

"The Development of Nuclear Energy Policy in the UK"

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E=mc²



1896
HENRI BECQUEREL
DISCOVERS
RADIOACTIVITY

1898
PIERRE & MARIE CURIE
EXPERIMENT USING
RADIUM TO CURE
CANCER, A PROCESS
STILL USED TODAY



1902
RUTHERFORD LEARNS TO
MANIPULATE ELEMENTS BY
BOMBARDING THEM WITH
ALPHA PARTICLES

1905
ALBERT EINSTEIN PUTS
FORWARD HIS THEORY
RELATING MASS TO ENERGY

1954
ATOMIC ENERGY
ACT: THE UNITED
KINGDOM ATOMIC
ENERGY AUTHORITY
IS CREATED

1939-45
THE US DEVELOPS NUCLEAR
WEAPONS DROPPING TWO
BOMBS OVER JAPAN WHICH
LEADS TO THE END OF WWII

1934
ENRICO FERMI
ACHIEVES THE FIRST
CONTROLLED SELF-
SUSTAINING NUCLEAR
FISSION REACTION

1932
CHADWICK DISCOVERS
NEUTRONS AN IMPORTANT
PARTICLE IN NUCLEAR FISSION

1903
NIELS BOHR
PUBLISHES HIS MODEL OF
THE ATOMIC STRUCTURE
WHICH IS STILL TAUGHT
IN CLASSROOMS TODAY

1956-71
NINE MAGNOX
NUCLEAR POWER
STATIONS OPEN
ACROSS THE UK

1965-88
AFTER GOVERNMENT
APPROVAL SEVERAL
ADVANCED GAS
COOLED REACTORS
ARE BUILT

1971
BRITISH NUCLEAR FUELS
LIMITED IS CREATED TO TAKE
CONTROL OF THE UK'S
FUEL CYCLE OPERATIONS



1988-95
SIZEWELL B, THE UK'S
FIRST PRESSURISED
WATER REACTOR IS BUILT
AND STARTS GENERATING
ELECTRICITY IN 1995



2008

WHITE PAPER AGREES
NEW NUCLEAR SHOULD
PLAY A ROLE IN THE
FUTURE UK ENERGY MIX

2006
In a speech to business
leaders Prime Minister Blair
calls for a new generation
of nuclear power stations

2005

THE NUCLEAR DECOMMISSIONING
AUTHORITY IS CREATED TO TAKE
STRATEGIC RESPONSIBILITY FOR
THE UK'S NUCLEAR LEGACY

1997

Two nuclear waste
stores are to be
built at Sellafield,
for intermediate
level waste for the
next 50 years with
another 10 planned

27%
OF ELECTRICITY IN
THE UK IS SUPPLIED
BY NUCLEAR POWER

2009

£12.5BN
EDF TAKEOVER
BRITISH ENERGY

- UK NEW BUILD PLANS**
- EDF ENERGY at Hinkley & Sizewell
 - HORIZON NUCLEAR POWER at Wylfa & Oldbury
 - NUGENERATION LTD at Moorside

FUKUSHIMA ACCIDENT:
CHIEF NUCLEAR INSPECTOR
SAYS UK PLANTS HAVE NO
FUNDAMENTAL SAFETY
WEAKNESSES

2011

2015

GOVERNMENT INVESTS IN
NUCLEAR RESEARCH AND
DEVELOPMENT FOR
FUTURE TECHNOLOGY

2016

EDF ANNOUNCE FINAL
INVESTMENT DECISION
FOR HINKLEY POINT C, THE
UK'S FIRST NEW NUCLEAR
PLANT IN OVER 20 YEARS

Calder Hall, where it all started



Tokai-1



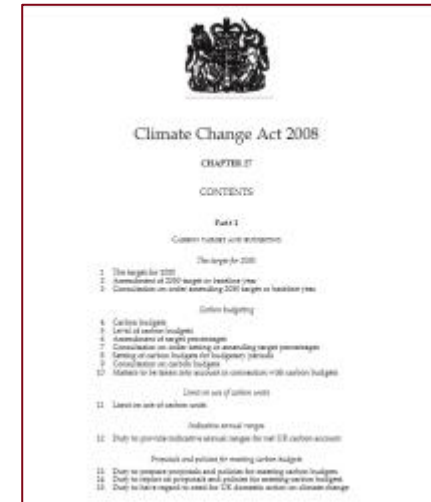
By KEI at Japanese Wikipedia, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=11450757>

