UK National Renewable Energy Centre

UK Energy, Renewables and Innovation

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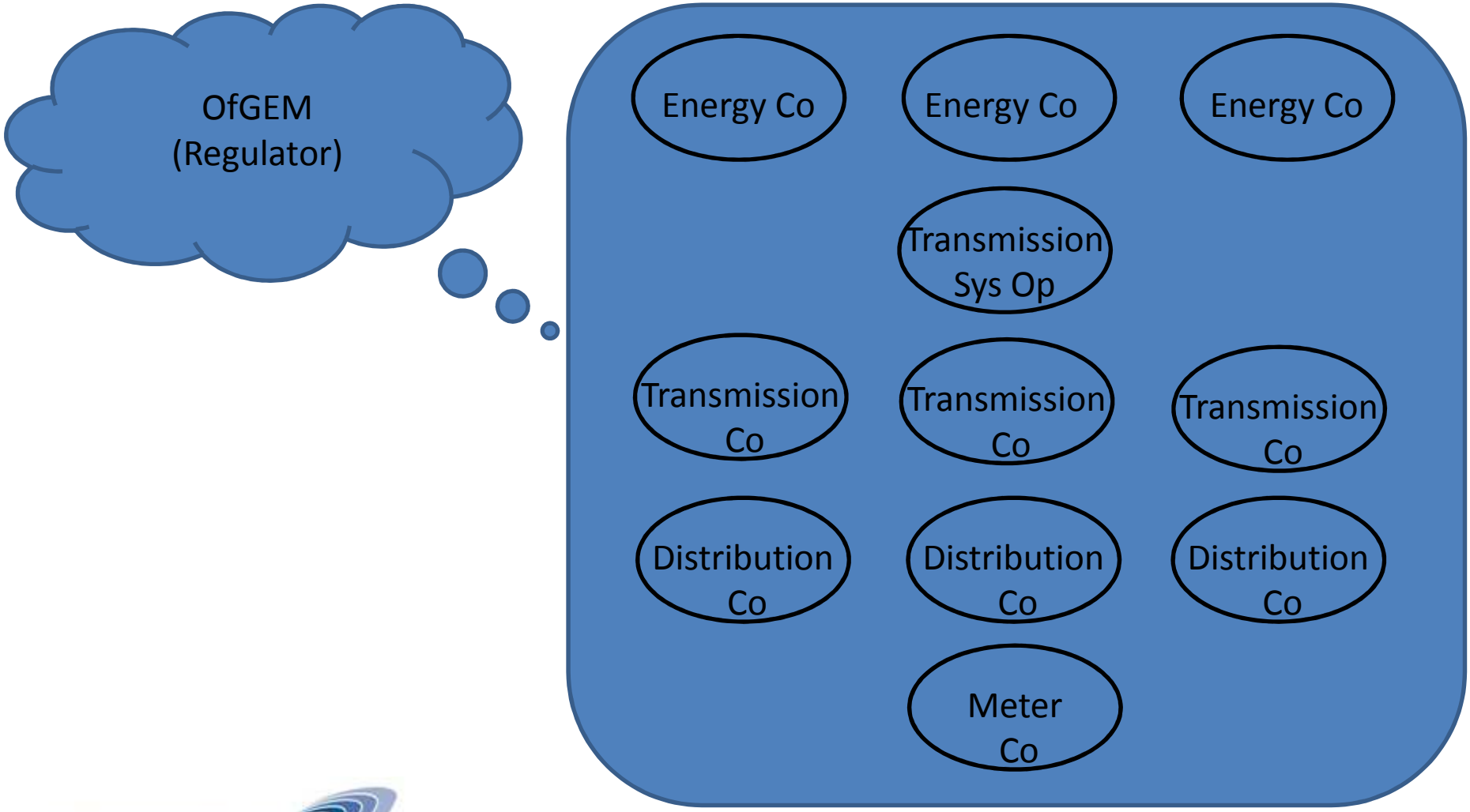
Director of Electrical Networks
October 2010

Discussion Outline

- UK industry structure and energy policy
- Rollout of renewables
- UK operational experience
- New government, new priorities?
- Regulatory review
- Innovation models
- Narec and the future...

UK Electricity Supply industry Structure



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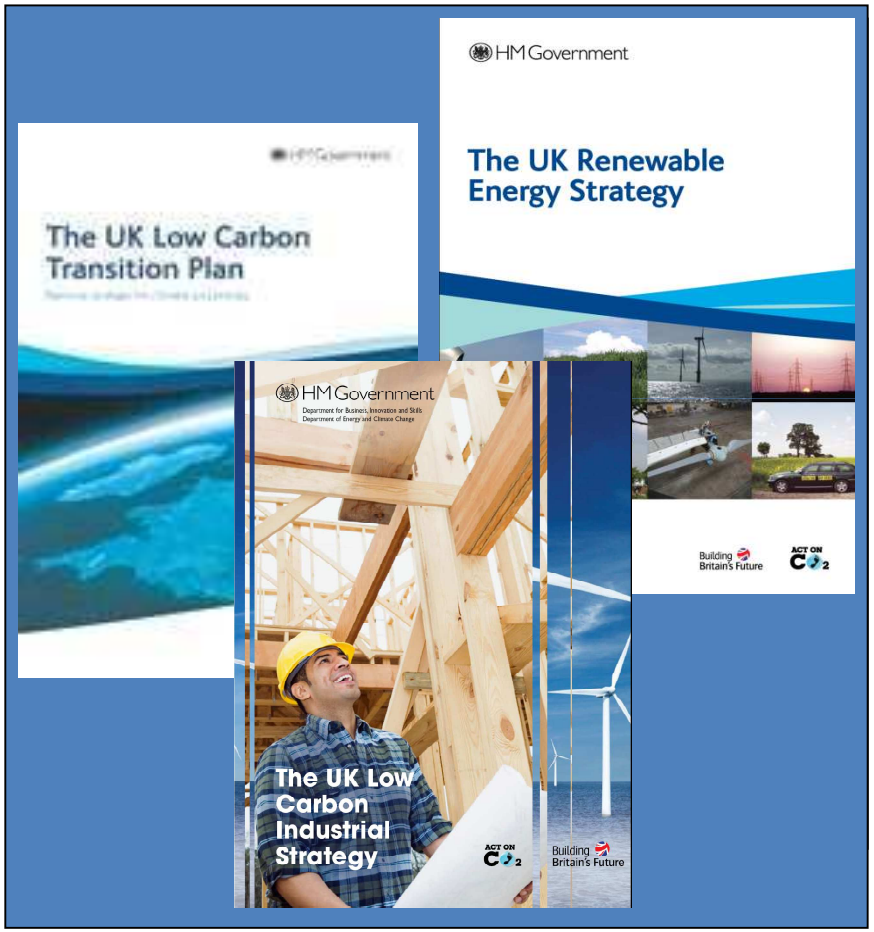
UK Government Policy Development

