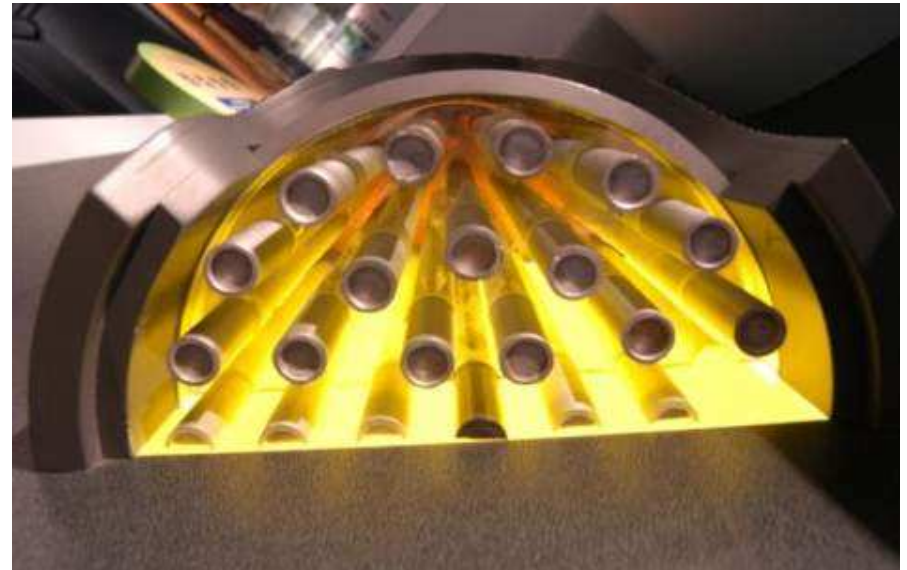


## **Nuclear: all talk, no action? Where is the real opportunity?**

**Samir Brikho, Chief Executive, AMEC plc**

29 April 2010



## Agenda

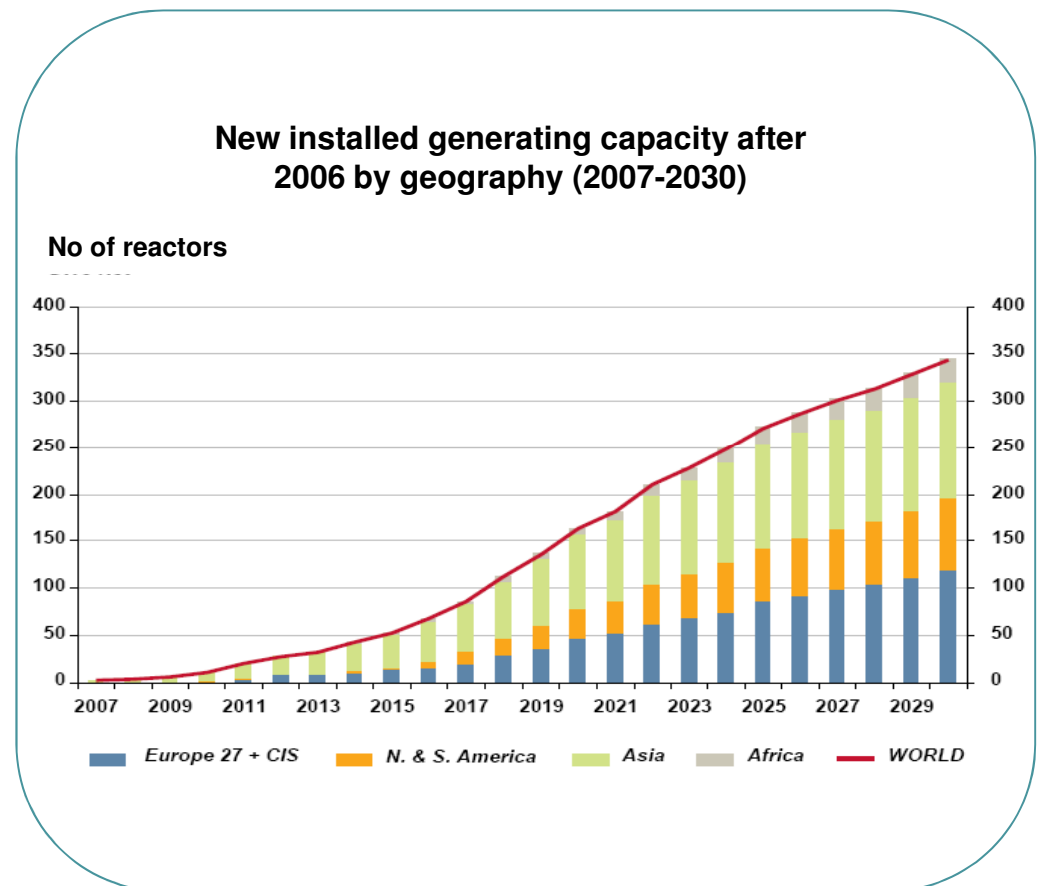
- Global nuclear market
  - Size and drivers
  - Market structure and characteristics
  - Investment costs and timelines
  - Challenges
- UK nuclear market
  - Key part of energy mix
  - Market-driven approach
  - New build process
  - Addressing the challenges
- Global opportunity



