The Nuclear Sector Deal

Nuclear Industry Council Proposals to Government for a Sector Deal

nuclear industry council

Foreword

The UK's civil nuclear sector is amongst the most advanced in the world. Our global leadership status has been earnt through a record across the entire nuclear lifecycle – from enrichment, through fuel production, generation, operation, new build, research and decommissioning – and increasingly enhanced by our world class regulatory system as the country's new build programme takes shape.

Our sector is an economic powerhouse – currently equivalent in scale to aerospace manufacturing – providing tens of thousands of highly skilled jobs, driving growth in diverse regions across the UK. Our world leading research and development puts us at the forefront of waste and decommissioning, with UK companies well placed to benefit from opportunities in a global market worth £100bn.

The existing fleet of nuclear power stations provides more than 20% of the UK's electricity supply, and its low carbon, reliable baseload characteristics complement a changing energy system with a greater penetration of intermittent and variable renewable sources of generation. The combination of low carbon power sources has helped the UK reduce its carbon emissions, and will be vitally important to maintain that progress as both transport and heat become less carbon intensive, and more reliant on clean electricity in the future.

The potential to build on that record is real, and the Nuclear Industry Council has worked under my leadership to present the opportunities for where greater collaboration by industry, with the right levels of facilitation from the government, can maximise that potential, and make a significant contribution to meeting the objectives set by the government in its Industrial Strategy white paper.

The Council, whose membership is drawn from across energy, manufacturing, engineering, science and research, has a clear vision for the UK to not only enhance its global status in civil nuclear, but also to realise the opportunity to drive economic growth around the country, develop highly skilled and well paid jobs, support manufacturing, engineering and science, and access a burgeoning series of export markets. Innovation, new technology and collaboration will maintain nuclear power as cost competitive with the full costs of other forms of low carbon power generation, but will also drive opportunities for the future where the UK can be a global success.

That potential is not only the next generation of nuclear power, to replace our current ageing infrastructure, but is also the development of new technology and fostering innovation that will impact decades into the future.

We are presenting a series of actions for industry, with government involvement, across key activity areas for our industry – new build, decommissioning and future technology. There are areas where industry will work collaboratively on skills, on research, on helping develop the supply chain and with local economic partnerships and the holders of devolved powers, to realise that potential.

It is an exciting agenda, and a series of opportunities which can best be realised with a shared determination and commitment from both industry and government, which will both enhance a strategically important sector but also help deliver the country's ambitious industrial strategy for the future.

Nuclear has an integral part to play not only in powering our country, but also powering the economy. These proposals will help ensure this happens.

Lord Hutton of Furness
Co-chairman, Nuclear Industry Council

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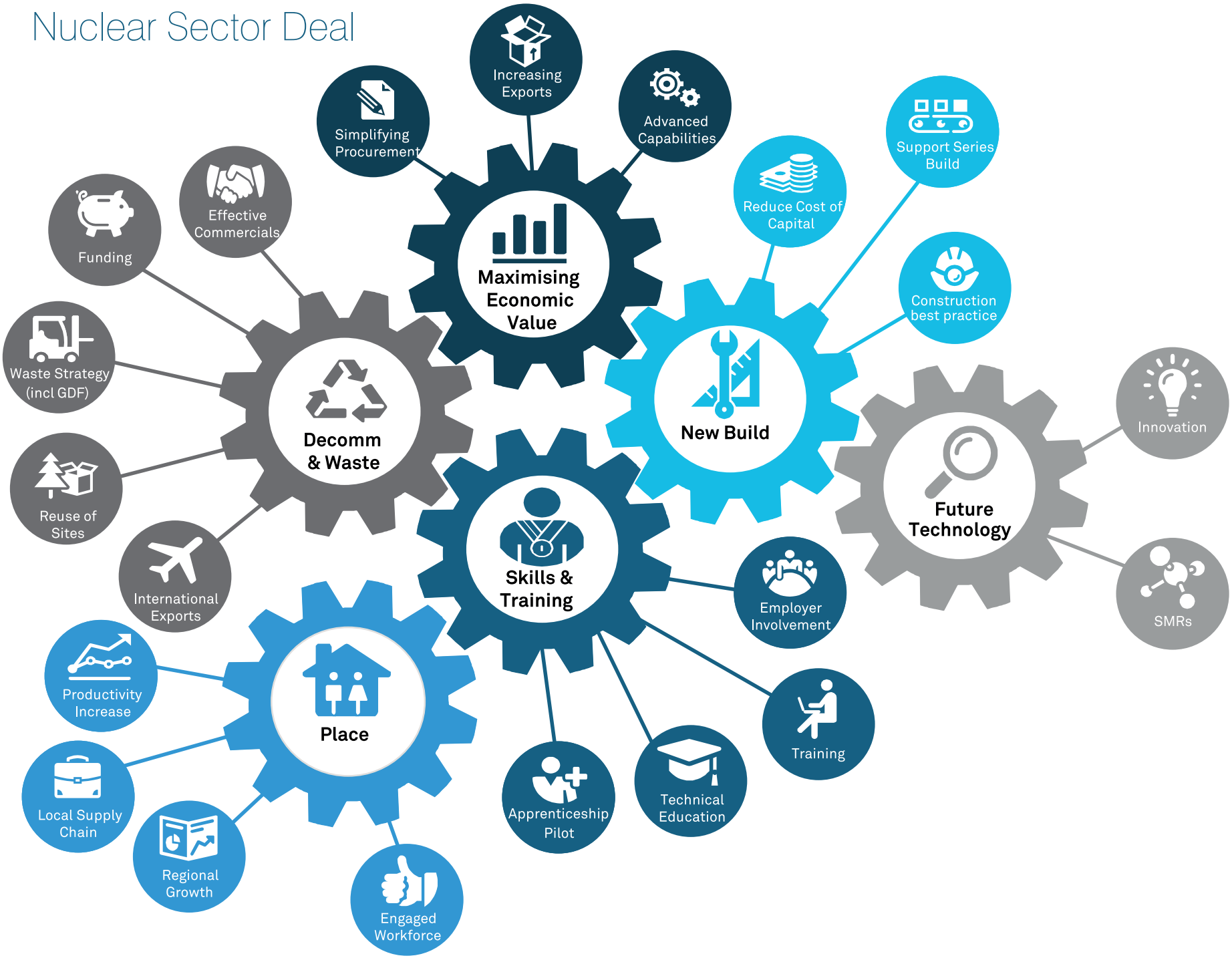


Introduction

ONE

Vision and Priorities

"The UK nuclear industry will generate reliable, secure, low carbon power that is cost competitive, provide jobs and growth across the country, foster innovation and collaboration to demonstrate best in class construction, operation, support and decommissioning of nuclear facilities, capitalising on domestic and international opportunities."

1.1 The UK is one of the few countries in the world with a nuclear industry covering the full life-cycle. From enrichment to decommissioning - through fuel production, power generation, manufacturing, engineering, legal, financial and advisory services, spent fuel recycling and research & development - nuclear has provided more than fifty years of highly skilled jobs and industrial value across the UK while producing low carbon, secure and reliable electricity to power the nation's homes, businesses and public services. It has an enviable safety record in construction, operations, decommissioning and waste management. It is a sector with a strong regional presence in different parts of the country, a highly skilled workforce and employment opportunities for future generations.

1.2 The industrial strategy and these proposals for a nuclear sector deal present an important opportunity for the industry and government together to commit to a long term approach which will enable the delivery of low carbon electricity while creating and sustaining jobs, growth and economic opportunity for UK communities and the supply chain. The UK's nuclear sector is committed to improving productivity, increasing value and remaining cost competitive with the overall costs and contribution of other low carbon technologies. Our capability, expertise and innovation in decommissioning will become an increasingly exportable commodity, as will our experience in developing, financing and structuring new build projects.

1.3 The UK has a wealth of world-leading expertise in nuclear science, research & development and innovation, much of which will help to deliver long term benefits for generations to come. These proposals are focussed initially on the period until 2030 to be consistent with the government's industrial strategy but will also be the foundation for much longer term progress and activity. This will better equip the UK to capitalise on opportunities in a domestic market worth £75bn and global markets for new build estimated to be worth £1.2 trillion and for decommissioning estimated to be worth £100bn up to 2035.

1.4 This proposed sector deal has five main elements set out below, where we believe industry action and government intervention will deliver significant change. With the adoption of these proposals, nuclear can continue to play a significant role in driving down the cost of low carbon electricity for the UK as part of a vibrant, world-leading industrial sector able to maximise economic opportunity at home and abroad. Much of the work relating to skills has been undertaken by the Nuclear Skills Strategy Group (NSSG), but for these actions to be fully effective, we have a collective responsibility to develop the skills necessary and this element presents the actions and interventions needed.

1.5 A cross cutting theme is the regional perspective which we refer to as place. There are significant collaborations and partnerships with industry-led clusters, academia, skills and business support providers coalesced by Local Enterprise Partnerships. This activity is essential to support added value, and enables the underpinning of significant local economic growth as well as providing additional capacity for delivery and implementation.

Governance

1.6 The Nuclear Industry Sector Deal has been drawn up by the Nuclear Industry Council under the leadership of Lord Hutton. The NIC brings together senior leading representatives from across the nuclear industry to develop a shared vision and priorities for the development of the industry.

1.7 The deal has been developed in response to the government's Industrial Strategy Green Paper. It has benefited from wide consultation across the industry and with stakeholders and from the active participation of industry bodies in their respective areas.

1.8 The NIC is supported by an industry-led Delivery Group which will have a key role in implementing the agreed outcomes.

Working in Partnership – Industry Bodies

1.9 The nuclear sector has a group of industry bodies covering all aspects of the sector that have a shared goal of promoting a successful nuclear industry and its capabilities. These include:

- the Nuclear Industry Association
- the National Skills Academy for Nuclear
- the Nuclear Advanced Manufacturing Research Centre
- the National Nuclear Laboratory
- the Nuclear Decommissioning Authority
- the Nuclear Institute
- UK Atomic Energy Authority

1.10 These bodies work together through the N group and regular collaboration and dialogue. Collectively they have a shared interest in promoting an industry that is capable of delivering the full nuclear life cycle in a safe and cost effective way.

Working in Partnership - Trade Unions

1.11 The nuclear industry benefits from a strong partnership with its employees exemplified through productive relationships with its trades unions. This partnership contributes to a high productivity working environment, building public support for nuclear and maximising socio-economic benefits.

1.12 Unions have a vital role to play in the future of UK nuclear, and should be at the heart of the sector deal. High level social dialogue at the centre, underpinned by similar arrangements in each corporate environment as at Hinkley Point C, can help the nuclear sector succeed in a number of key ways:

- Unions' strong base of members within the nuclear workforce, places them in an ideal position to shape workforce priorities and development. A central part of the sector deal is ensuring the maintenance and development in the UK of a skilled workforce. This requires co-operation and engagement around a sector skills strategy.
- Increasing productivity and developing flexibility in the workforce requires a joint approach to minimise disruption and build shared benefits. As there are high levels of union membership across the sector, there is also scope to set the price of labour at the most equitable and efficient level, whilst giving employers clarity and certainty about future labour costs.

- Unions' national stature and the strong relationships with government at Westminster and in the devolved administrations, regional and other key stakeholders are a positive influence for the industry and help to increase positive perceptions of nuclear amongst the media and the public.

Working in Partnership – Communities and Clusters

1.12 There is a strong network of regional bodies collaborating with and supporting the nuclear industry especially in the parts of the country (predominately the North West and South West) where it is most concentrated as well as where there is an ambition to see the sector grow. In Wales for example, the Welsh Government has an ambition to expand the sector and is working with local stakeholders.

1.13 The sector deal has been developed in partnership with LEPs coordinated by the Cumbria and Heart of South West LEPs and with input from the Welsh Government. There are specific place elements to the deal, focusing on skills, business support and innovation where, potentially, local stakeholders can support implementation and delivery of many aspects of the sector deal, specifically in terms of maximising economic benefit.

Working with Regulators

1.14 The Sector Deal has benefited from dialogue with regulators including a joint workshop. Several of the proposals affect regulation and will need to be taken forward in discussion with them and consistent with their responsibilities and legislative environment.