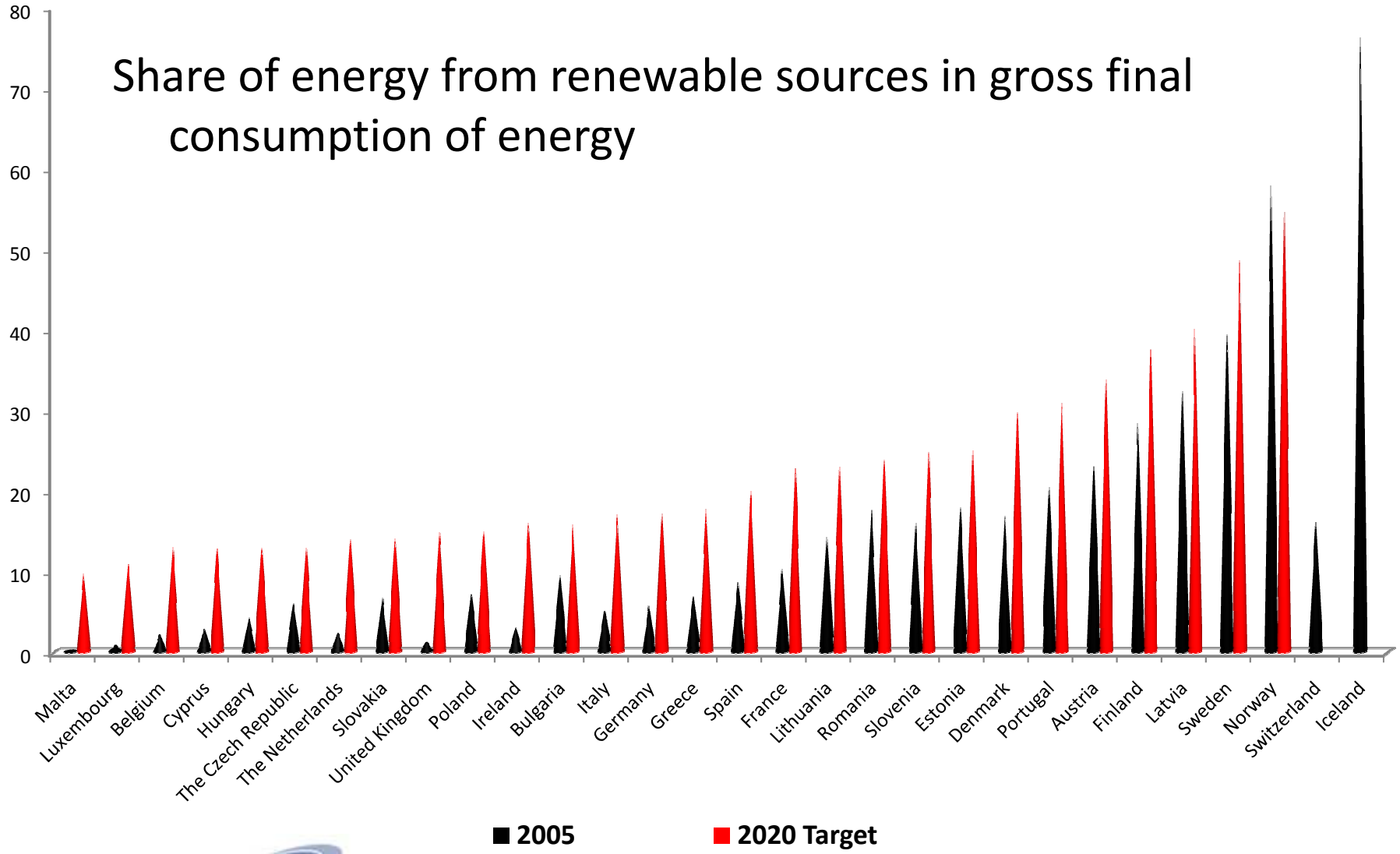
- Kyoto agreement to cut greenhouse gases
- EU Legislation 15% renewable energy by 2020
- UK Legislation
  - Climate Change Bill
  - Energy White Papers
- July 2009 additional strategy plans issued
- Three imperatives
  - Energy security
  - Climate change
  - Economic energy



The UK Renewable Energy Strategy, July 2009

- 30% of electricity generated from renewables.
- 12% of heat generated from renewables.
- 10% of transport energy from renewables.
- Provide mechanisms for financial support for renewable electricity and heat worth £30 billion by 2020.
- Remove barriers to progress of renewable energy deployment.

EU Member Targets



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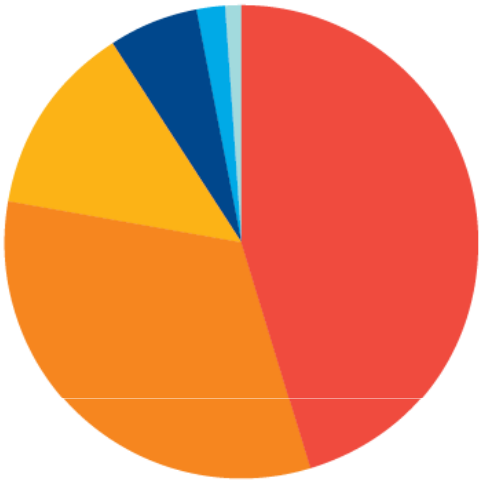
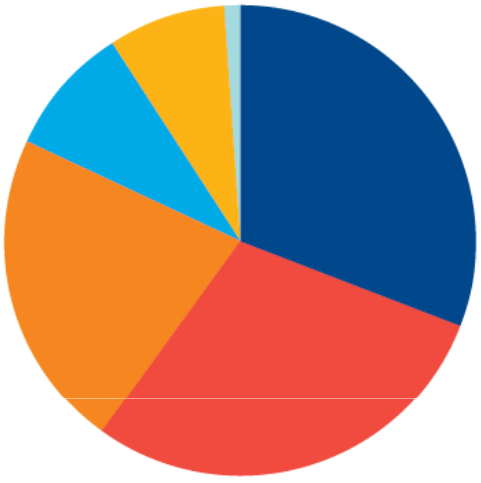
UK Generation Contributions Today and 2020

Around 75% of our electricity is currently generated from gas and coal today; renewables will expand to around 30% of our generation by 2020[1]



Today

- Gas 45%
- Coal 32%
- Nuclear 13%
- Renewables 6%
- Other sources 2%
- Oil 1%



2020

- Gas 29%
- Coal 22%
- Nuclear 8%
- Renewables 31%
- Other sources 9%
- Oil 1%

Source: Energy Trends (2009,Quarterly)Department for Business Innovation and Skills (2009)

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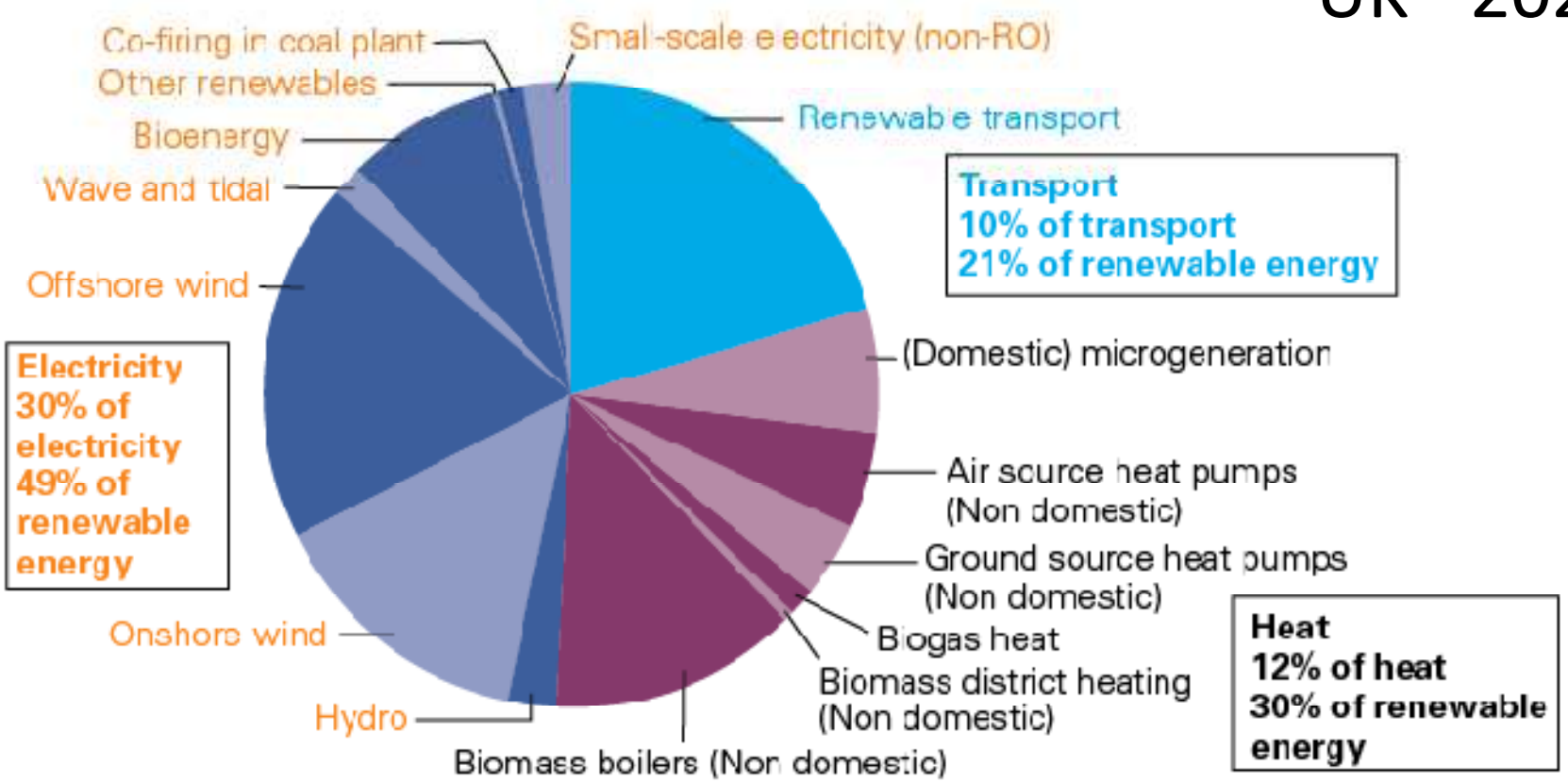
Illustrative Mix of Renewable Energy Technologies in Lead Scenario

