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Compiled By :	Tom Major & Caroline Longman
Verified By :	Matthew Scott
Approved By :	John Wilkinson
Signed :	

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Originating Office: FRAZER-NASH CONSULTANCY LIMITED
The Cube, 1 Lower Lamb Street, Bristol, BS1 5UD
T: +44 (0)117 9226242 F: +44 (0)117 9468924 W: www.fnc.co.uk

EXECUTIVE SUMMARY

This report details the research commissioned by Nuclear South West (NSW) and completed by Frazer-Nash Consultancy Ltd (Frazer-Nash). It updates the original report commissioned in 2015 into the Nuclear Sector Capability in the South West (Ref. 1). In order to complete the study, Fraser-Nash used a combination of desktop study and key stakeholder interviews.

The South West of England is home to a number of very large and nationally significant nuclear infrastructure projects, which represent around £50bn of economic opportunity, of which around £15bn could be delivered by the South West (Ref. 1). This report highlights the huge opportunity facing South West companies and what support is needed to maximise the economic value that can be extracted from this regional nuclear industry. This report concludes that the South West region, as host to some of the major nuclear projects in the UK, is perfectly positioned to capitalise on this opportunity, but support and interventions are essential enablers to make this happen.

The report gives a comprehensive update of the South West's nuclear sector by addressing the following:

- Current nuclear market overview;
- Existing supply chains;
- Skills, training, and academia;
- Policy; and
- Analysis of current and future projects.

To gain this understanding, Frazer-Nash engaged and interviewed key stakeholders in industry, academia, and government between February and April 2018.

This document is developed for NSW to understand what actions are necessary to maximise the economic value of nuclear in the South West. It has also been written for the South West supply chain to aid understanding of the opportunities, and what support mechanisms are in place to help companies win work in the nuclear industry. This includes industry, academia, and government.

A number of recommendations have been made in order to aid the already positive situation with regard to opportunities within the nuclear sector in the South West. The specific recommendations can be found at the end of each section of this report. They are colour coded, in order of priority for consideration and potential action, as high (green), medium (yellow) or low (red).

High (green) priority recommendations are defined as relatively straightforward to implement and will result in high impact results. The study has identified 30 high priority recommendations and can be found in Section 27.1.

Medium (yellow) priority recommendations are defined as requiring planning, collaboration and some investment. The study has identified 14 medium priority recommendations and can be found in Section 27.2.

Low (red) priority recommendations are defined as requiring significant planning, investment and collaboration. The study has identified 9 low priority recommendations and can be found in Section 27.3.

Four recommendations are made outside the individual sections of the report. These take into account the cumulative knowledge gained in this study.

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Five key High Priority recommendations that could substantially improve the region's nuclear economic outlook are summarised below:

- Identify and address the workforce and skills shortage to the next stage at Hinkley Point C (Mechanical, Electrical and HVAC stage);
- Promote innovative skills in the South West to meet demand at Hinkley Point C and improve local capability to supply future projects within and beyond the region;
- Develop cross-sector innovation in decommissioning between the civil nuclear and defence nuclear sectors;
- Assess the opportunity for the South West to host and supply Advanced Modular Reactor technologies;
- Deliver a programme to support South West companies sell their capability into the fusion programme, in the UK and abroad.

Overall, the results of the study show that there are significant and substantial opportunities for suppliers of both nuclear and non-nuclear capability in the South West. Opportunities exist in the short and long term for Small and Medium Enterprises (SMEs), large organisations, skills and training, and academia. Government support, in a variety of initiatives explained in this report, offer SMEs aid in securing opportunities within the nuclear sector. The wealth of opportunities currently available can be further enhanced by implementing recommendations made in this report.

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1. INTRODUCTION

In 2018, Nuclear South West commissioned a new research project into the South West region's nuclear sector capability. This project, delivered by Frazer-Nash, updates a 2015 report (Ref. 1) with new information on progress of the major nuclear projects, together with the supply chain support and academic environment. Further to this, the study conducted an up-to-date assessment of the opportunities that could be realised for the South West supply chain across all the major projects. The project was also supported by Heart of the South West, GFirst, Swindon and Wiltshire, and Dorset LEPs, as well as Plymouth County Council, Sedgemoor District Council, and West of England Combined Authority/Invest Bristol and Bath.

1.1 BACKGROUND

In 2015, the Paris Climate Change Agreement set out a global action plan to manage the risk presented by climate change by keeping the global temperature rise this century to below two degrees Celsius. Worldwide, this has initiated vast growth of a global nuclear industry. There are currently 447 nuclear reactors operating worldwide with a further 61 under construction (Ref. 2). Nuclear technology provides the ability to generate large volumes of baseload power, with very little carbon footprint. In 2008, the UK Government invited energy companies to bring forward plans to build and operate new nuclear power stations in the UK, which heralded a new nuclear industry. This represented a huge change in UK energy policy, signifying the start of the 'nuclear renaissance' in the UK**.**

1.2 NUCLEAR NEW BUILD CURRENT POSITION

The UK currently has one of the largest programmes of new nuclear build in the world, with plans to build approximately 16GWe of new capacity. The new nuclear renaissance not only allows the UK to significantly grow indigenous low carbon electricity generation capability, it provides the UK with an opportunity to develop and grow new skills and capability to support a new generation of nuclear reactors. In 2013, UK government published its Nuclear Industrial Strategy (Ref. 3). The intention of this strategy was to support a long-term approach to the deployment of Government and industry resources to grow commercial opportunities, stimulating economic growth and job creation. It is clear that nuclear energy generation must play a significant role in the UK's energy mix. It is therefore important to ensure that industry capitalises on the substantial economic benefits that could be delivered if the right strategies are deployed.

1.3 THE SOUTH WEST'S CURRENT POSITION

The South West of England (the region) is home to the first planned new nuclear power station in the UK in 20 years; Hinkley Point C (HPC) in Somerset will provide low carbon electricity to more than 6 million homes and represents a huge industrial opportunity for the region. A great deal of activity is already taking place to ensure that local industry makes the most of this opportunity. The region is also home to other planned new builds, existing generation, and a longstanding defence sector. There are a host of academic establishments, skills and training facilities, nuclear related companies, and supporting functions such as the Office of Nuclear Regulation and UK head offices of Horizon and EDF Energy.

Much has happened since the original report, titled *South West Nuclear Cluster, Inward Opportunities Evaluation and Initial Engagement* (Ref. 1), was published in 2015. The 2015 report recognised that the South West region is home to other major projects and programmes which may require the same skills and capabilities as that of the HPC project. In addition, future nuclear projects in the UK, beyond HPC, could also represent significant opportunity for South West industry.

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The 2015 report stated: “There are significant and sustainable growth opportunities for the nuclear industry in the South West Region (the Region) over the next 20 years and beyond. A programme of 15 major nuclear industry projects will be undertaken in this period, with activities centred within the Region and representing investment worth up to £50bn”.

1.4 RECOMMENDATIONS GUIDE

From the discussions and interviews conducted in this project’s research, this report makes a number of recommendations for action.

A guide to using the recommendations is outlined in **Table 1**.

Recommendations are made at the end of each section. Section 27 then lists all recommendations in order of priority.

Table 1: Guide to using recommendations.

Skills Set Benefit	**The skills set which may benefit if the recommendation is implemented.** Pre-construction Skills | Construction Skills | MEH Skills | Operational Skills | Decommissioning Skills | Care and Maintenance Skills
Priority	**Consideration of the priority of the recommendation** Easy Win. Relatively straightforward to implement and high impact results. | Requires planning, collaboration and some investment. | Requires significant planning, investment and collaboration. Potential step change impact.

2. PROJECT AIM AND OBJECTIVES

The aim of this project is to understand what actions are required to maximise the South West industrial contribution to the major nuclear projects in the region. In order to achieve this aim, a number of specific objectives are identified:

- To deliver an up to date account of the nuclear industrial landscape in and surrounding the South West, including the status of supply chain activity, education, and academia;
- To understand how current and future government policy could benefit South West companies;
- To give a brief update on the cluster maps from the initial report in 2015, to give a sense of scale of the nuclear sector;
- To report on major existing and future nuclear infrastructure projects;
- To recommend what actions are necessary for the South West to maximise its economic gain through supporting the major nuclear programmes;
- To provide a 20 year timeline for the major nuclear projects in the area that could generate regional economic benefit;
- To consider the cumulative effect of the region's supply chain activity to major nuclear projects and what additional industrial opportunity this might present to the region;
- Provide a prioritised list of recommendations to improve the South West industrial contribution to the nuclear opportunities over the next 20 years.

The research was completed using a combination of desktop investigations and interviews with key representatives. This report presents the research methodology, the findings of the research, and makes a number of recommendations.

Research was conducted into the scale of the nuclear industry in the region, using data courtesy of the Hinkley Supply Chain Team and the Nuclear Industry Association's Jobs Map, as well as desktop study. Brief methodologies are included in each section rather than as a whole, due to the nature of this report and varied sources and methodologies.

Where costs are discussed the values are in today's prices or those of the source report, unless otherwise stated.

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3. PROJECT SCOPE

3.1 GEOGRAPHICAL SCOPE

The geographical scope of this report is the South West (Figure 1). Whilst the report focusses on how to maximise economic activity from nuclear projects in the South West, it also addresses industrial activity for new nuclear build projects across the UK where there is good potential for South West companies to export new capability.

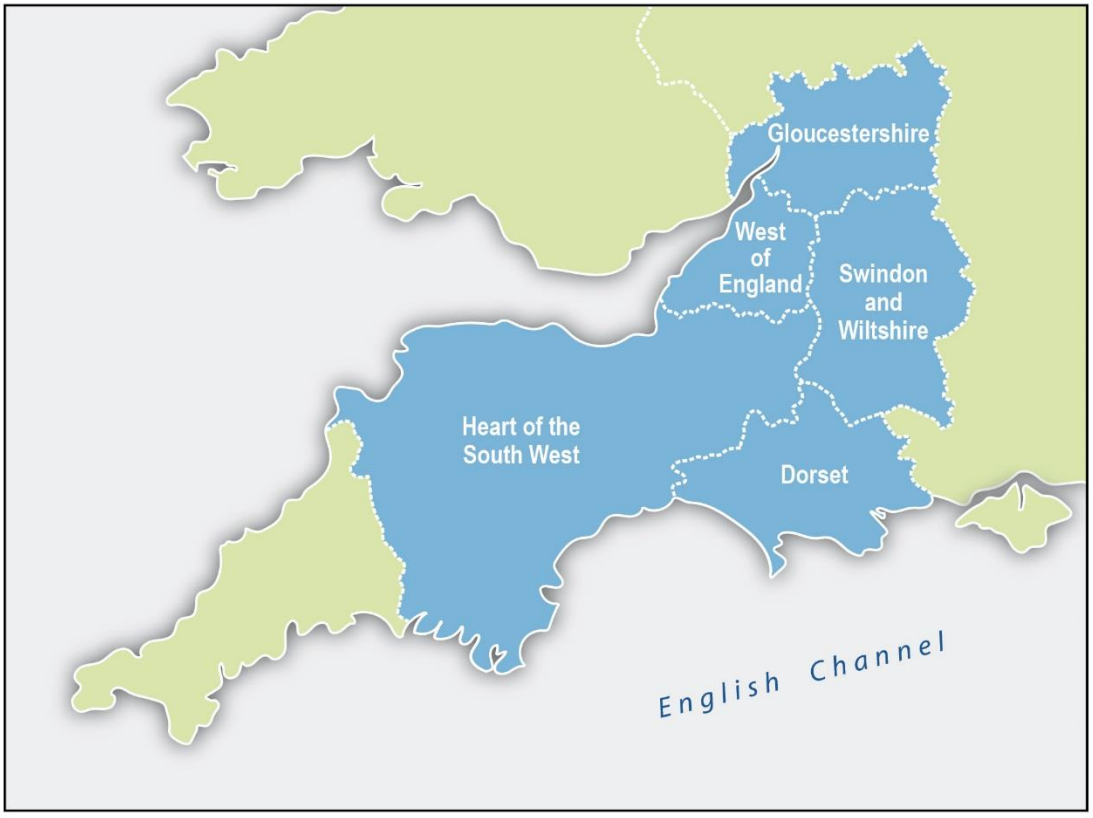

Figure 1: A geographical representation of the area covered by this report.

3.2 INDUSTRIAL SCOPE

The scope of this report covers major nuclear industry activity. The project objectives are related to the industrial sectors and projects provided in Table 2 below.

Table 2: Industrial Scope of the Project.

Civil Nuclear Electricity Generation	Nuclear New Build Projects	In region	Hinkley Point C, Somerset
			Oldbury (New), South Gloucestershire
		Out of region	Wylfa Newyyd, Anglesey
			Moorside, Cumbria
			Sizewell C, Suffolk
			Bradwell B, Essex
	Existing Generating Stations	In region	Hinkley Point B, Somerset
	Stations in decommissioning phase	In region	Berkeley (Magnox), South Gloucestershire
			Oldbury (Magnox), South Gloucestershire
			Hinkley Point A (Magnox), Somerset
			Winfrith (Magnox), Dorset
Nuclear Defence	Submarines	In region	Abbey Wood, Bristol
			Devonport, Devon
Nuclear Medicine	Radiological imaging devices and radiopharmaceuticals	In region	Across hospitals, dentistry surgeries, and veterinary surgeries

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4. INTRODUCTION TO UK NUCLEAR INDUSTRY & SUPPLY CHAIN

4.1 OVERVIEW

The UK currently has 15 nuclear reactors generating approximately 20% of the UK's electricity needs. Most of the current operating fleet is due to come off line and cease generating electricity by 2028 (Ref. 4). This has the potential to lead to a significant gap in energy supply. The 2008 Energy Act and the 2013 Nuclear Industrial Strategy signalled an intent to significantly develop the UK as a nuclear nation (Ref. 3). The act and strategy lay the foundations for government expectations that nuclear will play a significant role in the UK's future energy mix. They also pave the way for the regenerated nuclear industry to deliver significant economic benefit, creating new indigenous skills and capabilities that could be exported globally. Government policy has remained consistently in favour of nuclear power in the UK since the 2013 Strategy. This chapter describes the current UK nuclear marketplace and its relevance to the South West nuclear supply chain.

4.2 THE UK NUCLEAR MARKET OVERVIEW

Table**Error! Reference source not found.** 2 shows the major nuclear industry projects in the South West. Nuclear power generation can be split broadly into three key markets of decommissioning, existing generation, and new build. There are also defence and healthcare industries. Supporting this is a network of services and manufacturers, skills and training centres, academic establishments, consultancies, and office-based work.

4.2.1 Decommissioning

The nuclear decommissioning sector covers the activities required to decommission the original nuclear power generating and research sites. The decommissioning industry in the UK is directed by the Nuclear Decommissioning Authority (NDA). The NDA is a non-departmental public body responsible for the safe decommissioning and clean-up of UK nuclear facilities. The NDA tasks Site Licence Companies (SLCs) with the decommissioning of each of the sites. A SLC holds the nuclear site licence (granted by the UK regulator, the Office for Nuclear Regulation (ONR)) to operate the nuclear site. Magnox Limited is the SLC responsible for the decommissioning sites in the South West: Berkeley; Winfrith; Hinkley A; and Oldbury. The UK decommissioning supply chain is well established, with a public sector spend of over £3bn annually. Approximately £1.6bn of this is within the nuclear supply chain. Tier 1 contracts let by the NDA and Magnox are advertised on the government procurement website, Contract Finder. Tier 2 contracts can be let by major suppliers to Magnox and the NDA. These would not necessarily need to be advertised publically.

4.2.2 Current Electricity Generating Sites

There are currently eight nuclear energy generating stations in the UK. These are owned and run by EDF Energy. The supply chain spend in existing generation is around £600m per annum. This spend is primarily focussed upon the maintenance and plant life extension for existing sites. Many of the existing generation sites are approaching the end of their generating life, and will subsequently be decommissioned. The skill set required to support decommissioning is different to that required to support generation. The EDF Energy generation supply chain is well established and much of the work is procured through established frameworks with long-term suppliers (Ref. 5).

4.2.3 Nuclear New Build

The nuclear new build sector covers the build of the new nuclear power stations required to meet future energy needs and deliver the low carbon energy supply to UK consumers. There

are currently five nuclear new build projects in the UK in different stages of planning and construction. The five projects all use Generation III+ reactors, which utilise water-based technologies (Ref. 6). Within the next twenty years, the UK could also consider the build of a new generation of reactor technologies (known as Generation IV technologies), which may use alternative cooling technologies to water. In addition, there has been recent interest in Small Modular Reactors (SMRs). SMRs have a smaller power output than conventional large-scale reactors, and use modular offsite construction build techniques which could result in reduced construction costs. More recently, the term Advanced Modular Reactors (AMRs) has been used, which includes SMRs, but means there is no restriction on size. If built in the UK, this would herald the introduction of a new technology generation of reactors into the UK.

The nature of the UK supply chain for nuclear new build has been dictated largely by the ownership and development of nuclear technologies by overseas companies. This has brought huge inward investment into the regions hosting the projects. It is recognised that inward investors will still have existing supply chains abroad. Cost and risk considerations create challenges for new UK supply chains wishing to compete with these existing overseas supply chains. However, foreign investors are investing in HPC and building a knowledge of the ONR and its standards. This will help with future new builds; now is a good opportunity for local UK supply chains to engage with international investors and build a relationship for future builds.

4.3 SUPPLY CHAIN CONSIDERATIONS

For all nuclear sectors described in this report, a competitive supply chain already exists within the UK and abroad. There is no requirement for clients to procure from South West suppliers and there is no current legal basis for government to demand the use of a local supply chain.

Where nuclear work is procured by a UK government organisation, it is publically advertised (usually on the government website's Contract Finder). Much of the work in the decommissioning market is let this way.

Often, framework agreements are procured. Framework agreements allow buyers to put commercial arrangements in place with suppliers, which mean that each time goods or services are procured, there is no need to go through a lengthy tender and procurement process. This reduces complexity for the procuring organisation. Gaining a position on a framework can provide an efficient and convenient route to market.

Private buyers, such as large project management organisations and technology developers and operators in the UK, will conduct procurement in line with their own quality processes and procedures.

The nuclear new build market is a significant opportunity with substantial long-term value for the South West. The challenge is to establish the UK as an indispensable supplier to the new generation of nuclear power stations, with a view to successfully competing with overseas supply chains.

