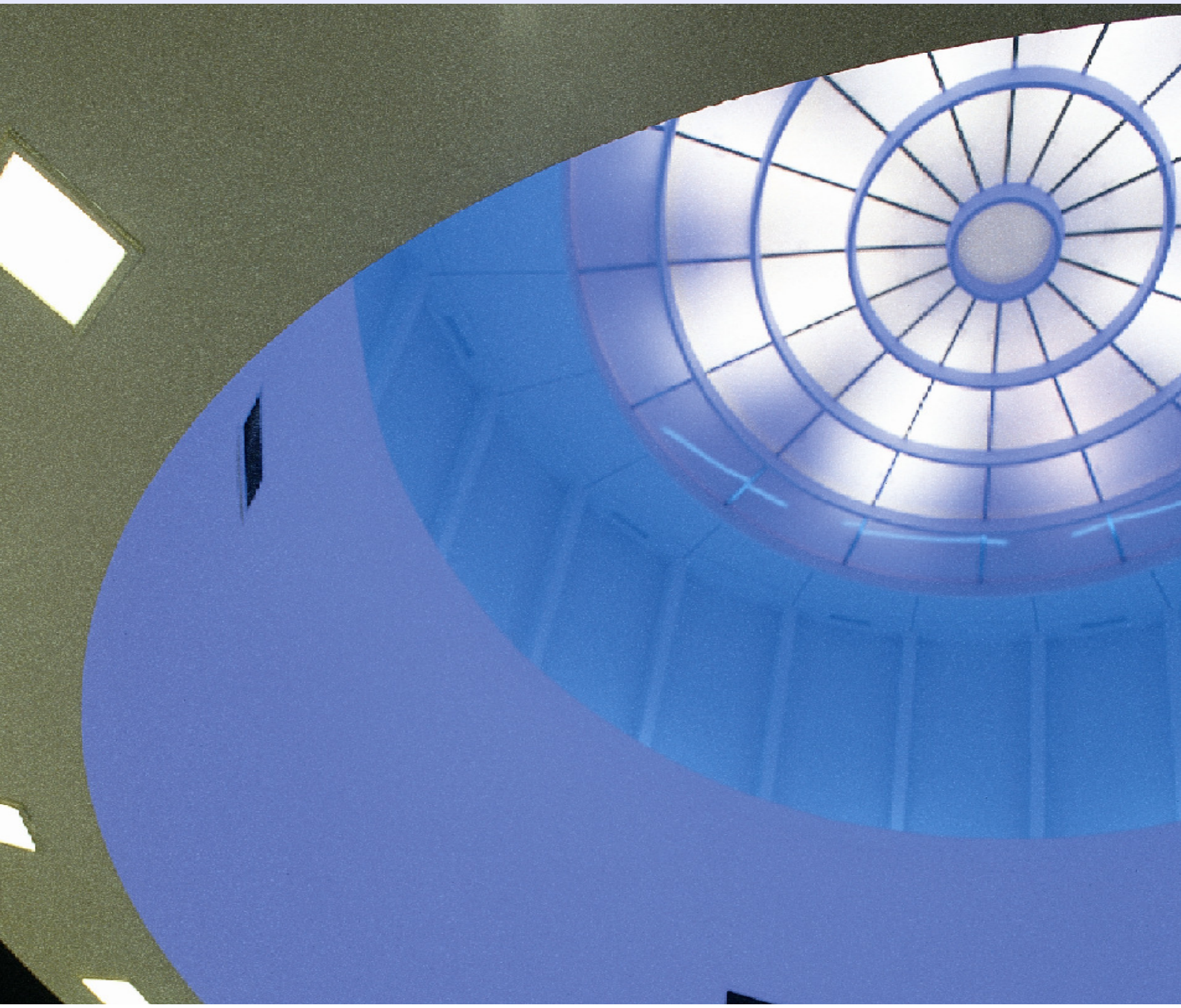
The South West Nuclear Workforce

A report by Cogent Sector Skills Council



September 2010

CONTENTS

Executive Summary and Recommendations

The Executive Summary details the labour market facts and the future skill projections.
Where a recommendation is provided the relevant text is emboldened.

1. The South West of England is an important region for skills in the Nuclear sector. It is also one of a few regions in the vanguard of early development of the new nuclear estate across England and Wales. The success of new nuclear in the South West will be a major determinant of its success across the UK.

2. The South West has the second largest proportion of employment in the civil Nuclear sector at 15%. The region is also one of the most important in the UK for nuclear Electricity Generation, currently hosting approximately 35% of UK employment in the sector, although both nuclear power stations in the region are due to transition to decommissioning within the decade.

3. The new nuclear programme in the South West will require 42,400 person years* of employment across the Manufacturing, Construction and Operation sectors. This is the number equivalent of a London Olympics project for the region, but with a greater demand for higher and specialist skills.

4. Nuclear provides approximately 70% of UK low carbon electricity. The nuclear estate hosted by the South West region delivers approximately 15% of nuclear generated electricity and will thereby contribute around 10% to low carbon electricity generated across the UK during 2010.

5. Current nuclear electricity generating capacity in the region is 1.6 GWe; sufficient to power 2m homes. By this measure, nuclear in the region is able to supply 2-3% of peak UK electricity demand. The South West is in the vanguard for new nuclear build and dependent on the type of reactors built in the region, around 6 GWe of nuclear generated electricity will be provided. The region would provide over 30% of the projected UK nuclear generating capacity by 2025.

6. The predicted nuclear electricity generating estate in the South West from two twin-unit power stations could produce the equivalent low carbon generating capacity of over 4,000 wind turbines; and up to 10,000 if generating efficiency is taken into account. (These estimates assume a UK average of 1.5 MWe per turbine). Furthermore, the nuclear generating estate of the region would provide a 60-year demand for high-tech employment in the region, together with significant extended and induced employment in the services sector.

7. At present there are in the region: two national nuclear operator headquarters (Magnox South and British Energy); two nuclear power stations (Oldbury and Hinkley Point B); and three sites undergoing decommissioning (two reactors at Berkeley, two reactors at Hinkley Point A, and an experimental reactor and research site at Winfrith).

8. The Nuclear industry today provides employment for approximately 6,200 people in the South West. The civil operators employ 3,600 in the Electricity Generation and Decommissioning sectors. The remainder are employed in the immediate supply chain to the industry, leading to a high ratio of direct to indirect employment. A further 800 are employed in the Defence sector at Abbey Wood and Devonport.

9. Overall, skill levels are high with 78% of employment being at technical and associated professional levels or higher.

* Construction projects accommodate many skilled workers, some for short periods only. In this manner the full-time equivalent (fte) in demand will convert to a multiple 'headcount'. Recent estimates place the upper limit of the employment 'coefficient' for nuclear projects at three times the fte figure. To allow the employment demand to be accurately represented in the absence of established build profiles, and to capture the variety of task lengths, overall employment demand is given in units of person years; so that, 4 person years work might be carried out by 1 person for 4 years, 2 people for 2 years or 4 people for 1 year.

10. The South West civil nuclear workforce is older than and retires earlier than the UK workforce generally. This is in line with all other regions that host civil nuclear employment. This profile acts most harshly on the higher skilled and more experienced parts of the workforce, where up to 65% of employees will retire by 2025.

11. By the end of 2010, electricity generation at Oldbury will transition to decommissioning. By 2016, Hinkley Point B will also transition to decommissioning. Accounting for this, and without further demand for new build, the South West faces a reduction of 45% in the workforce employed by 2025.

12. In November 2009, 10 sites were cited as potentially suitable in the government's draft National Policy Statement for new nuclear, including Oldbury - nominated by NDA and EON, and Hinkley Point - nominated by EDF Energy.

13. By 2018, the first of the projected new UK fleet of nuclear power stations will have been commissioned and will be generating the first new nuclear electricity from Hinkley Point. Each of the new power stations will provide employment for 800-1,000 personnel.

14. It is highly likely that employment demand from new build in the region will occur in two phases, due to the staggered development of the two potential sites. The first phase will raise demand for approximately 3,700 full-time equivalents (ftes); the second, approximately 4,500 ftes. The second phase adds to the demand of the first as it transitions in to operation. The demand is accumulated across the Construction (including Mechanical and Electrical) and Operation sectors. The distribution across these sectors is estimated to be 60% Construction, 25% Operations and 15% Manufacture.

