Nuclear Sector Deal
Two Years On

September 2020
Foreword

Today, nuclear is one of the most strategic, competitive and innovative sectors in the UK. It has proved robust and resilient throughout the pandemic, and can drive investment and job creation as we recover from COVID-19. Furthermore, nuclear fission is an essential source of clean power in the UK, and is essential to achieving Net Zero by 2050.

In line with this, the Nuclear Sector Deal is at the centre of the UK’s strategy to generate national economic stimulus to increase UK business and employment opportunities as well as to contribute to the global and national climate change ambitions.

We recognise the importance of government and industry working together to achieve the agreed goals and ensure greater opportunities such as the regeneration of regions, increased exports, cost reduction, increase diversity and a sustainable commitment to innovation that allows the UK to remain competitive and at the forefront of technology worldwide.

Reducing costs and promoting new nuclear projects will have a significant impact on the civil nuclear industry, as well as defence and security in the UK. The progress we have made since the NSD was published lays a solid foundation for the UK to have clean, affordable, sustainable and reliable energy for all.

Furthermore, we recognise all the work that different organisations and individuals have been delivering in the last two years, working collaboratively toward our shared vision. We appreciate their continued contribution and welcome others to join us in this ambition. There is still a long way to go and the only way to achieve these NSD goals is if we work even more closely together in an open and transparent way.

Dr Tim Stone CBE
Industry Co-Chair
Nuclear Industry Council (NIC)
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive summary</td>
<td>P. 02</td>
</tr>
<tr>
<td>Introduction</td>
<td>P. 04</td>
</tr>
<tr>
<td>1. Where are we today?</td>
<td>P. 05</td>
</tr>
<tr>
<td>2. Working together to deliver the NSD objectives</td>
<td>P. 08</td>
</tr>
<tr>
<td>3. Reducing the cost of new builds to promote economic regeneration and secure low-carbon energy in the coming decades</td>
<td>P. 11</td>
</tr>
<tr>
<td>4. Working collaboratively to achieve cost-effective decommissioning</td>
<td>P. 15</td>
</tr>
<tr>
<td>5. Maximising the benefit of industry to the economy and providing high-value jobs across the UK</td>
<td>P. 17</td>
</tr>
<tr>
<td>6. Promoting diversity to reach 40% of women in the nuclear industry</td>
<td>P. 21</td>
</tr>
<tr>
<td>7. Putting innovation at the heart of the nuclear sector to increase competitiveness and ensure a clean energy future</td>
<td>P. 24</td>
</tr>
<tr>
<td>Conclusion and next step</td>
<td>P. 28</td>
</tr>
</tbody>
</table>

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Executive Summary

Published in June 2018 as an element of the UK’s industrial strategy, the Nuclear Sector Deal (NSD) is a commitment between government and industry to work together to drive green economic growth and make nuclear power an integral part of the UK’s Net Zero energy future.

The initial focus of the NSD is to deliver the nuclear sector vision by 2030, generating significant socio-economic benefits and ensuring greater long-term job opportunities, cleaner energy and a secure supply of nuclear energy for all. However, the NSD has the potential to be the foundation for much longer-term progress and activity. This foundation is built upon the NSD’s four key 2030 targets:

1. **30% women** in nuclear
2. **40% reduction** in the cost of new build projects
3. **savings of 20%** in the cost of decommissioning compared with current estimates
4. **up to £2 billion** domestic and international contract wins

The NSD targets are aligned to legislation the UK government published in June 2019, following the recommendation of the Climate Change Committee, to legislate for net zero greenhouse gas emissions by 2050. The Nuclear Industry Association’s assessment of the future contribution of nuclear power to Net Zero, “Forty by ’50: The Nuclear Roadmap”, considers that nuclear power could provide up to 40% of the UK’s clean power by 2050, while delivering £33bn of annual gross value added to the economy, and up to 300,000 jobs.

Considering the critical role that nuclear power has in meeting these targets and that the existing fleet of nuclear power plants provides 40% of the UK’s domestically-generated clean electricity, we consider the NSD as a strategic vehicle to enable the appropriate prioritisation and collaboration to lead to profitable, growth-driven decisions for all parties involved.

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During the first two years since the NSD was published, a significant number of achievements have been made. These include:

- The publication of a Gender Roadmap in late 2019, outlining an increasing programme of interventions in the areas of attraction, retention, targeting and monitoring to improve industry diversity, starting with gender. 25 key organisations, including major employers in the civil and defence sectors, and hundreds of high-level individuals and personalities have formally pledged to reach 40% female workforce by 2030.

- A comprehensive analysis of the key factors that will reduce the costs of new nuclear power plants by 30% by 2030.

- A National Decommissioning and Waste Management Pipeline for the UK, developed jointly by Government and industry (civil and defence) for the first time.

- A plan to work jointly with the local and national supply chain programme is underway to allow new companies to support nuclear activities in the future, presenting the opportunity to introduce innovation and achieve more domestic contracts.

- The launch of a number of programmes and grants, such as the Nuclear Innovation Programme: Advanced Manufacturing and Materials Competition and the Industrial Strategy Challenge Fund to promote innovation in the sector. These initiatives will help unlock intellectual property and investment and increase opportunities for local suppliers.

Looking ahead, there are some specific challenges that will need to be addressed to unlock further progress and ensure that the NSD targets are met by 2030. Among the main actions to be prioritised in the coming months are new nuclear contracts, which are essential for economic recovery, increased job opportunities and a greater focus on innovation.

Additionally, effective collaboration between all organisations involved must be promoted and improved. All parties should work together under the same vision and have a clear focus on delivering significant socio-economic benefits for the UK: cleaner energy and prosperity for the coming decades.

Finally, it is necessary that the nuclear sector has the constant commitment and support of the government and all non-departmental public bodies (NDPB). It is essential that the relevant government policies are reviewed to improve processes and increase business opportunities and that the role of the nuclear sector and the increasingly important need to invest in innovation are recognised in the government plans to address the economic recovery and growth of the UK.

Tom Greatrex
Chief Executive
Nuclear Industry Association (NIA)
Introduction

The Nuclear Sector Deal (NSD) was published in June 2018, establishing a joint commitment by the nuclear industry and the government to maximise the industrial benefits of the UK nuclear sector, while providing proven affordable, and reliable, low-carbon energy. The nuclear sector currently provides around 20% of the UK’s electricity\(^3\) and provides tens of thousands of highly skilled jobs.