Summary Tables

New Build

		Benefits	Ask of Government	Industry Offer	Next Steps
1	**Reduce cost of capital for new projects**	Reduce overall project costs and strike prices: 1% reduction in cost of capital equates to 10% reduction in CfD strike price	To explore options for government financial involvement as set out in the recent NAO report	Commit to reduce new build costs across the programme over time Support government-led supply chain development initiatives	Government and developers to work jointly to assess options
2	**Support series build of projects**	Reduce costs and increase delivery certainty	Continuity of policy and support across projects	To maximise scope for utilising experience and supply chain capability across projects	Developers and supply chain to assess scope for collaboration across projects
3	**Establish nuclear projects as exemplars of best practice in construction**	Ensure that projects are delivered on time and within budget	Support a centre for innovation and best practice in nuclear construction Utilise involvement in projects to promote innovation and collaboration	Support and co-invest in supply chain initiatives Share experience and best practice across projects	Agree scope for a centre for innovation and best practice in nuclear construction

Decommissioning and Waste Management

		Benefits	Ask of Government	Industry Offer	Next Steps
1	**Effective Commercial Arrangements**	Reduce costs and encourage innovative solutions Strengthen supply chain capability and innovation Increased export opportunities from supply chain developing IP Savings of 20% equating to £3-4bn over the next ten years	Support Industry review of commercial arrangements Consider policy and procurement changes in light of review Develop a through life pipeline of decommissioning projects across the NDA, MoD & EDF estates	Lead review on commercial arrangements in decommissioning projects, including risk management, contracting arrangements and procurement strategies and suggest improvements and alternatives Deliver incentivised cost reduction through gain share arrangements Utilise improved visibility of UK decommissioning pipeline to invest in the correct capability and to drive to cost/risk improvements	Jointly develop through life pipeline for the UK decommissioning and waste management programme. Define scope and timetable for review of commercial arrangements
2	**Funding**	Optimise through-life planning and management of costs Greater programme clarity for the supply chain Consistent progress on low-hazard decommissioning projects, avoiding stop/start project costs Lower "hotel costs" through acceleration of the programme	Consider an annexe to The Green Book for decommissioning projects to allow alternative financing arrangements. Maintain funding levels to ensure progress of lower hazard projects Allow NDA to re-invest savings made to deliver further decommissioning and waste management benefits	Deliver cost savings in care and maintenance costs due to more efficient financing methods To increase capability and capacity on the back of increased programme certainty	Review The Green Book as it applies to decommissioning Examine approaches to financing in comparable infrastructure projects
3	**Integrated waste management strategy including Geological Disposal Facility**	Improve capacity and suitability of UK capability to manage the UK's total nuclear waste liability: lifetime savings of £3.7bn for the Sellafield programme Cost and time savings for industry through standardisation in waste packaging and disposal or storage: lifetime savings of £1.1bn for the Sellafield programme Increased public confidence and accelerated schedule for GDF implementation Acceleration in decommissioning projects due to more available waste disposal and storage capability Increased efficiency in sharing of waste management capability between sites Greater incentive for industry to invest in waste management capability due to certainty in future	Engage with industry to define route map for implementation of GDF Develop national waste management infrastructure strategy Continue review of proportionate regulation	Support government to develop a route map for GDA Identify industrial capability required for GDF implementation with appropriate readiness plans Build public support for employment and industrial benefits of GDF in volunteer communities Utilise greater certainty in waste management pipeline to invest in waste management and storage capability	Establish joint industry/government group to develop GDF route map Develop national waste management strategy

4	**Reuse of nuclear licensed sites**	Cost savings to be gained through appropriate site end states, e.g. brown or green field site Cost savings and programme acceleration in nuclear programmes that would benefit from re-using nuclear licensed sites	Consider the re-use of nuclear licensed sites after, or during decommissioning for other nuclear projects/ applications Determine UK nuclear programmes that would benefit from the reuse of nuclear site	Identify suitable nuclear sites for re-use Facilitate the reuse of nuclear sites for other projects	Select and create group to review UK reuse of sites
5	**International exports**	Incentive for UK industry to invest in decommissioning services for the larger global market Increase capability and lower costs for the domestic programme	Complete robust assessment of the international decommissioning market Develop current initiatives to support industry to target high value opportunities. Diplomatic effort to raise profile of UK decommissioning	Work with Government in assessment of export opportunities Make effective use of Government support to leverage targeting of markets	Review of international decommissioning market opportunities

Future Technology and Innovation

		Benefits	Ask of Government	Industry Offer	Next Steps
1	**SMR and future reactor programmes**	Expand the nuclear contribution to energy goals Long term strategic vision for industry Bring forward reactor designs at lower cost Increase UK IP and technology content Capture share of export markets	Clear direction on conclusion of SMR competition and next steps Funding for R&D for new designs Facilitative actions to enable projects to be brought to market	Bring forward projects at successively lower costs Develop significant UK IP and technology content	Announce conclusion of SMR competition Agree next steps with industry Agree long term vision for the nuclear industry
2	**Nuclear Innovation**	Industry-relevant R&D programmes to support current programmes and to take advantage of future opportunities	Agree R&D priorities jointly with industry Provide adequate funding of agreed priorities	Provide leadership to guide innovation priorities Provide expert personnel to support innovation programmes	Reconvene NIRAB with significant industrial leadership

Maximising Economic Benefits

		Benefits	Ask of Government	Industry Offer	Next Steps
1	**Simplifying procurement in the nuclear industry**	Increased market competition, standardisation and digitisation – resulting in lower costs and increased international competitiveness and taxpayer value Greater order visibility leading to more business investment in jobs, capabilities and capacity	Consider bringing together nuclear owners (including the NDA and MoD) and engage industry to improve procurement practices and data management systems Consider appropriate funding options for a new national supply chain programme Facilitate access to demand data on defence, decommissioning and new build projects	Take responsibility for improving procurement practices and data management systems Lead supply chain programme that supports new entrants, improves capability and helps the manufacturing supply chain to navigate the nuclear sector	Industry standardisation programme scoped out and agreed by the NIC Delivery Group New supply chain programme (incl. demand model) scoped out and delivered by Nuclear AMRC

2	**New advanced capabilities**	New intellectual property generated within the UK, leading to greater content of domestic programmes and greater UK share of export markets Additional high value jobs, GDP and private investment Reduced risk of programme delay to major nuclear projects e.g. new build and decommissioning	Support, where appropriate development of proposals by industry for new innovation infrastructure Formally recognise the economic value that UK content delivers when making policy decisions	Collaborate and invest in new innovation partnerships on modular manufacturing, advanced construction, equipment qualification and control & instrumentation Invest in skills, R&D and capital infrastructure once it has confidence it is competing on a level playing field and has visibility of future demand	Business cases for new innovation partnerships and infrastructure considered by NIC for prioritisation and approval Government consultation(s) on changes to procurement and policy frameworks
3	**Increasing exports and overseas investment**	Increased clarity on future trade arrangement and growth markets Increased business investment in overseas markets, resulting in increased UK jobs and capacity	Work with industry to define a nuclear trade strategy	Invest in new export markets once it has clarity over future trade strategy	Government to scope out programme to assess export priorities and define nuclear trade strategy

Skills and Training

		Benefits	Ask of Government	Industry Offer	Next Steps
1	**Nuclear Skills Strategy Group**	Strategic oversight of the skills challenges facing the sector Improved labour market intelligence to inform policy and employer recruitment practices and support planning for educational providers at a local and national level Regional delivery of skills interventions and a co-ordination of approaches across the sector as appropriate Enhancing the synergies between civil and defence sectors	Commit to continuing BEIS resourcing and funding support for NSSG with a minimum of £30k in 2018 Commit to supporting NSSG to implement the nuclear skills action plan across the industry and on a regional basis through the LEPs	Continue to develop the robustness of labour market intelligence Continue to fund and provide resource to support the activities of the NSSG and implement the nuclear skills action plan on a regional basis through the LEPs	Continued cross-industry/government support for the delivery of the NSSG action plan
2	**Apprenticeships**	Overall increase in number of apprenticeships in nuclear, from 2,000 to 4,000 by 2021 Enabling diverse supply chain, including smaller organisations, to under-take apprenticeships targeting 20% increase in the total number of organisations recruiting apprentices by 2021. Improved quality of apprenticeships Addressing known skills gaps including Safety Case Engineers, Project Managers, Control and Instrumentation Engineers Making best use of levy funds to attract high quality apprenticeships in nuclear that could flex to other sectors as required, to enable development of a community approach to apprentices	Commit to a continued dialogue with the sector on the apprenticeship levy including consideration of proposals on flexibility of unspent funds Work with employers to develop clear measures of success in maximising impact of the use of the apprenticeship levy in the sector Work with the Institute for Apprentices on the potential for prioritised nuclear apprenticeship standards Work with industry in the locations to support the development of a scheme to increase apprentices into nuclear using the levy	Undertake to monitor the impact of the Apprenticeship Levy and analyse the uptake of apprenticeships including across Cumbria Prioritise development of trailblazer apprenticeship standards that satisfy key skills gaps in the sector Develop the community apprenticeship scheme proposal with quantification and clarification of apprentices and disciplines required at a local level, and the associated industry support to deliver this	Work with LEPs in Cumbria, other regions as appropriate, and DfE to monitor the uptake of apprentices and assess any lessons learned in order to maximise impact Establish working groups in each location to develop apprenticeship scheme proposals including industry, LEPs, ITBs and skills organisation

3	**Subject matter experts**	Increase number of nuclear related PhDs and EngDocs [targeting an increase of 30% by 2021] Accelerate development of subject matter experts in critical areas including physics, chemistry and materials science Increased number of individuals, with key knowledge to ensure civil and defence nuclear programmes can progress to plan Using retirees with subject matter expertise to mentor and enable accelerated knowledge transfer to people within the sector	Explore with industry the development of a bursary scheme for nuclear focused Masters, and PhDs and EngDocs Continue to support the current strategy of setting recruitment levels within the defence sector the transfer of resource from defence to civil sectors that recognise Continue to provide investment in BEIS Nuclear Innovation Programme, as highlighted in Clean Growth Strategy	Prioritise funding PhDs and EngDocs for nuclear subject matter experts Establish knowledge management process with recently retired nuclear experts utilising existing platforms such as Talent Retention Solution (TRS) to facilitate this where appropriate Continue to use research funding sources to increase the pipeline of subject matter experts	Government and industry to work together to set up a nuclear focused bursary Set up mentoring scheme for recently retired nuclear experts
4	**Technical Education**	Viable career routes will be made simpler and more visible to attract a diverse range of new employees to the sector Clearer routes for technical education and training visible allowing more informed career choices Courses targeted at the right locations and known skill gaps	Provide clarity and stability in the technical education landscape including ensuring wide understanding of the role of the NCfN and the opportunities it offers. Consider regional proposals for coordinated technical education delivery across the sector	Conduct review of possible locations for the expansion of the NCfN Provide resources to support the development of appropriate standards, curricula and qualifications and to make simple career frameworks available Work with providers to develop proposals to optimise technical education delivery in regions	DfE to provide clarity of the future direction on technical education institutions Investigate the appetite and benefit for North Wales of a NCfN
5	**Training**	Increase take up of nuclear awareness courses for mature individuals transferring into the sector Provide easier transfers into the sector from non-nuclear sectors Increase the pool of diverse talent available for the industry	Consider providing £200k funding for bursaries for training to NCfN qualifications	provide resources and career opportunities and commit to simplifying and signposting the process for those moving from non-nuclear sectors Industry will work across the sector to explore a managed exchange programme between Civil and Defence and from other relevant sectors into nuclear	Investigate potential funding routes for nuclear awareness training for potential transferees Workshop between civil and defence sectors to develop firm plans for collaboration
6	**Nuclear involvement in STEM education**	Improve diversity in the sector [including 40% women in nuclear by 2030] Improve STEM subjects taught at schools and colleges with real world experience to complement academic study	Promote nuclear as a STEM destination [targeting primary, secondary and tertiary audiences] Review its policy for employer's to have greater involvement in STEM teaching in schools and colleges Work with industry to discuss the options for T-Level work placement schemes in the nuclear sector Facilitate exchanges between schools, colleges and industry	Establish a programme of engagement with schools and colleges to improve diversity and attractiveness of the industry Increase its contribution by working with schools and colleges to improve STEM training Commit to create a national database of suitably qualified industry based individuals to teach courses to the appropriate level Support the development and utilisation of existing platforms such as TalentView and Nuclear Gateway to promote nuclear opportunities	Discuss with DfE plans for work placements as part of T-Levels Explore potential funding routes for teaching experts Develop a coordinated approach for employer interaction with schools and colleges Develop plans for a database of training experts suitable for teaching

TWO

The UK Nuclear Sector Today

2.1 The UK is one of only a few countries with a nuclear industry covering the full life cycle of enrichment capability, fuel production, generation, decommissioning and research. It consists of major nuclear engineering companies supported by a strong supply chain and skills network, a vibrant research capability and a highly respected regulator and regulatory framework. Together, this provides an important element of the UK's industrial capacity.

The Economic Impact of Nuclear

2.2 Nuclear contributes to sustained technology and skills development and delivers wider economic and employment benefits through high value jobs and industrial opportunities.

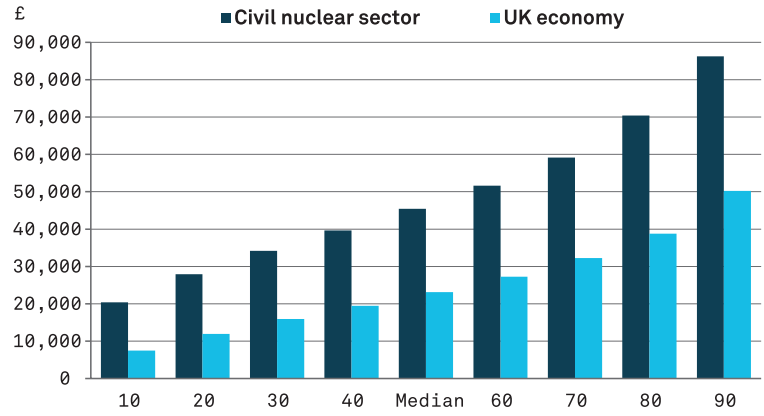
2.3 The UK nuclear industry currently provides highly skilled, long term employment for 87,500 people (NWA 2017) across the civil and defence sectors and their associated supply chains. This is expected to rise to 100,000 in 2021, with the (currently anticipated) new build programme peaking and overlaid onto existing programmes.

2.4 The economic impact of nuclear is felt not just in construction but in 60 years of operation and maintenance, with associated equipment and services support, followed by funded decommissioning and long term waste management.

2.5 As well as opportunities in equipment supply, construction and installation, the growth of the industry also contributes to legal, financial and other professional services in the UK.

2.6 The value of nuclear plants is felt not just in the direct spending and employment generated in building the plants but also in the indirect effects through the supply chain and the induced effects through increased consumer spending in the wider economy. Recent work for the NIA by Oxford Economics shows that the industry contributes in total £12.4bn to the UK economy. Just over half of this is generated directly within the nuclear industry itself, but an additional £6.1bn is generated indirectly in the supply chain or the wider economy.

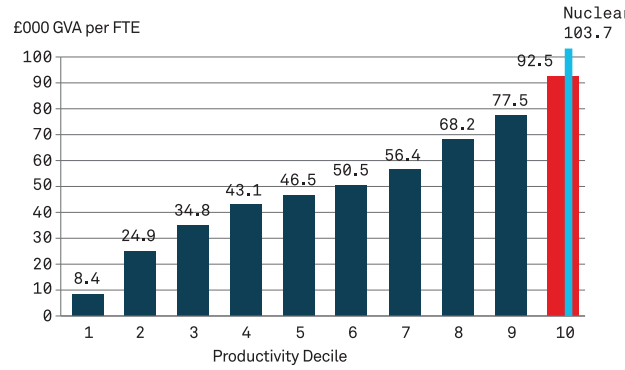
2.7 Across the income scale, the civil nuclear sector's salaries far exceed UK averages, with a median salary fully twice as high as the equivalent figure for the UK economy as a whole. This disparity underlines the prevalence of highly-specialised skills among workers in the civil nuclear sector.



