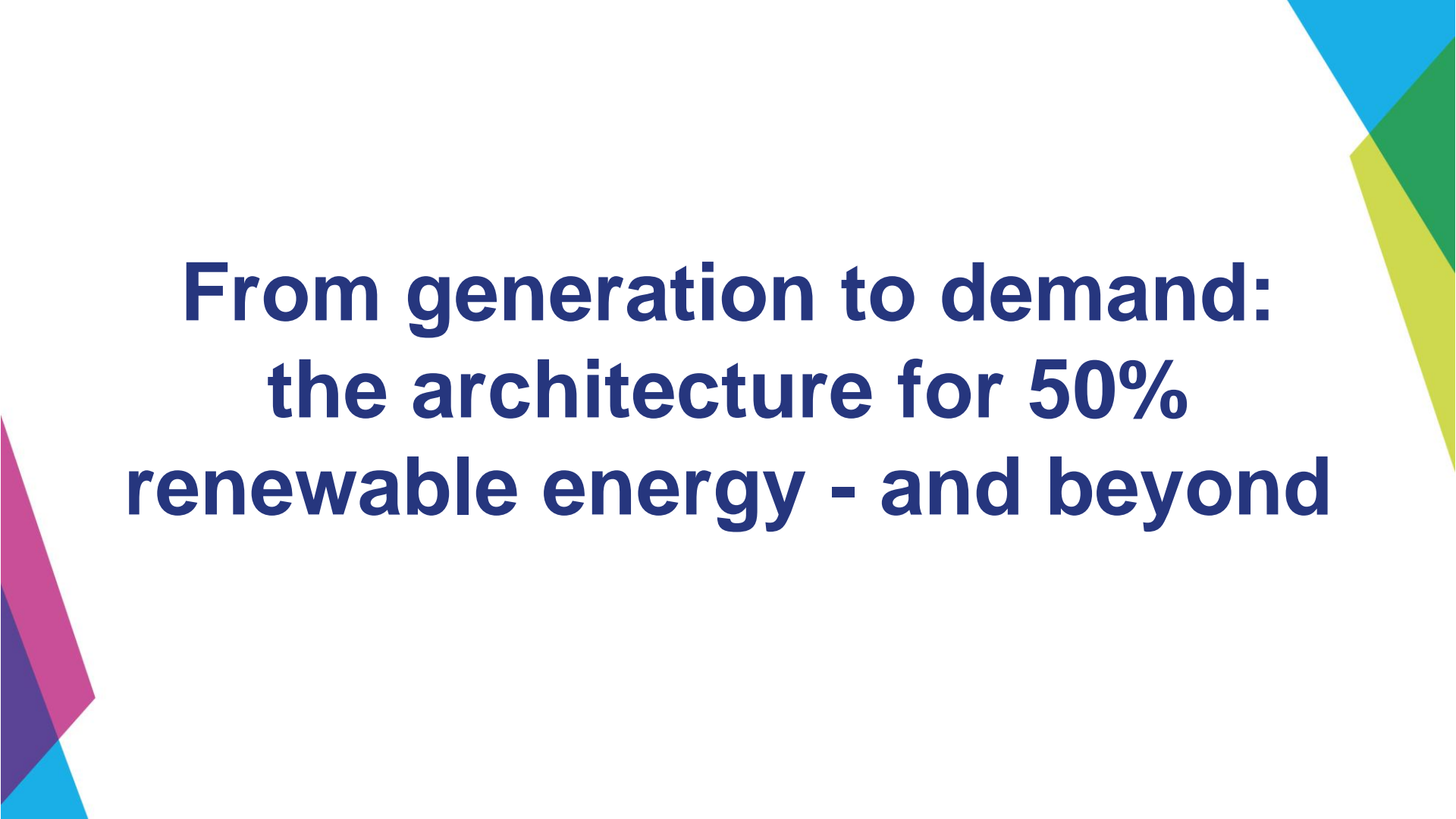


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**From generation to demand:
the architecture for 50%
renewable energy - and beyond**



Hannah Smith
Senior Policy Manager
Scottish Renewables



Professor Martin Cave

Chair

Ofgem

Scottish Renewables Annual Conference

Martin Cave, Chair, Ofgem



13 March 2019



Ofgem's role

Ofgem is the independent GB energy regulator, working to protect the interests of current and future energy consumers.

Our core purpose is to ensure that all consumers can get good value and service from the energy market.

Our energy system is in the midst of a **significant transformation**. The growth of EVs, heat pumps, and other new sources of demand form part of these wider changes.

Innovation in technologies and business models has also led to **rapid evolution within the energy system**.



**Facilitating
the energy
system
transition**

We see our role as facilitating these goals, while ensuring that energy consumers, including vulnerable consumers, are protected against undue cost increases.

Our core purpose is to ensure that all consumers can get good value and service from the energy market. In support of this we favour market solutions where practical, incentive regulation for monopolies and an approach that seeks to enable innovation and beneficial change whilst protecting consumers.

We will ensure that Ofgem will operate as an efficient organisation, driven by skilled and empowered staff, that will act quickly, predictably and effectively in the consumer interest, based on independent and transparent insight into consumers' experiences and the operation of energy systems and markets.



Marcus Stewart

Energy Analysis Senior Manager

National Grid SO



FES and Scotland

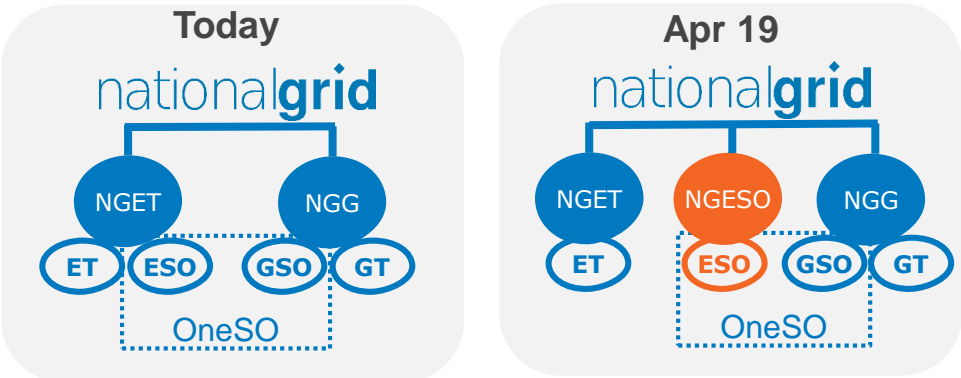
Marcus Stewart

Energy Analysis Senior
Manager National Grid SO

13th March 2019

I am representing National Grid SO

The creation of a new Electricity System Operator company within the National Grid Group