UK - 2020



Source: DECC analysis based on Redpoint/Trilemma (2009), Element/Pöyry (2009) and Nera (2009) and DfT internal analysis

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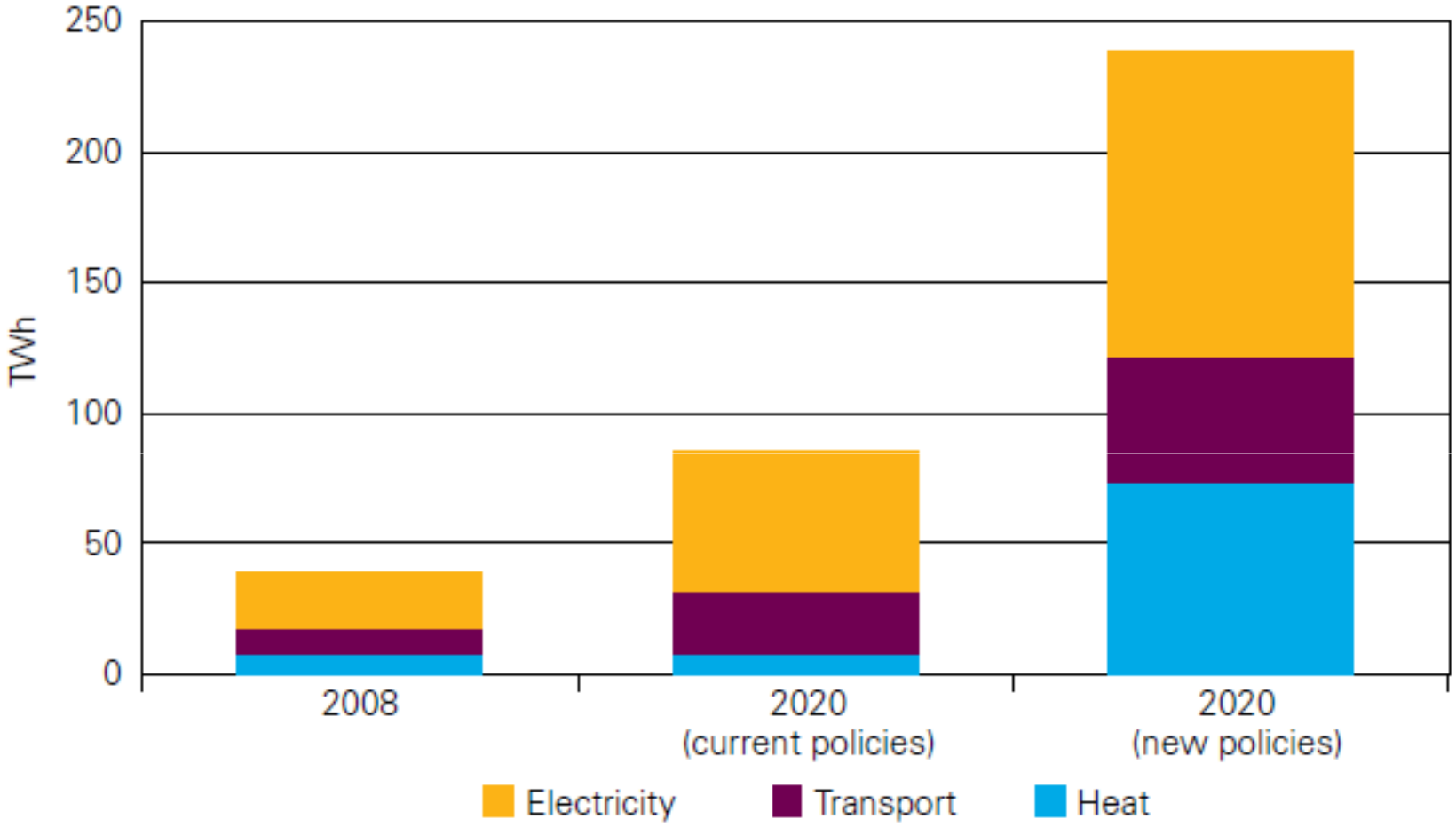
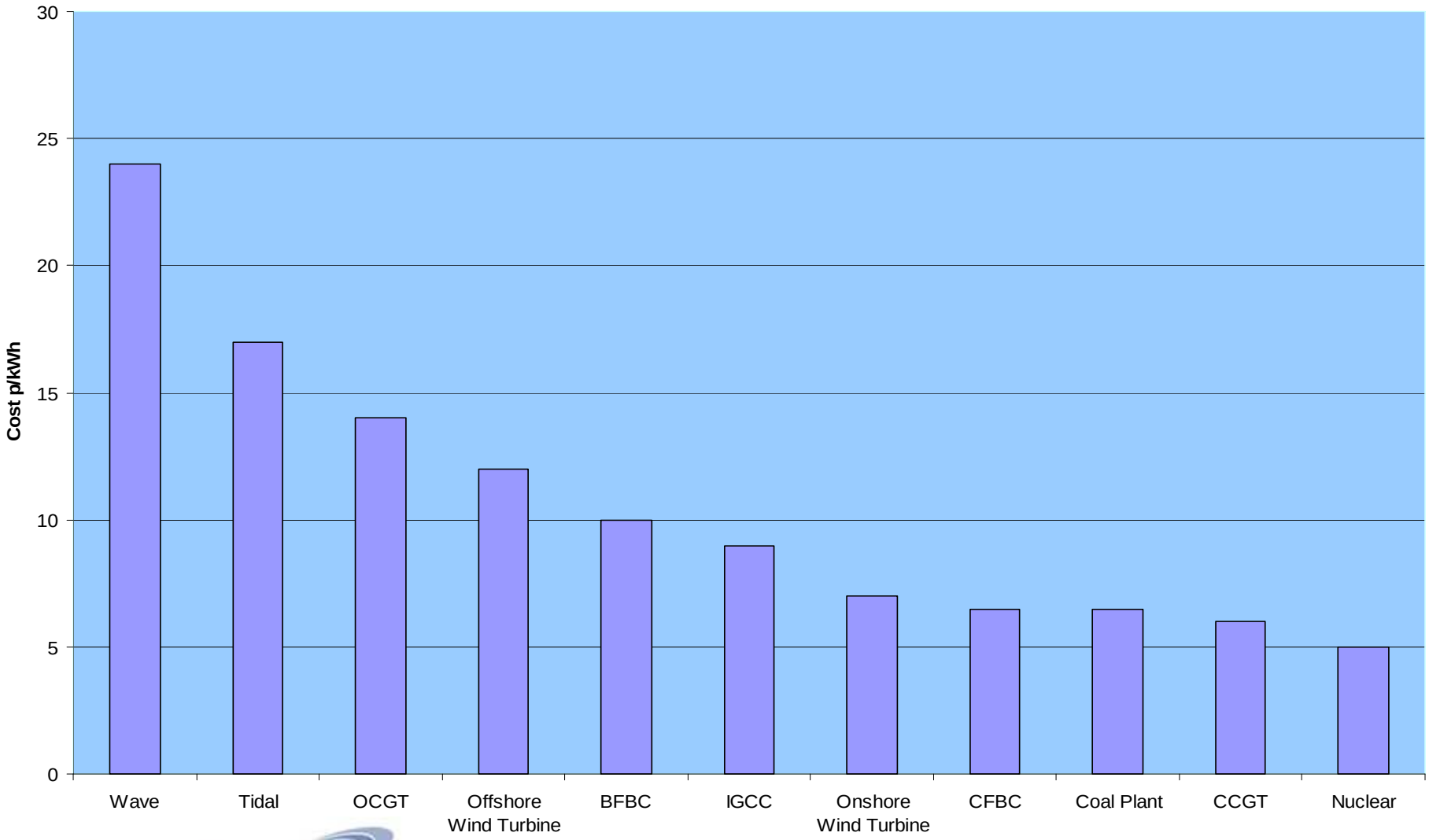
The size of the challenge – a potential scenario to reach 15% renewable energy by 2020