Distribution of gross annual salaries UK and civil nuclear 2016

Source: NIA, ONS, Oxford Economics

2.8 The higher salaries in the nuclear industry reflect the high productivity profile of the sector, requiring a highly skilled workforce and high technology content. The Oxford Economics report shows that productivity in the nuclear industry places it firmly in the top decile of UK employment, making it an important contributor to maintaining productivity and therefore growth for the economy as a whole.



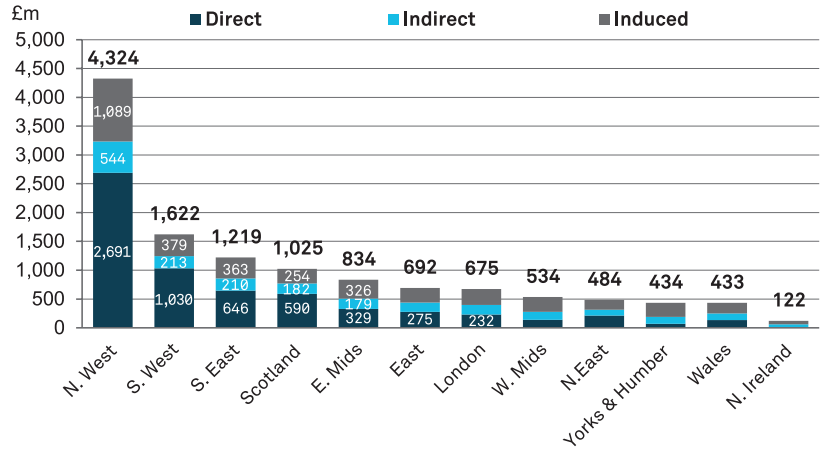
Nuclear industry productivity is in the top decile

Source: ONS, Oxford Economics

Regional Economic Impact

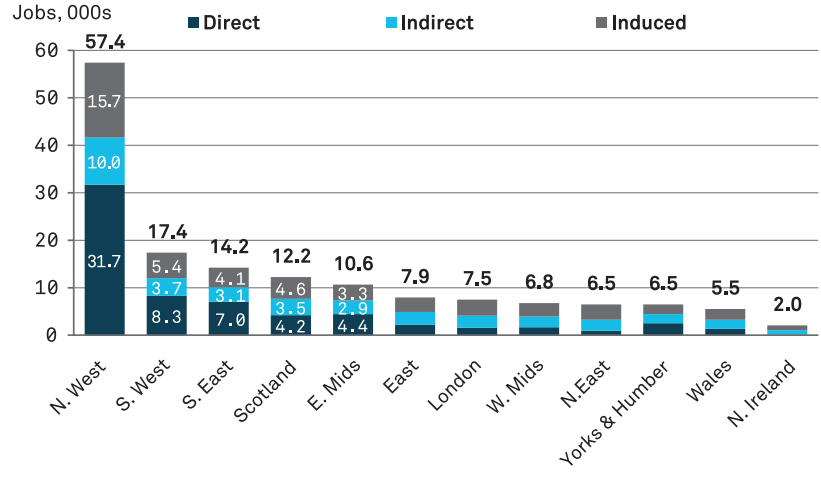
2.9 A strong sense of place is an inherent feature of the UK nuclear industry as it has developed over time, often clustered in remote coastal or rural locations. The nuclear industry brings benefits to the whole of the UK, and these benefits are seen most clearly in the local communities which host and support nuclear facilities.

As the figures below show, the biggest benefits are concentrated in the North West and South West of England.



GVA impact of the civil nuclear sector, by UK nation/region, 2016

Source: NIA, ONS, Oxford Economics



Jobs associated with the civil nuclear sector, by UK nation/region, 2016

Source: NIA, ONS, Oxford Economics

2.10 The North West is home to the UK's Waste and Decommissioning expertise, including Sellafield, the NDA, the National Nuclear Laboratory (NNL) and Drigg's Low Level Waste Repository. Cumbria employs 27,000 people in the nuclear industry, which is approximately 40% of the UK's nuclear workforce. As well as Civil Nuclear, this also includes BAE's Dreadnought programme based at Barrow and Furness. With NuGen's proposed Moorside project, Cumbria's capabilities could cover the full spectrum of the nuclear industry within the next 20 years or so.

2.11 The South West of England hosts of the UK's first new nuclear plant in a generation at Hinkley Point C in Somerset, which will provide up to 7% of the UK's electricity needs with low carbon nuclear energy. One of the largest construction projects in Europe, Hinkley Point C will also create up to 25,000 jobs over the lifetime of the project as well as bringing other benefits such as housing and transport upgrades and training programmes and facilities.

2.12 In the East of England, Suffolk is host to the youngest operating UK nuclear plant at Sizewell B and there are proposals to build new plant at Sizewell C and in Essex at Bradwell B. The South East hosts the Culham Centre for Fusion Energy and the world's largest magnetic fusion experiment, JET (Joint European Torus). At this facility, scientists are collaborating on world leading research to develop fusion as a new source of cleaner energy for tomorrow's power stations.

2.13 Approximately one third of power generation in Scotland comes from nuclear power stations at Torness and Hunterston. The nuclear industry makes an important contribution to communities which host decommissioning and defence facilities, including Dounreay and Faslane. Civil nuclear supports up to 4,000 jobs in Scotland. In the future, there may also be opportunity to make use of the wealth of manufacturing and engineering talent from the North Sea Oil and Gas industry by re-training and re-deploying those people in the nuclear industry.

2.14 In Wales, Anglesey is the site of Horizon's proposed Wylfa Newydd nuclear power station, which will provide 900 full time roles and support 4,000 jobs during construction. We have already seen Hitachi partnering with Bangor University to set up the Boiling Water Reactor Research Hub and Network to help boost the UK's capabilities in this technology. Nearby, in Greater Manchester and Merseyside, there are a huge range of nuclear institutions and capabilities which span across the sector, including the Office for Nuclear Regulation (ONR) and fuel manufacturing facilities at Springfields and Capenhurst.

Major Nuclear Regions - case study

South West

Local productivity in the Heart of SW LEP area is about £56,000 GVA per FT. Energy productivity is approaching £130,000 GVA per FTE and has been growing faster than average. Power generation adds GVA of £500 million a year to total output.

A nuclear sector deal would provide an important contribution raising productivity and doubling the LEP area economy. The deal has the potential to raise productivity in the local energy sector to £250,000 GVA per FTE by 2030 which would in turn bring better quality jobs and will add £900 million or more per annum to overall GVA.

2.15 There is much to learn from current regional activity both in the North West and South West in terms of activities that have been engineered to cater for local requirements. Examples include addressing the skills demand for Hinkley via the Hinkley Point Training Agency (HPTA) and delivering innovative approaches to decommissioning at Sellafield.

2.16 The proposed nuclear sector deal will provide the opportunity for LEPs and other key regional stakeholders to shape how a place based approach can maximise the economic benefits of a nuclear sector, creating a circle of benefits driving up productivity in the regions

2.17 Working in partnership, the LEPs have put forward a number of proposals around skills, supply chain and innovation support, which align with the Maximising UK Benefits and Skills strands of the Nuclear Sector Deal. Furthermore, industry will work with Government, the Devolved Administrations and the LEPs to develop an implantation plan for the proposals set out in this document.

Major Nuclear Regions - case study

Cumbria

Average GVA per job in Cumbria is £43,000 (all sectors). In the past 10 years, that has grown by 32% compared with UK growth of 25%.

9% of Cumbria's GVA is derived directly from nuclear reprocessing (not including supply chain) which is the highest of any area in the UK (average for UK is 1.2%).

Export Opportunities

2.18 Nuclear power plant construction, long-term operation, life time extensions and decommissioning all offer potential multi-billion dollar overseas markets over the next two decades. There are significant opportunities within these markets for UK industry to use its experience and capability to increase its share of international exports.

2.19 The global market for new build is likely to be worth £1.2 trillion up to 2035 (World Nuclear Association Reference Scenario, 2016), with significant international procurement of £20bn-25bn a year after 2025 (up from about £5bn-10bn a year currently). Long term operation of plants could be worth a further £3.5 billion a year in international procurement. And the decommissioning market could be worth £100 billion up to 2035, of which £10 billion is the cost of cleaning up the Fukushima Daiichi site and at least £50 billion needs to be spent in Germany as it moves to phase out its nuclear power plants.

2.20 Not all of this work will be available to the international market. A significant amount of site-related activity will be procured locally because of the nature of the work, and large parts of equipment supply will be directed towards the reactor vendors' existing supply chains. However, the most significant nuclear operators and technology vendors have all built up supply chains which are increasingly global in scope, and internationally diversified in their corporate make-up and supplier base. Many UK companies already play a strong and active role in the internationally competitive segment of the market, with industry already focussing on expanding its future international order book.

2.21 Whilst UK companies need to ensure they are competitive in international markets, the UK government also needs to play its role in supporting the international success of the industry. As nuclear can be a politicised issue in many markets, targeted political and diplomatic support from government can be valuable in supporting commercial propositions. This means ensuring that government-to-government dialogues, agreements and other appropriate suitable fora are utilised to emphasise the UK's nuclear capability and to progress specific UK interests. The government should consider whether it is using its full spectrum of political and diplomatic levers across all priority markets to support UK export success, and whether the forward programme can be strengthened.

2.22 The UK government also provides a range of operational trade support to UK companies. This includes drawing the UK supply chain together into campaign groups to target specific market opportunities and support the formation of UK plc consortia, coordinating bespoke events and missions across priority markets, and providing export finance. This operational support is available for UK exporters to draw on; however industry recognises that there is more it can do to increase the awareness and uptake of this support. The government should consider whether there is scope to take a joint UK plc approach further, including to wider markets, and also ensure that it is providing support to the full breadth and depth of the UK supply chain including SMEs.

2.23 Further detail on export opportunities is provided in the sections on Decommissioning and Waste Management, Future Technology and Maximising Economic Benefits.

The UK Energy Mix and Future Demand

2.24 Nuclear energy provides a competitive source of low carbon power, making an important contribution to a balanced power mix and the largest single low carbon source of power (21% of the electricity generated in the UK in 2016) while increasing security of supply and reducing the impact of fossil fuel price volatility. Nuclear power is an essential element in providing a secure, reliable, low carbon electricity mix alongside other technologies. It is a key contributor to the goals of the government's clean energy strategy

2.25 The increased proportion of non-dispatchable renewable sources of electricity generation reduces the flexibility of the electricity system. National Grid is working to promote demand-side flexibility which will increase the ability of the system to handle supply-side variability, but this has a long way to go before it can make a difference at scale.

2.26 Innovation in battery technology and other storage is developing, but currently provides 30Gwh of stored power to the grid, and National Grid's latest scenarios (July 2017) predict overall storage capacity (including 2.86Gw of established hydro) to the grid will reach 6GW by 2030.

2.27 The same Grid scenarios suggest that the demand from electric vehicles alone could require an additional 18GW of generation by 2030, and that the total capacity required in the system could rise to over 150GW when taking account of increased use of electricity in heat and vehicles. The heat market in particular has much more variable demand and requires dispatchable capacity to meet variations between hours of the day, and from day to day.

2.28 Renewable sources of generation make an important contribution, providing a source of low carbon power. However, available renewable sources are intermittent by nature, have lower energy density, requiring more sites to meet a given level of demand, and they are highly dependent upon location. Developers naturally focus activity on where the best return can be achieved. This means that although costs of repeat construction have reduced, it is increasingly the more expensive and technically challenging opportunities that remain.

2.29 An electricity system with a higher level of intermittent generation has to be larger, with surplus capacity, to meet the same level of demand. The current system in the UK can meet peak demand of around 60GW with 85GW of capacity,

but the BEIS projection is that with a greater proportion of intermittent power, the amount of capacity required to meet the same peak will rise to 125GW by 2030 (BEIS Energy and Emissions Projections 2016).

2.30 Headline levelised costs of energy (LCOE) of different forms of generation do not account for the full picture, and with some generation assets lasting for 60 years or more, do not reflect the operating lifetime of the plant. Additional whole systems costs, both network and back-up capacity, are higher for intermittent sources than baseload power generation.

2.31 The requirement remains for a mixture of sources of future generation capacity. Nuclear provides a long term, reliable and low carbon source of power that strengthens resilience to changes in technology, the economy and policy priorities. It is an integral part of a future power generation mix designed to achieve energy security, reduce carbon emissions, be cost competitive and maximise economic opportunity across the country.

New Build

3.1 The nuclear industry is commiited to delivering its new build programme at a cost that works for consumers, taxpayers and the government, as well the investors in nuclear projects. Developers and supply chain companies commit to work together with government, regional and other partners to ensure that as we move forward from Hinkley Point C – the first nuclear new build in the UK in a generation – onto Wylfa Newydd, Moorside, Sizewell C, Bradwell and the wider programme - that we focus maximum effort on driving down the costs of successive projects.

3.2 Other forms of low carbon generation – must notably offshore wind – have shown that developing a pipeline of projects can help deliver cost reduction over time and we are committed to delivering a similar programme effect in nuclear as nuclear new build in the UK builds on from its first project.

3.3 The priority for new build is to deliver the current industry-proposed 18Gw new build programme successfully, building on the regulatory and policy framework that the Government has established since 2007, in order to secure the low carbon power generating capacity the UK needs. The start of construction of the 3,200 MW Hinkley Point C power station is already bringing substantial economic benefits to the regional economy, with contracts worth over £465m already let to businesses in the South-West of England. During the core construction period, the regional economy should see an annual boost of around £200m. Overall, it is expected that 64% of the value of the construction work will be placed with businesses in the UK.