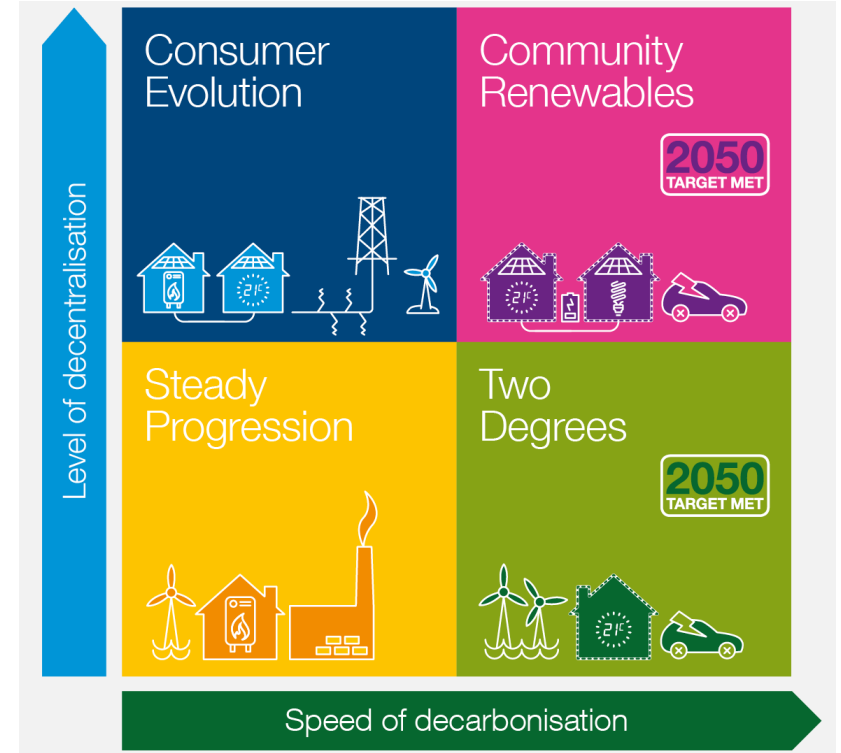


Why are we doing it?
To build trust and drive value for consumers

1. Address perceived or real conflicts of interest
2. Greater independence & transparency
3. Facilitate competitive markets and enable whole system thinking
4. Enable ET to focus on delivering efficient solutions for its customers

The Future Energy Scenarios (FES) look at a range of credible future energy landscapes out to 2050

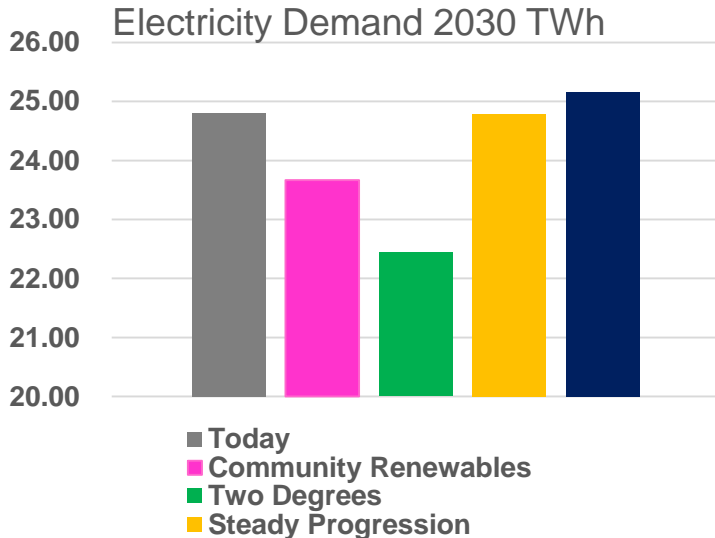
- The FES framework consists of four credible futures for the GB energy landscape
- For 2018, based on stakeholder feedback, the scenarios reflect **levels of decentralisation** and **speed of decarbonisation**
- Two scenarios **Community Renewables** and **Two Degrees** meet the UK's 2050 climate change targets



2030 Electricity demand: Broadly similar to today, with energy efficiency offsetting new transport demand.



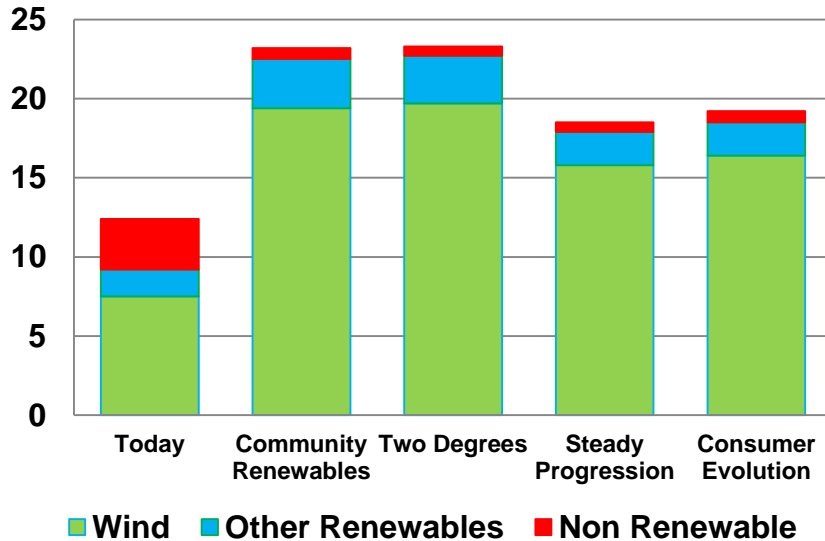
	CR	TD	SP	CE
Scotland	820K	777K	205K	201K
GB	10.1m	9.7m	2.6m	2.5m



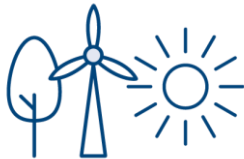
- By 2030 there could be up to 800,000 electric vehicles in Scotland
- However, energy efficiency drives down demand in **Community Renewables** and **Two Degrees**
- Leading to electricity demand being 10% lower than today in **Two Degrees**, despite having high growth of electric vehicles

2030 Generation mix: Wind will continue to dominate generation in all scenarios with increasing capacity.

Generation Capacity - 2030 - GW



- In **all scenarios** wind capacity will more than double from today's levels
- In total renewable capacity will make up 97% of all capacity by 2030
- By 2030 flows from Scotland to the rest of GB could reach 12,000 MW on windy winter days – with infrastructure and commercial arrangements in place to support this