The NSD includes commitments to achieve cost reduction in waste management and decommissioning and construction of nuclear new builds, win up to £2 billion in national and international contracts, increase diversity and promote innovation. Achieving these goals will ensure that nuclear generated energy remains highly competitive, and continues to play a key role in the regeneration of the regions and the economic growth of the country.

Given the current global socio-economic environment and the UK’s commitment to achieving net zero greenhouse gas emissions by 2050, it is increasingly important to leverage the role of the nuclear industry in the economic recovery from COVID 19 and growth in the near and long-term future, including levelling up across north of the UK and export growth.

Over the last two-years, five Working Groups and an NSD Programme Management Office (PMO) were established with the objective of supporting the delivery and monitoring of the NSD goals and aligning the efforts that different organisations and individuals were undertaking. This structure enables effective delivery against the 82 commitments, including the four key targets, identified in the deal. A significant number of organisations and senior leaders from industry, government, academia, and others across the wider industry, have been working together to address the sector’s challenges and agree on the appropriate actions to ensure that the NSD’s targets and intent is met by 2030.

This publication explains the targets agreed in the NSD and the achievements to date. It also addresses the challenges and the actions that need to be unlocked to achieve the proposed goals, as well as the main focus of the work for the near future and the key socio-economic benefits that can be unlocked if industry and government work together effectively.

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1. Where are we today?

As mentioned in the report “Forty by 50: The Nuclear Roadmap”, today, nuclear energy powers 1 in 5 homes across the UK; its role is becoming increasingly important in addressing the current national challenges. Nuclear power can play a key role in the immediate and long-term economic recovery and in the UK’s ambition to provide clean, accessible, low-carbon energy for all. The impact and benefits of nuclear power have been shown to be robust, sustainable and profitable, generating long-term economic growth, competitiveness and prosperity.

To support this aim and unlock the opportunities that nuclear power can provide, the NSD was established, setting out clear priorities and commitments for industry and government to work together and ensure the achievement of the agreed targets by 2030.

Since October 2019, the NSD PMO has been working alongside a number of organisations and senior leaders to support and monitor the progress of this agreement. The PMO has worked closely with each of the five Working Groups to develop roadmaps through to the end of the programme in 2030.

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Increasing female participation to 40%

While gender diversity is one of the main themes of the NSD, one of the key products of achieving the related ‘40% Women in Nuclear’ (WiN) target lies in the diversity of thought that it can bring to the sector, which in turn would lead to innovation and increased productivity; the NSD themes are somewhat linked to each other and therefore a holistic approach has been adopted to deliver the programme.

The baseline figure for women in the nuclear sector was 22% at the time the NSD was published. However, this figure does not provide any insight into the inequalities that exist between different levels and occupations. Currently, the percentage of WiN is higher in administrative roles and much lower in roles related to engineering and commerce. This goal is therefore ambitious, and the impact of planned initiatives and interventions will take some time to translate into measurable results.

Since the 40% WiN target was published via the NSD, different organisations and individuals have been working collaboratively to identify the key components that contribute to effective data analysis and the expected results. This is still a work in progress. Efforts to meet the target must include initiatives that help retain women who currently work in the sector and support their development and professional growth, as well as attract more women, particularly in those areas where they are underrepresented. Greater effort and focus is being applied to drive growth in the nuclear workforce to increase overall job opportunities.

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Reducing the cost of nuclear new build by 30%

EFD and its partner CGN are currently building the UK’s first new nuclear power plant in a generation at Hinkley Point C (HPC) in Somerset. The two EPR reactors being built at the site will have a combined capacity of 3.2 GW and will provide 7% of the country’s electricity when they come online. The first reactor will be commissioned in 2025.

HPC alone is not enough to meet the UK’s net zero target – a total of 8 sites have been identified for new build across the UK and the industry stands ready to deliver. In doing so it must show how it can follow a similar cost-reduction trajectory to other low carbon technologies such as wind. To achieve this, the Working Group examined empirical evidence from nuclear plant construction around the world, and from the construction sector and major infrastructure projects.

The report sets out why it is much less risky and cheaper in the long run to address project risks through investment in establishing a stable base (of project purpose, stakeholder alignment, governance, design planning and R&D) before construction and manufacturing start, with subsequent copies providing further risk reductions. The report also recognises that the technology choice for a nuclear power plant can have an impact on overall cost.

### Reducing 20% of decommissioning and waste management cost

The target of reducing the cost of decommissioning by 20%, compared to current estimates, will be supported by initiatives to change decommissioning and waste management practices. A draft metric to measure the ‘cost of decommissioning’ indicates that there have been no change in the overall cost of decommissioning compared to 2018; this is expected as the actions agreed following the publication of the NSD have yet to be fully implemented. These include national waste treatment centres, non-annualised funding, more effective governance arrangements and interim passivation of waste.

As part of the efforts and initiatives to deliver this target, a Decommissioning and Waste Management Pipeline was published in June 2019 for the first time in the UK. The Nuclear Decommissioning Agency (NDA), EDF and the Ministry of Defence (MoD) supported the analysis and publication of this report, which integrates decommissioning programme data from across the whole nuclear sector, including both civil and defence.

### Winning up to £2bn on domestic and international contract

The target to create or sustain up to 12,500 jobs and up to £2bn domestic and international contract wins by 2030 demonstrates the commitment of the nuclear industry and government to creating and promoting high value jobs across the UK, providing more career opportunities and generating greater long-term regional prosperity. Upon reaching the £2bn target, the UK economy will benefit not only from Gross Value Added (GVA) from contracts won, but also from an improvement in local economies, generating a more balanced and equitable growth at the national level. To date, a UK capability assessment for exports has been completed, nine key export growth regions have been identified of which seven have campaign plans, and a comprehensive plan for a national supply chain programme has been developed and submitted to BEIS for approval to help UK companies win business domestically and internationally. Work has been undertaken to understand and define how Government and industry can potentially work together more efficiently and effectively, under the ‘whole of sector approach’ work.