UK Nuclear Industry – The Future

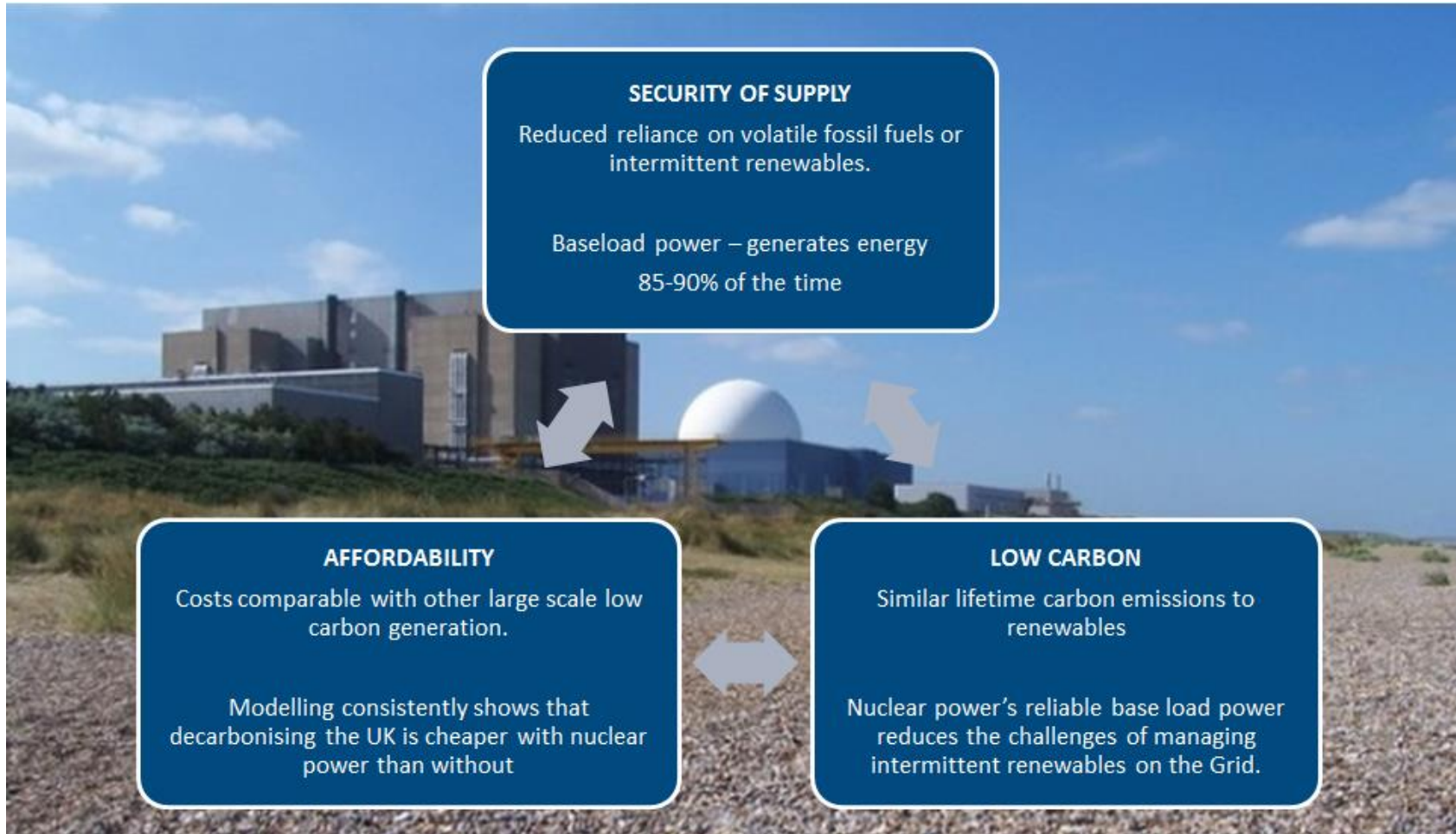
- New Build is the future
- Operating is the future
- Decommissioning is the future

Energy Policy Drivers

- UK remains committed to the Paris Agreement which calls on countries to keep global temperature rises below 2C.
- UK own legally binding commitment to reduce carbon emissions by 80% by 2050 compared with 1990 levels.

