

# Britain's Energy Coast - Investment Strategy

NUCLEAR TOPIC PAPER

- Issue 1
- 22 December 2011



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## Glossary

Acronym	Description
<b>BEPPS</b>	Box Encapsulation Plant Product Store
<b>BOP</b>	Balance of Plant
<b>COL</b>	Combined License
<b>CREC</b>	Crystal River Energy Complex
<b>CSR</b>	Comprehensive Spending Review
<b>DECC</b>	Department for Energy and Climate Change
<b>DILWEP</b>	Decommissioning ILW Encapsulation Plant
<b>EA</b>	Environment Agency
<b>EPC</b>	Engineering, Construction and Procurement
<b>EPR</b>	European Pressurised-water Reactor
<b>FTE</b>	Full-Time Equivalent
<b>GDA</b>	Generic Design Assessment
<b>GDF</b>	Geological Disposal Facility
<b>GGBS</b>	Ground Granulated Blast furnace Slag
<b>GVA</b>	Gross Value Added
<b>HAST</b>	Highly Active Storage Tanks
<b>HAW</b>	Higher Activity Wastes
<b>HNP</b>	Horizon Nuclear Power
<b>HPC</b>	Hinkley Point C
<b>HVAC</b>	Heating, Ventilation and Air Conditioning
<b>ILW</b>	Intermediate Level Waste
<b>IPC</b>	Infrastructure Planning Commission
<b>LDF</b>	Local Development Framework
<b>LLW</b>	Low Level Waste
<b>LLWR</b>	Low Level Waste Repository
<b>LNP</b>	Levy Nuclear Plant
<b>MOX</b>	Mixed Oxide (fuel)
<b>MRF</b>	Metals Recycling Facility
<b>MRWS</b>	Management Radioactive Waste Safely
<b>NDA</b>	Nuclear Decommissioning Authority
<b>NDA RWMD</b>	Nuclear Decommissioning Authority, Radioactive Waste Management Directorate
<b>NIA</b>	Nuclear Industry Association



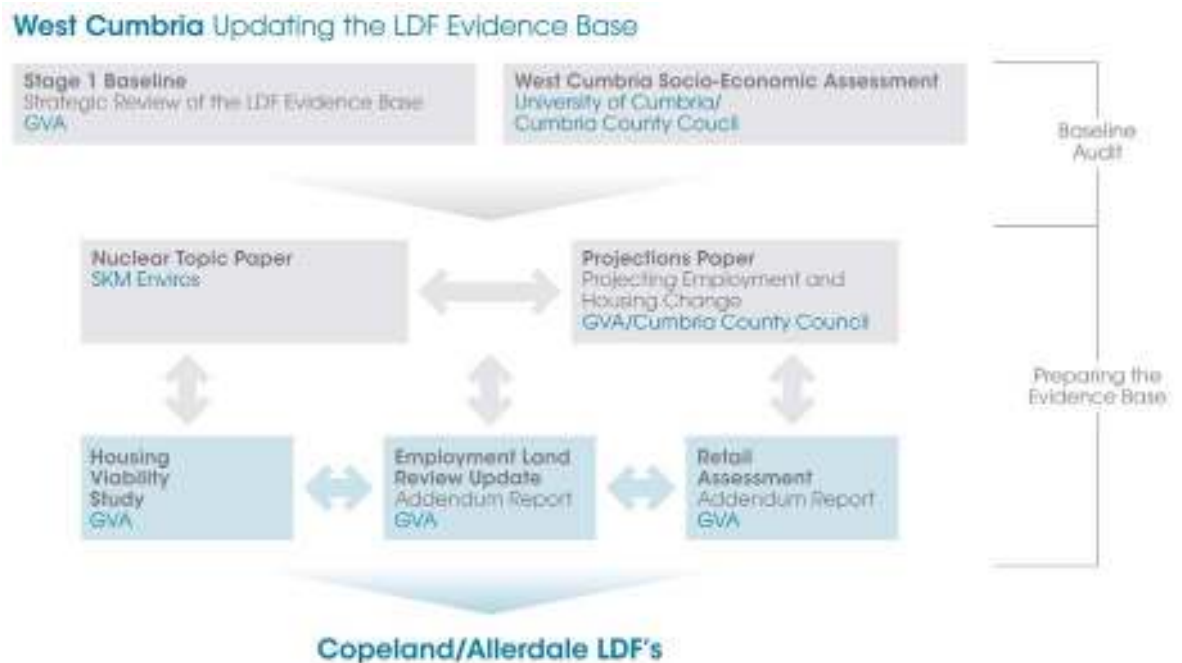


Acronym	Description
<b>NMP</b>	Nuclear Management Partners
<b>NNL</b>	National Nuclear Laboratory
<b>NPS</b>	National Policy Statement
<b>OJEU</b>	Official Journal of the European Union
<b>ONR</b>	Office for Nuclear Regulation
<b>PBO</b>	Parent Body Organisation
<b>PEF</b>	Progress Energy Florida
<b>SCE&amp;G</b>	South Carolina Electric and Gas
<b>SF</b>	Spent Fuel
<b>SLC</b>	Site License Company
<b>SMP</b>	Sellafield MOX Plant
<b>SSA</b>	Strategic Siting Assessment
<b>SSE</b>	Scottish and South Electric
<b>THORP</b>	Thermal Oxide Reprocessing Plant
<b>UKAEA</b>	United Kingdom Atomic Energy Authority
<b>UKNWM</b>	UK Nuclear Waste Management
<b>USACE</b>	United States Army Corps of Engineers
<b>US NRC</b>	United States Nuclear Regulatory Commission
<b>VCSNS</b>	Virgil C. Summer Nuclear Site

## 1. Introduction

GVA were appointed in December 2010 to undertake a programme of works to assist the West Cumbria Authorities to update their Local Development Framework (LDF) evidence base and produce a new Economic Blueprint and Spatial Plan to establish the future of the area, taking account of the potential for Nuclear New Build and other related investment.

SKM Enviros was commissioned to undertake the Nuclear Topic Report (this document) which represents one of a number of outputs associated with updating the LDF evidence base and informing the Economic Blueprint. These are set out in the following diagram.



- **Figure 1: Updating the LDF Evidence Base for West Cumbria and Evidencing the Economic Blueprint (Source: GVA, 2011)**

As the diagram illustrates this paper includes information which is then utilised in other evidence base reports. Primarily the paper focuses on the physical and non-physical implications of the nuclear sector from:

- Decommissioning activities; primarily from Sellafield Limited and its supply chain, but taking into account the activities of the Low Level Waste Repository (LLWR).
- New Nuclear Build activities anticipated by NuGeneration, with comparative information from other UK and European new nuclear reactor programmes.



## 2. Information Sources

It is recognised that this nuclear topic report will form part of the LDF Core Strategy evidence base and as such the clear referencing of information sources used to formulate the opinion stated within this report is of primary importance.

The key<sup>1</sup> information sources used to inform the report's dataset and opinion are:

- West Cumbria Spatial Master Plan (West Cumbria Partners, 2007)
- Sellafield Performance Plan (Sellafield Plan, 2011)
- Sellafield Workforce Profile (Sellafield Profiles, 2011)
- NuGeneration (meeting June 2011 with NuGen Property Developer)
- NIA Nuclear Jobs Profile, September 2011
- NNB GenCo Permit Applications, July 2011.
- Britain's Energy Coast Business Cluster, November 2011
- Nucleus, November 2011

These and additional information sources are fully referenced in Section 11, with clear in text referencing to enable the readers of this report to ascertain where information has been sourced.

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<sup>1</sup> In this instance, key information source relates to those documents that have provided multiple sources to opinion or fact-based evidence, or where changes to that information source substantially changes the opinion stated within the report.

### 3. Baseline Position

West Cumbria is located in the North West of England and comprises the Boroughs of Allerdale and Copeland, within the County of Cumbria. It has a population of 165,000 and is predominantly rural in nature, covering an area of 762 square miles. It has a dispersed settlement pattern of many coastal, small towns and villages, lacking critical business mass and appropriate modern infrastructure<sup>2</sup> [ERM, 2003].

#### 3.1. Nuclear Overview

Nuclear power production has been a part of the local economy in West Cumbria for over 60 years. It developed from a military programme at Sellafield which became part of the civil programme for nuclear energy in the 1940s and 1950s. Activities currently comprise Sellafield (including the Magnox reprocessing programme, the Thermal Oxide Reprocessing Plant (Thorp), the Sellafield Mixed Oxide plant (MOX), Windscale decommissioning, a range of waste treatment plants and redundant facilities associated with early defence work) and Low Level Waste Repository near Drigg. There is also the Studsvik Metals Recycling Facility treating low level waste and a number of other facilities and operations positioned to service the nuclear industry such as the Nuclear Decommissioning Authority and National Nuclear Laboratory.

Facility	Activities	Employees
<b>Sellafield, near Seascale</b>	Decommissioning	10,200 <sup>3</sup> (excl. Risley and Capenhurst)
	Removal of nuclear materials, plant and buildings. 55 buildings safely demolished and 108 decommissioning projects underway	
	Waste Management	
	Treatment, processing, storage and disposal of historic legacy materials as well as current waste arisings	
	Reprocessing	
	The Magnox plant deals with metal fuel from early nuclear reactors and Thorp deals with oxide fuels.	

<sup>2</sup> This relates to transport and communications infrastructure and is reflected in the lack of good road access, poor rail services, a lack of modern information technology infrastructure and distance from major external gateways such as major ports and airports.

<sup>3</sup> Source: Sellafield Ltd, 2011 / CCC 2011

Facility	Activities	Employees
	Fuel Manufacturing The MOX plant uses plutonium from used nuclear fuel reprocessing and recycles it into new MOX fuel.	
<b>LLWR, near Drigg</b>	Waste Management and Disposal Low Level waste is disposed of in engineered concrete vaults.	167
<b>Studsvik</b>	Metals recycling Volume reduction and stabilisation of waste prior to final disposal	20
<b>NNL</b>	Research and scientific support activities.	450 (Cumbria only)

■ **Table 1: Direct Employed FTEs in West Cumbria Nuclear Sector (excl. supply chain) in 2011 (NIA, 2011 and Sellafield Ltd, 2011/CCC, 2011)**

Sellafield is located about a mile north of Seascale, on the coast of Cumbria. Sellafield Ltd currently employs 10,200 (Sellafield Ltd/CCC, 2011), down from 12,100 in 2002/03 (ERM, 2003). 15% of staff would be termed professional and 45% skilled. The workforce profile is 71% male and 29% female. 87% of the women employed are between the ages of 25 and 54. Some 22% of the total jobs in West Cumbria are nuclear related. In Copeland this rises to 40% with a further 20% dependant on the nuclear supply chain (socio economic impacts of decommissioning). 80% of the staff at Sellafield live in Copeland and Allerdale

In 2003 it was calculated that the Sellafield sites supported approximately 2,630 indirect local jobs, from the purchase of goods and services. Using this same multiplier of 1.22 derived in the 2001 Socio economic study (ERM, 2003) it could be estimated that 2,244 indirect jobs are supported by the staff at Sellafield. The value of the supply chain from equipment, materials, subcontractor and other costs was £1.024 billion.

The Cumbria Economic Bulletin was published by the University of Cumbria and the Cumbria Intelligence Observatory in March 2011. It reports that the population in Copeland and Allerdale has remained stable since 2009, after a period of decline; however the number of those above retirement age has increased. Average full time gross workplace earnings are considerably higher than both the county and national average in Copeland and while unemployment is below the national average, the proportion of people claiming out of work benefits was higher at 14.2% than the national average of 12.9%. The qualification levels of the population in Copeland are much



lower than the national average of 29.8%, with just 15.2% of the working population with high level qualifications.

West Cumbria has contributed towards improved GVA performance since 2002 and the number of business in Cumbria has increased significantly since 2004 by around 40%. In the last two years this has fallen by about 2.8% in line with national trends. West Cumbrian towns experience a disadvantage in attracting investment however, due to the remoteness of the area.

## **3.2. Sellafield Workforce Contribution**

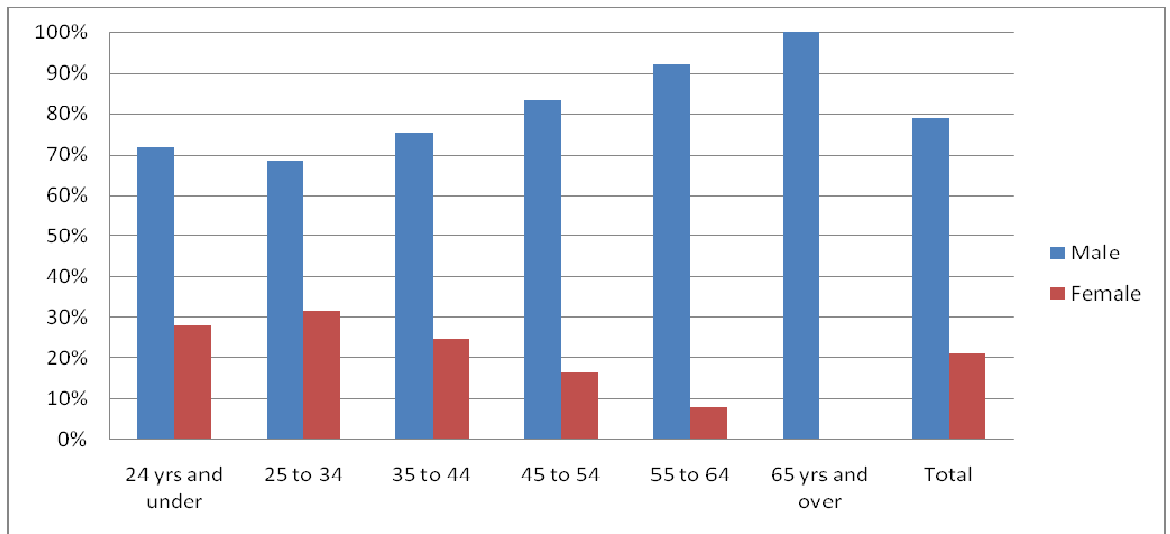
Sellafield Ltd provided 2011 workforce data by age, gender and location of residence in order to assist in assessing the impact of Sellafield as an employer and the potential impact on specific groups and communities of any change in employment on site. In addition, they provided some information on job titles to allow for an analysis by occupation groupings (Sellafield Ltd, 2011)

### **3.2.1. Overview**

The data relates to approximately 9,200 employees primarily based at the Sellafield site. Of these, 7,292 (79%) are male and 1,953 (21%) female and a third (33.3%) are aged 45-54. Whitehaven is the most likely area of residence (35.1%), followed by Egremont (16.1%) and Workington (15.4%). The largest proportion of staff (26.2%) works in maintenance occupations, followed by process operations (16.3%).

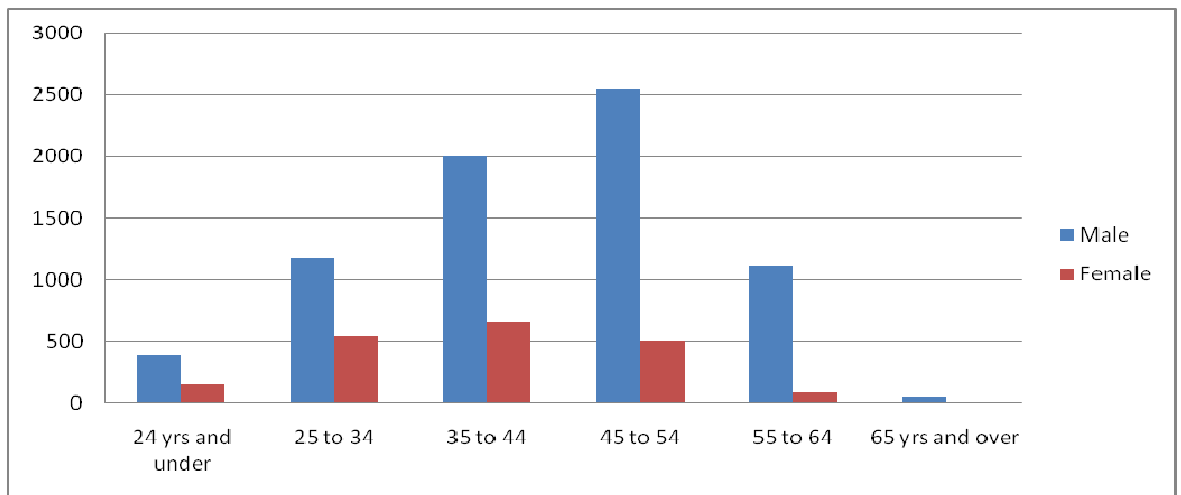
### **3.2.2. Workforce by Age & Gender**

Four fifths (79%) of the Sellafield workforce is male, although this proportion is lower among the younger age groups where around two thirds are male. This contrasts to the workforce in Cumbria as a whole where just over half (54%) of those in employment are male. However, it is very similar to the manufacturing workforce throughout the county where 77% are male (APS, March 2011). The following chart shows the % of each age group within the Sellafield force by gender.



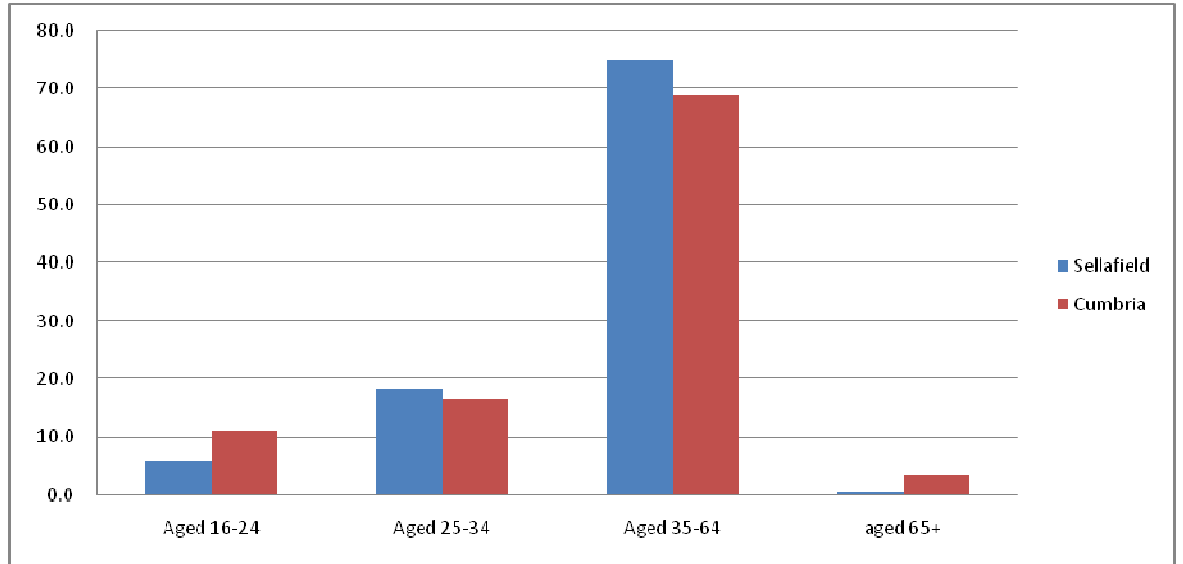
■ **Figure 2: Sellafield Workforce, % of Age Group by Gender (Source: Sellafield Ltd)**

The highest number of employees at Sellafield, 3,058 (33.1%) is in the 45-54 age group, followed by the 35-44 age group which accounts for 28.9% (2,669) of the workforce. The following chart shows the number of employees in each age group by gender.



■ **Figure 3: Sellafield Workforce by Age and Gender (Source: Sellafield Ltd)**

Due to data reliability, it is difficult to compare the age profile at Sellafield with that of the wider population in the same level of detail. However, analysis using broader age bands shows that Sellafield employs a slightly lower proportion of 16-24 year olds than in Cumbria as a whole and a slightly higher proportion of those aged 35-64. This is not unexpected given the nature of employment at Sellafield compared to the wider economy.



■ **Figure 4: Workforce by Age, Sellafield vs Cumbria (Source: Sellafield Ltd; APS, March 2011)**

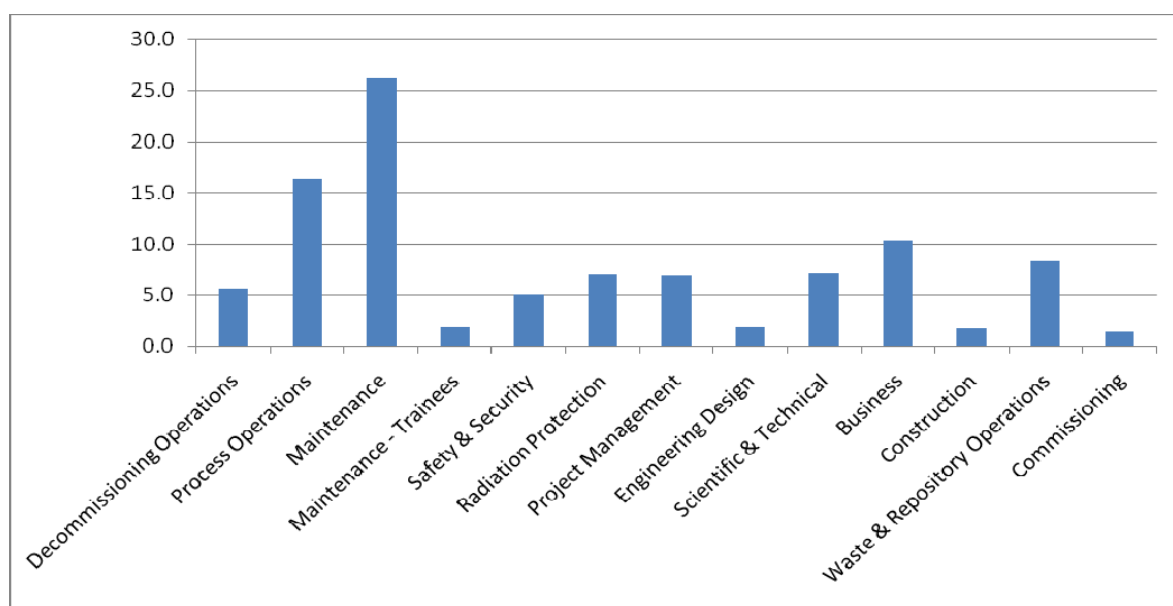




### 3.2.3. Workforce by Occupation

Just over a quarter of the Sellafield workforce (2,400 people, 26.2%) works in maintenance occupations and a further sixth (1,500 people, 16.3%) works in process operations. These job roles are specific to the nuclear sector and it is therefore not possible to relate them to standard occupational classifications in the wider workforce.

In addition just over 10% of the workforce is classified as working in business. This serves to illustrate the diversity of the jobs on site and the range of skills employed.