The work done to date on identifying international opportunities has demonstrated the willingness and the appetite of the nuclear sector to increase working with its international partners, who recognise and value the UK’s experience in many relevant areas such as decommissioning. This work promotes greater competitiveness at the global level, encouraging the sector to develop competitive and attractive systems and solutions for other countries, thus stimulating the growth of exports and domestic regional areas.
Innovation to drive sustainability and economic growth

Innovation plays a fundamental, enabling role in achieving the objectives of the NSD. Together with the low-carbon energy target, innovation is a common theme across many of the commitments made through the NSD. Industry and government recognise that only by doing things differently will the nuclear sector make a significant contribution to net zero ambition and unlock its long-term potential to generate benefits at a national level.

Over the last two years, innovation in the civil-nuclear industry has increased as a result of a series of investment programmes. The outcomes of these initiatives provide a strong platform for the nuclear industry to contribute significantly to the net zero ambition and increase UK business competitiveness.

Underpinning and enabling commitments

A total of 82 commitments were agreed between government and industry through the NSD. Successful implementation of these commitments against their original intent will ultimately enable the headline targets and more to be realised. Two years into the 12-year programme, Working Groups and a PMO have been established to deliver the commitments. Significant progress has been made with the delivery of 27 commitments and 48 commitments being actively worked by government or industry, or jointly. These 48 commitments are at various stages of completion, from initial planning to near delivery. The graphic below shows the distribution of the commitments and delivery to date.
2. Working together to deliver the NSD objectives

Since the Nuclear Sector Deal was published in June 2018, several initiatives have been implemented to enable the effective and timely delivery of agreed targets and commitments identified from the NSD, including establishing five Working Groups and a PMO:

The members of these groups are volunteers from multiple organisations from across the nuclear Industry and Government, and success is dependent on continued collaboration and commitment to deliver the NSD targets and commitments to realise the benefits for the whole sector. During the last two years, collaboration between the various organisations, individuals and senior leaders involved in the delivery of the NSD has been essential to obtain the achievements highlighted in the previous sections of this publication. The core programme organisation structure is as follows:

Programme organisation structure
Last updated 12/08/20
Setting up for success

The NSD Programme Management Office was initiated in October 2019 with the appointment of as the PMO Director and with some of the core PMO roles filled in Spring 2020. Following mobilisation, the PMO started to drive momentum in delivery of the NSD commitments across the programme, with five primary objectives:

1. Deliver an integrated performance and risk dashboard with regular reviews
2. Identify and manage strategic dependencies
3. Communicate and manage key stakeholder groups
4. Support the delivery of the NSD Working Groups
5. Transparency and Traceability

To enable successful delivery of the NSD Programme and achieve these primary objectives, the PMO needed to mature its capability quickly to establish the basic systems of processes and controls, develop a framework to measure performance, and ensure the commitments are understood and align plans to deliver those commitments. To achieve this, the PMO developed a 12-month roadmap for maturing the NSD PMO which is shown on the following page.

The main purpose of the core PMO is to independently manage performance against the NSD targets and commitments and enable/facilitate decision making through reporting of progress to the Programme Board. Over the last 3 months, the PMO have progressed in setting up the core PMO processes such as governance, reporting, planning and performance management. Once these core processes have been established around a regular operating drumbeat, the PMO model will mature.

Communications & Stakeholder Engagement

To address the lack of communication on the NSD progress over the last two years, the PMO developed a NSD communication and stakeholder engagement strategy and the first phase of the plan is currently being implemented. This plan enables the PMO and working groups to effectively communicate and engage with key stakeholders, as well as timely update nuclear industry, government, and other associations on the priorities, progress, challenges, and achievements of the NSD targets and commitments. In addition, it allows the NSD to have a unified and coherent voice for the NSD, and to be part of the effort to communicate more frequently in a positive and modern image of the Nuclear sector. To date, significant stakeholders have been identified and engagement initiated to promote the significant impact delivery of the NSD will have in transforming the Nuclear Industry. This has been done through various communication channels including hosting a webinar and establishment of a website to promote the ambition of the programme.
<table>
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<tr>
<th>PMO Type</th>
<th>Outcome</th>
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| Policeman | • PMO team fully resourced, light touch processes in place and operating rhythm established, creating consistency in delivery across the programme.  
• Significant NSD stakeholder identified and engagement initiated to promote the significance of impact the NSD will have in transforming the nuclear industry.  
• Initial visibility of performance against baseline, demonstrating progress made and enabling timely and informed decision making.  
• 2030 roadmaps aligned to performance indicators ensuring delivery of the NSD commitments and enabling incremental progress to be delivered through well constructed plans, highlighting resource requirements to achieve milestones.  
• PMF finalised and will endure the lifecycle of the programme ensuring consistency of measurement against baseline throughout, creating better data and insights.  
• Overall programme plan creating better visibility of planned activity aligned to the strategy.  
• Key stakeholders from the industry informed and engaged in NSD progress.  
• In its independent role, the NSD PMO is providing challenge and assurance to programme delivery.  
• Key stakeholders from other industries engaged and insights shared.  
• Forward plan for programme delivery aligned to the 2030 roadmap and aligned to strategy. |
| Strategist | • Explore establishing a cross-sector steering group to engage other sectors & identify common themes.  
• Initial health checks on Working Groups to provide advice and guidance on delivery.  
• Confirm PMF delivery approach.  
• Review relevance of commitments & determine if change request is needed.  
• Refine and finalise PMF (incl. Performance Indicators, data source, dashboard and reporting rhythm).  
• Use visibility and insight of progress to assure and challenge working groups.  
• Maintain delivery of existing Working Group plans.  
• Support Working Groups in reviewing progress against performance indicators.  
• Facilitate development of Working Group 2030 roadmaps (incorporating Performance Indicators). |
| Integrator | • Implement C&SE Strategy Phase 1: Create and share NSD image on comms channels, FAQs, Strengthen relationship with stakeholders.  
• Review effectiveness of C&SE strategy.  
• Implement C&SE Strategy Phase 2: Document lessons learned, update stakeholders map, include stakeholder comms channels, refresh plan and timeline based on feedback and new requirements.  
• Populate PMF with Working Groups (incl. Identify Performance Indicators and baseline data) and draft dashboard, seeking feedback from senior leadership.  
• Review roles & responsibilities within the core PMO.  
• Support industry in implementation. |

**Nuclear Sector Deal Roadmap**
3. Promoting diversity to reach 40% of women in the nuclear industry

Both industry and government recognise that it is the workforce who will competitively build, operate, service and decommission the UK’s nuclear power plants and Nuclear Defence Enterprise (NDE) assets. Additionally, the skills and expertise will form the intellectual property that can be marketed overseas. Whilst working toward achieving the 40% WiN target, efforts are being made to ensure increases in job opportunities at the same time as promoting higher diversity within the sector. Whilst gender diversity is the headline target, the emphasis is on diversity of thought, which in turn will lead to innovation and increased productivity in the sector. To achieve diversity of thought we firstly need to engage with, and recruit, people from different backgrounds, people that reflect the societies in which we operate. But to achieve diversity of thought, it is important to recognise and value the differences that people bring with them, and encourage people to bring their true selves to work.