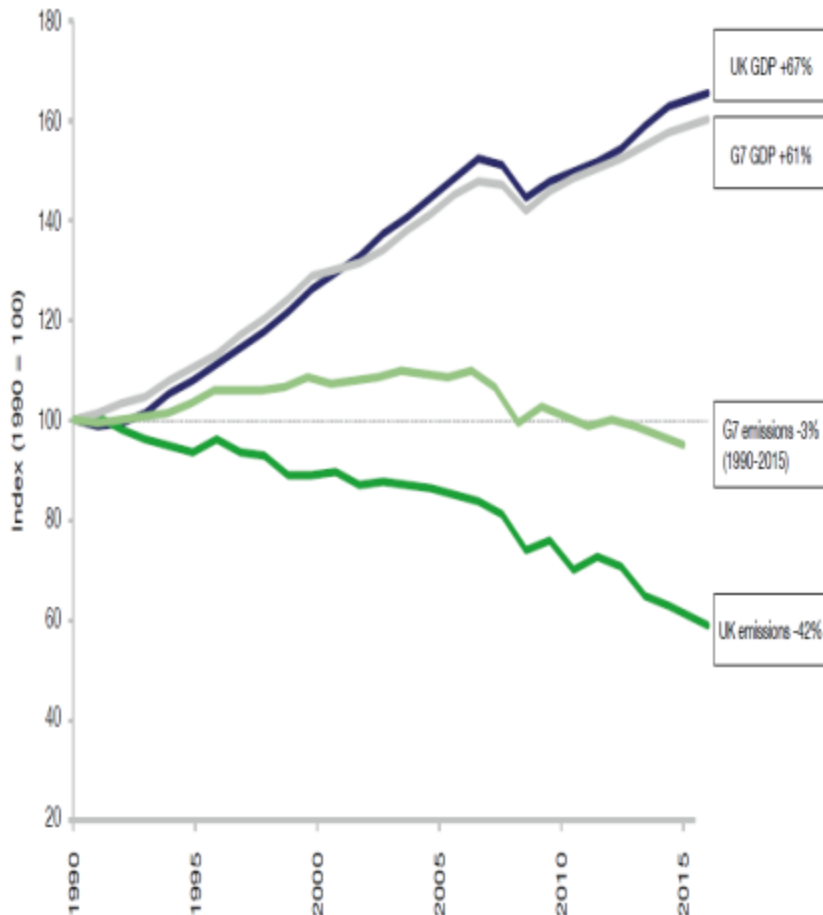


Nuclear Energy Policy Drivers



Clean Growth Strategy: increased economic growth and decreased emissions

UK and G7 economic growth and emissions reductions



Source: UNFCCC; World Bank; BEIS

The Clean Growth Strategy

Leading the way to a low carbon future



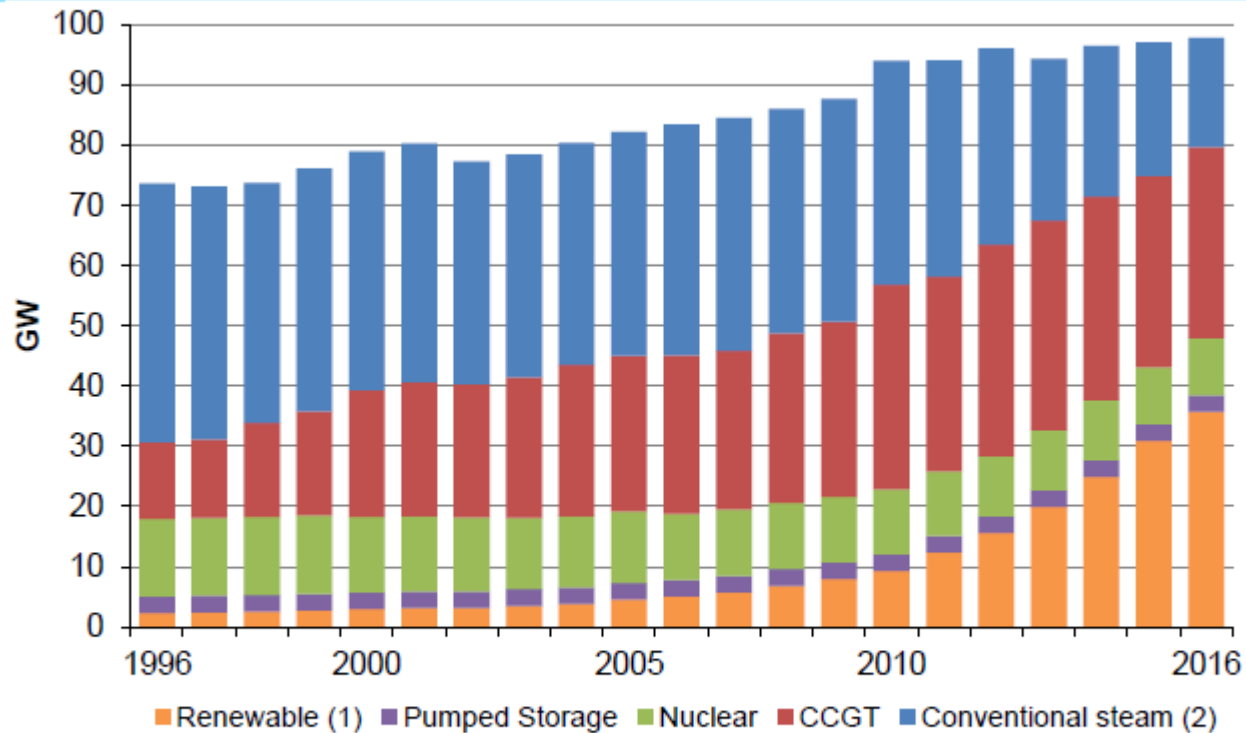
HM Government

Major commitments include:

- Progress discussions with **nuclear** developers to secure a competitive price for future projects
- £557m for further **renewables** subsidies
- £1bn to support the take-up of **ultra low emission vehicles**
- £3.6bn to improve household **energy efficiency**
- £4.5bn on low carbon **heat** technologies in homes and businesses