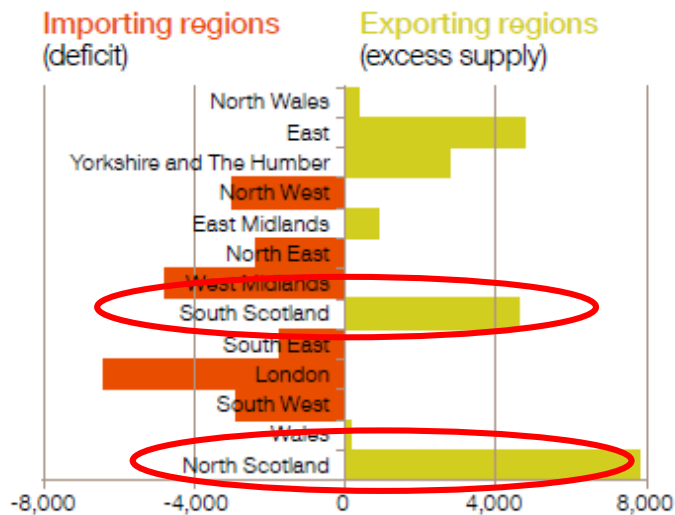
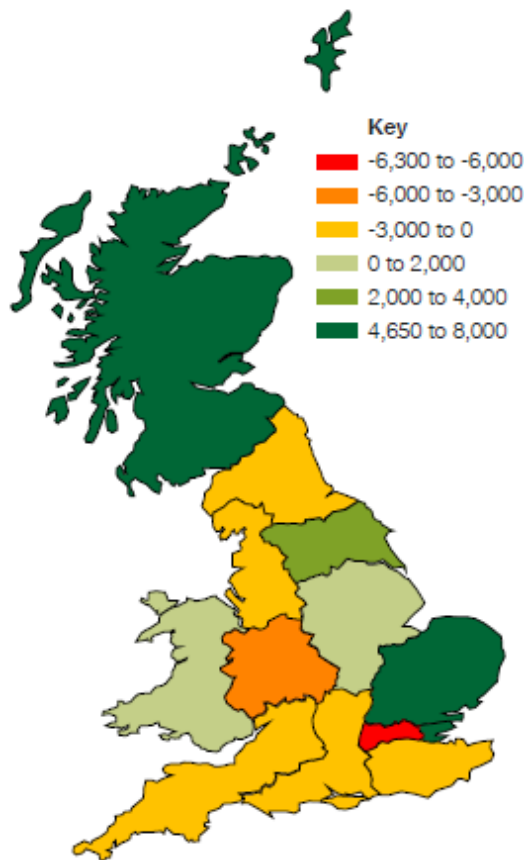
97% of capacity is renewable



67% to 77% of wind capacity is onshore

What does this mean for the networks?

Winter 2030 in Community Renewables world:

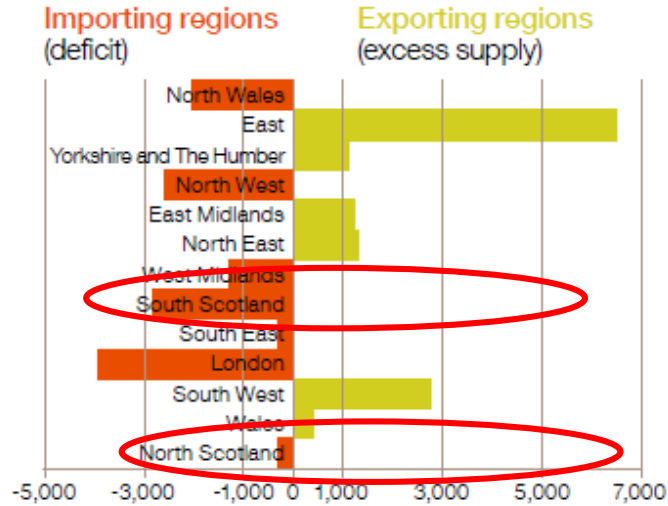
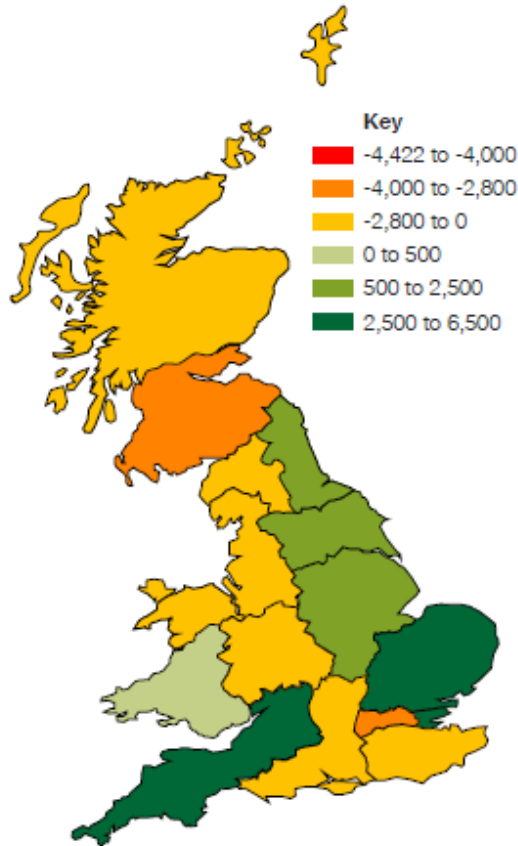


Winter 2030, Community Renewables

This map illustrates a time period with high wind output and high demand. Here some areas with high wind capacity, such as Scotland, have an excess of generation, and this flows south down the country to be used in areas of high demand such as London.

What does this mean for the networks?

Summer 2030 in Community Renewables world:



Summer 2030, Community Renewables

This map illustrates a time period with high solar output and medium demand. Here the areas with excess generation are different, and consequently we can see that flows of electricity across the country will be different to those in figure 3.8.

Looking Forward to FES 2019

- We have just published our Forward look at the 2019 scenarios
 - Framework retained
 - 5 year forecast
 - Net zero sensitivities
 - Improved regional data provision
- Publication date 11th July
- Find out more and sign up to our newsletter at

fes.nationalgrid.com



nationalgrideso.com

National Grid ESO

Faraday House

Warwick Technology Park

Gallows Hill

Warwick

CV34 6DA

nationalgridSO



Professor Ian Hunter

Hatsopoulos Professor of Mechanical
Engineering

Massachusetts Institute of Technology

Hannah Smith

Senior Policy Manager, Scottish Renewables

Professor Martin Cave

Chair, Ofgem

Marcus Stewart

Energy Analysis Senior Manager, National Grid SO

Professor Ian Hunter

Hatsopoulos Professor of Mechanical Engineering, Massachusetts Institute of Technology

Phil Steele

Product Manager, Octopus Energy

Felicity Jones

Partner, Everoze

Andrew Bissell

Chief Executive Officer, Sunamp

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Renewables and Scotland's economy



Claire Mack
Chief Executive
Scottish Renewables



Professor Graeme Roy

Director

Fraser of Allander Institute

University of Strathclyde Business School



Claire Mack

Chief Executive, Scottish Renewables



Professor Graeme Roy

Director, Fraser of Allander Institute, University
of Strathclyde Business School

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Planning for Scotland's low-carbon, sustainable economy



Jenny Hogan
Deputy Chief Executive
Scottish Renewables



Tony Rose

Director



Infrastructure Commission for Scotland



Scottish Renewables Annual Conference

Infrastructure Commission for Scotland

Infrastructure vision for an inclusive growth low carbon economy

Tony Rose

Director, Commission Secretariat

Commission Background

- Proposed in Scottish Government's Programme for Government in September 2018
- Ian Russell appointed Chair in December 2018
- Remit established in December 2018
- Commissioners appointed February 2019
- Initial Call for Evidence published March 2019