The baseline figure for WiN at the publication of the Nuclear Sector Deal\(^5\) was 22%. However, this figure hides Inequalities that exist between levels, and between different job occupations. Currently the percentage is higher in administrative roles, and much lower in engineering and trade related roles. In December 2019 the Future Workforce Working Group set out a roadmap toward achieving the target (see below), detailing the expected progress against time. In addition, a target for balanced gender representation at different levels and in different workplace areas have been set. The target is intentionally ambitious and the impact of the initiatives and interventions that are planned will take some time to translate into meeting the target.

The gender target is just one of a number of skills-related commitments made in the NSD. Other commitments focus on ensuring a resourced pipeline of talent to deliver a prosperous nuclear industry in support of a low-carbon future. As The skills-related NSD commitments are effectively enablers, they contribute to the other primary targets, including supporting cost reduction, and enabling competition on a global stage.

The NSD programme recognises that many aspects of the nuclear future workforce are shared with the future workforce of other sectors, and therefore understand the opportunity to collaborate across the other Sector Deals.

In the first two years since the NSD was published, key achievements have contributed towards the NSD’s goals and targets:

To promote diversity and collaboration

- A Gender Roadmap was launched in partnership with the non-profit organisation 'Women in Nuclear (WiN)', having been endorsed by senior industry and government leaders
- The Nuclear Skills Summit 2020 and Skills Awards was successfully held in March
- Working closely and strengthening collaboration with key stakeholders including: Construction Industry Training Board, Engineering Construction Industry Training Board (ECITB), Institute for Apprenticeships and Technical Education, National College for Nuclear, National Skills Academy Nuclear, Women in Nuclear, Nuclear Industry Association

To increase job opportunities

1. The Labour Market Information (LMI) for 2019 Nuclear Workforce Assessment and apprenticeship survey has been published.
2. Launch of the North West Nuclear Community Apprenticeship.
3. A new bespoke ECITB Accelerated Experience and Learning Programme has seen 23 individuals on a transfer programme from EDF’s Coal-fired Power Station at Cottam to Nuclear pre-operations roles for HPC.
4. 21 Apprentices from Horizon were also transferred to EDF to continue with their training, now working towards an EDF Degree Apprenticeship or a Level 3 Engineering and Maintenance Apprenticeship.
5. Bursary scheme designed and implemented to support individuals for education and training.

Since publication of the 40% WiN target, work has been undertaken to understand the contributing factors. The ability to change the headline figure depends on:

- **Retention** – retaining women in the industry, consequently supporting their career development and helping them to progress to the most senior roles.
- **Attraction** – attracting more women into the sector, and particularly into those areas where females are underrepresented.
- **Growth** – growing the overall size of the workforce to better enable more women to enter the industry.

A key challenge is that since publishing the NSD, new build programmes have been postponed thereby stunting the opportunities for growth. Organisations have committed to working towards gender balanced recruitment across all levels and disciplines. However, limited recruitment results in limited opportunity to impact on the makeup of the workforce.

Evidence from Canada, presented at UK-Canada Civil Nuclear Dialogue in March 2020, shows that where organisations have the opportunity to grow a workforce from nothing, then the gender balance is significantly improved.

The UK has a legacy demographic issue with its nuclear workforce that will need to be addressed with activities and initiatives set out in the NSD. An additional challenge when looking at routes to employment, either through apprentices and graduates, or through career transfers, is that gender balance in these potential resource pools is poor, so fundamental education system changes need to be implemented alongside practices within our sector.

The Future Workforce Working Group is delivering against commitments made in the NSD to ensure the creation of well-paid and high-quality employment in the regions, bringing economic benefit to parts of the country that are often most socio-economically disadvantaged. The whole industry will benefit greatly through achieving the 40% WiN target by 2030. The Gender Roadmap sets out the route to achieving this.
CASE STUDY: Nuclear Sector Gender Roadmap

The development of the Nuclear Sector Gender Roadmap and commitment was a collaborative exercise. In the first instance the NSSG established a Gender Subgroup within its wider Diversity Working Group, with WiN UK chairing this group.

The Group set out the key commitments required from industry to meet this ambition. This will see the sector recognising the need to recruit at least 50% women now to meet replacement demand (across apprenticeships, graduates, and experienced hires). This important subgroup consists of a core group of employers, including representatives from the Nuclear Decommissioning Authority (NDA), NNL, EDF, The Department of Business, Energy and Industrial Strategy (BEIS), Cavendish Nuclear, Babcock, Prospect Trade Union and Ministry of Defence (MoD). The subgroup therefore represents both the civil and defence sectors; it is chaired Stacey Hatch, Magnox Ltd, and WiN UK board member responsible for aligning WiN UK and NSSG gender focussed activities.

“The successes set out in this publication demonstrate the progress made through the effective collaboration between the different organisations involved, and the ongoing commitment to our future workforce even during these challenging times. Work has progressed well in all 5 areas of the People theme of the sector deal. One example, undertaken in partnership with Women in Nuclear, is publishing the roadmap to achieve 40% Women in Nuclear by 2030, and gaining public commitments made by all major organisations to this goal.

But there is more to do, and as Chair of the Nuclear Skills Strategy Group responsible for delivering the future workforce elements of the sectors deal, I commit to us making further progress in the next phase of the Nuclear Sector Deal, and creating even more ambitious targets for the sector going forward.”

Corhyn Parr
Future Workforce Working Group Lead
4. Reducing the cost of new build to promote economic regeneration and secure low-carbon energy in the coming decades

The first new nuclear power station in the UK in a generation is currently being built at Hinkley Point C (HPC) in Somerset. The two EPR reactors being built on the site will have a combined capacity of 3.2GW and will provide 7% of the country's electricity. The first reactor is due to be commissioned in 2025.