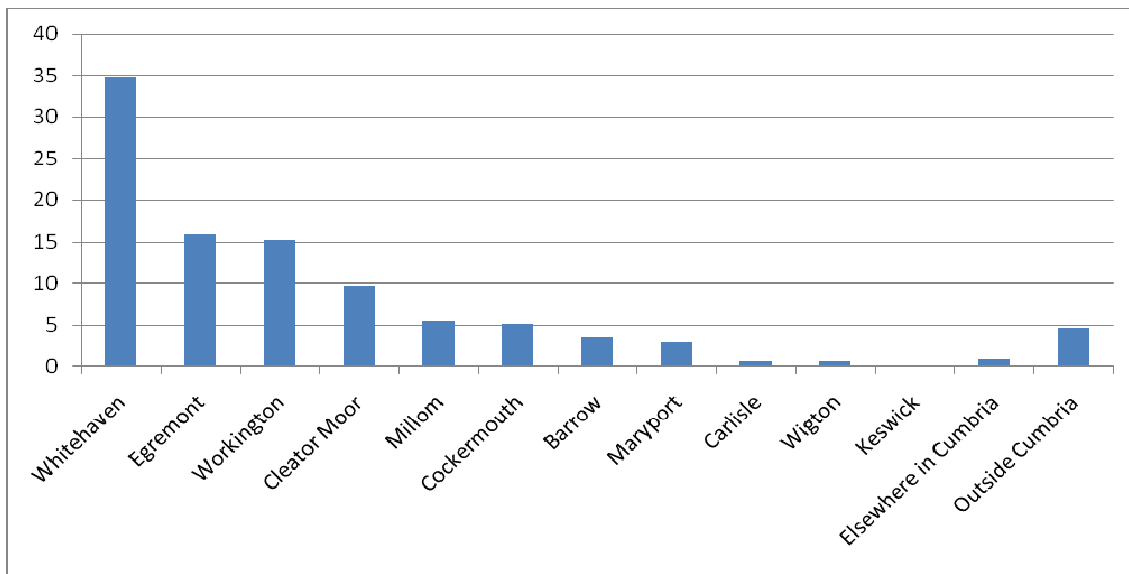


■ **Figure 5: Sellafield Workforce by Occupation (Source: Sellafield Ltd)**



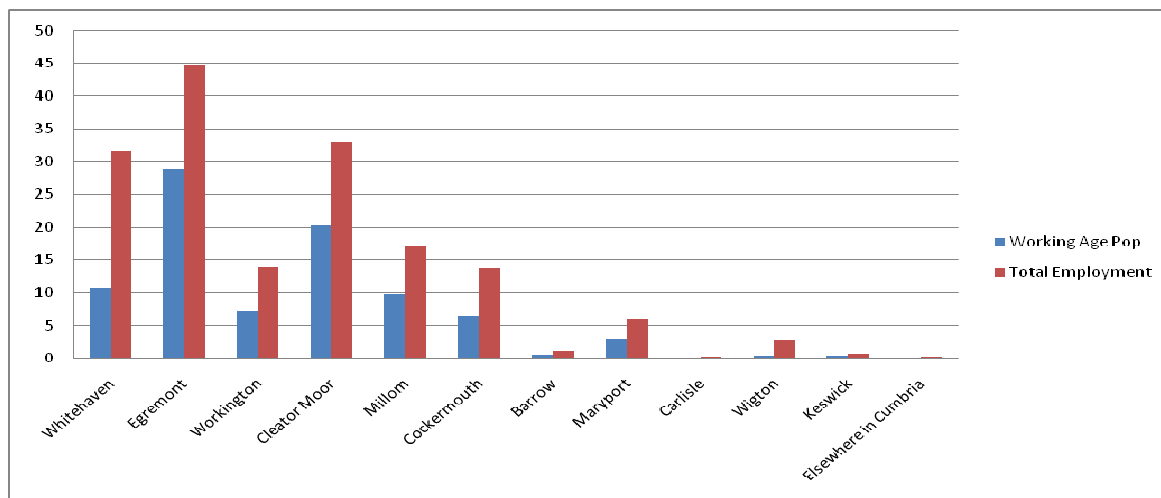
### 3.2.4. Workforce by Residence

Based on the information supplied by Sellafield, 95% of the workforce resides in Cumbria. Whitehaven accounts for the highest number of employees, 3,220 (34.8%), followed by Egremont with 1,480 (15.9%) and Workington with 1,420 (15.3%).



■ **Figure 6: % of Sellafield Workforce by Town (Source: Sellafield Ltd)**

The importance of Sellafield as a provider of employment in particular communities cannot be understated. For example, in Egremont, 45% of all those in employment work at Sellafield, in Cleator Moor 32.9% do so and in Whitehaven 31.8% do so. In these areas, Sellafield will frequently provide employment for several members of the same household.



■ **Figure 7: Sellafeld Employees as % of working Age Population and % of Total Employment (Source: Sellafeld Ltd; APS, March 2011; Census 2001)**

In terms of the wider population, in Egremont, 28.9% of all those of working age are employed at Sellafeld whilst a further 14.3% are claiming DWP out of work benefits. Similarly, in Cleator Moor, 20.4% of the working age population work at Sellafeld with a further 18.9% on out of work benefits. The dependence of these two communities in particular on Sellafeld is very apparent with evidence of limited alternative employment options for those who are unable to gain employment at Sellafeld.

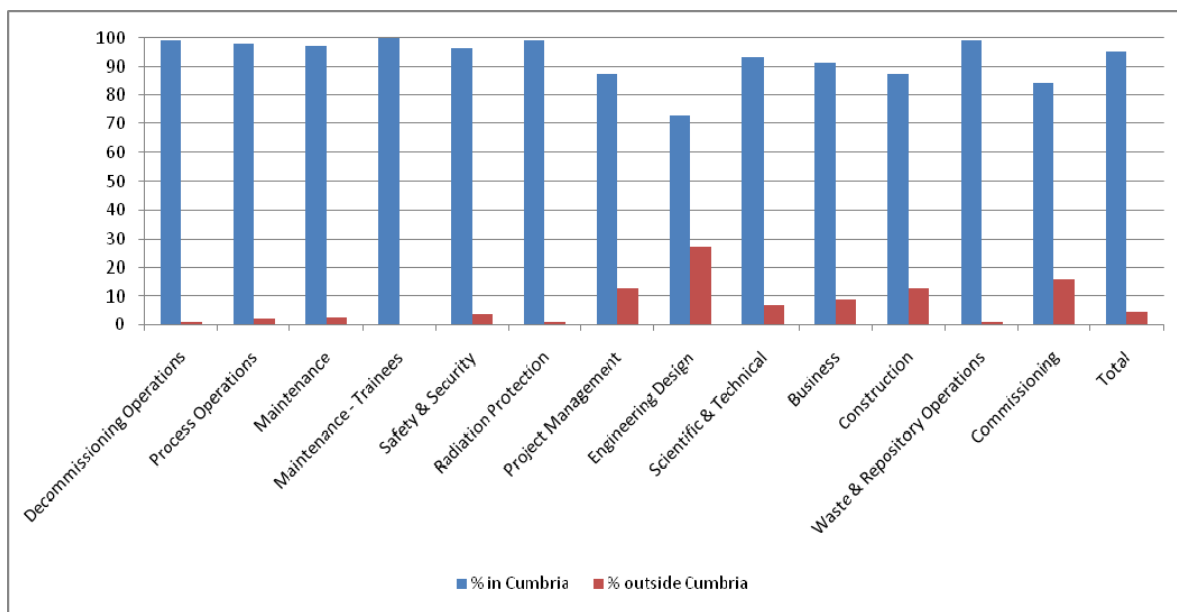
The map overleaf, Figure 8, illustrates the geographic spread of the workforce. This illustrates the relative dependency of some settlements on the plant and the geographic linkages of this.



■ Figure 8: Geographic Spread of Sellafield Ltd Workforce



Analysis of the occupations data from Sellafield alongside the workforce residence data shows that employees in some occupations are more likely to live outside Cumbria than others. For example, more than a quarter (27.2%) of those working in engineering design roles are resident outside Cumbria and a sixth (15.9%) of those in commissioning roles do so whilst only a handful of those in decommissioning, process operations and maintenance live outside the county.



■ **Figure 9: % of Occupation Resident Inside / Outside Cumbria (Source: Sellafield Ltd)**

## **4. Influences on the Nuclear Sector in the UK**

The background to strategic economic development and planning policy drivers as well as the investment context has significantly changed since issue of the 2007 West Cumbria Master Plan with a programme of change expected to continue in the short-term. It is anticipated that within the next year to eighteen months the Generic Design Assessment of the two reactor technology choices for new nuclear will be completed and the National Policy Planning Framework, incorporating the National Policy Statements and National Infrastructure Strategic Projects, will be statutorily adopted.

This section provides a concise summary of the changing policy and investment context and influencing factors on the nuclear sector within the UK; Cumbria specific factors and impacts are discussed separately.

### **4.1. Policy Position**

Recent UK energy policy has been formed around the need to reduce the emissions of greenhouse gases which are contributing to global warming and climate change, and to ensure secure, clean and affordable energy. The Energy White Paper 2007, which built on the previous White Paper of 2003, sets out the government's strategy in responding to the changing energy environment including climate change, rising fuel prices, increased UK reliance on imported fuel and the need for investment in new energy infrastructure.

The Climate Change Act 2008 has set legally binding targets to achieve an 80% cut in UK carbon emissions by 2050, pushing beyond the 60% target proposed by the Climate Change Bill. In producing the 2007 White Paper a number of scenarios were modelled and under some of these it would be possible to reduce the UKs carbon emissions by 60% by 2050, but we may fail to meet other policy goals such as security of energy supply and the ability to further reduce carbon emissions. In recognition of the need to encourage low carbon energy technologies, the Government considered it was in the public interest to give the private sector the option of investing in new nuclear facilities and consulted with the general public on a range of issues related to nuclear power.

The White Paper on Nuclear Power, published in 2008 sets out the government's decision on nuclear power in response to this consultation. It states that new nuclear power generation has a role to play alongside other low carbon technologies, that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations, and that the Government should take steps to facilitate this. Steps include improving the planning system of electricity generating stations in England and Wales, to include nuclear power stations. This would comprise



a framework for development consents that gives full weight to policy and regulatory issues that have already been the subject of national debate.

The Infrastructure Planning Commission (IPC) was established under the Planning Act 2008. The IPC is an independent body responsible for examining applications for nationally significant infrastructure projects. The Government has produced National Policy Statements for infrastructure, establishing the national case for them. The IPC then makes decisions based on the framework within the NPS's. The National Policy Statement for Nuclear Power Generation (EN-6) was published in July 2011.

## 5. Planned Changes within West Cumbria

Since the West Cumbria Spatial Master Plan (the 'Master Plan') was issued in 2006, and updated in 2007, significant economic and policy change has occurred within the UK and in West Cumbria. Policy changes and current status has been considered in Section 4.

This section identifies the key changes since issue of the Master Plan, the current position and the likely changes looking forward for:

- Decommissioning
- New Build
- Potential Investments (nuclear 'deltas')

Investments are identified as are the uncertainties associated with each of the activities and any limitations this may pose in accurately attributing implications arising for the West Cumbrian authorities.

### 5.1. Implementation of the West Cumbria Masterplan

ERM (2003) identified a number of initiatives related to the nuclear industry; these being:

- Forthcoming establishment of the Nuclear Decommissioning Authority's (NDA) new headquarters in West Cumbria
- BNFL's own local economic development funding;
- other energy sector investments, such as new wind farms;
- improvements to transport and communications, such as further upgrades to the A595; and
- other public sector investments, and in particular the regeneration spending by West Lakes Renaissance, the new Urban Regeneration Company for West Cumbria, the local authorities' own regeneration activities and the new Rural Regeneration Company

These initiatives have been undertaken and superseded with changes in the West Cumbria sector, such as:

- Completion of the A595 upgrade between Lillyhall and Whitehaven
- Abolishment of BNFL as announced in October 2010, with Sellafield Limited being the new legal entity of the Sellafield, Windscale and Capenhurst nuclear licensed sites (WNN, 2010). BNFL's research and development activities transferred to the National Nuclear Laboratory with BNFL's commercial arm being acquired by Babcock International
- West Lakes Renaissance, trading latterly as Britain's Energy Coast West Cumbria, was wound-up in April 2011 following the withdrawal of funding from the Northwest Regional





Development Agency – a result of the Government's decision to abolish all of the UK's Regional Development Agencies (Westlakes Renaissance, 2011)

The specific influence of Sellafield Limited, Low Level Waste Repository and their respective Parent Body Organisations is reviewed within the relevant sections.

Following the withdrawal of funding in April 2011 investment from the NDA and Nuclear Management Partners (NMP), Sellafield Ltd's parent body organisation, has enabled the continuation and re-energising of the Britain's Energy Coast (BEC) Masterplan [BEC, 2007] for regenerating Cumbria as a renewable and nuclear energy centre of excellence. The Masterplan outlined the activities to fulfil the BEC mission and to address the employment gap generated by decommissioning of the Sellafield Ltd site.

As part of the University of Cumbria's arrival in Lillyhall, Workington, in 2008 the area was renamed the Britain's Energy Coast Campus [BECC, 2008]. This has since developed into a partnership arrangement of:

- ENERGUS (a joint venture of nucleus and GenII)
- Lakes College
- University of Cumbria
- University of Central Lancaster (UCLan)
- Lancaster University
- University of Manchester

The aim of the partnership is develop an integrated campus in and around Lillyhall that provides a world-class exemplar of partnership between further education, higher education, specialised vocational training, business and the community. The BECC is driving initiatives such as the development of a Centre for Nuclear Reactor Operations Training ahead of a NuGeneration technology choice and a Energy Coast Construction Centre to train construction students who could then go on to work at the planned nuclear new-build at Sellafield or building offshore wind-farms as part of the renewable aspiration [BECC, 2011; Nucleus, 2011].



## **5.2. Decommissioning**

The decommissioning sector is integral to Cumbria's economy. This section considers the current and future position of decommissioning.

### **5.2.1. Current Position**

Since publication of West Cumbria Partners (2007), significant changes have occurred within the Cumbrian decommissioning sector, most notably competition of both Sellafield Limited and the Low Level Waste Repository (LLWR) with the NDA appointing two Parent Body Organisations (PBOs) to own and operate these Site Licence Companies (SLC) for the duration of their contract with the NDA.

The successful PBO for Sellafield Limited was Nuclear Management Partners (NMP) a consortium of URS, AMEC and Areva and for the Low Level Waste Repository was UK Nuclear Waste Management Limited (UKNWM) a consortium led by URS with Studsvik UK, Areva, and Serco Assurance.

Advances have been made in making West Cumbria a centre for nuclear (decommissioning) excellence through the opening of Energus in 2009 as a Centre of Excellence for skills training, education and business support. As part of this, Nucleus Training, a joint venture of GenII (training provision) with Energus (training facilities) has been set-up to provide skills in new nuclear and the wider Energy Coast sectors.

The intricacy of the nuclear sector can be seen by reviewing the 'make-up' of Energus and its partners. Its formation was driven by the NDA as a key strategic investment in support of Britain's Energy Coast with Nuclear Management Partners, University of Cumbria and the National Skills Academy Nuclear as partners. The collaboration of public sector and supply chain for the success of nuclear (regardless of sub-sector) is widely seen within successful initiatives such as Energus.

The Studsvik Metals Recycling Facility opened in Lillyhall, Workington in 2009 and provides waste volume and activity reduction of low level radioactive waste for UK-wide customers. The facility was designed to form part of the wider National LLW Strategy developed by the NDA in conjunction with its sites and implemented by the LLWR and as such is likely to bring investment into the area.

### **5.2.2. Sellafield Limited**

As noted in Section 5.2.1, Sellafield Limited has undergone a change in ownership as a result of the Parent Body Organisation competition with Nuclear Management Partners (NMP), a consortium of URS, AMEC and Areva, under contract to operate the site. The scope of decommissioning has



also increased with the transition of the Windscale Nuclear Licensed Site from UKAEA<sup>4</sup> to Sellafield Limited as part of that competition process.

#### **5.2.2.1. Performance Plan**

Sellafield Limited has published their performance plan (Sellafield Plan, 2011) which is a stretch-target programme for decommissioning against their contract baseline. Significant construction activity will be undertaken to provide facilities and plant for the decommissioning and management of wastes from the Sellafield site.

#### **5.2.2.2. Procurement Plan Strategy**

The published procurement plan (separate Strategy and Procurement Plan) for Sellafield Limited identifies contracts over £50k value and the objectives for the Sellafield Ltd Commercial Directorate.

Supply chain expenditure, £800m per annum, accounts for approximately half of the annual funding levels for Sellafield Limited (Sellafield Limited, 2011). An objective for Sellafield is to reduce the supply chain spend by £500m over the next five years through:

- Supply Chain Value Optimisation - Contract Review - Refine and implement procedures for Demand Management and Contract Assessment; establish and operate a procedure to monitor and report on supply chain cost reductions.
- Supply Chain Value Optimisation - Make Buy - Define and deploy Make/Buy or 'Insourcing/Outsourcing' procedures, establish and operate a procedure to monitor and report on supply chain cost reductions.

Sellafield recognises the role it has in the West Cumbrian economy and as such engages with the local supply chain and applies a weighted supplier selection criterion to take into account socio-economic factors, where relevant to the scope of the procurement and / or the conditions of contract. The weighting applied to those contracts is 5% [WCSSG, 2011].

The Sellafield procurement plan (Sellafield Procurement, 2011) identifies the projects and frameworks to be competed or awarded. The timeline for these opportunities does not extend beyond 2014 and therefore only provides a short-term view of supply chain potential expenditure. Further, there is limited visibility of full Sellafield procurement activities due to work packages being completed or to be completed under frameworks or with values under £50k. For those

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<sup>4</sup> UKAEA was privatised with its subsequent acquisition by Babcock. It remains as a distinct organisation responsible for the UKs research into fusion technology at Culham, Oxfordshire, but otherwise is no longer active within the decommissioning or new build sectors.



contracts over Official Journal of the European Union (OJEU) thresholds there is a high degree of transparency due to the requirement to publicise in OJEU.

#### **5.2.2.3. Socio-Economic Investment**

Sellafield Ltd and the NDA provides a pivotal socio-economic funding role with £3.1million committed annually through a contract with Sellafield, NMP providing £4.5million annually and a NDA contribution of £2.5million annually. A further £300k is provided by the NDA to the centre for leadership performance, contributing towards socio economics, community enterprise, business support and new enterprises, education resources, Gen II and the supply chain, [WCSSG, 2011].

#### **5.2.2.4. Investment Uncertainties**

Completion of the Sellafield Limited contract baseline and performance plan is dependent on the certainty of public sector funding. The Comprehensive Spending Review (CSR) resulted in certainty of funding for decommissioning activities through the NDA for the next 3-years (from April 2011). The NDA then has responsibility and accountability for that funding and its allocation to the UK's decommissioning sites. As a high hazard site Sellafield Ltd's funding is relatively secure and at a level of circa £1.5bn per annum. However, post the CSR period, certainty of funding at this level or the level required to implement the contract baseline or performance plan is not guaranteed. As such, there is uncertainty in whether the workforce profile and supply chain funding will be as indicated in the plans and may be reduced, though over a stretched period, to enable compliance with funding levels.

### **5.3. New Build**

New build considers new reactor build only. New build associated with Sellafield Ltd or geological disposal for example, are considered as being potential investments nuclear (or nuclear 'deltas') and are therefore discussed within Section 5.4.

Within the West Cumbria Spatial Master Plan Working Paper 2 [West Cumbria Partners, 2007] new nuclear build was considered a possibility following issue of the Government Energy White Paper [DTI, 2007] and the Jackson Consulting report produced a year previously on the potential sites for new nuclear. The investment recommendations were based on new nuclear being located in the Calder Hall area of the Sellafield nuclear licensed site.

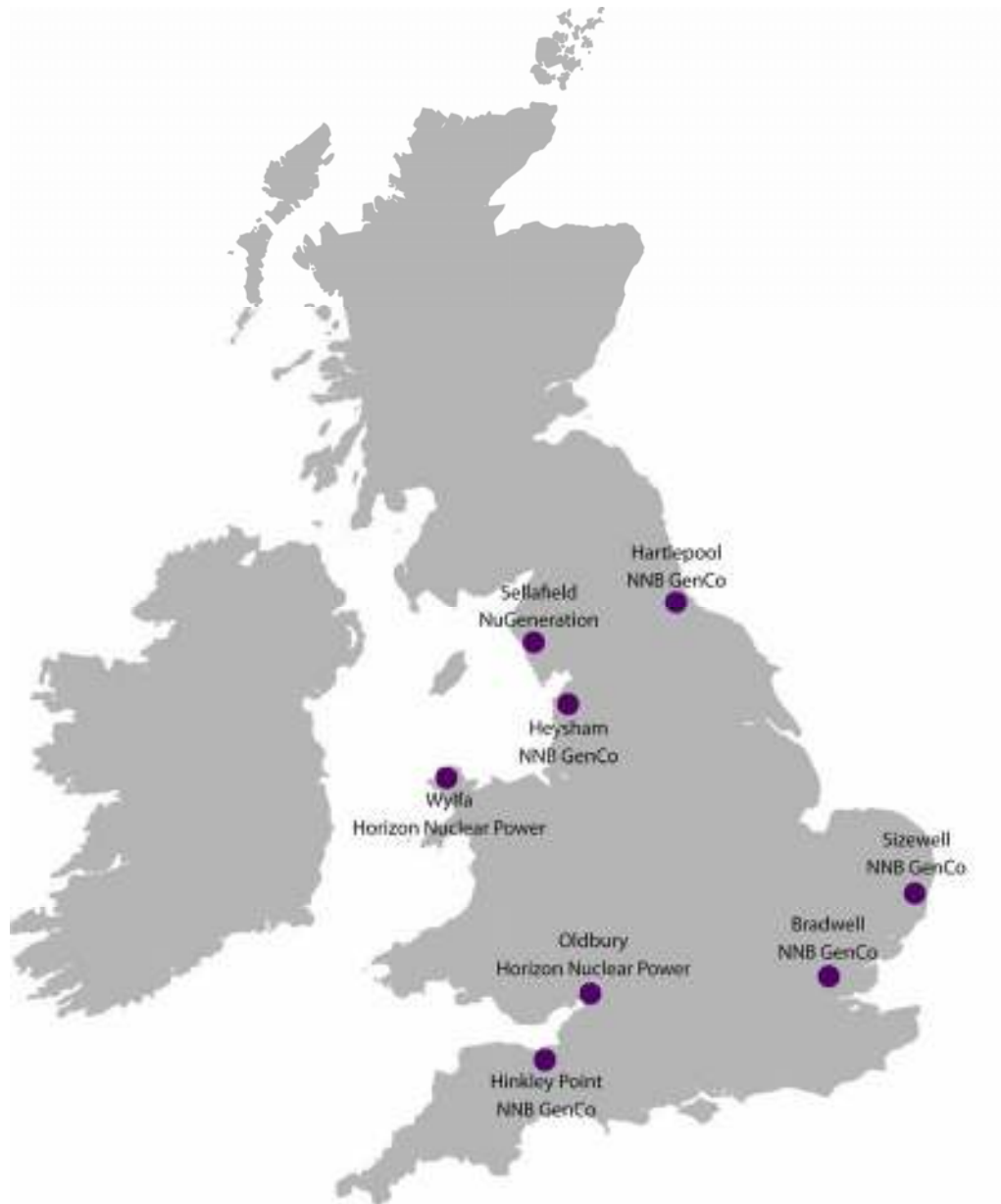
The economic and policy climate has changed substantially since issue of the West Cumbria Spatial Master Plan, as indicated within Section 4, with the Coalition Government now committed to new nuclear build and the stance reinforced through the issuing of a dedicated National Policy Statement. Three West Cumbrian sites were initially identified for new nuclear build, Braystones,



Kirksanton and Sellafield, with the Sellafield site 'accepted' within the National Policy Statement (NPS) on Nuclear Energy [DECC, 2011].