15. The Construction and Operation sectors of new nuclear are likely to draw significantly from the regional labour pool. Engineering design of the reactor, however, is largely predetermined by the technologies of the global vendors. Local adoptions will, nevertheless, be required.

16. New nuclear demand in the Manufacturing supply chain is likely to be of the order of 500 ftes per reactor unit. In this sector, global capacity and capability for major nuclear items, such as reactor pressure vessels, will be a major determinant of where employment resides in this sector. **The regional body, local enterprise partnerships and similar organisations will wish to ensure that these opportunities are optimized for employers in the South West.**

17. A new build scenario of two twin-unit nuclear power stations in the region by 2025 will require 42,400 person years* of activity. This translates to 26,000 person years in construction and 10,000 person years in operations, the remainder being in manufacturing. This translates into a demand for approximately 700 apprentices and 150 graduates per year over the next 15 years. The operational element will be full-time and permanent employment for the 40-year initial operating licence with a further 20 years likely, thereafter as operating licence extensions of this order would be within the lifetime specifications of the new technologies.

18. Given the timescale of more than a decade for new build activity, the supply of skills for the long-term demand will come from young people (14-21 year olds) in education and/or training today. The Nuclear sector will demand large volumes of apprentices and graduates in science and engineering generally. **Since the UK and the region are already producing large numbers of relevant graduates, the emphasis will need to be on sector attractiveness in the region and working with employers, skills bodies and training providers to promote engagement in Apprenticeships and Higher Level Apprenticeships as well as workplace Foundation Degrees.**

19. Securing the skills for the first few reactors will be critical. In this context, labour market research and standard setting bodies for the industry, such as Cogent, and accreditation-of-training bodies, such as the National Skills Academy for Nuclear, are critical for workforce development in the region. When new nuclear burgeons, the complex construction projects will be vast 'campuses' of training to high standards for a safety critical sector. This will ensure the next generation of skills. **The regional body, sector and skills bodies, local enterprise partnerships and similar organisations should work to ensure workforce development in the region is realised.**

20. A peer reviewed Skills Risk Register has been recently published (Next Generation -Cogent, 2010).The Risk Register identifies the most at-risk skills required to achieve the first new reactor unit. At the time of writing, the most at-risk skills are in: Project Management, Safety case Authoring, High-integrity Welding, Design Engineering, Geotechnical Engineering, Manufacturing Engineering, Non-destructive Engineering, Control and Instrumentation, Planning and Estimating, Regulation. The Skills Risk Register should be evaluated, tested and developed as new build emerges in the South West. **The regional body, local enterprise partnerships and the Nuclear Energy Skills Alliance should ensure that the Skill Risk Register (Next Generation, Cogent 2010) is enhanced as new build is taken up first in the South West.**

21. In 2018, the regional demand for employees trained through apprentice and graduate routes peaks at approximately 7,600. This is mainly due to new build construction. However, it is stressed that this is the point at which the experienced personnel must be sourced; it is not the point at which the demand for skills should first trigger a response. **Individually, employers must assess the stock and flow of their workforces in order to achieve this demand for skills and experience in time to secure business. Jointly, the various employers with regional bodies, local enterprise partnerships and the sector bodies should** co-ordinate training suppliers and employers to produce business cases for training and subsequently promote their take up.

22. With a significant future in decommissioning, and as the likely first site for a new wave of nuclear power plants, the South West is an important region in which to test the cross-sector Nuclear Apprentice scheme as proposed in the Next Generation report. **The various regional bodies, local enterprise partnerships and skills bodies, should work together to ensure that relevant nuclear modules are included within Apprenticeship schemes.**

23. A small but critical supply of nuclear scientists and engineers will be required for operation, decommissioning and waste management. Taught masters provision currently exists within a number of HEIs (The Nuclear Technology Education Consortium). However, **recent changes to funding from the UK research councils will require close employer and HEI collaboration to ensure these courses continue to provide for the needs of UK nuclear community. The Sector Skills Council, together with the HEIs and regional body and local enterprise partnerships should ensure this is facilitated.**

1. Origin and Scope

This report provides an outline of the current and future skills of the nuclear workforce in the South West region of England. The report has been produced by Cogent Sector Skills Council for the South West Regional Development Agency and the Regional Employment and Skills Board.

The report extracts the regional workforce scenarios from the models developed and published recently in the peer reviewed Renaissance Series of Nuclear reports by Cogent, namely: *"Power People: the Civil Nuclear Workforce 2009 – 2025*" (Cogent, 2009) and "Next Generation: Skills for New Build Nuclear" (Cogent, 2010).

One of the main drivers for this regional analysis is the potential for a significant influx of skills in this sector, driven by the projected new build programme in the UK. The South West is a region of significance as it is one of a few in the vanguard of early development of the new nuclear estate. A nuclear renaissance will be a vital re-emerging growth sector, and will present a major opportunity for the county of Somerset and the wider region, for all businesses in the construction, engineering and other development oriented sectors.

Success in new nuclear in the South West will be a major determinant of success of new nuclear across the UK.

2. Background

In November 2009, 10 sites were identified as potentially suitable in the government's draft National Policy Statement for new nuclear. Two of these sites are in the region: Oldbury (nominated by the NDA and EON) and Hinkley Point (nominated by EDF Energy).

Their approval opens up potential for the private sector to deliver a new nuclear powered estate with capacity beyond current levels.

The full list of sites that are potentially hosts of new nuclear power stations are:

- Hartlepool nominated by EDF Energy
- Heysham nominated by EDF Energy
- Sellafield nominated by NDA
- Kirksanton nominated by RWE
- Braystones nominated by RWE
- Wylfa Peninsula nominated by NDA and RWE
- **Oldbury nominated by NDA and EON**
- **Hinkley Point nominated by EDF Energy**
- Bradwell nominated by NDA
- Sizewell nominated by EDF Energy

3. Secure, Low Carbon Electricity

For the UK to achieve a national commitment of an 80% reduction in green house gas emissions by 2050, electricity generation must be largely from low carbon energy sources.

As most of the current fleet of coal and nuclear power stations are due for replacement in the period leading up to 2030, there is an unprecedented opportunity for nuclear to make a major contribution to low carbon electricity generation.

Nuclear Power is a primary energy source that is carbon free and coupled to an industry that offers: security of supply; a technology that has advanced in safety management; a national skills capacity and capability that covers the full fuel cycle; and, a power output to match that of any fossil fuel plant on a station-for-station basis.

Today Nuclear is the prime provider of low carbon electricity - of the order of 70%; and the South West hosts an important part of this national estate. The nuclear estate in the region contributes around 10% of all low carbon electricity generated across the UK. However, all but one of the UK fleet of nuclear power stations is due to close over the next two decades - including all of those in the South West region.

4. Nuclear Heritage, South West

4.1 The Nuclear Estate

The South West has long hosted nuclear sites and has, accordingly, the matching infrastructure.
Currently there are:two national headquarters in the region (Magnox South and British Energy); two power stations (Oldbury and Hinkley Point B); four reactors in decommissioning (two at Berkeley, two at Hinkley Point A, and an experimental research site and reactor at Winfrith). (See Figure 4.1.1 and Table 4.1.1). There are also nuclear related defence sites in the region, MOD support HQ at Abbey Wood and the Naval Base and Royal Dockyard at Devonport from where submarines are operated, repaired and refuelled.

4.2 The Nuclear Workforce

The South West has the second largest population of the civil nuclear workforce (15%) and the largest in electricity generation (2,300 employed). The region and its skilled employees thereby contribute significantly to UK electricity generating capacity.

The nuclear industry today provides employment in the South West for approximately 6,200 people: approximately 800 are employed in Defence at Abbey Wood and Devonport; 3,600 are employed across both Electricity Generation and Decommissioning; the remainder is employed in the direct supply chain.