The Commissioners

IAN RUSSELL CBE
CHAIR

PROFESSOR IAIN DOCHERTY
UNIVERSITY OF GLASGOW

KEN GILLESPIE
HOMES FOR SCOTLAND

BENNY HIGGINS
COMMISSIONER

MARY PITCAITHLY OBE
SCOTTISH POLICE AUTHORITY

RACHEL SKINNER
UK HEAD OF TRANSPORT, WSP

GRAHAME SMITH
GENERAL SECRETARY, TUC

SARA THIAM
DIRECTOR, ICE SCOTLAND

JOHN TROWER
OPTIMITY

PROFESSOR JANETTE WEBB
UNIVERSITY OF EDINBURGH

The commissioners will be responsible for:

- Bringing specific skills and experience
- Providing expert, impartial advice
- Engaging widely with stakeholders including industry, expert and interest groups, government, local government and public bodies, civic society and the public



Remit - Overarching objectives

- Delivering sustainable inclusive economic growth across Scotland
- Managing the transition to a more resource efficient, lower carbon economy
- Supporting delivery of efficient, high quality, modern public services
- Increasing industry competitiveness, whilst tackling inequality
- Enhancing societal living conditions now and in the future
- Ensuring alignment with the new National Planning Framework





Remit – infrastructure scope

“The physical and technical facilities, and fundamental systems necessary for the economy to function and to enable, sustain or enhance societal living conditions”.

These include the networks, connections and storage to permit the ready movement of people, goods and services:

- Transport
- Energy
- Water
- Telecoms

The built environment of:

- Housing
- public infrastructure such as education, health, justice and cultural facilities;
- safety enhancement such as waste management or flood prevention
- public services such as emergency services and resilience



Remit – What and how

The purpose of the Commission is to provide independent, informed advice on:

- the Vision ambition and priorities for a long term, 30 year strategy for Infrastructure including key strategic and early foundation investments
- guiding principles to support a coherent SG Infrastructure Investment Plan
- the delivery of Infrastructure in Scotland

It will report on:

- Infrastructure ambition and priorities by the end of 2019
- Delivery options by July 2020

The work of the Commission will be taken forward independent of Scottish Government, and the Commission will determine itself how to progress its work.

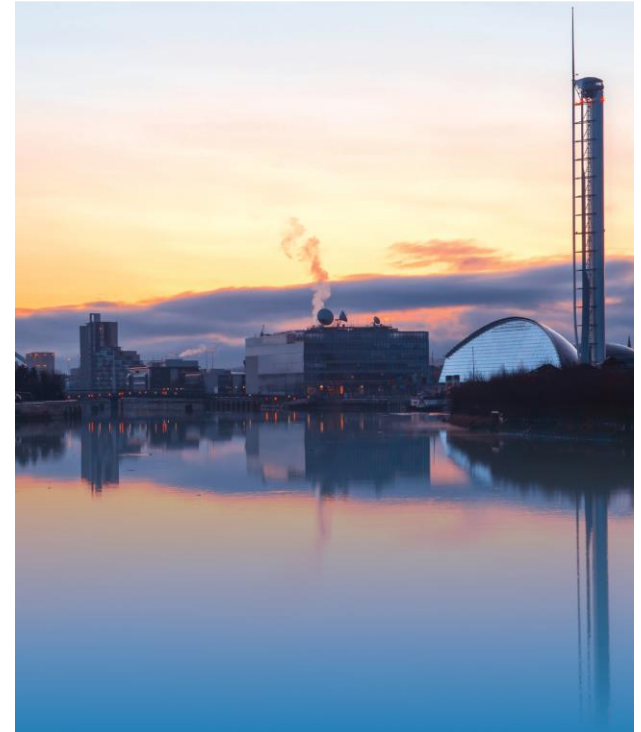
The Commission should work in a way which is:

- Engaging and widely consultative across all of Scotland and civic society
- Credible, objective and evidence-based
- Outward looking, forward thinking and innovative



Engagement

- This is a critical element of the work of the Commission; creates foundation and evidence base
- Overall aim is to capture the expertise and opinions of people from across industry, business, the public sector, academia, civic society and the wider public
- A range of approaches anticipated during 2019, targeted at various stakeholder groups
- Initial Call principally aimed at individuals, representative bodies, public bodies and organisations who use, plan, manage, maintain, finance and deliver infrastructure



Engagement – Initial call

- Contributors will be free to shape their submission according to their field or sector of interest, recognising the 5 and 30-year horizons of the Commission
- As a guide, questions provided along themes:
 - Key drivers to an inclusive growth low carbon economy
 - The role of infrastructure
 - The demand and need for infrastructure
 - Assessment, prioritisation and decision making

<https://infrastructurecommission.scot/page/call-for-evidence>

Closing date 3rd May 2019

initial.evidence@infrastructurecommission.scot





In summary

- Advising on a 30 year vision for infrastructure to support a inclusive growth low carbon economy
- Commissioners operating independent of Government providing impartial, expert advice
- Covering a wide ranging definition of infrastructure, economic and social
- Engagement across stakeholder groups to draw on opinions and expertise

Initial Call: Closing date 3rd May 2019

initial.evidence@infrastructurecommission.scot





Stuart Black

Director of Development and Infrastructure
The Highland Council

Planning for Scotland's low-carbon, sustainable economy

**Stuart Black, Director of Development and
Infrastructure, The Highland Council**

Economic Growth and Planning



Growth



Planning



Economic Growth and Planning



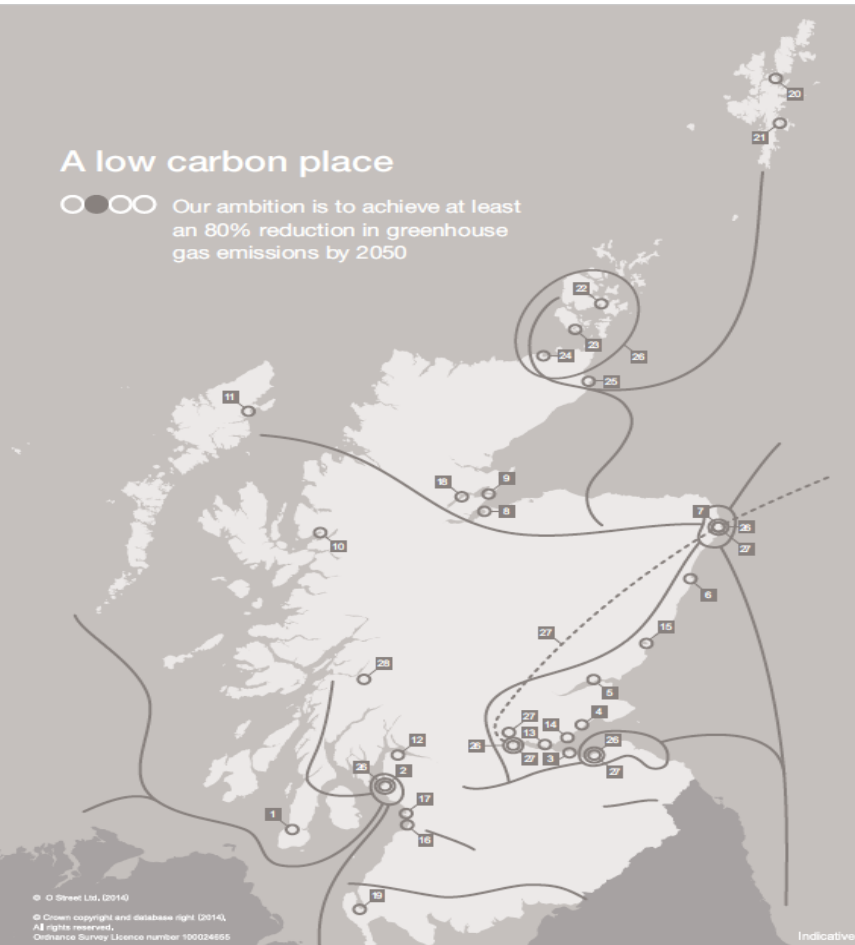
Ambition • Opportunity • Place
Scotland's Third National Planning Framework