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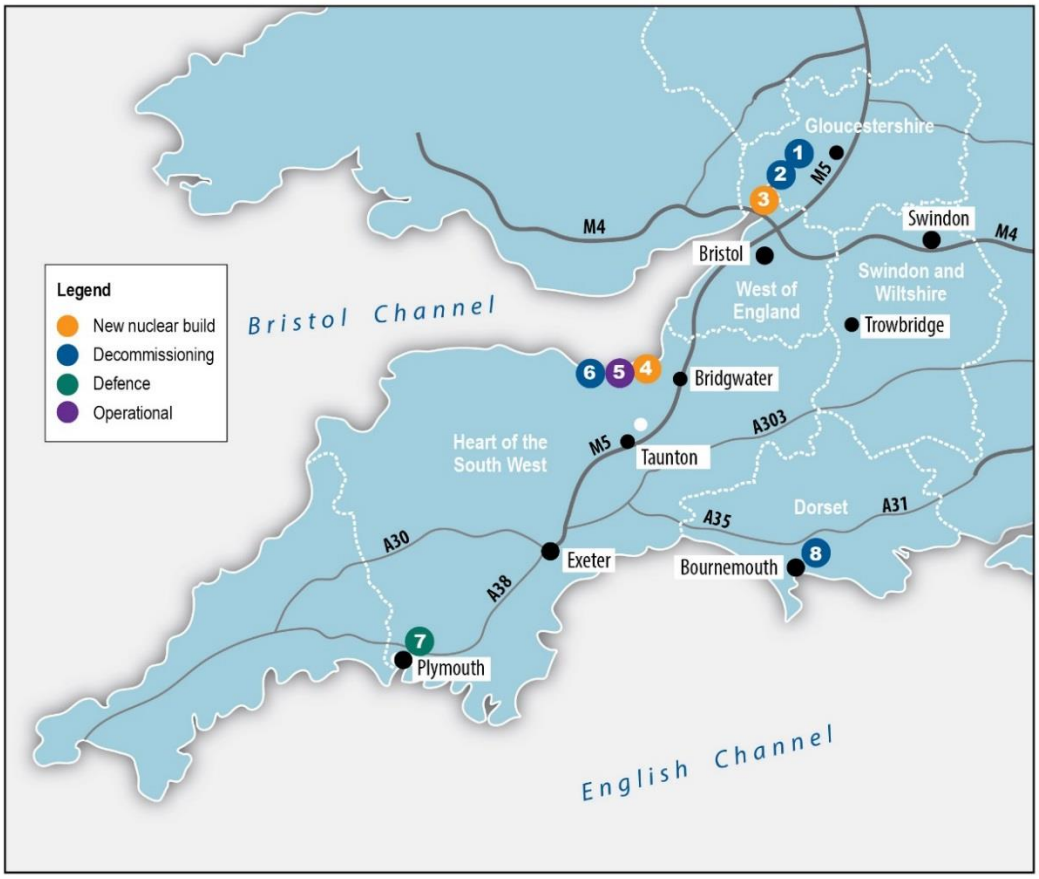

1 **Berkeley**
Decommissioning C & M
Production ended 1989

2 **Oldbury A**
Decommissioning
Production ended 2012

3 **Oldbury B**
Late 2020's start of construction

4 **Hinkley Point A**
Decommissioning

5 **Hinkley Point B**
Operational
Planned end 2023

6 **Hinkley Point C**
Construction
Planned delivery 2025

7 **Devonport**
Defence
Disposal

8 **Winfrith**
Decomissioning
Operations ended 1990

Figure 2: Major nuclear sites in the South West.

4.4 UNDERSTANDING ECONOMIC IMPACT OF NEW BUILD

The local economic impact of a large project, such as the development of a new nuclear power station, can be extremely positive in respect to economic benefit to the region. Positive benefits include the creation of long-term, sustainable, high value jobs. New build developers have, therefore, set an aim for around 60% localised content (Ref. 7).

It would be beneficial to provide clarification on the meaning of 60% localised content for the South West, to understand whether 60% constitutes the high-end advanced engineering and manufacturing skills and capabilities, or whether it constitutes value awarded to South West companies.

It is also important to consider flow through work, where work is awarded to a UK contractor, but then a significant proportion of that work is subcontracted overseas. This has the potential to count as UK content, but is unlikely to deliver great benefit to the local communities.

Due to these identified gaps, it is recommended that a clear method be established and implemented for measuring the value of nuclear contracts awarded to South West companies and for categorising the type of contracts that are awarded (R4.1), for example high value manufacturing and professional services. This measuring process, once in place, would enable measurement of the success of implementing the recommendations of this report.

4.5 THE SOUTH WEST NUCLEAR SUPPLY CHAIN

The South West has a longstanding history in the nuclear sector, with nuclear power, defence, research, and healthcare programmes established in the region since the 1950s. The region therefore has a mature nuclear sector supply chain. The South West is also home to universities delivering state of the art research and development, such as University of Bath, Bristol University, University of Exeter, and University of Plymouth. Research themes span from mapping supply chains to simulating materials' porosity.

The region's diversity in the sector has already created a hub of skilled workers, manufacturers, and businesses, with a calculated £1.6bn Gross Value Added (GVA) annually in the region's civil nuclear sector (Ref. 8). This demonstrates that the South West has unique capability on which to grow its support to a new nuclear industry.

The region has a diverse mix of nuclear projects at every stage of lifecycle, from planning to construction, operation and decommissioning. This brings huge potential for the region to support long-term nuclear related opportunities. It is therefore important to understand the cumulative opportunity in the nuclear sector and essential that the right support mechanisms are put in place to support South West companies capitalise on the opportunities.

4.6 RECOMMENDATIONS

Table 3: UK Nuclear Industry and Supply Chain Recommendations.

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R4.1	Measuring Economic Value	Government Industry		Develop appropriate metrics to measure the success of economic development strategy. Focus on: 1) Measurement of contract wins by South West companies; 2) Measurement of content won by South West companies categorised appropriately to reflect the future economic value to the region for winning the work.	

5. MARKET STAKEHOLDER ENGAGEMENT

5.1 OVERVIEW

The conclusions and recommendations made in this report are a result of the openness and willingness of South West Nuclear Sector organisations to engage and provide information to the research team. Market engagement with these organisations was undertaken via a combination of meetings and telephone conversations with key stakeholder representatives from industry, academia and government. These meetings and conversations were focused on understanding where each stakeholder perceived there to be capability gaps and supply chain opportunities. The subsequent sections of this report provide a synopsis of the outcomes, conclusions, insights, and experience-based knowledge from these meetings.

This report is structured to highlight gaps and opportunities in each key area of the nuclear sector, then to provide recommendations to maximise the positive impact of the nuclear industry on the South West.

5.2 MARKET ENGAGEMENT PLAN

Through the course of the research, the following key stakeholders were engaged.

Interviews:

- Department of Business, Energy and Industrial Strategy;
- The South West Hinkley Supply Chain Team;
- SWMAS;
- National College for Nuclear Southern Hub;
- South West Nuclear Hub at Bristol University;
- HPC Supply Chain Innovation Lab, Bath University;
- NNB GENCO;
- EDF Energy;
- Babcock International Plc.;
- Ministry of Defence;
- Department of International Trade.

In addition, conversations were held with:

- Nuclear Advanced Manufacturing Research Centre;
- Hitachi-GE.

Engagement with key stakeholders has been supplemented by data gathering and review of available research into the UK nuclear sector. This combination has allowed for the consideration of national requirements, sector trends, and considerations at a local level, based upon local stakeholder input and experience.

The information compiled to produce this report is from many different sources, including interviews with multiple stakeholders. Therefore, the level of detail provided is commensurate with the level of detail gained from the research. In addition, attention was focused on projects that have the highest impact on the region.

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6. GOVERNMENT POLICY AND THE SOUTH WEST

6.1 INDUSTRIAL STRATEGY AND CLEAN GROWTH STRATEGY

In 2017, the Industrial Strategy White paper was published which outlined the government's plans to grow the economy. Clean growth is at the heart of the industrial strategy, and the Clean Growth Strategy sets out a significant number of proposals that aim to accelerate clean growth in the UK.

The Clean Growth Strategy (Ref. 9) is designed as a blue print for how the UK delivers low carbon emissions in the UK. It exists to lay out the pathway needed to meet the challenging UK carbon budgets until 2050. The rebranding as 'clean growth' is significant. This rebranding is to ensure that the UK not only meets energy demand whilst reducing carbon emissions, but that benefits to the economy are maximised.

The strategy includes actions to enhance clean growth around business and industrial efficiency, transport, enhancing natural resources, improving homes and clean, smart flexible power.

6.2 INDUSTRIAL STRATEGY CHALLENGE FUND

The Industrial Strategy Challenge Fund (ISCF) set out the four Grand Challenges (Ref. 10), which aim to improve people's lives and the country's productivity by putting the UK at the forefront of global industrial changes. Clean Growth is one of the four grand challenges that are set out in the industrial strategy.

The Clean Growth Grand Challenge aims to maximise the advantages for UK industry from the global shift to clean growth, through leading the world in the development, manufacture and use of low carbon technologies, systems and services that cost less than high carbon alternatives. Government and industry have been invited to submit proposals for challenges that could be solved with funding from the ISCF. The ISCF is designed to be industry led and powered by a multi-disciplinary research programme and focused on improved productivity and economic benefit across the UK.

There are three waves of ISCF; Wave 2 and 3 funding rounds are due to be competed for over the next two years and it is important that South West collaborations understand, and maximise their involvement in the relevant competitions. It is recommended NSW raise awareness of the ISCF and opportunities for collaborations of companies to bid for funding opportunities under the grand challenges (R6.1).

6.3 BEIS NUCLEAR INNOVATION PROGRAMME

At the Spending Review 2015, the UK Government, Innovate UK, Research Councils, and BEIS proposed to invest a total of around £460m between 2016 and 2021 in nuclear research and innovation, including around £180m within the BEIS Energy Innovation Programme. Contracts valued at up to £12.5m have already been awarded in Phase One of the nuclear innovation scheme, and a second phase was announced in December 2017, focusing up to £8m for work on modern safety and security methodologies and advanced fuel studies. There are some

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aspects of this programme that could be relevant to the South West. Bristol University and the South West Nuclear Hub have had significant involvement in the programme to date, and there is certainly more potential for the South West to be involved and capitalise on the results of this research (R6.2).

6.4 NUCLEAR SECTOR DEAL

As part of the 2017 Industrial Strategy, a number of sectors in the UK were offered a Sector Deal. A Sector Deal is a partnership between the government and industry on sector-specific issues that can create significant opportunities to boost productivity, employment, innovation and skills (Ref. 11).

The nuclear industry was one sector that was offered a Sector Deal. Government invited the nuclear industry to make proposals to government and these have been led, on behalf of industry, by the NIA. The Sector Deal proposals were published in 2018. The South West LEPs contributed to the Sector Deal, and indeed, a regional theme runs strongly through the proposals. The value of industry clusters, and collaborations between academia and industry, as well as business support are recognised as adding great value and essential to support local economic growth. The Sector Deal represents a significant opportunity for the South West to grow the region's nuclear economy, however, it is important that action is taken. The Sector Deal may not come around again, and proactivity in ensuring that action is taken to capitalise on the opportunities it represents is crucial. The deal itself does focus in on skills, business support and innovation, but there are wider opportunities and it is important to understand how the South West can capitalise on them. Captured below are the key elements of the proposal that could represent significant opportunities for the South West.

- This proposal asks government to support a centre for innovation and best practice in nuclear construction. This would establish nuclear projects as exemplars of best practice in construction, including direction of R&D funds to support advanced construction techniques. The next steps are to agree the scope for the centre. The document recommends that active cross-sector collaboration is important to identify construction industry solutions to maximise productivity performance during nuclear construction. Plans should be made for South West involvement in future Sector Deal opportunities around development of advanced construction capabilities (R6.3).
- Another key aspect of the Sector Deal that could be highly relevant to the South West is the proposal considering the re-use of nuclear licenced sites after or during decommissioning for other nuclear projects. The South West host four such sites: Winfrith, Berkeley, Oldbury and Hinkley A. The recommendation is to select and create a group to review UK reuse of sites (R6.4).
- Ensuring that SMRs/AMRs and other Generation IV reactors form part of the UK's future energy mix is also a key component of the strategy. Significant economic benefit could be realised from supporting a new Generation IV era through, for example, supporting new designs, and the generation of intellectual property rights associated with technology development. It is important that active steps are taken to ensure that South West

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industry understands and is kept up to date with opportunities to support the development of the Generation IV industry (R6.5).

- The Sector Deal proposes that the government consider appropriate funding options for a new national supply chain programme. A supply chain programme to encompass all nuclear projects, ensuring skills and capability transfer between projects, promoting good practice and learning, and promoting cost reduction in the supply chain would be highly beneficial. This prospect of a national nuclear supply chain programme has been raised previously in this document. The next step, as outlined in the Sector Deal, is for the Nuclear AMRC to scope out and deliver the programme. However, it is important to consider nuclear skills and capabilities beyond manufacturing, and many opportunities to increase the economic growth of the sector lie outside of the manufacturing sector. A plan should be made for South West involvement in developing, supporting, and delivering a national supply chain programme (R6.6).
- Developing new advanced capabilities in the region is an area which has also been raised in this report and is repeated again in the Sector Deal. The government is asked to support proposals by industry for a new innovation infrastructure. It is recommended to deliver a programme to support innovation in the supply chain (R6.7).
- Regional Innovation hubs are highlighted in the Sector Deal as having potential for regions to support innovation in the nuclear sector through a combination of 'industry, academia and world class assets'. The University of Bristol's NUCLEATE project is an 'innovation factory', acting as a national centre for innovation in nuclear energy.
- There are a number of asks of government pertaining to skills development, with a stated commitment to increase the number of apprentices in the industry to 4,000 by 2021. The next steps are to establish working groups in each location to develop apprenticeship scheme proposals.
- The Sector Deal highlights that decommissioning costs are an area that will be targeted for savings. One way of achieving this is in utilising cross-sector skills and combining civil and defence requirements. This will require supply chain management from the highest level. However, industry have not approached BEIS with ideas on this. The South West region is in the unique position of having a supply chain that could support all these projects. Therefore, there could exist an opportunity for a South West cluster of companies to come together, with academia, to offer a deal to government. This would take a significant amount of supply chain management and leadership, but the benefits could be huge for the region (R6.8).

It is recommended that an action plan is made by NSW to ensure the South West is at the forefront of the Sector Deal and Government ambitions (R6.9).

One area of the Sector Deal is centred on maximising economic benefit to the UK. Key funding proposals for the South West are:

- Deliver a supply chain support programme;
- Form a new C&I research hub;
- Establish a new equipment qualification centre; and
- Establish a new centre for modular manufacturing, building on the existing Cammell Laird and Nuclear AMRC pilot centre in Birkenhead.

The focus here is around creating new advanced nuclear capabilities. Research activity in the South West is already high but there is scope to create new capability which could significantly

reduce costs in the nuclear sector. A much greater focus on academia and industry will ensure that the South West is at the forefront of these government ambitions and interventions.

6.5 SUPPLY CHAIN PLANS

In 2016, Government announced that developers will be required to show evidence that their projects will support growth in the UK supply chain, improve competition and boost innovation skills. This is a significant part of the Government's Industrial Strategy.

The intention is that the plans will form part of a negotiation pack when the UK government is negotiating the strike price with future nuclear site operators. The proposal is that economic benefit will become an element of negotiations, the focus having previously been on the cost of electricity. The idea of tying in supply chain involvement with commercial negotiations for new build will not present immediate benefit to the supply chain, but over the next 20 years, we can expect to see real changes. The draft policy is likely to be out in autumn 2018.

6.6 RECOMMENDATIONS

Table 4: Government Policy and the South West Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R6.1	Industrial Strategy Challenge Fund	NSW		Raise awareness of the ISCF, and opportunities for collaborations of companies to bid for funding opportunities under the grand challenges.	
R6.2	BEIS Nuclear Innovation Programme	NSW		Raise awareness of the South West's involvement in this programme, and better understand the future opportunities for economic development that this programme will realise.	
R6.3	Sector Deal: Construction	NSW		Plan South West involvement in future sector deal opportunities around development of advanced construction capabilities.	
R6.4	Sector Deal: Reuse of future nuclear sites	NSW		Plan a programme of proactive involvement to promote the reuse of South West nuclear sites for future nuclear projects.	
R6.5	Sector Deal: Generation IV Reactor Support	NSW		Develop a strategy for promotion of South West skills and capability to support SMR/Generation IV reactors.	

R6.6	Sector Deal: National Supply Chain Programme	NSW		Plan South West involvement in the development of a national supply chain programme.	
R6.7	Sector Deal: Innovation	NSW		Deliver a programme to support innovation in the supply chain.	
R6.8	Sector Deal: Reducing Decommissioning Costs	NSW		Develop collaborative proposals to utilise cross sector skills by combining defence and civil nuclear supply chains to reduce costs in decommissioning. A South West cluster of companies has the potential to offer a deal to government.	
R6.9	Sector Deal: Action Plan	NSW		Focusing in on Sector Deal opportunities, create an action plan to ensure that the South West is at the forefront of these government ambitions and interventions.	

7. EXPORT AND INWARD INVESTMENT

7.1 OVERVIEW

The UK has some of the highest nuclear standards in the world. This plays to the advantage of UK companies that are able to meet UK nuclear standards, as they are well placed to take advantage of worldwide export markets.

The significance of having a South West export market is more than simply an increase in output. Diversification in UK and foreign markets provides increased stability for companies already involved with local projects. For example, lower tier contracts on a UK new build might be sporadic and thus prevent local SMEs from competing. An international market can increase stability of workflow and an increase in potential output for SMEs. These factors may also make financially viable the initial costs of meeting nuclear standards and investment in people and equipment.

Nuclear South West's 2015 report (Ref. 1) focused on inward investment opportunities and maximising the benefit of having international companies working in the region. This section details the export potential and inward investment, with information from meetings with the Department of International Trade (DIT).

7.2 DEPARTMENT OF INTERNATIONAL TRADE

Currently, DIT covers 109 markets from 174 Embassies and High Commissions, and focus on five key areas:

- International trade and investment;
- Trade policy;
- Export control organisation;
- GREAT campaign;
- UK export finance.

DIT's Civil Nuclear Team aims to increase levels of exports by connecting UK suppliers to international demand, attract inward investment with long-term benefit to the UK, and support the sustainability of the UK nuclear sector (Ref. 12).