Figure 4.1.1 Nuclear in the South West

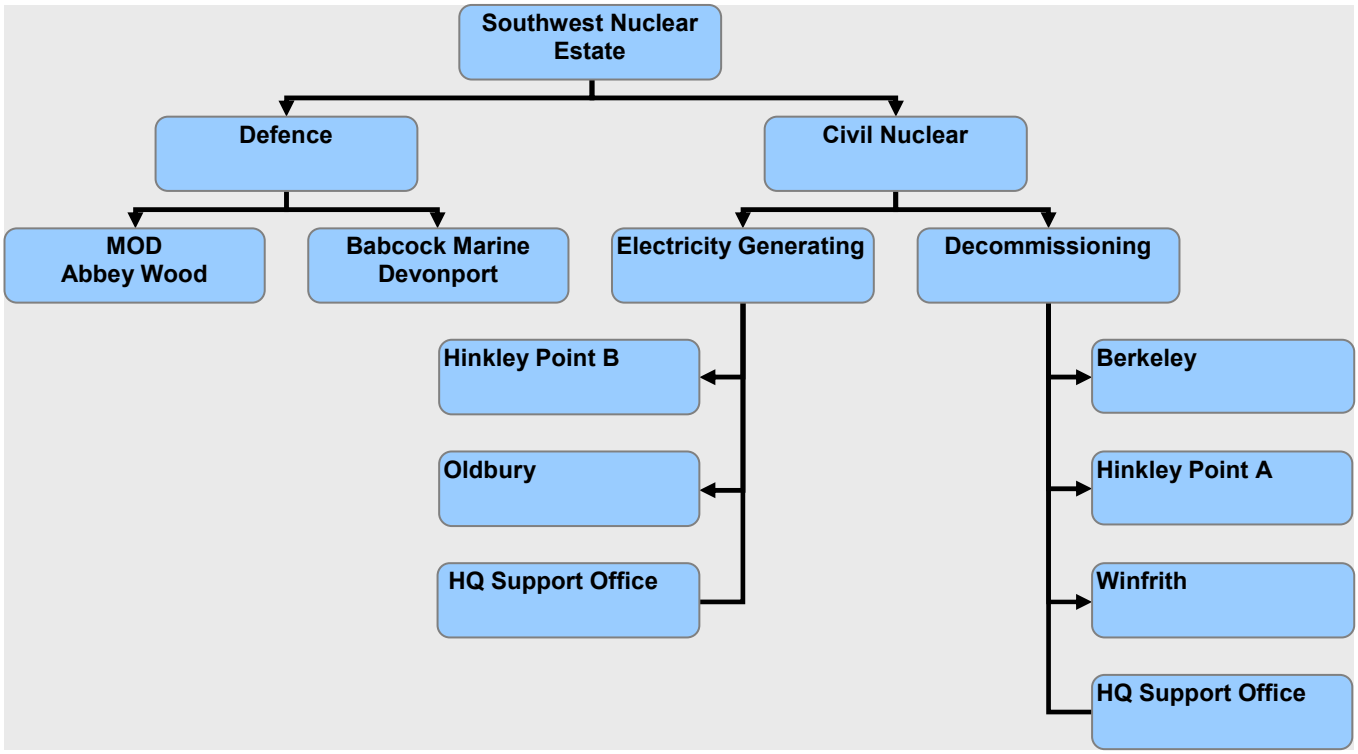


Table 4.1.2 The Current Civil Nuclear Estate, South West

		Winfrith	Berkeley	Hinkley Pt-A	Oldbury	Hinkley Pt-B
Operation	Start	1958	1962	1965	1968	1976
	End	1990	1989	2000	2010	Currently 2016
Defueling	Start	-	1989	2000	2010	2016
	End	-	1992	2004	2012	2018
Decommissioning	Start	2008	1992	2004	2012	2018
	End	2048	2083	2104	2118	2120
Reactor		Experimen-tal reactor research site	2 X 167 MW Magnox	2 X 221 MW Magnox	2 X 313 MW Magnox	2 X 660 MW AGR
Operator		NDA, RSRL*	NDA, Magnox South Ltd	NDA, Magnox South Ltd	NDA, Magnox North Ltd	British Energy part of EDF Energy
Location		Dorset	Gloucester-shire	Somerset	Gloucester-shire	Somerset

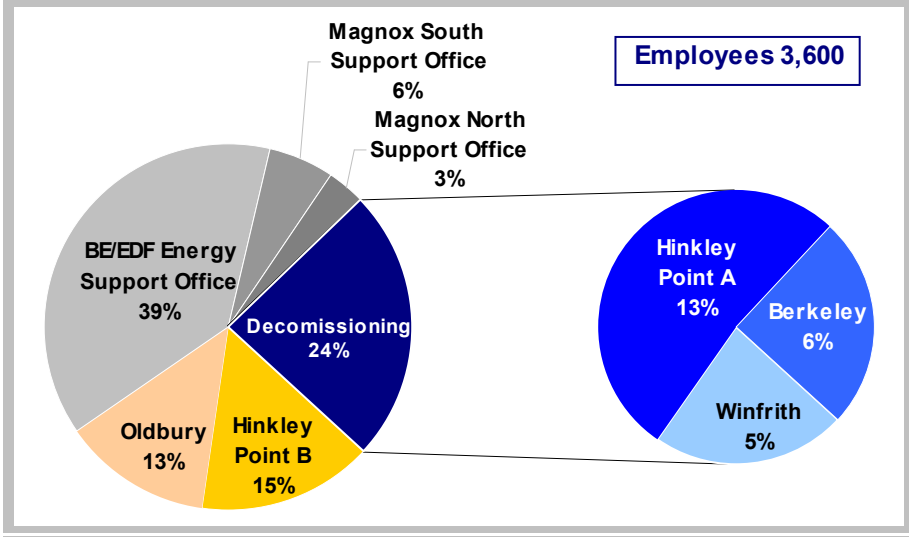
* Research Sites Restoration Ltd

5. The Civil Nuclear Workforce, South West

5.1 Employment Sectors

By far the major part of employment in the sector is in the Electricity Generation and Decommissioning sectors (Figure 5.1).

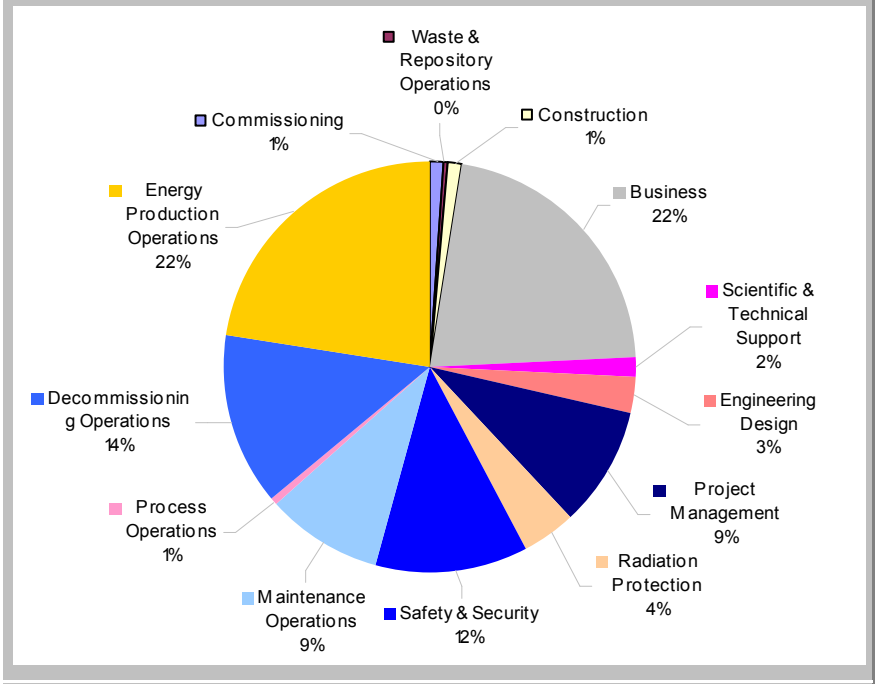
Figure 5.1 Civil Nuclear Workforce



5.2 Occupational Distribution

The four core nuclear 'job contexts' of Energy Production, Decommissioning, Processing and Maintenance make up 43% of the workforce with the remainder in supporting, service, and value-adding 'job contexts'. Examples are: Project Management, Engineering Design, Safety and Security, and Business (Figure 5.2).