3.4 Developers and their delivery partners will demonstrate both long term economic value to UK industry and host communities, and prove that the cost of construction and operation can be brought down over time. In this way, nuclear new build will contribute to reducing the costs of the low carbon energy market as a whole, reflecting the whole system costs of electricity supply.

Value to the Local Economy – Hinkley Point C

- Hinkley Point C is supporting SMEs to engage in the supply chain through consortia and regional upskilling of capability
- EDF Energy aims to support collaborative supply chain partnerships that will enable firms to invest in capability and take a long-term view

Construction is expected to see £4bn of investment in the South West economy over the lifetime of Hinkley Point C.

Hinkley Point C is positioned to deliver a sustainable positive legacy, with £450m of contracts already awarded to South West companies.

- An increasing percentage of SMEs are engaging in the nuclear supply chain and supporting regional employment and skills
- The UK nuclear supply chain is increasing its capacity to deliver new nuclear, whilst also winning international opportunities

During the construction of HPC EDF Energy have committed to support UK **suppliers to be "fit for nuclear"**, through **project pipeline visibility** and invest in their **capability to win international opportunities** as well as **maintaining the openness of the UK to inward investment**, and to support UK companies to **achieve export potential from nuclear capability**.

A supplier consortium approach, such as the Somerset Larder, has enabled SMEs to bid for large contracts at Hinkley Point C, contributing to regional economic benefit to communities and approximately £40m in salaries.

- 64% of Hinkley Point C construction value will come from UK companies
- 25,000 constructions roles will be required during construction of which 36% will be recruited within the South West
- A minimum of 1,000 new apprenticeships will be created

HIRE

3.5 Set out below are the key areas where industry, working with government – both of whom have key roles to play – can deliver the changes that can drive the biggest reductions both in the immediate term with developments by Horizon, NuGen and CGN and EDF Energy's projects beyond Hinkley Point C, and into the future programme beyond 2030.

New Build Cost Reduction Targets

3.6 The Nuclear Industry remains committed to a journey to reduce costs across the sector and are setting out a target within this sector deal of reducing the cost to the consumer of low cost low carbon electricity from nuclear new build, based upon the actions in the sector deal being delivered by government and industry together, by up to 30% up to 2030.

3.7 There are opportunities for further reductions beyond 2030 through support for disruptive advances in product and process technologies, lower cost reactor designs and interventions to improve the capability and capacity of the supply chain. Further improvements in confidence in programme delivery and the management of risk will lead to continued reductions in the costs of capital.

3.8 The measures to reduce costs for nuclear new build will be delivered through a strong and sustainable partnership between Industry and Government as reflected within the Nuclear Sector Deal.

3.9 The key areas where Industry and Government must work together to deliver cost reductions for nuclear new build are outlined below:

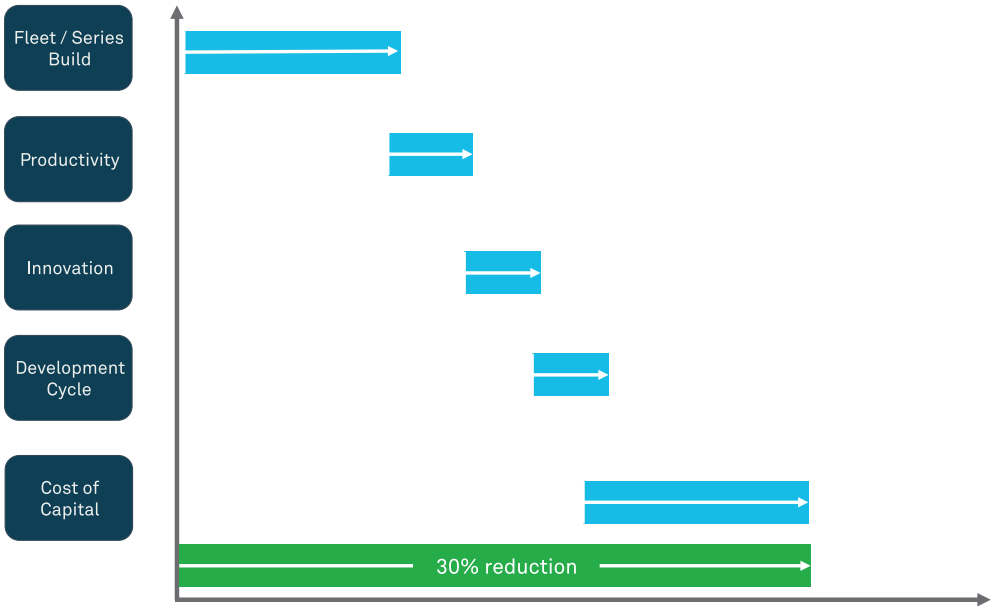
- **Fleet Deployment Benefits**
  a. Maximize the extent to which the UK fleet can benefit from the knowledge, experience and cost efficiencies from successful global fleet deployment of technologies by introducing those fleet-rich technologies into the UK new build development opportunities
  b. Pursue fleet deployment of reactor designs within the UK which will deliver significant cost reductions from areas like:
     i. reuse of designs already approved by the regulators
     ii. reuse of detailed engineering design
     iii. avoiding repeat equipment manufacturing set up costs
     iv. avoiding repeat equipment qualification.

- **Productivity and Collaboration Improvements**
  a. Actively collaborate on a cross sector basis to identify construction industry solutions to maximize productivity performance throughout the build phases of nuclear new build programmes and share those experiences and lessons across the industry
  b. Explore global best practice productivity measures in both nuclear new build programmes and large complex infrastructure programmes.
  c. Foster collaboration between UK supply chain and global nuclear new build supply chain to facilitate the transfer of knowledge and capability into the UK supply chain.

- **Innovation and Technology**
  a. Exploit innovation and technology to drive new build costs lower.
  b. Maximize adoption of innovation in construction to increase productivity, quality and performance.

- **Development Cycle and Planning Opportunities**
  a. Explore opportunities to reduce the development, siting and planning process to achieve the Final Investment Decision and First Nuclear Concrete in the shortest possible time.
  b. Collaborate effectively to reduce the overall schedule for nuclear new build from initiation to operation which in turn will significantly reduce the delivery and financing costs of new nuclear.

- **Cost of Capital**
  a. Utilising proven technologies with proven delivery and operational track records which will drive down the cost of capital as the technology and completion risks are reduced.
  b. Maximizing the attractiveness of nuclear new build in the UK to various forms of debt instruments, including but not limited to forms of Export Credit Agency funding and other sources of Institutional debt.



Nuclear new build cost - Targeted reduction of 20-30% by 2030

Note: Cost Reduction Target on the Nuclear New Build - cost to consumers

Reducing Financing Costs Through the Effective Management and Allocation of Risks

3.10 The economics of new nuclear power plants, even more so than for other large infrastructure projects, are heavily influenced by their costs of capital. The high upfront costs, long construction period before any revenues are generated, and the requirement for pre-funding of decommissioning liabilities during the operational phase, generate substantial financing requirements.

3.11 The historic experiences of delays in plant construction have resulted in the perceived need for a risk premium on lending to new nuclear compared to other large projects. This is compounded by the limited pool of potential lenders and investors to nuclear projects, and the large sums involved, which in turn reduces competition for capital and limits the pressure that can be applied to reduce costs of capital. Reducing the risk perception of new nuclear projects is important to reduce future cost of capital.

3.12 Construction interest is an important element of total project costs: studies show this can be as high as 54% of total construction costs (15% cost of capital, 10 year construction duration). Once a nuclear plant has been constructed, the production cost of electricity is low, predictable and stable and the project will have been significantly de-risked relative to during the construction phase. This means the market for lending and investment is greatly increased, which significantly lowers the costs of capital in the operational phase.

3.13 Specifically, **the government should evaluate the range of different financing models, including those assessed in the recent NAO report on Hinkley Point C, and how government involvement could reduce the cost of capital and deliver direct benefits to electricity consumers**. Each reduction in the cost of capital by 1% on a typical new nuclear construction project would lead to a c10% reduction in the strike price of a Contract for Difference. This should take into account the changing risk profile across the life time of a project and look at opportunities for lower cost financing of early stage risks and subsequent refinancing, within the current legislative framework.

Capturing the Benefits of Building a Series of Plants

3.14 Building a series of nuclear power stations can yield significant benefits in terms of cost and risk reduction. Experience from the first project, Hinkley Point C, can be applied to subsequent projects even if the nuclear reactors at the heart of the plant are of different designs. The maximum advantages are gained through building a series of plants of identical design at a single site, as this allows the construction of shared facilities and reduces the set up costs for construction work.

3.15 The benefits of replication can still be realised with different reactor technologies if the changes from site to site are kept to a minimum, and if the supply chain is able to plan ahead and invest in advanced design and manufacturing facilities for the building of a series of plants, as part of an overall national programme. There is a significant part of the construction of a nuclear power plant, particularly beyond the equipment for the reactor island, which can be delivered by the same companies even where the design specifications and codes and standards are different. **Industry and government should work together to examine the potential for capturing the benefits of transferrable experience in construction and site installation across projects, and for maximising the common elements of equipment supply**. This will enable world class experience and capability to be available to developers across projects and technologies to improve delivery certainty, reduce costs and promote innovation. Work that the ETI (Energy Technology Institute) is currently undertaking on cost reduction in nuclear new build will also inform the approach of industry. Regulatory effort can also be significantly reduced through this process.

Utilising Best Practice in Construction

3.16 This includes maximising offsite manufacturing, assembly and modularisation and sharing best practice, resources and improved construction techniques and technology to ensure that projects are delivered on time and within budget. **The government should utilise its involvement in new build projects to encourage innovation and collaboration across the sector. Developers and supply chain companies will commit to working with initiatives that are supported by**

government and industry bodies to develop capability of UK companies and to ensure effective delivery. This This includes supporting the current work being led by industry to develop a suite of modular construction techniques and technologies (discussed in greater detail in the section on Maximising Economic Benefits). Drawing on the example of the Nuclear Advanced Manufacturing Research Centre, the government should consider supporting a new centre for innovation and best practice in nuclear construction. With assurance of a long term programme, the UK supply chain can develop a world class delivery capability that will improve delivery certainty and reduce costs.

3.17 Progress on these actions will also pave the way for further expansion of nuclear beyond the current planned programme and will enable nuclear power to make an increased contribution to the UK's energy requirements, as decarbonisation of transport and heat, as well as power, lead to higher demand for electricity. This, in turn, will increase demand for UK supply chain capability, generate new UK intellectual property and create export opportunities. This will encourage investment in jobs and equipment, including for uranium enrichment services and nuclear fuel production as well as manufacturing, engineering, construction and professional services expertise.

Industry will	Government will
Commit to reduce costs across the programme over time	Support a series build programme
Ensure continuous cost reduction through application of best practice	Provide a stable policy and regulatory environment for nuclear investment
Maximise use of offsite assembly and modular construction	Consider options to support lower cost financing of new projects
Support development of lower cost reactor technologies in future projects	Facilitate supply chain collaboration and direct R&D funds to support advanced construction methods.
Collaborate to consolidate world-class delivery experience across technologies and programmes	Support development of a centre for innovation and best practice in nuclear construction
Support initiatives to improve competitiveness of the UK supply chain	

FOUR

Decommissioning and Waste Management

4.1 The decommissioning of the UK's current and future nuclear liabilities represents a significant spend over a lengthy timeframe, with current undiscounted costs estimated at £119bn for the NDA estate, £7.5bn for the MoD and £19.5bn for EDF Energy's AGR and Sizewell B fleet. As more nuclear reactors come offline worldwide, the global decommissioning market is estimated to be worth £100bn to 2035, potentially representing a significant export opportunity for the UK supply chain.

4.2 The UK industry has demonstrated its ability to deal with the most complex decommissioning and radioactive waste management challenges in the world, including retrievals from the legacy ponds and silos at Sellafield and Dounreay and made significant progress decommissioning the Magnox fleet, with learning being shared across these programmes. This progress can be maintained if there is certainty over future funding and continuity of the programme, greater clarity and certainty in the decommissioning pipeline, and optimised management of radioactive wastes.

4.3 Industry and government also need jointly to develop plans for long term management and disposal of radioactive wastes including supporting delivery of a programme of geological disposal.

4.4 The NDA's undiscounted liabilities amount to £119bn, roughly three quarters of which are at Sellafield, and the programme is expected to take 120 years to complete. However, these central estimates are subject to wide uncertainties and the costs could range from £95bn to £218bn depending on assumptions about legacy waste types, technological development, political changes and the wider economy.

4.5 Sellafield poses levels of complexity and technological challenge that are unique in the global nuclear sector and accounts for a large part of the uncertainty in calculating the liabilities. Estimates of the projected costs have been rising in recent years as more information has become available about the nature of the challenges and the likely future costs of dealing with them. **An important objective is to narrow the range of uncertainty and to improve confidence in the projected costs by bringing forward the planning and delivery of the programme**.

4.6 The remainder of the NDA estate presents very different challenges. In the rest of the programme, which includes the 11 Magnox plants and the research sites at Dounreay, Harwell and Winfrith, there is greater certainty about the nature of the work to be carried out and the costs of the programme can therefore be projected with reasonable confidence. Whilst the projected costs of Sellafield have been going up in recent years as the nature of the challenge has become better understood, projections for the non-Sellafield programme have come down.

4.7 The challenges in the non-Sellafield part of the programme are more aligned with conventional commercial projects – ensuring effective risk management, project management, resource optimisation, supply chain integration, waste packaging optimisation and commercial contracting – and outturn costs can be brought down further through joint working and continued application of commercial disciplines.

4.8 There remain a number of specific technical challenges to be overcome at Sellafield, Dounreay and final dismantling of the Magnox reactors (currently planned from c.2070 – 2100) where uncertainty ranges could be narrowed with earlier funding being directed.