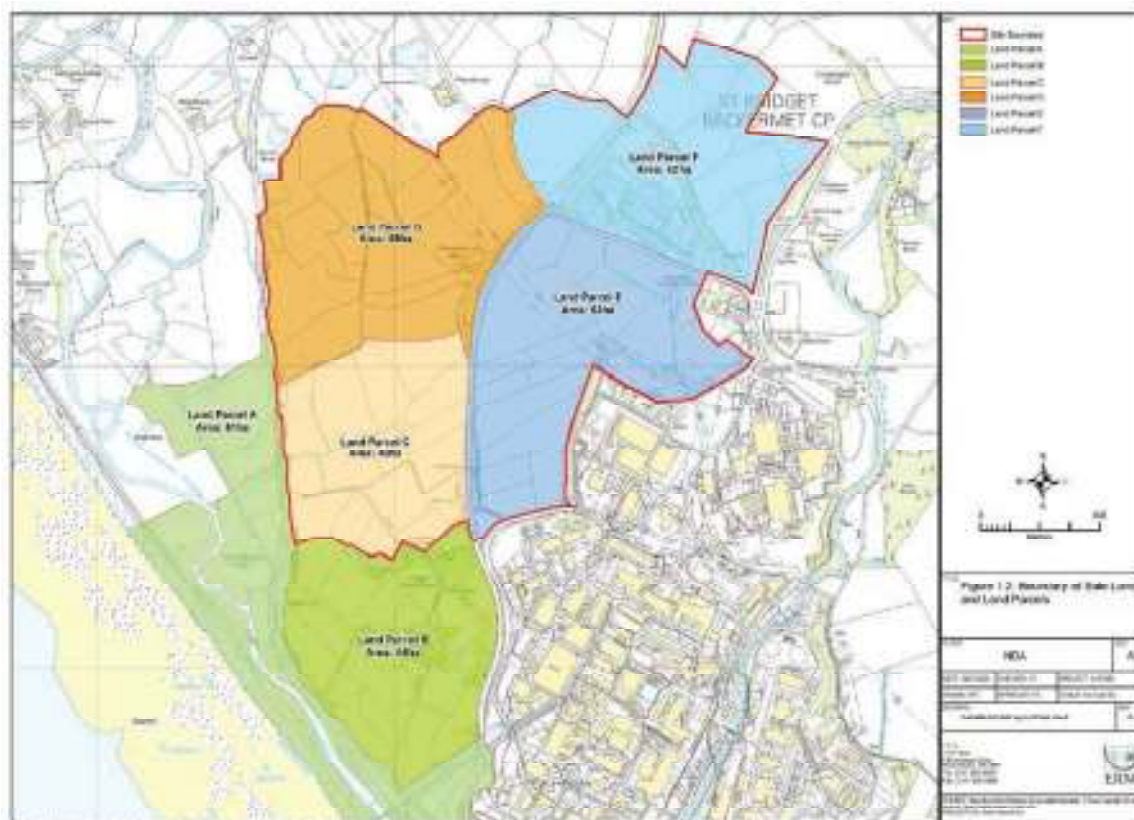
A total of eight (8) sites were 'accepted' for the construction of new nuclear reactors as detailed in Figure 10 overleaf. Three Joint Ventures have been created to progress new build at these sites; these are:

- NNB GenCo: EdF Energy and Centrica in a 80:20 JV
- Horizon Nuclear Power: RWE and E.ON
- NuGeneration: GDF Suez and Iberdrola in a 50:50 JV



■ **Figure 10: New Nuclear Reactor Sites, [Information from DECC, 2011]**

As stated above, NuGeneration (NuGen), a joint venture of GDF Suez and Iberdrola each having a 50% stake, has secured an option to purchase 200Ha land from the Nuclear Decommissioning Authority (NDA) in order to construct and operate a nuclear power plant of up to 3.6MW. The land is adjacent to the Sellafeld Limited site and is nominated within the NPS, see Figure 11.



■ **Figure 11: NuGen Land Purchase Options**

NuGen has two reactor technology choices, both of which are undergoing Generic Design Assessment (GDA) by the Office for Nuclear Regulation (ONR) and the Environment Agency (EA). The choice of the Westinghouse AP1000 or the Areva European Pressurised-water Reactor (EPR) will shape the siting, construction and operation requirements of NuGen and therefore the investment need within Cumbria as detailed below in Table 2

Likely Investment	Key Features	Uncertainties
<b>Land</b>	NuGen has option to purchase 100Ha out of 200Ha (NuGeneration, 2011)	Decision will be based on technology choice and suitability of land for construction / long-term usage (60 years +).
<b>Worker accommodation (construction phase)</b>	Itinerant workforce requiring temporary accommodation. NNB GenCo are proposing	Workforce numbers and timing will be dependent on reactor technology and new nuclear



Likely Investment	Key Features	Uncertainties
	campus accommodation for 1510 workers [NNB GenCo, 2011]	programme. This issue is examined further within the accompanying 'Projections Paper', GVA, 2011.
<b>Worker accommodation (operation phase)</b>	A permanent workforce will be required, figures vary dependent on technology choice and assumptions. NNB GenCo has a stated requirement of 700 workers with 200 contract staff [NNB GenCo, 2011]. Long-term accommodation will be required (e.g. permanent relocation to West Cumbria), likely to be ~700 workers plus dependents.	Requirement for further homes, comparison of decommissioning and new nuclear workforce profiles to determine potential differences. This issue is examined further within the accompanying 'Projections Paper', GVA, 2011.
<b>Port upgrades</b>	Ability to receive reactor vessel components	Whether necessary (see jetty), potential existing Port facilities at Workington or Barrow
<b>Bespoke jetty for construction</b>	Ease of access for NuGen site deliveries of major components. Mirrors Evap D project approach.	Access to NuGen site restricted by existing trainline which runs between the NuGen site and the coast.
<b>Road Access</b>	Civil improvement of link to A595	Choice of technology and location of reactors may influence road infrastructure required to deliver required components and materials for construction.
<b>Maintenance Accommodation</b>	Maintenance (outage) periods will require in the order of a 1000-worker temporary	Maintenance workforce requirements and frequency are dependent on the technology





Likely Investment	Key Features	Uncertainties
	workforce in addition to permanent staff. Temporary accommodation and facilities will be required for the outage period on a ~18-month frequency.	choice and performance of the reactor. Typical maintenance frequencies are 18 to 24 months.

■ **Table 2: New Build Likely Investment**

A detailed discussion of the reactor technology choice and the wider implications of new build are provided within Sections 7 and 9. As noted above these have a fundamental bearing on the levels of investment which will be required and delivered in the provision of a new nuclear facility.



#### **5.4. Potential Nuclear Investment (Nuclear 'deltas')**

The nuclear 'deltas' are those potential investments that fall outside of the Lifetime Plan or Performance Plan for the decommissioning sector (Sellafield Ltd and LLWR), are outside the scope of NuGen's new nuclear remit or is not current UK policy / a strategic investment decision by Government.

For this report, the agreed nuclear deltas are:

- 1) Extension of Magnox operating plan end date
- 2) Early completion of SMP operations
- 3) Late provision of a UK MOX plant in West Cumbria
- 4) Provision of chemical pre-treatment facilities to support UK Pu conversions
- 5) Consolidation of exotic fuel management in West Cumbria
- 6) Early closure of Thorp
- 7) Provision of new nuclear build spent fuel storage in West Cumbria
- 8) Avoidance of provision of replacement highly active storage tanks (HAST) at Sellafield.

These deltas will impact the workforce profile and supply chain investment with its impact being dependent on whether this is an increase workscope or removal of scope due to policy decisions or client direction (e.g. Delta 5 is dependent on NDA strategic decision making).

##### **5.4.1. Nuclear 'Delta' Impacts**

Data was provided by Sellafield Ltd to inform the construction of this scenario. In order to provide a context to the employment implications of each project a short introduction is provided alongside tables showing direct employment and sub-contractor spend estimates, on a year by year basis, as well as the anticipated phasing of the projects delivery.

A similar approach to that used in the treatment of the Sellafield Lifetime Plan has been taken for each project to convert spend and job data provided by Sellafield into inputs into Experian's forecasting model<sup>5</sup>. It is important to note that a number of the projects result in a reduction in employment as a result of investment in technologies. This therefore has an impact in moderating the net effect of the uplift in jobs projected through the investment in Nuclear New Build set out in the preceding scenario and carried forward into this.

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<sup>5</sup> Further details around the methodology and assumptions are included within the accompanying 'Projections Paper', GVA, 2011.



#### 5.4.1.1. Early Completion of SMP Operations

This delta was identified prior to the announcement of the early closure of the Sellafield Mixed Oxide (MOX) Plant in August 2011 (NDA, 2011). This decision was made by the NDA as part of a review with the key Japanese clients following the earthquake and subsequent tsunami in March 2011.

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2011	0	0	0
2012	-27,300	-470	-50,300
2013	-28,500	-490	-48,200
2014	-27,500	-470	-36,000
2015	-18,700	-320	-16,300
2016	-1,900	-30	2,000
2017	900	10	5,000
2018	3,700	60	8,000

■ **Table 3: Early Closure of SMP**



#### 5.4.1.2. Late Provision of UK MOX Plant

A new UK MOX plant may be required as part of UK policy on the management of nuclear fuel. This delta considers the timing impact of that delivery.

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2024	49,700	860	212,800
2025	49,700	860	212,800
2026	49,700	860	212,800
2027	49,700	860	212,800
2028	49,700	860	212,800
2029	49,700	860	212,800
2030	49,700	860	212,800

■ **Table 4: Late Provision of a UK MOX Plant**

#### 5.4.1.3. Provision of Chemical Pre-Treatment Facilities to Support UK Pu Conversion

Sellafield has stocks of plutonium that is in the process of being transferred from their existing stores into the Sellafield Product and Residue Store. Plutonium is also stored at the Dounreay site and EdF Energy sites. The NDA has presented a credible options study on plutonium to the Government in 2008; consultation was undertaken and a response provided by Department of Energy and Climate Change on the long-term management of UK-owned separated civil plutonium issued in December 2011 [DECC, 2011]. The response confirmed the preliminary policy view to pursue re-use of civil nuclear plutonium stocks as MOX fuel. Should this be established as implementable through further assessment, then treatment of the plutonium at Sellafield may be credible.

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2021	8,700	150	37,500
2022	8,700	150	37,500
2023	8,700	150	37,500
2024	8,700	150	37,500

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2025	8,700	150	37,500
2026	8,700	150	37,500
2027	8,700	150	37,500
2028	8,700	150	37,500
2029	8,700	150	37,500
2030	8,700	150	37,500

- **Table 5: Provision of Chemical Pre-Treatment Facilities to Support Pu Conversion**

#### 5.4.1.4. Provision of New Nuclear Build Spent Fuel Storage in West Cumbria

Construction of new nuclear units in Cumbria will require appropriate storage facilities for the spent fuel. An option is to consolidate the storage of spent fuel in a purpose built facility within West Cumbria.

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2022	1,100	20	4,900
2023	1,100	20	4,900
2024	1,100	20	4,900
2025	1,100	20	4,900
2026	1,100	20	4,900
2027	1,100	20	4,900
2028	1,100	20	4,900
2029	1,000	20	1,100
2030	1,100	20	1,200

- **Table 6: Provision of New Nuclear Build Spent Fuel Storage in West Cumbria**



#### 5.4.1.5. Extension of Magnox Operating Plan End Date

As detailed in the Magnox Operating Plan introduction:

*“The Magnox Operating Programme (MOP) is an integrated programme covering all business areas associated with the cost-effective management and safe disposal of spent Magnox fuel and, as such, supports the Nuclear Decommissioning Authority (NDA) strategy of managed reduction of potential hazards.”*

With respect to Sellafield Ltd operations, the MOP defines the receipt and reprocessing of Magnox fuel from the Magnox Ltd operating sites and defines the end-date for those operations. An extension of that planned end date would require the extension of operations at Sellafield Ltd for certain facilities.

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2016	-100	0	-100
2017	6,600	110	7,000
2018	14,200	250	15,100
2019	15,000	260	14,300
2020	15,300	260	13,700
2021	11,600	200	7,000
2022	3,600	60	-1,800
2023	7,400	130	2,200
2024	1,700	30	-4,700
2025	11,800	200	2,900
2026	14,100	240	7,300
2027	22,500	390	19,500
2028	5,800	100	3,600
2029	3,400	60	7,900
2030	3,000	50	7,900

■ **Table 7: Extension of Magnox Operating Plan End Date**



#### 5.4.1.6. Avoidance of Provision of Replacement Highly Active Storage Tanks at Sellafield

The Highly Active Storage Tanks are currently scheduled to be replaced. Avoidance of this occurring results in the following impacts.

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2017	-200	0	-400
2018	3,600	60	3,500
2019	9,500	160	10,100
2020	3,800	60	2,500
2021	14,200	240	9,400
2022	13,800	240	8,800
2023	300	0	-1,100
2024	5,100	90	8,000
2025	21,300	370	21,100
2026	29,200	500	31,200
2027	11,800	200	15,200
2028	2,200	40	300
2029	2,800	50	8,300
2030	2,700	50	10,200

■ **Table 8: Avoidance of Provision of Replacement Highly Active Storage Tanks at Sellafield**



#### 5.4.1.7. Consolidation of Exotic Fuel Management in West Cumbria

Across the NDA estate approximately 500 tonnes of non-standard fuels are stored. These non-standard fuels are commonly referred to as 'exotics'. These fuels are a legacy from activities such as the development of research, experimental or prototype reactors. The NDA is completing an overarching research paper to inform an exotic fuels strategy. A potential option is the consolidation and appropriate management of the fuel in West Cumbria with which this delta is concerned.

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2011	200	0	800
2012	200	0	900
2013	1,000	20	4,300
2014	2,000	30	8,500
2015	1,100	20	4,900
2016	1,000	20	4,200
2017	5,500	90	23,500
2018	6,500	110	27,900
2019	7,100	120	30,500
2020	2,000	40	8,700
2021	1,300	20	5,700
2022	300	10	1,400
2023	300	10	1,400
2024	-400	-10	-1,700
2025	-1,200	-20	-5,200
2026	100	0	600
2027	100	0	600
2028	-3,600	-60	-15,500
2029	-3,600	-60	-15,500
2030	-4,100	-70	-17,600

■ **Table 9: Consolidation of Exotic Fuel Management in West Cumbria**





#### 5.4.1.8. Early Closure of Thorp

This delta considers the impact of closing Thorp in advance of the contract baseline and performance plan.

Year	Direct labour cost	Direct FTEs	Supply Chain Spend
2015	200	0	400
2016	-4,100	-70	-4,400
2017	-9,800	-170	-10,700
2018	-5,300	-90	-5,100
2019	-14,400	-250	-9,900
2020	-14,300	-250	-10,100
2021	-300	-10	100
2022	-4,500	-80	-2,700
2023	2,000	30	4,100
2024	-20,200	-350	-16,900
2025	-6,600	-110	-9,400
2026	-1,200	-20	-1,400
2027	600	10	2,800
2028	-3,300	-60	-11,100
2029	-900	-20	-1,600
2030	-1,100	-20	-1,800

■ **Table 10: Early Closure of Thorp**



#### **5.4.2. Other Potential Nuclear Investment Projects**

In addition to the Nuclear Projects incorporated within the scenario there are a number of other potential areas of future investment by the nuclear sector which were identified by Sellafield Ltd. At this point in time it is difficult to assess when or whether these will be delivered and as such have not therefore been considered at any level of detail. It will be important to carefully monitor with Sellafield Ltd the potential delivery of these projects as a number of them could have a significant impact the economy of West Cumbria.

- Geological Disposal Facility in West Cumbria
- Early provision of a UK MOX plant in West Cumbria
- Extension of Thorp reprocessing (additional reprocessing)
- Extension of Thorp reprocessing (existing)
- Acceleration of broad front decommissioning
- Consolidation of intermediate level waste treatment facilities
- Increased investment in replacement national nuclear infrastructure
- Implementation of MoD Through-Life Plan

## **6. Implications of Decommissioning**

Decommissioning is the main activity undertaken within West Cumbria as part of nuclear activities. If development of new nuclear build occurs this will affect the workforce profile significantly and counter the inevitable reduction in workforce and supply chain needs as decommissioning is progressed.

### **6.1. Sellafield Limited**

As discussed in Section 5.2.2, Sellafield Limited currently provides circa £800m per annum on supply chain expenditure, with many organisations having offices or setting-up new offices in West Cumbria to service the needs of Sellafield Ltd (NIA, 2011).

The supply chain also provides temporary skilled and semi-skilled workers into West Cumbria on long- and short-term deployments associated with consultancy and construction projects. These workers provide valuable expenditure into the hotel and tourism sectors, particularly during off-peak seasons.

This section outlines the Sellafield Limited performance plan timelines and key activities and from this reviews the likely investment and workforce implications (physical and non-physical).

#### **6.1.1. Performance Plan Outline**

Sellafield Limited issued their Performance Plan in August 2011 (Sellafield Plan, 2011) which is a stretch-target plan of what could be achieved through the deployment of the skills that NMP bring as the PBO. An overview of the key plants and projects, as contained in the Sellafield Plan (2011), provided overleaf in Figure 12.

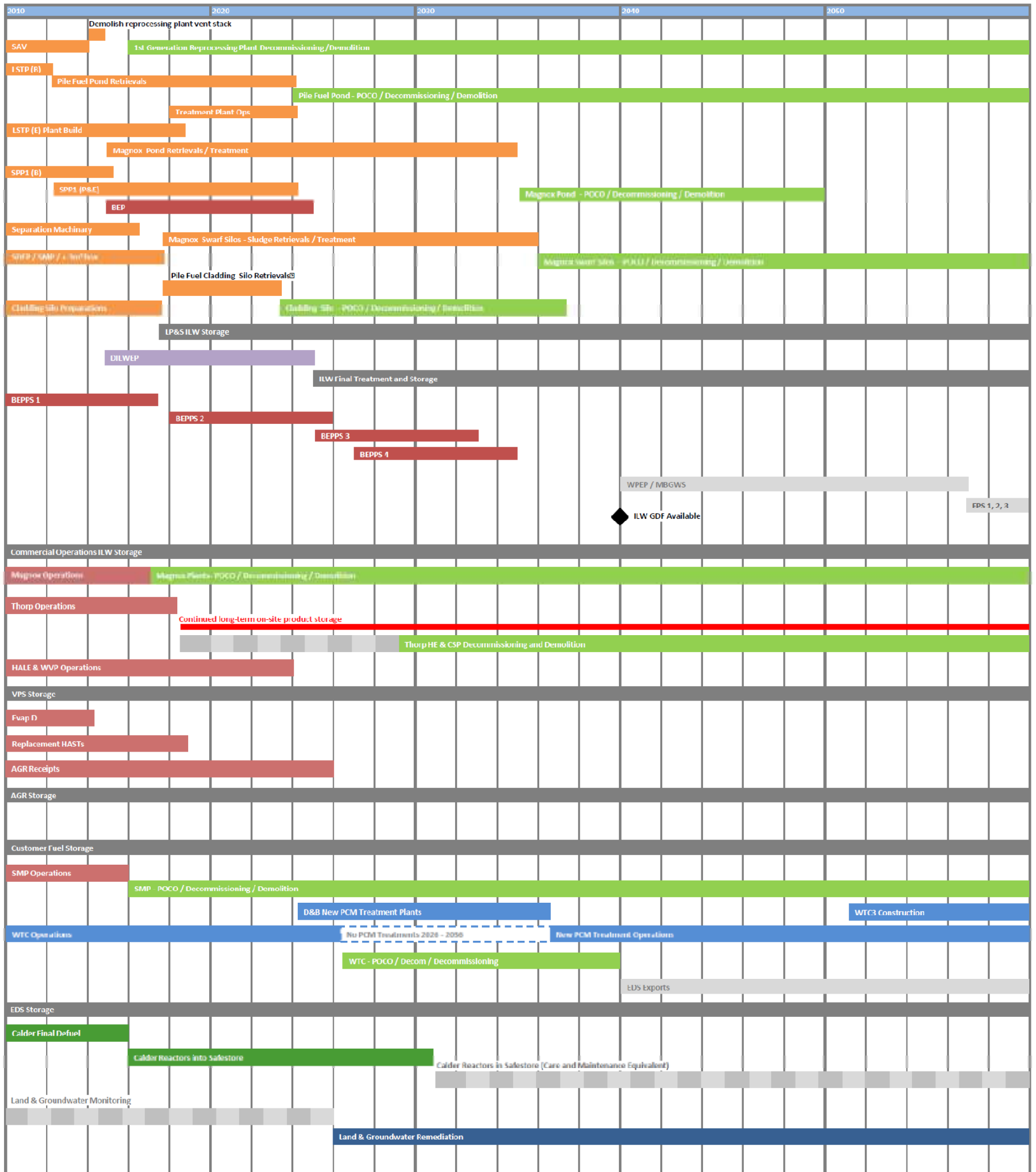
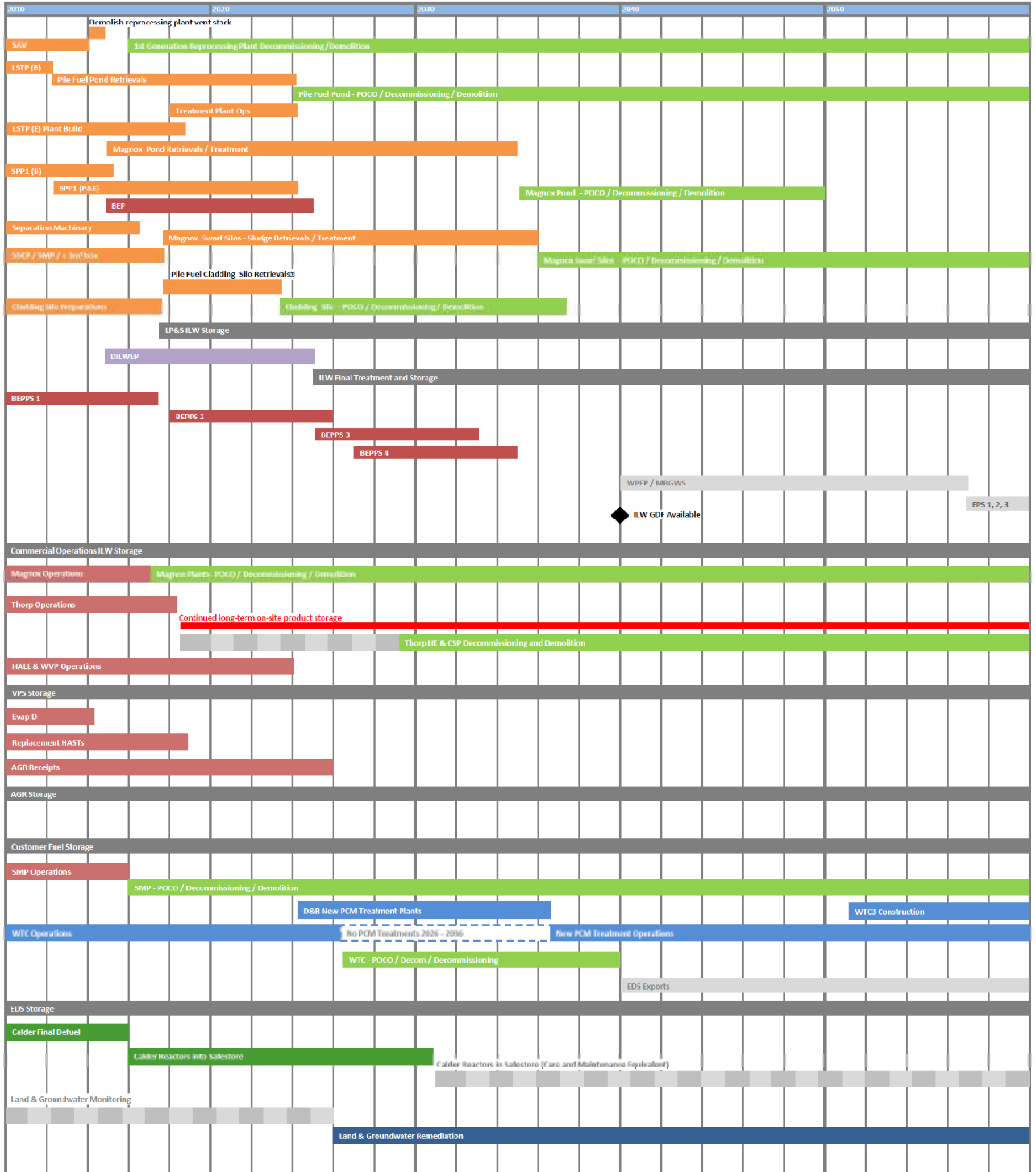


Figure 12

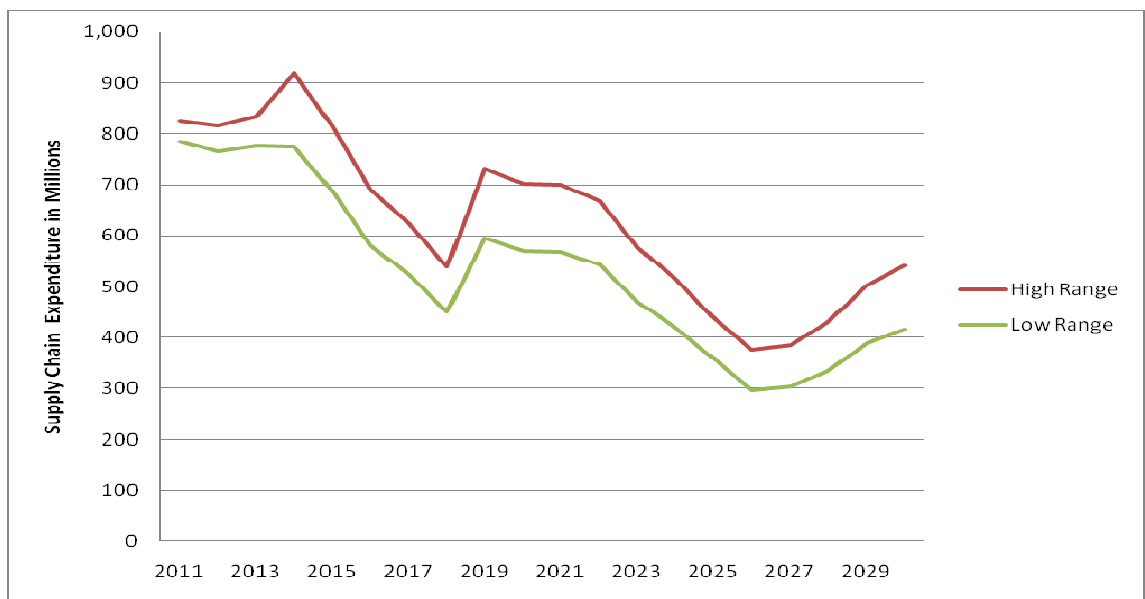


■ Figure 12: Key Plants and Projects 2010 – 2060 (Replicated from the Sellafeld Plan, 2011)



### 6.1.2. Supply Chain Spend

As contained within the Sellafield Plan (2011), a consequence of effective decommissioning is a reduction in manpower needs, both as direct workers and supply chain expenditure. This is demonstrated in the supply chain spend graphic included within the Sellafield Plan (2011), see Figure 13.