The current focus markets for DIT in the nuclear sector are shown in Table 5.

Table 5: DIT Current Export and Investment Markets

Market	Exports	Investment
China	✓	✓
Japan	✓	✓
France	✓	✓
Middle East	✓	
Turkey	✓	
Germany and Sweden	✓	
Central Europe and Finland	✓	
United States		✓

7.3 EXPORTS

In conjunction with the inward investment initiative, DIT also matches UK companies to international opportunities. DIT offer support in market access with government-to-government interactions, market introductions, providing access to trade specialists, and facilitating tradeshow access. The biggest current opportunities for the export of nuclear products and services are decommissioning markets in China, Japan, and Germany.

DIT also works to develop an international strategy. To do this, DIT communicates with Nuclear AMRC to use information from the 600+ companies registered with the F4N (Ref. 13) scheme. DIT also support the development of the Small Modular Reactor (SMR) programme, the Nuclear Industry Council (NIC) Exports and Investment group, and the Nuclear Industry Association (NIA) International Group.

DIT runs three 'Campaign Groups' focusing on coordinating a UK approach to commercial opportunities in Japan, China, Germany and Sweden. The groups are comprised of UK supply chain companies (for example there are 60+ in the China Group) and are sometimes also joined by the overseas customers. The research identified positive feedback on how the groups work to ensure a coherent UK offer. This consistency allows UK companies to be more competitive including competition with state owned enterprises. It is recommended that LEPs and local companies look into the benefits of involvement in these Campaign Groups (R7.1).

7.4 INWARD INVESTMENT

NSW is active in maximising inward investment to the South West through the current nuclear programmes, as highlighted in their 2015 report on the subject (Ref. 1). NSW has a presence at national and international nuclear industry events and liaises with UK government. DIT is also working with government partners and industry to identify UK capabilities and gaps in products and services. Where gaps exist, DIT use connections with the investment markets in Table 5 as well as new opportunities with South Korea. In order to minimise displacement of UK capability, DIT aim for UK foreign joint ventures or expansion of existing UK capabilities.

DIT attracts foreign investment by building a pipeline of potential high value foreign investment across the nuclear lifecycle. Currently the emphasis is on Nuclear New Build (NNB) and Waste Management and Decommissioning (WM&D). DIT also offer advice for companies on relocating to the UK, such as support with tax, recruitment, visas, sites, and regulatory and planning issues. Further, DIT markets the UK capabilities on an international stage and highlight domestic opportunities.

7.5 RECOMMENDATIONS

Table 6: Export and Inward Investment Recommendations

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R7.1	DIT Campaign Groups	LEPs Local Companies		Look into involvement in DIT Campaign Groups. For information, contact: nuclear.enquiry@trade.gov.uk	

8. SUPPLY CHAIN SUPPORT

8.1 OVERVIEW

There are many groups and initiatives, both in the UK and regionally in the South West, that are working to support supply chains to win work in the nuclear sector. This section summarises these support networks.

8.2 NUCLEAR ADVANCED MANUFACTURING RESEARCH CENTRE

The Nuclear Advanced Manufacturing Research Centre (Nuclear AMRC) is a part Government-funded centre based in Sheffield with the key aim to support manufacturing companies win work in the nuclear industry. On a national level, Nuclear AMRC delivers the Fit for Nuclear (F4N) programme. F4N aims to measure UK manufacturers' capabilities against the standards required in the nuclear industry. The programme uses an online assessment tool, which considers Health and Safety Culture, Strategy and Leadership, Design and Project Management, People Excellence, Process Excellence and Quality Management. 137 companies nationwide have completed F4N to date (Ref. 14).

In conjunction with the Nuclear Industry Association (NIA), the Nuclear AMRC are also developing a Demand Model, which looks at the potential national demand for manufacturing components in the nuclear industry. The purpose of this work is to identify periods of peak demand for goods in the national new build development programme. This is a useful, high-level tool. It is recommended that further work and engagement with Nuclear AMRC is completed to understand how this model can benefit South West companies in the future (R8.1).

8.3 NUCLEAR SOUTH WEST

Nuclear South West (NSW) brings together, as a cluster, key industry, academia, education, and government stakeholders from the nuclear sector. NSW coordinates dialogue between stakeholders providing the region with one unified voice for existing and developing projects.

NSW meet with governmental departments and industry to maximise industrial competitiveness, research and innovation and promote skills in the region. NSW aim to secure government and private investment with a long-term goal of maximised economic legacy.

Within the South West, the Stakeholder Alliance Group – a part of NSW – bring together key public and private stakeholders with common goals. These goals are:

- To understand market conditions;
- To identify gaps and opportunities;
- To optimise local supply chains;
- To match employment needs with high value skills and training;
- To deliver world-class research, development, and innovation; and
- To promote inward investment opportunities.

NSW also work to communicate with LEPs outside the South West, paving the way for more national collaboration and learning from experience. Internationally, NSW work with European Nuclear Clusters, and recently made over 70 contacts at the World Nuclear Exhibition in Paris with foreign businesses looking to collaborate with South West SMEs. This work reinforces the South West's chance for stability in providing nuclear sector skills and manufacturing now and

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as a legacy. Trade beyond the region can increase productivity and decrease fluctuations in workflow.

8.4 HINKLEY SUPPLY CHAIN TEAM

The Hinkley Supply Chain Team (HSCT) is an excellent example of an initiative to help local suppliers to win work on major infrastructure projects. It is a collaboration of Somerset Chamber of Commerce, SWMAS, and Business West with EDF Energy at HPC. The consortium use their local knowledge and expertise to support suppliers in Somerset and the South West to compete for HPC contracts. To date, £465m of contracts have been won by local companies. HSCT have identified and assessed over 90 work packages and matched over 3000 suppliers, with a potential for £200m in future contracts.

Examples of success include Blackhill Engineering, part of Devon-based SC Group, who in 2017 won two EDF Energy Hinkley Point C Excellence Awards for their delivery of a 650 tonne steel fabrication contract to support the project's jetty. Components included steel pile caps and bridge beams. The awards were for best Local/Regional Business and Best Manufacturing Supplier.

HSCT help raise awareness of available contracts amongst the local supply chain. Key to success is that local suppliers are notified, as early as possible, of opportunities. This early notification will give suppliers time to prepare and develop in order to meet high nuclear standards.

One way HSCT support local companies to compete for HPC contracts is to build consortia. The consortia, of two or more companies, provide a capability to fulfil contract requirements where each individual company would lack capability or capacity. An example is Advanced Precision Engineering Consortium (APEC), formed of six companies covering a range of engineering fields, who have successfully supplied to the HPC project.

HSCT also runs workshops and supplier development programmes to develop local SMEs. It must be recognised, however, that the capability of the South West stretches across the entire nuclear life cycle, including advanced manufacturing construction support.

The early phases of the HPC project have been focused primarily on earthworks, and site establishment, and, therefore, many of the contracts awarded locally to date have been service-based contracts. As the HPC project moves into the Mechanical, Electrical and HVAC (MEH) phase in 2019, HSCT has shifted focus to helping local companies to engage with industrial, engineering and manufacturing contracts. Significant progress has been made in this area; HSCT are currently handling over £200m of industrial opportunities for potential local suppliers, and strong relationships have been built with EDF Energy and the industrial Tier 1 partners working on the project.

HSCT bridge local SMEs with HPC contracts and this is vital to maximising the local economic impact and leaving a legacy of skills in the region. There is a need for this support throughout all the phases of HPC into its operation, as contracts continue and the type of contracts change with time. However, HSCT has confirmed funding only until 2020; it is therefore recommended that further funding be provided to maintain HSCT until HPC is operational and beyond (R8.2).

8.5 SWMAS

SWMAS combines knowledge of South West manufacturers and businesses with opportunities in industry. This is achieved through working to improve companies' productivity, capabilities, and capacity in order for companies to compete for contracts in new and existing markets.

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This knowledge of South West companies' capabilities gives SWMAS good understanding of which nuclear sector opportunities are feasible and where gaps lie. SWMAS harness and lead support from government programmes, LEPs and public sector funding, which, along with their expertise in business development, they use to develop companies' training, strategy, supply chains, and innovation. It is this local capability knowledge and programmes of development that SWMAS has brought, and continues to bring, to HSCT (Ref. 15).

8.6 SOMERSET CHAMBER OF COMMERCE

Somerset Chamber of Commerce is one of the fastest growing chambers of commerce and EDF Energy's primary contact for local supply chain engagement for the HPC project. Their relationship with EDF Energy's Nuclear New Build (NNB) team goes back to 2010 and their role in the supply chain project is vital in ensuring strategic alignment and engagement with all parties. Somerset Chamber of Commerce, with EDF Energy, have mapped the local supply chain capability through the Hinkley Supply Chain Portal providing a simple mechanism to engage with the HPC project (Ref. 16).

8.7 BUSINESSWEST

BusinessWest are the largest chamber of commerce in the South West and one of the founders of Nuclear South West. BusinessWest bring expertise in international trade and wider stakeholder connections to the HSCT.

8.8 RECOMMENDATIONS

Table 7: Supply Chain Support Recommendations.

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R8.1	Demand Model	Government NSW		Understand how the national demand model could benefit South West companies.	
R8.2	Increased HSCT funding	Industry Government		It is recommended that further funding be provided to maintain HSCT until HPC is operational.	

9. SKILLS

Defence and power generation projects bring a large number of direct employment and apprenticeship roles, but there is a broader scope to use these projects as vehicles and raise the region's overall pool of cross-industry skills. Work is therefore being done to develop high-value, legacy skills for the South West, and it is important that this is maximised.

Skills requirements need to be mapped to the current infrastructure and supply chain, with foresight of the needs of future projects. The benefit of this match has more importance than meeting industrial requirements; it maximises local involvement in national projects, increases local engagement, and improves the area's productivity and social prosperity.

This section discusses some of the activities underway to maximise skills development in the South West and nationally. It is recommended, however, that more is done to map, coordinate, and deliver an increased number of training interventions with maximum focus on high-value roles. This will likely require increased coordination between the groups discussed throughout this report and increased funding (R9.1).

9.1 NUCLEAR SKILLS STRATEGY GROUP

As well as support for UK manufacturers' capabilities to access the nuclear supply chain, there is a need to map skills in the UK to capitalise on opportunities in the nuclear industry. Nuclear Skills Strategy Group (NSSG) aims to be the single voice to Government on skills needed in the nuclear workforce – both civil and defence. They provide information on strategy, policy, standards and qualifications. It is recommended that the South West ensure alignment of supply chain and skills development activity with NSSG (R9.2). NSSG also publishes Annual Nuclear Workforce Assessment Reports through their Labour Market Information group; it is recommended that Nuclear South West contact NSSG to view this information at a South West-level and align regional delivery of national priorities (R9.3).

9.1 NATIONAL COLLEGE FOR NUCLEAR

The National College for Nuclear (NCfN) (Ref. 17) opened in 2018 and is one of five National Colleges aimed at training a high-tech workforce to meet national industry demands. NCfN has two hubs, the Southern Hub at Cannington near Bridgwater in Somerset and the Northern Hub at Workington in Cumbria. The aim is to support the development of a skilled workforce in high value positions across the gamut of roles required in the nuclear industry.

NCfN take information from links with industry and NSSG to mould the courses they offer to the current and future demands of the nuclear sector (both for civil and defence). For example, NCfN are working with EDF Energy to help place and train apprentices for existing generation and Nuclear New Build (NNB). The North and South Hubs aim to train 3,500 skills interventions (students) by 2022, in order to meet the predicted workforce need. To achieve this aim, NCfN are delivering training programmes at all levels, including programmes for entry-level school leavers, apprenticeships, and degree-level qualifications. Curriculum development is aligned to charter specifications, such as those described by the Engineering Council, in order to support the Continuing Professional Development (CPD) of students.

The Hubs also offer professional development and modular courses, where people can join modules specific to their needs and interests without undertaking a larger course. To address the skills gap in the South West, NCfN are looking at transitional courses, where the same workers can be retained in a project as their skills are updated throughout the differing phases of the project's life cycle. Similar courses can also be used to develop people from different sectors, for example defence and rail. These are all ways of retaining a skilled workforce in the

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South West, which also has the benefit of retaining people's existing knowledge of the region and developing legacy skills.

9.2 HINKLEY POINT TRAINING AGENCY

Hinkley Point Training Agency (HPTA) (Ref. 18) focuses on skills for the nuclear industry, rather than training for nuclear-specific roles. These skills naturally surround the construction, maintenance, and decommissioning phases of nuclear generation projects, as opposed to skills needed more specifically during power station operation.

HPTA is a not-for-profit organisation part funded by EDF Energy and HOTSWLEP, with the largest proportion of its funding coming from the Provider Network. It aims to be the single point of contact to coordinate skills for nuclear in the South West, sitting between Further Education (FE) and independent training providers, industry, government, and the local community. HPTA promotes a business-led (instead of qualification-driven) campaign to bring together Education and Training provision (both existing and specifically developed) with industry needs, encompassing HPC requirements whilst aware of broader skills and the legacy impact of high-value roles. HPC, like many modern construction projects, has a need for higher innovation in its manufacturing and construction techniques. The skill sets required are therefore changing accordingly, and the demands of the nuclear sector concerning quality and behaviour are exceptionally high.

Skills currently needed for the HPC project and across national projects include welders, jointers, pipe fitters, and cable pullers. There is a lack of available, skilled workforce in these disciplines in the South West and nationally, including for HPC, as described further in this report.

HPTA is working in support of the activity to increase the awareness and appetite of school leavers to skilled roles, as well as encouraging the uptake of apprentices by local SMEs and HPC contractors. The legacy from this training are skills that can be transferred to other sectors in the region, such as aerospace, marine, and defence, and HPTA actively seek a collaborative approach with employers to maximise this opportunity.

It is therefore recommended that a single South West training agency is funded into the future, coordinating the training of skills across nuclear power station life cycles and the defence sector (R9.4).

9.3 INDUSTRY OPPORTUNITIES

This report goes on to discuss the current and future nuclear projects in the South West, in which more specific skill areas are explored. More general points are discussed here.

Whilst upskilling a workforce has a positive impact on the region and is efficient in filling the roles required, it can be hard to find funding to put into practice. It is therefore recommended that access to funding is advertised, increased where possible (R9.5), and this funding focusses on innovative training (R9.6).

Utilising the skills learnt to support HPC, there is a great opportunity for South West suppliers to provide them to future nuclear projects beyond the region. It is therefore recommended that further work be done to highlight these opportunities (R9.7).

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9.4 RECOMMENDATIONS

Table 8: Skills Recommendations.

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R9.1	Increase High-Value Training and Funding for it	NSW Government		It is recommended that skills and training needs are better mapped, coordinated, and delivered within the South West. This may require increased funding.	
R9.2	Work with NSSG	Government NSW		Ensure alignment of South West supply chain and skills development activity with NSSG.	
R9.3	Workforce Assessment	NSW		It is recommended that the annual workforce assessment is analysed at a South West-specific level and national priorities are delivered at the regional level.	
R9.4	Fund a Combined Training Agency	Industry NSW		It is recommended that a single training agency is formed, or HPTA developed further, to equally support and combine training in all sectors of the nuclear industry in the South West.	
R9.5	Access to Finance	Industry Government		There should be facilitated/advertised access to funding to upskill the South West's workforce and to meet the required standards of the nuclear industry.	
R9.6	Innovative Training	Industry Government		Focus in on innovative ways of training to ensure the local workforce have the basic training requirements that are essential for HPC.	
R9.7	Future Nuclear Project Awareness	NSW Government		Provide advanced awareness of future nuclear projects to industry. HSCT is relevant to HPC, but a wider programme could ensure that companies are aware of the wider nuclear sector opportunities.	

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10. RESEARCH, DEVELOPMENT, AND INNOVATION

The South West is home to many Higher Education establishments that feed into nuclear skills and skills for the broader nuclear industry. There is also much research and development surrounding the nuclear industry. This report focuses on two examples below, describing how they are directly supporting activity in the South West's nuclear sector.

10.1 SOUTH WEST NUCLEAR HUB: BRISTOL UNIVERSITY

The South West Nuclear Hub (Ref. 19) (the Hub), based at Bristol University, incorporates the Nuclear Research Centre (NRC), (Ref. 20) a collaboration between Bristol University and Oxford University. It aims to reduce the cost of nuclear and grow research and teaching activities, driven by industry demand and the Department for Business, Energy and Industrial Strategy (BEIS) strategy.

Currently, Oxford is researching fusion, whilst key research at Bristol is focusing on nuclear fission and materials performance, especially in the Advanced Gas-cooled Reactor (AGR) fleet.

In 2015, Bristol University established the MSc in Nuclear Science and Engineering, which has grown to 18 students (September 2017) (Ref. 21). The course has links with industry partners (Sellafield, EDF Energy, Culham Centre for Fusion Energy, as well as consultancies) and the National College for Nuclear – bridging education establishments, improving collaborative working and increasing interest in higher education.

The NRC across Bristol and Oxford Universities is currently undertaking research on the following themes:

- *Nuclear Futures:* modelling future scenarios; new power systems; economic, social and environmental impact; sustainability and resilience; national and global policy; risk assessment; safety case management; non-proliferation strategies.
- *Advanced Research:* physics; materials (including nano-scale); chemistry; geosciences; engineering; and exploring atomised modelling, nuclear batteries, novel control and protection, and smart sensors.
- *Applied Research:* operational needs; lifetime extension; non-destructive testing; human factors and organisational safety; instrumentation obsolescence; waste disposal; new build digital systems assurance; system resilience; decommissioning; and risk and uncertainty assessment.

10.2 HINKLEY POINT C SUPPLY CHAIN INNOVATION LAB: BATH UNVERSITY

HPC Supply Chain Innovation Lab (Ref. 22) (the Lab) is a partnership between HPC and the University of Bath, School of Management based on a donation by EDF Energy for a five-year period. The aim of the Lab is to deliver insightful and impactful research focusing on complex supply networks and connecting business leaders, policymakers and academics.

The Lab have been mapping the journey of SMEs to become an integral part of HPC's support network. In 2018, the Lab is exploring two core research themes: managing the involvement of local SMEs in complex supply chains and capital projects; and managing contracts and collaboration over the lifecycle of a complex capital project. In regards to integrating SMEs, the Lab are researching scaling up the quantity and quality of SMEs to meet nuclear contract requirements, with the aim to leave a lasting legacy.