Source: Energy Trends June 2009 and DECC internal analysis

Comparison of Generation Costs 2008



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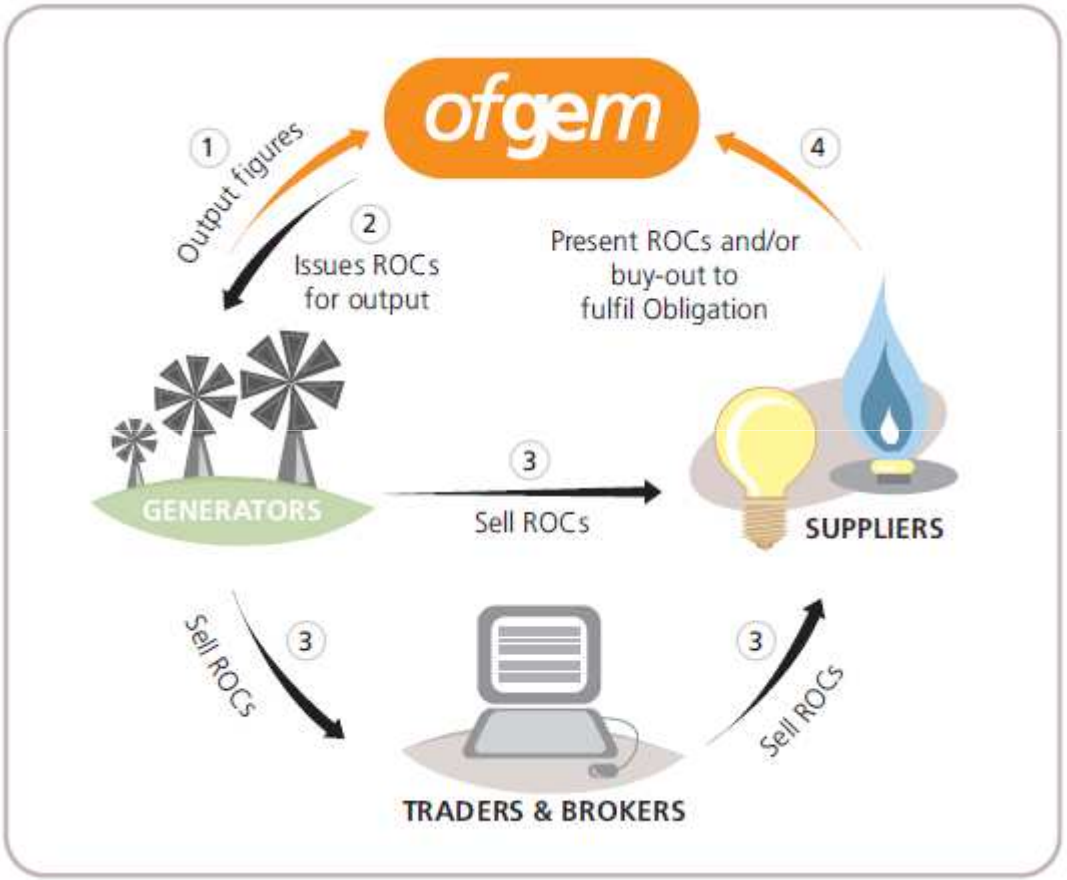
Economic Incentives for Renewable Development

- The EU emissions trading scheme (ETS)
- Renewable obligation (ROCs)
- Carbon emissions reduction target (CERT)
- Feed-in tariffs (FITs), from 2010
- Renewable heat incentive, from 2011



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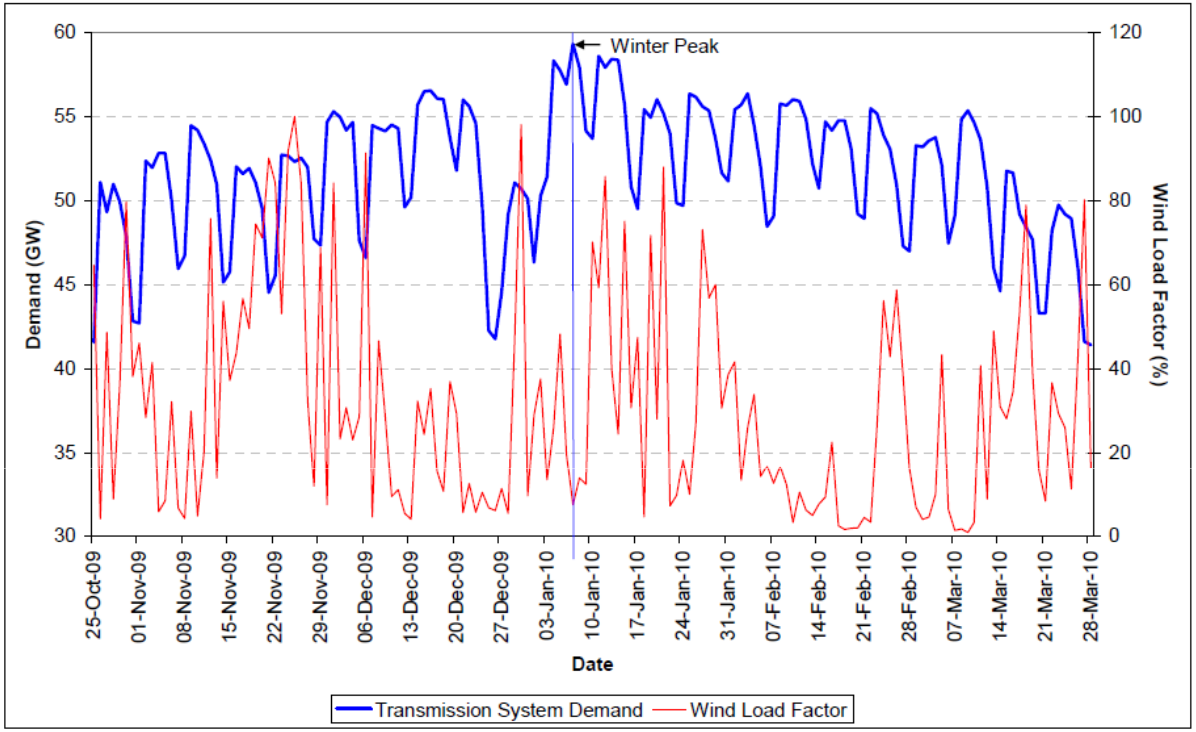
UK Incentives for Renewable Generation – from April 2009

Band	Technologies	Level of support ROCs/MWh
Established	Sewage gas; landfill gas; co-firing of non energy crop (regular) biomass.	0.25
Reference	Onshore wind; hydro-electric; co-firing of energy from waste with combined heat and power (CHP); other not specified.	1.0
Post-demonstration	Offshore wind; dedicated regular biomass	1.5
Emerging Technologies	Wave; tidal-stream; advanced conversion technologies (gasification, pyrolysis and anaerobic digestion); dedicated biomass burning energy crops (with/without CHP); dedicated regular biomass with CHP; solar photovoltaics & geothermal. ***Offshore wind installed before 2014***	2.0

Technical barriers to widespread development of low carbon generation

- Intermittency
- Max size per useful MW produced
- High capital & maintenance costs, existing infrastructure development needs
- Unknown reliability for marine applications
- Optimistic expectations for commercial availability
- Human resources & technical competence.



Graph shows UK national demand vs. wind generation load factor

Source: National Grid Winter Consultation Report 2010/11

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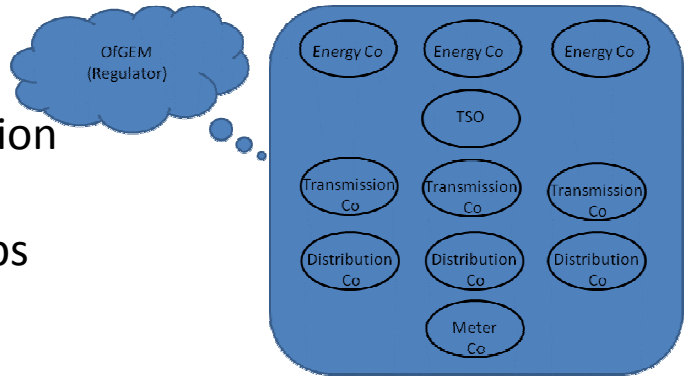
The non-technical barriers to widespread development of low carbon generation

- Challenge of making large numbers of small , low carbon investments attractive to institutional investors
- Public & government lack of understanding of development of new and innovative technology
- A disaggregated electricity industry in UK, and limited utility balance sheet capacity
- Political and regulatory risks – government policy determines returns and history of policy changes
- The recession, uncertain capital markets and risk aversion
- The consultation process & influence of pressure groups
- Lack of political will in many democracies



Some important UK electricity supply issues up to 2020

- Capital & credit availability

- New nuclear generation by 2018
- Clean coal generation by 2018-20?