A low carbon place

○○○○ Our ambition is to achieve at least an 80% reduction in greenhouse gas emissions by 2050



Detail key

Infrastructure

NRIP sites

- | | |
|----------------------------|-------------|
| 1 Machrihanish/Campbeltown | 6 Aberdeen |
| 2 Hunterston | 7 Peterhead |
| 3 Leith | 8 Ardersier |
| 4 Methil | 9 Nigg |
| 5 Dundee | 10 Kishorn |
| | 11 Arnish |

NRIP – further potential sites

- 12 Inverclyde
- 13 Rosyth
- 14 Burntisland
- 15 Montrose
- 16 Ayr
- 17 Troon
- 18 Highland Deephaven
- 19 Stranraer/Cairnryan
- 20 Sella Ness
- 21 Lerwick
- 22 Hatston (Kirkwall)
- 23 Lyness
- 24 Scrabster
- 25 Wick

Energy Hubs –

Areas of Co-ordinated Action

- 25 Peterhead, Hunterston, Cockenzie, Grangemouth, Pentland Firth and Orkney Waters

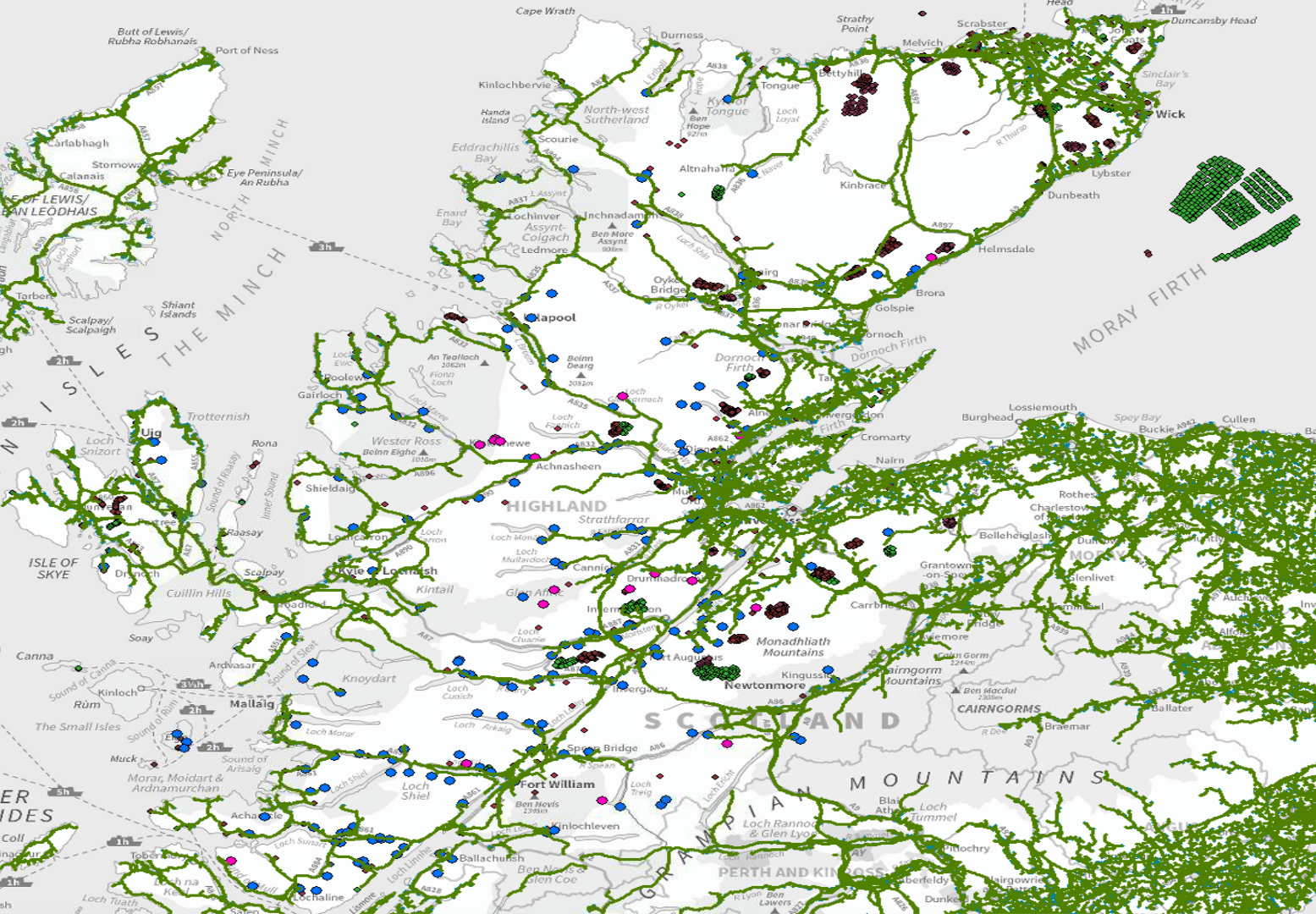
National Developments

- 27 Carbon Capture and Storage (CCS) Network and Thermal Generation
- High Voltage Energy Transmission Network
- 28 Pumped Storage (Cruachan)