■ **Figure 13: Supply Chain Spend at Sellafield Limited (excluding materials and equipment, source: Sellafield Ltd)**

Of particular relevant is the workforce peak between 2014 and 2017 and again between 2019 and 2023 which relates to construction activity at the Sellafield. The first peak coincides with NuGeneration site preparation works with the second peak coinciding with construction activities.

Aside from direct supply chain implications, such as reduced revenue streams, local businesses will be impacted due to loss of in-county expenditure by those supply chain organisations. National firms may exit from the county and local firms may cease to exist unless they diversify their client base to outside of the nuclear sector or the county.

### 6.1.3. Sellafield Construction Activities

From the Sellafield Plan (2011) construction activities have been identified and summarised in this section.

Activity	Time period
<b>Combined Heat and Power Plant</b>	2015/16 - 2024/25
<b>LLW Metals Recycling and Treatment facility construction</b>	2012/13 – 2017/18
<b>Box Encapsulation Plant Product Store (BEPPS) 2</b>	2017/18
<b>BEPPS3</b>	2024/25
<b>Class II Decommissioning store</b>	2015/16 – 2022/23
<b>Decommissioning ILW Encapsulation Plant (DILWEP)</b>	2014/15 – 2024/25
<b>Medium Active (MA) Tanks Local Treatment Plant</b>	2018/19 – 2024/25
<b>Store 9 Export Facility</b>	2014/15 – 2018/19
<b>Engineered Drum Store 4</b>	2015/16 – 2023/24
<b>Vitrified Product Store (VPS)</b>	2022/23
<b>Sludge Storage Tanks ID2 (construction)</b>	2015/16 – 2023/24

Note: This excludes any activities where design/construction has already commenced.

#### ■ Table 11: Sellafield Construction Activities

### 6.1.4. Site Resident Strategy

Sellafield Ltd currently employs 10,200 people in Cumbria [Sellafield Ltd, 2011/CCC, 2011]; of these people the majority work on the Sellafield site itself with a small proportion of staff located at Westlakes Science Park and the Vertex in Whitehaven. It is understood that Sellafield Ltd intends to reduce its onsite staff numbers by re-locating staff that do not necessarily require being on the site itself to undertake their work requirements. Indicative figures are between 2000 and 3000 staff to be relocated, with the potential for them to be located in Whitehaven town centre (e.g. the Albion Square development) or to extend Sellafield's Westlake's presence through development of



a new office block. A further opportunity is to explore relocation of staff to Egremont, Cleator Moor or possibly Millom, creating welcome economic input into these areas [BECBC, 2011; / Whitehaven News], or to provide offices in Workington / Maryport.

#### **6.1.4.1. Physical and Non-physical Implications**

Relocation of staff would reduce peak hours transport requirements into the Sellafield site, but would increase transport needs into the chosen location. The West Cumbria Sites Stakeholders Group Chairman has called for an integrated transport study that would undertake a study into the potential impacts and the needs of such a relocation. This would be appropriate and could form part of a wider study that considers the transport needs of the County associated with new nuclear construction and decommissioning.

Relocation to one of the towns would bring welcome expenditure to local businesses from the relocated staff; the predicted increased footfall may enable positive conversations with high-street chains to open stores within the towns. This was experienced during the construction of THORP which resulted in the employment of up to 5,000 contractors on site and supporting a further 10,000 with suppliers and subcontractors off-site [www.sellafielddesites.com]. Increased transport through Egremont, prior to the Egremont by-pass, and the bulk accommodation being situated in the town brought a period of economic prosperity. [BECBC, 2011]

Any development scenarios associated with Sellafield staff relocation would need to consider an appropriate plan for the exiting of Sellafield in the area once its decommissioning mission has been fulfilled or when staff levels are reduced to a level that consolidation of its staff is required.

#### **6.1.5. Implications**

This section considers the physical and non-physical implications of Sellafield construction activities on West Cumbria in terms of labour force, transport, workers accommodation and spatial.

##### **6.1.5.1. Physical Implications**

The physical implications of advancement of the Sellafield Ltd programme will be primarily associated with the social needs of any temporary construction workforce for new facilities to aid decommissioning (e.g. encapsulated product stores), the transport associated with this workforce and the materials required to construct the facilities. Based on the contract baseline and the performance plan, these activities are likely to coincide with the anticipated construction period for new nuclear reactors adjacent to the Sellafield site. This will require close coordination between the two operators in terms of in-muster and out-muster, shift work patterns and effective transport to and from the site (e.g. public transport).



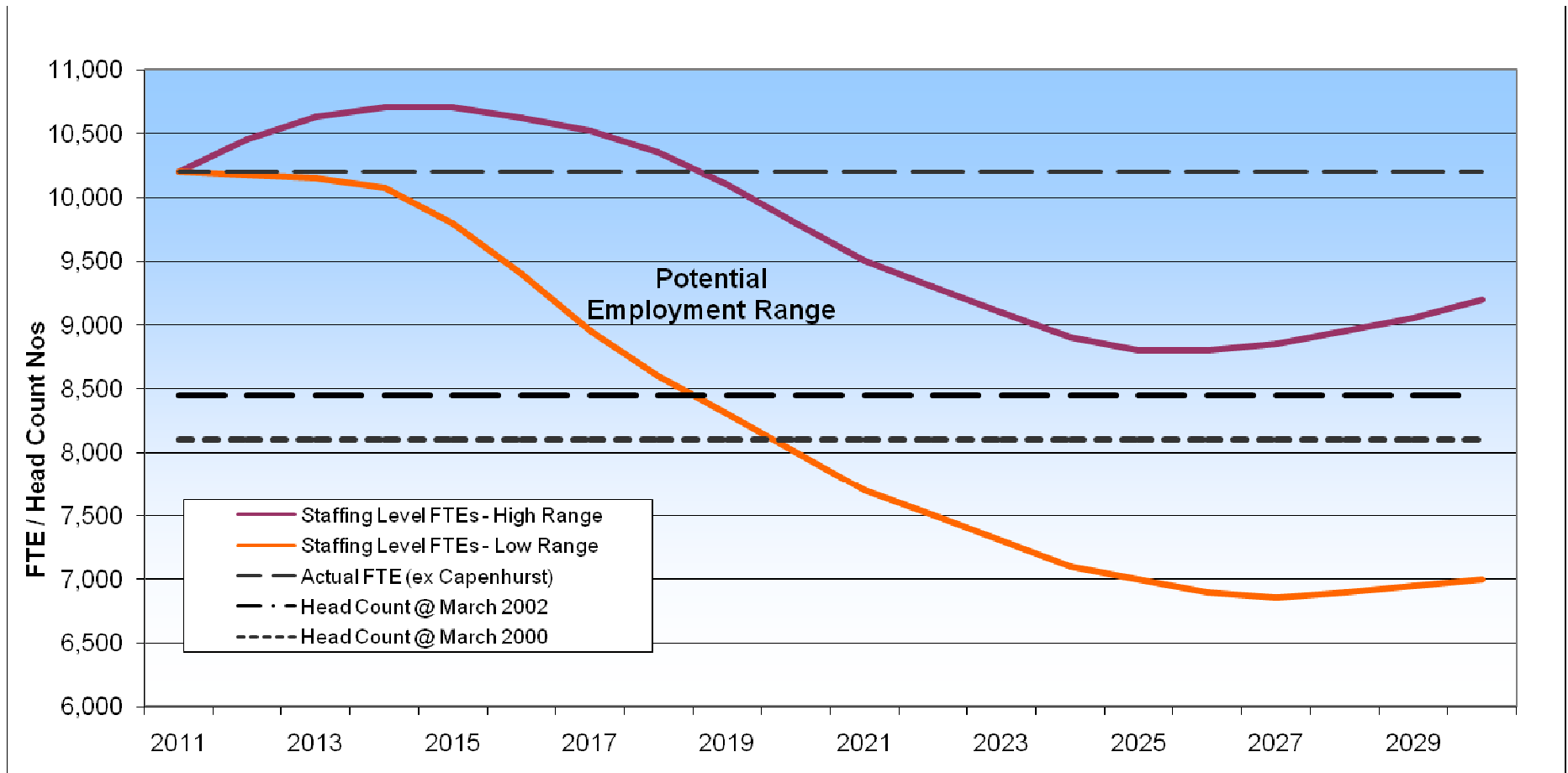


As discussed in Section 6.1.4, the site resident strategy would impact any area that residents are re-located to, both in terms of economic benefits through increased footfall during breaks and through increased transport requirements. Relocation could also positively impact transport needs during the peak construction period for decommissioning and the new nuclear build activities; a reduction in transports by personnel that are not required to work on the Sellafield site to fulfil their role would be beneficial.

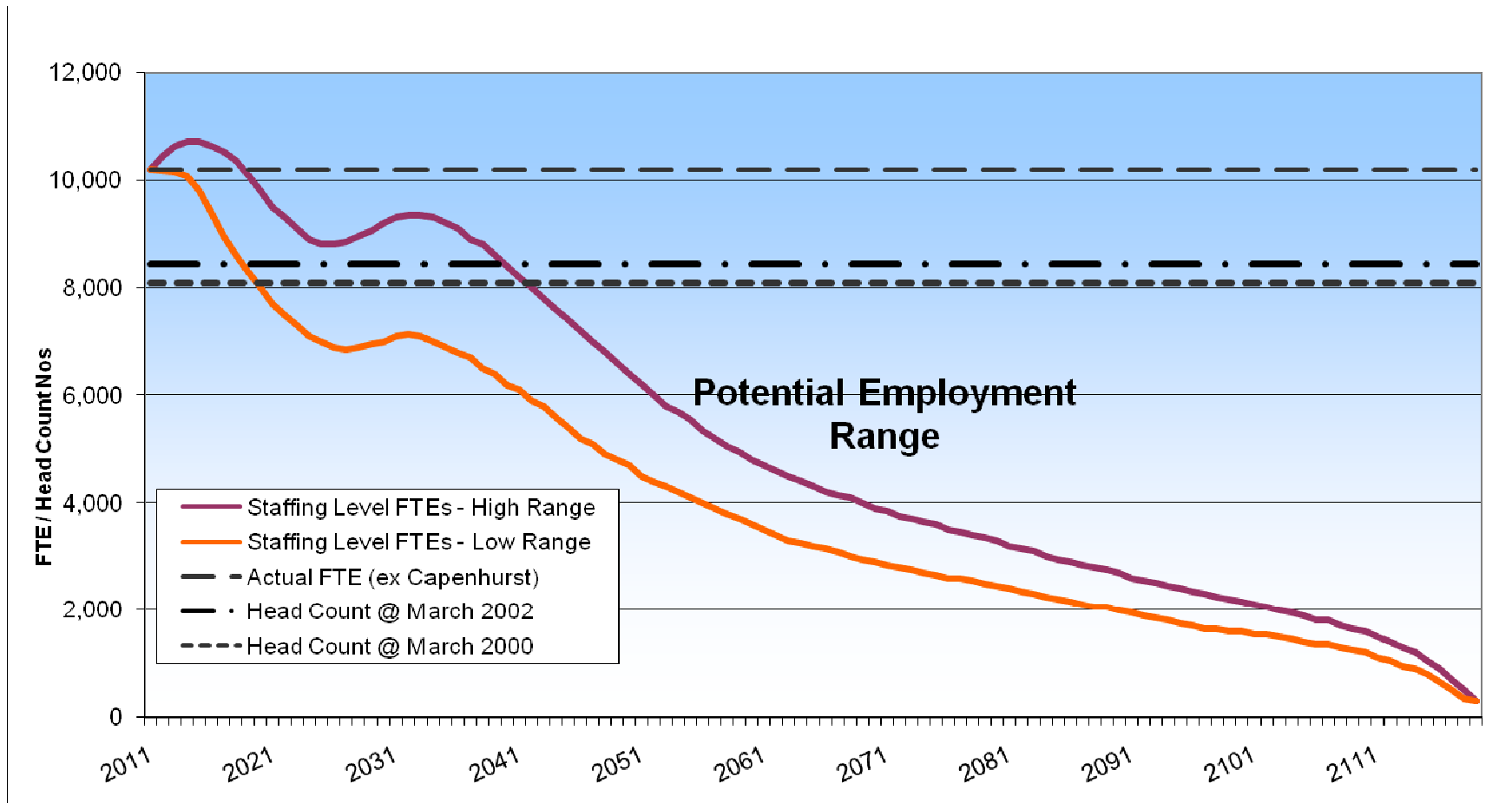
Due to the limited available space on the Sellafield site, there is a potential requirement for secure lay-down areas within West Cumbria. Again, should the current schedules for Sellafield Ltd and NuGeneration hold, there is the potential for competing needs for these secure areas.

#### **6.1.5.2. Non-Physical Implications**

Decommissioning of the Sellafield site will result in a steady decline in the level of FTE and supply chain expenditure, with peaks occurring at times of construction or major decommissioning activities. This is demonstrated in the 20-year projection of FTE requirements provided in Figure 14 and the whole-life projection in Figure 15 overleaf.



■ **Figure 14: 20-year FTE Profile Forecast for Sellafeld Ltd (excluding Capenhurst, including Sellafeld, Windscale and Risley) (Sellafeld, 2011)**



■ **Figure 15: Lifetime FTE Profile for Sellafield & Windscale (ex. Capenhurst) Aligned to Current & Historic Staffing Levels (Sellafield, 2011)**



In terms of supply chain expenditure, the impact of construction activities is noticeable with a peak in expenditure between 2018 and 2022,



■ **Figure 16: 20-year Projection in Subcontractor Expenditure at Sellafield Ltd (Sellafield, 2011)**



## **7. UK New Nuclear Programme**

### **7.1. Context**

Cumbria and those companies operating in the region have an active (leading) capability in the operation of nuclear power plant as well as in full fuel cycle facilities, nuclear plant decommissioning and nuclear waste management. As for the construction, maintenance and operational support, the UK industry as a whole can provide the complete design, manufacture, construction and operational support capability for nuclear power and fuel cycle facilities [NRDA, 2005].

Most of the principal UK contractors and engineering firms either have a presence in or have gained direct experience from the building, operation, maintenance and upgrading of nuclear plant and facilities in the Cumbria.

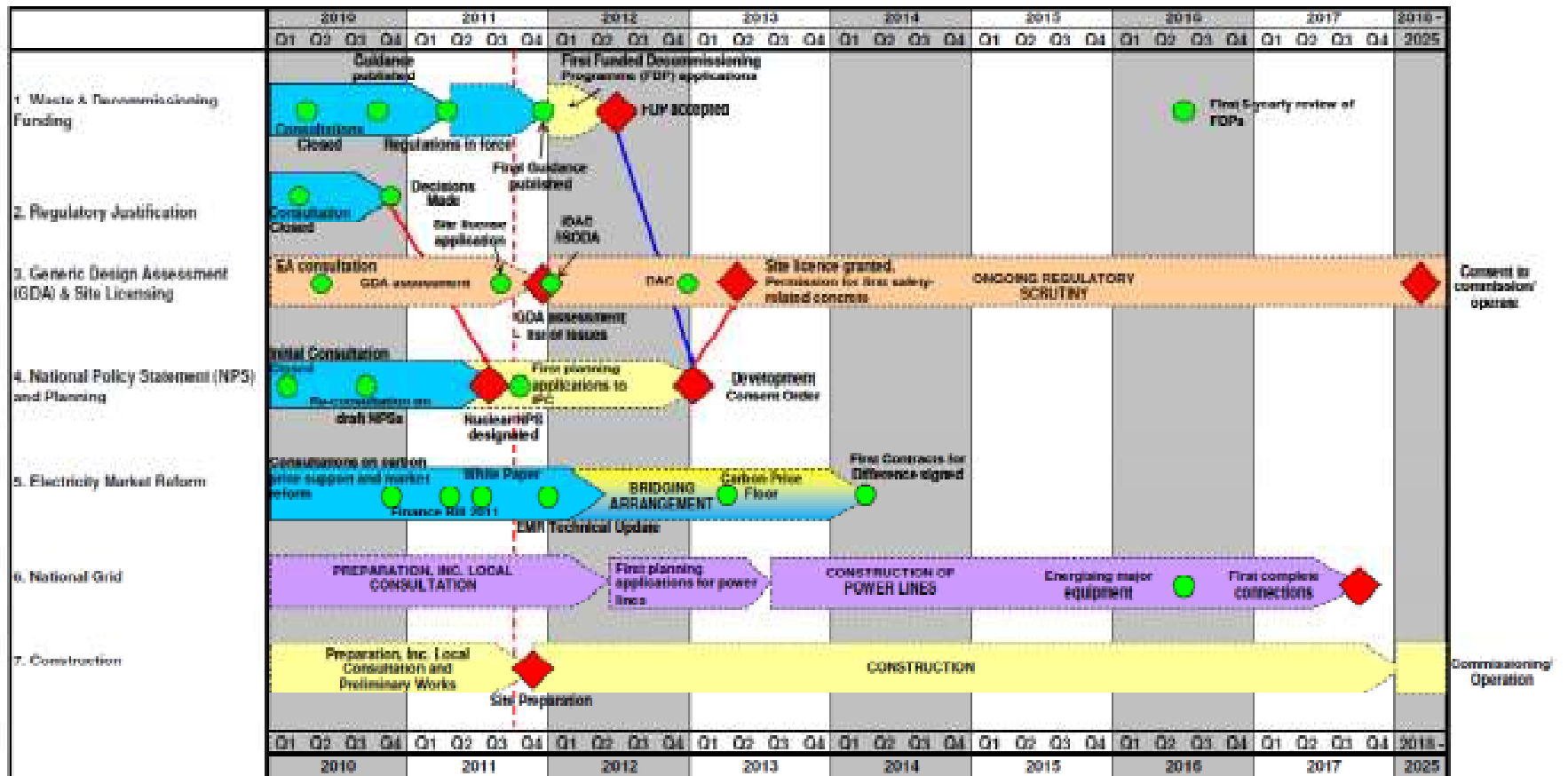
In terms of the wider context of new build the primary nuclear industry operators are supported by a wide variety of supply chain companies, such as engineering and construction contractors, fabricators of specialist equipment, manufacturers and specialist service providers. However, there is a recognition that some elements of the supply chain(s) for nuclear power plant and equipment in Cumbria has been eroded quite considerably over the past 15 years or so where decommissioning plans have reached new phases of decommissioning [Mott, 2007].

In addition to the constraints now becoming evident on the staffing profiles there are existing global supply chain issues, such as the availability and/or lead times of critical components, which could lead to delays in a UK nuclear new build programme in general and/or to cost escalation. These pressures will also exist for the proposed NuGeneration programme at Sellafield.

In addition, despite the events in Japan in March this year there does not appear to be any material reduction in global orders for new nuclear plant, which will stretch the supply chain still further, with significant programmes still expected in USA, Europe (excluding Germany), South Africa, Russia and the Middle East or ongoing in China.

### **7.2. Timescale**

In October 2011, the Department of Energy and Climate Change published an updated version of its indicative timeline for the first nuclear new build in the UK, which includes the actions the Government are taking. The timeline is focused on the first reactor to be commissioned, Hinkley Point C, NNB GenCo, and is replicated overleaf.



**INDICATIVE TIMELINE FOR NEW NUCLEAR**

**IMPORTANT**  
All timings are indicative only  
Current as of: 10th October 2011

National Grid Operators
  Government Regulators
  Milestone
  Key Goals

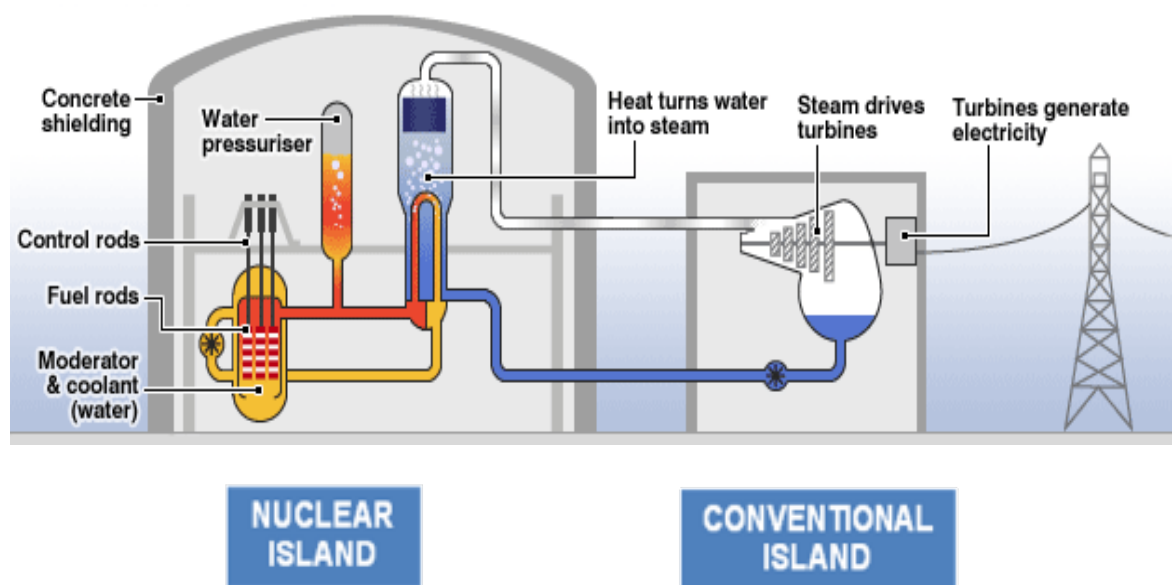
■ Figure 17: Indicative Timeline for New Nuclear (First Reactor)

### 7.3. Reactor Technology Choice

This section outlines the key differences and their implication on development strategy for NuGen which will result in different investment scenarios.

#### 7.3.1. Areva EPR

A simple schematic of a Pressurised Water Reactor (PWR) is shown below in Figure 18 and a schematic of the AREVA EPR is shown in Figure 19.