- The return of some "central planning" and speed up procedures for both generation and transmission build.
  Connect and Manage approach to grid connections
  Review of Security and Quality of Supply Standards (GBSQSS)

- -25000MW of offshore wind, -4000 machines. AC & DC offshore grid
  Reduce risks and cost, improve performance

- Develop power system for new generation portfolio
  Smart networks, new structure to govern offshore transmission (OFTO)

- Possible selective "life extension" of old coal & nuclear generators

Changing OfGEM to implement Sustainable Network Regulation

Past focus (RPI-X)

- Driving down costs
- Increasing efficiency
- Improving security of supply

New focus - RIIO model (**R**evenue based on **I**ncentives, **I**nnovation, and **O**utputs)

- Deliver a low carbon economy while maintaining security of supply
- Change from 5 to 8 year price control periods, to build long-term focus
- Reward innovation
- Sustainability

"RIIO is designed to promote smarter gas and electricity networks for a low carbon future"

The Government's Strategic Role

- Greater financial support including access to European Investment Bank (EIB)

- Swifter delivery including changes to:
    - The planning system
    - Supply chains
    - Grid connections and development
    - Bio-energy

- A stronger 'push' on new technologies and resources driving more commercially proven products.

- Government creates the conditions for innovation to flourish

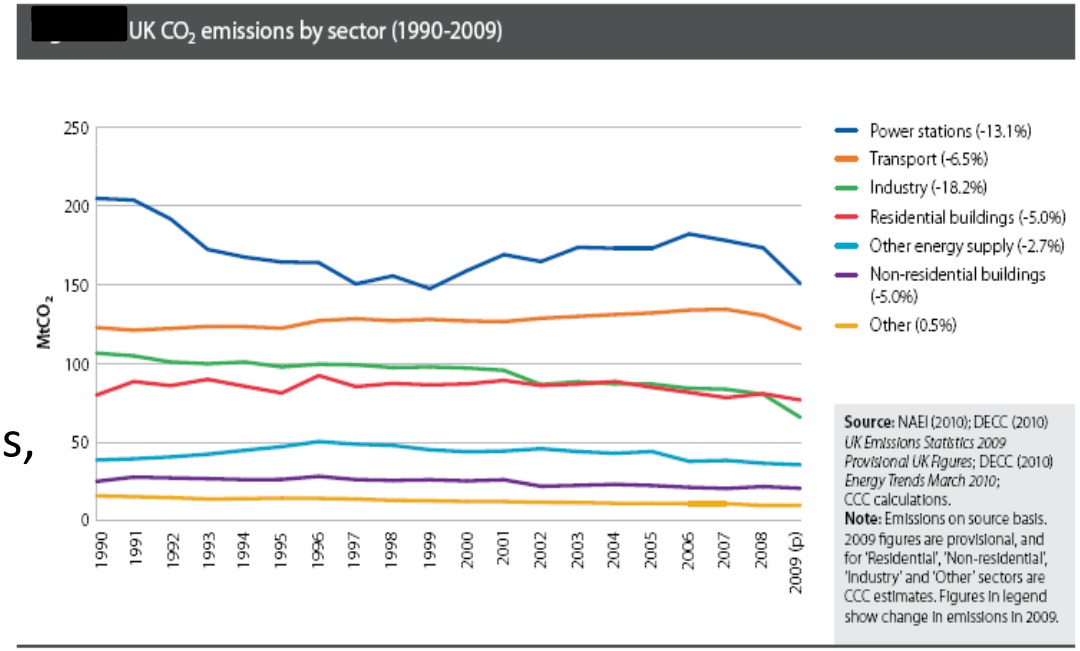
UK Coalition Government – Programme for Government

Specific Focus

- Seek to increase targets subject to Climate Change Committee
- Smart grid and metering
- Feed in Tariff (FIT) and Renewable Obligation Certificates (ROCs)
- Green Investment Bank
- Technologies – Carbon Capture and Storage (CCS), offshore wind, marine
- Offshore grid
- Micro gen and increased efficiency
- Security of supply

2nd Progress Report
Committee for Climate Change

- Issued June 2010 announcing reductions of 8.6% in greenhouse gas emissions 9.7% in CO_2, 2008 /9
- Reduction mainly due to economic recession
- Step change need to deliver targets
- New policies needed including strengthening incentives; energy market reform, carbon pricing
- Over 3GW per annum of new renewable generation needed
- Changes to; planning, grid access, CCS, nuclear
- Need for new technologies!



June 2010

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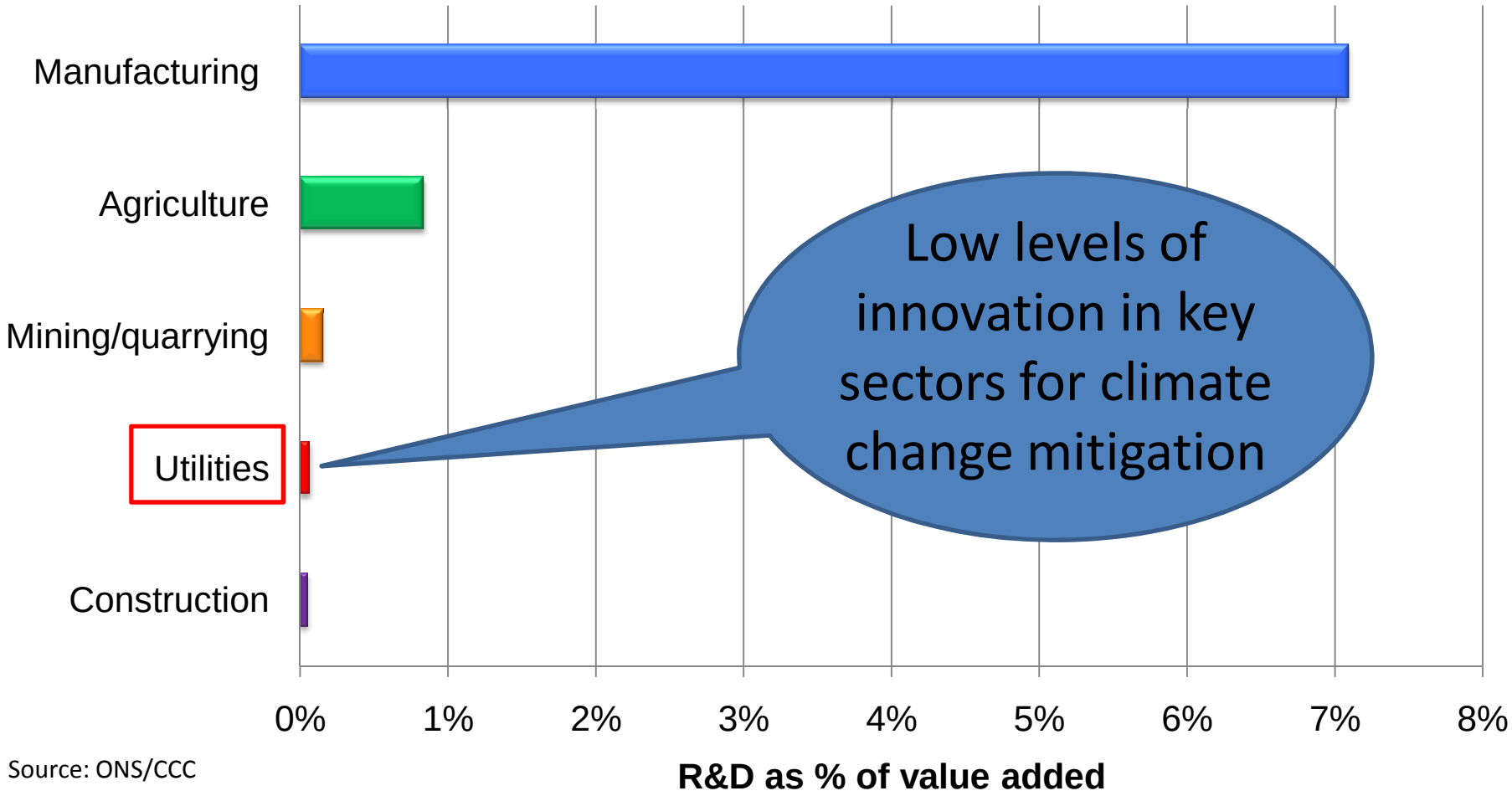
The Case For Intervention