4.9 These proposals are intended to apply across the nuclear industry, offering benefits for reduction in public liabilities associated with the NDA and MoD estates, as well as enabling private sector organisations (including those in other industries such as healthcare) to realise better, faster and cheaper decommissioning of their own nuclear assets. Furthermore, they offer greater certainty and clarity to new nuclear build entrants, as well as enabling the most efficient and cost effective decommissioning of the AGR fleet.

Effective Commercial Arrangements

4.10 In order to ensure that programme objectives are delivered efficiently and at lowest cost, it is important that commercial structures and contracting strategies reflect a range of different risk profiles, from high-hazard through to deconstruction and site restoration.

4.11 Procurement of contracts for nuclear decommissioning has tended to be based on prescriptive specifications and limited contractor engagement prior to formal tendering. Both industry and client organisations recognise that more could be done to incentivise and improve contracting arrangements and strengthen commercial disciplines. The industry is learning from other sectors in implementing contracting structures which focus on outcomes, and the behaviours and culture which are needed to make these work effectively. A shift towards more use of output-based or functionally-specified procurement would deliver significant benefits in bringing down costs and managing risks more effectively:

- enabling the supply chain to bring cost effective innovative solutions to problems
- allowing equipment to be designed for manufacture and thus facilitating cost reduction
- reducing clients' design and specification costs and allowing these activities to be carried out where the product-specific knowledge lies: in the supply chain
- shortening procurement schedules and therefore accelerating delivery
- allowing the supply chain to manage the trade-offs between product design and through life repair and maintenance costs
- developing a programme-wide planning approach to allow delivery of repeatable cost effective solutions
- enabling the supply chain to develop IP with export potential

4.12 The obstacles to developing more commercial approaches to procurement lie in a combination of the cautious nature of the nuclear industry, public sector cultures and practices around procurement and perceptions about regulators' willingness to sanction the sharing of risk between licensees and contractors. But these obstacles can be overcome and there is already evidence that this is being achieved in the Magnox programme. With a joint commitment from government, licensees and the supply chain there is much more that could be done to reduce costs and improve delivery.

4.13 A significant issue in the nuclear industry is the flow down of terms and conditions that must be accepted by supply chain companies tendering for decommissioning contracts. In many cases these impose liabilities and other conditions which mean SMEs are unable to compete and also result in substantially increased prices to the customer reflecting the liability and risk for suppliers. In some cases the terms and conditions for contracts are unacceptable even for the largest of organisations, resulting in extremely expensive re-tendering processes.

4.14 **The best way of exploring these opportunities will be through an industry-led review of the commercial arrangements for decommissioning, opening the way for more output-based procurement allowing industry to identify more cost-effective solutions for delivering projects and to manage risk effectively**.

4.15 Industry believes there is scope to realise further cost savings through improved commercial disciplines of **20% across the programme towards 2030** and that the gains could be shared with the public sector through appropriate contractual incentives. **This equates to £3-4bn over the next ten years**.

4.16 This improved commercial approach will also pave the way for industry to support the cost-effective decommissioning of the AGR fleet which will start to enter decommissioning from the mid-2020s.

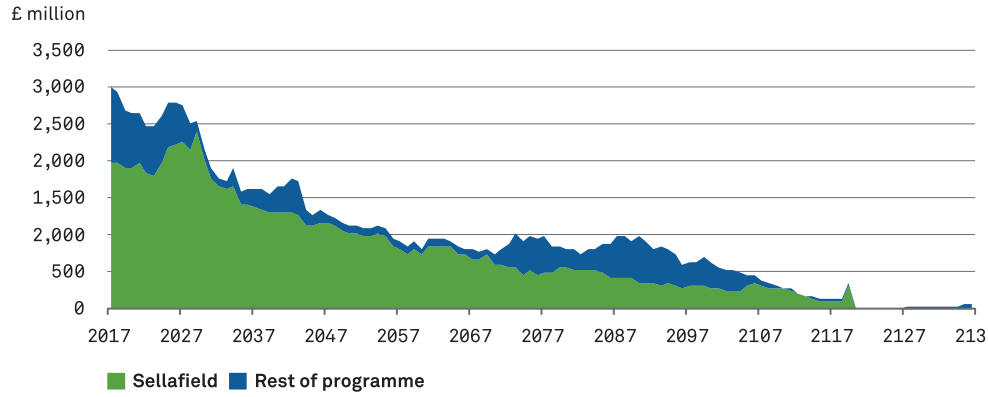
4.17 The recommendations made in these areas for improvements in standard practice across the nuclear industry will require an implementable plan that would require government support, potentially including appropriate funding. In addition a representative review group would be formed by industry, including representatives from the NDA, MoD, Sellafield, BEIS, RWM, NIRO and the regulator.

Funding of Decommissioning

4.18 The NDA budget is currently approximately £3bn per annum, just over half of which is spent in the supply chain. The spending profile is set out in the figure below. The high hazard programme at Sellafield will reach a peak of expenditure in 2030, which will squeeze the budget for the rest of the programme. Potential delays in low hazard decommissioning and elsewhere in the NDA estate would result in increasing costs and lack of supply chain engagement and investment due to uncertainty. An illustration of this is the Dounreay SRL decommissioning programme being extended by up to 8 years, due to contract specification changes and annual capped funding.

NDA provision: forecast undiscounted expenditure

Source: BEIS Annual Report and Accounts



4.19 There would be benefits from maintaining the current level of overall funding for the NDA programme and at the same time bringing forward the hazard reduction programme at Sellafield and Magnox reactor dismantling (depending on ongoing technical assessment), which would allow for:

- a faster reduction in liabilities over the long term, reducing 'hotel costs' (the cost of maintaining redundant facilities for later decommissioning)
- earlier reductions in risk and hazards, lowering the likelihood of incidents over the long term
- more efficient and timely delivery of the non-Sellafield elements of t he programme

4.20 Managing the nuclear legacy requires very long term planning and commitments. It is important that there is clarity and transparency of the programme both from the SLCs and from the tier 1 and tier 2 contractors for lower tier suppliers,

especially SMEs. There is some evidence that the programme can be constrained by government rules on appraisal of projects (The Green Book) which make it difficult to assess projects over the long term – for example how to accrue costs and benefits over time. **A specific annex to the Green Book rules as they apply to nuclear decommissioning projects could allow the spending profiles of projects to be optimised over their full life cycles**, leading to a more efficient use of resources and cost reduction. There are already a number of examples (including PFI, economic regeneration and transport projects) where this has created helpful clarity about how projects can be assessed.

Optimised Waste Management Arrangements

4.21 Long term, the industry's priority is to work with government and RWM to develop a geological disposal facility. **By 2030, the goal should be to have selected a site for a GDF and to have developed implementation plans for commissioning and operating the facility**.

4.22 Without compromising the government's consent-based approach to siting of a GDF, there would be benefits in industry and government working together to define a programme and route map for developing a geological facility. As well as helping to define the route map more effectively, this would also:

- help the supply chain to prepare itself and to plan the necessary investment in people and capability that will be needed to deliver the programme, and
- ensure that the employment and industrial benefits of the programme could be made for communities considering entering into the process.

4.23 The lack of clarity in current UK waste management policy is a blocker for many decommissioning projects. The infrastructure for the management of radioactive waste is fragile, not simply because the UK lacks a solution for Higher Activity Waste (e.g. geological disposal) but also for the volumetric bulk of its waste – the lower activity wastes. Current capacity for these (approximately 1.2 million m3) is insufficient to accommodate the predicted arisings of radioactive wastes quoted in the UK Radioactive Waste Inventory (approximately 4.5 million m3), nor for the additional wastes from final site clearance of nuclear sites (estimated at 6 million m3 from one site alone). This disposal capacity is also used by other sectors whose activities, such as the decommissioning of offshore installations, is expected in the near term to further reduce this available capacity.

4.24 Government policy on waste should be clarified to ensure that classification and disposability of waste are clearly differentiated, and to enable the provision of national programme arrangements for radioactive waste management.

4.25 This would enable industry to adopt a more proportionate and risk-based approach to the management of waste, opening up alternative routes for existing wastes, and enabling safe, final disposal sooner rather than later – accelerating decommissioning and clean-up and a reduction in "hotel costs." Greater use of existing Low-Level Waste Repository vaults, and construction of new near-surface waste capacity could realise significant savings by enabling acceleration of the NDA programme. Reducing the capital expenditure on stores pending geological disposal and avoiding the expense of packaging wastes for geological disposal are significant contributors to this.

4.26 Furthermore the ways in which radioactive wastes are managed across the industry vary considerably. A waste box at one site costs £11,000, whereas at

another it costs £35,000 – for ostensibly the same wastes. There may be up to 43,000 boxes required and therefore smart procurement and sensible use of standardisation could deliver significant savings. This would also provide increased confidence in the deliverability of disposal and in the development of a robust safety case for geological disposal. Current arrangements in new build drive the industry to develop site-by-site solutions for processing and storage, and large cost reduction benefits could be realised by the sharing of processing and waste storage capability between sites. There have been good examples of the benefits of this approach deployed in the NDA's Magnox programme, for example stores at Berkeley being used for intermediate level waste from Oldbury.

4.27 A more national or regional approach to management of spent nuclear fuel and waste rather than individual site solutions would reduce capital costs, estimated at £500 million per site for spent fuel processing plant, reduce the level of management (e.g. security and asset care) needed for the duration of interim storage, and allow earlier transfer of risk from waste producer to waste manager responsible for its final disposal.

4.28 Historically, contractual and regulatory arrangements address waste management on a site by site basis, leading to duplication of effort and inconsistencies in approach, and decisions constrained by limited volumes and funds. The Magnox programme is now benefiting from programme wide and regional solutions. Further developing optimisation of waste management decisions at a more national or regional level would provide better opportunities for waste management and enable more efficient use of industry and regulatory resource.

4.29 **Savings through the changes to policy in waste management and standardisation could be up £4.8bn through the lifetime of the Sellafield programme**.

Proportionate Regulation

4.30 The goal-setting nature of UK regulation provides for flexibility in how regulation is applied. Industry welcomes the fact that the regulators are committed to using this flexibility in a way that is enabling rather than compliance-driven.

4.31 Greater understanding of what regulators expect will minimise over-cautious and unnecessary responses from industry, so improving communication and understanding will be a mutual benefit. This will also improve transparency and public accountability.

4.32 Areas where better regulation could enable costs to be reduced and at the same time regulatory outcomes improved should be explored, including:

- greater standardisation on issues such as packaging and transportation of waste
- sites that do not have radioactive material being regulated in ways that do not treat them in the same way as sites that do.

4.33 Industry welcomes the current work by the government to review the current regulatory framework for final stage decommissioning and clean-up of nuclear sites, and the consultation on revised arrangements expected later this year and will continue to work with regulators to promote an enabling approach to regulation. Industry will explore ways of engaging with regulators in a more structured way to ensure effective dialogue and feedback.

Re-use of Nuclear Licensed Sites

4.33 NDA sites are currently expected to be decommissioned to a green-field state. However, this misses an opportunity to generate additional income for the NDA programme, by re-using appropriate nuclear licensed sites for other UK nuclear programmes. UK programmes such as SMR development, new reactor development and research and development can be accelerated through using the infrastructure already in place at nuclear sites. This would allow the acceleration of the NDA decommissioning programme through greater funding, providing more cost saving and hazard reduction. Additionally, the acceleration of domestic nuclear programmes would further position the UK to be world leading in nuclear technologies, with potential to export these technologies worldwide.

International Exports

4.34 Successful delivery of decommissioning projects in the UK can also enable companies to compete in the growing global market for decommissioning services and equipment, worth £100bn-150bn over the next 25 years. UK companies are well-placed to win orders in export markets and can benefit from export promotion support from DIT, overseas embassies and export credit guarantees.

4.35 The NDA plays an important and valuable role in supporting UK companies in overseas markets although this is not formally part of its mission. A greater recognition of this potential role, whilst ensuring that it does not detract from the NDA's core mission to manage the waste and decommissioning legacy in the UK, would be a valuable additional support for exporters. In addition, there are instances where the NDA owns the IP for equipment procured in the UK, and the process of companies obtaining IP rights to enable them to export equipment overseas can be cumbersome. Accelerating the process for the NDA to release IP could improve export opportunities for UK manufacturers.

4.36 With a robust assessment of the international decommissioning market, matched to the UK's nuclear capabilities, high-priority opportunities can be identified through industry and government collaboration and captured through targeted interventions, bringing additional revenue into the UK supply chain and further expanding its capability.

Industry will	Government will
Lead a review to strengthen commercial arrangements in decommissioning	Maintain current levels of funding
Continue to increase efficiency and productivity of projects	Consider an annex to the Green Book to facilitate more innovative financing models
Support development of the GDF programme	Support the industry-led review of commercial arrangements for decommissioning
Support development of common infrastructure for spent fuel and waste	Work with industry to support supply chain readiness for timely delivery of a GDF
	Lead development of national waste management strategy with common policy and infrastructure
	Support development of innovation agenda
	Reinvest savings generated to further accelerate decommission programme

Future Technology and Programmes

FIVE

5.1 Building on the successful delivery of the current industry-proposed 18GW new build programme, industry and government should jointly set out a vision of the opportunities for successor projects to the current Gen III programme, development of UK reactor design and IP, and research into advanced reactors.

5.2 The objective should be to develop **a long term strategic vision of the nuclear industry's future direction and the policy and investment decisions needed to underpin it**, with a planning horizon leading well beyond the 2030 window for industrial strategy, but guiding the actions that need to be taken within that window. This vision should have a strategic thread running from successful delivery of current programmes (new build, decommissioning and defence), through successor programmes to expand the industry's contribution to energy goals, and on to advanced designs with the UK holding significant IP and technology content.