Figure 5.2 Occupational Distribution

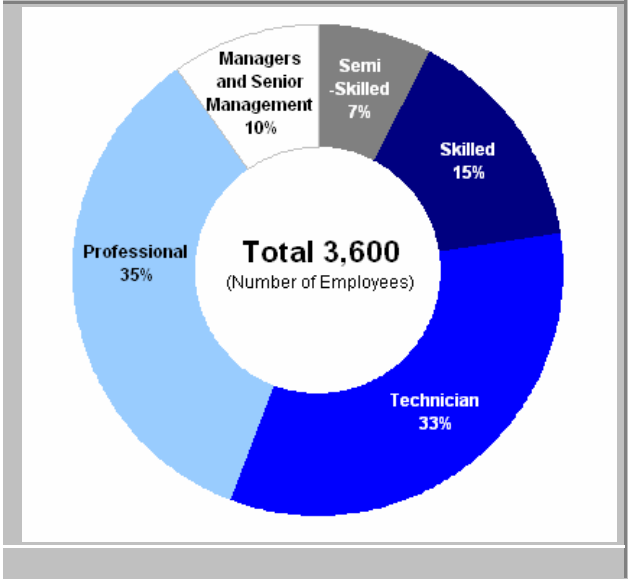


Includes Support office HQ workforce etc...

5.3 Skill Level

Skill levels are high, with 78% of employment being at technical/associated professional level (L3/L4), or higher in management and senior management levels (L4+) (Figure 5.3). Employment in this category is of the order of 3,600.

Figure 5.3 Skill Level Workforce



5.4 Age Profile

The civil nuclear workforce in the South West is ageing and retires early. (Figures 5.4.1 and 5.4.2). This is in line with the pattern for the UK nuclear workforce generally. Notable statistics are: (i) 57% of the workforce in the region is 45 and above; and, (ii) 65% of the highly skilled managers and professionals are over 45 years of age.

Figure 5.4.1 Age Profile

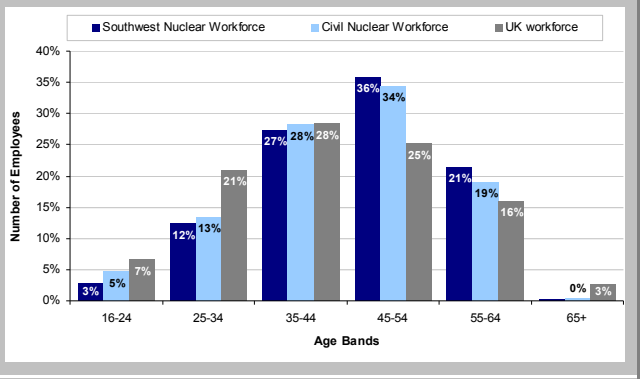
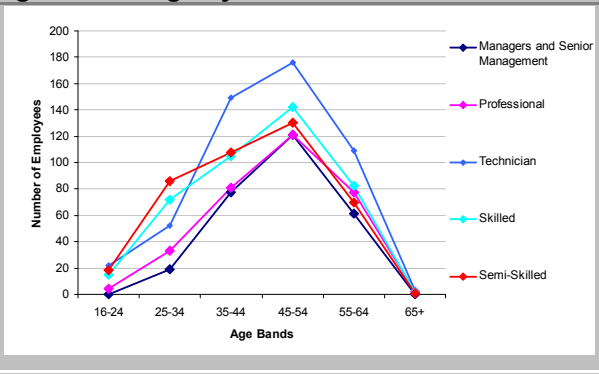


Figure 5.4.2 Age by Skill Level



5.5 Retirement Profile

The accumulated retirement profile of this workforce corresponds to an attrition of over half of the workforce by 2025. (Figure 5.5.1). As would be expected, the greatest reduction is from the higher and more mature skill levels and older workers, so that, at occupational levels 4 and 5 (Professional and Manager/Senior Manager), up to two-thirds of these skills pools will be eroded by 2025 (Figure 5.5.2).

Figure 5.5.1
Accumulated Retirement Profile

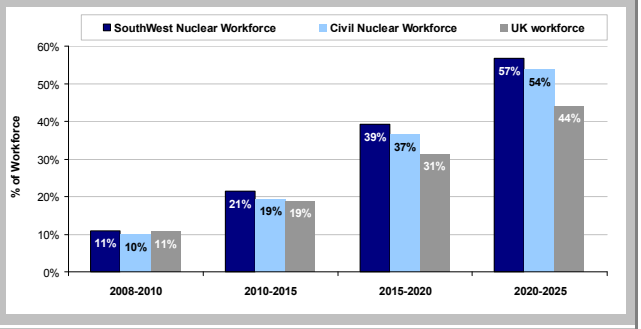
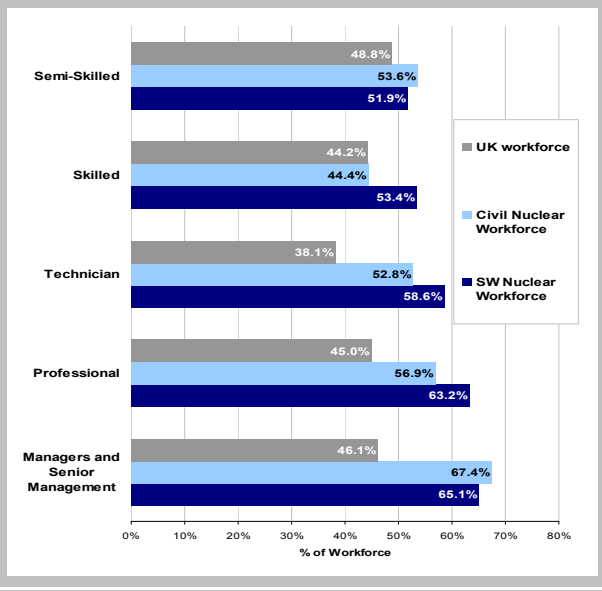


Figure 5.5.2
Retirement by Skill Level 2025

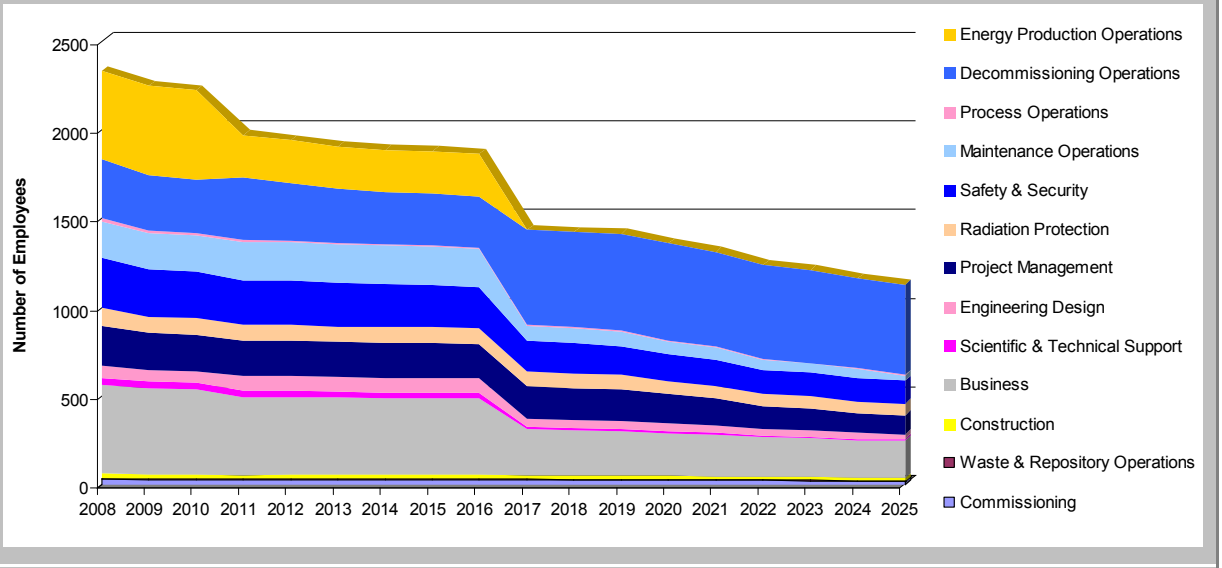


6. Workforce Demand without New Build

Forecasts of employment demand without new build are reliable and reflect the known lifetime plans of the existing estate in both the Electricity Generation and Decommissioning sectors. The scheduled transition to decommissioning of Oldbury in 2010 and Hinkley Point B in 2016 are the main determinants of attrition. As a result, the employment demand in Nuclear electricity generation will decline from 2,300 to 1,100 by 2025.