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Indicative



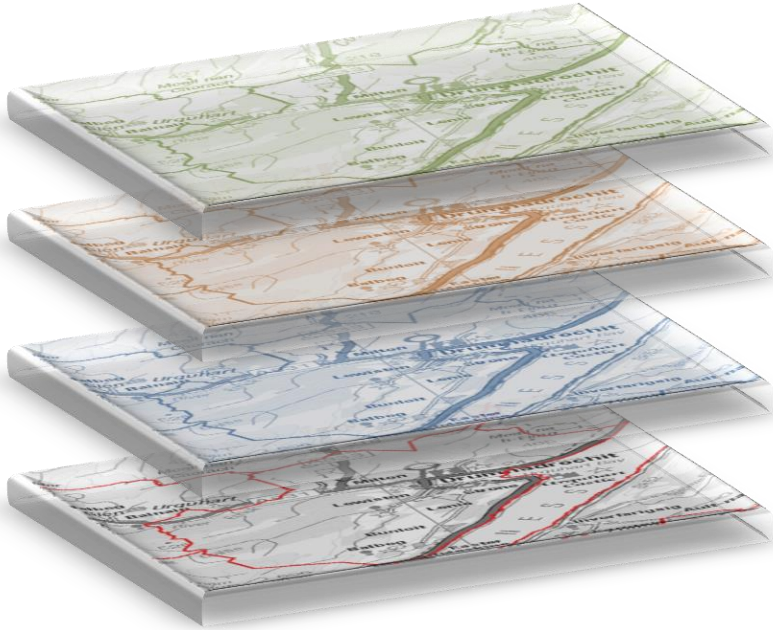
- All constructed and approved wind turbines
- All constructed and approved hydro
- All overhead electricity cabling
- Transmission and distribution networks



With thanks to HIE for supplying photos. Credits: 'SIMEC Atlantis Energy' (images relating to the MeyGen project) and 'BOWL' (Beatrice images).



The Local Authority's role?



- Local authority duties
- Energy opportunities
- Community priorities
- Social factors

Thank you





Jennifer Ballantyne

Partner

Pinsent Masons



Scottish Renewables Annual Conference

13 March 2018

The Planning (Scotland) Bill

Jennifer Ballantyne, Pinsent Masons

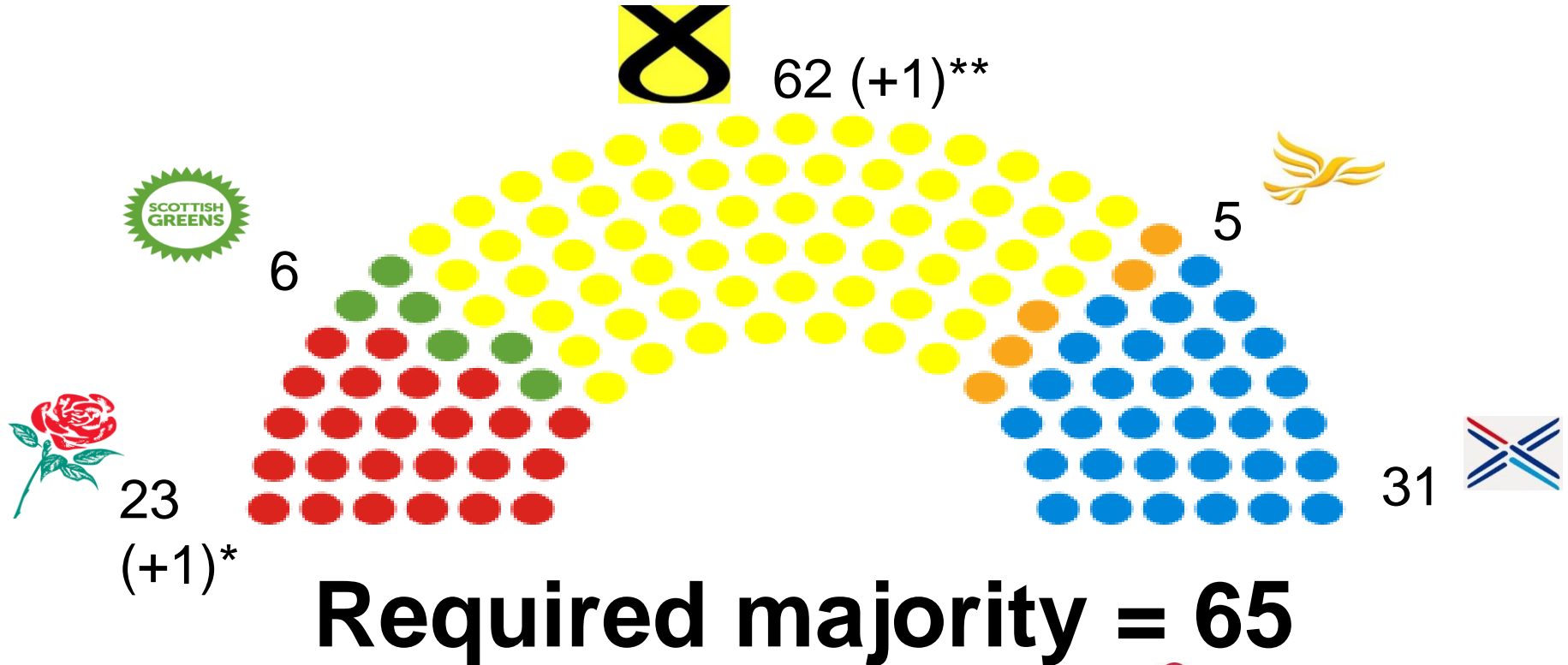


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Bill progress recap

- Bill introduced 4 December 2017
- Stage 1 (principles) completed 29 May 2018
- Stage 2 (Committee scrutiny/ detailed amendments) completed 14 November 2018
- Stage 3 (final amendments & Parliamentary vote) expected mid 2019

Parliamentary arithmetic



*1 Presiding Officer – Ken Macintosh MSP - no party affiliation - uses casting vote in event of tie – guiding principle is to 'maintain status quo' and vote accordingly

**1 seat independent, Mark McDonald MSP

Direction of travel

- Original stated aims:
 - A streamlined planning process
 - A planning system ‘open for business’ to encourage investment and sustainable economic growth
 - To facilitate development of infrastructure and housing
- Focus to date on localism agenda and re-kindling the debate on appeal rights reform
- Focus on housing/built development: risk of unintended consequences for renewable energy development?

“Equalisation” of Appeal Rights

- Possible alternatives to status quo:
 1. Unlimited Third Party Right of Appeal (TPRoA)
 2. Limited TPRoA;
 3. Limited applicant right of appeal
 4. No applicant right of appeal
- All resisted so far; all damaging to ‘open for business’ planning system
- Last 3 years: 58-67% windfarm appeals allowed (32 projects)

Pre-Stage 3: Where we are

- Development plan would now comprise:
 - National Planning Framework - 10 year cycle
 - Scottish Planning Policy?
 - Strategic Development Plan (where applicable) + supplementary guidance
 - Local Development Plan – 10 year cycle (no supplementary guidance)
- Local Place Plan(s) – promoted by ‘community body’
- New ‘sequential test’ to justify development within the “Green Belt” rather than on “Brownfield Land”
- Infrastructure Levy – no detail yet; could it apply to renewable energy development?
- Expanded fees and enforcement powers

Influencing change

- Don't allow limiting developer appeal rights to emerge as a perceived “middle-ground” option between status quo and TPRoA
- Quantify the impact of unintended consequences
- Strength in numbers...but politicians also crave insight “from the horse’s mouth”
- Change is coming. Engage positively and constructively to shape it