5.3 The vision should be driven by an overall assessment of the economic value to the UK economy, taking account of:

- Lower costs to the consumer, with a commitment to developing new nuclear projects that deliver successively lower generation and CfD costs
- Contribution to energy market goals (tackling fuel poverty, stability of supply, emission reduction) and energy system flexibility
- Opportunities for the UK supply chain especially in higher value equipment supply through ownership of IP in technology
- Maximising the UK share of export markets in new reactors

5.4 Underlying this is the need for the UK to generate a commercial revenue stream from programmes where the UK holds, or could develop, IP in order to finance further growth and development.

5.5 The UK is well placed to contribute to and benefit from higher value opportunities in the development of reactor programmes in the UK.

Small Modular Reactors

5.6 In the short term, government should give a clear direction on the future for SMRs including an announcement on the outcome of the SMR competition and next steps and associated funding.

5.7 This should demonstrate continued support for the development of SMRs and advanced reactors through:

- Funding for development of new designs with significant potential benefits to the UK, for instance through IP, with a clear and early commitment of R&D funding
- Facilitative actions to enable projects to be brought to market, including:
  - Early access to regulators, which should be adequately resourced for this task; the challenges facing regulators will change over time and they are likely to be required to regulate technologies and processes that are different than those currently available
  - Greater clarity about future site availability, e.g. through planning policy and statements
  - Identifying new, easier ways of building and financing nuclear projects, with the aim of allowing industry to attract the broadest range of investors and at competitive rates and for this to be reflected in lower electricity prices
  - Making available expertise and resource from DIT, UKEF, NNL, UKAEA, NAMRC and other government bodies to support credible propositions through development, deployment and export.

5.8 These facilitative actions should build on those put in place for the current new build programme (the Infrastructure Planning framework, GDA, EMR) and should include the additional proposals for managing risk in project development set out in the new build section, enabling access to lower cost of capital for new projects on the same basis as those currently in the pipeline. This should provide a consistent framework of support and facilitation from current new build and extending through further expansion of the programme and to future designs.

Nuclear R&D and Innovation

5.9 Government, industry, academia and research bodies have worked in partnership to address the significant gaps that have been identified in support for nuclear R&D and infrastructure and the lack of systematic decision-making on funding. Through this successful collaboration, the Nuclear Innovation Programme was developed with a focus on future reactor systems and the associated fuel cycles in a low carbon economy. Industry welcomes the recent confirmation to reconvene the Nuclear Innovation and Research Advisory Board (NIRAB) and of the role of the Nuclear Innovation and Research Office (NIRO). With the commitment from industry this should bring forward recommendations on the industry-relevant R&D to support successful delivery of nuclear programmes as a growing part of the future UK energy mix. To enable it to provide a strong and independent voice, NIRO and NIRAB should draw on secondments and experience from across the UK nuclear industry.

5.10 Industry welcomes government action in this area, and there should be a joint and continued **commitment to a sustained programme of industry-relevant innovation and research, with access to necessary research infrastructure in the UK and overseas. This could include access to domestic infrastructure such as the UKAEA fusion research facility at Culham and collaboration with overseas national laboratories through nuclear co-operation agreements**.

5.11 Close collaboration between research bodies, industry and government will support industry to deliver current programmes and to develop innovation in technology and processes to position the UK to take advantage of future opportunities. **Industry welcomes the decision to reconvene NIRAB which should enable government, academia and industry to coordinate nuclear R&D programmes. Industry will commit to providing the senior leadership to guide an industry-relevant programme and the expert personnel to support it**.

Industry will	Government will
Establish industrial and financial consortia to bring forward projects	Work with industry consortia to set requirements for development of future reactor technologies
Develop new nuclear projects with successively lower CfD costs	Provide R&D funding for new technologies
Fund design and development of nuclear technologies	Develop facilitative actions to enable projects to be brought to market
Provide the skills, knowledge and resources to deliver the technology	Support mechanisms to provide leadership on and coordination of nuclear innovation
Develop international marketing plan for new reactors	Continue to fund its ambitious Nuclear Innovation Programme and ensure infrastructure access
Provide leadership and personnel for an innovation programme	

Regional Innovation Hubs

The long term strategic vision for R&D and innovation should also include the importance of the contribution of regions. **The first wave of Science and Innovation Audits commissioned by BEIS** highlighted the potential for regions to support innovation in the nuclear sector through a combination of industry, academia, and world class assets.

The University of Bristol are developing their capability with their NUCLEATE project with its lead partner the National Nuclear Laboratory. NUCLEATE is a nuclear 'innovation factory' that provides an environment where fundamental research can be combined with industrial experience and commercial innovation to create technologies, solutions and skilled people that are taken up by the global nuclear supply chain. NUCLEATE will act as the national centre for innovation in nuclear energy – creating new jobs, new wealth and ensuring that the region extracts maximum benefit from this burgeoning national renaissance.

In Wales, Bangor University is working to both develop its own academic capability in the nuclear sector and provide support for Hitachi in progressing the Wylfa Newydd project. With both nuclear decommissioning and new-build projects on its doorstep, the University is building a world leading capability in nuclear engineering which will be the hub of a global network.

Already, Bangor University and Imperial College London, with Hitachi-GE providing technical expertise and support, have established a joint "BWR Research Hub and Network". This BWR Research Hub and Network brings together the UK research base with Hitachi Nuclear researchers to help develop future generations of Boiling Water Reactor technology.

Maximising Economic Benefits for the UK

SIX

6.1 The UK has industrial capability across the whole nuclear lifecycle, from design and commercial planning, through construction, commissioning and operation, fuel cycle management, waste management and decommissioning, as well as a strong research base in both industry and academia.

6.2 With the support and partnership of government, these strengths can be leveraged not just to deliver domestic programmes safely and successfully, but to increase the UK's share of the global market.

6.3 However, supply chains are also complex, tiered and operate across national and international boundaries. Furthermore the nuclear sector has stringent safety and quality standards, which are included in regulatory requirements and must be demonstrated throughout the entire supply chain to nuclear. This creates barriers to market entry and competition, which consequently constrain firms from growing their business through diversification into nuclear.

Key Funding Proposals

Financial support over 5 years to:

- **Deliver a supply chain support programme (from Jan 2018)**
- **Form a new C&I research hub (from Jan 2018)**
- **Establish a new equipment qualification centre (from Apr 2018)**
- **Establish a new centre for modular manufacturing, building on the existing Cammell Laird and Nuclear AMRC pilot centre in Birkenhead (from Oct 2018)**

The outcomes and benefits of these programmes will be determined through a full business case. In broad terms, however, it has been shown that every £1 of public money invested in the High Value Manufacturing Catapult (Nuclear AMRC) delivers £15 of net benefits to the UK economy.

6.4 Substantial opportunity can therefore be realised if we capitalise on our strengths and tackle key drivers of cost and complexity in the supply chain. The current Civil Nuclear Sharing in Growth programme of supply chain support has supported £455m in contracts, 5,436 jobs and £49.2m in private investment but ended in September 2017. The Fit 4 Nuclear programme facilitates entry to the sector particularly for SMEs, but feedback shows a greater need for follow-on support to understand export markets (particularly non-EU in light of Brexit), identify contracts and find supply chain partners. Industry is already working together to develop a new programme that addresses market and government needs.

Cost Reduction

6.5 An internationally competitive supply chain will support cost reduction of new nuclear, decommissioning and submarine programmes – and thus reduces costs to taxpayers and consumer (electricity) bills through:

- Increased competition in the nuclear supply chain, leading to more efficient markets
- Increased capability and capacity to qualify nuclear components and equipment, thus reducing project risk and financing costs
- Quicker deployment of new innovations that deliver a step-change in productivity – for example, past research projects delivered an 80% reduction in heat exchanger assembly time.
- A 20% improvement in SME competitiveness and productivity, using a new system of National Manufacturing Competitiveness Levels utilising best practice and working across the wider advanced manufacturing support programmes

6.6 Working together industry and government can simplify procurement in the nuclear industry, create new advanced capabilities and increase the UK's share of export markets. Such a partnership will increase UK manufacturing productivity and improve delivery times, which in turn will:

- Reduce the cost and risk of nuclear programmes (civil and defence) including delivery of the 30% cost reduction commitment in nuclear new build set out above, and potentially higher savings for future technologies- and thus increase value for money to the taxpayer and enable an economic transition to a low carbon economy.
- Drive economic benefit across the UK so that, by 2025, there are:
  - double the number of apprentices – from c.2,000 to 4,000, with the aim of employing over 5% of England's new engineering and manufacturing apprentices
  - £2bn of new contracts across domestic and export markets
  - £200m of new private sector investment
  - an additional 500 SMEs operating in the nuclear sector

Simplifying Procurement in the Nuclear Industry

6.7 The stringent safety and quality requirements that are needed for the safety critical products and systems in the nuclear industry can often be overused and become a barrier to new entrants. Additionally, the procurement systems and methods in the industry can result in overly prescriptive practices. This can result in the same product being supplied to different industries, but with the nuclear product attracting a much higher degree of specification and therefore price. The method of procurement and specifications can be so different that it is hard to understand for new entrants, and existing suppliers, which again results in increase of cost. The result is the UK supply chain becomes more expensive than necessary and less competitive on the open market, new entrants are deterred and innovation stifled.

6.8 An opportunity therefore exists to reduce costs, save programme time and increase labour productivity through a more fit-for-purpose approach to procurement and implementation of more standardised systems. To seize this opportunity, industry will improve:

- Procurement practices by:
  - specifying more appropriate component requirements (i.e. according to need, rather than driving up costs through over specification);
  - procuring based on outcomes rather than detailed component specifications – thus encouraging innovative solutions; and
  - encouraging tenderers to outline the full lifecycle costs of products or services, thus ensuring that all costs (including through-life costs such as maintenance) are taken into account when making procurement decisions.
- Data management systems, for example establishing a common data platform through Building Information Modelling (BIM) so that construction, asset and design information can be more efficiently shared across the supply chain. This approach has generated benefits for publicly procured construction works, as highlighted in the Government's Construction Strategy, and there is considerable scope to adopt these digital techniques in the nuclear industry to reduce the risk of error and project delays (particularly given the large-scale nature of many nuclear projects, which often require significant financing and thus delays can result in substantial interest costs).

6.9 Based on the successes of the Sharing in Growth (SiG) and Fit 4 Nuclear (F4N) programmes, participants of those programmes will deliver and support – including through potential match-funding of any future government support - a supply chain programme that supports new entrants, improves capability and helps the manufacturing supply chain to navigate the nuclear sector. Building on existing schemes the new programme will link to the questionnaires that developers use to qualify suppliers and provide tailored interventions that are informed by customer demands. Industry will establish greater clarity of manufacturing capability and work with the Department for International Trade to represent and increase visibility of UK manufacturers in international markets, particularly non-EU markets in light of Brexit, as well as provide demand data to create a robust forecast of domestic and export contract opportunities (both mechanical and electrical) across the sector.

6.10 Spanning five years and targeting tier 3 and 4 manufacturers, this programme will make the UK one of the most competitive places to grow a business and help less productive companies to close the gap with their peers. It will support the development of new advanced capabilities and exports (see below) and, as tier 3 and 4 manufacturers often serve multiple sectors, benefits will be shared across industry. This can then link to a national manufacturing development programme that spans all sectors.

6.11 To support this industry-led initiative, Government should bring nuclear developers and owners together, including the NDA and Ministry of Defence, to actively engage in the above activities and implement changes that fall to the public sector, including potential operational, policy and regulatory changes. Government should also consider appropriate funding options to support the nuclear supply chain, for example, from wider advanced manufacturing support programmes and facilitate access to demand data across new build, operations, decommissioning and defence.

Creating New Advanced Capabilities

6.12 There are a number of areas in the nuclear sector where research activity is relatively low, but where there is scope to create new capabilities that can reduce the cost of domestic programmes and create value from export potential. Cost reduction enablers, plus other methods such as reduction in the cost of capital, are what developers will utilise in order to reduce overall project costs and strike price. To ensure these enablers are put in place **industry will collaborate and invest in a series of new innovation partnerships** that focus on the following opportunity areas:

- **Modular manufacturing techniques** – where we will increase the number of consortia able to assemble and manufacture components in a modular environment and at lower cost. This will build on the modular design and assembly philosophy successfully deployed in industries such as shipbuilding, aerospace and civil engineering to make the UK a world leader.
- **Advanced construction techniques** – where a new national innovation programme/centre would lead research into nuclear construction-related technologies and techniques that reduce build time and increase build certainty for new build and decommissioning projects. This would include use of digital construction, on-site automation to increase site safety and transferring proven construction techniques from other sectors, taking factory methods into construction to ensure the UK is a world leader.
- **Equipment qualification** – where industry will establish a national method for qualifying components for use in safety-critical applications, as well as build

the supply chain's understanding of EQ and improve access to test houses. This will enable UK companies to qualify products more efficiently to domestic and international requirements and establish a common sector benchmark for each component, so that the same method can be used for projects in different markets e.g. nuclear decommissioning, submarines, new build or fleet maintenance. This will remove barriers for UK companies, reduce over specification and link to our world-renowned regulatory framework to develop export potential and facilitate access to overseas markets.

- **Control and instrumentation (C&I) technologies** – where there is a credible baseline of academic and industrial experience in the UK, but a limited number of recognised, nuclear-specific research programmes. New build reactor vendors typically tend to do C&I research in their home country. Increasing the UK's C&I research capability – from legacy (analogue) systems used in existing plant, to future (digital and wireless etc.) systems used in new designs – would enable the UK to compete for more C&I work in operations, decommissioning and new build markets.

6.13 These partnerships will be located so that they form a network of support and innovation infrastructure in key clusters of the nuclear supply chain and manufacturing excellence – and will draw on existing assets such as the National Nuclear Laboratory, Nuclear Advanced Manufacturing Research Centre, National Physical Laboratory, Dalton Institute and Local Enterprise and university networks. This includes distributed hubs in the most relevant manufacturing regions of the UK, as well as around key nuclear new build sites. It will create a key catalyst of innovation and information sharing across the nuclear industry, as well as underpin the place-based focus of industrial strategy. Spill-over benefits will also be realised by the creation of new advanced capabilities, as an aim of these partnerships will be to identify innovations that will be applied in other sectors including aerospace and oil and gas.