■ Figure 18: Schematic of PWR (Source: Areva)



■ Figure 19: Standardised EPR Site Layout (Source: NNB GenCo)





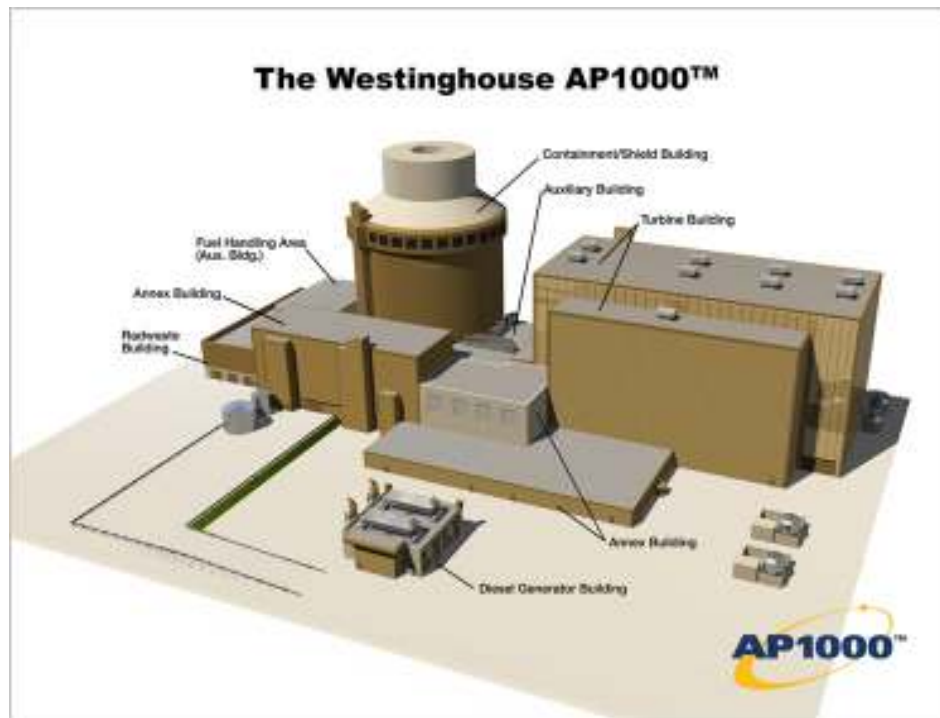
### 7.3.2. Westinghouse AP1000

The AP1000 is a two-loop, 1000 MWe pressurised water reactor (PWR) with passive safety features and extensive plant simplifications that enhance the construction, operation, maintenance and safety. The AP1000 design is derived directly from the AP600, a two-loop, 600 MWe PWR, including the passive safety model. The modular format of the AP1000 is a defining feature of this reactor design, see Table 12, and will impact the infrastructure investment required in Cumbria should this technology be chosen by NuGen.

	Structural Modules	Piping Modules	Mechanical Modules	Total
Containment	41	20	12	73
Auxiliary Building	42	34	29	105
Turbine Building	29	45	14	88
Annex Building	10			
<b>Total</b>	<b>122</b>	<b>99</b>	<b>55</b>	<b>279</b>

■ **Table 12: Typical Breakdown of AP1000 Modules**

As with Areva, Westinghouse have offered both simplified schematics and elevations of plant listed in the modules above.



■ **Figure 20: Westinghouse AP1000 (Source: Westinghouse)**

Westinghouse is also at pains to point out the “Localisation Drivers and Benefit” that focus on:

- Using existing local workforces and supporting technical skills
- Inclusion in the global industries
- Extending existing “indigenous” manufacturing capabilities
- Effective economic development, simplified logistics and management, Scheduling and Control

However, in the Westinghouse context ‘localisation’ is likely to refer to the UK in a global market, rather than Cumbria in the UK market.



### **7.3.3. Generic New Build Requirements**

As indicated, the infrastructure investments required for new nuclear build will be dependent on the choice of reactor technology; however, there are common elements of a new build programme which are detailed below:

#### **7.3.3.1. Phasing**

The construction and operation of a new build project is split into four elements:

- Pre-Build (Design)
- Construction
- Operation, and
- Decommissioning

The main sub elements which will overlap in the overall programme are:

- Planning & licensing;
- Up-front' services – infrastructure, professional services (legal, insurance, finance, etc.);
- Engineering and design services;
- (Nuclear) consultancy services;
- Project management;
- Civil construction ('civils');
- On-site erection/fabrication ('mechanicals');
- Nuclear island plant and equipment (e.g., reactor pressure vessel, steam generators, heavy forgings, pressure pipework, pumps, valves, etc.);
- Non-nuclear island plant and equipment (e.g., steam turbines, generators, switch gear, transformers, etc.);
- Balance of Plant (BoP);
- Nuclear fuel supply;
- Plant commissioning;
- Plant operation;
- Nuclear waste management and disposal (and/or recycling); and
- Plant decommissioning;



### **7.3.3.2. Associated Development**

As well as the power station itself there will be significant additional requirements for associated development. These will be broadly focused on the logistics of the build programme itself and would expect to focus on issues surrounding:

- Workers accommodation – proposals for workers campuses and existing housing accommodation near the site
- The transport network including
  - Enhancements of existing port facilities to support significant freight handling
  - Park and Ride Facilities
  - Road improvements and other road works including potential bypasses
  - Enhancements in the rail network

### **7.3.3.3. Constraints**

Westinghouse and Areva have identified the following constraints that would require to be addressed locally with Cumbria no less impacted, including:

- Raw material supply
  - Extended lead times
  - Price fluctuations
- Sub-component supply (i.e. forgings, subsystems, tubing)
  - Capacity constraints
  - High cost to increase capacity
  - Long lead-time for capacity expansion
- Lack of specialized manufacturing workforce & equipment/machinery
  - Translating orders into factory instruction for Procurement, Manufacturing and QA Procedures
  - No or limited capacity
  - Long lead-time to process equipment/ramp-up production
- Limited Nuclear Grade Suppliers
  - Certification has lapsed
  - Loss of “nuclear grade” discipline



#### 7.4. Supply Chain Management

Delivery arrangements to be employed by NuGen have yet to be publicised although they are currently developing a **Technology Choice Strategy**<sup>6</sup> document which will include information around procurement strategies / principals. Iberdrola in particular has a major in-house Architect Engineering subsidiary. It is possible that they could employ the model being used by EDF Energy (using a Tiered Approach of Suppliers) and use their own Architect Engineering companies to procure major packages of work under contract to the Licensee. However this model has not been made public as yet and we therefore have to assume that NuGen will adopt any one of three models including:

- a) To procure the Architect Engineer through one of their subsidiary companies
- b) To procure the services of an Architect Engineer through an external company to manage the delivery and construction on their behalf
- c) To procure the plant on a turnkey engineering, procurement, construction (EPC) basis from the technology providers

The Regulator will expect NuGen to have adequate arrangements to act as “intelligent customer” for the products and services being procured, to have arrangements to control the procurement process and to maintain oversight of the work carried out by the supply chain.

The main elements of the nuclear new build supply chain are shown in Figure 21 overleaf:

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<sup>6</sup> Meeting with NuGen Project Developer Tom Cassells on 26 June 2011



■ **Figure 21: Main Elements of New Build Supply Chain**



#### **7.4.1. NNB GenCo Supply Chain Model**

NNB GenCo is the most advanced of the UK new nuclear providers in their procurement and development programme. Procurement is overseen by NNB GenCo from their London HQ, with the procurement being managed by EdFs office in Paris.

The NNB GenCo model is to deliver the reactor through a range of main contracts let to national Tier 1 companies; the conventional nuclear sector supply chain will be engaged via this route. In conjunction with the Somerset Chamber of Commerce and Industry, EdF Energy has set-up a specific Somerset Supply Chain, including a specific microsite<sup>7</sup>, to encourage contracts to be let to local organisations, or for national organisations to set-up offices within Somerset. Encouragement is made to relocate to Somerset with EdF providing advice and knowledge on how to do so.

Main contractors are being encouraged to consider local businesses as part of their supply chain. Although not sighted, it is not uncommon for socio-economic assessments to be made as part of the supply chain tender assessment process such as location of employees or proposed project team or through carbon footprinting. This is demonstrated by Sellafield Limited's and LLWR's socio-economic commitments (see Section 5.2.2)

#### **7.4.2. Horizon Nuclear Power Supply Chain Model**

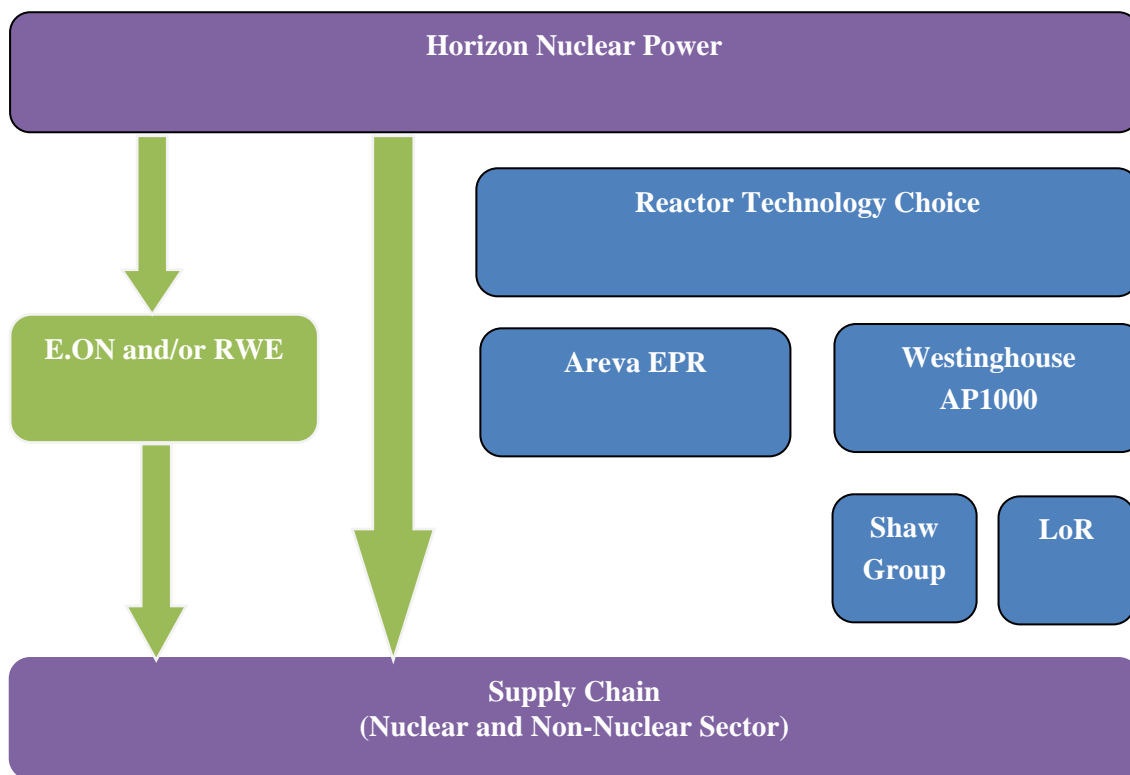
Horizon Nuclear Power (HNP) is in a similar position to NuGen in that the reactor technology decision is yet to be made. As with NuGen this is a straight choice between the Areva EPR and the Westinghouse AP1000.

Each reactor technology has a defined Nuclear Project Delivery team; those contract organisations will have a supply chain to enable implementation of its programme elements. For the Westinghouse the nuclear project delivery team is Shaw group and Laing O'Rourke (LoR). The delivery organisations will be contracted under an Engineering, Construction and Procurement (EPC) arrangement. This differs to the NNB GenCo approach deployed.

HNP will be required to undertake pre-construction works such as environmental permitting and site characterisation. This work will be directly and indirectly tendered providing opportunities for UK-wide and local contractors and consultants.

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<sup>7</sup> <http://www.hinkleysupplychain.co.uk>



Green shading represents pre-construction works, work packages (e.g. environmental permitting) or independent assessment services. Blue shading indicates the EPC supply chain.

■ **Figure 22: HNP Supply Chain Model**

### 7.5. Implications of Reactor Technology Choice on Cumbria

The choice between the Westinghouse AP1000 and the Areva EPR will have an impact on the investment need in Cumbria.

The AREVA EPR is primarily manufactured outside of the UK and is a holistic purchase in that all training, the reactor simulator and the components are part of the purchase.

The Westinghouse AP1000 is based on manufacturing within the UK and offers the potential for simulator providers and training to be provided from or via UK organisations.

There is variation in the workforce level required to construct the 2-off EPRs or the 3-off AP1000 units.



## 8. Comparative Work Programmes

While the precise details of the development programme have still to be published for NuGen, it is possible to provide some context to the sorts of programmes that might conceivably be applied at the Sellafield site.

Comparison of current new nuclear build EPRs and AP1000's have been undertaken by a number of organisations; these studies have tended to focus primarily on construction lessons learnt such as the Engineering the Future study [ETF, 2010]. Studies on the skills requirements and therefore the potential skill gaps have been completed by Cogent, with specific papers produced for the South-west [Cogent, 2010] and also in known skill gap areas such as power engineering [Cogent, 2009].

Three reviews of new nuclear plants that have either commenced construction or is currently subject to a regulator application assessment process. The three nuclear plants reviewed and the reasoning for doing so is detailed below:

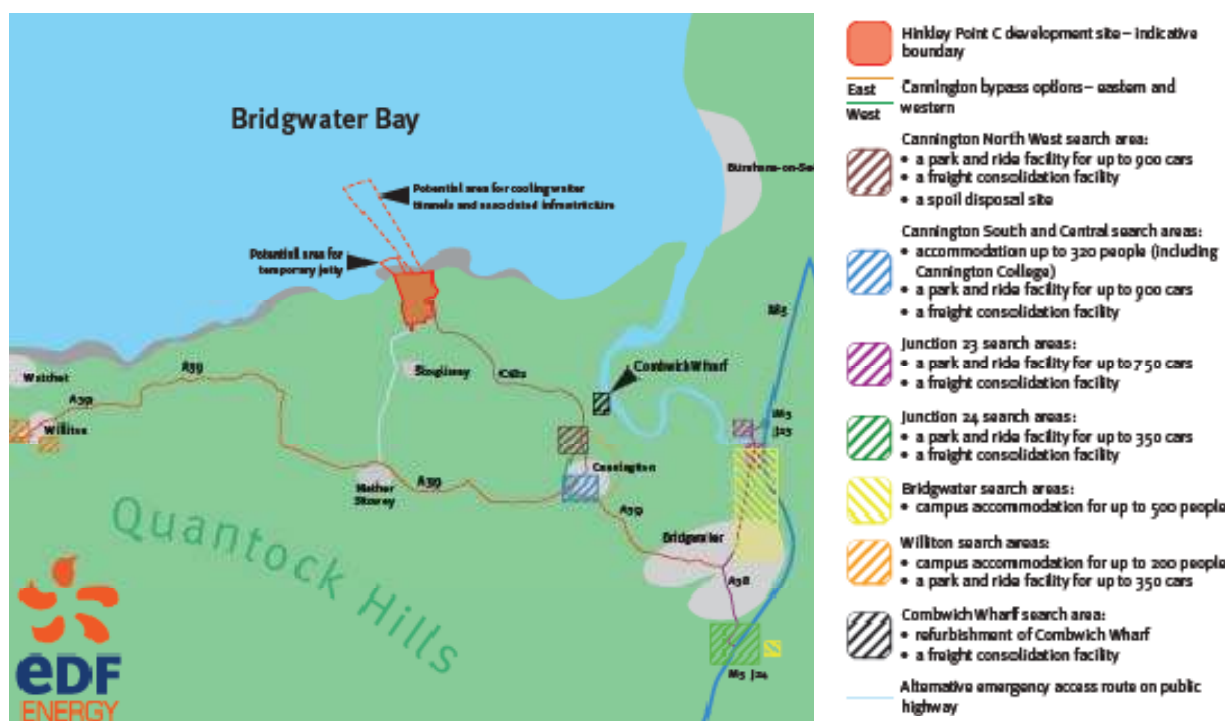
Site	Country	Reactor Technology	Reasoning
Hinkley Point C	UK	AREVA EPR	Design based on Flamanville units under construction. Permits and consent applications advanced in terms of UK programme enabling review of infrastructure requirements that may be applicable to Cumbria scenario.
Virgil.C. Summer	USA	AP-1000	Application for licensing submitted to the NRC with significant level of detail in 2011. Additional units to an additional site which differs to Cumbria scenario. Cooling provided by a reservoir.
Levy Nuclear Plant	USA	AP-1000	Application for licensing submitted to NRC in 2008. New nuclear site requiring all infrastructure to be installed. Located on the Florida coast in the Gulf of Mexico.

■ **Table 13: Comparative New Nuclear Plants**



### 8.1. Hinkley Point C, NNB GenCo

The first comparative example presented is the programme for the EDF site submitted by NNB GenCo for 2-off 1600MW EPR's at its new build plot at Hinkley. The Hinkley reactor design is based on the current construction of Flamanville on the north coast of France. The Hinkley Point C (HPC) site is located next to Hinkley Point B, operated by EDF Energy, and the Hinkley Point A site that is being decommissioned by Magnox. These sites are located in Bridgwater Bay in North Somerset as depicted in Figure 23, which also details infrastructure investments associated with the HPC site.



■ Figure 23: NNB GenCo Hinkley Point C Site (Source EDF)

The base information for this comparison is the NNB GenCo permit and consents applications and its Stage 2 consultation documentation that, following final revision, will have supported the Development Consent Order (DCO) provided to the IPC in October 2011. This information has been supplemented by insights provided in a meeting with ConstructEnergy<sup>8</sup> into the process of construction at Hinkley Point C on workforce, accommodation, employment, logistics and transport.

<sup>8</sup> Meeting held between ConstructEnergy and Copeland Borough Council – note ConstructEnergy is a consortium of four major construction organisations – Costain, Sir Robert McAlpine, Hochtief and Heitkamp



### **8.1.1. Overview of Construction**

As with NuGen, NNB GenCo has assumed a 5 year construction period from first concrete. However they also estimate the overall construction programme, including preliminary works, will take around ten years. In that period they expect that the number of people working on the site to peak at around 4,000 although a contingency has been added and assumed that the maximum number could be 4,800.

There are five key permanent components identified for the project:

- Main station buildings including the reactor buildings, fuel building, nuclear auxiliary building, turbine halls and ancillary buildings
- Supporting infrastructure including cooling water tunnels and pump houses, fuel and waste management facilities, overhead lines to a new on-site electricity sub-station, staff facilities, administration and stores
- A public information centre to provide educational and visitor facilities
- Access from the main Hinkley Point road and on-site parking
- A secondary emergency access road to the power station.

In addition to these principal components on-site associated development comprises:

- all infrastructure and facilities needed to support the operation of the nuclear power station including offices, workshops, storage buildings and transport infrastructure and car parks;
- a sea wall along the frontage of the site for coastal protection;
- interim spent fuel storage facilities;
- interim radioactive waste storage facilities;
- cooling water tunnels (two intake and one outfall) and associated infrastructure;
- construction areas and facilities including a Temporary Aggregates Jetty (the jetty) for bulk aggregate delivery;
- temporary accommodation for construction workers;
- spoil disposal/landscape integration; and
- transmission infrastructure from the generating station to a proposed National Grid sub-station.

National Grid will be responsible for providing overhead power lines to connect the new on-site sub-station to transmission lines near Hinkley Point.



### **8.1.2. Associated Development**

A package of off-site developments will also be a significant part of the overall development programme, the most significant of which will be the accommodation of workers near to site. The off-site associated development comprises:

- a bypass around the village of Cannington;
- accommodation facilities for construction workers (campuses);
- park and ride facilities;
- freight consolidation/storage facilities;
- refurbishment of Combwich Wharf and a heavy loads berthing facility;
- temporary laydown and storage facilities on land adjacent to Combwich Wharf;
- road improvements; and
- spoil disposal/landscape integration.

### **8.1.3. Transport Requirements**

This section draws on the Stage 2 Consultation Documentation prepared and consulted on by NNB Genco, namely:

- Hinkley Point C, Proposed Nuclear Development, Pre-Application Consultation, Stage 2A, Consultation: Update on and Proposed Changes to 'Preferred Proposals', February 2011, Revision 3.
- Draft Freight Management Strategy, February 2011

#### **8.1.3.1. Vehicle Movements**

Maximum vehicle movements per month are those for July 2014 where the following numbers are envisaged:

- Concrete aggregate – approx 1600
- Concrete cement – approx 200
- Concrete GGBS (Ground Granulated Blast furnace Slag) – approx 400
- Concrete sand – approx 1400
- Reinforced steel – approx 280



### **8.1.3.2. Managing Traffic Flows**

Materials deliveries will be made using the jetty and other delivery routes to minimise road transport. Where no alternative to road, material logistics tool will be used to control routes, timings, vehicle speed etc. One way system for deliveries will also be explored.

The proposal will also include four park and ride sites to reduce the number of cars travelling on the local roads to and from the Hinkley Point site. Consequently the movement of project workers using these facilities combined with project accommodation close to the site will be used to minimise road transport. Works will be planned so that workers are not on the road at peak times.

### **8.1.3.3. Temporary Jetty**

The relevant permit applications have been made by NNB GenCo to compulsorily purchase land and then construct a temporary jetty to west of the existing Hinkley Point Power Stations. The strategic intent of the jetty is to provide an effective route for delivery of bulk construction materials (principally stone, sand and cement) to the construction site and minimise HGV construction traffic on local roads [NNB GenCo, 2010].

### **8.1.4. Accommodation during Construction**

The initial proposals for accommodating workers during the construction period are:

- A 700-bed temporary campus and other amenities (restaurants, leisure facilities etc) at Hinkley Point C.
- A 200-bed campus and amenities near Cannington to the south of the village and adjacent to the A39. This could be either a temporary or permanent facility if a longerterm use for the buildings can be found
- Accommodation at Cannington College – for up to 120 workers
- Accommodation near Williton on the A39 for up to 200 workers, with the potential for long term residential use
- Accommodation in Bridgwater for up to 500 workers, with the potential for subsequent use as a hotel
- Existing owner-occupied and privately rented accommodation, including guesthouses and caravan parks

The non-local workforce would look to temporarily reside in a range of accommodation types (typical % split in brackets/campus), all as close to the site as possible (max 40 minutes away)

- Rented houses / apartments (35%)
- Hotels (5%)



- Caravans (15%)
- NNB GenCo supplied hostels / campuses (45% - subject to the NNB GenCo supplied campuses being of a decent quality and available at an affordable rate.

#### **8.1.5. Location of Workers**

The assumptions made by ConstructEnergy are that the:

- Split of local/non-local workers for the main civils contract will be circa 50%/50%. However they would find it difficult to support 'conditioned' targets with respect to this ratio. Their logic being that as a commercial company they must be commercially free to appoint the most appropriate organisations to deliver best value to NNB throughout all stages of the contract.
- With respect to defining local (home-based) and non-local (non home based) workers it is anticipated that local workers will be those returning home on a daily basis. This is likely to be bounded by a maximum travelling time of circa 90 minutes in either direction inclusive of the time required for park and ride transfer into the site.
- It is expected that non-local workers will seek to find accommodation in and around the surrounding area. Workers will be expected to make their own bookings. These workers will use a mixture of cars, car shares with a smaller percentage of the workforce using public transport.
- It is proposed that ConstructEnergy would provide minibuses and coaches to transport those living near the limit in centres of population.
- A local shuttle bus will be made available for those living near the site. This will stop at every village centre or junction.

#### **8.1.6. Shift Patterns**

In order to achieve the sectional completion a number of different shift patterns are proposed. The maximum workforce across all shifts is approximately 2250 in November 2014. Levels above 1000 are evident for 3 years from January 2013. The work would be planned for different buildings in one of 3 shifts:

- Single 10 hour shift Monday to Friday (05:00h-15:00h)
- Two 10 hour shifts Monday to Friday (05:00h-15:00h, 14:30h-00:30h)
- 24 hour shifts Monday to Friday (05:00h-15:00h, 14:30h-00:30h, 11:00h-07:00h)



The volumes of worker traffic during each of these shifts would be expected to include:

- Shift 1 (assumed to be 05:00-15:00h) shows range from approx 100 to 1000+ workers over the lifetime of the project. Jan 2014 to March 2015 is most intensive period with 800+ workers on site.
- Shift 2 (assumed to be 14:00-00:30h) shows a similar range. Starts in July 2012 with approx 250 workers increasing to maximum of 900+ in September 2014.
- Shift 3 (assumed to be 11:00-07:00) is more consistent. Starts Jan 2013 approx 75 workers. Increases to approx 160 workers from June 2013. July 2014 to March 2015 is most intensive period with between 230 to 300+ workers on site.