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Jenny Hogan

Deputy Chief Executive, Scottish Renewables

Tony Rose

Director, Infrastructure Commission for Scotland

Stuart Black

Director of Development and Infrastructure, The Highland Council

Jennifer Ballantyne

Partner, Pinsent Masons

David Bell

Director – Planning & Development, JLL

Eleri Davies

Head of Consents UK, innogy Renewables UK

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Trends in Global Renewables

Presentation to Scottish Renewables Annual Conference

12 March 2019

Contact us:



Anthony Legg

Head of Power & Utilities,
Economic Advisory

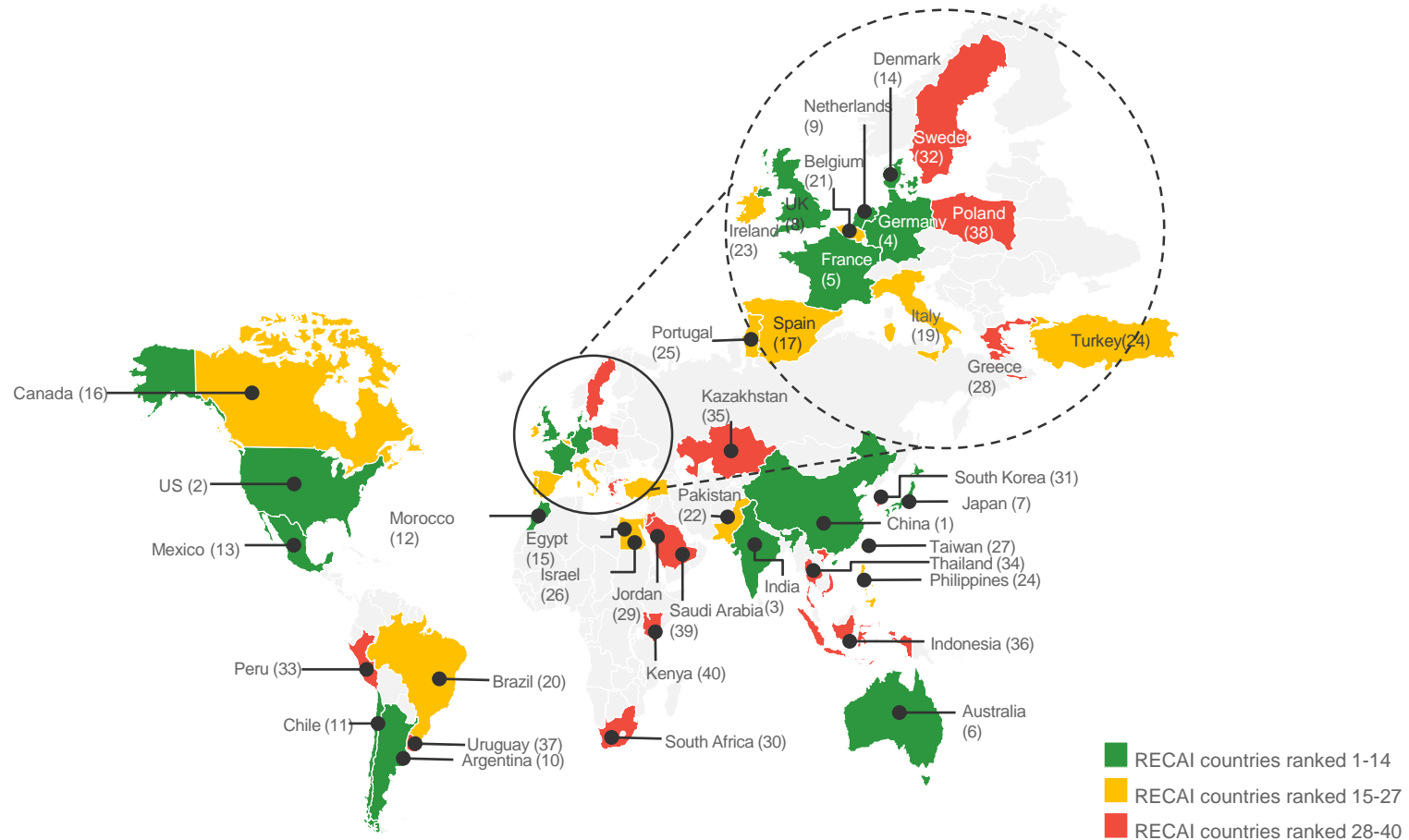
Mobile: + 44 775 3300 520

Email: alegg@uk.ey.com



Building a better
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EY's RECAI suggests there are significant opportunities for renewables in many European (and global) markets



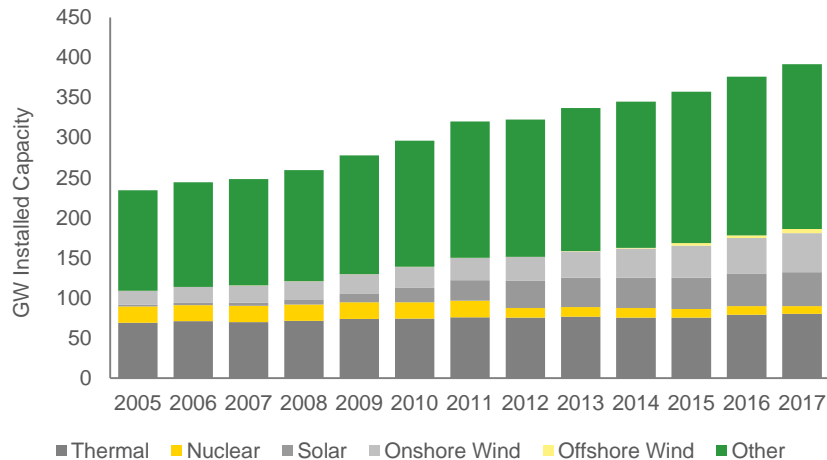
EY Renewable Energy Country Attractiveness Index (RECAI) – Issue 52

Germany is looking to replace its coal and nuclear fleet with subsidy-free solar and onshore wind



Market Today

- ▶ Renewables accounted for 24% of electricity generation in 2016, principally onshore wind and solar.
- ▶ Largest generation source in 2016 was coal (45%)



Source: BNEF

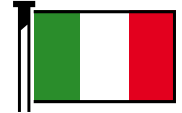
Ambitions for Decarbonisation

- ▶ Targets set for CO2 reduction from 1990 levels of:
 - ▶ 40% by 2020
 - ▶ 55% by 2030
 - ▶ 80-95% by 2050
- ▶ Renewable share of generation to increase to:
 - ▶ 35% by 2020
 - ▶ 50% by 2030
 - ▶ 80% by 2050
- ▶ Policy aim to phase out of existing nuclear fleet by 2022 and the existing coal fleet by 2038, with replacement by solar and offshore wind.