A significant proportion of this workforce will transition to decommissioning followed by managed decline in tandem with securing the safe remediation of the site. Figure 6.1 illustrates a general 45% decline in the civil nuclear workforce by 2025. This portrays the shift to decommissioning operations and the decline of most other 'job contexts'.

Figure 6.1 Civil Nuclear Workforce Demand
(without New Build)



Excludes HQ; includes nuclear licensed sites

7. Nuclear Electricity Generation: A South West Scenario

Figure 7.1 illustrates a scenario for nuclear electricity generation in the South West. This is based on the peer reviewed models developed in the Next Generation report (Cogent 2010).

A period of stable electricity generation is likely to end by 2016.

Nuclear electricity generation may start to build up again from 2018 and incrementally step up to 6.5 GWe by 2025 (40% of UK capacity in nuclear). In this picture there is a gap year of 2017 in which electricity generation would cease in the region. By comparison, the current Nuclear electricity generating capacity of the region is 1.655 GWe (Figure 7.1).

By 2018, the first of the projected new UK fleet of nuclear power stations will have been commissioned and will be generating the first new nuclear electricity from Hinkley Point.

As with all models, it is recognized that the future will not completely match that projected. Nevertheless, the scenario given is the best peer reviewed intelligence available to the sector at the time of writing.

The early part of the programme – at Hinkley Point – is the most assured of any new build programme in the UK, with planning and technology partnerships already well-established. By contrast, the latter part of the scenario – at Oldbury – is currently one of the least certain, and is likely to be dependent upon policy and the success of developments at Wylfa in North Wales.

The indicative timelines for these builds, as customized from the Next Generation report (Cogent 2010) are given in Figure 7.2.

The nuclear electricity generated in the South West from two twin-unit power stations, could produce the equivalent low carbon electricity of over 4,000 wind turbines; and up to 10,000 if generating efficiency is taken into account. (These estimates assume a UK average of 1.5 MWe per turbine). Furthermore, the nuclear generating estate of the region would provide a 60-year demand for high-tech employment in the region, together with significant extended and induced employment.

Figure 7.1 Nuclear Electricity Generation 2009-2025

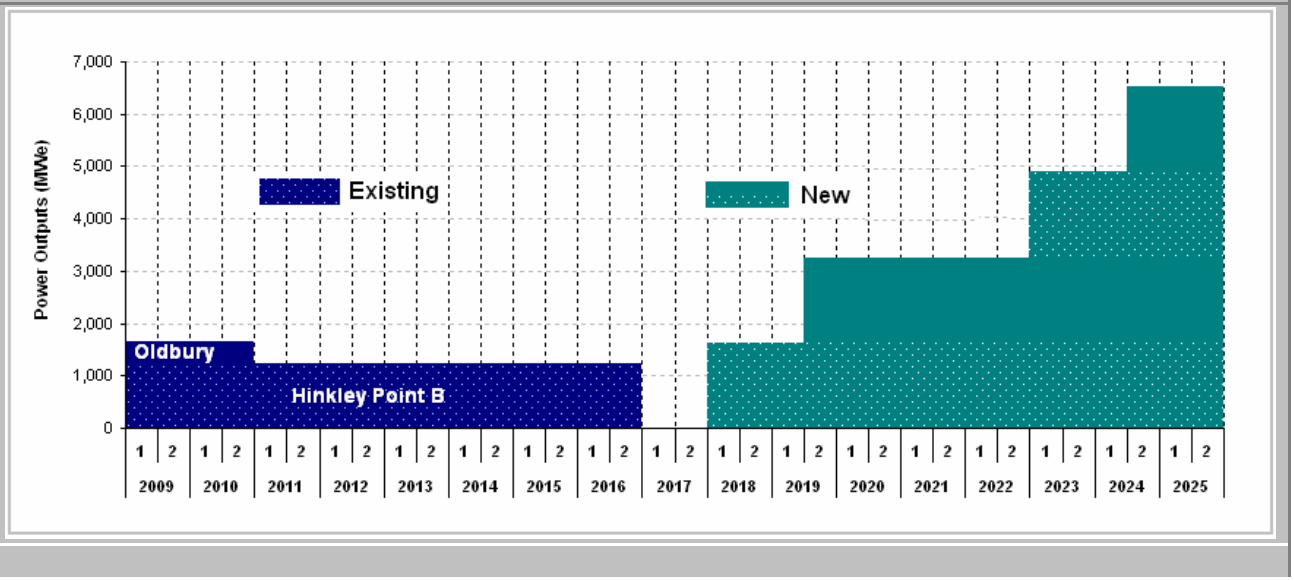
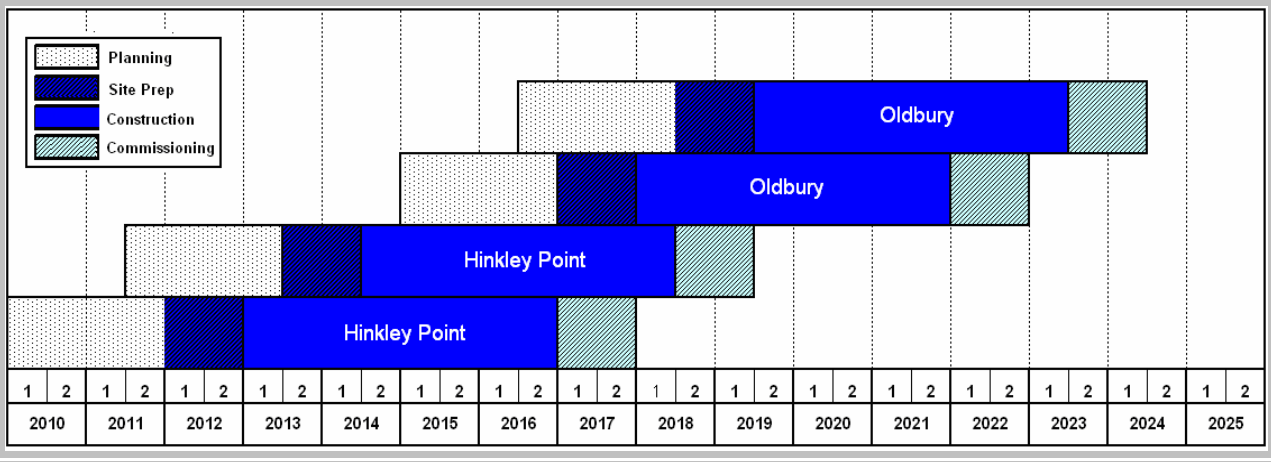


Figure 7.2 Nuclear Electricity Generation 2009-2025



8. Workforce Demand with New Build

An estimate of the workforce required to operate each new twin-unit station is of the order of 800 - 1,000. This is made up of 500 for the first reactor unit, efficiency savings of the order of 25% for the second, and associated HQ services.

Figure 8.1 illustrates the build up of the various sectors of the new build workforce for a single PWR reactor. Figure 8.2 integrates this across the timeline of Figure 7.2 to give an integrated demand for four new PWR reactors as twin-units in each of two stations. The same information is portrayed as separated demands for each sector in Figure 8.3.

The approximate employment distribution across sectors during the course of construction to commissioning and operation is 60% Construction. 25% Operations and 15% Manufacturing. The construction and operation of new nuclear is likely to draw significantly from the regional labour pool. Construction marks a sharp influx of a transient workforce.

Operations builds up gradually to full complement in time for hand-over into operation. (Figures 8.1 and 8.2).

It is highly likely that employment demand from new build in the region will occur in two phases, due to the staggered developments at the two potential sites (Hinkley Point and Oldbury). The first phase raises demand for approximately 3,700 full-time equivalents (fte); and the second approximately 4,600 fte. The second phase adds to the demand of the first as it transitions into operation. (Figures 8.2 and 8.3).

Although the employment demand is in units of fte for comparison with the largely full-time and permanent operations workforce, multiple 'headcounts' per fte are common in construction activities - construction projects accommodate many skilled contributions, some for short periods only. Recent estimates place the upper level of this employment 'coefficient' for nuclear projects at three times the fte figure.