### **8.1.7. Materials**

The bulk of materials comprise concrete (aggregate, sand, GGBS and cement), reinforced steel and structural steel. Based on ConstructEnergy's current proposals the following modes of main deliveries are anticipated:

#### Delivery via Temporary Jetty

- Cement – 100% by sea to Hinkley Point (road options available as back up)
- Aggregates for concrete – 100% by sea to Hinkley Point. If local quarries are used aggregates will be delivered to Avonmouth by road and rail where they will be transferred onto barges for delivery by sea
- Sand for concrete – 100% by sea to Hinkley Point
- Steel based products – circa 90% by sea to Combwich Wharf with final delivery by road or 90% by sea to Hinkley Point (subject to alternative Marine Off Loading Facility being adopted). Circa 10% by road to include embedded parts.

#### Delivery by Road

- Items of temporary works & consumables i.e. shuttering materials, scaffolding and consumables from the consolidation centre – 100% by road albeit in consolidated loads.



## **8.2. Virgil C. Summer (AP1000, 2-units), SCE&G**

### **8.2.1. Context and Location**

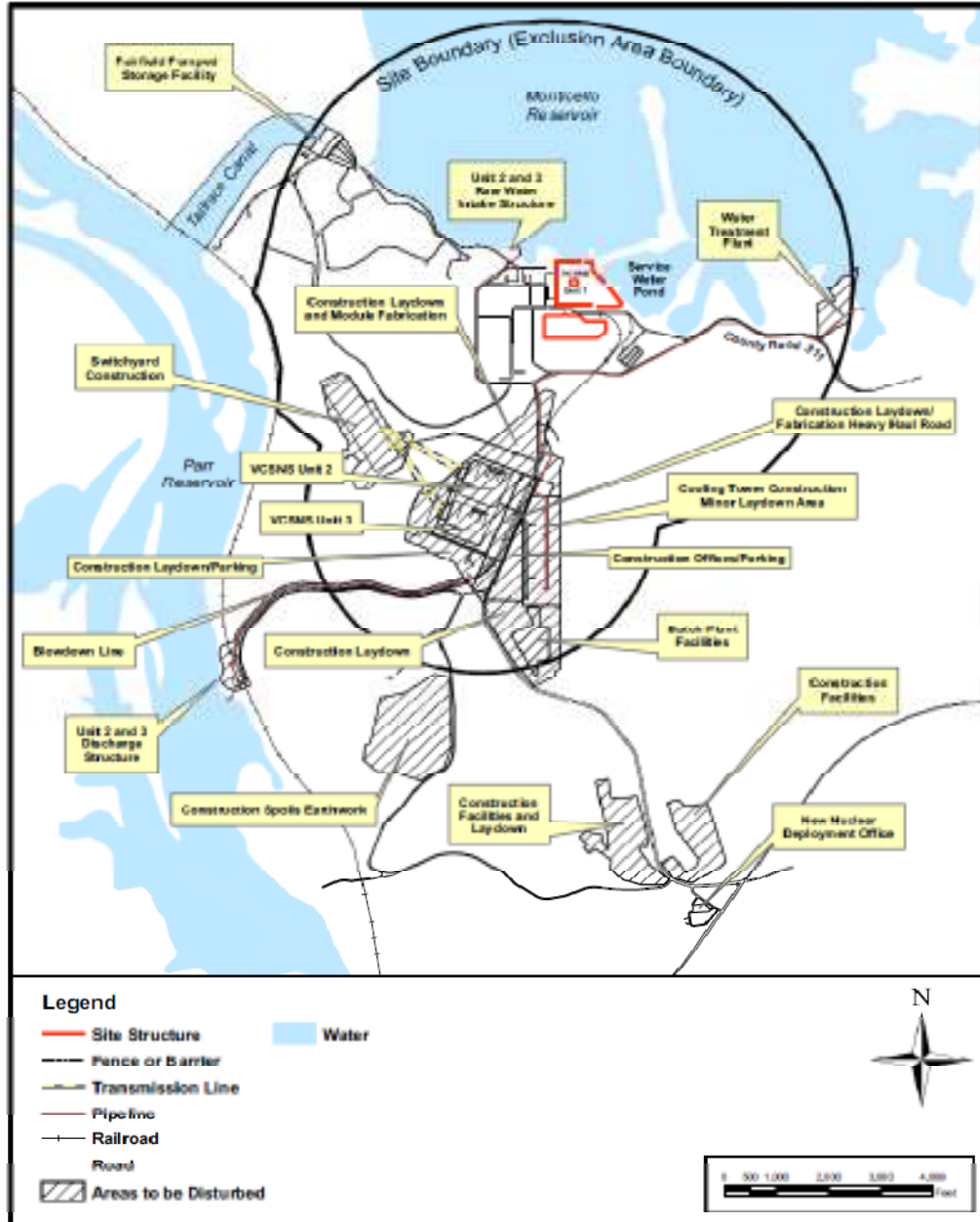
South Carolina Electricity and Gas (SCE&G) proposes to construct and operate two Westinghouse AP1000 reactors at the Virgil C. Summer Nuclear Site (VCSNS) site in Fairfield County, South Carolina. These two reactors will be an extension of nuclear generating capacity at the site. The basis of information for this comparison is the SCE&G submission to the US Nuclear Regulatory Commission (NRC) for its combined licence (COL) application [SCE&G, 2010]. An assessment of SCE&G's Environment Report by the US Army Corps of Engineers (USACE) has been completed and has recommended to the Commission that a permit be issued [USACE, 2011].

The VCSNS site is on the east side of the Broad River with the existing Unit's power block area (generating facilities and switchyard) situated on the south shore of the Monticello Reservoir and is overleaf in Figure 24.

The VCSNS site's closest major town (i.e., having more than 25,000 residents) is Columbia, South Carolina, approximately 15 miles southeast of the VCSNS site, with the closest community being Jenkinsville, approximately 3 miles southeast of the site.

Road access to the site is via a County Road 311, which intersects with a State Route approximately 1.5 miles east of Unit 1, with rail access via a railroad spur off of the Norfolk Southern Transportation track from Columbia.





■ Figure 24: VCSNS Site Plan (South Carolina Electric & Gas, COL Application, Part 3 – Environmental Report)



### 8.2.2. Plant Layout

Each AP1000 unit consists of five principle generation structures:

- Nuclear island (Power base)
  - Structures that make up the nuclear island include the containment, shield building, and auxiliary building. The containment is a freestanding steel containment vessel with elliptical upper and lower heads. It is surrounded by the shield building. The shield building is a structure that, in conjunction with the internal structures of the containment, provides the required shielding for the reactor coolant system and other radioactive systems and components housed in the containment. The shield building roof is a reinforced concrete conical structure. The auxiliary building is a reinforced concrete structure and shares a common basemat with the containment and the shield building. The auxiliary building wraps around approximately 70% of the circumference of the shield building and provides protection and separation for the safety-related mechanical and electrical equipment located outside the containment.
- Turbine building
  - The turbine building is a rectangular metal-sided building with its long axis oriented radially from the containment. The turbine building houses the turbine, generator, and associated mechanical and electrical systems.
- Annex building
  - The annex building is a combination reinforced concrete structure and steel framed structure with insulated metal siding. The annex building provides the main personnel entrance to the power block. The building also contains the control support area, a machine shop, the ancillary diesel generators, other electrical equipment and various heating, ventilation, and air conditioning systems.
- Diesel generator building
  - The diesel generator building is a single-story steel-framed structure with insulated metal siding. The building houses two diesel generators to provide backup power in the event of disruption of the normal power source.
- Radwaste building.
  - The radwaste building is a steel-framed structure. The radwaste building houses low-level liquid radwaste holdup tanks and processing system.

Two mechanical draft cooling towers and a circulating water pump intake structure are required as part of the cooling water system. The cooling towers would be approximately 70 feet high and require an area of approximately 38 acres for the four towers and their supporting facilities. In addition, the units would require space for service water system cooling towers (one per unit).



These mechanical draft cooling towers would require an area of approximately 0.5 acre per unit and would be located near the turbine building.

The proposed new units would share common intake structures, discharge structure, and certain support structures such as office buildings, water treatment, and waste handling facilities.

The existing Nuclear Learning Centre would be expanded to support the training needs for the new units. A new Technical Support Centre will be constructed and used for emergency response for the existing unit and Units 2 and 3. Existing administrative buildings, warehouses, and other support facilities would be used.

### **8.2.3. Construction Timescale**

SCE&G proposed a phased construction schedule for the two units with site preparation for the two units being undertaken in parallel. The schedule assumes a 30-month duration for site preparation activities including placement of the power block (nuclear island) concrete foundations with major power plant construction activities following issue of the COL by the NRC.

SCE&G has estimated the duration of sequential construction of the two new units to be approximately eight years; this covers the period between issue of the COL to commercial operation of Unit 3. The sequence of activities from commodity installation to commercial operation will be:

- 1) Civil completion of structure
- 2) Installation of mechanical and electrical equipment
- 3) Installation of piping and electrical commodities
- 4) Completion of the mechanical, piping, and electrical systems in each structure
- 5) Component testing, circuit and loop testing, flush and hydrotesting, system testing
- 6) Functional testing and integrated leak testing
- 7) Fuel load and power ascension testing
- 8) Commercial operation

Construction of Unit 2 would begin in 2011 and would be completed in 2015. Construction of Unit 3 would begin in 2011 and would be completed in 2018. Unit 2 would become operational in 2016 and Unit 3 in 2019.



### **8.2.3.1. Pre-Construction Activities**

As detailed above, SCE&G proposes a 30-month site preparation period prior to Unit 2 major construction. The activities undertaken in this period are detailed below, with a detailed description where relevant to the focus of this report:

#### ***Installation and Establishment of Environmental Controls, duration: 4 months***

#### ***Road and Rail Construction, duration: 9 months***

A new main access road would be built to the construction laydown/fabrication area and cooling tower area of the new plants. An existing access road will be upgraded and used as a construction access route from the State Road to minimise disruption of traffic to the existing operating unit.

A heavy haul route will be built to support transport of heavy modules and components from the construction laydown and fabrication areas to the construction site. A site perimeter road system will be installed around the new units. An access road approximately 1 ½ miles long from the Units 2 and 3 cooling tower area to an intake structure at the Monticello Reservoir will be built and will replace sections of the existing road to support delivery of material to the intake construction site, water treatment building, and to service the underground circulating water makeup lines routed adjacent to this road.

The existing rail line will be rerouted through a construction fabrication and laydown area between the new units and the cooling towers, and supplemented with an additional rail spur. SCE&G are considering whether a spur may also be routed into the unloading areas at the concrete batch plant. Upgrades to the existing rail line to facilitate the heaviest loads has not been ruled out and could include installing new ballast or rail sections on the existing rail bed.

Temporary construction parking lot areas will be generated.

#### ***Security Construction, duration: 3 months***

#### ***Temporary Utilities, duration: 6 months***

Temporary utilities will include aboveground and underground infrastructure for power, communications, potable water, wastewater and waste treatment facilities, fire protection, and for construction gas and air systems. The temporary utilities will support the entire construction site and associated activities, including construction



offices, warehouses, storage and laydown areas, fabrication and maintenance shops, the power block, the batch plant facility, and intake/discharge areas.

***Temporary Construction Facilities, duration: 9 months***

Temporary construction facilities including offices, warehouses, sanitary toilet, craft change, training, and personnel access facilities will be constructed. The site of the concrete batch plant will be prepared for aggregate unloading and storage, and the cement storage silos and the batch plant will be erected.

***Laydown, Fabrication, Shop Area Preparation, duration: 5 months***

Activities will include installation shop and fabrication areas including the concrete slabs for formwork laydown, module assembly, equipment parking and maintenance, fuel and lubricant storage and installation of concrete pads for cranes and crane assembly.

***Underground Installations, duration: 8 months***

Concurrent with the power block earthworks, the initial non safety-related underground fire protection, water supply, sanitary and gas piping, and electrical power and lighting duct bank would be installed and backfilled. These installations will continue as backfill operations occur.

***Unloading Facilities Installation, duration: 9 months***

Additional rail spurs may be constructed into the batch plant area to support concrete materials unloading, into the fabrication area to support the AP1000 components and modules, and into the construction laydown areas to support receipt of the bulk commodities. Any necessary crane foundations will be placed, and a heavy lift crane will be erected.

***Intake/Discharge Cofferdams and Piling Installation, Duration: 5 months***

***Power Block Earthwork (Excavation), Duration: 6 months***

The power block consists of an area footprint encompassing the nuclear and turbine island building areas, which include the containment, shield building, auxiliary building, annex building, radwaste building, diesel generator building, and turbine building. The excavation of the power block areas will occur as part of site preparation activities for both units. The deepest excavations in the power block area are for the reactor and auxiliary building foundations to approximately 40 feet below plant grade.



***Power Block Earthwork (Backfill), Duration: 5 months***

The installation of nonsafety-related backfill to support nonsafety-related structures or systems will occur as part of the site preparation activities.

***Module Assembly, Duration: 15 months***

The AP1000 design calls for a high degree of modularisation. The steel module components in the nuclear island will be fabricated offsite, shipped to site via rail or truck, and be assembled into complete modules before being set in the power block. The rail module component shipments will arrive in sections with dimensions up to 12 feet (H) x 12 feet (W) x 80 feet (L), weighing up to 80 tons, and be offloaded in fabrication assembly areas. The assembly of the component panels into complete modules on site will begin during the site preparation phase. The setting of completed modules will occur upon receipt of the COL. The completion of early module assembly is planned to coincide with the completion of Unit 2 nuclear island containment base mat foundation.

***Nuclear Island Base Mat Foundations, Duration: 5 months***

**8.2.3.2. Post COL Issue**

The estimated construction duration for the two units from issue of the COL to commercial operation of the second unit is approximately eight years. This section outlines the activities undertaken with respect to installation of construction commodities with the major commodities being:

- **Civil commodity installations such as** concrete pipe and culverts, backfill, piling, concrete formwork and structural modules, concrete, reinforcing and embedded steel, structural steel shapes and plate, and painting, coatings and architectural features
- **Mechanical/HVAC commodity installations, including** vessels, pumps, compressors, tanks, heat exchangers, turbine generators and diesel generators, condensers, auxiliary boiler, circulating and service water cooling towers, Heating, Ventilation and Air Conditioning (HVAC) fans, ductwork, and dampers, process equipment
- **Electrical commodity installations include,** high- and low-voltage transformers, high- and low-voltage electrical panels and instruments, motors, switchgear, cable trays and conduit, power, control, and instrument cable, buss, wire, and electrical, terminations, transmission lines and interconnections
- **Pipe and Instrumentation commodity installations include,** piping, valves, hangers, supports, and restraints, instrument trays, tubing, and supports, control instruments and racks



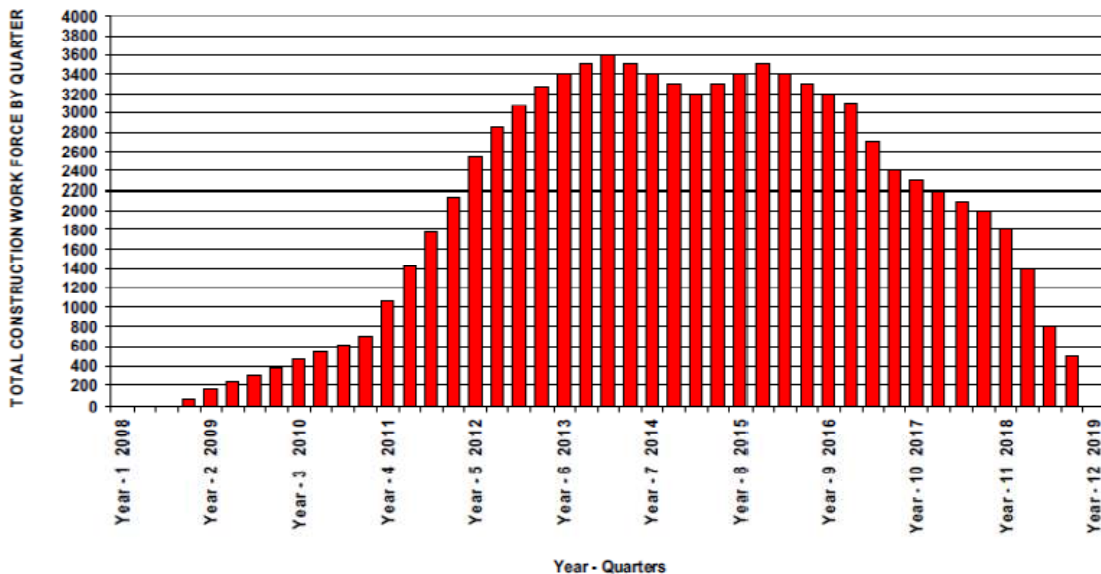
With the major site preparation activities completed the construction focus will concentrate on the power block (nuclear and turbine islands). Each AP1000 unit consists of a series of buildings or structures with systems within the structures. The buildings have varying durations to construct, but the longest duration activity is the containment, shield building, and auxiliary building. Greater has been provided where appropriate:

- Shield Building and Containment, Duration: 40 months
  - Erecting the containment vessel, with the bottom head set and grouted
  - Setting and welding out three vessel rings
  - Installing the reactor pressure vessel, steam generators, reactor coolant pumps and pipe
  - Setting the polar crane
  - Setting the upper vessel head.
- Auxiliary Building, Duration: 40 months
  - The auxiliary building civil modules are delivered to the site and assembled before setting in the power block. The mechanical and electrical equipment and modules will be installed as the building is erected, followed by the HVAC, piping, and electrical installations.
- Turbine Building, Duration: 36 months
- Annex Building, Duration: 17 months
- Diesel Generator Building, Duration 12 months
- Radwaste Building, Duration: 11 months



### 8.2.4. Workforce Characterisation

SCE&G estimate the maximum onsite peak construction workforce for two AP1000 units to be 3,600 people, assuming eight years from the placement of safety-related concrete to having both units in commercial operation. The projected workforce by year/quarter is presented in Figure 25.



■ **Figure 25: Projected Construction Work Force by Year – Quarter for Two AP1000 Units**

Further, SCE&G have provided a percent construction labour force by skill set based on previous nuclear construction projects and is replicated in Table 14 overleaf.



Labour	Installation Items - Responsibility	Percent of Total Workforce
<b>Mechanical Equipment</b>	Nuclear Steam Supply Systems, Turbine generator, condenser, process equipment, HVAC	3 - 4
<b>Electrical</b>	Equipment, cable, cable tray, conduit, wire, connections	10 – 12
<b>Concrete</b>	Concrete and reinforcing steel	10 – 15
<b>Structural Steel</b>	Structural and miscellaneous steel	2 – 4
<b>Other Civil</b>	Piling, architectural items, painting, yard pipe	2 – 5
<b>Piping/Instrumentation</b>	Pipe, tubing, valves, hangers/supports	14 – 20
<b>Site Support</b>	Scaffolding, equipment operation, transport, cleaning, maintenance, etc.	20 – 30
<b>Specialty</b>	Fireproofing, insulation, rigging, etc.	7 – 13
<b>Non-Manual</b>	Management, supervision, field engineering, QC/QA, safety and health, administration.	25 - 30

■ **Table 14: Percent construction labour force by skill set**

### 8.2.5. Considered Implications for Cumbria Scenario

VCSNS has a dedicated Nuclear Learning Centre and Technical Centre for the two plants. This would require replication for the NuGeneration plant. Should the AP1000 be the chosen reactor technology there is an opportunity for Cumbria to pursue a centre of excellence in AP1000 operations via simulator driven training and blended higher and further education provision. This opportunity has been identified and a concept approved by the Britain's Energy Coast Campus to progress a Centre for Reactor Operations [Nucleus, 2011].

Due to the modular nature of the AP1000, large, secure lay-down areas are required significantly ahead of the construction period. The VCSNS application programme constructs these areas during the 30-month pre-construction phase. There is likely to be a requirement for safe, secure lay-down areas, located near to good transport links in Cumbria with the supply chain seeking to identify/obtain such locations well in advance of the reactor technology choice decision in 2015.

As an existing site, VCSNS is intending to undertake upgrades to both its rail and road links in order to accept the large components associated with the AP1000 and to minimise the impact to existing VCSNS workers on the generating unit. An integrated transport study to ascertain the likely impacts and alternatives based on the scenarios presented within this report may be beneficial in determining the infrastructure investment strategy.

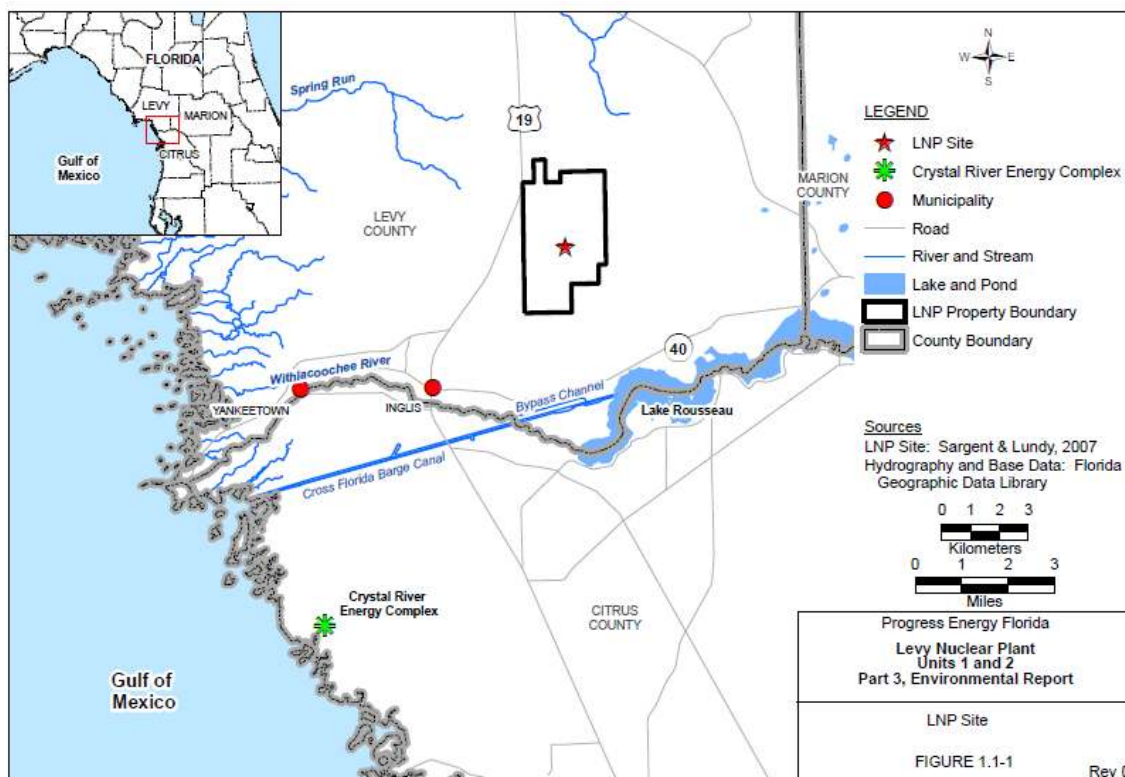


### 8.3. Levy Nuclear Power Plant (AP1000, Two Units), PEF

#### 8.3.1. Location and Context

Progress Energy Florida (PEF) proposes to construct and operate two Westinghouse AP1000 reactors at the proposed Levy Nuclear Power Plant (LNP) site in Levy County, Florida. These will be the first nuclear units built at this location. The basis of information for this comparison is the PEF submission to the US Nuclear Regulatory Commission (NRC) for its combined licence (COL) application [PEF, 2008]. An initial assessment of PEF’s Environment Report by the US Army Corps of Engineers (USACE) has been completed and has provided a preliminary recommendation to the Commission that a permit be issued [USACE, 2010].