In order to achieve the UK's Net Zero target, the industry stands ready to deliver further new nuclear stations which will provide firm, reliable, low carbon power. For the industry's ambitions to be achieved, it must demonstrate that nuclear is able to follow a similar cost-reduction path as other low-carbon technologies such as offshore wind. To address this, the NSD makes a 30% cost reduction commitment; the strike price of Hinkley Point C (HPC) has been taken as the baseline. By examining a breakdown of the cost to the consumer of HPC it is possible to target some key areas for cost reduction irrespective of the technology deployed, while noting that technology can play a role in cost reduction.

To identify how this target will be achieved by 2030, the New Built Cost Reduction (NBCR) Working Group conducted a comprehensive analysis, evaluating the components of the Hinkley Point C strike price to target cost and risk reduction areas, and examining international evidence of new nuclear construction and major infrastructure delivery. This study resulted in identification of 14 key “risk reduction enablers” for new nuclear projects. For each one of them, work is being undertaken to establish the specific tests that would enable a robust risk scoring of the project, and a target state will be identified with associated deliverables, which represents the best possible state in which the project could be in order to minimise risk.

1. **Financing** — Is the financing model secure, are stakeholders and Her Majesty’s Government committed and aligned to the model?
2. **Regulation** — Are Regulation and permitting requirements understood?
3. **Governance** — Is the governance defined and fit-for purpose: roles of Owner and delivery team defined and distinct, with a strong multidisciplinary owner’s team?
4. **Site Data** — Are the site-specific data understood and taken into account?
5. **Technology Data** — Are the data on processes and components accurate enough, and innovations under control?
6. **Design** — Is the design mature?
7. **Estimates** — Are Costs and schedule estimates realistic, integrating robust risk assessment?
8. **Contractual Interfaces** — Are interfaces identified, understood and managed at each level of the project?
9. **Project Management** — Is the management of the project strong enough: Robust organisation and processes, effective and experienced project team?
10. **Data System** — Is the data structure access and related systems strategy consistent with the Project context?

11. **Construction Preparation** — Is the construction execution plan fit for purpose? Are Nuclear Safety and Construction special requirements taken into account, including management of quality and defects?

12. **Supply Chain** — Are the Procurement and contracting Strategies defined and fit-for purpose; Are suppliers incentivised to deliver the best for the project?

13. **Skills** — Are the critical skills identified and managed - with particular attention to safety and quality culture?

14. **Operations Preparation** — Is the transition to operations planned, with operation staff embedded in the project early?

The impact of risk reduction on the cost of capital, coupled with actions to reduce the cost of construction, will ensure that the 30% cost reduction target can be achieved. The analysis, findings and recommendations have been included in the Cost Reduction report, which draws on empirical evidence from nuclear build around the world, and from major infrastructure projects and the construction industry.

This report also recognises that a series of initiatives have been implemented successfully in the last decade with the intention of improving construction practice, which include the flagship London 2012 Olympics. These have increased the UK expertise in delivering complex major infrastructure projects. A key theme in the report is the learning curve benefit from replication which both reduces construction cost and risk. The report also recognises that the technology choice for a nuclear power plant project or programme can have an impact on overall cost. Opportunities for cost reduction can be achieved from inherent plant design and construction methodology. Going forward, the NBCR Working Group will focus on the following key areas to develop a more detailed 2030 roadmap:

- Develop the risk assessment tool based on the 14 categories identified in the cost reduction report.
- Undertake further work to assess the impact of additional cost reduction strategies e.g. modularisation.
- Review working group scope to embrace broader nuclear sector areas i.e. small and advanced reactor technology and nuclear manufacturing and processing.
- Identify, understand and focus on key areas where innovation can support further delivery of the cost and risk reduction.

**CASE STUDY: Knowledge transfer between replica reactors**

There is already strong evidence of learning through doing at Hinkley Point C. The lessons learned and innovations applied during the ongoing construction of HPC’s first reactor unit are already benefitting the second. On average it has taken 25 hours to install a tonne of rebar on Unit One. At Unit Two, the average is now 16 hours - an improvement factor of 1.6. Learning from reactor one enabled the pre-stressing gallery on unit two to be completed seven weeks ahead of the initial schedule.

“I am very pleased to say that the nuclear new build cost reduction workstream has made great progress, and our report clearly shows it’s possible to deliver a cost-effective programme of new nuclear power stations in the UK. But promises of cost reduction is not enough - in making this case, the developers of new nuclear plants are showing that we recognise the delivery risks we face, and how to manage them.”

Humphrey Cadoux-Hudson CBE
New Build Cost Reduction Working Group Lead
5. Working collaboratively to achieve cost-effective decommissioning

The cost of waste management and decommissioning the UK’s total nuclear nuclear liability was estimated at approximately £150bn7 in the original Nuclear Sector Deal document, over the next 100 years, split largely between the NDA, EDF and MoD estates. Both Government and Industry recognise the opportunity to make large savings for the taxpayer through improved and more cost-effective decommissioning and waste management. Such changes can only be delivered through collaboration between Government and the whole nuclear sector.

Driving down decommissioning costs by further developing the UK’s waste management and decommissioning expertise is more critical than ever, to ensure taxpayer value and allow economic recovery. Additionally, by further bolstering the sector’s decommissioning capability and technology, economic recovery can be further supported by winning contracts in international markets.

The 20% cost reduction target set out in the NSD will be supported by completion of a number of commitments, as well as initiatives for change in decommissioning and waste management practices. The Legacy Cost Reduction (LCR) Working Group was established following the publication of the original NSD publication in June 2018, with the objective of driving and facilitating progress on the NSD commitments in the Waste Management and Decommissioning (WM&D) arena.

The ultimate objective for the LCR Working Group is to facilitate and support the nuclear sector in achieving the goal of a 20% reduction in the cost of decommissioning by 2030, compared against current estimates. To achieve this objective, there needs to be large scale change in how the UK delivers its decommissioning programmes, technically and commercially, and how it manages and consigns radioactive waste.

While good progress has been made in the Legacy Cost Reduction area, the challenge remains over the next 10 years to meet the 20% cost reduction target and ensure taxpayer value in managing our nuclear legacy. Achieving alignment and collaboration between Industry and Government across the nuclear sector is not a trivial task, but a critical enabler to drive progress going forward in the right way.

