

The UK Nuclear Sector



Cyrus Investment Management LLP

Sector Intelligence Report

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Sector Overview

Active Nuclear Reactors
16

% of UK Electricity Generation
20%

Direct Employment
25,000 people

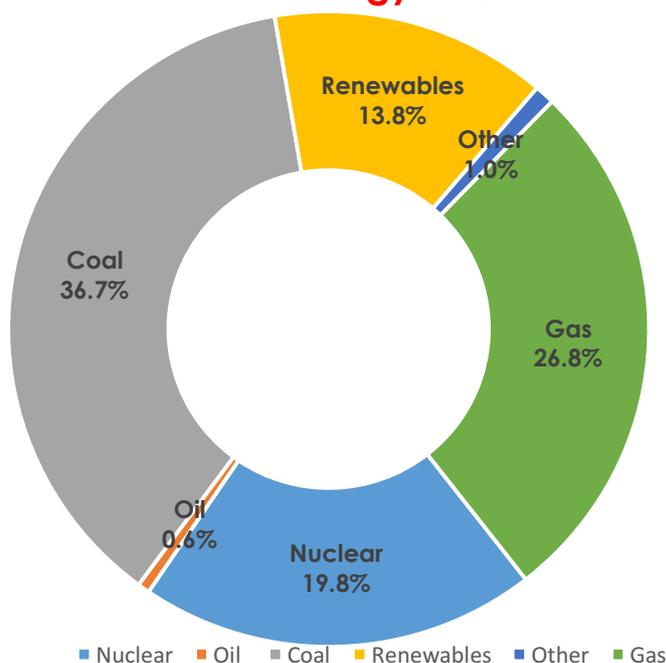
Supply Chain Employment
15,000

New Builds
5 sites worth 16GW

New Builds Completions
2025-2035

There are currently 15 active nuclear reactors across nine sites in the UK, which generates just under 20% of the country's total electricity. Most of these reactors are due for decommissioning by 2028, and will be replaced by extensive nuclear new builds. There are currently plans to build five reactors that will generate an estimated 16GW of energy, the first to be completed by 2025. These new builds will be key to help the UK reach its carbon emission goals as well as greatly improving its energy security – at the moment over half of the country's energy requirement is imported.

UK Energy Mix



Both the new constructions and the decommissioning process will generate many business opportunities for UK SMEs as well as stimulate production and employment in many low-income, low-employment areas. This report will examine these opportunities, positive benefits of having nuclear sector exposure, and Cyrus Investment Management's (CIM) positioning in the market.

The Nuclear New Builds

EDF Energy

Hinkley Point C

Capacity: ca. 3.2 GW.
Technology: European Pressurised Reactor (EPR) – Designed and developed by AREVA.
Strike Price: £92.50 per MWh
Lifespan: 60 years – Estimated to go online in 2023.
Employment: ca 25,000 employment opportunities during construction and 1,000 apprenticeships.
Construction Cost: ca. £18 billion.

Sizewell C

Capacity: ca. 3.2GW.
Technology: European Pressurised Reactor (EPR) – Designed and developed by AREVA.
Strike Price: £89.50 per MWh
Lifespan: 60 years – construction estimated to begin in 2018.
Employment: ca. 5,600 jobs during construction and ca. 900 permanent plant jobs.
Construction Cost: EDF has not yet released official estimates).

NuGen

NuGen is a JV between Toshiba and ENGIE.

Moorside

Capacity: ca. 3.4GW
Technology: AP1000 reactors designed and developed by Westinghouse.

Strike Price: -

Lifespan: 60 years – estimated to go online in 2024.

Employment: 14,000-21,000 jobs during construction.

Construction Cost: ca. £10 billion.

Horizon Nuclear Power

Horizon Nuclear Power is a wholly owned subsidiary of Hitachi Ltd.

Wylfa Newydd

Capacity: ca. 2.7GW
Technology: UK Advanced Boiling Water Reactor – Designed and developed by Hitachi-GE.
Strike Price:
Lifespan: 60 years - estimated to go online in mid 2020s.
Employment: ca. 6,800 jobs during construction.
Construction Cost: ca. £14 billion.

Oldbury

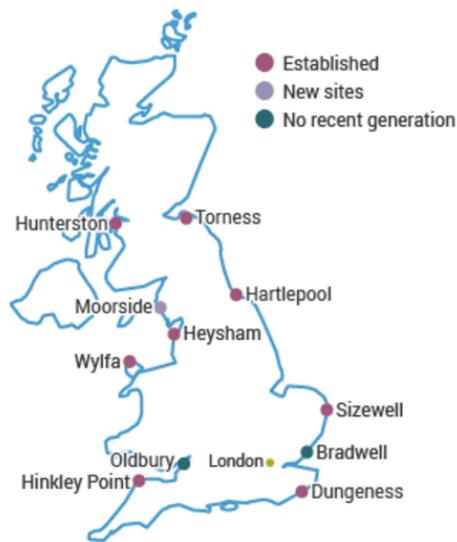
Capacity: ca. 2.7GW
Technology: UK Advanced Boiling Water Reactor – Designed and developed by Hitachi-GE.
Strike Price: -
Lifespan: Information not yet released.
Employment: ca. 800 plant workers and up to several thousand jobs during construction.
Construction of the Oldbury new build will not commence until the Wylfa Newydd has been completed.