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The Lab draws on learning from experience identified in other industrial sectors and projects, such as manufacturing, transportation, and oil and gas companies. The Lab team also deploys systematic academic research methods to produce decision-making tools, business and policy publications and accessible teaching cases.

The Lab offers tailored events and capability development workshops aimed at bringing together business leaders, policymakers, and academics to address key challenges in setting up and managing complex supply networks. These events and workshops further help build a collaborative working environment and increase access to cutting-edge research and cross-sector learning opportunities.

Beyond the Lab, the University of Bath also runs a 'Productivity Through People' programme (Ref. 23), which runs leadership masterclasses and workshops for employees of SMEs. It also offers online support, learning from case studies and visits to its four partners: Babcock International; BAE Systems; EDF Energy; and Rolls-Royce Plc.

It is recommended that NSW collaborate further with the Lab (R10.1).

10.3 RECOMMENDATIONS

Table 9: Research, Development, and Innovation Recommendations

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R10.1	Collaboration with the Supply Chain Lab	NSW		Explore opportunities to collaborate further with the Supply Chain Lab.	

11. INFORMATION ON NUCLEAR PROJECTS

The following sections provide an update of each of the in-scope projects. Depth of information is commensurate with the report's objectives, relevance to opportunities in the South West, and participation of stakeholders. This builds on the Government policy, supply chain support, skills, and research, development, and innovation information from the previous sections.

Sections include new nuclear builds, existing generation, decommissioning, advanced modular reactors, fusion research, defence, and healthcare.

The sections follow a general outline consisting of a project summary, an update since 2015, information on supply chains, and gaps and opportunities, before finishing with recommendations based on the project's research.

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12. HINKLEY POINT C

12.1.1 Project Summary

Nuclear New Build Generation Company (NNB), a subsidiary company of EDF Energy, is planning to build two nuclear reactors at Hinkley Point C (HPC). It is 'C' as it is the third nuclear project at the Hinkley site in the last 50 years. The project is one of the largest construction projects in Europe and the cost of construction is currently estimated to be around £18bn-£20bn.

HPC is expected to generate 3,200 MeW of electricity and account for around 7% of the UK's energy demand, generating low carbon electricity for around 6 million homes.

The two reactors will use the European Pressurised Water (EPR) design. Other EPRs are under construction in France, Finland and China. Construction at HPC in Somerset started in 2016 and it is due to be operational in 2025.

12.1.2 Project Update

12.1.2.1 Current Activity

There are currently approximately 3000 people working on site at HPC and the initial civil works are well underway with the Earthworks expected to be completed by 2019. The civil works will continue for several years and during this time the Mechanical, Electrical, and HVAC (MEH) fit out phase will begin in 2019/2020. The first unit is due to be online by 2025 and the second in 2026, where the skillset required to support the project will change to that required of an operational power station.

12.1.2.2 Final Investment Decision

In July 2016, the Final Investment Decision (FID) was made by the EDF Energy Board of Directors, creating surety of the project and allowing the major Tier 1 delivery contracts to be signed.

12.1.2.3 Framatome

The EPR is being designed and developed by Areva NP, a French reactor design business. However, following Areva's bankruptcy, the majority of the shares were bought by EDF Energy, and the company renamed Framatome in 2018. Therefore, Framatome will now be delivering the contract to provide the Nuclear Steam Supply System (NSSS).

12.1.2.4 Chinese Involvement

In 2015, EDF Energy and China General Nuclear Power Group (CGN) signed an agreement in which CGN took a 33.5% stake in HPC, which was agreed by UK government in 2016. This agreement also included agreements relating to future nuclear reactor construction projects at Sizewell in Suffolk (Sizewell C), and Bradwell in Essex (Bradwell B). As part of this agreement, CGN will bring its own technology to the UK, building a HPR1000 reactor at Bradwell B.

12.1.3 Supply Chain Update

Being the first nuclear new build in a generation, HPC provides both new opportunities and challenges in the local and national supply chain. The FID enabled seven major 'Tier 1' contracts to be signed. Tier 1 contracts are let directly with NNB, and are typically very large contracts, of the order of £100s millions. Major Tier 1 contracts are shown in Table 10.

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Table 10: **Industrial Partners for NNB**

Tier 1 Contract	Industrial Partner
Nuclear Steam Supply System	Framatome
Marine Works	Balfour Beatty
Main Civil Contract	Bouygues TP/Laing O'Rourke
Earthworks	Kier BAM Nuttall
Turbine Island	GE Power
Mechanical Works	Cavendish Boccard Nuclear (CBN)
Electrical Works	Balfour Beatty Bailey
HVAC (Heating, Ventilation & Air Conditioning	ACTAN (Axima, Doosan Babcock, and Tunzini)

A number of Tier 1 contracts have also been won through a competitive process by Chinese suppliers who are now contributing to the supply chain.

The majority of the Tier 1 contracts have now been awarded. In addition to the major Tier 1 contracts, there are 187 additional Tier 1 contracts, of which 163 have been signed. All contract awards are published on the EDF Energy website.

The interview with HSCT showed that more than £465m worth of contracts have been awarded in the South-West as a result of the development (Ref. 24). In addition, a third of the jobs created are expected to be filled by local people and nearly 200 apprenticeships have already been created. Around 400-500 suppliers are supporting the project to date.

Tier 2 contracts are let by NNB Tier 1 suppliers, but there are also many more Tier 1 contractors creating supply chains at Tier 2 and below (Figure 3). Tier 2 contracts can also represent significant value. For example, a Tier 2 contract has been awarded to Express Reinforcements at £140m, and Hanson, supplying the cement and managing the batching plant, have been awarded a Tier 2 contract worth £100m.

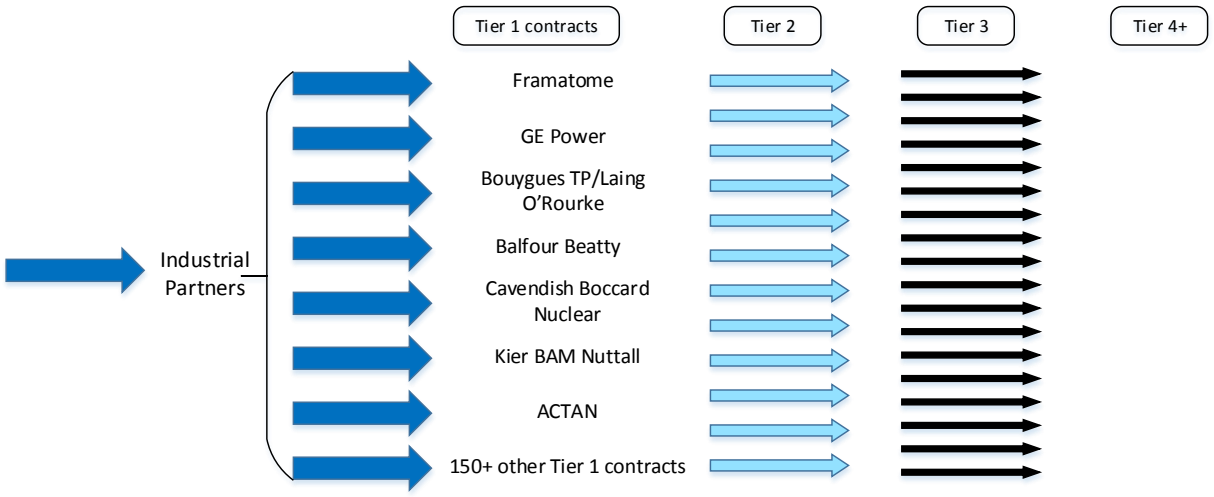

Figure 3: Illustration of HPC Tiered Flow Contracts

The profile of activity is broadly as below:

- **2018 – 2021:** Civil works will represent the majority of work activity on site.

- **2019 – 2025:** the work profile will change to MEH kit out, where the majority of the skills requirements will be equipment supply, manufacturing, and installation. There remains a significant volume of work to be awarded in this phase. The first unit is due to come online in 2025 and skills required will change to those required to deliver an operational reactor. The second unit is due to come online in 2026.

12.1.4 Support to Local NNB Supply Chain

A lot of work has been and continues to be done to support the South West supply chain to meet HPC requirements. NNB have been very active in communicating what a local supply chain would need to do to win work at HPC and there is work ongoing to provide visibility of opportunities and to break down the barriers that remain between the supply chain and the opportunity. There is currently a lot of activity aimed at continuing to grow economic benefits to the local supply chain. For example, NNB have a target of 1000 apprenticeships over the construction period of the project.

There is an online supply chain portal for potential providers to register their business, and on which NNB advertise their contracts. 4,000 suppliers are currently registered on the Hinkley Supply Chain Portal, which covers all sectors of the project (Ref. 25).

Somerset County Council also funds the Hinkley Supply Chain Team (HSCT), which comprises of organisations contracted to work with local Small or Medium Enterprises (SMEs). The aim is to help SMEs understand nuclear supplier standards and to use innovative methods to make SMEs capable of delivering into the HPC programme. In 2018, the Welsh government announced additional funding for this programme to deliver further services beyond the South West and into Wales.

HSCT are providing an induction programme for companies to align their skills to international-scale projects, and to international and Office for Nuclear Regulation (ONR) standards. Supporting local companies in this way opens the door to longevity of work across the UK nuclear sector, and also the opportunity to export skills and resources, as discussed in Section 7 on Export and Inward Investment.

12.1.5 Gaps and Opportunities

A number of Tier 1 contracts have already identified a large part of their supply chain. However, at Tier 2 level and below the vast majority of the work is still to be completed. Thousands of Tier 2, 3, and 4 contracts are yet to be awarded or identified, and consequently there are plenty of opportunities for local SMEs now and in the future to win or feed into these. It is recommended that work is done to advertise these lower tier opportunities (R12.1). It is also recommended that measurements of lower tier contracts are made to understand the real local economic benefit and identify flow through work that could be improved (R12.2).

The reality is that although the construction phase is well underway, there remains a significant opportunity for South West suppliers to become part of the supply chain.

The large scale of HPC has made matching local SMEs and people to the project inherently difficult. Work has been done in supply chain support (Section 8) and planning but there remains a demand that local businesses and people can fill.

Tier 1 companies are starting to pre-qualify their supply chain in order to be ready to place orders during the MEH phase in 2019. According to EDF Energy and NNB Genco during stakeholder interviews, the South West does not have the capacity to meet the entire requirements of the work during the MEH phase. It is recommended that there is a boost in support for HSCT now going into the MEH phase (R12.3) and further work undertaken to identify exactly the skills and quantities needed (R12.4). There is more work available to the

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South West supply chain than the region currently has the capacity to deliver. For example, there remains a significant opportunity to maximise South West supply chain contribution to the MEH phase. In addition to the surety of the HPC project, progress has been made on the EDF Energy Bradwell B and Sizewell projects. Suppliers that can win work during the MEH phase of the HPC project will be in an advantageous position to win work on future projects; this cumulative potential should be considered (R12.5).

The key barriers which are preventing South West suppliers from winning work at HPC include:

- Access to finance to increase capability and capacity;
- Funding for upskilling;
- Visibility of opportunities;
- Meeting capability and capacity requirements.

Meeting Supply Chain requirements for the project. The project supply chain requirements are stringent and unique to working on a nuclear site. Typical requirements might include:

- Technical/Design Expertise;
- Commercial Competitiveness;
- Health, Safety & Environment;
- Organisational Culture;
- Quality Management Systems;
- Project Management Capability;
- Sub-Supply Chain Controls;
- Organisational Strength;
- Experience, Competency, and Capacity; and
- Security Controls.

Companies have to be ‘ready’ to work at HPC prior to a procurement being published, and this requires commitment, investment, and support.

Specific areas where there is a great shortage include:

- Pipework manufacturers;
- Welders;
- Formwork carpenters; and
- Steel fixers (rebar).

The skills profile will change dramatically in 2025/26 as the plant enters its operational phase. In the short term, HPC has a significant requirement for innovative basic skills training. The development and introduction of innovative ways of training will ensure the local workforce has the basic training requirements that are essential for HPC. In 2015, EDF Energy opened their UK training centre in Cannington, Somerset, to help address their training needs. The NCfN also plays, and will continue to play, a key role in training people for HPC roles.

There is much more that can be done to help suppliers win work at HPC. HSCT, NSW, and DIT all work on highlighting the opportunities of inward investment; it is recommended they collaborate and have a plan to highlight the benefit to inward investors (R12.6).

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CASE STUDY

Advanced Manufacturing & Innovation at HPC during the MEH Phase

NNB remains open to new ideas and linking research and development (R&D) in the region to reduce time and cost in delivery of the project. There is great scope for innovation to be introduced at this stage in the construction project.

An example would be the introduction of new welding techniques. Welding is one of the only technologies that links all current and future reactor technologies, decommissioning, and other high value manufacturing driven industries. A typical nuclear reactor plant will have hundreds of kilometres of steel pipework with hundreds of thousands of welded pipe sections. Welding does not just join pipework, but also the primary containment, boilers, pressure vessels, reactor support structures, waste containers, steam generators and auxiliary plant. Developing and improving advanced joining techniques or introducing new techniques from other sectors could have a huge global impact, presenting significant opportunities.

Automated welding techniques, electronic modelling and laser scanning all represent examples of innovation that can be applied during the construction phase of the project. These high-tech areas provide the high value roles and sought after skills that maximise local economic benefit now and as a legacy.

There is scope for pre-assembly off site. There are still many possibilities here, and a recommendation is to deliver a programme to accelerate innovation in the region, and work with customers to bring that innovation to HPC (R10.7).

Current focus is to bring the South West supply chain on board to meet the standard requirements of HPC. There is also tremendous scope to bring innovation into the project, and urgent action should be taken to promote the South West's ability in this area, providing companies, or local industrial/academic consortiums opportunities to deliver innovative solutions to HPC (R10.8). This is a key recommendation that could result in Intellectual Property Rights (IPR), skills, and capabilities developed from the project, which will generate long-term economic benefits for the region.

12.1.6 Recommendations

Table 11: HPC Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R12.1	Visibility of Lower Tier Opportunities	Industry		Increase the level of visibility of Tier 2 and below opportunities.	
R12.2	Understanding real economic benefit	Industry Government		Develop more comprehensive metrics for calculating economic value of all tiers and flow through work. This would help calculate the real local economic benefit.	

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R12.3	HSCT funding Boost for MEH	Industry Government		Address the workforce shortage for HPC's MEH stage. Recommend continuing the supply chain support from HSCT, but with a 'boost' to ensure MEH opportunities are capitalised on. The timing here is crucial. There should be a review of the funding of the HSCT with this in mind.	
R12.4	HSCT Activities specific to MEH	Industry Government		Identification of specific activities that can be done to increase understanding of what skills are needed to deliver at HPC during the MEH phase in order to increase visibility and awareness of future opportunities.	
R12.5	Consideration of SZC and BRB	Industry Government Education		When considering investment for capitalising on HPC opportunities, include the potential to support SZC and BRB. Engagement in the SZC and BRB supply chain is needed straight away.	
R12.6	Inward Investment	Industry Government		Develop a consolidated programme to highlight to inward investors the benefit of partnering with local SMEs. It is recognised that this area is covered by the HSCT, NSW and DIT, but a review may identify what more can be done.	

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13. WYLFA NEWYDD

13.1 PROJECT SUMMARY

Horizon Nuclear Power Limited is the Site Licence Company (SLC) that plans to build two nuclear power stations in the UK. Horizon Nuclear Power is a wholly-owned subsidiary of Hitachi, and both nuclear power stations will use the Hitachi Advanced Boiling Water Reactor (ABWR) technology. There are four ABWR reactors already operating in Japan.

Two reactors will be built on the island of Anglesey in North Wales at the Wylfa Newydd Site. This nuclear power station will provide 5,400MeW of electricity, capable of supplying power to approximately 10 million homes.

Horizon is the site operator and will be the nuclear site licensee. Hitachi GE is the technology vendor and will supply most of the nuclear island. Horizon also plan to build a new nuclear power station at Oldbury.

Horizon have staggered the Wylfa Newydd and Oldbury projects, with Wylfa Newydd planned to be the first reactor build. As such, Oldbury's schedule is somewhat dependent on progression at Wylfa Newydd. Whilst this might set back the completion of Oldbury timewise, it allows for significant learning from experience to input in the Oldbury construction process.

The Horizon Nuclear Power's head office, Sunrise House, is located in Gloucestershire.

13.2 WYLFA NEWYDD SUPPLY CHAIN UPDATE

For the Wylfa Newydd Project there has been a significant amount of work carried out between Hitachi, Horizon and the UK and Welsh governments to support localisation of the supply chain. This work has created an understanding of which aspects of supply could be delivered by the local Welsh capability and the UK supply chain. There has also been significant work in the last three to four years to understand what the potential of the UK supply chain is to meet the requirements of the Hitachi and Horizon supply chain. This insight is invaluable in preparation for a future sister reactor at Oldbury.

Horizon and Hitachi have issued a joint Supply Chain Charter, which commits to supply chain transparency, development of the UK Supply chain and maintaining performance standards throughout the entire supply chain (Ref. 26).

Broadly, the site operator supply chain requirements are more aligned to that of a local supply chain. The Hitachi supply chain has plenty of scope for UK companies to be involved, but, as with NNB and the EPR at Hinkley, many of the high end nuclear components will be supplied by overseas supply chains. For example, it is highly unlikely that certain elements of the nuclear island will be available to UK companies, such as RPV, reactors internals, and Class 1[1] components.

However, many areas will be let as open competition and it is expected (UK-wide) that capability exists to deliver this work. Examples of likely areas that could be open to competition are mechanical equipment, HVAC equipment, heat exchangers, pumps, pipework, etc.

It is expected that a policy announcement will be made in 2018 by UK ministers concerning the introduction of supply chain plans, which will place obligations on vendors to share procurement information to allow greater visibility of future opportunities for the required vendors to share

[1] The ONR define Class I as any structure, system or component that forms a principal means of fulfilling a Category A safety function. A Category A function is defined as playing a principal role in ensuring nuclear safety.

procurement plans (Section 6). This may also help South West suppliers to better understand opportunities by the time that construction starts at Oldbury.

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14. OLDBURY NEW BUILD

The second power station to be built by Horizon will be built will be situated at Oldbury, in Gloucestershire, within the South West region, which will generate around 2,700MeW electricity.

14.1 OLDBURY SUPPLY CHAIN UPDATE

It is expected that the supply chain profile for Oldbury will be similar to that of Wylfa Newydd, noting that 'localisation' in this event will be the South West supply chain.