Investment Trends

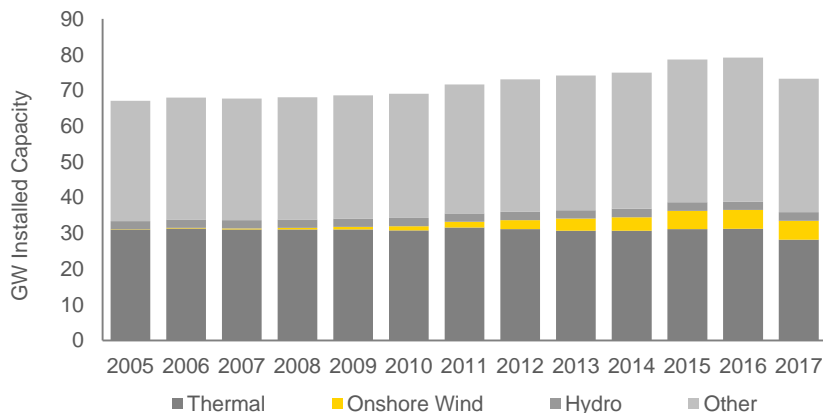
- ▶ Subsidy auctions for offshore wind contracted at an average floor price of €47/MWh, indicating a move to subsidy-free renewables
- ▶ Germany is planning to build its largest solar park without subsidies – enabled by reductions in solar and battery storage technology costs

Solar increasingly viable without subsidy as Italy becomes second-largest solar market in Europe



Market Today

- ▶ Renewables accounted for 37% of electricity generation in 2016, principally Solar and Onshore Wind
- ▶ Largest generation source in 2016 was coal (44%)



Source: BNEF

Ambitions for Decarbonisation

- ▶ Italy has a target to increase the renewable share of generation to 26% by 2020.
- ▶ Italy's 2017 National Energy Strategy sets longer term targets for 55% of generation from renewables by 2030.
- ▶ To deliver the 2030 targets the government envisages investment in new capacity:
 - ▶ Solar: 7GW new by 2025 and 31GW by 2030
 - ▶ Onshore wind: 6GW new by 2025 and 3GW by 2030

Investment Trends

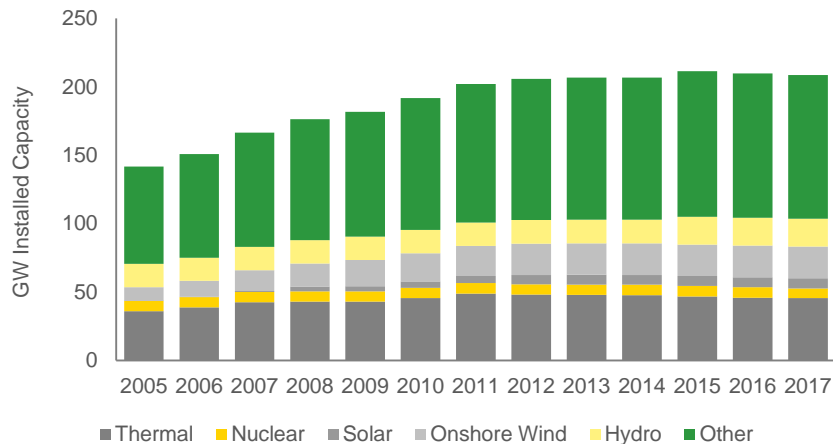
- ▶ Seven new auctions expected to be held between 2019 and 2021 for wind and solar projects >1MW, with first auction expected to contract 500MW of new capacity
- ▶ Large-scale solar projects are increasingly viable without subsidy, with Limes-RE and Prothea Srl announcing joint plans for 500MW of solar projects >10MW at market parity

After years of low investment, Spain is seeing a surge in zero-subsidy renewables investment



Market Today

- ▶ Renewables is the largest generation source, accounting for 38% of electricity generation in 2016
- ▶ This is principally from onshore wind and hydro



Source: BNEF

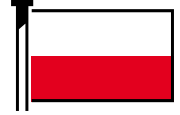
Ambitions for Decarbonisation

- ▶ Targets for renewable share of generation to increase to:
 - ▶ 39% by 2020
 - ▶ 35% by 2030
 - ▶ 100% by 2050
- ▶ At the end of 2015, Spain achieved its first electricity tariff surplus following a major restructuring of the market.
- ▶ New renewables are currently supported through auctions that set a price-floor, with projects exposed to merchant price risk above the floor.
- ▶ Government has proposed that existing renewables be able to maintain existing remuneration rates until 2031

Investment Trends

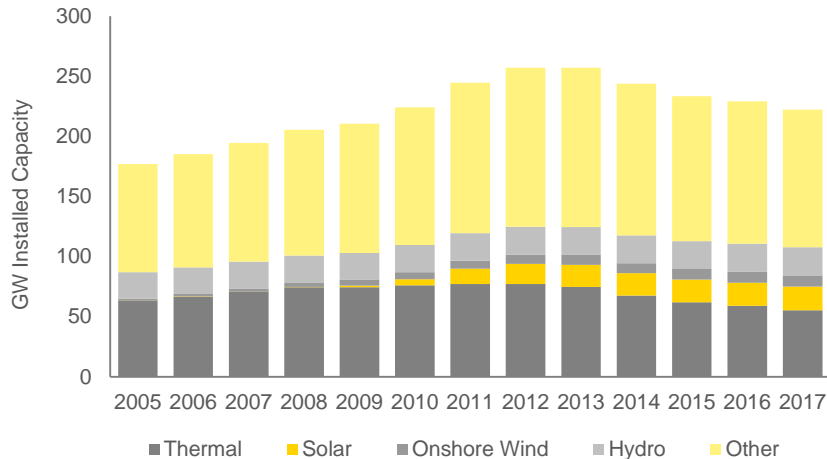
- ▶ Spain allocated 8.7GW of contracts in 2016 and 2017 to new renewable projects with a floor price potentially below market prices (from €40/MWh)
- ▶ Developers now face a challenging environment to finance the renewable projects, secure PPAs, and to commission by January 2020.

Poland is creating opportunities for new wind projects while capping revenues for existing wind



Market Today

- ▶ Renewables accounted for 14% of electricity generation in 2016, principally onshore wind/hydro
- ▶ Largest generation source in 2016 was coal (78%)



Source: BNEF

Ambitions for Decarbonisation

- ▶ Target for renewable share of generation to be 19% by 2020
- ▶ Poland's Energy Policy 2040 has set ambition for:
 - ▶ 27% renewable share of generation by 2030
 - ▶ 60% coal share of generation by 2030
 - ▶ 6-9 GW of new nuclear by 2043 (with first plant operational by 2033)
 - ▶ 50% reduction in CO2 by 2040
- ▶ Government is tendering for 2.5 GW of new wind capacity and 700 MW of solar power in 2019 to help reach the EU renewable energy goal. The Government is also looking to ease restrictions on locations of wind turbines near homes.

Investment Trends

- ▶ Investor confidence has been hit by amendments proposed to the Renewables Energy Act cap revenues of existing plants receiving green certificates – seen as a significant retrospective change
- ▶ Onshore wind dominated 2018 renewables auction for >1MW, with solar uncompetitive at average clearing price of c£40/MWh

Thank you

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ED None

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