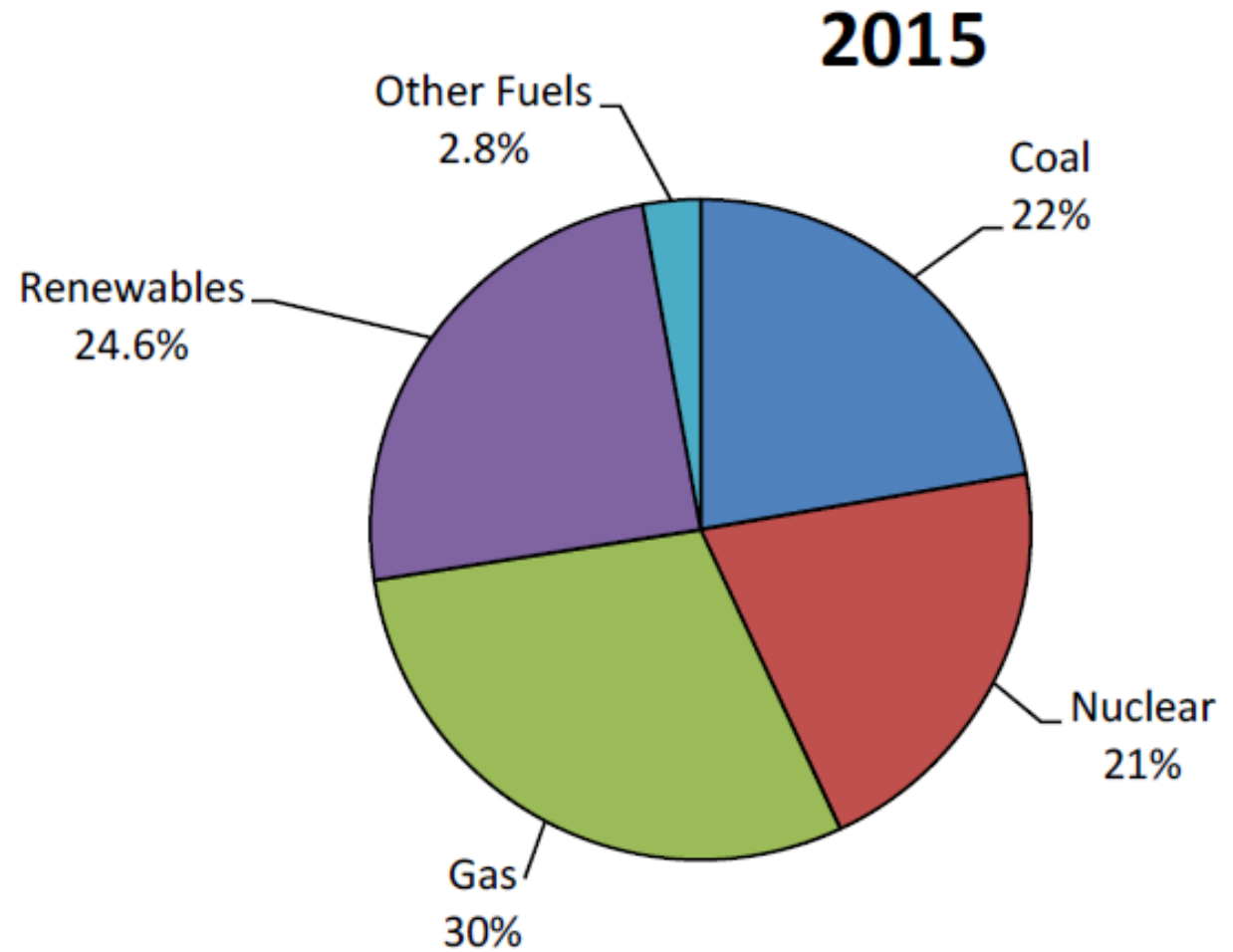
Building our
Industrial Strategy

Electricity capacity, 1996 to 2016



(1) Renewable capacity is on an Installed Capacity basis. Data for other fuels/technologies relates to Declared Net Capacity from 1996 to 2005, data for 2006 onwards is transmission entry capacity (TEC)