The timescales are much longer, and it seems sensible to consider how the South West can support an Oldbury supply chain in two categories: near term and long term opportunities.

14.2 CONSIDERATION OF THE NEAR TERM

Near term opportunities are likely to be generated by Horizon Nuclear Power, and could be realised in the time period 2020-2030. It is recommended that an early investigation is made to look into near term opportunities (R14.1). Taken from the Nuclear Industry Association Essential Guide to Nuclear, the opportunities are likely to include the following areas (Ref. 27):

- Safety, health and environment management;
- Site investigation;
- Management including quality assurance and quality control;
- Obtaining Development Consent Orders and other permits and consents;
- Development of Licensing processes and documentation in support of attaining a Site License Grant;
- Site-specific engineering and Design Authority capability;
- Programme and project management, including integration of all supply chain activity within each owner's programme;
- Development of a robust project execution strategy that may include owners engineering/architect engineering/construction management capabilities, depending on the specific strategy the developer selects;
- Risk management;
- Cost planning, cost control and engineering management;
- Supply chain engagement, procurement, commercial and contract management;
- Waste and decommissioning strategy;
- Recruitment, training and skills development;
- Business planning and financial modelling;
- Safety case development; and
- Obtaining regulatory consent.

14.3 CONSIDERATION OF THE LONG TERM

These opportunities could represent those associated with construction of the power station. Although some way off, they may still materialise within the 20-year window to which this report

refers. Whilst these opportunities are in the future and in consideration of investment for Hinkley, it is worth including the possibility of also supporting Oldbury in similar areas (R14.2).

There is a possibility that more content could be opened up to the UK than for Wylfa Newydd, and this should be explored with the vendor and operator at an early stage (R14.3 and R14.4).

14.4 GAPS AND OPPORTUNITIES

Based on experience with the Wylfa project, there is an early opportunity to work with Horizon and Hitachi to identify what content could be delivered by South West companies, with investment.

Specific gaps for Oldbury might be around the following:

- HVAC: The UK is generally very experienced in providing nuclear HVAC, both in design and manufacture. The existing supply chain has detailed understanding of safety standards, regulations, and licencing. However, depending on timings, there may be a large demand which exceeds UK capacity. The UK supply chain will need to expand significantly. There is very large capacity in the non-nuclear sector that could be upskilled for nuclear work and presents an opportunity for South West suppliers;
- Class 3 or below heat exchangers are routinely produced by many companies in the UK. Most will be manufactured to EN or ASME code requirements. The barrier is likely to be the level of inspection, verification and documentation that will be required, which will currently be more than most companies employ;
- UK-wide, the type of pipework required is currently being manufactured in the UK for other sectors. As a result, there are a significant number of companies that can manufacture pipework to the required standards. There is an opportunity for South West companies to upskill to capitalise on this opportunity; and
- Electrical Cables: UK industry had previously supported the home and global nuclear and conventional power programme through a home-grown capacity. However, competition from abroad and market forces has led to a reduction and consolidation within the UK capability to support any new power station build. There could be potential to regenerate electrical cable capability in the UK if the market opportunity presented, which would need to be explored further.

14.5 RECOMMENDATIONS

Table 12: Oldbury Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R14.1	Oldbury Near Term Opportunities	NSW		Develop a plan to help the supply chain understand how the South West can capitalise on near term opportunities.	
R14.2	Oldbury Long Term Opportunities	NSW		Understand better the long-term (beyond 2030) opportunities from Oldbury, which would require significant investment to enable the South West supply chain to capitalise.	

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R14.3	Visibility of Oldbury Procurement	Industry Government		Well in advance of early works at Oldbury, there should be work to ensure that clear visibility of project timelines and when major procurements will take place and understanding of procurement processes which are likely to be used.	
R14.4	Ensure early Supply Chain support for Oldbury	Industry Government		Provide early viewing of the breakdown of the project work packages and requirements, to allow time for government support mechanisms to be put in place.	

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15. SIZEWELL C

15.1 PROJECT SUMMARY

EDF Energy and its partner, CGN, plan to build a 3.2 GW nuclear power plant with two EPR reactors (each of 1.6GW) at the Sizewell C (SZC) site in Suffolk, capable of generating electricity for approximately 5 million homes.

Currently, Sizewell C has finished stage 2 consultation and is looking at stage 3 in 2019. There is currently no timeline for construction, but an early indication is that Sizewell C could become operational in 2031.

15.2 SUPPLY CHAIN UPDATE SIZEWELL C

EDF Energy is already working with local companies in Suffolk and the Suffolk Chamber of Commerce to promote the opportunities that SZC represents for local firms. The SZC Supply Chain Portal has been set up, with more than 1,100 businesses already registered (Ref. 28).

It is understood that the procurement process will be different for SZC than for HPC, however, the differences are not yet known.

15.3 GAPS AND OPPORTUNITIES

South West companies investing to deliver at HPC should be aware that supply chain activity has already begun at SZC. Therefore, early engagement is important to ensure that new capability, and that built as a result of HPC, can be exported to other nuclear projects such as SZC (R15.1). If any company is part of the HPC supply chain, it may well be advantageous for winning work at SZC.

There is also a large scope for LEPs, Local Authorities (LAs), nuclear clusters, and any other groups interested in nuclear, across the UK, to work collaboratively, bringing together the expertise from nuclear industry-rich regions to maximise opportunities, fill gaps, learn from experience, and share good practice (R15.2).

15.4 RECOMMENDATIONS

Table 13: Sizewell C Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R15.1	Exporting and Sharing Skills to SZC	NSW Industry		Run activity to support South West companies export their skills to Sizewell C. Potential participation areas that include: Engineering – design, transportation and access routes and abnormal loads studies; Project management – project, engineering and site management; Environment – safety case, meteorology (Met Office = SW potential), terrestrial ecology, ornithology etc.	

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
				Planning – consents and permits management, scheduling, construction planning, topographic mapping; Logistics, IT, legal consultancy.	
R15.2	Collaboration between UK LEPs and LAs	NSW Government Industry Groups		Further UK-wide collaboration between nuclear industry-rich regions to maximise future nuclear project opportunities.	

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16. BRADWELL B

16.1 PROJECT SUMMARY

China General Nuclear Power Corporation (CGN), with its partner EDF Energy, plan to build a new nuclear power station at Bradwell-on-Sea in Essex. The proposed reactor is a Chinese design, known as UKHPR1000. This design is currently undergoing a Generic Design Assessment (GDA), which will decide whether the design is acceptable to the UK regulator, the ONR. It is expected this process will take five years.

In addition, the process to gain the appropriate planning and regulatory consents and permissions has now started, and is expected to continue until around 2023 - 2025, before construction starts.

16.2 SUPPLY CHAIN UPDATE

South West companies investing to deliver at HPC should be aware that supply chain activity has already begun at Bradwell B. Therefore, early engagement is important to ensure that new capability, built as result of HPC, can be exported to other nuclear projects such as SZC and Bradwell B. It should be noted that there will be supply chain activity from CGN as well as EDF Energy. It is recommended that activity be run to support South West companies to engage (R16.1).

16.3 RECOMMENDATIONS

Table 14: Bradwell B Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R16.1	Exporting Skills to Bradwell B	NSW Industry		Run activity to support South West companies export their skills to Bradwell B. Potential participation areas that include: Engineering – design, transportation and access routes and abnormal loads studies; Project management – project, engineering and site management; Environment – safety case, meteorology (Met Office = SW potential), terrestrial ecology, ornithology etc. Planning – consents and permits management, scheduling, construction planning, topographic mapping; Logistics, IT, legal consultancy.	

17. EXISTING GENERATION

17.1 HINKLEY POINT B

EDF Energy-owned Hinkley Point B (HPB) nuclear power station is the only nuclear power station currently generating electricity in the South West region. It began operation in 1976 and uses AGR technology.

HPB station supports approximately 535 EDF Energy full time equivalents (FTEs) and 220 contractors full-time. It is due to cease operations in 2023 (but may be extended) and enter a decommissioning phase.

In 2016, EDF Energy calculated their total economic impact to have been £149m GVA in Bridgwater and West Somerset (Hinkley Points' parliamentary constituency) alone, and £793m GVA in the South West region (Ref. 29). The same report states that EDF Energy's operations supported 15,395 direct and indirect jobs in the South West region – or 0.52% of the region's total employment – and 3,110 in the Bridgwater and West Somerset constituency[2]. This was calculated using an aggregation of investment and job creation as a result of existing generation, nuclear new build, and commercial supply operations.

Decommissioning of the AGRs will be funded by the Nuclear Liabilities Fund (NLF), held by the NDA into which EDF Energy have been paying. This pot of money will pay for the decommissioning. In the next couple of years, the NDA and BEIS will decide who does the de-fuelling and who does the decommissioning programmes.

Whoever the customer is, the decommissioning opportunity will be the same. Looking at the scale of the opportunity for Magnox stations gives an indication of the supply chain requirements; Magnox's planned expenditure for 2017/2018 was £490m (Ref. 30).

The Nuclear Liabilities Fund (NLF) is a fund of approximately £9bn, which exists to meet the cost of cleaning and decommissioning the UK's more modern nuclear power stations.

As an AGR site, HPB is likely to undergo three main phases of decommissioning work:

- Pre-closure transition and de-fuelling;
- Site surveillance, care and maintenance; and
- Reactor building decommissioning and final site clearance.

De-fuelling is planned to start in 2023, followed by post-operational clear out and dismantling of plant and systems. Safestore is expected to be entered into around 2033. Therefore, the decommissioning period will be the 10 years between 2023 - 2033.

The initial strategy (UK Government Policy) is for Early Safestore of AGRs. This means prompt decommissioning, with reactor dismantling occurring within 10 years from the end of generation. This still allows a significant period of time for the radioactive decay of some of radioactive material on site.

17.2 SUPPLY CHAIN UPDATE

The current supply chain supporting operations at HPB is well established. EDF Energy use frameworks to purchase the goods and services from long-established and well-known

[2] This was the best data made available to this report, but does not distinguish between the three projects at Hinkley Point.

suppliers. The real opportunity will come from the decommissioning of HPB, which will commence with de-fuelling in the early 2020s.

17.3 GAPS AND OPPORTUNITIES

Focusing on where the South West can meet the decommissioning requirements for HPB could represent significant opportunity for South West Business (R17.1). Transfer of skills from those used on the current decommissioning sites could represent an opportunity (R17.2).

17.4 RECOMMENDATIONS

Table 15: Existing Generation Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R17.1	Focus on Decommissioning	Industry Government		Engage with HPB/NDA early to understand Government's strategy for decommission AGRs and the opportunity to introduce new innovation into the project. This is likely to involve closer alignment with the NDA initiatives to grow the UK decommissioning supply chain.	
R17.2	Consolidation of decommissioning sites	Industry Government Education		Work to ensure alignment of skills with those used on current decommissioning sites to ensure the new decommissioning opportunity is fully capitalised.	

18. DECOMMISSIONING SITES

18.1 OVERVIEW

As described in Section 4.2.1, civil nuclear and research decommissioning sites in the UK are owned by the NDA. The NDA are responsible for 17 sites nationally. Four sites are currently undergoing decommissioning in the region and are managed by Magnox Limited:

- Berkeley: production ended 1989.
- Winfrith: production ended 1990.
- Hinkley Point A: production ended 2000.
- Oldbury: production ended 2012.

Magnox is currently operated by a Parent Body Organisation (PBO) of Cavendish Fluor Partnership. However, this arrangement is expected to end by 2020, after which another model will be implemented.

Whilst every Magnox site has its own decommissioning challenges, the broad order and principles of decommissioning are the same. Magnox has grouped its decommissioning activities into strategic programmes. This is to ensure a consistent approach across the decommissioning sites, and benefit from a 'lead and learn' approach. For example, where an innovative approach has been successful at one site, another site could benefit from the same approach. The programmes are:

- De-fuelling;
- Ponds;
- Plant and Structures;
- Waste Projects;
- Waste Operations;
- Reactors;
- Asset Management;
- Care and Maintenance; and
- Site Restoration.

The NDA regularly publishes its Business plan on its website. Its latest three-year Business Plan (Ref. 30) was published in March 2018, and describes the forthcoming decommissioning plans for all the NDA sites. A summary of the state of each of the decommissioning sites within the South West is provided below.

18.2 BERKELEY

Current activities until 2021 include the continuation of retrieval and packaging activities in the active waste vaults and continuation of the waste retrieval plant design, commissioning and then waste packaging. Also, decommissioning and demolition activities are ongoing in preparation for entry into Care and Maintenance in 2023.

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18.3 WINFRITH

The main decommissioning activities at Winfrith are the continued decommissioning of the DRAGON and SGHWR reactors. Aside from this, the site is in an advanced state of decommissioning.

18.4 HINKLEY POINT A

In addition to the ongoing decommissioning and demolition activities in preparation for entry into Care and Maintenance in 2027, there is still significant work to do under the waste management programme. For example, waste packaging and conditioning, fuel element debris retrieval activities and construction of a storage facility.

18.5 OLDBURY

Decommissioning of the Magnox Oldbury station is in its infancy. Activities in the near term will include intermediate level waste retrieval and progressing activities that will support waste storage solutions.

18.6 SUPPLY CHAIN UPDATE

NDA's 2016 strategy paper states that 3,500 contractors are used in their supply chain across the UK, and £12bn has been spent with suppliers since 2005 (Ref. 31). The strategy paper also states that £90m is invested annually in R&D, most of which is spent at Sellafield in the North West. It is recommended that the South West nuclear cluster increase their involvement in NDA's R&D portfolio (R18.1). Current annual spend in the supply chain is £400m.

NDA have initiatives to ensure that the use of SMEs is promoted. A key element of NDA work is deployment of SMEs, and initiatives exist such as the SME steering group, a mentoring scheme, and events around the country. Around 3000 SMEs are currently employed across the NDA Estate. It is recommended that there is increased knowledge of routes to market for South West SMEs (R18.2), which could come from increased participation of clusters in supply chain events (R18.3).

In 2014 the NDA published a Map and Chart showing levels of spend and location of SMEs working across the NDA Estate (Ref. 32). This shows the South West region as the second lowest spend in the NDA supply chain. From this statistic, it is therefore assumed that there is scope for improvement.

NDA already operate a transparent supply chain, with contract notices published on the Government's contract finder. Furthermore, the NDA has a supply chain charter to ensure good supply chain engagement across the entire supply chain. For NDA procurement, The Public Procurement Regulations 2015 apply, so the use of the Official Journal of the European Union (OJEU) applies over the thresholds. The NDA and its SLCs also use Achilles and frameworks to procure goods (Ref. 33).

In addition, Magnox Limited, the SLC decommissioning HPA, Berkeley and Oldbury posts opportunities on its website (Ref. 34) and has information on suppliers (such as standards) in their Supplier Communication Plan (Ref. 35).

Within the decommissioning market, there are significant opportunities in remotely controlled survey and demolition/deconstruction equipment. New technologies can decrease the dose burden on workers. There is an opportunity to take these technologies and skills to export, but also to cross over to other industries (R18.4). For example, remote camera work using drones is used in nuclear decommissioning and also in building surveys and inspections. The NDA also have a strong focus on development of new technologies & deployment of new technologies from other sectors and employ strategic interventions to help emerging technologies. In

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addition, the NDA is very happy to work with new suppliers. This could present opportunities for South West companies that are able to bring cross-sector innovation into decommissioning.

There is also an opportunity to be gained from introducing new innovation into the waste management sector. In particular, retrievals, size reduction, conditioning, and container and storage solutions. There is good opportunity, by honing in on decommissioning skills for the current fleet, to capitalise on opportunities in the future HPB and Defence decommissioning markets.

In general, it is recommended that the South West engage closely with NDA initiatives (R18.5).

18.7 GEOLOGICAL DISPOSAL FACILITY

Radioactive Waste Management (RWM) has been chosen by the government as the body responsible for planning, building and delivering a Geological Disposal Facility (GDF), whose headquarters are in Harwell, Oxfordshire. A GDF is a major infrastructure project, which will support skilled jobs and investment for local communities well into the next century.

The facility will be designed to take higher activity waste, which comprises of High Level Waste, Intermediate Level Waste and a small amount of Low Level Waste (Ref. 36). The solid radioactive waste will be packaged in highly secured and engineered containers made of either metal or concrete and surrounded by clay or cement. These containers will then be placed in a stable rock formation between 200 - 1000m below the surface. The waste will be isolated deep underground in order to contain the radioactivity while it decays naturally over time. The facility will require no ongoing maintenance and will be much less susceptible to surface risks such as climate change, and human activities including war and terrorism (Ref. 37).

The project is currently undergoing a public consultation process to gather views from the public and stakeholders on the policy for working with communities during the siting process for the GDF (Ref. 38). Construction cannot start until a suitable site has been identified, and a local community is willing to host the site. Currently no sites have been selected or are under consideration (Ref. 39). It is estimated that the first waste will be received into the site in the 2040s, and filling and closing the facility will run into the next century (Ref. 40).

To build and operate a GDF is a multi-billion pound, national infrastructure project, which is likely to bring a number of significant benefits to the host community. It will involve the provision of hundreds of skilled jobs spanning several generations, and it is recognised that during the process to identify a suitable site both the economic opportunities and potential environmental impacts will need to be clearly communicated to any potential host community (Ref. 39). It is recommended that NSW consider the South West's future involvement in the GDF programme (R18.6).

18.8 RECOMMENDATIONS

Table 16: Decommissioning Sites Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R18.1	Involvement in NDA's R&D portfolio	NSW Industry		Support greater involvement of the South West supply chain in the NDA's R&D portfolio. This would require proactive engagement with the NDA and its stakeholders to understand	

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
				the opportunities available to the South West supply chain.	
R18.2	Improve knowledge of Routes to Market	NSW Industry		Suppliers interested in supporting the decommissioning market must ensure that they open all possible routes to market. This includes access to framework opportunities (either directly or through Tier 1 suppliers), presence on the Achilles database, knowledge of the forthcoming procurement timeline, and contract opportunities and subscribing to the e-bulletin and NDA Estate supply chain linked in group (700 members).	
R18.3	Supply Chain Events	NSW Industry		The NDA holds annual decommissioning supply chain events and if not already, these should be attended by representatives of South West industry clusters.	
R18.4	Cross Sector Innovation into Decommissioning	NSW Industry		NDA also have a strong focus on development of new technologies & deployment of new technologies from other sectors and employ strategic interventions to help emerging technologies. This could present opportunities for South West companies that are aware of the opportunities to bring cross-sector innovation into decommissioning.	
R18.5	Close Engagement with NDA initiatives	NSW Industry		Engagement with the NDA initiatives to grow the South West's contribution to the NDA spend.	
R18.6	GDF Programme Involvement	NSW Industry		Consider the South West's future involvement in the GDF Programme.	