Sellafield panorama

## New build - market size and drivers

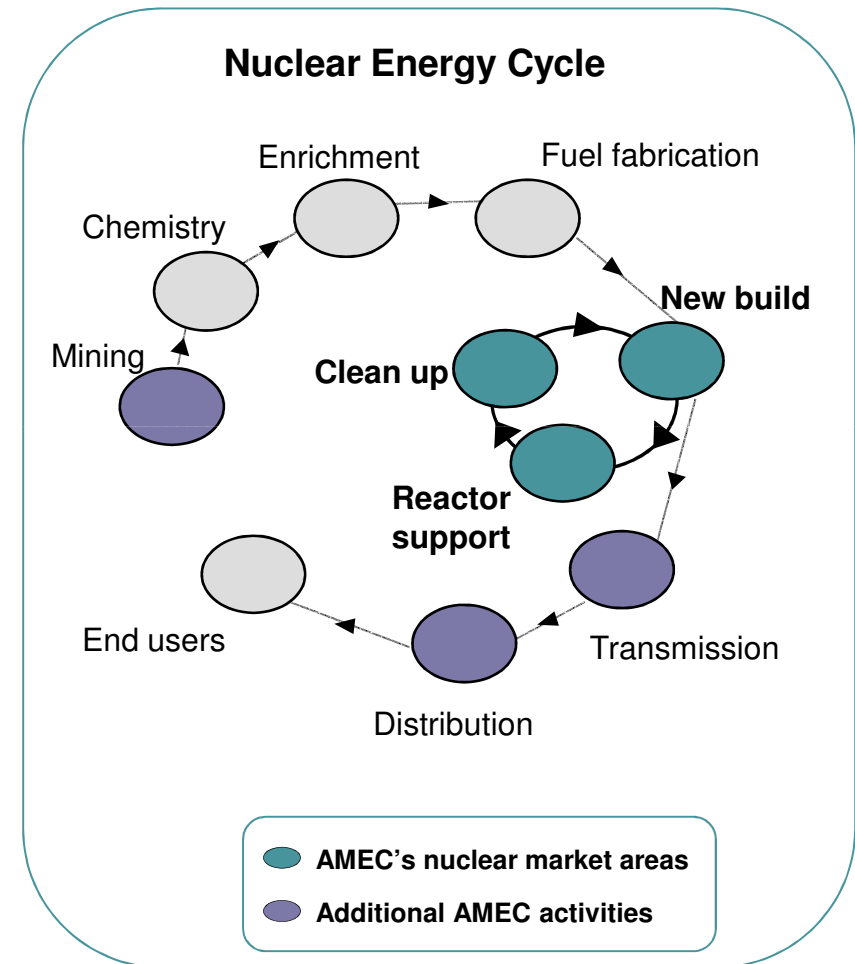
- Over 300 reactors are planned or proposed for construction
- The number of countries with intent to expand or launch nuclear programmes has increased significantly in the last four years
- 6 countries dominated nuclear market historically - represent 90% of installed capacity
- Asian countries will generate most growth into the future