Source: ONS/CCC

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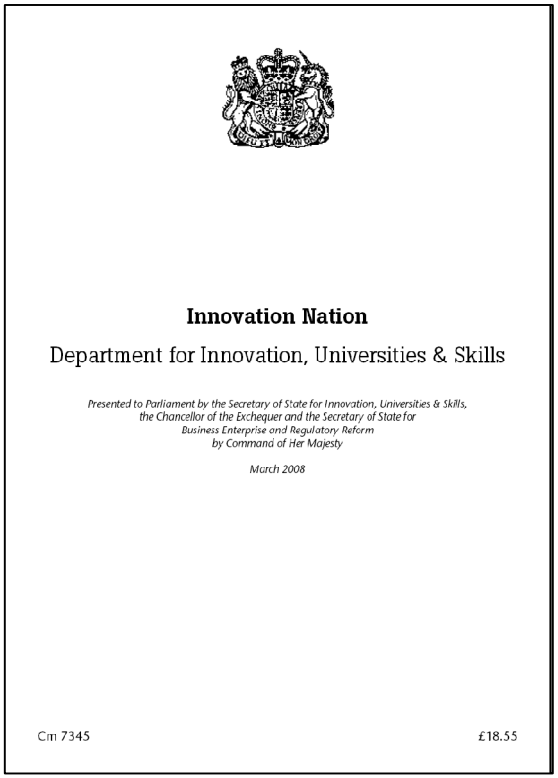
The Answer is Innovation – Political Context

- Key element in government policy
  Science and Innovation as the bedrock of UK success both economic and social
- Built on sustaining UK Excellence in science and technology and relevance to users
- Sustained increases in funding for both university research base and interaction with business
- Sequence of Government Reports:
  - Lord Sainsbury's "Race to the Top" Oct 2007
  - *Innovation Nation* March 2008
  - *New Industry, New Jobs – Building Britain's Future* April 2009
  - **Hauser Review (March 2010)**
  - **Ingenious Britain (March 2010)**



Innovation Nation

Department for Innovation, Universities & Skills

Presented to Parliament by the Secretary of State for Innovation, Universities & Skills, the Chancellor of the Exchequer and the Secretary of State for Business Enterprise and Regulatory Reform by Command of Her Majesty

March 2008

Cm 7345 £18.55

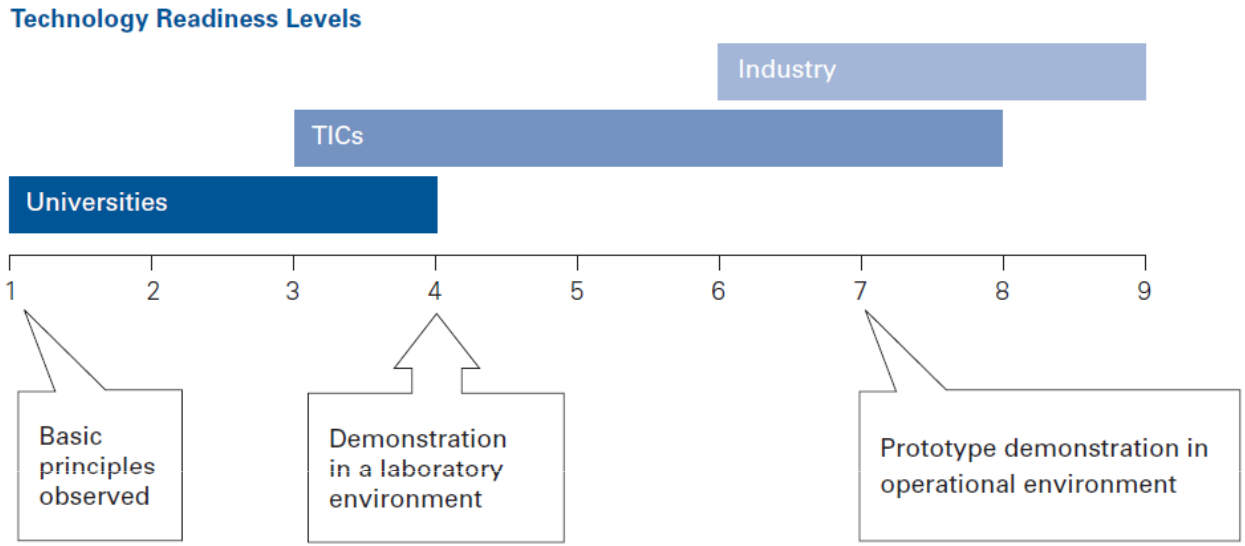
Rt Hon John Denham MP
Secretary of State for Innovation, Universities and Skills

Common Themes

- Government creates the conditions for innovation to flourish
- Science & Technology as key enablers but alongside other policies
  - Finance and entrepreneurship
  - Intellectual Property (IP), design, standards
  - Clusters and regional innovation
  - Sectors and (not) picking winners
  - Regulation and procurement
- Role of Universities and technology transfer
  - Research priorities and exploitation
  - Spin outs and IP generation
  - Incentive structures for institutions and individuals
- Combining science push and market pull

Innovation models

Hauser Review (2010)



- UK is a leading research centre
- Gap exists between R&D and translating into commercial products
- Translational infrastructure to close gap between academia and industry
- Technology Innovation Centres (TICs)
- Successes (Fraunhofer in Germany, ITRI in Taiwan, TNO in the Netherlands, ETRI in S Korea)
- UK needs business led TICs, from central strategic focus

Innovation models (2)

Ingenious Britain – James Dyson
(March 2010)

Patents filed in 2007:
330,000 – Japan
240,000 – US
17,000 – UK
"World Intellectual Property Organisation"

- Culture: Developing high esteem for science and en g
- Education: Getting young people excited about sci and engineering
- Exploiting knowledge: Collaboration, not compe n, between universities, companies and not-for-profits. Pu -private research institutes...
- Financing high tech start-ups: Turning goo ideas into world beating products
- Supporting high tech companies: Creating the right conditions for R&D investment, Tax credits for R&D spend

Develop and Deploy

Offshore Wind

Marine

CCS

Smart Grid & Smart Meters

Aviation

Electric Vehicle

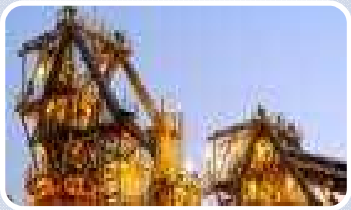
- Technologies not yet competitive with high-carbon alternatives
- UK has relevant capabilities
- UK well placed to accelerate development

Deploy

Nuclear Fission

Heat Pumps

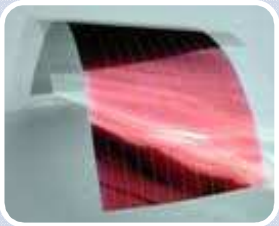
Advanced Insulation Materials



Industry CCS

- UK appears to lack an advantage
- Unlikely to influence direction of development
  - may develop some components
  - can participate in international collaborations