 (2) Includes coal, non-CCGT gas, oil and mixed/dual fired. Does not include thermal renewables.

The UK Electricity Mix



Nuclear Power in the UK – Operating Stations

Advanced Gas-Cooled Power Stations (7)

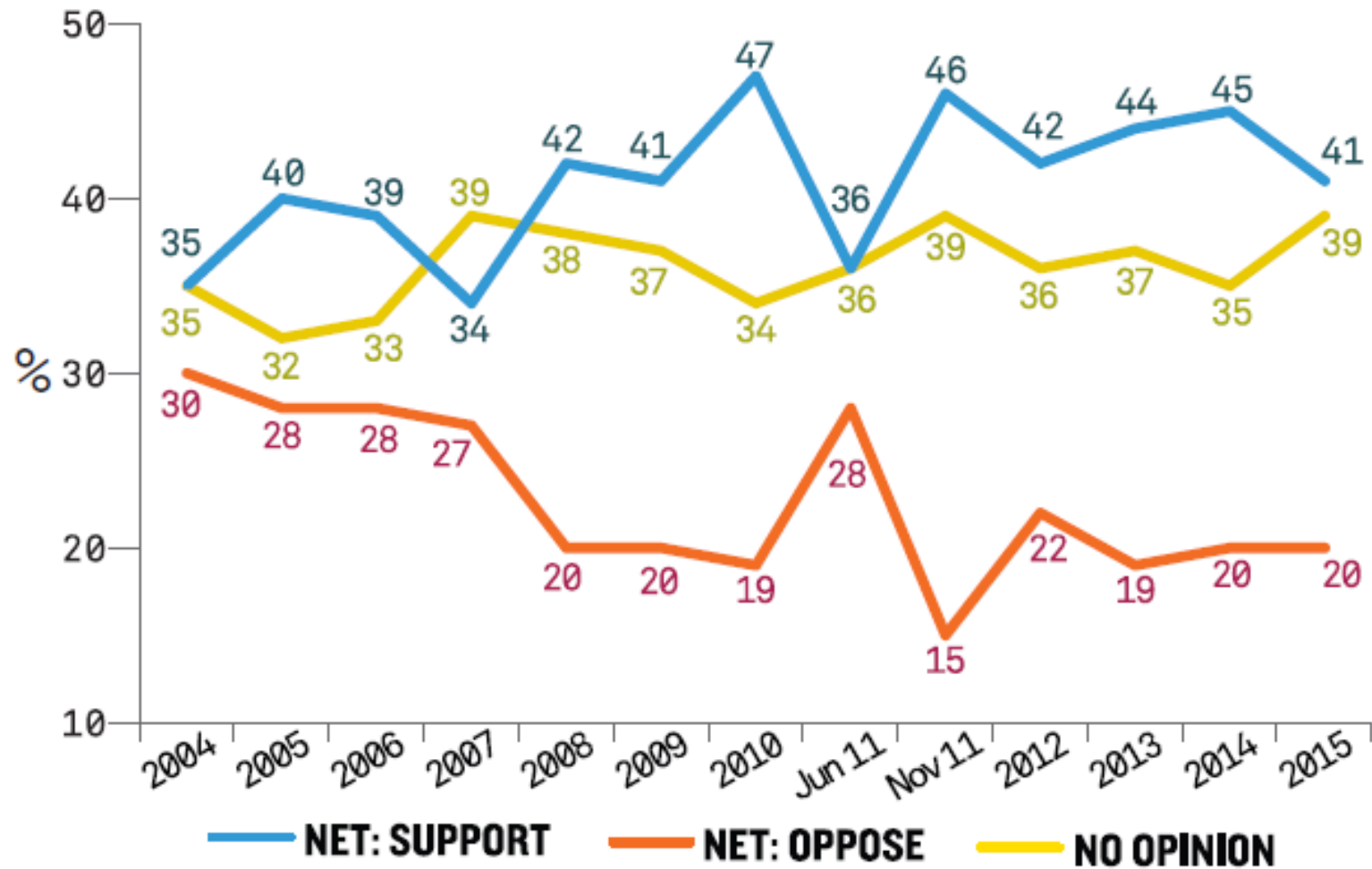
Dungeness B	1983	2028
Hartlepool	1983	2024
Heysham 1	1983	2024
Heysham 2	1988	2030
Hinkley Point B	1976	2023
Hunterston B	1976	2023
Torness	1988	2030