Commitments were made in the NSD which ultimately support the 20% cost reduction target. These can largely be grouped into three areas of, initiatives to directly support cost reduction, update of relevant regulation, and development of a National Decommissioning and Waste Management Pipeline:

1. A 20% reduction in the cost of decommissioning by 2030, compared with current estimates - in progress.

A key commitment as part of the Nuclear Sector Deal and for the Legacy Cost Reduction Group. The 20% target will be supported by completion of other commitments, as well as initiatives for change in decommissioning and waste management practices that are produced and facilitated by the working group. A draft metric for measuring the ‘cost of decommissioning’ indicates there has been no change in the cost of decommissioning when compared to 2018, which is to be expected as NSD initiatives have not yet been implemented, but means driving progress over the next 10 years.

Current initiatives in progress include national waste treatment centres, non-annualised funding, more effective governance arrangements and interim passivation of waste. Additionally, the working group aims to collaborate closely with BEIS on upcoming changes to Decommissioning and Waste Management Policy to facilitate cost reduction.

2. A public consultation on proposals for a more up to date approach to regulation of nuclear sites in the final stages of decommissioning.

A BEIS led public consultation on the framework of regulation for nuclear sites in final stages of decommissioning and clean up, concluded in October 2018, four months after publication of the Nuclear Sector Deal. BEIS intend actualise the recommendations of this consultation by legislating changes to amend the Nuclear Installation Act 1965 when parliamentary time allows.

3. A joint comprehensive six-month review of decommissioning and waste management to develop a National Decommissioning and Waste Management Pipeline.

The National Decommissioning Pipeline\(^8\) (NDP) was published in June 2019 in collaboration with the NDA, EDF and the MoD and integrated decommissioning programme data from across the whole nuclear sector for the first time.

Alongside the document, the data was published in a GIS (Geographic Information System) tool to enable temporal and geographical analysis. Further analysis to determine cost reduction or innovation opportunities is in progress.

Additional initiatives in progress include national waste treatment centres, non-annualised funding, more effective governance arrangements and interim passivation of waste. The aim is for industry to collaborate closely with BEIS on upcoming changes to Decommissioning and Waste Management Policy to facilitate cost reduction. The LCR Working Group has developed a roadmap for future activities through to 2030, which covers four key workstreams to achieve the target.

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## Legacy Cost Reduction Roadmap

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<td>Proportionate Safety Case LFE Sharing</td>
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<td>Support industry in implementation</td>
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<td>Facilitate innovation for ‘Grand Challenges’</td>
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<td>Identify and facilitate innovation in target areas to support business cases and/or implementation</td>
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**CASE STUDY: Proportionate Safety Cases for Decommissioning - ONR-led NSD Seminar**

During meetings of the Legacy Cost Reduction group, it was agreed that decommissioning organisations often struggled with a proportionate and fit for purpose interpretation of the regulatory requirements during decommissioning, often leading to overly costly and involved measures to demonstrate compliance. In particular, the development of safety cases appeared to be an area where improvement could be made.

To tackle this issue, the LCR group agreed the approach of an ONR-led seminar to share best practise across industry and find ‘pain points’ that made developing proportionate safety cases difficult. The seminar was comprised of presentations sharing best practise, round table sessions to identify and tackle ‘pain points’, and a networking session. Sixty-five delegates attended from twenty organisations across the nuclear decommissioning industry.

Six key pain points were identified from the seminar, which were: application of Regulatory Good Practise, licensee’s governance arrangements, over-engineered solutions, regulatory proportionality, short-term funding and knowledge sharing, which were further discussed in on-going collaboration between Sellafield Ltd and the ONR.

“It has been a pleasure leading the Legacy Cost Reduction group and we’ve made good progress starting to tackle the 20% cost reduction target over the last 2 years, from publishing the National Decommissioning Pipeline to initiatives in regulation, waste management, innovation and commercial models. As a team we remain committed (and will be looking for further support from our colleagues in industry and government) to develop and implement ideas to drive down cost; it is my belief that this provides real opportunities to create a more collaborative and connected decommissioning sector.”

Simon Bowen
Legacy Cost Reduction Working Group Lead
6. Maximising the benefit of industry to the economy and providing high-value jobs across the UK

One of the objectives of the NSD is to maximise the contribution of the civil and defence nuclear industries to the economy and thus provide high-value jobs across the UK. This led to one of the key targets of the NSD being to provide £2bn worth of domestic and international contract wins by 2030.

This objective is important for the sector as achieving the £2bn milestone demonstrates that the nuclear industry continues its long history of providing high-value jobs across the UK and continuing to provide long term career prospects and regional prosperity. By meeting the target to create or sustain up to 12,500 jobs and up to £2bn domestic and international contract wins by 2030, the UK economy will benefit not only by the GVA of the contract wins, but also at a local economy level as these jobs will be generated across the country and helping to “level-up” those local economies.

The international element of the £2bn objective highlights the need for the nuclear industry to continue working together and with our international partners who value our expertise in a number of areas such as decommissioning. It also provokes the sector to develop systems and solutions that are attractive globally in order to stimulate export growth. Furthermore, the sector can really demonstrate its impact to enable international partners to achieve their net-zero targets.

In support of the Winning UK Business NSD theme, four workstreams have been established:

- Understanding the current UK Capability to support international/domestic opportunities
- Developing a UK Supply Chain Programme to improve UK Capability
- Supporting international export campaigns
- Ensuring a whole of sector approach is being taken and the industry/government is working as efficiently as possible

A number of key achievements have been made over the first 2-years of the programme, including:

1. Delivery of a comprehensive proposal to BEIS to launch a national supply chain programme which will lead to more jobs in the future. The proposal was submitted formally early 2020 and the team await the BEIS decision.

2. An industry wide UK capability survey was completed in support of driving the right focus on export campaigns.

3. Completed a review of the international Nuclear market, identifying nine regions of focus that can offer the biggest potential export growth opportunities. This has resulted in the development of a simple ‘plan on a page’ for seven nuclear export campaigns.
4. In order to improve the way Government and Industry work closer together, a ‘whole of sector approach’ paper has been developed and is in the process of being reviewed by industry and senior government officials, including the Parliamentary Private Secretary to the Prime Minister, to establish a potential way forward.