Research & Develop



Solar PV
3rd gen

Energy Storage

Hydrogen Fuel Cell Vehicles

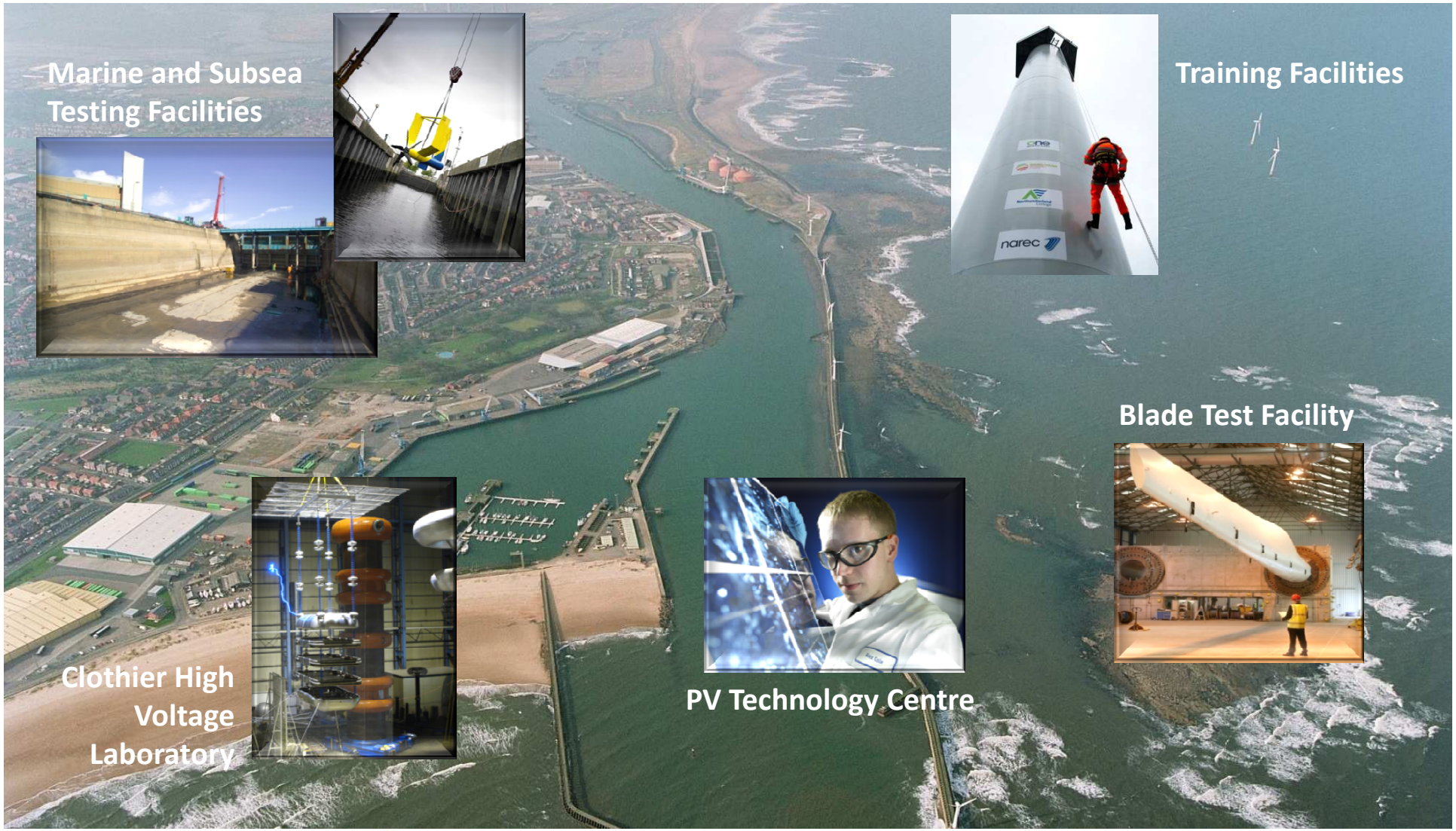
Adv. Biofuels

Agriculture Techs

Industry Techs

- Technologies further from market
- Unclear which country has, or will have, an advantage
- Potential for UK to lead/continue to lead some research areas

Narec - A National Renewable Energy Hub



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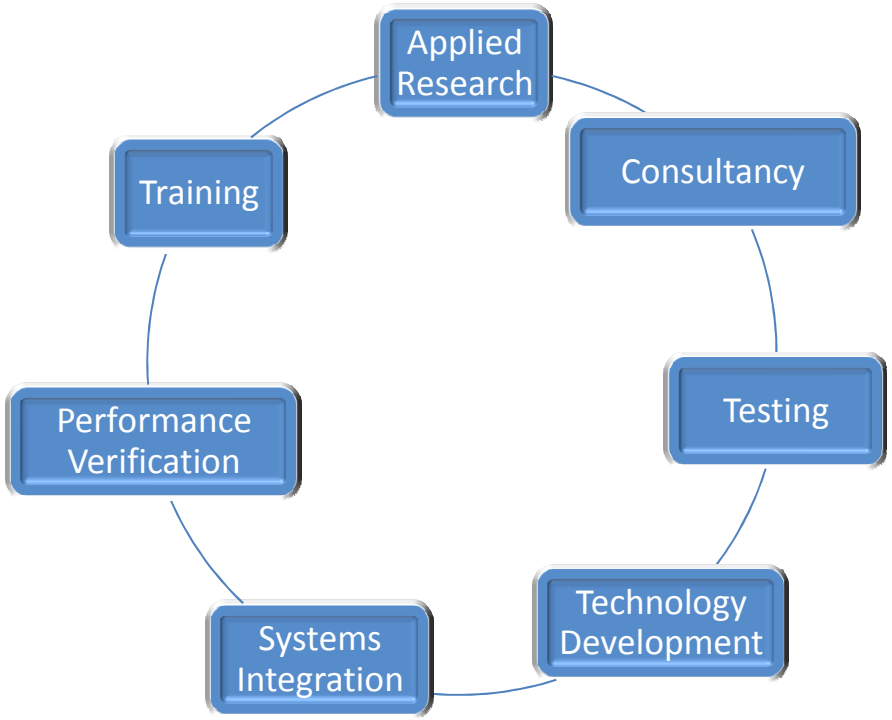
narec wind energy

narec marine renewables

narec distributed energy

narec electrical networks



RESEARCH → DEVELOPMENT → DEMONSTRATION

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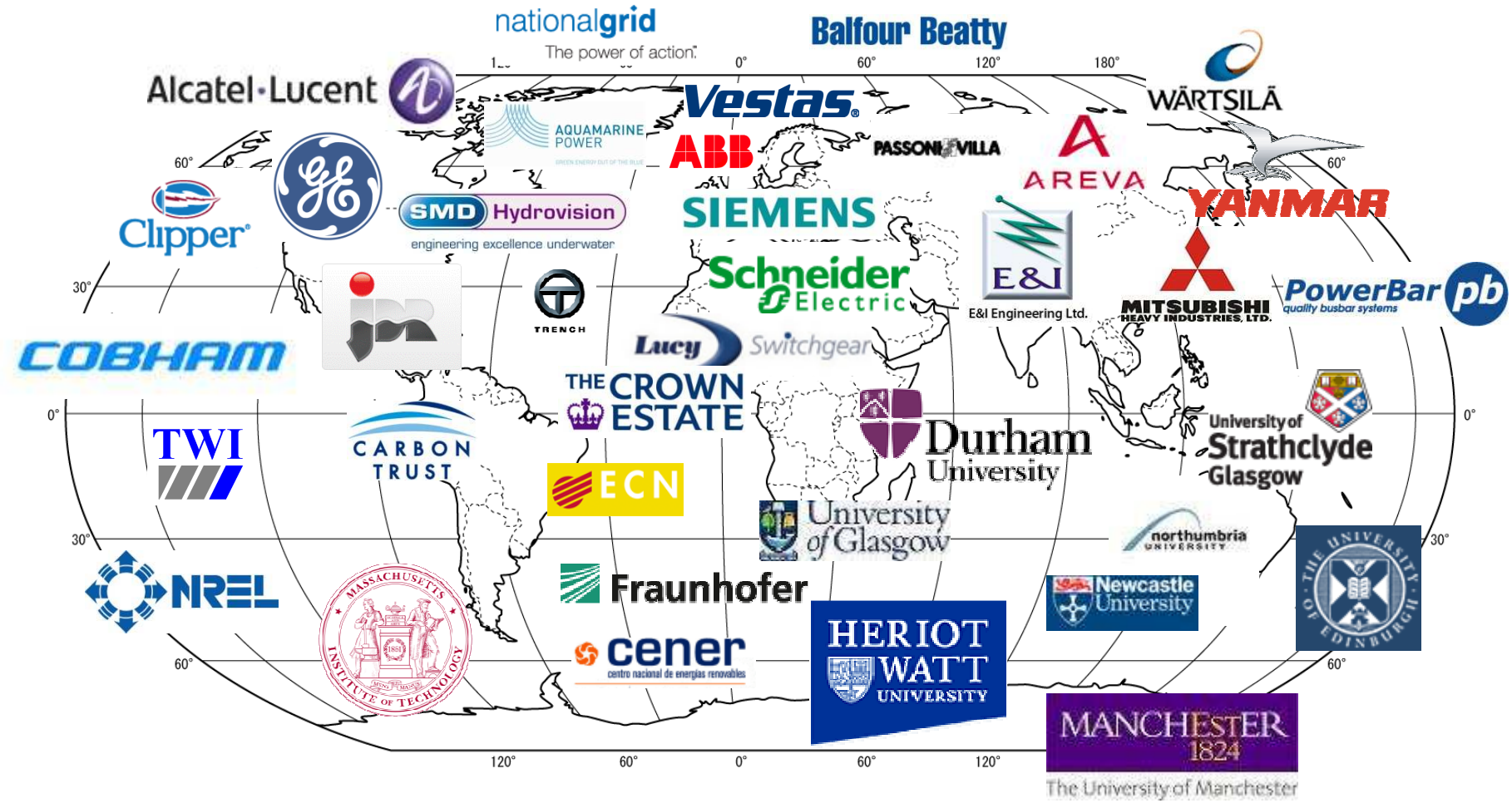
An International Client Base