Figure 8.1 Single PWR

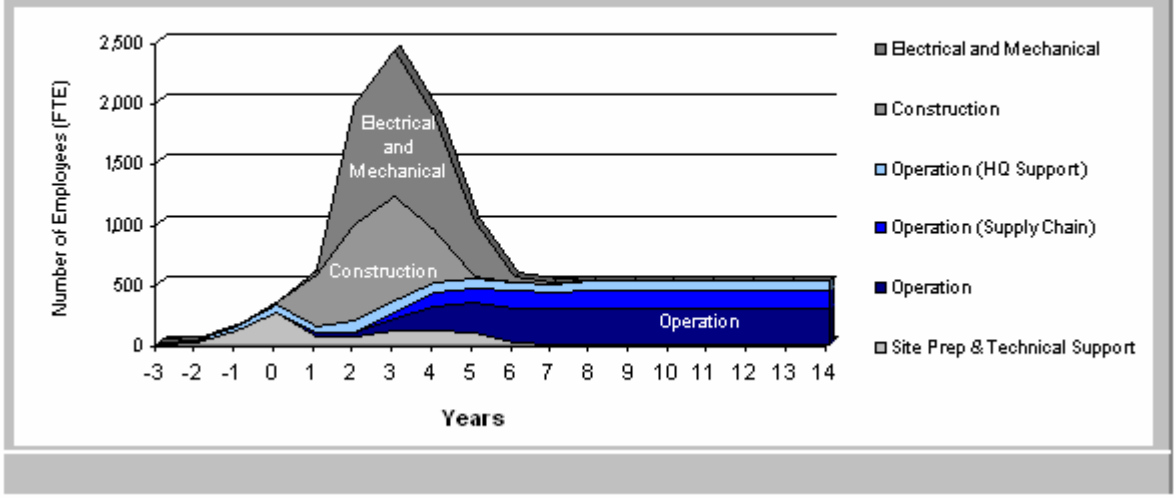
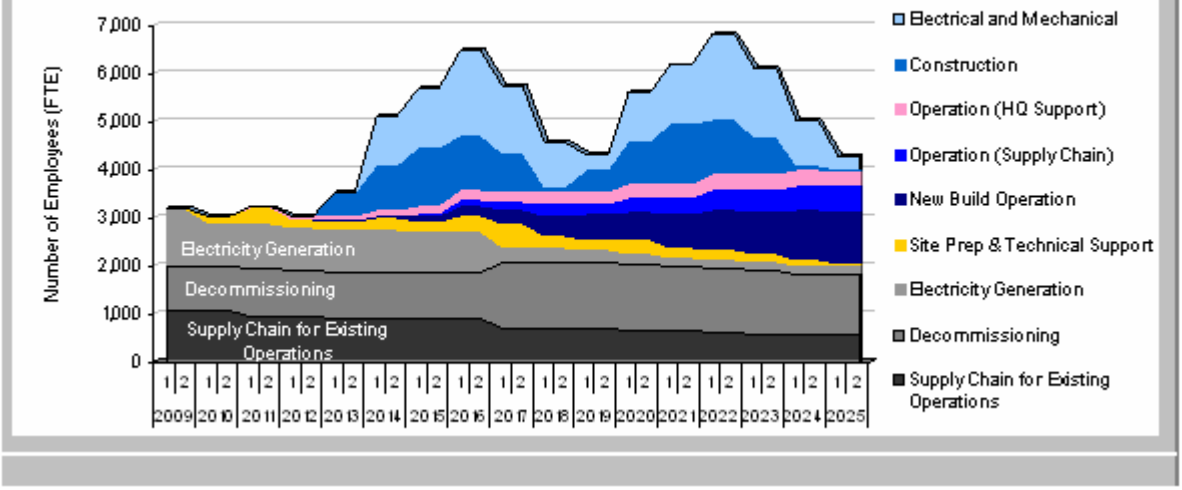


Figure 8.2 Civil Nuclear Workforce Demand- Integrated (Incl. supply chain)



The new build manufacturing workforce demand is not included in Figures 8.1-8.5. However, local engineering manufacturers have opportunity in the supply chain to support the tier-one nuclear manufacturers. Successful local manufacturers may have significant global opportunities with the nuclear vendor companies.

This is likely to be of the order of 500 fte per reactor unit. In this area, global capability (*e.g.* large forgings and reactor pressure vessels) will be a determinant of where employment resides. The most acute short-term demand will be in construction.

Both construction and operation are likely to draw significantly from the regional labour pool. However, the amount of locally sourced manufacture and construction will depend on the type of reactor chosen by the utilities. Only the EPR technology at Hinkley Point appears clear at present.

The profile of Figure 8.4 suggests that an active workforce transitioning programme, working between old and new, is necessary to make efficient use of existing skills and knowledge.

Figure 8.3 New Build 4 PWR, 6.5GWe Approximation Model

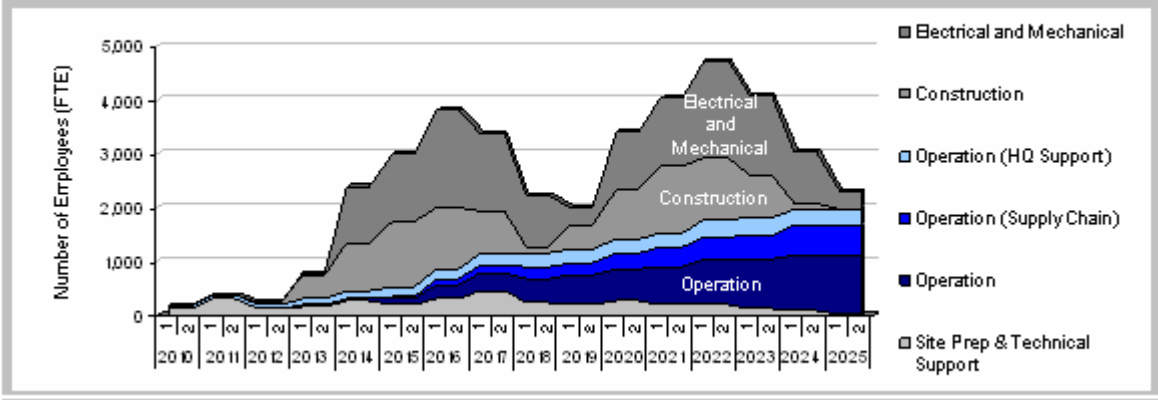


Figure 8.4 Demand- 4 PWR, 6.5GWe Approximation Model

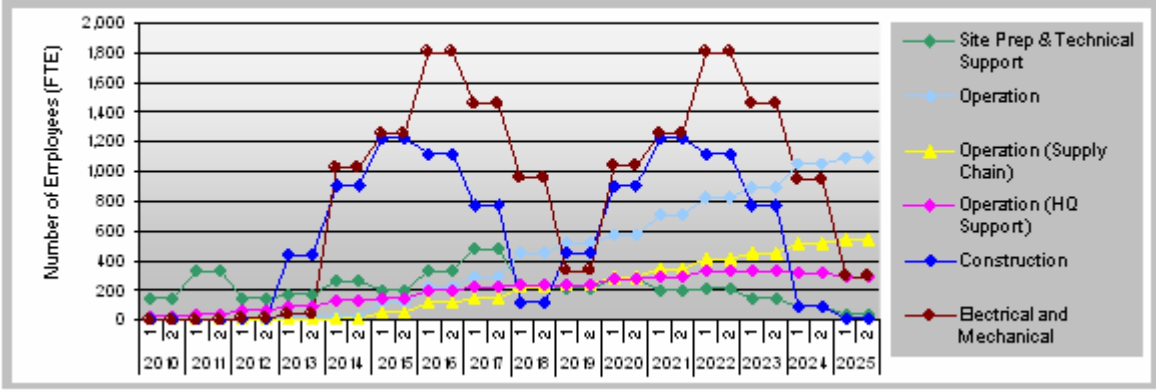
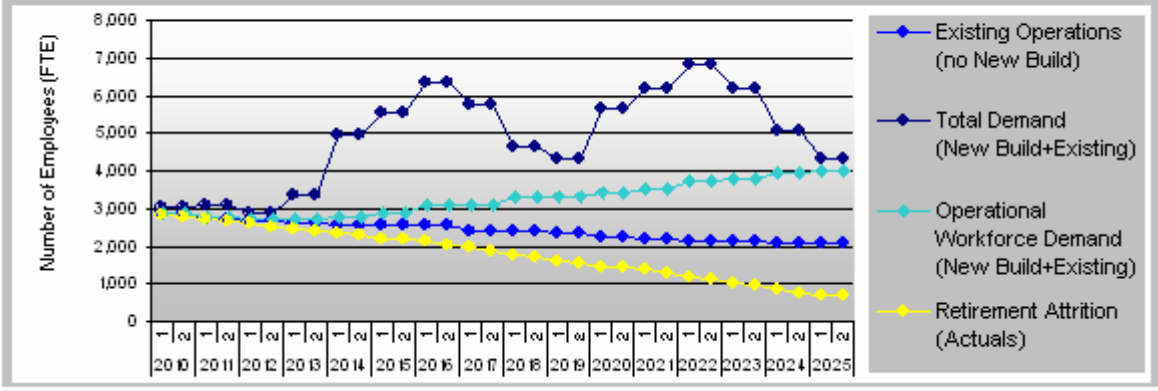