The process to measure progress against the 12,500 jobs and £2bn domestic and international contract wins target is going to be established going forward. The challenge is around understanding what data is available. This will require collaboration between the working group members including government to agree on the data sources and frequency of reporting. There is a strong view that the target is too low, and work is continuing to review this in line with potential opportunities in the domestic and international market.

A high-level roadmap has been developed for this Winning UK Business Working Group (see below). A more detailed roadmap for Winning UK Business is still under construction; the journey ahead appears exciting and challenging. Further detail is required in the future years and this will be populated over the coming months. The challenges ahead are to be embraced and we look forward to supporting all the Nuclear Sector Deal working groups and better understanding how we can collectively innovate to succeed. The support from industry has been tremendous in what can only be described as a uniquely challenging time in history.

**CASE STUDY: Supply Chain Proposal**

As part of the Nuclear Sector Deal, a supply chain proposal has been developed and submitted to government for review. The proposal covers development of a supply chain programme to improve the capability of a number of companies across the UK nuclear supply chain leading to future contract wins/jobs for participating companies.

The proposal has been developed collaboratively with input from a number of companies (such as NAMRC and EDF Energy) and supported by Local Government organisations such as the South West Local Enterprise Partnerships.

“It has been an exciting challenge for me to lead the Winning UK Business group. We have brought together a number of industry and government groups to work together to achieve our aim of winning £2bn of domestic/international contracts which in turn provides high-value jobs across the UK.

We’ve made good progress towards our target over the last 2 years, from gathering data on the UK capability to support international opportunities, to submitting a supply chain proposal to seek funding for a programme which will be match-funded by industry and will invest in the UK Supply Chain to improve capability and help secure future contracts. We have also worked closely with the Department of International Trade (DIT) on implementing campaign plans for agreed target countries. As a team we remain committed to working collaboratively with industry and government to ensure the UK nuclear industry can continue to provide jobs and prosperity across the UK.”

Andy Storer
Winning UK Business Working Group Lead
Winning UK Business Roadmap

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<td><strong>Export Campaigns</strong></td>
<td>Identify and develop plans for key export regions</td>
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7. Putting innovation at the heart of the nuclear sector to increase competitiveness and ensure a clean energy future

Innovation is a key enabler for the other NSD Working Groups, in support of delivering the commitments and targets. The nuclear sector has seen a marked progression in innovation over the past two years with investment and, more importantly, results being delivered. This success has provided a platform for the civil nuclear Industry to significantly contribute to a clean energy future, be commercially competitive in a decarbonised economy and influence the International Civil Nuclear Agenda.

Over the past two years the following innovation-related achievements have been delivered through the NSD:

- **Advanced Modular Reactors Competition** – £40M made available to support the development of Advanced Modular Reactors (AMR). In July 2020 the winning projects were announced including UBattery, Westinghouse’s LFR and the Spherical Tokomak from Tokomak Energy.¹⁰

- **A Framework for Advanced Nuclear Technologies** - Government launched a Framework for Advanced Nuclear Technologies.¹⁰ This was achieved at the 2019 Clean Energy Ministerial in Vancouver; an event the UK was proud to support and which brought civil nuclear under the umbrella of clean energy for the first time. The UK’s policy framework draws together work associated with regulation, siting, public perception, finance and technology feasibility and demonstration.

- **A return to the International Stage** - The UK Civil Nuclear Sector has returned to active participation on the International stage; a move which brings renewed credibility to the UK’s status as a civil nuclear nation. Focussed around the return to active participation in the Gen IV International Forum, including the appointment of specialists and academics from across the UK, our engagement goes wider and includes support for international initiatives such as the NICE Futures Initiative in support of the Clean Energy Ministerial; working closely with colleagues in the US, Canada and Japan.

- **Advanced Manufacturing and Materials** - Government awarded £20M towards research and development in the field of advanced materials and manufacturing. This has been delivered through the AMM competition and match funded with money from the UK Civil Nuclear Industry. Across three phases the Advanced Manufacturing and Materials tranche of the Nuclear Innovation Programme has inspired technology transfer and innovation in civil nuclear including work on EV welding, modular design and Integration and manufacturing codes and standards to enable new nuclear build.

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• **Innovation in Regulation** - Over the past two years, ONR has further embed its enabling approach and developed its position on innovation. A drive to minimise the regulatory uncertainty and burden have underpinned the ONR’s forthcoming publication; it’s ‘Approach to Regulating Innovation’. The intent is to establish an environment which encourages Innovation and its efficient delivery for the benefit of the sector.

• **Funding future Civil Nuclear Projects** - Government conducted a review of the civil nuclear sector finance and the delivery of infrastructure through private finance. This has been delivered through the Expert Finance Working Group report\(^\text{11}\) which the government responded to with the consultation on the Regulated Asset Base model (RAB).

• **National Fusion Technology Platform** - In 2018 Government announced a commitment to £86M funding for a new National Fusion Technology Platform.\(^\text{12}\) Work has started on this ambitious project, which will underpin both the H3AT and the Fusion Technology Facility focusing on Fusion thermal-hydraulics.

• **Advanced Fuel Cycle Programme (AFCP)** - The AFCP is a core component of the UKs £180M Nuclear Innovation Programme led by the National Nuclear Laboratory. The objective of AFCP is to develop the advanced fuel cycle solutions of the future. Under the four major focus areas, Capability, Capacity, Cost reduction and Collaboration, the programme has already delivered major successes:
  — Working in more than 15 significant UK facilities, including the Nuclear Fuel Centre of Excellence and the Sir Henry Royce Institute.
  — Over 80,000 hours of work on advanced fuel cycle, around 50 FTEs, across more than 250 individuals since April 2019.
  — Working with 65 organisations on the programme (70% Academic, 16% SMEs); across academia (14 UK Universities), industry, national laboratories and government.
  — Nationally and internationally engaging with more than 100 organisations.
  — More than £130 million leverage across national and international programmes.

• **Learning the lessons of repeatability** - Reactor 2 at HPC Is being delivered ahead of schedule and benefited from significant productivity gains. The lessons from reactor 1 being learnt and put into practice. This confirms that nuclear need not be expensive so long as, amongst others, fleet approaches are taken.\(^\text{13}\) Completion of the second 49,000tonne reactor base was the longest continuous concrete pour in UK history and was only possible due to the Innovations employed by the project to enable continued operations during the Covid-19 outbreak.