The LNP site is located in Levy County, Florida, with the town being Inglis located approximately 4.1 miles from the nearest boundary of the LNP site. It is located in a primarily rural area approximately 9.6 miles northeast of the Crystal River Energy Complex (CREC), an energy facility also owned by PEF. While there are small communities and clusters of homes in the region, the area is sparsely populated. The Gulf of Mexico is located approximately 7.9 miles west of the LNP site and Lake Rousseau lies about 3 miles to the south, see Figure 26.



■ **Figure 26: Location of Levy Nuclear Plant [PEF, 2008]**



### **8.3.2. Access and Transport**

LNP will require new access routes to transport the components and materials to the site. LNP envisage the following access construction:

- Heavy haul road and barge slip access road south from the site
- Barge slip along the Cross Florida Barge Canal
- Blowdown pipeline corridor and associated cooling water intake structure
- Makeup pipeline corridor

### **8.3.3. Onsite Construction**

The new Units 1 and 2 will result in a large industrial facility similar in general appearance to most nuclear power generating facilities with the plant arrangements being the same as VC Summer Nuclear Site due to use of the Westinghouse AP1000 generic design as certified by the US NRC.

The two reactors and ancillary power production support facilities will be situated on approximately 300 acres near the centre of the site. The size of the developed area (including material and equipment laydown areas) is expected to be approximately 600 acres.

The construction impacts of the following major LNP components are:

- On-Site Areas:
  - Proposed Levy Nuclear Plant Unit 1 (LNP 1), proposed Levy Nuclear Plant Unit 2 (LNP 2), and associated cooling towers.
  - 500-kilovolt (kV) switchyard.
  - Site access roads.
  - Stormwater ponds.
- Transmission Corridor and Off-Site Areas:
  - Transmission corridors (south transmission line corridor leaving the site as well as the individual 500-kV transmission line corridors and associated substations and switchyard).
  - Heavy haul road and barge slip access road.
  - Anticipated barge slip.
  - Makeup and blowdown pipeline corridor and associated cooling water intake and discharge structures.

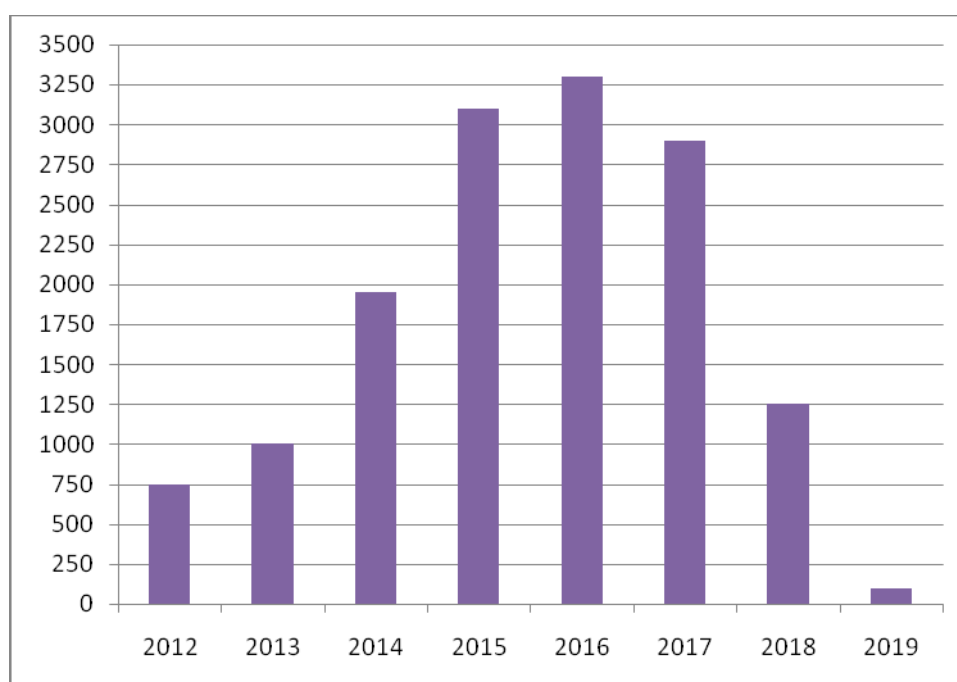


### 8.3.4. Programme

PEF anticipate site preparations lasting approximately 18 months with construction taking approximately 3 to 4 years, with the construction schedule staggered 1 year between units.

### 8.3.5. Workforce Characteristics

PEF anticipates that the combined construction workforce for both units will reach its peak of 3300 workers during 2016 with the profile as indicated below.



#### ■ Figure 27: LNP Construction Workforce Profile [Data from PEF (2008)]

There would be a gradual ramp up in the construction workforce beginning with 700 workers during the first three quarters of the site preparation phase. This would increase to 800 workers by the end of the 18-month site preparation phase. The first quarter of the construction phase would require about 950 workers. This figure would increase for about 30 months until it reached the peak workforce of 3300 workers for two units during the first two quarters of 2016. Thereafter, the number of workers would decline for the duration of the construction and testing periods.

It is anticipated that there would be a 1-year overlap between the construction workforce for LNP 2 and the operations workforce of LNP 1. A combined workforce of 600 workers is estimated for 2019, based on the 200 remaining construction workers at LNP 2 and an initial operations workforce of 500 for LNP 1.



### **8.3.6. Considerations for the Cumbria Scenario**

The PEF construction period duration and site preparation activities are significantly different to the VCSNS scenario; however, the peak workforce predictions are reasonably similar (approx 3400 workers) which provides a degree of comfort in workforce population should NuGeneration identify the AP1000 as their reactor choice.

Due to its location, LNP makes use of the waterways to transport equipment onto the site using the Cross Florida Barge Canal and a purpose built barge slipway. A heavy haulage road will be constructed also. Given the location of the NuGeneration site and the benefit in minimising road transport during peak times, transport of major components or bulked-components by sea to one of the Ports located on the Cumbria coast, particularly if the components could be forward transported by rail (noting that some components will be out of scope for rail transport).



## **9. Implications of New Build in Cumbria**

### **9.1. Context**

Cumbria and those companies operating in the region have an active (leading) capability in the operation of nuclear power plant as well as in full fuel cycle facilities, nuclear plant decommissioning and nuclear waste management. As for the construction, maintenance and operational support, the UK industry as a whole can provide the complete design, manufacture, construction and operational support capability for nuclear power and fuel cycle facilities [NRDA, 2005].

Most of the principal UK contractors and engineering firms either have a presence in or have gained direct experience from the building, operation, maintenance and upgrading of nuclear plant and facilities in the Cumbria.

In terms of the wider context of new build the primary nuclear industry operators are supported by a wide variety of supply chain companies, such as engineering and construction contractors, fabricators of specialist equipment, manufacturers and specialist service providers. However, there is a recognition that some elements of the supply chain(s) for nuclear power plant and equipment in Cumbria has been eroded quite considerably over the past 15 years or so where decommissioning plans have reached new phases of decommissioning [Mott McDonald, 2007].

In addition to the constraints now becoming evident on the staffing profiles there are existing global supply chain issues, such as the availability and/or lead times of critical components, which could lead to delays in a UK nuclear new build programme in general and/or to cost escalation. These pressures will also exist for the proposed NuGen programme at Sellafield.

In addition, despite the events in Japan in March this year there does not appear to be any material reduction in global orders for new nuclear plant, which will stretch the supply chain still further, with significant programmes still expected in USA, Europe (excluding Germany), South Africa, Russia and the Middle East or ongoing in China.

### **9.2. NuGeneration Overview**

As stated in Section 5.3, NuGeneration (NuGen) is a joint venture between GDF Suez and Iberdrola. Scottish and Southern Electric (SSE) withdrew its 25% stake in NuGen in September 2011, with GDF Suez and Iberdrola respectively raising their stakes to 50% each. NuGen has established a presence within Cumbria at the Westlakes Science and Technology Park.

NuGen has participated in a number of sector events across the UK and is now planning a series of stakeholder meetings starting with parish councils closest to the proposed development. [NuGen, 2011].

### 9.3. Programme

The proposed programme that has been identified by NuGen provides a high level and indicative scale for each of pre-build, construction and operation of their site. This programme was released in 2010 and is likely to be updated in 2012.



■ **Figure 28: NuGen Indicative Timeline (Source: NuGen)**

Progress against this programme has been seen by submission of planning consent for site assessment and radiological characterisation of the proposed location of the reactors (NuGen Briefing, 2011) as discussed in Section 9.6.

This broad timeline has been used to inform the scenario modelling undertaken by Experian on behalf of Cumbria County Council which has informed the potential workforce needs as provided in Section 9.9.1.1 (these are incorporated within the Projections Paper, GVA, 2011).

### 9.4. Technology Choice

NuGen has the choice of two reactor technologies the Areva EPR or the Westinghouse AP1000, both of which are subject to an ongoing Generic Design Assessment (GDA). The choice of reactor technology will affect the workforce employed and the potential routes for transporting the components onto the Sellafield site. An outline of the two reactor technologies and the potential implications on local infrastructure is provided within Section 7.3. The current timeline indicates that the technology selection will be made by 2013, although this timescale may potentially be extended; Horizon Nuclear Power has taken longer than anticipated in its reactor technology selection, though it should be noted that during this time the GDA process has been delayed and the





selection was likely impacted by the event at Fukushima Dai-chi and the subsequent report prepared by HM Chief Inspector of Nuclear Installations [ONR, 2011].

#### **9.5. Supply Chain Engagement to Date**

NuGen are at a relatively early stage of their nuclear programme development in comparison to NNB GenCo and Horizon Nuclear Power. It is recognised that the NuGen team is not presently at full-strength and they are in the early stages of a programme of consultation and engagement with local stakeholders and the supply chain.

Contracts have been let to progress the programme with the temporary site investigation and characterisation works being led by a consortium between IBERDROLA Ingeniería y construcción and Tractebel Engineering, part of the GDF SUEZ Group.

Nugeneration has also appointed Arup as its lead planning consultant and GL Hearn as its strategic planning advisors in relation to NuGen's plans to build a new nuclear power station in West Cumbria.

#### **9.6. Planning and Consents**

NuGen has submitted and gained planning permission from Copeland Borough Council to undertake a preliminary phase of temporary site investigation and characterisation works on the land NuGen has an option to purchase for a planned 3.6GW generating station. This is in line with their programme and enables the physical characterisation work to commence on schedule and expected to be completed during 2013.

The purpose of the preliminary work is to investigate the geotechnical, geophysical, radiological, chemical and seismic conditions of the land and to determine which part of the available land will be most suitable for a nuclear power station.

The planning application envisaged the sinking of 5 deep investigative boreholes (up to 150m), 5 shallow boreholes (up to 50m), 30 boreholes (up to 50m) for intrusive ground sampling and up to 42 further boreholes (up to 65m) for groundwater pressure measurement. Additionally, 8 pumping wells sunk to 50m together with a number of pressure meter tests and standard penetration tests to a similar depth.

The reactor technology choice will be key for developing the applications for the environmental permit (construction and operation) and development consent order. It is envisaged that these will be developed post-2013, with a Scoping Opinion Report submitted to the Infrastructure P Committee prior to this to provide early engagement with the IPC.





## **9.7. Skills Needs and Opportunities**

This section considers the existing skills base in Cumbria and an assessment of likely need as a basis for the physical and non-physical impacts of new build.

As discussed at the beginning of Section 8, workforce needs and skills profile studies have been undertaken by a number of organisations with each using differing assumptions such as reactor technology choice. Due to the varying assumptions, there is a disparity between the outputs; though it should be noted that they are not substantially different.

West Cumbria has an existing workforce for decommissioning activities, including construction associated with decommissioning, with a small percentage undertaking new nuclear build activities (likely in the consultancies based in the area). Future new-build capacity would elevate workforce demand, specifically in construction and operation, and would likely draw, in part, from the regional labour pool in Cumbria.

The new-build manufacturing workforce demand is likely to be of the order of 500 FTE per PWR unit but in this area global capability (*e.g.* large forgings and reactor pressure vessels) will be a determinant. Most of this manufacture is unlikely to be in the Cumbrian region but many UK component manufacturers in the supply chain are likely to be sourced nationally through the client and vendor companies.

Studies by the NIA and Cogent, along with predicted workforce numbers or skills split by the comparative case studies has been compared with the modelling outputs completed by Experian, on behalf of Cumbria County Council, to determine the robustness of the data and the conclusions drawn. Manufacturing requirements have not been considered.

### **9.7.1. Nuclear Industry Association (NIA) Nuclear New Build Capability Review**

A recent updated review of the supply chain capability of UK industry to support the delivery of a UK nuclear new build programme has been carried out by the 'New Build Working Group' (NBWG) of the Nuclear Industry Association (NIA) [NIA, 2006 and 2008]. In this review, two fundamental assumptions were made, namely that:

- 1) The AREVA NP European PWR (EPR) and the Westinghouse Advanced Passive PWR (AP1000) were selected as the reference reactor designs.
- 2) A programme of five twin Nuclear Power Plants (NPPs) would be built over approximately 20 years on or adjacent to existing nuclear power station sites to replace the current nuclear generated electricity supply capacity of around 10 GWe.



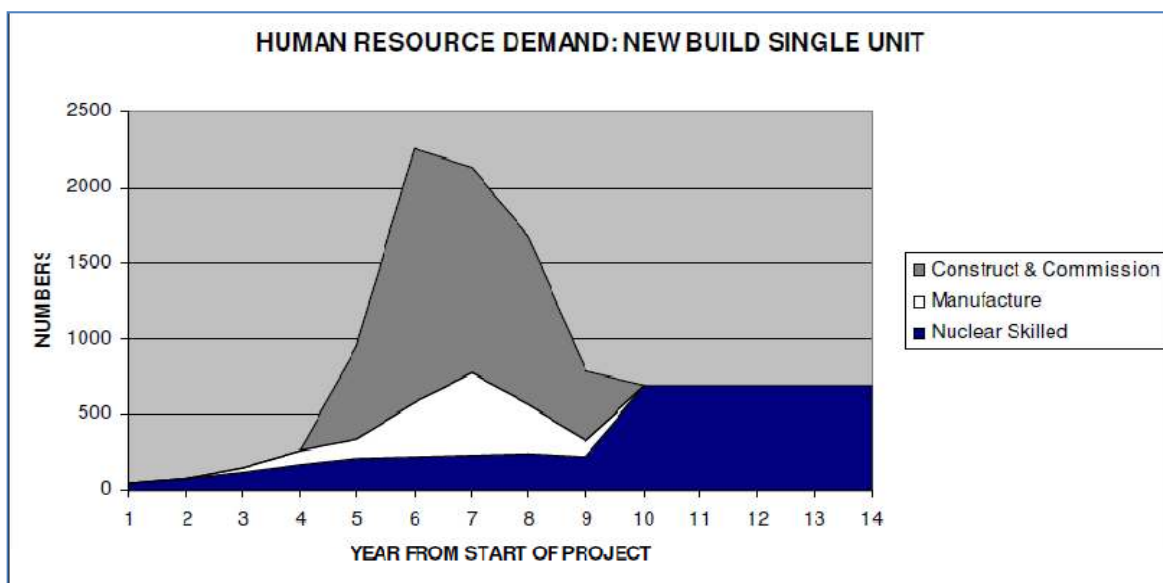
The report focused on the UK’s capability in three broad areas:

- Programme Management and Technical Support;
- Civil Engineering Construction; and
- Plant and Equipment.

Of the above, ‘Plant & Equipment’ typically comprise approximately 55% of a nuclear power plant build, with ‘Civil Engineering and Construction’, and ‘Project Management and Technical Support’ accounting for approximately 30% and 15%, respectively. However, it should be noted that these percentages are based on ‘volume’ (% of total activity), rather than the value of the different aspects of a new build nuclear plant.

### 9.7.2. Cogent Studies

Cogent has undertaken a series of studies, the Renaissance Nuclear Skills Series, and regional reviews that considers the skills aspect of new nuclear build in the UK. The South-West Nuclear Workforce publication [Cogent, 2010] provides the following workforce profile for a one-unit PWR.



■ **Figure 29: Estimated of Demand for single unit [Cogent, 2009]**

This indicates that 2,250 workers will be required during construction of one unit; therefore around 5,000 workers will be required for a two-unit site. The report projects that between 800 and 1000 workers will be required for normal operations based on 500 FTE per unit with efficiency savings factor of 25% used for a second unit and for associated Head Quarter activities.

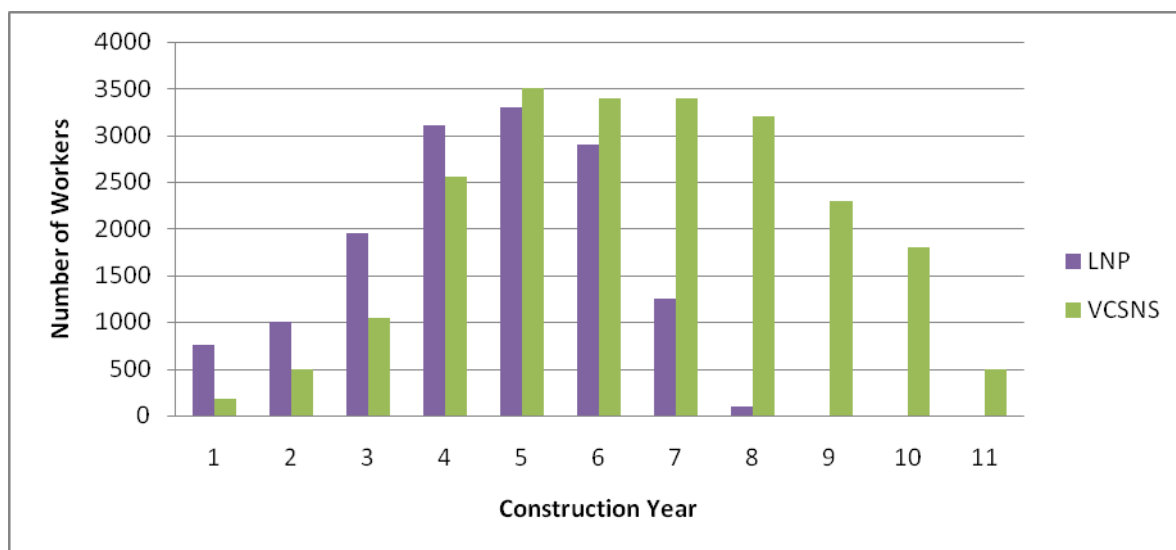


### 9.7.3. Comparative Case Studies

This paper has considered three comparative case studies:

- Hinkley Point C
- VC Summer Nuclear Site
- Levy Nuclear Plant

The projected total construction workforce profile for VCSNS and LNP based on two AP-1000 units is provided in Figure 30:



■ **Figure 30: Workforce by Construction Year**

The ramp-up of the two programmes varies but the peak workforce projections are similar. The projected NNB GenCo peak construction workforce is higher at approximately 5,600 (includes civils and M&E); however, it should be noted that the output of 2 Areva EPR units is broadly equivalent to 3 Westinghouse AP-1000 units, therefore the peak workforce projections from LNP and VCSNS should be multiplied by a factor of 1.5 to be broadly equivalent. By doing so, this raises the AP-1000 peak workforce projections to between 4950 (LNP) and 5250 (VCSNS).

On the basis of the comparative case studies, West Cumbria could need to base investment decisions on a peak construction workforce of between 5,000 and 5,600.

In terms of operation of the commissioned plant, NNB GenCo has approximated that 500-staff and 200-contractors will be required for HPC, with an additional 1000-workers during outage periods which would occur every 18-24 months. PEF has estimated that 770 workers will be required for operations at LNP with an additional 800 workers every 18-months during outages. SCE&G have



estimate that 800 operational workers will be required for their proposed units at VCSNS with an additional 800 workers during outages.

Worker Numbers	HPC	LNP	VCSNS
<b>Operations</b>	700	770	800
<b>Outage</b>	1000	800	800

■ **Table 15: Comparative Case Studies Operations and Outage Worker Numbers**

#### 9.7.4. Study Scenario Modelling

Scenario modelling was undertaken by Experian to inform the Projections Paper (GVA, 2011) that forms part of the revised Local Development Framework (LDF) evidence base that will inform the new Economic Blueprint and Spatial Plan for West Cumbria.

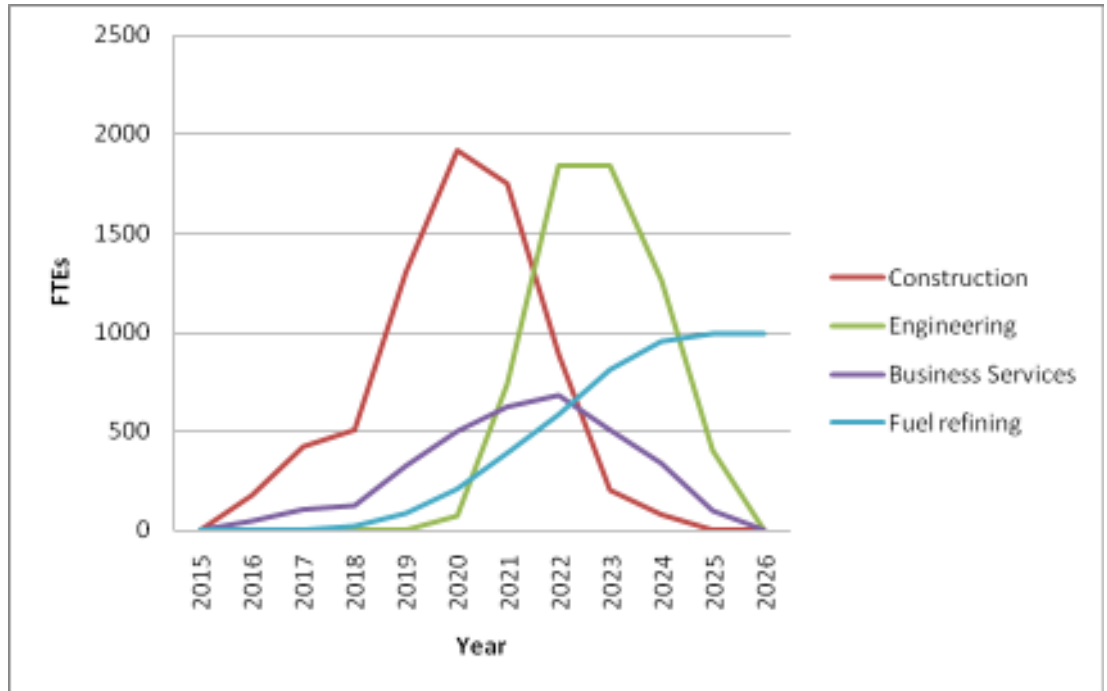
The Projections Paper (GVA, 2011) provides specific details on the scenario modelling including the assumptions used; this paper provides a summary of the modelling to enable comparison with the other data sources provide to underpin conclusions and recommendations relating to workforce and skills profiles.

Peak employment is circa 4,000 FTEs with an annual average requirement of almost 2,000 FTEs. This is in broad alignment with the comparative studies and Cogent data. Construction and engineering roles peak at ~2,000 FTEs and ~1,800 FTEs respectively with business services roles peaking at ~700 FTEs.



Experian determined that approximately 1000 FTEs will be required for operation of the new units (noted as being in fuel refining); again, this is in broad alignment with the comparative data.