Figure 8.5 Integrated Workforce Demand (Including Supply Chain)



9. New Nuclear – South West Workforce Metrics

For new build alone, a total of 21,200 person years of employment is predicted for the region for each station. With two stations predicted, the resultant 42,400 person years of employment is equivalent to the London Olympics project in employment terms but with greater emphasis on the complexity and the higher skills needed to understand the technology. This demonstrates that projects of this scale are achievable in the UK. Nevertheless, pinch-points in skills will depend on nuclear activities elsewhere in the UK. Seven to eight reactors are projected to be in various stages of development around 2020 according to the Next Generation scenario (Cogent 2010).

Regardless of timeline, 42,400 person years will be the demand for the region for four reactors in two stations.

A shorter timeline will simply raise the peak demand and a longer timeline will correspondingly reduce the peak demand. For Construction and Operations sectors separately, this amounts to 26,000 and 10,000 person years respectively, during the period. The latter will largely be full-time and permanent employment for the 40-years of the initial operating license with a further 20 years likely thereafter, as operating licence extensions of this order would be within the specifications of the new technologies. As noted above, the construction workforce is, by nature, transient and the ftes will convert to multiple 'headcounts' of employment, typically three times the fte figure.

Table 9.1 summarises a number of metrics for a 3.2 GWe twin reactor station. Although demand is of the order of tens of thousands, for some occupations, capability rather than capacity may be the determinant. Table 9.2 represents an employer peer reviewed **Skills Risk Register** for the first new build reactor.

Table 9.1 New Nuclear – South West Workforce Metrics

Unit	Station (twin unit)	Construction (twin unit)	Manufacture (twin unit)	Operation (twin unit)
Person years %	21,200	13,000 61%	3,200 15%	5,000 24%
Timeframe of build	6 years	6 years	6 years	6 years[1]
Employment – pn yrs per GWe[2]	7,571	4,643	1,143	1,786
Employment - fte p.a. (aver.)[3]	3,533	2,167	533	833
Skill Levels		25% L2 60% L3 15% L4+	15-30% L2[4] 30-40% L3 20-40% L4+	10% L2[5] 40% L3 45% L4+
Workforce Split		37% Civil 47% Mechanical & Electrical 16% Management & Supervision	10% Civil 30% Major Nuclear 40% Balance of Nuclear island 20% Balance of Plant	60% Nuclear Operator 30% Supply Chain 10% Utility HQ etc

[1] Operations workforce employed during the build period. Thereafter 1000 fte pa for 60 years i.e. 60,000 person-years
[2] Based on a hypothetical EPR+AP1000 station
[3] 'Person Years' divided by 'Timeframe'
[4] L2 semiskilled, L3 technical/craft, L4 professional
[5] Based on nuclear operator data

Table 9.2 Critical Skills Risk Register[2]

Risk Register for a Single Reactor Unit	Skill Area or Competence	Estimated Number (peak demand)	Probability of current skill deficit High =3 Medium = 2 Low =1	Demand timescale4 Short = 3 Medium= 2 Long = 1	Risk of skill gap5	Priority rating High -7-9 Medium-4-6 Low -1-3
1. Design & Planning	Project and Programme Managers	25	3	3	9	High
	Safety Case Authors	50	3	3	9	High
	Design Engineers (various)[1]	140	3	3	9	High
	Geotechnical Engineers	not available	3	3	9	High
	Environmental Engineers	not available	3	2	6	Medium
	Regulators	not available	3	3	9	High
2. Equipment Manufacture	Design Engineers (various)[2]	50	3	3	9	High
	Manufacturing Engineers[1]	40	3	3	9	High
	Control & Instrumentation	50	3	3	9	High
	Welders (high integrity, materials)	40	3	3	9	High
	Cost Control	15	1	3	3	Low
	Non-Destructive Engineer[3]	20	3	2	6	Medium
3. Engineering Construction	Planners/Estimators	100	3	3	9	High
	Non-Destructive Engineers[3]	40	3	3	9	High
	Welders (40% high integrity)	200	3	2	6	Medium
	First-line Supervision	64	3	2	6	Medium
	Mechanicals[2]	1000	2	2	4	Medium
	Electricals[2]	200	2	3	6	Medium
	Control and Instrumentation	70	3	2	6	Medium
	Manufacturing Engineers[1]	not available	1	2	2	Low
	Scientists	not available	2	1	2	Low
4. Commissioning Operation Maintenance (note: all active from 2015, thus medium risk at most currently)	Energy Production Operations	150	1	2	2	Low
	Maintenance Operations	150	1	2	2	Low
	Safety & Security	100	1	2	2	Low
	Radiation Protection	20	2	2	4	Medium
	Project Management	30	3	2	6	Medium
	Engineering Design	30	3	2	6	Medium
	Scientific &Technical Support	25	2	2	4	Medium
	Commercial	150	1	1	1	Low
5. General Nuclear Culture and Experience of the Workforce	The basic requirements of working on nuclear sites in the UK	1,000	2	3	6	Medium
	The understanding and awareness of the nuclear industry	1,000	2	3	6	Medium
	The Project Management skills required to deliver effective projects	200	3	3	9	High
	The Quality Control/Quality Assurance skills and processes to maintain the highest standards of quality and safety across the sector	200	3	2	6	Medium
	Adequate and relevant Capability/ Experience of the sector	500	3	3	9	High

Notes

1. Production, Mechanical, Electrical, Chemical
2. Graduate, technical, craft
3. The risk assessment for Non-destructive engineers differs between Equipment Manufacture and Engineering Construction. This may reflect a margin of error, or a real difference in the respective employment environments. Further data refinement, particularly with regard to potential mobility between the sectors, will address this.
4. S = 1-3y, M = 4-5y, L = 6-9y
5. Product of probability of current skill deficit and demand timescale

10. Demand for Apprentices and Graduates

Given the timescale of more than a decade for new build activity, the supply of skills for the long-term demand will come from young people (14-21 year olds) in education and/or training today.

The Nuclear sector will demand large volumes of apprentices and graduates in science and engineering generally.

The graduate and apprentice demands have been approximated from the demand for each level of job in the various sectors. Tables 10.1-10.3 provide some guidance as to the demand for experienced personnel from these routes.

In 2018, the regional demand for employees trained through apprentice and graduate routes peaks at approximately 7,600 (Table 10.3). This is mainly due to new build construction. However, it is stressed that this is the point at which the experienced personnel must be sourced; it is not the point at which the demand for skills should first trigger a response.

Table 10.1
Demand for Apprentices

Nuclear Industry	Peak Demand	Average per year
New Build Operation	950	63
New Build Construction	2,700	180
Manufacturing*	1,050	70
Existing Operations (incl. supply chain)	720	360
Integrated Demand	**5,420**	**673**

Table 10.2
Demand for Graduates

Nuclear Industry	Peak Demand	Average per year
New Build Operation	850	57
New Build Construction	500	33
Manufacturing*	450	30
Existing Operations (incl. supply chain)	390	26
Integrated Demand	**2,190**	**146**

Table 10.3
Demand for Apprentices and Graduates

Nuclear Industry	Peak Demand	Average per year
New Build Operation	1,800	120
New Build Construction	3,200	213
Manufacturing*	1,500	100
Existing Operations (incl. supply chain)	1,110	386
Integrated Demand	**7,610**	**819**

*Most of the manufacture is unlikely to be in the Southwest region.

Securing the skills for the first few reactors will be critical. When new build burgeons, the complex construction projects will be vast 'campuses' of training for the next generation of skills.