• **A response to COVID-19** - It needs to be recognised that the UK Nuclear Sector has suffered along with the remainder of the UK economy during the COVID-19 crisis with jobs furloughed or lost. Yet, it should also be recognised that:
  — Throughout the crisis the civil nuclear generating assets have continued to deliver low carbon energy via the commitments and measures put in place by EDF and their supply chain.
  — The wider supply chain has received regular support and guidance from, for example, the Nuclear Advanced Manufacturing Research Centre the catapults and other support forums.


The civil nuclear has adopted to the ‘new normal’ while still successfully delivering the major projects and milestones needed to build delivery confidence.

The UK Civil Nuclear Industry has a role to play in accelerating our post COVID-19 economy and has been actively supporting Government in this endeavour.

The Innovation and R&D working group was predominately focused on technology-oriented innovation. With the delivery of most of the working group commitments, the working group has now entered phase two of its focus. Phase two of the Innovation and R&D working group will look at a broader range of innovations, including and beyond technology, e.g. Commerce, Process, and Cultural. The below table provides an initial indication of themes which phase two of the Working Group will use to identify industry-wide innovations.

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<thead>
<tr>
<th>Innovation in COMMERCE</th>
<th>Innovation in TECHNOLOGY</th>
<th>PROCESS Innovation</th>
<th>CULTURAL Innovation</th>
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<tbody>
<tr>
<td>Transform decision making on nuclear to focus on economic targets and energy market need.</td>
<td>Driving technology innovation to ensure nuclear plays a significant role in NetZero</td>
<td>Enabling solution led innovation through novel delivery methods across the sector</td>
<td>Embedding an innovation mindset to drive successful programmes</td>
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<th>OBJECTIVES</th>
<th>COMMERCE</th>
<th>TECHNOLOGY</th>
<th>PROCESS</th>
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<tr>
<td>Underpin and articulate the current and future energy markets into which nuclear energy can be sold (e.g. hydrogen, heat, electricity).</td>
<td>Propose, demonstrate and bring to market innovative, commercially viable and investible technologies to meet UK energy needs.</td>
<td>Establish a process for effective capture and transfer of tried and tested innovations from other sectors and infrastructure projects and coordination with other Sector Deals.</td>
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<td>New or refreshed value metric for energy from nuclear used across the energy sector.</td>
<td>One or more demonstrators operating in the UK.</td>
<td>UK guidance framework for enhancing innovation through adoption of best practice.</td>
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<th>MEASURES</th>
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This approach will allow the expansion of the potential innovation solutions available and greater cross sector learning and sharing. The group is now focused on capturing the needs and requirements from the other working groups to priorities and develop a detail roadmap to deliver the biggest benefits and outcomes.
CASE STUDY: Environmentally-friendly machining for the supply chain

Derbyshire-based SME Nuclear Energy Components (NEC) is now working with the Nuclear AMRC to develop environmentally friendly machining techniques which will reduce the cost, lead time and risk of high-value nuclear components.

The year-long Process Improvement Through CO2 Cooling (PITCO2C) project is funded by the latest round of Nuclear Innovation Programme. It builds on the earlier Inform project, which demonstrated that a mix of supercritical carbon dioxide coolant with a minuscule amount of oil lubricant can significantly improve machining performance and increase tool life while meeting all quality requirements. Minimising oil-based coolant also improves component cleanliness, an important consideration for safety-critical nuclear components, while reducing health risks to machine operators and environmental risks from used oil.

The new project will develop the technology to take it closer to production and demonstrate its benefits for the production of fuel assembly components. NEC will also work with the Nuclear AMRC to develop a rotary gas connector for retrofitting a CO2 coolant unit to legacy machine tools, removing barriers to adoption for the supply chain, and model the financial benefits of adopting supercritical CO2 in place of traditional coolants. By optimising the cutting parameters for tool life and productivity, machining costs could be cut by half.

“Innovation is being undertaken throughout the Nuclear Sector Deal and it is exciting to see the outputs of this work, from the challenges of New Build to the commercial innovations being trialled in decommissioning. The Innovation Group is now well set to expand out scope to look at the strategic innovation challenges in Culture, Process, Commercial and Technology facing our sector. Our new team is built from multiple sector as well as multiple viewpoints in the civil nuclear sector, from the regulator, government, academia and the supply chain. Together we are well placed to address the challenges identified as we embark on the next phase of Nuclear Sector Deal delivery”

Fiona Rayment
Innovation and R&D Working Group Lead
Conclusion and next steps

Over the last two years both Industry and Government have made good progress in delivering and implementing governance, strategies and plans that will deliver the NSD targets and commitments.

The delivery of these targets and commitments will give rise to significant contribution to the green energy requirements, recovery from COVID 19 and social-economic benefits.

The working groups have worked well to establish themselves and their teams and have already delivered a number of commitments. The establishment of the NSD Programme Management Office, 10 months ago, has also made good progress with the implementation of a sustainable governance structure and communications, back-office systems, and procedures that will allow ongoing review, monitoring and independent challenge to 2030.

However, there is still more to be done. Progress metrics for top-level commitments (targets) are in detailed development and will begin to be used to formally communicate progress towards the end of the year on an annual basis. In order to continue to deliver the targets and commitments the working groups and the PMO face some challenges that require both government, including non-departmental public bodies (NDPB), and industry to work in a more-integrated, open and transparent way to fully unlock the potential of the NSD. This change in behaviours will be a key driver for the PMO going forward to ensure the working groups are coordinated and integrated in an appropriate way to provide support and open constructive challenge to industry and government. Another key area of challenge going forward will be the obtain the voluntary resource required to deliver the actions, tasks and plans that have been identified.

A number of different organisations and individuals have significantly contributed to the NSD programme to date. This support is greatly appreciated, and vital to the future success of the programme. I look forward to working with you all to continue to deliver on the NSD going forward.

Over the next 12 months, we aim to have a clear policy direction on the future of nuclear, allowing both Government and industry to deliver the Nuclear Sector Deal more effectively, and realise the social-economic benefits and contribution to the green energy requirements.

Jay Bhart
PMO Director
Nuclear Sector Deal
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