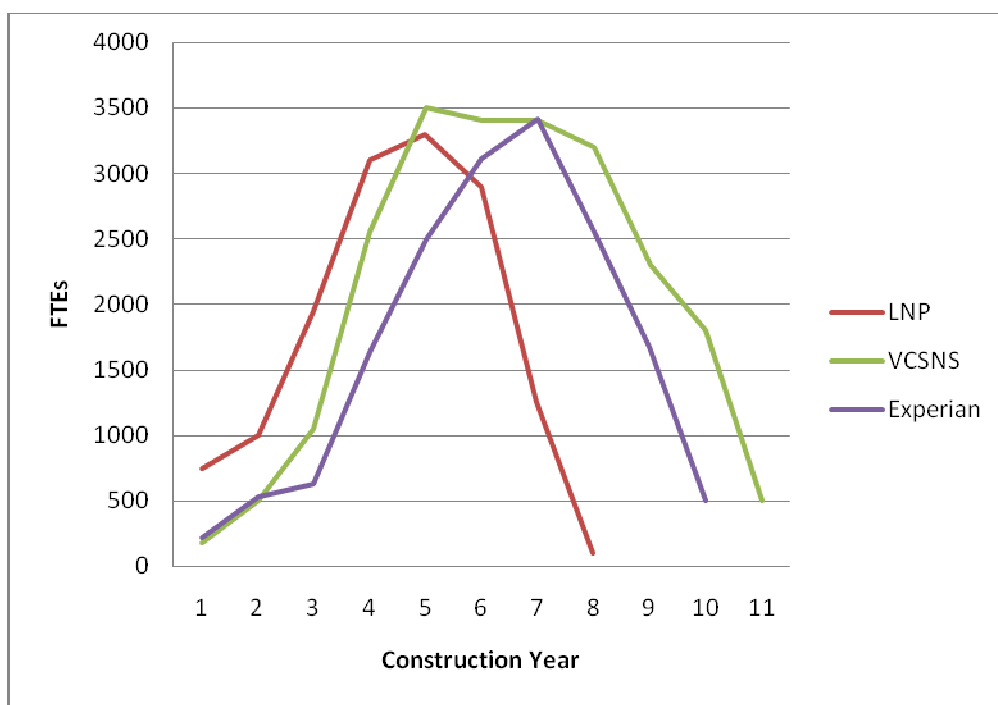
The workforce profile by sector identified by Experian’s modelling is provided overleaf in Figure 31.



■ **Figure 31: Workforce Profile by Sector**



A comparison of the Experian workforce modelling against VC Summer and Levy is provided below for construction numbers with operational roles (fuel refining) excluded from the Experian data.



■ **Figure 32: Experian Workforce Profile vs Comparative Case Studies**

These results are comparable to the Hinkley Point C, VC Summer and Levy projected workforce employment levels as provided in Section 9.7.3 and as would be expected. This provides confidence that an investment strategy could be based on these data without significant risk of over or under investment.

### 9.7.5. Skills Needs Summary

The required workforce profile and skills categories will depend on the choice of reactor technology and the capacity of the plant proposed. These factors are still open for the Sellafield development with NuGen being clear that it remains “technology neutral”.

Figures that have been used by both suppliers and others on the total number of construction worker required in new build are largely based on the assumptions made on the number of units proposed and the technology type. The Experian modelling indicates a peak of around 4,000 FTEs which is in broad alignment with comparative data. It should be noted that the peak workforce will be dependent on the construction programme adopted, such as phased unit construction, and the technology type.

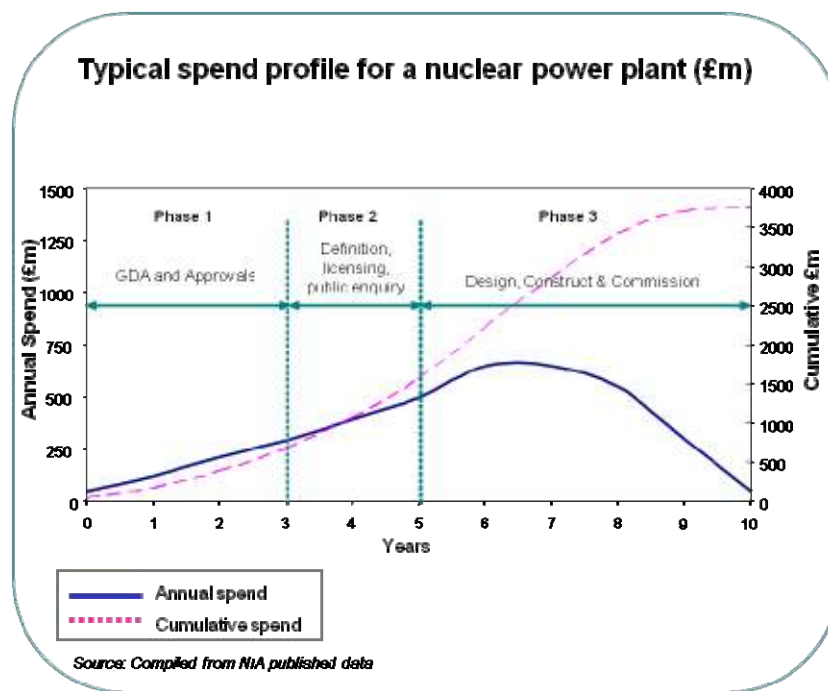


In terms of operations, Experian indicates that circa 1000 FTEs will be required which is in the upper estimate of data reviewed with a “typical” estimated figure of around 700 people<sup>9</sup> tending to be used in the operation and maintenance of a new facility.

Outage requirements have not been considered in depth; however, it can be expected that up to 1,000 temporary workers will be required on the NuGeneration site for refuelling and maintenance activities (known as an outage) every 18 to 24 months during the reactors lifetime.

### 9.8. Investment costs and timelines

A the investment costs and timelines for new nuclear build will be dependent on the choice of reactor technology and the specific site; however, typical spend profiles are available that represents a useful basis on which to provide some indications of the levels of investment that the NuGeneration site will expect to see, Figure 33.



■ Figure 33: Spend Profile for a nuclear power plant

There is considerable uncertainty when forecasting cost of new nuclear power generation. It is important to note however that previous programmes, including the obvious example of Sizewell B, tend to be used in as a baseline. However this ignores the obvious shifts in approach

<sup>9</sup> NNB GenCo provides a provisional maximum figure of 700 staff and 200 contractors for the operation of the two HPC units within their draft Workforce Profile [NNB Genco, 2011]



that have now been adopted in the UK which has moved away from a new design and onto standard models promoted through the GDA.

There is a clear lesson to be learnt from this experience in that costs were compounded by there being a number of costly design changes imposed by the regulatory authorities during the construction process. In addition, the project sponsor for the Sizewell B project was a public sector company operating under a soft budget constraint; evidence suggests that cost inflation might be expected under these circumstances.

The expectation therefore is that costs for new reactor designs will fall after the first plant has been constructed; the cost premium in the case of Sizewell B would be diluted for a programme. Costly changes in safety standards during construction might be avoided through the clear regulatory framework now in place for the new build programme and, in particular, through setting out detailed design standards prior to commencement of construction. Capital costs of more modern reactor designs are expected to be lower than those for Sizewell B, given that modern designs have a relatively small footprint and require less equipment.

## **9.9. Implications**

This section considers the physical and non-physical implications of the new build programme on West Cumbria in terms of labour force, transport, workers accommodation and spatial implications.

### **9.9.1. Non-Physical Implications**

#### **9.9.1.1. Workforce Requirements**

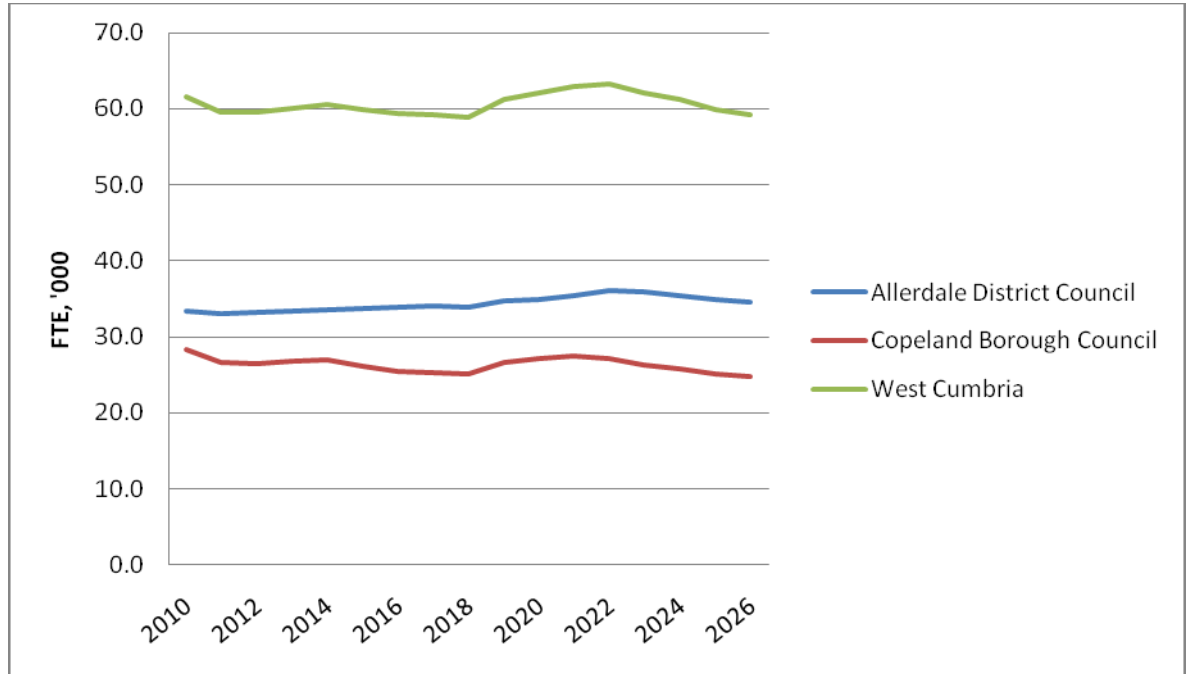
As stated within Section 9.7.5, new nuclear build in West Cumbria will attract both permanent and temporary workers for an extended period. Employment modelling has identified the following workforce needs which have been demonstrated as being in broad alignment with comparative literature data:

- Total peak workforce employment linked to New Build of circa 4,000 FTEs with average annual workforce of circa 2,000 FTEs
- Permanent operations workforce of circa 1,000 FTEs
- Temporary outage workforce of circa 1,000 FTEs every 18 to 24 months during operations.

This does not account for the increase in consultancy staff into the area supporting NuGeneration and the successful reactor technology vendor.

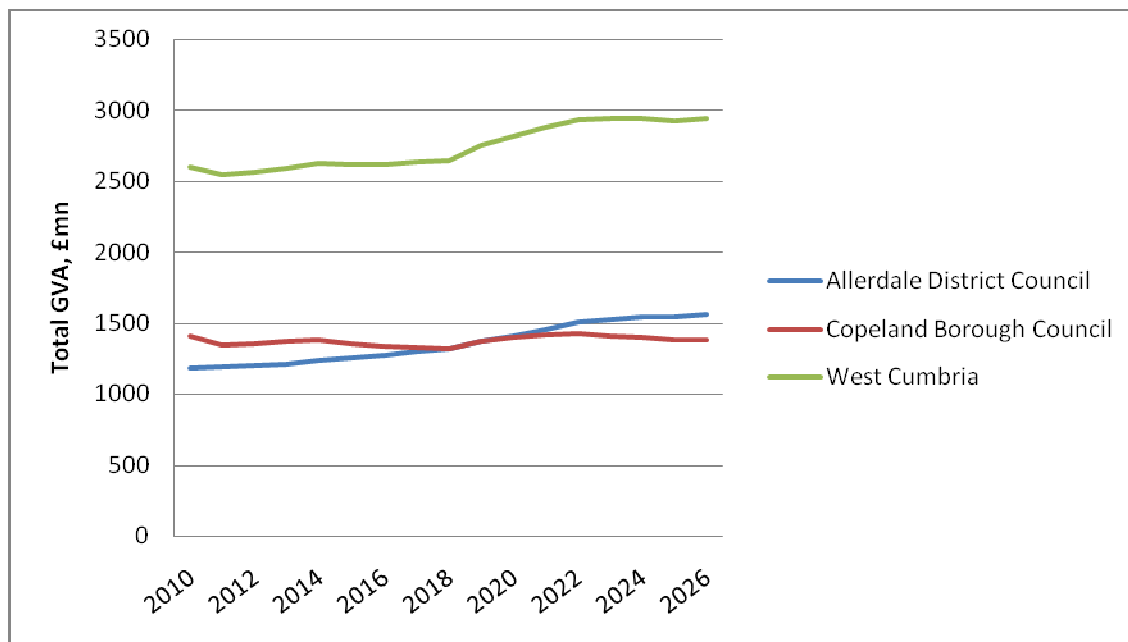
In terms of overall contribution to the economy, Experian has modelled the employment in West Cumbria, divided into Copeland and Allerdale, including the affect of new nuclear which is provided in Figure 34.





■ **Figure 34: Employment including New Nuclear Build, FTE [Experian 2011]**

The total GVA for West Cumbria, and again depicting Allerdale and Copeland contributions, is provided overleaf in Figure 35.



■ **Figure 35: Total GVA including New Nuclear Build [Experian 2011]**

### 9.9.2. Physical implications

Physical implications can be considered in terms of the social needs of the construction and operation workforce (e.g. temporary or permanent accommodation) and the specific physical infrastructure developments opportunities for the NuGeneration site itself.

The Projections Paper – Projecting Employment and Housing Change (GVA, 2011) considers the investment required for accommodating the site specific workforce and is not replicated within this report. This section therefore focuses on the NuGeneration pre-construction and construction activities as well as infrastructure investment indirectly associated with the site.

#### 9.9.2.1. Transport Requirements

Each comparative site aims to minimise road transport in order to minimise impact to existing road users. The West Cumbria road infrastructure has been substantially upgraded since construction of THORP at Sellafield which required large components to be escorted by the major utilities to safeguard telecommunication lines etc which should enable the existing road infrastructure to be used, noting that a suitable assessment should be made to underpin this.

NNB GenCo is proposing the construction of a temporary jetty to facilitation transport of the large volumes of construction material onto site; LNP has also proposed use of water transport to minimise transport by road. Due to its proximity to the Port of Workington and the Port of Barrow, investment into one of these ports to ensure that there is the capacity to accept, handle and onward



transport, ideally by rail, the major components would minimise construction traffic into the county via the main roads of the A66 and A595.

As new nuclear construction is currently scheduled to coincide with construction of decommissioning facilities at Sellafield congestion on the existing road infrastructure is likely to worsen during in-muster and out-muster. Typically, road congestion is worse heading north through the county on the A595 towards Whitehaven and Workington, with those located in Cockermouth typically using Cold Fell. Travel south towards Millom and Barrow is typically not as congested during these times with good use of the rail links to these towns from Sellafield station. An integrated transport study would be beneficial to determine any additional rail transport needs from the north of the county to service both Sellafield and NuGeneration and off-set road travel. Increased use of the rail network for commuting to Sellafield may require improved car parking, onward public transport, station amenities or platform extensions. Consideration of timetable alterations would be of benefit, particularly heading south from Workington and Whitehaven.

#### **9.9.2.2. Lay-down and Manufacturing Areas**

Each of the comparative sites has substantial lay-down areas that are developed at the site preparations / pre-construction works stage. These areas are required to be secure and with good transport links. Use of existing industrial areas such as Lillyhall or areas located near to transport hubs, such as the Port of Workington could offer opportunities for these lay-down areas.

#### **9.9.2.3. Training Facilities**

The Britain's Energy Coast Campus is committed to exploring the training and education provision to service new nuclear activities within West Cumbria [BECC, 2011]. Review of comparative case studies shows that reactor simulators and dedicated training centres will be required as part of the new nuclear programme. Other facilities may be required to ensure that West Cumbrian workers are appropriately up-skilled or re-skilled for the new nuclear market.

#### **9.9.2.4. Professional Accommodation**

As indicated in Section 9.9.1.1, there is likely to be an increased number of professionals from academia, consultancies, regulators and the technology vendors as new nuclear build progresses. High quality accommodation that is conveniently located for transport access, local facilities and the new nuclear focal points are likely to be required.

## 10. Conclusion

This report has considered the ‘Nuclear Sector’ in West Cumbria from a broad perspective, considering both the current picture but also importantly potential changes which will have a significant impact on the area in the future. This section is not intended to summarise the content of this detailed appraisal of the sector but instead pulls out a number of key headlines and priority activities for the two local authorities in the short-term.

The appraisal of the nuclear sector highlights that linked activities within West Cumbria will result in employment and supply-chain expenditure for a significant time period. Decommissioning at the Sellafield site will steadily decrease, with the potential for a ~3,000 FTE reduction by 2032 based on low range estimates, but will remain an important overall contributor to the economy for a considerable period beyond this. The reduction in employment will impact on local communities due to the high dependency on Sellafield Ltd for employment, particularly within proximate settlements in Copeland. Supply chain expenditure will experience a peak in 2018-2021 associated with the construction of new facilities in the existing operation and will likely bring a temporary workforce into West Cumbria with its associated social needs and expenditure. This highlights the relatively dynamic nature of this employer within the area even during a period of decommissioning.

Alongside the impact of decommissioning the potential proposed new nuclear build will have a significant impact on the local economy. In employment terms it will have a net positive impact in the area with a peak workforce of circa 4,000 FTEs during the construction phase and an operating workforce of circa 1,000 FTEs beyond the construction phase. In addition to this operating workforce maintenance (outage) activities will also result in a temporary workforce of up to 1,000 FTEs every 18 – 24 months. These will require accommodation and transport capability beyond the initial surge of employment envisaged through the construction period of the new build project.

In order to maximise the benefits of nuclear sector activities and minimise the negative impacts, the following activities should be considered by the authorities and partners:

- Copeland Borough Council should discuss with NuGen the development and implementation of a local supply chain mechanism to encourage investment in Cumbria through use of local companies or relocation of national organisations.
- Undertake an integrated transport study to ascertain the likely impacts of new nuclear build and decommissioning activities for infrastructure investment strategy purposes.
- Assess the level of high quality accommodation required and available which is conveniently located for transport access and local facilities



- Sellafield Ltd and NuGeneration to coordinate closely on construction activities and the transport requirements associated with these, particularly shift-work patterns, public transport needs and in-muster/out-muster times.
- Review and consider the rail timetable and carriage numbers to maximise transport by rail to the Sellafield sites

These actions are being considered through the development of the respective LDF's by Copeland and Allerdale Councils as well as by Cumbria County Council. The future engagement between NuGen and the local authority partners will clearly be a key priority as any nuclear new build project progresses.

## 11. References

APS (2011), 'Annual Population Survey' [www.nomisweb.co.uk](http://www.nomisweb.co.uk).

BEC (2007), Britain's Energy Coast Masterplan Summary, [http://www.nwda.co.uk/pdf/WCSM\\_Summary\(Final\)%20\(2\).pdf](http://www.nwda.co.uk/pdf/WCSM_Summary(Final)%20(2).pdf), accessed 22 November 2011.

BECBC (2011), Discussion with Britain's Energy Coast Business Cluster, November 2011.

BECC (2008), <http://www.westlakesrenaissance.co.uk/PRESS%20RELEASES/10-08%20BEC%20Campus%20announcement.pdf>, accessed 22 November 2011.

BECC (2011), Presentation Provided to NuGen by Britain's Energy Coast Campus, 15 November 2011.

Cogent (2009), Power People: The Civil Nuclear Workforce 2009 – 2025, A report by the Cogent Sector Skills Council, 2009

Cogent (2010), The South West Nuclear Workforce, A report by Cogent Sector Skills Council, September 2010

DECC (2011), National Policy Statement for Nuclear Power Generation (EN-6), Volume I of II, DECC, London: Stationary Office, July 2011

DECC (2011), Management of the UK's Plutonium Stocks, A consultation response on the long-term management of UK-owned separated civil plutonium, DECC, 1 December 2011.

DTI (2007), Meeting the Energy Challenge, A White Paper on Energy, DTI, The Stationary Office, May 2007

ERM (2003), The Environment Council: BNFL National Stakeholder Dialogue, West Cumbria: Socio-economic Study – 2003 Update, Prepared by ERM Economics, August 2003

ETF (2010), Nuclear Lessons Learned, published by the Royal Academy of Engineering on behalf of Engineering the Future, October 2010 (available online at [www.raeng.org.uk/nll](http://www.raeng.org.uk/nll))

GVA (2011), Projections Paper – Projecting Employment and Housing Change, GVA Grimley, November 2011.

Mott Macdonald (2007), The UK Power Sector', draft report from Mott MacDonald to UK Trade & Investment, 2007



NDA (2011), Geological Disposal – Development of Manpower and Skills Data, NDA/RWMD/076, NDA, May 2011. (<http://www.nda.gov.uk/documents/upload/Geological-Disposal-Development-of-manpower-and-skills-data.pdf>)

NDA (2011), NDA Statement on the Future of the Sellafield MOX Plant, <https://www.nda.gov.uk/news/smp-future.cfm>, Issued 3 August 2011.

NIA (2006), 'The UK Capability to Deliver a New Nuclear Build Programme', Nuclear Industry Association, 2006.

NIA (2008), 'The UK Capability to Deliver a New Nuclear Build Programme: 2008 Update', Nuclear, Industry Association, 2008.

NIA (2011), [http://www.nuclearsupplychain.com/images/stories/pdfs/jobs\\_map\\_2011\\_final.pdf](http://www.nuclearsupplychain.com/images/stories/pdfs/jobs_map_2011_final.pdf), accessed 3 October 2011.

NNB GenCo (2010), Temporary Jetty Applications, Hinkley Point C - Proposed Nuclear Development, Non-Technical Summary, November 2010

NNB GenCo (2011), Hinkley Point C, Proposed Nuclear Development, Pre-Application Consultation, Consultation: Update on and Proposed, Changes to 'Preferred Proposals', February 2011, Revision 3

NNB Genco (2011), Draft Freight Management Strategy, February 2011

NNB GenCo( 2011), Hinkley Point C Development Consent Order Application, Application Summary Document (including Navigation Guide to documentation), November 2011, NNB GenCo

NRDA (2005), Northwest Nuclear: A Strategic Approach to the Nuclear Sector in the Region', Northwest Regional Development Agency, April 2005

Nucleus (2011), Discussion, Nucleus, November 2011.

NuGen (2011), NuGeneration Ltd Site Assessment and Radiological Characterisation Project Briefing Note, September 2011

ONR (2011), Japanese earthquake and tsunami: Implications for the UK nuclear industry Final Report, HM Chief Inspector of Nuclear Installations, ONR Report ONR-FR-REP-11-002 Revision 2, September 2011.

SCE&G (2010), South Carolina Electric & Gas, Combined Licence Application, Environmental Report, Revision 2.

**SKM Enviros**



Sellafield (2011), 35.0.14 Procurement & Contracting Strategy, Sellafield 2011/12 Procurement Plan, April 2011.

Sellafield Plan (2011), Sellafield Plan, Sellafield Limited, Issue 1, August 2011.

USACE (2010), Draft Environmental Impact Statement for Combined Licenses (COLs) for Levy Nuclear Plant Units 1 and 2, Draft Report for Comment, Draft NUREG-1951, US Army Corps of Engineers, August 2010

USACE (2011), Final Environmental Impact Statement for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3, Final Report, NUREG-1939, US Army Corps of Engineers, April 2011.

WCSSG (2011), Meeting of the 13<sup>th</sup> Socio-Economic Sub-committee, 7<sup>th</sup> June 2011, West Cumbria Sites Stakeholder Group

(<http://www.wcssg.co.uk/documentstore/final%20Minutes%2013th%20Socio%20Economic%20sub%20committee.pdf>)

West Cumbria Partners (2007) West Cumbria Spatial Master Plan, Energy, Technology and Nuclear: Working Paper 2

West Lakes Renaissance (2011), <http://www.westlakesrenaissance.co.uk/>, accessed 4 October 2011.

West Cumbria MRWS (2011) <http://www.westcumbriamrws.org.uk/default.asp?>, accessed 4 October 2011.

WNN (2010), [http://www.world-nuclear-news.org/C\\_BNFL\\_reaches\\_its\\_end\\_1510103.html](http://www.world-nuclear-news.org/C_BNFL_reaches_its_end_1510103.html), accessed 4 October 2011.