Beginning a new and long-term cycle

## Market structure and characteristics

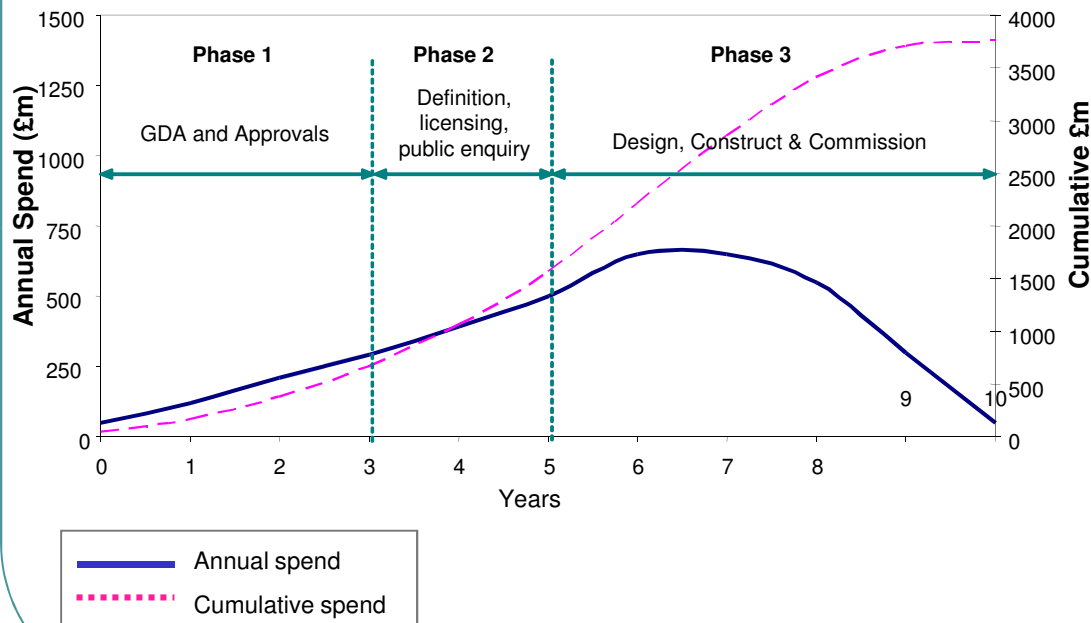
- Market structure
  - Sectors
  - Players: countries, global OEM, nuclear utilities
  - Technologies: <10 globally
  
- Market characteristics
  - Political
  - Regulated
  - Competitive



# Investment costs and timelines\*

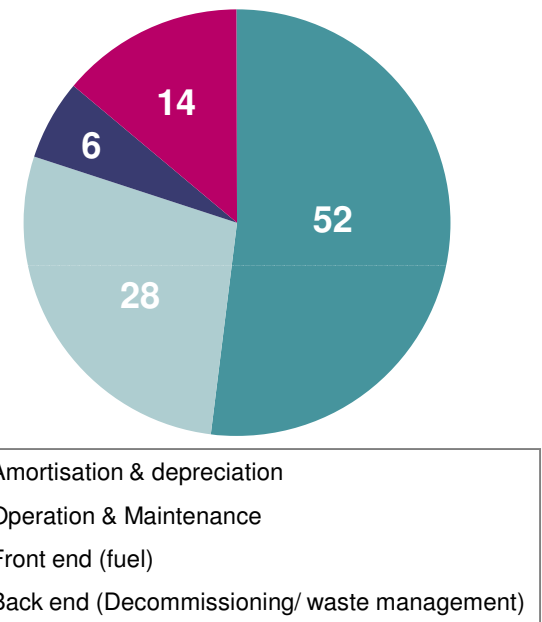


### Typical spend profile for a nuclear power plant (£m)



Source: Compiled from NIA published data

### Generating cost per MWh (% of total)



Source: Department for Business, Enterprise and Regulatory Reform White paper on nuclear power Jan 2008; AREVA

High up-front costs but lower operational costs\*\*

\* Approximate – for guideline only, using UK European Pressurised Reactor (EPR)