UK Supply Chain Opportunities

The UK government has predicted that there will be a 60 GW energy demand by 2025, 35 GW generation is to come from renewables, to meet necessary EU emission targets, and 25 GW from nuclear power, although an official nuclear target has not yet been set. The initial goal for the nuclear new builds has been set at 16 GW output.

The UK has a strong supply chain capable of handling most of the needs of both the nuclear new builds as well as the decommissioning of old reactors. There are currently around 40,000 people working in the UK civil nuclear industry – ca. 25,000 in direct employment and ca. 15,000 employed indirectly through the nuclear supply chain. It is anticipated that the new builds and decommissioning over the next 10-20 years will drastically increase the demand for workers to around 66,500 at the peak of the new build period. Long term this number will decrease to ca. 47,000, based on the 16GW programme. However, this number is likely to be higher if the new build programme exceeds the initial target.

Nuclear Power Plants in United Kingdom



Source: World Nuclear Association

The UK supply chain is well equipped in providing services including civil engineering, construction, manufacturing, project management, and security. The manufacturing sector will supply the new builds with products such as: pumps and valves, pipework, vessels, tanks, heat exchangers, HVAC, radwaste plants, control, instrumentation and electrical equipment, and forgings. Many of these mission critical components will come from UK's precision engineering firms. The primary nuclear industry operators will be awarded contracts to construct and supply the necessary components for the new builds. These will then be supported by a variety of supply chain companies, including precision engineers, construction contractors, fabricators of specialist equipment and manufacturers. Current estimations are that ca. 50% of the plant and equipment required for a new site will be outsourced to local engineers, and with likely investments from many UK firms to upscale facilities and broaden their skills, this capacity could increase towards 70%.

Many UK construction, manufacturing, and engineering firms are already global market leaders in key areas necessary for the new builds:

- High quality forgings
- Precision material components and assemblies, including valves and pumps
- Plant instrumentation and control for reactors
- Accumulators, tanks and heat removal systems
- Fuel transfer tubes and key interlock systems
- Validation of advanced NDT, inspection and materials
- Waste measurement instrumentation
- Radioactive waste management systems
- HVAC systems.

There are a small number of products which the UK currently do not have the capability to manufacture, including: pressure vessels, main turbo-generators, steam generators, reactor coolant pumps, associated ultra-large forgings, and large diesel engines. Only a few companies in the world have the capability to produce these products to the standard required by the nuclear industry. These products are also highly cost and time demanding, hence there are only a few companies in the UK that have the ability to develop the capability of manufacturing these products.

It is likely that nuclear system providers will utilise their own specialist engineering teams for installation of safety-critical components within the nuclear island, however the manufacturing of many of the other mission critical components are to be outsourced to local UK engineering firms, in particular contractors with extensive experience in sectors such as oil & gas, or safety critical engineering sectors such as aerospace.

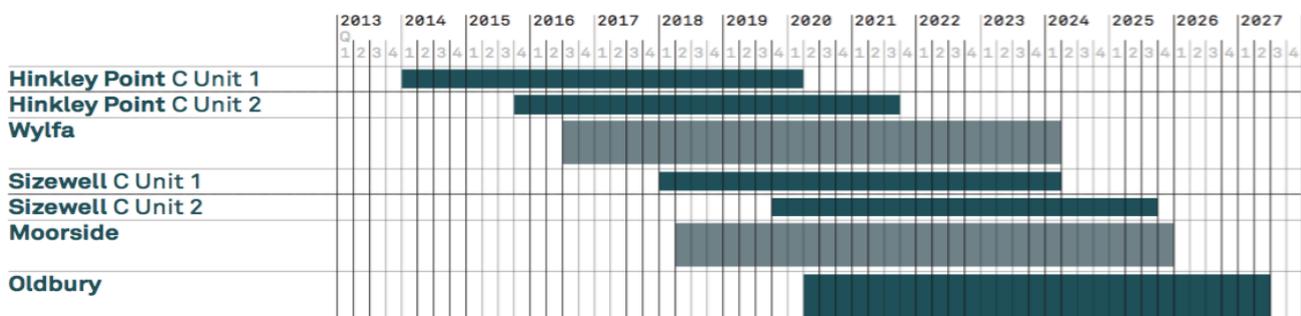


Figure shows the estimated timeline of the UK nuclear newbuilds.
 Source: NIA – *The Essential Guide to the Nuclear New Build Supply Chain* –
 2013 – 2014 – 2015

The new builds will generate a tremendous increase in the demand for materials, most of which can be sourced locally within the UK. An estimated 50,000 tonnes of structural steel will be required for each new site, as well as ca. 60,000 tonnes of steel reinforcement bar. This will greatly benefit UK's largest steel producer, Tata Steel, who has a manufacturing capacity of ca. 1.2 million tonnes per annum. Other large steel companies are also likely to benefit include Alpha Steel in Newport, and Celsa Steel in Cardiff. The demand for ferritic steel forgings as well as other weld metals for corrosion resistance will be high throughout the building period.