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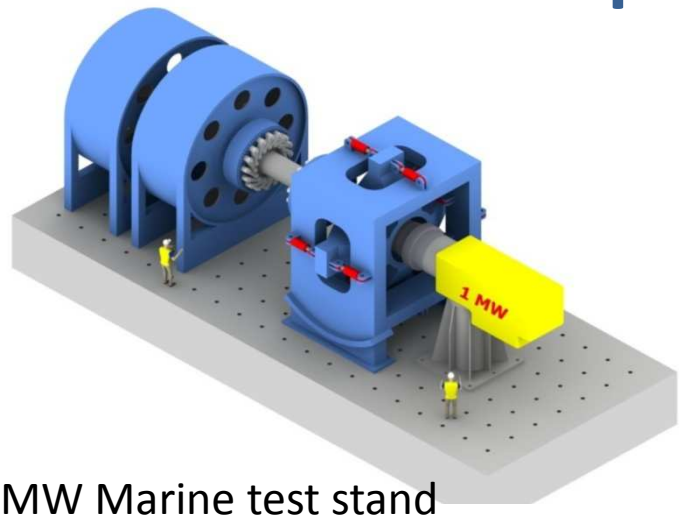
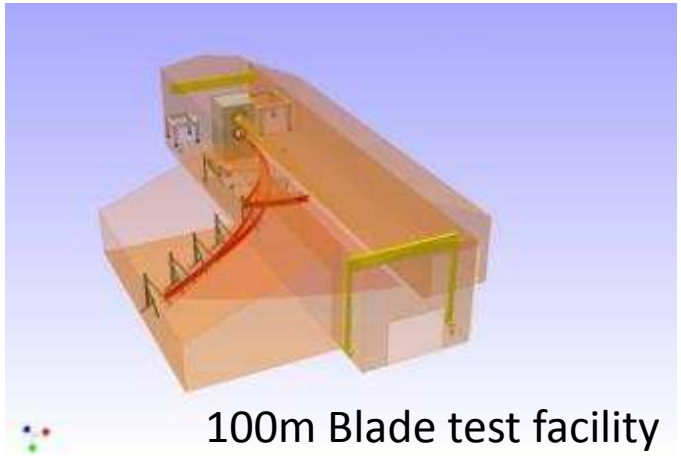
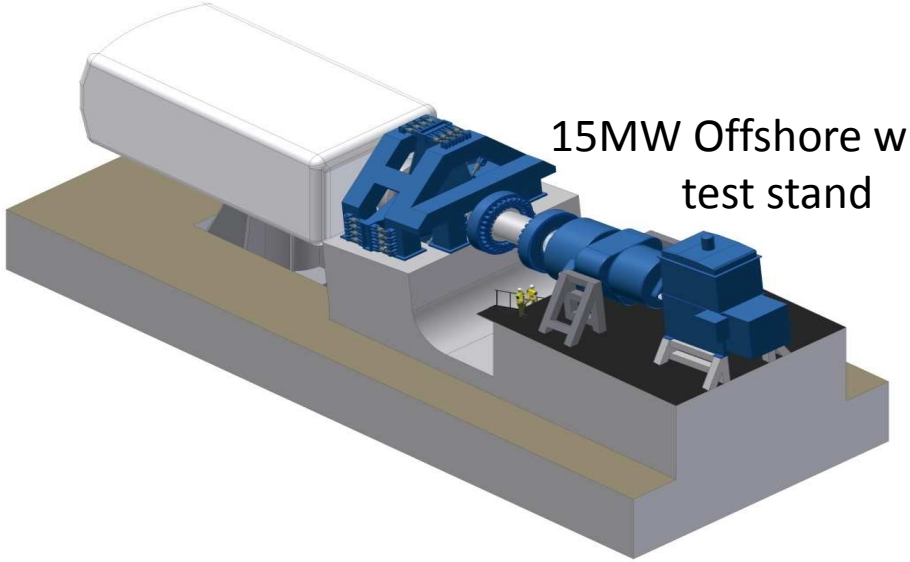
New Capital Asset Development



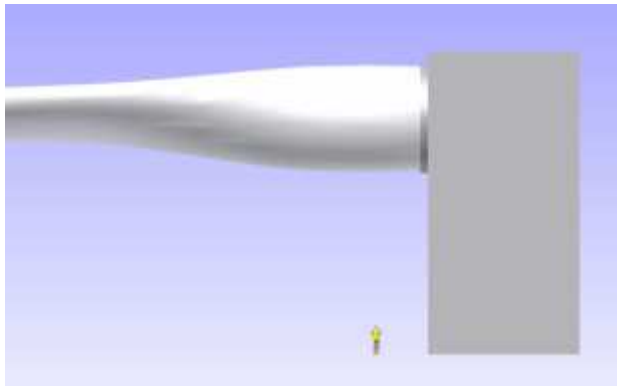
3MW Marine test stand



100m Blade test facility



15MW Offshore wind test stand



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Offshore Wind Demonstration Site

- 2010 Narec awarded £18.5m grant funding by central government for grid connection, onshore substation and monitoring platform build
- Up to 20 turbine positions available
- Up to 99MW
- Array depths 20-25m, 35m, 45m and 55m
- 3~10MW class turbines
- Offshore measurement available from Q2 2011
- Onshore substation construction Q1 2013
- Site available for tenants connection 2013

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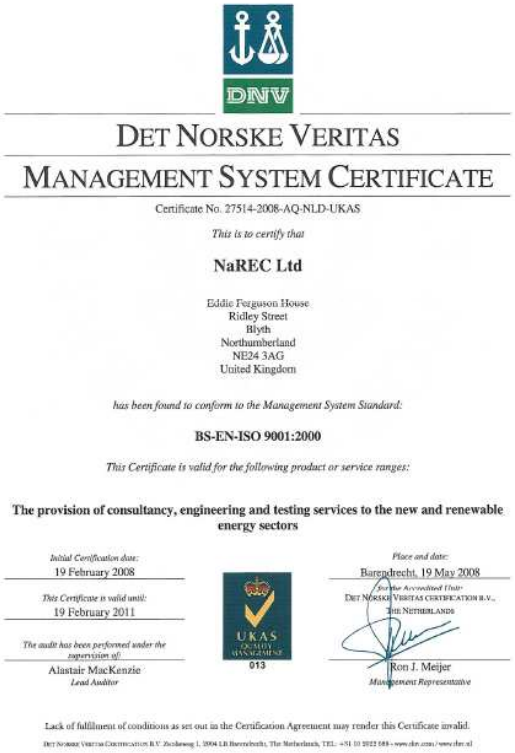
Independence, Professionalism and Assurance



DET NORSKE VERITAS

MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 27514-2008-AQ-NLD-UKAS

This is to certify that

NaREC Ltd

Eddie Ferguson House
Ridley Street
Blyth
Northumberland
NE24 3AG
United Kingdom

has been found to conform to the Management System Standard:

BS-EN-ISO 9001:2000

This Certificate is valid for the following product or service ranges:

The provision of consultancy, engineering and testing services to the new and renewable energy sectors

Initial Certification date: 19 February 2008

This Certificate is valid until: 19 February 2011

The audit has been performed under the supervision of: Alastair MacKenzie, *Lead Auditor*

UKAS QUALITY MANAGEMENT 013

Place and date: Barendrecht, 19 May 2008

For the Accredited Unit: DET NORSKE VERITAS CERTIFICATION B.V., THE NETHERLANDS

Ron J. Meijer, *Management Representative*

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

DET NORSKE VERITAS CERTIFICATION B.V. Zwolseweg 1, 3994 LB Barendrecht, The Netherlands, TEL: +31 10 2022 888 - www.dnv.com / www.dnv.nl

Narec recognises that the successful control of business risk, specifically in the areas of health and safety, environment and quality, is essential to underpin our global reputation for independence and professionalism.

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In Summary

Renewables mix driven by:

- Legislation, resources, existing system

Does resource development suit needs?

- Exploit advantages
- does curricula suit market needs

Industry structure and infrastructure should facilitate achieving strategic goals

National Renewable Energy Centre

Thank you for your attention!

Alex Neumann
Director of Electrical Networks