\*\* Compared to coal and fossil fuels

## Challenges

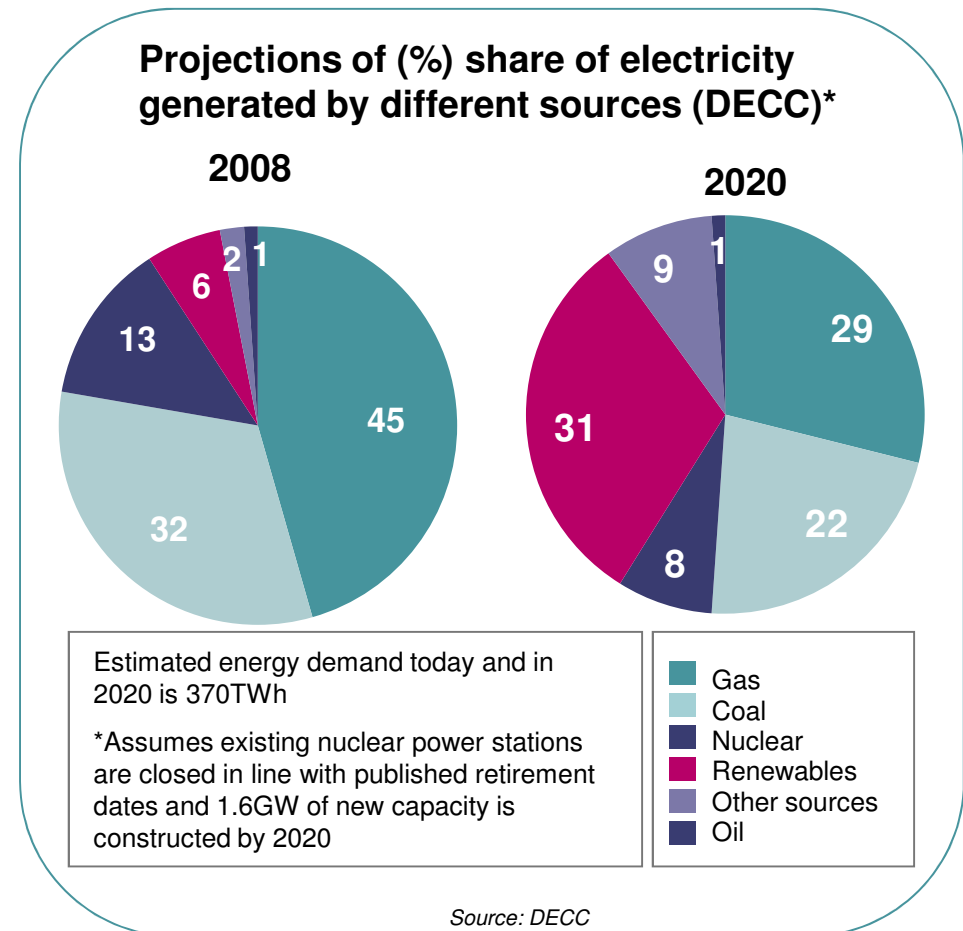
- Safety
- Waste management and disposal
- Public opinion
- Nuclear proliferation
- Resources and aging skill base
- Cost
- Process



Must be addressed to ensure nuclear renaissance

## UK – nuclear a key part of energy mix

- UK energy demand forecast to be 370TWh in 2020
  - Cutting emissions by 34% by 2020 requires shift in energy mix
- Nuclear will remain a key part of UK energy mix
  - 10 plants currently operational
  - Aging nuclear fleet: 8 will close by 2025
  - Life extensions opportunities limited
- New build: 6 planned, 2 operational by 2020



Nuclear will help to fill UK's 'energy gap'

- Building an environment that attracts nuclear investment
  - Regulatory framework
  - Processes to enable licensing and construction of reactors
  - Carbon pricing structure
  - Support skills development



Labour Party

*“Setting the framework and investing in research...”*



Conservative Party

*“Green light to nuclear power”*



Liberal Democrats

*“Yes to clean energy; no to nuclear”*

Hung parliament may cause delays

# UK - new build process



## UK - addressing the challenges



### Skills base

- Each nuclear plant needs approx 4,000 people to build
  - 700 people to operate and maintain
- UK has an aging engineering base - average age 50 years\*
- Bridging the skills gap will require collaboration
  - Government, industry, academia



### Waste (legacy and future)

- NDA spending £73bn to decommission legacy UK sites
  - Sellafield, Dounreay, Magnox
- Future waste management addressed as part of the new build planning process