Pressurised Water Reactors (1)

Sizewell B	1995	2035
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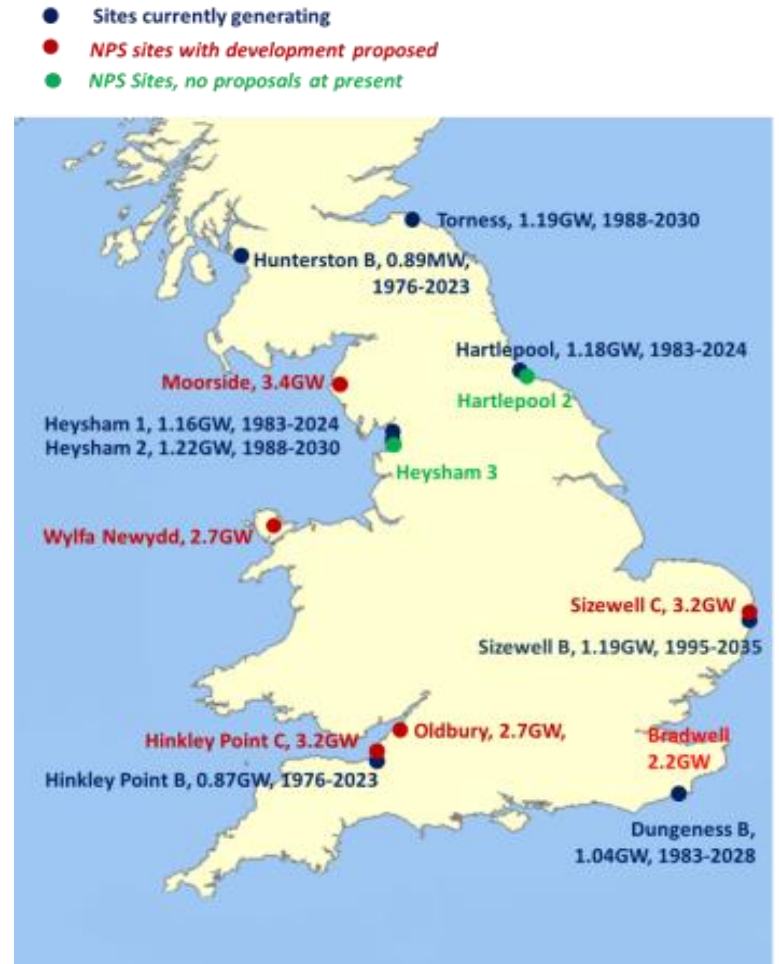
Estimated decommissioning dates – subject to approval and life extensions