19. ADVANCED MODULAR REACTORS

Currently, the UK new nuclear build renaissance is focused on large-scale energy generation, with the capability to deliver a significant proportion of the future UK energy demand. However, there remains difficulties in financing such large infrastructure projects.

As a consequence, there is a new emerging global market in Advanced Modular Reactors (AMRs) and Small Modular Reactors (SMRs). For the purpose here, where the term AMR is used it encompasses SMRs. AMRs present many advantages to that of conventional large-scale nuclear reactors, such as:

- Flexible siting (that is, they may not need to be situated near the coast);
- Cheaper and quicker to construct, reducing financing and construction costs. In particular, if several are built, allowing the application of a modularised approach to construction, further reducing costs;
- Repeated manufacture through a modularisation approach can further reduce costs, supporting delivery of low cost electricity; and
- Additional functionality (e.g. heat output for domestic or industrial use).

With the amount of nuclear licenced sites in the South West (Figure 2) the region has strong potential to host AMRs.

The size of the potential global SMR market has been estimated at approximately 65-85GW by 2035, valued at £250 - £400bn. The potential UK market is around 7GW by 2035 (Ref. 41). The UK government is interested in the AMR market as part of a clean energy solution, but also to understand how the UK can capitalise on the economic benefits of this new technology.

In addition to Advanced Fission Reactors, new technologies utilising Fusion as the process for heat generation are considered here.

19.1 RECENT AMR DEVELOPMENT

In 2017, the government announced up to £56m R&D funding for new technologies through a two-stage AMR R&D project over three years. In 2018, the UK government launched an AMR Competition to encourage a wide range of new technologies to bid to win funding to develop their designs. The competition is aiming to capture a broad range of reactor technologies, which differ from the technologies of conventional reactors. The competition is looking to maximise the use of off-site factory fabrication of modules and target applications. Successful applicants will secure funding to deliver a feasibility study. This feasibility study will then go forward to a second competition phase for development funding. The winning organisations, at the point of researching and writing this report, are not yet known. However, the winning organisations could potentially deploy their technologies in the UK. This is likely to be towards the end of the 20-year scope of this report.

In the nearer term, there are a number of other water-based technologies whose designs are potentially more advanced, and who are now engaging with the UK regulator (ONR) to understand how they could advance their design through the UK regulatory process, with a view to deployment in the UK. There is currently no UK siting policy, but it is important that the South West market potential sites for future deployment of AMRs (R19.1).

AMR development would complement skills-use and manufacturing capabilities from large-scale nuclear projects. It is important that South West companies follow policy developments in the

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AMR domain so that skills from large-scale nuclear projects can be transferred to the AMR market (R19.2).

19.2 RECOMMENDATIONS

Table 17: AMR Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R19.1	Opportunities for Hosting AMRs	Local Government		It is important that the South West keeps abreast and understands opportunities for hosting AMRs in the future.	
R19.2	Following Policy Developments	NSW Industry		The AMR programme could certainly represent future business opportunities for South West companies, who have developed capabilities to support large-scale generation projects. The AMR opportunities are in their infancy. However, it is important that South West companies follow policy developments so they are positioned to capitalise on the new industrial opportunities that they present.	

20. FUSION RESEARCH

The Joint European Torus (JET) operations at Culham have been instrumental in positioning the UK and Europe at the forefront of fusion research (Ref. 42).

The United Kingdom Atomic Energy Authority (UKAEA) mission is to continue to lead the commercial development of fusion power and related technology, positioning the UK as a leader in sustainable nuclear energy and the associated technologies – a core objective of the Government's Industrial Strategy.

20.1 GAPS AND OPPORTUNTIES

In December 2017, Energy Minister Richard Harrington MP announced an £86 million investment in fusion research, to set up a national fusion technology platform at the UK Atomic Energy Authority's (UKAEA) Culham Science Centre.

The new investment will reinforce the UK's world-leading fusion research and development capability, and allow UK firms to compete for up to a further £1 billion of international contracts for fusion technologies.

Fusion requires integrated solutions for the whole power plant lifecycle: structural materials, coolants, balance of plant, lifetime maintenance and monitoring, control and instrumentation, decommissioning and waste processing.

ITER, a scaled-up version of JET, offers opportunities to UK industry to develop systems and components. In providing fusion relevant skills, facilities and emphasising the UK's commitment to international collaboration the UKAEA is able to support the supply chain and help the UK win that business.

Fusion needs to develop the materials, processes and the supply chain for machines beyond ITER. The Technology Facilities will address some of these areas. This is a unique opportunity for UK industry, including SMEs and academia to develop new facilities for fusion and the wider need.

A joint industry and academia South West Fusion Technology Facilities workshop, hosted with UKAEA, took place during February 2018. This workshop provided industry with an opportunity to inform UKAEA what the areas of interest are, to shape these facilities and the fusion programme and how industry would like to work with UKAEA to move the UK nuclear industry forward through fusion.

It is recommended that the South West develop a programme to engage with fusion developments (R20.1).

20.2 RECOMMENDATIONS

Table 18: Fusion Research Recommendations.

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R20.1	Programme for South West Engagement with the fusion programme	NSW Industry Academia	Not Applicable	Deliver a programme to support South West companies sell their capability into the fusion programme, in the UK and abroad.	

21. DEFENCE

While the Defence and Civil nuclear programmes are often viewed as different, many aspects are similar or related. The use of pressurised water technology in HPC mirrors the technology in the UK submarine reactor programme over the last 60 years. Many of the skills in the two sectors are transferable.

The nuclear-specific areas of defence include both reactors used in propulsion of UK submarines and the warheads of the Trident missile system. Whilst these aspects only form a small part of the overall submarine, the larger supply chain and support opportunities are similar to many offered in civil nuclear.

Currently, there are three classes of submarine in operation – Astute Class, which is replacing the retiring Trafalgar Class, and Vanguard Class.

In July 2016, the House of Commons agreed to maintain the UK's nuclear deterrent beyond the early 2030s, and was soon followed with start of construction on a fourth Class – Dreadnought – which will replace Vanguard as the UK's Continuous At Sea Deterrence (CASD) carrying Trident missiles and associated warheads.

The UK's military submarines are categorised into two groups:

- **SSN, nuclear-powered submarines**

  Trafalgar Class: SSN. 7 in total, built from 1977 to 1986. In operation since 1983 to present. 3 active, 4 retired;

  Astute Class: SSN. 7 in total planned, built from 2001 to present. In operation since 2010 to present. 3 active, 4 being built.

- **SSBN, nuclear-powered ballistic submarines (holding nuclear arms)**

  Vanguard Class: SSBN. 4 in total, built from 1986 to 1999. In operation since 1994 to present. All 4 active. Scheduled to remain in-service into the 2030s;

  Dreadnought Class: SSBN. 4 in total, the first being built from 2016 to present. Due to be in operation from 2028 with a service life of over 30 years.

21.1 MOD ABBEY WOOD AND MOD OPERATIONS BACKGROUND

MOD Abbey Wood in Filton, Bristol, is home to the Defence Equipment and Support (DE&S) organisation, which oversees and manages the majority of the procurement and support for the Defence Equipment Programme. Established in April 2017 as part of the DE&S, the Submarine Delivery Authority (SDA) is responsible for delivery of the Dreadnought programme, the remaining Astute build programme, and management of all in-service submarines plus the preparations for the disposal of legacy vessels. It also contains equipment specific teams managing the nuclear reactor and Trident missile programmes. Independent of the SDA, Defence Nuclear manage warhead activities and is also based in Abbey Wood, as is the MOD internal nuclear regulator, the Defence Nuclear Safety Regulator (DNSR).

A further 250 submarine engineers are employed at a Keynsham office located between Bristol and Bath. This office focusses on in-service support and platform systems required to support the day-to-day operations of submarines.

The design and manufacture of submarines occurs at the Barrow-in-Furness shipyard, Cumbria, which is a collaboration between the MOD, Royal Navy, and BAE Systems Maritime – Submarines. The plan remains for UK submarines to be built here.

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Rolls-Royce is the principal supplier of nuclear reactors and power and propulsion, with major offices in Derby and Bristol. AWE is the major supplier of nuclear warheads from one of its main locations in Aldermaston, Berkshire.

21.2 DEVONPORT BACKGROUND

Devonport in Plymouth is the largest naval base in Western Europe. Devonport is the only facility in the UK licensed by the ONR for submarine refit, refuel, and defuel. The naval base is a collaboration between the MOD and Babcock International and contains a number of facilities that support both the submarine and naval reactor programmes.

21.3 DEFENCE UPDATE

An estimated 28 - 30,000 employees are needed to sustain defence nuclear, which includes around 1,600 people in Devonport and a further 1,600 in Devonport suppliers (Ref. 43).

21.3.1 Devonport

Recent activity at Devonport includes the De-fuel, De-equip and Lay-up Preparation (DDLP) project which aims to equip number 14 Dock for submarine dismantling, including the building of a more efficient Reactor Access House (RAH) for defueling. Currently, nine fuelled and four defueled submarines await disposal at Devonport, and more submarines will be added in following years. Approximately £600m is spent per year in Devonport, around 80% of which is nuclear-related.

21.3.2 Submarine Delivery Agency

The SDA currently employs 1,300 FTEs and became independent from DE&S, as an Executive Agency, in April 2018. The aim is that, with independence and more autonomy, the SDA will attract and retain the highest standard of employees and subject matter experts. This initiative builds on learning from experience from the London Olympics Delivery Authority, specifically the ability to recruit the best managers and to deliver large programmes on time and on budget.

21.3.3 Dreadnought Alliance

Dreadnought Alliance sits within the SDA, phase 1 of the Dreadnought programme having commenced in September 2016.

Dreadnought is expected to support 6,000 FTEs. It is a £31bn project with £10bn contingency, with peak expenditure expected from now to mid-2030s (Ref. 43).

21.3.4 Maritime Underwater Future Capability

Looking to the future, early concept design work on the next generation of SSN, the Maritime Underwater Future Capability (MUFC), is starting in the Bristol area. At present details are limited, but it is an area of interest for the South West to bear in mind.

21.3.5 Defence Nuclear Training

The Nuclear Department of Defence is currently based at HMS Sultan in Gosport, Hampshire. They provide education and training, research, consultancy and advice to the Naval Nuclear Propulsion Programme. There are plans that the Department will collaborate with a university to increase hubs of nuclear activity (a number of sites across the country are being considered).

21.3.6 Supply Chain Update

There are opportunities for regional manufacturers to feed into the supply chain, especially in the Dreadnought programme. However, unlike in the civil sector, defence supply chains are less well publicised due to the sensitive nature inherent in defence projects. With three of the seven Astute Class submarines already built, the supply chain in this area is established.

Defence is always looking for engineering innovation to either improve in-service operation or enhance future new design.

BAE Systems and Rolls Royce are Tier 1 industrial partners for the Dreadnought Alliance. Submarine design and build, including reactor assembly, is in Barrow-in-Furness, Cumbria. Rolls Royce is the provider of nuclear propulsion (reactor systems) to the MOD, and in 2013 the two signed a ten-year Foundation Contract for Rolls Royce to continue its work on existing and future submarines. Its reactor core manufacturing facility is based at Raynesway in Derby.

Whilst less nuclear-specific, BAE Systems has publicised more on its supply chain of Dreadnought; BAE estimate that 85% of its early suppliers were UK companies (Ref. 44).

21.3.7 Gaps and Opportunities

Devonport provides an opportunity of relative longevity and stability in the South West's nuclear sector. Operations are set to continue past 2050 and with a submarine refit taking around four years, the underlying drumbeat of workflow is more frequent than in civil nuclear. While refuels only comprise part of a refit (and not always), there is always a significant amount of nuclear update and revalidation in all maintenance activities in Devonport. Devonport currently has capacity for two submarines to undergo refit or deep maintenance at one time.

Currently, opportunities are available in nuclear projects at Devonport in their need for mechanical and electrical engineers, construction engineers, project managers, naval architects, and non-destructive assessment skills. The facilities at the naval base need structural engineers, concrete engineers, safety control, and environmental workers. Specialists are often provided by contractors, which can help bridge gaps in the refits' four-year cycle.

It can be difficult to retain personnel to work on submarines, and to have the best SQEP takes years of experience. For example, to train a Category A nuclear watchkeeper (reactor supervisors) can take 12 years. Retention of SQEP in the South West as a region also poses an issue across the nuclear sector.

The SDA are hoping to recruit a further 160 FTEs in 2018, plus more in the years following.

Similar to the civil sector, defence nuclear is looking at a large proportion of subject matter experts nearing retirement age.

There is scope for cross over between the defence and civil nuclear sectors (R21.1). Currently, there is a larger transfer of SQEP from defence to civil, but the MOD is working on seconding employees into civil industry. Cross over also exists on a larger scale. For example, the nuclear waste streams of defence and civil could amalgamate in an effort to reduce costs and enhance the supply chain – a component of the Nuclear Sector Deal (R21.2). With Devonport the only facility in the UK licensed to refuel and defuel submarines, this is a unique selling point on which the South West could capitalise. Further standardisation of skills would increase the viability of this.

The sensitive nature of defence supply chains leads to reduced transparency. However, it is recommended that work is done to increase visibility of non-sensitive parts of the defence supply chain (R21.3).

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21.4 RECOMMENDATIONS

Table 19: Defence Recommendations

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R21.1	Standardisation	Industry	Not Applicable	Standardise nomenclature between civil and defence to facilitate transfer of skills within the nuclear sector. NSAN have worked on this with Nuclear Skills Passports but it perhaps needs greater industry commitment.	
R21.2	Amalgamation of Supply Chains	Industry	Not Applicable	In line with the Nuclear Sector Deal proposal, amalgamate supply chains in defence and civil, specifically waste disposal as Devonport provides a unique opportunity to the South West. This could lower the cost and make the region an example of good practice.	
R21.3	Visibility of Supply Chain Information	Industry	Not Applicable	Work to make non-sensitive areas of the nuclear defence supply chain publically visible. Progress in the civil sector is an early exemplar of this. Whilst these opportunities are likely non-nuclear-specific, they remain valuable contributions to regional SMEs' workloads. There may also be more cross-over between civil and defence than first thought, for example in environmental work and inspection.	

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22. HEALTHCARE

22.1 BACKGROUND

There are several nuclear disciplines in healthcare, notably imaging and the use of radioisotopes in diagnostics and therapy. There is a rise in the use of nuclear medicine as techniques are developed to better understand the diagnosis and treatment of diseases, as well as in the production of radioisotopes.

Radiological imaging devices, such as X-ray machines, are used across hospitals, dental surgeries, and veterinary surgeries. This involves a supply chain for the imaging devices and associated safety equipment, licensing for use of that equipment, inspection, and a supply chain for radioactive waste disposal.

Radioisotopes are used in diagnostic applications as tracers, and therapeutic applications such as in radiotherapy. Like radiological imaging devices, these applications have supply chains for associated machines and safety equipment, a requirement for licensing and inspection, and waste disposal, but also the supply chain of radiopharmaceuticals themselves. These radiopharmaceuticals can be categorised into two groups:

- Short half-lives that by the nature of their short lifespan must be produced locally or on-site. For example, flourine-18 (half-life: 109.8 minutes) used in Positron Emission Tomography (PET) scans; and
- Longer half-lives that are produced at a central location and transported to healthcare site. For example, molybdenum-99 (half-life: 2.75 days) which is transported to healthcare sites then used in the local production of technetium-99m, used as a tracer.

The key legislation the covers use of radiological substances at healthcare/veterinary sites is the Ionising Radiation (Medical Exposure) Regulations 2017 that came into effect on 1st January 2018 and affects all radioactive substance use, even small scale. The Health and Safety Executive (HSE) regulates radiological substance use and emergency plans. An Environment Agency (EA) or Natural Resource Wales (Natural Resource Wales) permit is required for radiological waste.

22.2 SUPPLY CHAIN UPDATE

The common supply chain between nuclear medicine and the civil and defence nuclear industry is broadly around licencing and regulatory compliance and represents a small percentage of the economic value of the South West nuclear supply chain.

The British Nuclear Medicine Society believe that leaving Euratom will increase the cost of medical radioisotopes. This may open a new market for UK produced radiopharmaceuticals if the radioisotopes can be produced more cost effectively and without the need for international trade agreements.

22.3 GAPS AND OPPORTUNITIES

Nuclear medicine could be an increasing discipline in the South West's wider nuclear sector. To develop this would require dedicated market research and a comprehensive engagement plan (R22.1).

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22.4 RECOMMENDATIONS

Table 20: Healthcare Recommendations

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R22.1	Nuclear Medicine Market	NSW	Not Applicable	It is recommended that a further study of the South West's nuclear medicine market opportunities takes place. Due to the region's location, it is recommended that Bristol is considered as the most likely hub to develop a nuclear medicine market in the region, which could feed down contracts through South West suppliers.	

23. SOUTH WEST SUPPLIER CAPABILITIES

The information in this section gives an understanding of the scale and diversity of South West suppliers to the nuclear industry.

Two sources were used. The first uses information kindly provided by Somerset Chamber of Commerce with the permission of EDF Energy, and is based on companies who have registered with the Hinkley Supply Chain Portal.

For the second, information from the Nuclear Industry Association (NIA) Jobs Map 2017 (Ref. 45) was used to show how many employees in the South West work in the nuclear industry.

23.1 HINKLEY SUPPLY CHAIN PORTAL DATA

Capabilities are broken into 18 key groups, and the data outline the number of companies assessed as having that capability. A single company may have more than one capability and the data does not represent every company within the geographic region.

Table 21 shows the number of South West companies who were identified as having capability in each group. The largest number was in Somerset, which logically centres around activity at the Hinkley Point sites.

Table 21: HSCT-Registered Companies' Capabilities.