6.14 To facilitate this approach, Government should consider supporting proposals by industry for appropriate funding, for example through future rounds of the Industrial Strategy Challenge Fund (ISCF).

6.15 Government should also formally recognise the economic value that UK content delivers when making procurement and policy decisions, including through consideration of financial support for future new build projects and should accelerate implementation of its announcement in December 2016 on the requirement for new build developers to produce Supply Chain Plans (SCPs) for their projects. This could include requiring early UK participation in reactor design and procurement discussions, or a degree of design standardisation to enable sufficient market volume in certain components and so enable new capital investment that increases competitiveness.

6.16 This should include requiring early UK company participation in the procurement process and an expectation for the use of UK firms to enable sufficient market volume in certain components and thereby stimulate new private sector capital investment that further increases competitiveness. The UK cannot compete purely on the basis of costs with manufacturing centres that have lower material and labour costs and therefore needs to be able to innovate in both products and processes.

Increasing Exports and Overseas Investment

6.17 The UK has substantial expertise which should be more effectively leveraged to create value in overseas markets and drive exports. However, it is important that UK industry has an understanding of where future export growth opportunities should be targeted.

6.18 Industry will invest in exports to new markets if it can be given the necessary direction, certainty and support from Government. **Government should work with industry to define a nuclear trade strategy** that sets out its approach and considers innovative models of support, such as overseas technology parks and enterprise zones, as well as successful models of expansion like the approach taken to UK expansion by Hitachi Rail, Honda, Nissan and Toshiba. Access to finance will also be a critical enabler of business investment and overseas expansion.

Maximising the capability and growth of SMEs in the regions

6.19 Nuclear activity within the regions provides enormous and far reaching opportunities for SMEs to access supply chain opportunities that will lead to improved capability and capacity and most importantly sustainable growth. Experience within the regions has demonstrated that SMEs require significant support to enable them to become procurement ready, as detailed above. Both new build and decommissioning have wide and extensive supply chains that have considerable value and are not simply restricted to advanced manufacturing. Given timely and intensive business support the rewards in terms of increased growth and productivity are high, as detailed in the two case studies below.

6.20 Many SMEs wanting to access the nuclear supply chain would benefit from mainstream business support, complementing specialist support through Fit 4 Nuclear, brokered by appropriate local specialists in conjunction with Local Enterprise Partnerships.

Industry will	Government will
Take responsibility for improving procurement practices and data management systems Deliver and co-fund a supply chain programme that supports new entrants, improves capability and helps the manufacturing supply chain to navigate the nuclear sector Collaborate and invest in new innovation partnerships on modular manufacturing, advanced construction, equipment qualification and control & instrumentation. Invest in skills, R&D and capital infrastructure once it has confidence it is competing on a level playing field and has visibility of future demand Invest in new export markets once it has clarity over future trade strategy	Consider bringing nuclear owners together (including the NDA and MoD) to improve procurement practices and data management systems Consider appropriate funding options for a new national supply chain programme Facilitate access to demand data on defence, decommissioning and new build projects support industry proposals for new innovation infrastructure, as appropriate, e.g. through the Industrial Strategy Challenge Fund Formally recognise the economic value that UK content delivers when making procurement and policy decisions Work with industry to define a nuclear trade strategy

Hinkley Supply Chain Service

As part of its procurement strategy for Hinkley Point C, EDF Energy partnered with the Somerset Chamber of Commerce to manage the Hinkley Supply Chain Portal which provided the opportunity for local SMEs to register, and gain visibility of their capability from EDF Energy and Tier 1 Contractors. This has been overlaid by a bespoke supply chain support service delivered by a consortium approach from the Somerset Chamber, South West Manufacturing Advisory Service and Business West. The current contract also provides an element of inward investment specialist services. This additional layer of business support is currently funded by the HotSW and West of England LEPs. The Welsh Government are currently negotiating to join the contract, utilising the business support elements. The core offer of the service is to:

- Match suppliers with EDF Energy and Tier 1 contractor work package requirements
- Co-chairing and enabling the Site Operations and Industrial Partner steering groups that oversee the developing supply chain response
- Communicate project and work package news and information to suppliers registered on this supplier portal
- Broker relevant business support to help suppliers meet quality and safety standards

EDF Energy have recently announced that they have placed £600m of contracts locally, and this has been achieved in most part due to the efforts of the HPSC Team. The return of investment from funding the HPSC at the levels of circa £166,000 per annum per LEP area has clearly shown significant value for money. The HPSC Team have been universally successful in supporting a number of joint ventures to win significant contracts including this particular case study.

To provide a brief summary of recent interactions – the current LEP funded supply chain contract commenced on 1 March 2017, and to date has helped local SMEs to access circa £1.7m of contracts.

Scope of Supply	Customer	Works	Support Provided	Type of Supplier	Contract Value	Support to Supply Company
Design, Manufacture, Test and Certify	HPC Tier 1	Water Filtration System	Review of supply chain plans	Metal Fabricator	£10k-30k	Facilitated workshop to discuss customer requirements and de-risk the project based on common understanding of risks and capabilities.
On site electrical installation services	EDF Energy	Various on site electrical applications		Electrical installation contractor	~£500k	Supported company into initial consortium for first contract into the project
Manufacture and Supply only	HPC Tier 1	Temporary Jetty Structure	Supplier searches provided of local companies in the area that can provide the product to the standard	Metal Fabricator	£500k - £1m	Company supported through customer interactions, promoted to customer. Supported on Nuclear safety culture training.
Manufacture and Supply only	HPC Tier 1	Civil Engineering Contract	Supplier searches provided of local companies in the area that can provide the product to the standard	Metal Fabricator	£100k-250k	Supplier supported through customer introduction, pre-qualification support for the company. Company has invested over £600k in upgrading the facility and is now bidding for excess of £2M additional work.

Business Support provided by Energy Supply Chain Opportunities Programme – Cumbria

In Wales, appropriate and specific support measures are either already in place (e.g. Construction Futures Wales, Fit 4 Nuclear) or being considered to support the supply chain to develop across the main project areas of construction, engineering and manufacturing. 20 companies across Wales participated in the Fit4Nuclear programme during 2016/17, a further cohort of 50 is being sought to participate in 2017/18 with a target of a total of 250 by 2022. The Welsh Government is also working with the NAMRC to ensure that future F4N programme(s) consider Welsh supply chain needs . Appropriate measures to support the local supply chain to gain non-nuclear specific contracts (e.g. in food, local transport etc.) on the Wylfa Newydd project are also currently being developed in association with local stakeholders in North Wales.

The development of the Menai Science Park is underway on creating what will be Wales' first dedicated Science Park, the first element of which will become operational by the beginning of 2018. The UK National Nuclear Thermal Hydraulic facility at Menai Science Park on Anglesey, is a proposal to bring a £50 million major research and testing facility to North Wales that has a legacy expectancy of up to 50 years.

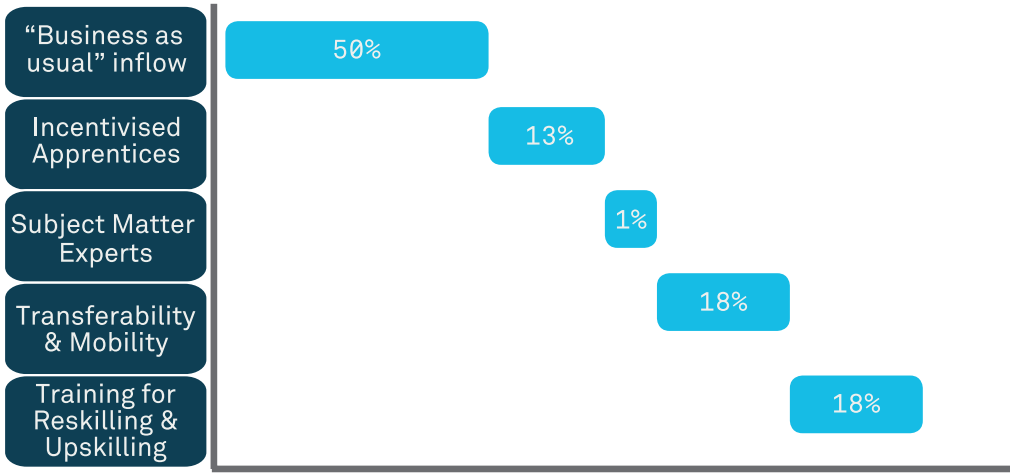
In addition, the proposed Advanced Manufacturing Research Institute investment at Broughton will be a dual centre facility which will encourage collaboration to develop new manufacturing innovation, systems, processes and capability to enhance the quality and productivity of businesses in the region and across Wales. This in turn will provide a key focus on skills and opportunity development for the region, Wales and cross border into the area considered as the Northern Powerhouse.

Skills and Training

SEVEN

7.1 For decades, the UK nuclear sector has built an enviable position for safe, high quality and reliable civil and defence nuclear generation. However the sector is now facing a considerable challenge, including the nuclear new build programme up to 2030, a large programme of decommissioning work and the building of the Dreadnought submarine class. This is all in addition to the safe running of the UK's existing nuclear operations, both civil and defence and a growing challenge to create an energy portfolio with greater reliance on electricity as the need for electric transportation increases.

7.2 Through the new build, defence and decommissioning programmes the nuclear industry will build a pipeline of talent that is exportable to other UK sectors and beyond. By 2021 we will have over 100,000 people working in our sector, with a large proportion in highly skilled STEM jobs in regions that provide local economic benefits. To meet this challenging target within the timescales required we must enable an average inflow of 7,000 people per annum into the nuclear sector.



Required inflow per annum (Total required = 7,000 FTEs)

7.3 The above diagram shows the expected impact of proposed Sector Deal programmes on the ability of the nuclear sector to fill required positions with suitably skilled people.

7.4 The Nuclear Workforce Assessment shows a required net inflow (replacement and expansion demand) of 7,000 FTEs per annum for the next 5 years. Without any intervention, the current inflow is approximately 3,000 FTEs per annum which falls short of our skills requirement levels by a significant amount (4,000 FTEs). This substantial gap can be filled through specific interventions which can only occur through a partnership approach between industry and government. These interventions are highlighted within this document and include: a) incentivised apprentices (13%); b) subject matter experts (1%); c) transferability and mobility (18%); d) training for reskilling and upskilling and (18%). It should be noted that although some of the requirements are small in terms of volume, it takes significant time to develop certain skills and as such lack of intervention now will create a larger challenge for the future. The longer the delay in action around apprenticeships, the greater the need to pull in skills from other sectors or countries, and this will lead to inflationary pressures on salaries.

7.5 To address this Government and industry's strategic intervention is required now to ensure the nuclear sector has the diverse and talented skills to meet all future requirements.

7.6 Building a vibrant nuclear industry will provide opportunities for long term employment for individuals at all levels. **The industry will endeavour to build a pipeline of diverse talent through academic and technical vocational routes for the industry to adopt without undue reliance on overseas labour. Similarly, industry will build training, development, qualifications and certification processes to be recognised internationally and therefore provide opportunities for their use and transfer into the international market.** This will be achieved by a collaborative and flexible approach to skills deployment across the civil and defence sectors. Whilst we acknowledge that there is already good work in this area, we have recognised the need for government support to build the necessary infrastructure.

7.7 This proposal has been developed with input from the key skills organisations in the sector; namely Nuclear Skills Strategy Group (NSSG) and its associated supporting organisations such as the ECITB, NCfN and NSAN. The NSSG was created as a result of the sector needing to address significant skills challenges, and is supported through partnership of organizations between industry, government and the trade-unions. Through ongoing engagement at a national and local level, the group has identified and underpinned the size of the skills challenge across the nuclear sector both now and in the future. Industry is keen to continue working in collaboration with a range of skills partners, government and the trade-unions and, in particular, to deliver the actions in this proposal via a local approach by close working with LEPs and other regional partnerships.

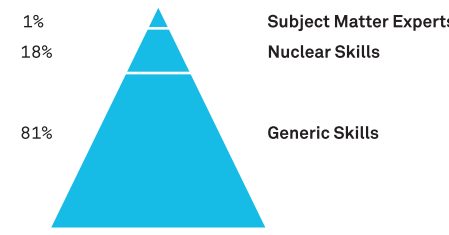
7.8 Whilst the industry faces many challenges with respect to skills, it sees the current priorities as:

1. **Meeting the forward demand** – in order to meet requirements of the future nuclear programme, industry needs to recruit apprentices at an unprecedented rate, at a time of competition with other major infrastructure projects.
2. **Maintenance of our subject matter expertise** – in order to meet projected requirements for the nuclear sector, maintenance and growth of key areas of subject matter expertise will be required. Data from the LMI work forecasts that if subject matter experts take up their retirement option at 60 years of age the industry could lose up to 300 experts or 30% within the next five years.
3. **Transferability and mobility** – the sector is committed to increasing the opportunities for transferability between civil and defence industries and generally increasing mobility to ensure resources are positioned at required locations, both nationally and internationally. However, the impact of mobility post Brexit has to be considered in the longer term.