More people in the UK support new build than oppose

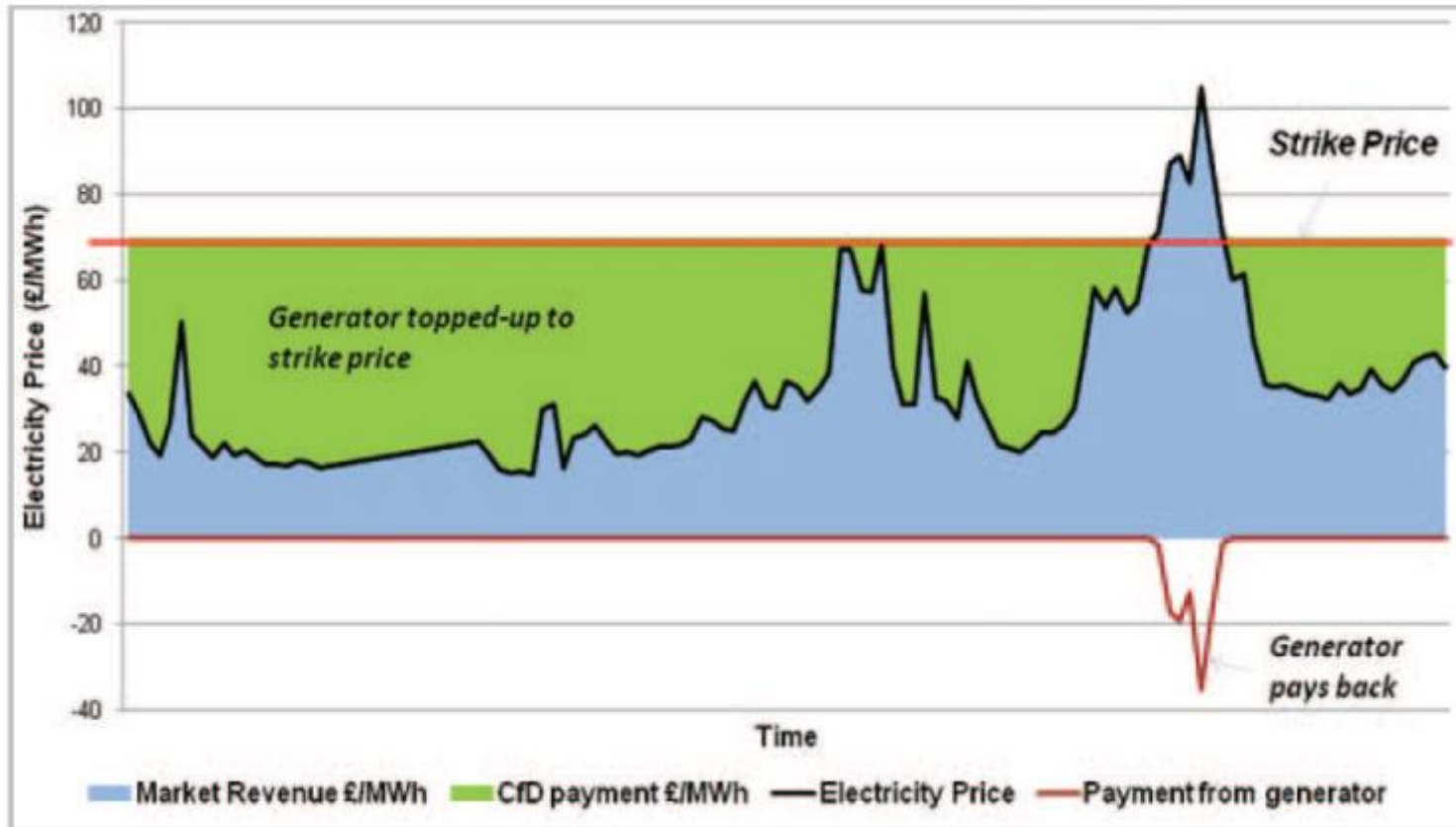


New Nuclear

- The UK currently has 8 nuclear power stations across the UK comprising 15 individual reactors (19% of the UK electricity).
- Without new nuclear build, the share of nuclear generation could dip to 3% in 2030.
- Hinkley Point C – 7% of UK's generation needs
- Wylfa/Oldbury
- Moorside
- Sizewell
- Bradwell



Electricity Market Reform (EMR) – Contract for Difference



Small Modular Reactors

- SMRs present an opportunity for the UK supply chain and **could** reduce the cost of energy through modularisation and lower financing costs.
- Government have been exploring this potential through the **SMR Competition** and studies such as the **Techno-Economic Assessment**.
- Wide range of technologies, at different levels of maturity and market readiness; suggesting that a **multi-track** approach to SMR policy is needed.
- We are making targeted investments, including **£7m** to develop capability of nuclear regulators to support and assess advanced nuclear technologies.
- Government working with industry to explore role that emerging nuclear technologies could have in UK. **Announcement on next steps for SMRs soon.**



Nuclear Power in the UK – Decommissioning Stations

Magnox Power Stations (11)

Wylfa	1971	2015	(44 years)
Bradwell			(40 years)
Chapelcross			(45 years)
Dungeness A			(41 years)
Hunterston A			(25 years)
Hinkley Point A			(35 years)
Calder Hall			(47 years)
Trawsfynydd			(26 years)
Berkeley			(27 years)
Oldbury	1967	2012	(45 years)
Sizewell A	1966	2006	(40 years)