Must address challenges to maintain government/public support

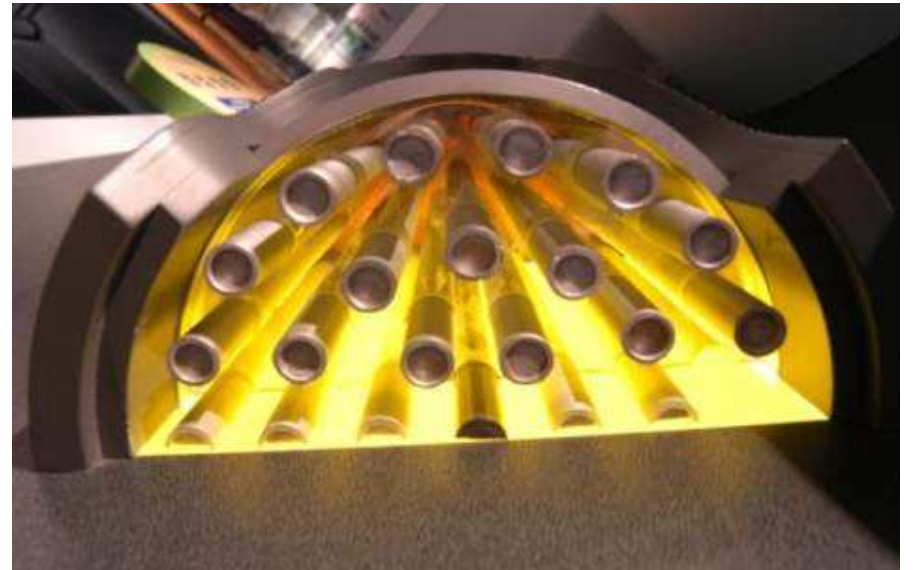
\*Source: Gibson Review

- Nuclear renaissance is under way
  - Long term opportunities – domestic and international
  - Risk associated with applying ‘first of a kind’ technology
  
- UK companies have strong capabilities in fundamental nuclear expertise
  - Supporting operating reactor systems, consultancy, design, engineering, project & programme management
  
- Export highly skilled project and construction management services

Global opportunities for UK companies

## Questions

29 April 2010



## **Nuclear: all talk, no action? Where is the real opportunity?**

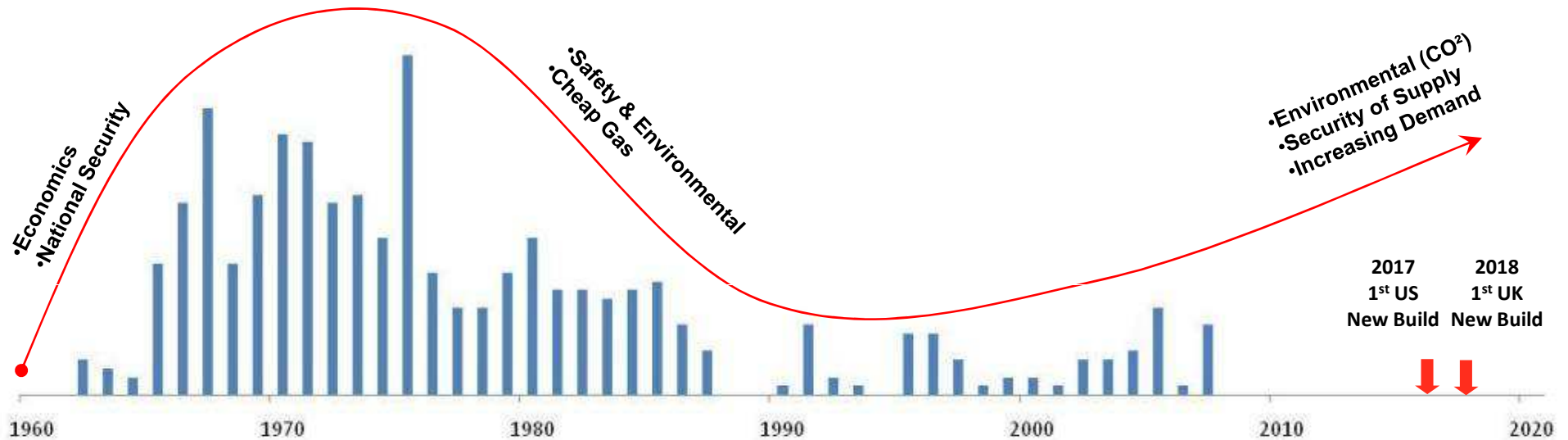
**Samir Brikho, Chief Executive, AMEC plc**

**Supplementary information**

# Market size and drivers nuclear renaissance



Commercial nuclear investment: number of reactors ordered (contract date)



435 operational reactors worldwide of which 42% are in excess of 25 yrs old

**Worldwide**  
 50+ under construction  
 99 reactors planned  
 232 reactors proposed

The nuclear industry is beginning a new and long-term cycle

Source: WNO Oct 2008 (World Wide)