	Gloucestershire	Somerset	Bath and NE Somerset	Bristol	Devon	Dorset	Swindon & Wiltshire
Total	**217**	**2977**	**161**	**489**	**444**	**109**	**177**
Building Works (On-Site)	1	49	3	10	15	3	6
Catering	2	93	8	10	17	0	0
Civil & Building Supplies	2	37	3	10	8	0	1
Civil Works (On-Site)	6	49	4	12	25	9	13
Commercial Property	3	70	0	9	3	3	0
Constructions Services	13	103	4	29	24	9	8
Control and Instrumentation Components (Off-Site)	2	4	0	1	5	1	1
Control and Instrumentation Installation (On-Site)	5	11	2	3	2	5	7
Electrical Components (Off-Site)	7	60	1	12	14	0	8
Electrical Works (On-Site)	3	81	4	16	11	2	3
Hard Services	20	245	13	39	34	9	20
Leisure and Home Services	4	338	4	10	16	2	2
Mechanical Works (Off-Site)	36	226	12	28	47	30	25
Mechanical Works (On-Site)	3	73	6	10	16	4	5
Professional Services	58	613	58	172	97	17	41
Soft Services	21	474	13	46	57	9	18
Training	26	198	18	33	30	2	12
Transport and Logistics	5	253	8	39	23	4	7

23.2 NIA JOBS MAP DATA

These data are limited by NIA membership, but give an idea of the scale of the industry on employment. It is also only applicable to the civil nuclear industry. Employee totals are grouped by parliamentary constituency. Figure 4 shows that the greatest concentration was in the Bridgwater and West Somerset constituency around HPC. Other areas of high employment were in Bristol and Gloucestershire, where NNB and Horizon have head offices respectively. Whilst other constituencies may have smaller figures, populations may also be smaller, so it is worth considering that there may proportionally be a large positive impact on the local area.

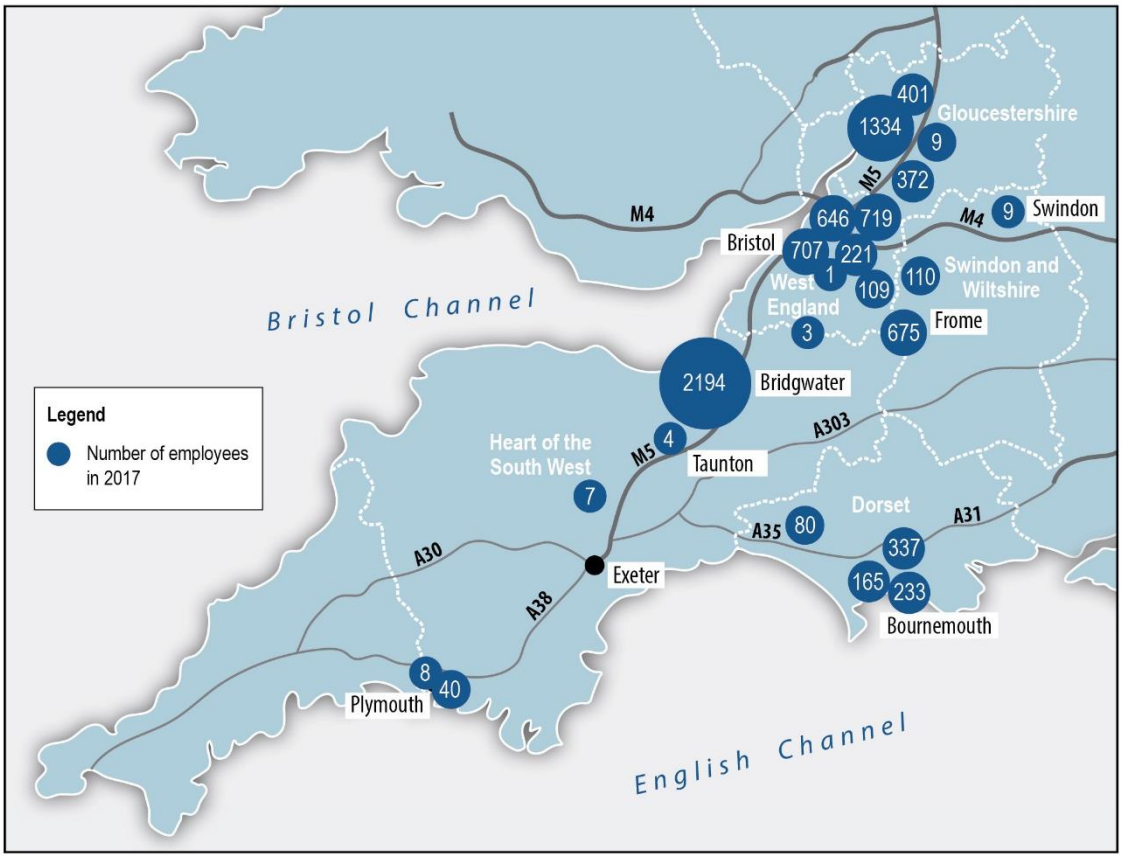

Figure 4: NIA Jobs Map data showing the number of employees of its members.

24. 20-YEAR TIMELIME

A time line of key high level, key activities was produced based on the research of the projects in scope. Activities and skills needed at each phase are similar across projects, and a non-exhaustive list is categorised as follows in Table 22 below.

Table 22: Non-exhaustive list of skills required at stages of a nuclear energy generation project.

PHASE	SKILLS
1 **Pre-Construction Activity** This phase represents the activities that are required for the period leading up to the construction phase. There are many safety, legal, environmental and planning activities that need to take place. The period prior to commencing construction of a project can last many years, and require many different skills.	Site Investigations Security Commercial & Legal support Obtaining Permits Licencing Cost planning Programme Management Risk Management Site Specific Engineering Technical Consultancy Safety, Health, Environmental Management Engineering Design
2 Construction Phase This phase represents the civil construction of the project. It concerns the earthworks, the civil works and the work required to construct the buildings, and ancillary buildings and access roads, for example.	Civil Construction Environmental Management Earthworks Steel Fixers Engineering Design Technical Consultancy Quality Control Management Project Management Cost planning consultancy Marine works Architectural Engineering Health and Safety
3 Mechanical, Electrical and HVAC Fit Out Phase (MEH Phase) This phase covers the mechanical and electrical fit out of the buildings. It includes installation and manufacture of internal components.	Manufacturing Welding & Joining Installation Advance Manufacturing Fitters Systems Design Electrical Installation Control & Instrumentation Design, Manufacture & Installation HVAC
4 Operational Phase Once the reactor has been commissioning, it will begin generating electricity. This phase is the reactors electricity generating life.	Routine Maintenance Operations Inspection Health Physics & Radiation Protection Welding Plant Life Extension Obsolescence Management Regulatory Compliance Security
5 Decommissioning Phase At the end of the reactors generating life, it will require decommissioning. This requires a new set of skills and capabilities.	Health Physics Waste Management Remote Handling Robotics Demolition Container Design Container Manufacture

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PHASE	SKILLS
	Size Reduction Operations Waste Conditioning Regulatory Compliance Environmental Monitoring and Restoration
6 Care and Maintenance (C&M) When decommissioning is far enough advanced, any structures that remain will be left for a long period of time to allow for longer lived radioactive material to decay.	Site Monitoring Environmental Monitoring Remote inspection Security

24.1 20 YEAR TIMELIME ILLUSTRATION

Figure 5 illustrates, at a high level, a 20-year timeline that provides a broad indication as to when each of the nuclear projects may be in the phases described above.

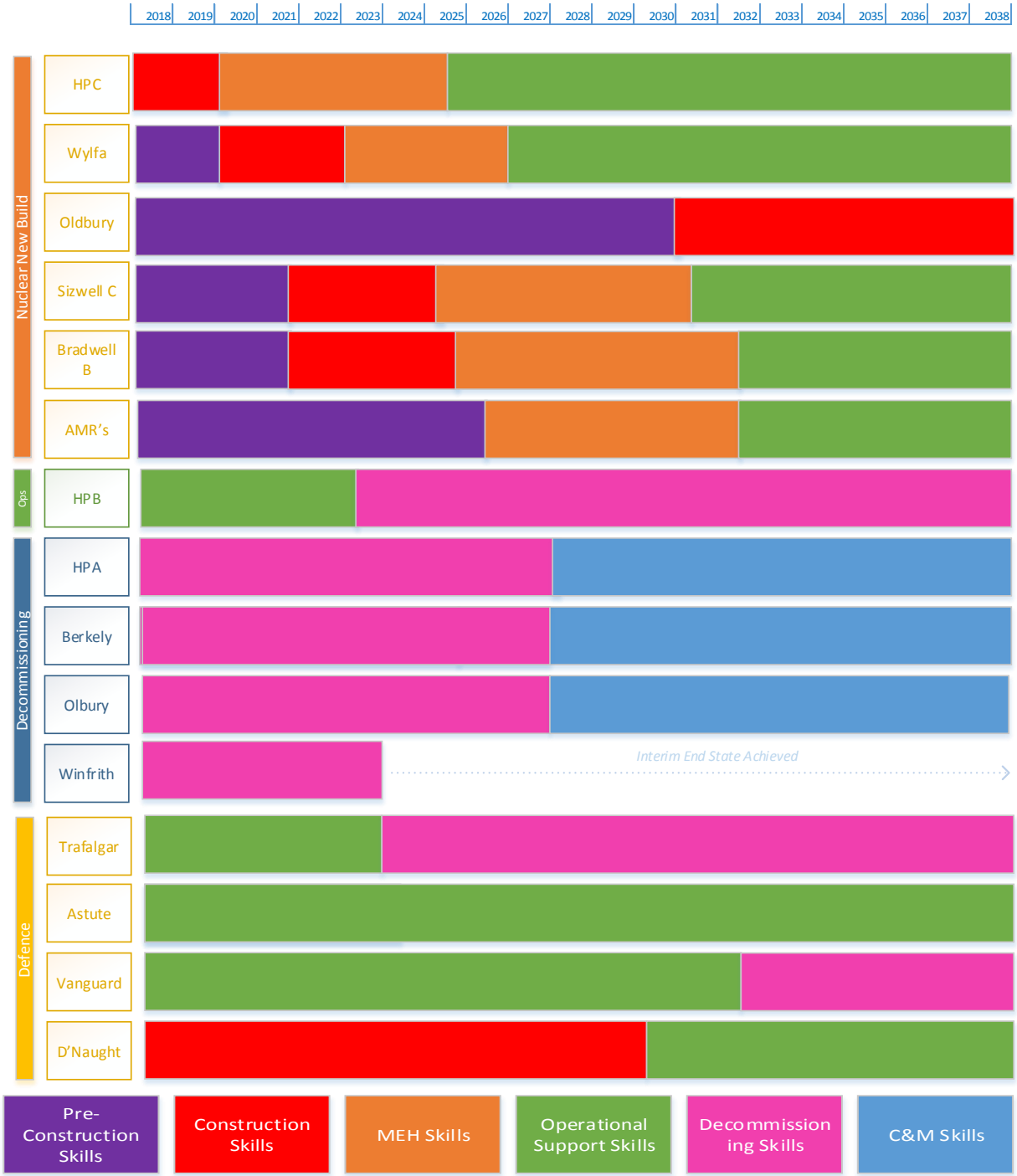

Figure 5: 20-year time line of projects.

25. SIZE OF THE PRIZE

It is important to understand the levels of spend across the different phases of the major nuclear industry projects. This section provides an estimate of the possible spend, in today's prices, across the different phases of the project.

Information used to calculate the figures was based on a National Audit Office report (Ref. 46), which states that the total lifetime cost associated with the HPC plant is £45.5bn. The same report states that the build cost is £18bn and the estimated decommissioning cost is £7.3bn.

Using these figures as a basis, the proportion of the lifetime cost for each phase was therefore calculated as:

- Planning & Construction- £18bn / £45.5bn = 39.5%
- Operation - (£45.5bn - (£18bn + £7.3bn)) / £45.5bn = 44.5%
- Decommissioning - £7.3bn / £45.5bn = 16.0%

Whilst it might be noted that these costs are estimates, and the build cost is already reportedly rising, these are the only figures found which have been reliably reported. Using these percentages as a basis to calculate spend on other projects, another limitation is the reliability with which these figures apply to other plants.

Using information provided from the World Nuclear Association, Planning & Construction was broken down to Pre-Construction, Construction, and Mechanical and Electrical Installation as follows in Table 23.

Table 23: Construction sub-category definitions.

Sub-Category	Activity	Relative Weighting	Proportion of lifetime cost
Pre- Construction	Project management services	10%	4.7%
	Other Services	2%	
Construction	Construction materials	12%	14.7%
	Labour onsite	25%	
Mechanical and Electrical Installation	Nuclear steam supply system	12%	20.1%
	Electrical and generating equipment	12%	
	Mechanical equipment	16%	

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Sub-Category	Activity	Relative Weighting	Proportion of lifetime cost
	Instrumentation and control system (including software)	8%	
	First Fuel Load	3%	
	TOTAL =	100%	39.5%

It is noted that there is likely to be overlap between the three sections, particularly for activities such as project management and labour on site, both of which will have a spread across all sub-categories. However, the grouping shown here has been used for consistency.

Decommissioning is the general term used to describe the end of a plant's lifecycle, but generally consists of two stages: active decommissioning; and a period of care and maintenance. These two stages are not accounted for separately in the general decommissioning category described above.

A lifetime plan for a decommissioning facility is available online for Magnox's Hinkley Point A Site (Ref. 47). This plan provides costs for active decommissioning (referred to as care and maintenance preparations) and care and maintenance. The planned cost for each phase are listed as: Decommissioning = £456.6m; and Care and Maintenance = £118.3m. Whilst the actual costs of activities are inaccurate, these figures are used only for the ratio of costs between Decommissioning and Care and Maintenance.

From the figures provided above, 79.4% of the cost associated with Decommissioning is associated with Active Decommissioning activities, whilst the remaining 20.6% is associated with the meeting the requirements for Care and Maintenance. As the combined "decommissioning" cost is 16% of the lifetime costs, this equates to a proportion of the total lifetime cost of 12.7% for Decommissioning and 3.3% for Care and Maintenance.

It should be noted that the preferred decommissioning strategy for HPC is Early Site Clearance with no Care and Maintenance, due to the use of EPR reactors (Ref. 48). The cost breakdown in this section retains Care and Maintenance as a stage as it is useful to projects currently decommissioning. As SZC also plans to use EPR technology, the same may apply.

Based on this methodology, Table 24 outlines the percentage costs of stages in a project.

Table 24: Each phase's percentage of lifetime cost of a project.

Stage	Percentage of Lifetime Cost
Pre-construction	4.7%
Construction	14.7%
Mechanical & Electrical Installation	20.1%
Operation and Upkeep	44.5%
Decommissioning	12.7%
Care and Maintenance	3.3%
Total	**100%**

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Based on the percentage costs in Table 24, spend over the above six stages are detailed for nuclear energy generation projects in Table 25 below. Costs are in today's prices to the nearest £bn for new build and the nearest £0.1bn for decommissioning. The accuracy is heavily limited by the methodology and the source or calculation of the lifetime cost of each project, which is listed as a footnote[3]. For some projects, no lifetime spend figure was found and is noted as N/A. The spend on defence projects was not readily available and is therefore not included.

Table 25: Breakdown of projects' lifetime costs into respective lifecycle stages.

	Pre-construction	Construction	Mechanical & Electrical Installation	Operation	Decommissioning	Care and Maintenance	**Lifetime Total[3]**
Hinkley Point C	£2bn	£7bn	£9bn	£20bn	£8bn	N/A*	**£46bn**
Wylfa Newydd	£2bn	£5bn	£7bn	£16bn	£4bn	£1bn	**£35bn**
Oldbury B	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
Sizewell C	£2bn	£5bn	£7bn	£20bn	£8bn	N/A*	**£42bn**
Bradwell B	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
AMRs	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
Hinkley Point B	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
Hinkley Point A	N/A	N/A	N/A	N/A	£1.2bn	£0.3bn	**N/A**
Berkeley	N/A	N/A	N/A	N/A	£0.9bn	£0.3bn	**N/A**
Oldbury (A)	N/A	N/A	N/A	N/A	£1.2bn	£0.3bn	**N/A**
Winfrith	N/A	N/A	N/A	N/A	£0.4bn	£0.1bn	**N/A**

*Note that these projects may not undergo a Care and Maintenance stage (Ref 48) so the C&M value was included in the Decommissioning column.

[3] Sources of the lifetime cost of projects:
HPC: https://www.nao.org.uk/wp-content/uploads/2017/06/Hinkley-Point-C.pdf
Wylfa Newydd: £14bn build cost* = 39.5% of lifetime, therefore lifetime cost is ~£35bn
*https://www.walesonline.co.uk/business/business-news/14bn-north-wales-nuclear-power-11368974
SZC: 20% lower construction cost than HPC*. HPC build cost of £18bn, therefore build cost of £14.4bn. Operation and decommissioning costs were assumed the same as HPC. *http://www.world-nuclear-news.org/C-EDF-Energy-expects-20-cost-saving-for-Sizewell-C-18011801.html
HPA: This is the approximate remaining lifetime cost according to the official government information: https://www.gov.uk/government/publications/nuclear-provision-explaining-the-cost-of-cleaning-up-britains-nuclear-legacy/nuclear-provision-explaining-the-cost-of-cleaning-up-britains-nuclear-legacy
Berkeley, Oldbury, and Winfrith: as per HPA.

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26. OVERARCHING OPPORTUNITIES FOR THE SOUTH WEST

26.1 OVERVIEW

Having addressed the projects in the scope of this report and gained an understanding of the cumulative opportunity across nuclear sectors within the South West, this section considers additional recommendations that are particularly relevant when considering the nuclear industry as a whole.

26.2 RECOMMENDATIONS

The following are recommendations to help address how we can maximise the economic impact of the whole nuclear consider the whole nuclear opportunity. Implementing these recommendations will require investment, but the returns are potentially significant.

Table 26: Top Level Opportunity Recommendations

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
R26.1	Welding Capabilities	Government Education Industry		The potential to develop indigenous advanced welding capabilities could have huge benefits across all of the nuclear projects. Welding is possibly the only technology that links all current and future reactor technologies, decommissioning, and other high value manufacturing driven industries. Developing and improving advanced joining techniques could have a huge global impact, the scale of this opportunity is huge. A new Centre of Excellence for Welding in the South West could create a unique 'sell point' for the region.	
R26.2	Supply Chain Guide	NSW		Production of a guide to the nuclear supply chain in the South West to South West Companies. The guide will aim to help suppliers find out more about the opportunities in the South West, what is required to win work, how to find out more about specific opportunities, and produce a clear sign-posting process on where to get help and support.	
R26.3	Delivering a Supply Chain Database	NSW		There is Government drive to create nuclear supplier database, the benefits of not just considering one project, but to	

ID	Title	Who	Skills Set Benefit	Recommendation	Priority
				facilitate the ability to transfer skills and capabilities across multiple projects is huge. The South West is in a position to lead on such an initiative. Recommendation for management and production of a South West-wide programme incorporating all nuclear sectors with full visibility across all tiers in the supply chain.	
R26.4	**Cost Reduction**	**Industry**	**Not Applicable**	Consideration of combining MOD and Civil requirements and supply chain to reduce costs. Common supply chains reduces cost, and this is a component of the Sector Deal. The South West is in the ideal position to consider, and make a proposal to Government as to how this could be achieved.	