To enable career transition and encourage new entrants into the industry, Cogent has ensured that all Nuclear Industry related Apprenticeships are included in industry career pathways. This includes the opportunity for up-skilling using units from the Qualifications and Credit Framework to enable existing employees to gain the skills required, ensuring a secure decommissioning process and successful new build programme. However such an approach requires flexible training provision from industry providers and Cogent will work with the National Skills Academy for Nuclear to identify most appropriate delivery methods.

11. Specialist Nuclear Education and Training

While much of the skilled supply from universities will sit across science and engineering, there will be a need for a number of specialisms for nuclear. Table 11.1 records the graduation subject areas of UK domiciled science and engineering students produced within the South West region and in the UK. With regard to specialism, four universities within the UK offer 11 undergraduate foundation degree courses with the term "nuclear" in the title. In addition, Gen II (in Cumbria) and Working Higher (a HEFCE initiative involving Cogent) will provide dedicated workforce development programmes.

The Bridgwater College in Somerset, the South West hub for the NSA-nuclear, is currently constructing a new Energy Skills Centre to be the centre of training for the nuclear industry covering the South of England.

For postgraduate provision, 13 universities offer 21 nuclear titled courses. In addition, many undergraduate engineering and physics degrees (BEng, MEng, BSc, MPhys, MSc) have nuclear options which contribute up to 30% of the final degree.

According to HESA 2008/2009, there are 180 physics students in postgraduate level, and another 1,124 students in undergraduate level studying physics in institution within the South West Region. In the case of demand for work-based learning, at foundation degree level the paucity of provision in the region will be addressed by the HEFCE Working Higher project under development with Cogent. This will deliver a work-based Foundation Degree for the Nuclear Industry with a South West college part of the likely franchised network. Qualifications linked to direct employment and training, rather than future supply direct from the education system, are in scarce supply across both the region and the UK.

Table 11.1 HE Science and Engineering Students 2008/2009 - Institutions in the South West region.

	Post graduate		Under graduate		Foundation degree	
	SW	UK	SW	UK	SW	UK
Chemistry	408	4,683	1,107	16,441	0	187
Physics	180	3,811	1,124	14,111	0	42
Geology	161	2,014	564	6,819	0	0
Physical geographical sciences	261	2,920	1,282	13,567	13	79
Mathematics	162	3,360	2,411	30,026	0	6
General engineering	313	5,717	1,077	11,327	20	206
Civil engineering	168	6,866	1,120	16,355	96	749
Mechanical engineering	242	4,337	1,294	17,577	99	750
Electronic & electrical engineering	481	8,063	1,189	18,229	50	821
Production & manufacturing engineering	2	2,111	197	3,375	20	121
Chemical, process & energy engineering	223	2,592	258	4,745	0	50
Total STEM	2,601	46,474	11,623	152,572	298	3,011

Source: HESA Students in HE Institutions 2008-2009

Table 11.2 Current National HE Provision for Nuclear

Undergraduate		
Institutions	**Degree**	**Course Title**
University of Brighton	FdEng/NucE	Nuclear Engineering
Lancaster University	MEng	Nuclear Engineering
University of Leeds	MEng (4yr FT)	Chemical and Nuclear Engineering
The University of Liverpool	BSc	Physics with Nuclear Science
The University of Manchester	BEng	Mechanical Engineering with Nuclear Engineering
University of Central Lancashire	FdSc	Nuclear Decommissioning
	FdEng/ENuc/HNC	Engineering (Nuclear)
	FdSc	Nuclear Project Management & Programme Control
	FdSc	Nuclear Related Technology - Science & Processes
	FdSc	Nuclear Related Technology - Commissioning & Maintenance
	FdSc	Nuclear Related Technology - Instrumentation & Control
	FdSc	HVAC Energy Engineering
	FdSc	Nuclear Project Leadership
University of Leeds	MEng	Chemical and Nuclear Engineering
Nottingham Trent University	BSc	Physics with Nuclear Technology
University of Surrey	BSc	Physics with Nuclear Astrophysics (3 or 4 years)
Imperial College, London	MEng	Mechanical and Nuclear Engineering
	MEng	Chemical and Nuclear Engineering
	MEng	Materials and Nuclear Engineering

Source: UCAS 2010

Postgraduate		
Institutions	**Degree**	**Course Title**
Nuclear Technology Education Consortium (NTEC)*	MSc	Nuclear Science & Technology
	PG Dip	Nuclear Science & Technology
	PG Cert	Nuclear Science & Technology
University of Birmingham	MSc	Physics & Technology of Nuclear Reactors
	MSc	Medical and Radiation Physics
	PGDip/ PGCert	Radioactive Waste Management and Decommissioning
University of Glasgow	Short course	Radiation Protection
Lancaster University	MSc	Safety Engineering
	MSc	Decommissioning and Environmental Clean-up
University of Central Lancashire	PGCert	Environmental Governance & Information
	PGCert	English for Nuclear Decommissioning
University of Liverpool	MSc	Radiometrics
University of Manchester	MSc	Nuclear and Radiation Physics
	MSc	Environmental Management & Technology (subject to approval)
	PhD	Nuclear Engineering Doctorate
University of Surrey	MSc	Radiation and Environmental Protection
	MSc	Radiation Detection & Instrumentation
Scottish Universities Environmental Research Centre (Previously Scottish Universities Research & Reactor Centre)		Postgraduate teaching in environmental geochemistry and radioactivity, isotope geology and isotopes in biomedical and ecological processes.
University of Strathclyde	CPD	Radiation Protection
University College London		Radiation Physics (Medical Applications)
Defence Academy Nuclear Department,		A range of nuclear related courses are available to MOD and civilian personnel
The Joint Department of Physics, The Royal Marsden NHS Trust & Institute of Cancer Research together with Department of Medical Engineering & Physics, King's College Hospital NHS Trust.		Radiation Protection Training Course

*The consortium is the Nuclear Technology Education Consortium (NTEC) comprises the Universities of Birmingham, Central Lancashire, Lancaster, Leeds, Liverpool, Manchester and Sheffield, City University, London, Defence Academy - College of Management and Technology, Imperial College London and UHI Millennium Institute.

Source: UCAS 2010

Table 11.4 Specialist research centres in the South West region

Institutions	
University of Bath	**Nuclear Energy Group—**the Nuclear Materials Group at the University of Bath core competencies are in nuclear materials, especially graphite. To provide a wider range of services the Group has been expanded to include expertise in decommissioning, mechanical design and energy systems analysis
University of Bristol	**Nuclear-Systems Performance** (Nuclear-SPC) is a Research Alliance between the University of Bristol and British Energy, and delivers strategic research and training to British Energy, the nuclear community and beyond
	Safety Systems Research Centre is a research centre established in 1995. It conducts research into the challenges of safe and reliable design, operation and maintenance of computer-based systems. The SSRC has a broad appreciation of safety issues across various industry sectors such as nuclear, naval and aviation industries.

The Cogent and the National Skills Academy for Nuclear are at the forefront in the development of standards and qualifications for the industry. This includes the Nuclear Skills Passport.

The Nuclear Skills Passport includes facility for new entrants from other sectors to top-up their original sector competencies with Nuclear awareness, behaviours and cultures. The Nuclear Skills Passport is already designated as 'desirable for Supply Chain Contracts' by the utility and vendor companies in the first wave of new nuclear.

Currently workforce qualifications and training that are under development include: a Certificate of Nuclear Professionalism, a Foundation Degree for the Nuclear industry, and standards and training modules that are accredited and recorded through the Nuclear Skills Passport.

According to current UCAS records, there are 12 HE and FE institutions offering various Engineering and Physics courses in the South West Region. In addition to specific taught courses, the region hosts a number of significant research centres that provide both nuclear relevant intellectual capital and niche training opportunities. Notable examples from the University of Bristol include the System Performance Centre (a research alliance with British Energy), which includes activities in Structural Integrity and Non-destructive Testing, Safety Systems, Earthquake Engineering and Geotechnics (Table 11.4). The university is also a partner in the consortia offering the Nuclear Engineering Doctorate degree, and operating the Keeping the Nuclear Options Open (KNOO) programme, established to maintain and develop skills relevant to power generation through nuclear fission. An Interface Analysis Centre includes research into nuclear waste disposal, nuclear waste remediation, uranium corrosion, environmental remediation and air sensitive metals analysis.

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