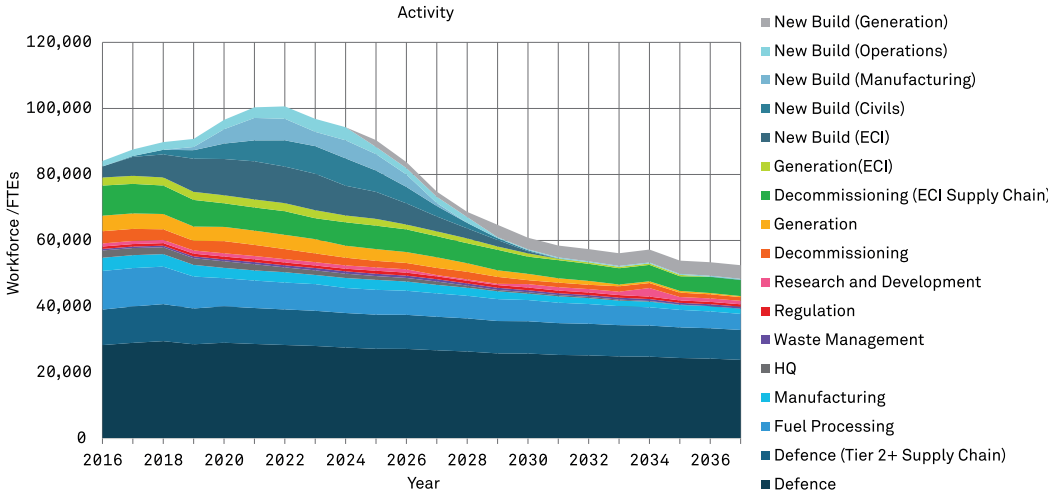
7.9 The nuclear industry has been working collectively on building a sustainable and competent workforce for many years now. There have been many groups, alliances and organisations, working closely with government, focused on building the necessary infrastructure to support the recruitment and training required; to date this has been successful in balancing supply and demand to create a stable, suitably sized workforce.

7.10 In the 2017 Nuclear Workforce Assessment report issued by the NSSG, reported:

1. the overall total demand for skills peaks at 2021 at 100,619 compared with the current workforce of 87,560. This results in a forecast average inflow, including replacement for retirees and leavers, of nearly 7,000 FTEs per annum for the next five to six years.



2. After the peak of the current new build programme (assuming there were no follow on projects) the demand is forecast to fall in a linear manner. Nevertheless, replacement demand averages 1,450 per year.
3. 81% of the total workforce are regarded as having generic skills (ie skills not specific to the nuclear sector and are easily transferable from others); 18% have a significant nuclear component and 1% fall into the category of subject matter experts (who take many years, if not decades, to gain the appropriate level of knowledge and experience).



7.11 The NSSG published their Nuclear Skills Strategic Plan in 2016 to address the infrastructure, processes and systems needed to support the recruitment and training of these additional resources. It was based on extensive research and risk analyses with dialogue with all the key employers and is in the process of being implemented via a comprehensive programme of actions.

7.12 The strategic actions are being addressed through the NSSG strategic plan and the Nuclear Sector Deal can play an important part in delivering these actions through meeting the priorities indicated above. In particular:

Meeting the Forward Demand

7.13 **Through Apprenticeships:** The nuclear industry has a long history of investing in its workforce, from apprenticeships to continuing professional development, and has a high proportion of apprentices compared with most other industries. This investment is not limited to the nuclear Site Licensed Companies, but extends into the supply chain to form a strong backbone of STEM apprentices across the UK.

7.14 However, there is currently a need to pump-prime skills development in the sector, in advance of commercial contracts being let to work on new developments. Without contracts, supply chain companies are limited in their ability to commit to the longer training lead times often necessary, especially for apprentices who may not be able to demonstrate sufficient competence for two to three years or more.

7.15 Nuclear employers see the benefit of the new apprenticeship reform and post 16 landscape and want to increase take up of apprenticeships at all levels. They can do this with the right supporting infrastructure in place.

7.16 Some nuclear employers are large organisations, and published plans for implementation of the Apprenticeship Levy will lead to a significant proportion of their levy credits being unspent. Given the importance of skilling the apprenticeship workforce. Government should work with employers to develop clear measures of success in maximising the impact of the use of the apprenticeship levy in the sector. The nuclear industry is committed to ensuring it contributes to the government's target of three million apprentices, while boosting the proportion of those apprentices following high quality STEM-related standards, and preparing the sector for its known future challenges. To achieve this challenging target requires a flexible approach to utilisation of the apprenticeship levy. To further support the sector, Government should work with the Institute for Apprentices to prioritise nuclear apprenticeship standards.

7.17 Similarly, in some regions with a particular high proportion of smaller businesses, a localized community apprentice scheme could be hugely beneficial for companies awaiting contracts. This would involve oversight of apprentices' training to meet the requirements of their Apprentice Standards (or frameworks) and rotating placements in different participating companies to enable them to gain the real experience and competence necessary. There would then be a ready supply of suitably qualified and experienced people who have completed their apprenticeships, at the point that commercial contracts are let.

7.18 A model for this, at graduate level, already exists in the successful nuclear graduates programme, and the group scheme can take relevant lessons from that programme. A suitable sector employer or nominated skills body would manage the programme, and it would be particularly suitable to have an Apprenticeship Training Agency involved. The sector will undertake a detailed analysis of the requirements of a pipeline of apprentices in Cumbria and other regions where appropriate, and work with Government to look at options to set up a Community Apprenticeship Scheme based on unspent levy funds.

7.19 **By enhancing provision:** The nuclear sector already benefits from a two-hub National College for Nuclear (NCfN) and the two hubs have commenced operations, in advance of a formal opening of new building in 2018. Industry proposes that this model should be expanded, after completing a benefit analysis or effectiveness review into the most beneficial location. To continue to support the development of the NCfN the Government should consider providing £200k for bursaries for training to NCfN qualifications. However, it is recognised that the technical landscape is crowded as the new reforms are implemented. The government should also provide greater clarity and, more importantly, stability to this landscape by providing clearer guidelines on the plans for the role of Institutes of Technology, UTCs, FE colleges, Academies and 6th Form colleges, and how they relate to existing arrangements such as the NCfN.

7.20 The increase in demand for skills will inevitably result in upward pressure on education and training institutions, not just in terms of teaching resources but access to facilities and equipment. Closer collaboration between providers and employers is seen as an important way forward, to ensure facilities are developed where they are needed and to the standards required. Likewise, training providers would benefit by being able to afford the time and money to better understand the needs of industry. Consequently, greater collaboration and sharing of personnel and facilities has wide support within the industry.

7.21 **Informing Young People:** Employers see benefit in helping with career advice in schools and colleges, to increase the potential pipeline of talent, but there are also facilities in industry which could enhance the learning experience of cohorts

of students. Moreover, employers are committed to supporting the existing agenda of STEM attractiveness, diversity and social mobility. To recognise the value of the sector and the need to increase the pipeline of diverse talent, the Government should work with industry to ensure nuclear is seen a STEM destination for young people.

7.22 An Ofsted report in September 2013 stated: "Three quarters of the schools visited for the survey were not implementing their duty to provide impartial careers advice effectively". However, there is significant activity in this space and value could be derived from understanding better what is good. Sharing best practice and building on good programmes provide the basis for increased impact and effectiveness on provision of careers information.

7.23 In March 2015, the Government published the nuclear sector skills strategy "Sustaining our Nuclear Skills", which outlined the goal to "cultivate a more diverse nuclear workforce, including by increasing the proportion of the sector's workforce who are women to 40%". The nuclear workforce assessment in 2017 reported "With some significant variations across the industry, women form an average of 22% of the work force across the industry, ranging from 14% in trades to 36% in professional roles". Consequently, the industry has some way to go to achieve the government's aspiration. Although there are numerous initiatives on diversity across the country, there needs to be an assessment of their effectiveness, sharing the best practice and consolidating efforts on the productive initiatives.

Maintenance of our subject matter expertise

7.24 Retention of experience within the nuclear sector is key to the industry's future success and in particular the retention of knowledge contained within a small number of nuclear subject matter experts. These experts have developed their knowledge through decades of engagement within the sector made possible through the broad range of nuclear programmes the UK industry has led on. This experience may decline significantly within the next few years, should experts decide to retire at the age of 60 , reducing this pool of expertise by as much as a third over a 5 year time horizon.

7.25 To ensure maintenance of our subject matter expertise, industry will establish best practice in the development of future Subject Matter Experts. This will include accelerating outcomes through effective industry/ academic engagement and funding of high level skills development. In recognition of the need to replace the nuclear expertise in this country, the Government should consider exploring with industry the development of a bursary scheme for nuclear focussed Masters, PhDs and EngDocs. In addition Government should continue to support the current strategy of setting recruitment levels within the defence sector that recognise transfer of resource to other parts of the industry. The sector must create an additional 300 subject matter experts by 2021 to deal with attrition through an aging workforce.

7.26 Furthermore, clarity will be provided through LMI of future demand for SMEs to identify implications for future interventions required.

Transferability and Mobility

7.27 **Attracting experience:** Whilst the industry acknowledges that it will benefit enormously by increasing the number of graduates and apprentices, it also recognises that the demand for resources cannot and should not be filled entirely

via this route. Experienced people from other sectors need to be recruited at all ages and levels to help offset the number of retirees from the industry.

7.28 The package of measures is not limited to funding initiatives, as the industry recognises that there are other ways to ease the transfer from other sectors. One such example is greater alignment of the civil and defence sectors with increased proactive two-way transfer of people and knowledge. As the military service sector tends to be age and nationality limited, we propose that we actively seek a recognisable career pathway between the civil and defence sectors to ease transfer between the two.

7.29 **Having common standards:** Transferability and optimum utilisation of the nuclear workforce will significantly support the objective of increased productivity and lower energy costs. The industry has an excellent record of working to standards and common standards facilitate and underpin these objectives. Collaboration on the development of common standards, for occupations, apprenticeships, qualifications and training is necessary by the industry. Standards need to be visible and accessible and promoted openly to support this agenda. The industry needs a simple, visible and easy to access repository to hone the standards. The colleges and training providers can develop and deliver clear training solutions in the knowledge that this will meet the needs of the nuclear industry.

7.30 **A global workforce:** Meeting the demand for skills will also take into account the final agreement made in leaving the EU. To date, we have benefited from two-way mobility as an EU member state, and any future stages of the sector deal will need to reflect any agreements made in the current exit negotiations.

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Skills provision within the Regions – maximizing local opportunities

7.31 There have been a number of regional initiatives and pilots that have been established to support the opportunities to grow, upskill and retain a local workforce. With unemployment comparatively low in some regions, the challenge has been more in tackling issues of under employment and in-work poverty. There is also a cliff edge scenario of skills shortages within advanced and mechanical engineering both within civil nuclear and defence.

7.32 The NSSG recognizes that the most successful skills interventions occur when implemented at a regional level and as such the industry commits to the development of close working relationships with LEPs and other key stakeholders. They key regional areas of focus for nuclear skills are the North West (Cumbria), South West, South East and Wales. Through bringing together national approaches and local needs, an optimized approach in skills growth and maintenance can be developed in a region. For example within Cumbria, significant interaction is already happening on the skills agenda through the work being undertaken by organizations like the National College for Nuclear, Centre for Nuclear Excellence (CONE), the Cumbria LEP, and Britain's Energy Coast (BEC). This collaboration would deliver targeted interventions as appropriate for the region.

Industry will	Government will
Continue to develop the robustness of the Labour Market Intelligence (LMI) Lead the development of a community apprenticeship scheme to enable an increase in the number of apprenticeships in the sector from 2,000 to 4,000 by 2021 Support the establishment of the NCfN and the associated scheme for qualifications Establish a programme of engagement in schools and colleges to improve diversity and promote industry attractiveness Develop standards to make simple career frameworks available and facilitate movement of skills between civil and defence sectors Provide resources to enable simple transfer of skills intra- and inter- sector Work in a collaborative manner to identify the need for and the best practice in developing subject matter expertise across the sector including prioritized funding for PhDs and EngDocs and mentoring schemes to facilitate knowledge transfer Work with training providers to improve available facilities Challenge traditional attraction and employment processes to encourage diversity	Provide clarity and stability to the education landscape and invest/direct capital to support capability of providers and delivery of practical work experience opportunities Support the industry in flexible use of the Apprenticeship lLevy and provide access to funding for life-long learning Support and facilitate a systematic way for employer to engage with academia and training providers Support NSSG to implement the nuclear skills action plan across the industry and the LEPs in the regional implementation of the proposals, enabling a co-ordinated, un-fragmented approach across the sector Support the development of subject matter expertise through the relevant research and development programmes that support the nuclear sector Support ongoing development of UK- wide labour market intelligence and labour- side data analysis, in order to consider where policy intervention is required

Regional Implementation of the Sector Deal and the Role of Place

EIGHT

8.1 The proposals outlined in these nuclear sector deal proposals clarify the nature and scale of the opportunities provided by the nuclear sector. The nuclear sector have worked together in identifying these opportunities for the UK as a whole. In many cases the opportunities proposed lend themselves to 'national' developments. However equally, the proposals cover a range of pilot schemes, and/or regional initiatives, that are specifically designed to be delivered locally, to build on strengths and opportunities within a locality.

8.2 In terms of implementation, it is recognised that utilising existing Local Enterprise Partnerships (LEPs), and devolved administrations will provide the best chance of successful delivery. In some areas, very mature partnerships with the nuclear sector already exist. The intention in delivering this sector deal will be to seek out these collaborations to ensure that this sector deal creates opportunities across the localities of the UK. Partnerships with these existing bodies will allow the UK to maximise, but also share the economic benefits which in turn will drive productivity across the whole of the UK. The nuclear sector is one of a very few that can truly claim to be nation-wide, and providing opportunities in areas remote from other economic activity, that would otherwise struggle from economic deprivation.

8.3 In developing this these Nuclear Sector Deal proposals, a number of such local and regional collaborations have already been identified, and many of these are not waiting for the publication of the a Nuclear Sector deal to progress. Work has already begun with LEPs, industry and educational providers to start to deliver in many of the areas identified. However there is more to be done, and the next steps for will be to develop a full implementation plan, with the involvement of these regional groups. This plan will collectively and collaboratively consider the skills, infrastructure, innovation and business support required at a regional level, to deliver each. Based on a range of factors, (such as maximising sector productivity and regional economic growth) the plan will identify the optimal location/s for delivery.

8.4 This delivery plan will consider the availability of funding streams, whilst at the same time quantifying the desired project/initiative outcomes. In some cases successful achievement of the desired outcomes will lead to regional specialist centre, in other case, these outcomes will identify best practice which can then be expanded into other regions. Importantly the delivery plan will acknowledge and encourage, collaboration within a region, as well as collaboration between regions.

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