NDA Estate



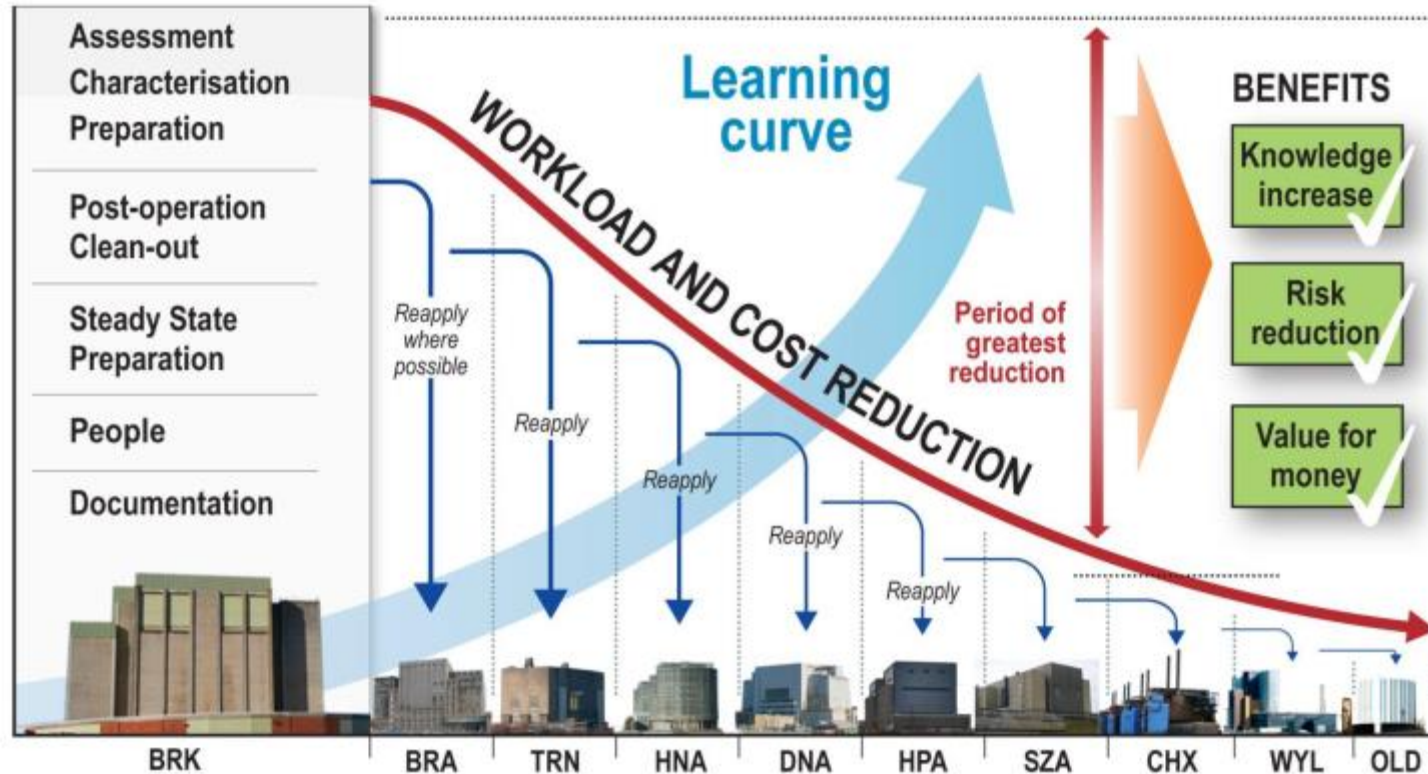
UK Decommissioning Experience: Demonstrable Progress



Sometimes a 'Skyline Change' is necessary to demonstrate progress.



UK Programme Approach to Decommissioning of a Reactor Fleet



- Appropriate project management arrangements
 - Decommissioning project management isn't the same as construction project management
- Appropriate Waste Management
 - A lot of the cost is in waste management

Reducing Decommissioning Costs

- **Appropriate project management arrangements**
 - Decommissioning project management isn't the same as construction project management
- **Appropriate Waste Management**
 - A lot of the cost is in waste management

Dounreay



The Importance of Nuclear Communities



Scrabster Harbour



The National Nuclear Archive



UK-Japan Collaboration on Decommissioning



Cricket in Fukushima Prefecture



Summary

- Nuclear Energy is very much part of the future policy for the UK
- Decommissioning, Operations and New Build are all part of the future of the industry
- The challenges of decommissioning are not just technical, and tackling them successfully can significantly reduce the costs
- The UK has 8 proposed sites for new nuclear build, with proposals for build on 5 of them