# Opportunities reactor support



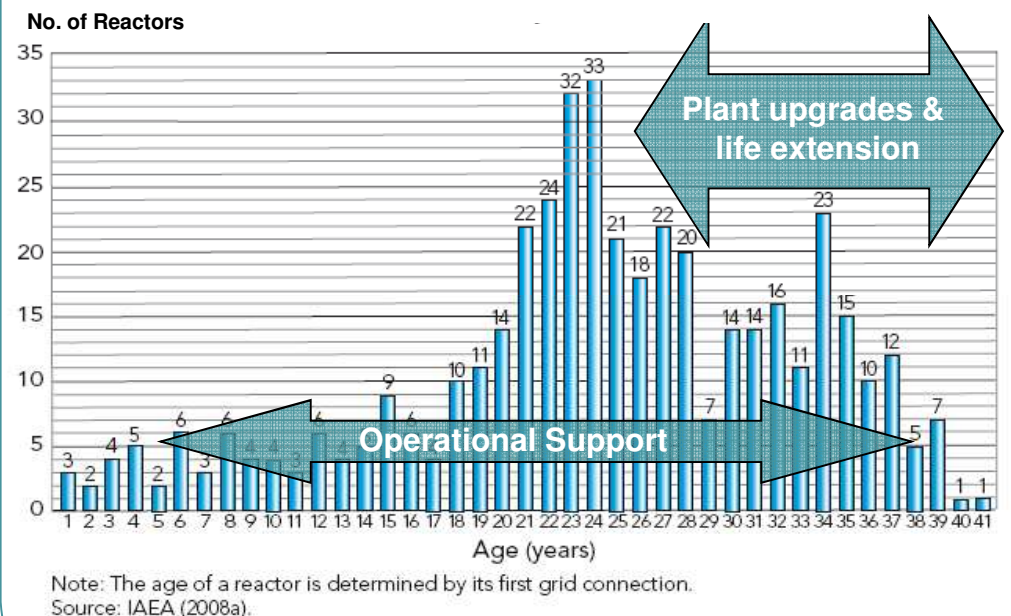
## Maintaining and extending existing fleet

- Significant number of reactors to be supported and extended

## Services

- Lifetime support
- Operational performance
- Reactor servicing

Number of operating reactor units by age (Jan 08)



More than 40 per cent of the fleet are more than 25 years old

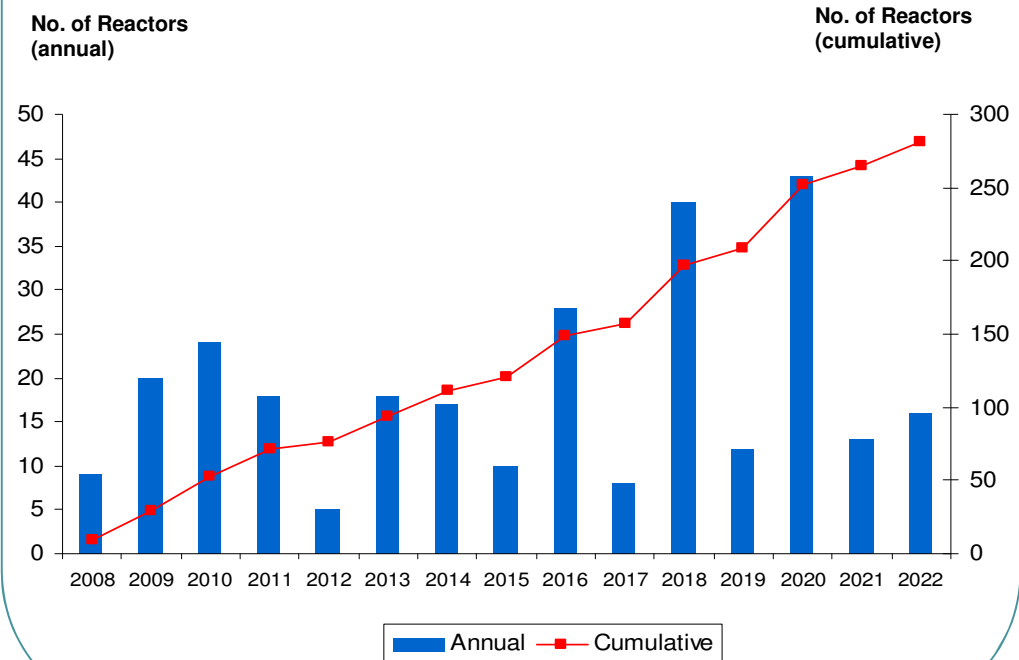
## Completing the life cycle

- Driven by regulatory requirements
- UK/US has the most developed clean up sector
  - UK: Sellafield / Dounreay / Magnox