27. PRIORITISATION OF RECOMMENDATIONS

27.1 HIGH PRIORITY RECOMMENDATIONS

Below is the summary list of the highest priority recommendations which should be given the most urgent consideration, these have the potential to make the most impact in the near term.

Table 27: High Priority Recommendations

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R4.1 SC Intro	Measuring Economic Value	Government Industry		Develop appropriate metrics to measure the success of economic development strategy. Focus on: 1) Measurement of contract wins by South West companies; 2) Measurement of content won by South West companies categorised appropriately to reflect the future economic value to the region for winning the work.	
R6.4 Govt	Sector Deal: Reuse of future nuclear sites	NSW		Plan a programme of proactive involvement to promote the reuse of South West nuclear sites for future nuclear projects.	
R6.6 Govt	Sector Deal: National Supply Chain Programme	NSW		Plan South West involvement in the development of a national supply chain programme.	
R6.7 Govt	Sector Deal: Innovation	NSW		Deliver a programme to support innovation in the supply chain.	
R6.8 Govt	Sector Deal: Reducing Decommissioning Costs	NSW		Develop collaborative proposals to utilise cross sector skills by combining defence and civil nuclear supply chains to reduce costs in decommissioning. A South West cluster of companies has the potential to offer a deal to government.	
R6.9 Govt	Sector Deal: Action Plan	NSW		Focusing in on Sector Deal opportunities, create an action plan to ensure that the South West is at the forefront of these government ambitions and interventions.	

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R7.1 DIT	DIT Campaign Groups	LEPs Local Companies		Look into involvement in DIT Campaign Groups. For information, contact: nuclear.enquiry@trade.gov.uk	
R8.2 SC Support	Increased HSCT funding	Industry Government		It is recommended that further funding be provided to maintain HSCT until HPC is operational.	
R9.3 Skills	Workforce Assessment	NSW		It is recommended that the annual workforce assessment is analysed at a South West-specific level and national priorities are delivered at the regional level.	
R9.4 Skills	Fund a Combined Training Agency	Industry NSW		It is recommended that a single training agency is formed, or HPTA developed further, to equally support and combine training in all sectors of the nuclear industry in the South West.	
R9.7 Skills	Future Nuclear Project Awareness	NSW Government		Provide advanced awareness of future nuclear projects to industry. HSCT is relevant to HPC, but a wider programme could ensure that companies are aware of the wider nuclear sector opportunities.	
R12.1 HPC	Visibility of Lower Tier Opportunities	Industry		Increase the level of visibility of Tier 2 and below opportunities.	
R12.3 HPC	HSCT funding Boost for MEH	Industry Government		Address the workforce shortage for HPC's MEH stage. Recommend continuing the supply chain support from HSCT, but with a 'boost' to ensure MEH opportunities are capitalised on. The timing here is crucial. There should be a review of the funding of the HSCT with this in mind.	
R12.4 HPC	HSCT Activities specific to MEH	Industry Government		Identification of specific activities that can be done to increase understanding of what skills are needed to deliver at HPC during the MEH phase in order to	

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
				increase visibility and awareness of future opportunities.	
R12.5 HPC	Consideration of SZC and BRB	Industry Government Education		When considering investment for capitalising on HPC opportunities, include the potential to support SZC and BRB. Engagement in the SZC and BRB supply chain is needed straight away.	
R12.6 HPC	Inward Investment	Industry Government		Develop a consolidated programme to highlight to inward investors the benefit of partnering with local SMEs. It is recognised that this area is covered by the HSCT, NSW and DIT, but a review may understand what more can be done.	
R15.1 SZC	Exporting and Sharing Skills	NSW Industry		Run activity to support South West companies export their skills to Sizewell C. Potential participation areas that include: Engineering – design, transportation and access routes and abnormal loads studies; Project management – project, engineering and site management; Environment – safety case, meteorology (Met Office = SW potential), terrestrial ecology, ornithology etc. Planning – consents and permits management, scheduling, construction planning, topographic mapping; Logistics, IT, legal consultancy.	
R15.2 SZC	Collaboration between UK LEPs and LAs	NSW Government Industry Groups		Further UK-wide collaboration between nuclear industry-rich regions to maximise future nuclear project opportunities.	

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R16.1 BRB	Exporting Skills to Bradwell B	NSW Industry		Run activity to support South West companies export their skills to Bradwell B. Potential participation areas that include: Engineering – design, transportation and access routes and abnormal loads studies; Project management – project, engineering and site management; Environment – safety case, meteorology (Met Office = SW potential), terrestrial ecology, ornithology etc. Planning – consents and permits management, scheduling, construction planning, topographic mapping; Logistics, IT, legal consultancy.	
R17.1 HPB	Focus on Decommissioning	Industry Government		Engage with HPB/NDA early to understand Government's strategy for decommission AGRs and the opportunity to introduce new innovation into the project. This is likely to involve closer alignment with the NDA initiatives to grow the UK decommissioning supply chain.	
R17.2 HPB	Consolidation of decommissioning sites	Industry Government Education		Work to ensure alignment of skills with those used on current decommissioning sites to ensure the new decommissioning opportunity is fully capitalised.	
R18.2 Decom	Improve knowledge of Routes to Market	NSW Industry		Suppliers interested in supporting the decommissioning market must ensure that they open all possible routes to market. This includes access to framework opportunities (either directly or through Tier 1 suppliers), presence on the Achilles database, knowledge of the forthcoming procurement timeline, and contract	

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ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
				opportunities and subscribing to the e-bulletin and NDA Estate supply chain linked in group (700 members).	
R18.3 Decom	Supply Chain Events	NSW Industry		The NDA holds annual decommissioning supply chain events and if not already, these should be attended by representatives of South West industry clusters.	
R18.4 Decom	Cross sector innovation into Decommissioning	NSW Industry		NDA also have a strong focus on development of new technologies & deployment of new technologies from other sectors and employ strategic interventions to help emerging technologies. This could present opportunities for South West companies that are aware of the opportunities to bring cross-sector innovation into decommissioning.	
R18.5 Decom	Close Engagement with NDA initiatives	NSW Industry		Engagement with the NDA initiatives to grow the South West's contribution to the NDA spend.	
R19.1 AMRs	Opportunities for Hosting AMRs	Local Government		It is important that the South West keeps abreast and understands opportunities for hosting AMRs in the future.	
R19.2 AMRs	Following Policy Developments	NSW Industry		The AMR programme could certainly represent future business opportunities for South West companies, who have developed capabilities to support large-scale generation projects. The AMR opportunities are in their infancy. However, it is important that South West companies follow policy developments so they are positioned to capitalise on the new industrial opportunities that they present.	

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ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R20.1 Fusion	Programme for South West Engagement with the fusion programme	NSW Industry Academia	Not Applicable	Deliver a programme to support South West companies sell their capability into the fusion programme, in the UK and abroad.	
R26.2 General	Supply Chain Guide	NSW		Production of a guide to the nuclear supply chain in the South West to South West Companies. The guide will aim to help suppliers find out more about the opportunities in the South West, what is required to win work, how to find out more about specific opportunities, and produce a clear sign-posting process on where to get help and support.	
R26.4 General	Cost Reduction	Industry	Not Applicable	Consideration of combining MOD and Civil requirements and supply chain to reduce costs. Common supply chains reduces cost, and this is a component of the Sector Deal. The South West is in the ideal position to consider, and make a proposal to Government as to how this could be achieved.	

27.2 MEDIUM PRIORITY RECOMMENDATIONS

Below is the summary list of medium priority recommendations.

Table 28: Medium Priority Recommendations.

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R6.3 Sector Deal	Sector Deal: Construction	NSW		Plan South West involvement in future sector deal opportunities around development of advanced construction capabilities.	
R6.5 Sector Deal	Sector Deal: Generation IV Reactor Support	NSW		Develop a strategy for promotion of South West skills and capability to support SMR/Generation IV reactors.	

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ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R8.1 SC Support	Demand Model	Government NSW		Understand how the national demand model could benefit South West companies.	
R9.1 Skills	Increase High-Value Training and Funding for it	NSW Government		It is recommended that skills and training needs are better mapped, coordinated, and delivered within the South West. This may require increased funding.	
R9.2 Skills	Work with NSSG	Government NSW		Ensure alignment of South West supply chain and skills development activity with NSSG.	
R9.5 Skills	Access to Finance	Industry Government		There should be facilitated/advertised access to funding to upskill the South West's workforce and to meet the required standards of the nuclear industry.	
R9.6 Skills	Innovative Training	Industry Government		Focus in on innovative ways of training to ensure the local workforce have the basic training requirements that are essential for HPC.	
R10.1 R&D	Collaboration with Supply Chain Lab	NSW		Explore opportunities to collaborate further with the Supply Chain Lab.	
R12.2 HPC	Understanding real economic benefit	Industry Government		Develop more comprehensive metrics for calculating economic value of all tiers and flow through work. This would help calculate the real local economic benefit.	
R18.1 Decom	Involvement in NDA's R&D portfolio	NSW Industry		Support greater involvement of the South West supply chain in the NDA's R&D portfolio. This would require proactive engagement with the NDA and its stakeholders to	

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
				understand the opportunities available to the South West supply chain.	
R21.1 Defence	Standardisation	Industry	Not Applicable	Standardise nomenclature between civil and defence to facilitate transfer of skills within the nuclear sector. NSAN have worked on this with Nuclear Skills Passports but it perhaps needs greater industry commitment.	
R21.2 Defence	Amalgamation of Supply Chains	Industry	Not Applicable	In line with the Nuclear Sector Deal proposal, amalgamate supply chains in defence and civil, specifically waste disposal as Devonport provides a unique opportunity to the South West. This could lower the cost and make the region an example of good practice.	
R21.3 Defence	Visibility of Supply Chain Information	Industry	Not Applicable	Work to make non-sensitive areas of the nuclear defence supply chain publically visible. Progress in the civil sector is an early exemplar of this. Whilst these opportunities are likely non-nuclear-specific, they remain valuable contributions to regional SMEs' workloads. There may also be more cross-over between civil and defence than first thought, for example in environmental work and inspection.	
R22.1 Healthcare	Nuclear Medicine Market	NSW	Not Applicable	It is recommended that a further study of the South West's nuclear medicine market opportunities takes place. Due to the region's	

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
				location, it is recommended that Bristol is considered as the most likely hub to develop a nuclear medicine market in the region, which could feed down contracts through South West suppliers.	

27.3 LOW PRIORITY RECOMMENDATIONS

These recommendations will require significant thought, planning and potentially investment. However, they have the ability to make significant step change if implemented.

Table 29: Low Priority Recommendations.

ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
R6.1 Govt	Industrial Strategy Challenge Fund	NSW		Raise awareness of the ISCF, and opportunities for collaborations of companies to bid for funding opportunities under the grand challenges.	
R6.2 Govt	BEIS Nuclear Innovation Programme	NSW		Raise awareness of the South West's involvement in this programme, and better understand the future opportunities for economic development that this programme will realise.	
R14.1 Oldbury	Oldbury Near Term Opportunities	NSW		Develop a plan to help the supply chain understand how the South West can capitalise on near term opportunities.	
R14.2 Oldbury	Oldbury Long Term Opportunities	NSW		Understand better the long-term (beyond 2030) opportunities from Oldbury, which would require significant investment to enable the South West supply chain to capitalise.	
R14.3 Oldbury	Visibility of Oldbury Procurement	Industry Government		Well in advance of early works at Oldbury, there should be work to ensure that clear visibility of project timelines and when major procurements will take place and understanding of procurement	

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ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
				processes which are likely to be used.	
R14.4 Oldbury	Ensure early Supply Chain support for Oldbury	Industry Government		Provide early viewing of the breakdown of the project work packages and requirements, to allow time for government support mechanisms to be put in place.	
R18.6 Decom	GDF Programme Involvement	NSW Industry		Consider the South West's future involvement in the GDF Programme.	
R26.1 General	Welding Capabilities	Government Education Industry		The potential to develop indigenous advanced welding capabilities could have huge benefits across all of the nuclear projects. Welding is possibly the only technology that links all current and future reactor technologies, decommissioning, and other high value manufacturing driven industries. Developing and improving advanced joining techniques could have a huge global impact, the scale of this opportunity is huge. A new Centre of Excellence for Welding in the South West could create a unique 'sell point' for the region.	
R26.3 General	Delivering a Supply Chain Database	NSW		There is Government drive to create nuclear supplier database, the benefits of not just considering one project, but to facilitate the ability to transfer skills and capabilities across multiple projects is huge. The South West is in a position to lead on such an initiative. Recommendation for management and production of a South West-wide programme incorporating all nuclear sectors with full	

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ID	Title	Who	Skills Set Most to Benefit	Recommendation	Priority
				visibility across all tiers in the supply chain.	

28. CONCLUSION

This study has found that due to the transition to a low carbon economy, primarily driven by the Paris Climate Change Agreement, the UK has significant appetite to promote nuclear capability. The UK Industrial Strategy and Clean Growth Strategy state that without nuclear energy generation, the UK will not be able to meet commitments for carbon emission reduction and economic growth. In order to facilitate this, the UK government is supporting a significant volume of work in the shape of initiatives. The UK Industrial Strategy includes a specific Sector Deal to promote opportunities and capability to meet those opportunities within the nuclear sector.

The UK has a large programme of nuclear new build and as such there is a substantial volume of supply chain opportunities for nuclear, non-nuclear, education and academia. The UK has some of the highest nuclear standards in the world, creating opportunities not just in the South West of the UK, but in exporting skills and capabilities to other countries' nuclear industries.

There are significant and ever-increasing opportunities within the nuclear sector for both nuclear and non-nuclear suppliers. A number of supplier-specific organisations exist to aid suppliers, particularly SMEs, to meet the requirements of the supply opportunities.

A key finding is that there is a shortage of skilled workers for the next phase of Hinkley Point C, starting in 2019 (MEH - Mechanical, Electrical, and Heating, Ventilation and Air Conditioning). Overall, to maximise economic benefit from the nuclear sector, South West companies need greater visibility of supply chain opportunities, and an increased stability in workflow would increase regional participation; this stability could come from diversification across nuclear sectors in civil and defence, as well as exporting beyond the region and abroad.

On a regional scale, there are opportunities for greater collaboration between civil and defence sectors, especially with regard to waste disposal. This could reduce costs and help meet Government targets.

A recommendation is made to consider creating a welding Centre of Excellence in the South West, which would cover all sectors in the nuclear industry. Further, collating a regional supply chain guide is a novel idea for a nuclear cluster, and could facilitate communication between industry opportunities and suppliers. The South West could also lead an initiative to create a national supply chain database; with its mixture of projects across civil nuclear life cycles, as well as strong presence in defence, the region is in a prime position to do this.

The South West is already capitalising on the new wave of nuclear projects and a lot of management is in place to maximise regional benefit. The wealth of opportunities currently available can be further enhanced by implementing recommendations made in this report.

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29. GLOSSARY

Term	Definition
ABWR	Advanced Boiling Water Reactor
AGR	Advanced Gas Cooled Reactor
AMR	Advanced Modular Reactor
AWE	Atomics Weapons Establishment
BEIS	Business, Energy and Industrial Strategy
CASD	Continuous At Sea Deterrent
CGN	China General Power Group
CPD	Continuous Professional Development
DDLP	Defuel, De-equip and Lay up Preparation
DE&S	Defence Support and Equipment
DIT	Department of International Trade
EA	Environment Agency
ECI	Early Contractor Involvement
EPR	European Pressurised Water Reactor
EWC	European Works Council
F4N	Fit for Nuclear
FID	Final Investment Decision
Frazer-Nash	Frazer-Nash Consultancy
FTE	Full Time Equivalent
GDA	Generic Design Assessment
GDF	Geological Disposal Facility
GVA	Gross Value Added
HMNB	Her Majesty's Naval Base
HMS	Her Majesty's Ship
HOTSW	Heart of the South West
HPB	Hinkley Point B
HPC	Hinkley Point C
HSCT	Hinkley Supply Chain Team
HSE	Health and Safety Executive
IBB	Invest Bristol and Bath
ISCF	Industrial Strategy Challenge
JET	Joint European Torus
LEP	Local Enterprise Partnership
LLRF	Low Level Refuelling Facility
MEH	Mechanical, Electrical and HVAC
MOD	Ministry of Defence
MUFC	Maritime Underwater Future Capacity
NCfN	National College for Nuclear

NDA	Nuclear Decommissioning Authority
NIA	Nuclear Industry Association
NIC	Nuclear Industry Council
NLF	Nuclear Liability Fund
NNB	Nuclear New Build
NNB Gen Co	Nuclear New Build Generating Company
NRC	Nuclear Research Centre
NSSG	Nuclear Skills Strategy Group
NSSS	Nuclear Steam Supply System
NSW	Nuclear South West
Nuclear AMRC	Nuclear Advanced Manufacturing Centre
OJEU	Official Journal of the European Union
ONR	Office of Nuclear Regulation
PET	Positron Emission Technology
PBO	Parent Body Organisation
R&D	Research and Development
RAH	Reactor Access House
RMW	Radioactive Waste Management
SDA	Submarine Delivery Authority
SLC	Site Licence Company
SME	Small and Medium Size Enterprise
SMR	Small Modular Reactor
SQEP	Suitably Qualified and Experienced Personnel
SSBN	Ship Submersible Ballistic Nuclear
SSN	Ship Submersible Nuclear
SZC	Sizewell C
UK	United Kingdom
UKATA	United Kingdom Atomic Energy Authority
WM&D	Waste Management and Decommissioning

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Frazer-Nash Consultancy Ltd
The Cube
1 Lower Lamb Street
Bristol
BS1 5UD

T +44 (0)117 9226242
F +44 (0)117 9468924

www.fnc.co.uk

Offices at:
Bristol, Burton-on-Trent, Dorchester,
Dorking, Glasgow, Plymouth, Warrington
and Adelaide