

#### Nuclear Power in the UK Energy Mix

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- Background to nuclear energy in the UK
- Current prospects for new nuclear stations
- The Nuclear Industrial Strategy
- The role of the UK's National Nuclear Laboratory

#### How a Nuclear Reactor Works







#### The Nuclear Fuel Cycle



## **UK Nuclear Industry**

- Pioneer in nuclear generation
- Full fuel cycle capability
- Highly skilled workforce
- Mature and flexible supply chain
- Exemplary safety record
- World leader in decommissioning nuclear reactors and associated facilities
- At forefront of global nuclear renaissance



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- The UK nuclear industry employs around 62,000 people
- Around half of these are in the North West of England, in particular Cheshire and Cumbria
- A programme of nuclear reactor new build could generate up to 40,000 additional jobs at its peak

#### Nuclear Generates Very Low Greenhouse Gas Emissions



### Electricity Emissions Factors (kg CO2e/kWh)





 There's plenty of uranium in the world, in countries like Canada and Australia

#### Known Conventional Uranium Resources\* (2003)







Total: 3,537 thousand tonnes

Sources: WEC, OECD, 2003 Sources: WEC, OECD, 2003 Generational Resources and "Class I Estimated Additional Resources" - all in thousands of tU (<\$80/kg)



- There's plenty of uranium in the world, in countries like Canada and Australia
- If supplies are disrupted, it doesn't matter for a long time
- We can afford to pay a bit more for the uranium
- Nuclear plants run around the clock, whatever the weather

## Closure Dates for AGR and PWR Fleet NATIONAL NUCLEAR



## Decision Time – Back in 2006



"By 2025, if current policy is unchanged, there will be a dramatic gap on our targets to reduce CO2 emissions;

> ...we will become heavily dependent on gas; and at the same time move from being 80/90% self-reliant in gas to 80/90% dependent on foreign imports,

These facts put the replacement of nuclear power stations, a big push on renewables and a step-change on energy efficiency, engaging both business and consumers, back on the agenda with a vengeance."



Former Prime Minister, Tony Blair 16 May 2006, CBI Annual Dinner





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#### 2008 Nuclear Power White Paper

- "Nuclear power has a key role to play as part of the UK's energy mix"
- Energy companies allowed to build
- Government to take forward:
  - Strategic Siting Assessment
  - Strategic Environmental Assessment
  - EU Justification
  - Pre-licensing (including ensuring the NII have adequate resources)
  - Funding framework for waste and decommissioning liabilities
  - A National Policy Statement to ensure effective passage through planning process



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Published 10 January 2008

### Cross Party Consensus (since October 2013)







•UK has had 19 nuclear power stations (of which 9 are still running), but 15 different designs

• 11 Magnox stations	10 designs
<ul> <li>7 AGR stations</li> </ul>	4 designs
• 1 PWR	unique in the world

•France has 58 nuclear power stations, but essentially just 3 designs

- 34 similar 900 MW plants
- 20 similar 1300 MW plants
- 4 identical N4 plants

#### Wastes from New Stations Would Add Little to Existing Stocks



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### 'Designated' Nuclear Sites



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## New Build Plans for UK





Horizon Nuclear Power Ltd (Owned by Hitachi) 2 x GE-Hitachi ABWRs at both Wylfa and Oldbury

## HORIZON

NUCLEAR POWER

**NUCCEN** NuGeneration Ltd (Set to become a Toshiba-Westinghouse/GDF Suez Joint Venture) 3 x 1100MW AP1000s at Moorside, near Sellafield

## Hinkley Point C Where are we now?

- Generic Design Assessment:
   Completed End 2012
- Site Licence: Awarded November 2012
- Planning: Approved 19 March 2013
- Electricity Market Reform: Energy Bill – End 2013
- "Strike Price":

Agreed in October 2013 as £92.50 per MWh (£89.50 if EDF Energy proceed with Sizewell C)





## **Electricity Market Reform**

- Carbon Floor Price
- Capacity Markets
- Contracts for Difference



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#### Public Opinion has Survived the "Fukushima Dip"



YouGov

To what extent would you support or oppose the building of new nuclear power stations in Britain to REPLACE those that are being phased out over the next few years? This would ensure the same proportion or nuclear energy is retained (Net: support; Net: oppose)



Tracking adjustment for method change: Support (-5%); Oppose (-4%). Based on comparable question on favourability Base: Online survey (2,009) Source YouGov Dec 2012

#### New Nuclear Build: Challenges to be Overcome



In an uncertain world, one thing is very important to potential investors in nuclear:







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#### UK Public Sector Fission R&D Funding



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#### UK Nuclear R&D Workforce



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#### House of Lords Report: November 2011





- Establish long-term nuclear energy strategy
- DECC to lead long term R&D roadmap
- Establish Nuclear R&D Board with funding
- National strategic R&D programmes on Generation IV reactors and advanced fuel cycles
- Broaden role of NNL

#### Nuclear Industry Strategy March 2013



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#### The Vision in the wider context: Nuclear Industrial Strategy









- Nuclear strategy supporting long term Government energy policy, ongoing programmes and industrial exploitation
- Nuclear Innovation Research Advisory Board (NIRAB) to be established to advise Government.
- Nuclear Innovation Research Office (NIRO) to be established to deliver NIRAB strategy – NNL to host.
- Government to implement long term R&D programmes based on advice from NIRAB.
- NNL mission to be restated to give emphasis to supporting UK national programmes.
- NNL to stay in Government ownership, but current management contract will not be replaced.

## Ownership and Management (GOGO)





National Laboratory for both UK Government and Industry
Support to national R&D programmes
Host and lead NIRO







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## National Nuclear Laboratory Remit

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To deliver the best nuclear science and

technology solutions in the world

#### **DECC Objectives**

- 1. Place NNL on a sound commercial footing
- 2. Safeguard the UK's strategic nuclear skills
- 3. Develop NNL's customer base beyond its historic nuclear markets
- 4. Optimise the utilisation of NNL facilities
- 5. Enable the use of NNL facilities by others; and
- 6. Provide support for the West Cumbrian master plan

## NNL – Facts & Figures



- Around 800 staff
  - Over 60% of whom have science or engineering degrees / PhDs
- Key customers
  - Sellafield Ltd, EdF Energy, NDA, Magnox, Cavendish Nuclear, MoD, Westinghouse, UK Government, Regulators
- Annual turnover of around £90M
- We operate as a commercial business
  - No direct funding grant from HMG



#### 6 Locations Across the UK





#### Sellafield

- Central Laboratory
- Windscale Laboratory
- Workington Laboratory
- Springfields
  - Preston Laboratory
- Risley
- Stonehouse
- Harwell

## The Role of the National Nuclear Laboratory

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#### NNL supports **all** nuclear programmes

- Continued operation of existing reactors & fuel cycle facilities (fuel fabrication, reprocessing)
- Legacy waste management / decommissioning
- New nuclear build
- Geological disposal
- Plutonium stockpile disposition
- Naval propulsion support
- Advanced reactor & fuel cycles
- Space energy systems
- Security, non-proliferation & safeguards

Between them, NNL employees have over 10,000 man-years of nuclear industry experience



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- The UK's nuclear industry is already a major contribution to meeting UK energy needs
- Plans for new nuclear build in the UK are very much alive
- The next important steps are the EU decision on the State Aid issue for Hinkley Point C, and EDF Energy's Final Investment Decision to proceed.
- The National Nuclear Laboratory is uniquely placed to support the industry – owned by UK Government, but run commercially and returning a profit



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