## Services

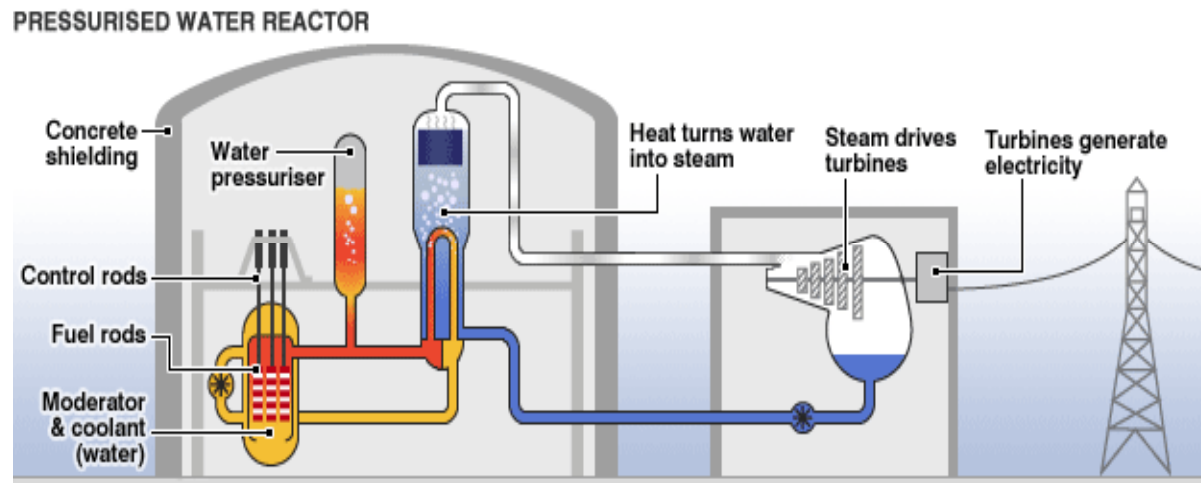
- Decommissioning
- Waste Management
- Environmental
- Radiological

### Anticipated reactor closure dates



Some 250 reactors are anticipated to close in the next 15 years

# How a nuclear power plant works








**NUCLEAR  
ISLAND**

**CONVENTIONAL  
ISLAND**

- Global technologies

- All current nuclear power plants are critical fission reactors
- Pressurised Water Reactor (PWR) is current modern design
- Several subtypes are classified at generation I, II, III, IV

Current reactor designs	
 Westinghouse	AP1000
 AREVA	EPR 1000
 AECL	ACR 1000
 GE Energy	ASBWR/ESBWR
 <b>MITSUBISHI</b> HEAVY INDUSTRIES, LTD.	ASBWR/ESBWR
Russia	VVER
Korea	KNP 1400

# Technology

**Diablo Canyon (PWR)**



- Nuclear fission reactors produce heat through a controlled nuclear chain reaction in a critical mass of fissile material
- There are several subtypes of critical fission reactors, classified as Generation I, Generation II and Generation III.