Nuclear Decommissioning

In addition to the nuclear new builds, the decommissioning of old nuclear sites is likely to be an excellent growth opportunity for several of CIM's portfolio companies. Precision engineering companies will play an important role in the decommissioning process through the supply of precision parts, instruments and overhaul required in the process. UK precision engineering firms have a unique knowledge in providing high precision renovations necessary in taking care of machining components and other metal parts.

The National Audit Office produced a report in 2012 estimating the total costs of decommissioning at ca. £100 billion. According to the Nuclear Industry Association (NIA) this will generate ca. £1.5 billion per annum to the supply chain. The planned expenditure for the 2015-16 period amounts to ca. £3.31 billion. The decommissioning is under the control of the Nuclear Decommissioning Authority (NDA) which was founded in 2005 to to develop an understanding and strategy on how to shut down and take care of the 17 civil nuclear plants in operation at the time.

“The UK's civil nuclear legacy is the largest, most important environmental restoration programme in Europe and tackling this legacy is a national priority” – Baroness Verma, Former Parliamentary Under secretary of State for Energy & Climate Change.

In the past the nuclear waste products have been taken care of by Sellafield, which has been in operation since the 1940s, operating over 1,000 facilities, including reprocessing, radioactive waste management, and storage. Cleaning up Sellafield and its storage sites is a key aspect of the overall nuclear decommissioning process. So far, 100 tonnes of contaminated metal has been retrieved from Sellafield's 60-year-old pile fuel storage pond. The annual Sellafield supply chain is currently worth around £900 million, of which ca. 20% is spent with SMEs. In 2014, the Cavendish Fluor Partnership, successfully bid to take over the decommissioning of all 12 Magnox Reactor and Research Sites Restoration Ltd sites. Magnox was a reactor designed in the UK and in operation for over 50 years. The first opened in Calder Hal in 1956, and a further ten Magnox sites were constructed after that. All Magnox sites are due to be decommissioned and placed in 'Care and Maintenance', so far eight of of eleven has been defueled and 99% of the radioactive waste has been removed from these sites.

Plant	Type	Present Capacity (MW)	Expected Shutdown
Dungeness B 1&2	AGR	2 x 520	2028
Hartlepool 1&2	AGR	595, 585	2024
Heysham I 1&2	AGR	580, 575	2024
Heysham II 1&2	AGR	2 x 610	2030
Hinkley Point B 1&2	AGR	475, 470	2023
Hunterston B 1&2	AGR	475, 485	2023
Torness 1&2	PWR	590, 595	2030
Sizewell B		1198	2035
Total 15 Units		8883 MW	

CIM's Nuclear Exposure

CIM has in the past year invested in businesses that have ideal capabilities and exposures to greatly benefit from the increased investments in the UK nuclear sector.

Rhino Doors (a CIM portfolio company) is one of the top three high security doors manufacturers in the UK. Rhino are also the most experienced UK provider of security doors to the nuclear sector and have completed projects at Hinkley Point, Sizewell, Haysham, and Wylfa, as well as numerous projects for Sellafield. They have a long history of making anti-terrorist, blast-proof doors and gates for both civil and military use, including for the Ministry of Defense. The 9/11 attacks in 2001 caused tightening of the security at all UK nuclear plants. With the persistent terror threat this will be a high priority at the new reactors as well. Rhino is accredited to the Ministry of Defense, hence has both the ability and capability to secure contracts for doors, barriers, gates and other physical security measures necessary at the nuclear new builds.

EDF's two nuclear new builds (as outlined previously) have indicated the following contracts to be awarded: Areva for the reactor systems, fuel, control, and instrumentation – worth £1.7 billion; Bouyges and Laing O'Rourke for civil engineering – worth in excess of £2 billion; Alstom will provide two steam turbines; and Rolls-Royce provide manufacturing services of components. Several of CIM's portfolio companies already have accredited, longstanding relationships with Rolls-Royce, and Laing O'Rourke providing them with servicing and high precision components.

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In 2015 CIM invested in City Engineering, a precision engineering firm that is qualified for the 'Fit For Nuclear' programme, implemented to assess companies suitable to participate in the supply chain for the upcoming nuclear expansion. City Engineering has already participated in several important projects with the 'UK Atomic Energy Authority', and is likely to continue benefiting from the new constructions through the supply of high precision parts, electronics, and overhaul required both for the new builds and the decommissioning process.

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