**Superphenix (FBR)**



**Ignalina (RBMK)**



**Igana Verde (BWR)**



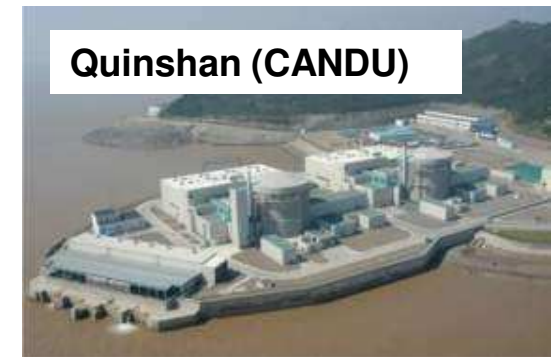
**Torness (AGR)**



**Sizewell A (Magnox)**

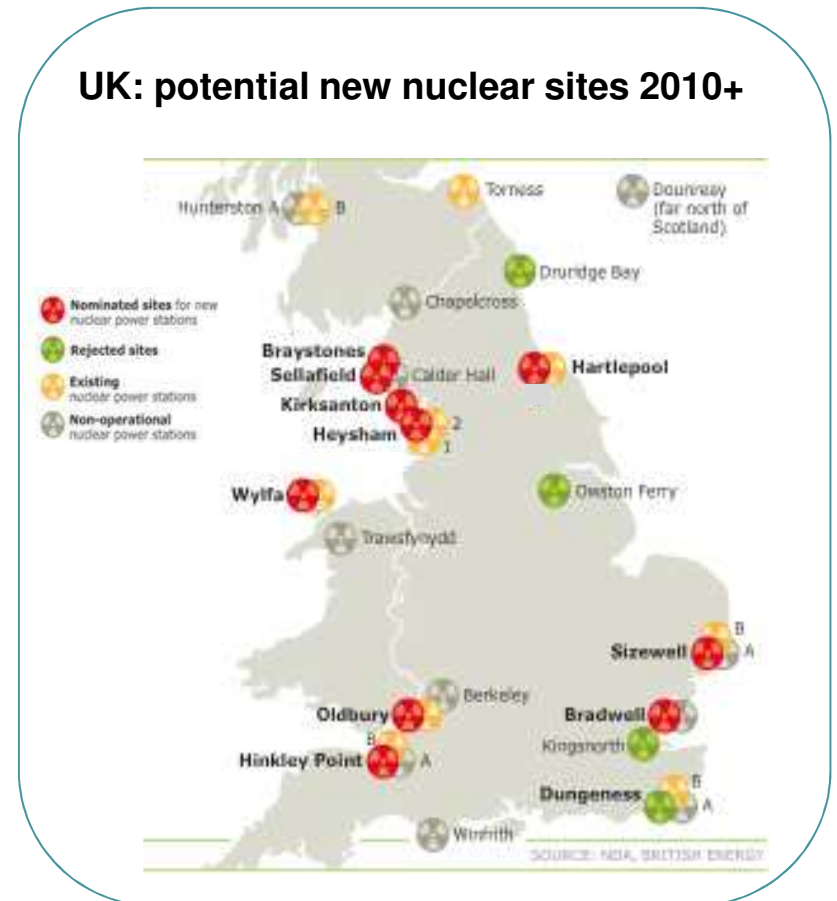


**Quinshan (CANDU)**



## UK: potential new nuclear sites

- Nuclear is a key part of UK energy mix
  - 10 operational (generate approx 20% of UK electricity)
- Aging nuclear fleet
  - Of the operational sites, 8 (AGR) reactors will close by 2025
  - 1 (PWR) will close by 2035
- New build: 6 planned, 2 operational by 2020



Nuclear energy required to fill UK's 'energy gap'

# UK supply chain (1 of 3)

✓	Capability
✓	AMEC capability
■	No UK capability



Item	Main components	UK Capability	UK capability supported by global	Global supply (no UK capability)
<b>Nuclear island</b>	<i>Nuclear Steam &amp; Fuel Handling Systems</i>	✓	✓	✓
	<i>Tanks</i>	✓		
	<i>Polar Crane</i>	✓		
	<i>Pumps (Safety Classified)</i>	✓		
	<i>Pipe-work, valves &amp; Heat Exchangers (Safety Classified)</i>	✓		
	<i>EC&amp;I</i>	■	✓	✓
	<i>HVAC</i>	✓		
<b>Balance of Plant</b>	<i>Turbine Generators</i>	■		✓
	<i>Tanks</i>	✓		
	<i>Cranes</i>	✓		
	<i>Pumps</i>	✓		
	<i>Pipe-work, valves &amp; Heat Exchangers</i>	✓		
	<i>Diesel Generators</i>	✓		
	<i>Transformers &amp; grid connections</i>	✓		
	<i>EC&amp;I</i>	■	✓	
	<i>HVAC</i>	✓		
	<i>Chemical treatment system</i>	✓		

## UK supply chain (cont 2 of 3)



<input type="checkbox"/>	Capability
<input checked="" type="checkbox"/>	AMEC capability
<input checked="" type="checkbox"/>	No UK capability

Item	Main components	UK Capability	UK capability supported by global	Global supply (no UK capability)
<b>Pre build</b>	<i>Planning &amp; licensing</i>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	<i>Legal &amp; financial services</i>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	<i>Nuclear consultancy services</i>	<input checked="" type="checkbox"/>		
	<i>Engineering &amp; design services</i>	<input checked="" type="checkbox"/>		
<b>Construction</b>	<i>Project management</i>	<input checked="" type="checkbox"/>		
	<i>Building &amp; construction</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	<i>Plant &amp; Equipment</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	<i>On-site erection / fabrication</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	<i>Nuclear Island</i>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	<i>Nuclear fuel supply</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<i>Commissioning – Nuclear island</i>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	<i>Commissioning BoP</i>	<input checked="" type="checkbox"/>		

# UK supply chain (cont 3 of 3)



<input type="checkbox"/>	Capability
<input checked="" type="checkbox"/>	AMEC capability
<input type="checkbox"/>	No UK capability

Item	Main components	UK Capability	UK capability supported by global	Global supply (no UK capability)
Operation	<i>Operations</i>	✓		✓
	<i>Nuclear fuel supply</i>		✓	✓
	<i>Engineering / technical services</i>	✓		
	<i>Waste management &amp; disposal</i>	✓		
Decommissioning	<i>Planning &amp; licensing</i>	✓	✓	
	<i>Decommissioning</i>	✓	✓	