ENABLER OF ENERGY & DIGITAL REVOLUTIONS

Westminster Energy Forum
Nuclear Review Webinar
10 February 2021
UK ASSESSMENT OF BUSINESS MODELS AND REQUIREMENTS TO ENABLE DEVELOPMENT AND DEPLOYMENT OF STRATEGIC NUCLEAR TECHNOLOGY


2. Supply Chain Companies Supporting the Deployment of International New Nuclear Technology in the UK.

3. Resourcing Strategic Nuclear Technology Deployment in the UK.
Advanced nuclear technology designs are based on factory-assembled modules that are delivered to site, installed and commissioned.

→ Necessary to realise economies of volume
→ But this represents a fundamental shift in behaviours needed from all parts of the supply chain

• Additional assembly, transport and installation loads must be considered by designers and justified in safety cases.
• Integration of equipment, components and skilled trades (welders) in a module manufacturing facility is well understood in automotive, aerospace, but not in energy.
• The re-definition of the construction site to installation site opens options to really innovate around how construction is delivered.

Business models that draw on cross-sector expertise need to be developed that enable the assured delivery of Advanced Modular Nuclear
International supply chains are assessed to be fully competent and capable to support the delivery of their domestic programmes

→ The differences in UK licencee/regulatory requirements are not always understood
→ Equipment shipped that doesn’t meet quality requirements/paperwork incomplete.

• International ISO 9001 accreditations cover factories that produce equipment, not the production process (the “how”) or those manufacturing/assembling the equipment (the “who”).
• Specifications do not fully detail the EQ and QC requirements.
• Suppliers follow a replication approach and may fail to meet UK EQ/QC requirements
• Qualification and testing records are missing / quality records gaps cannot be filled

A proactive UK – supplying country approach is needed to bridge the gap in UK licencee/regulatory understanding from contract specification through to equipment setting to work.
There is a need to develop capability and capacity in the supply chain to deliver both large scale nuclear and advanced modular nuclear at-scale. This capability/capacity development needs to start now if deployment timescales are to be achieved. The resource “pinch” could be exacerbated by other countries’ new build programmes starting.

- Assystem Nuclear Institute – UK roll-out starting in 2021
- #IncredibleWomen
- HPC Gender Project

**Developing the resources the UK will need to realise its net zero commitments**
ASSYSTEM SUMMARY

For 50 years, Assystem has supported governments, owners, contractors and OEM to develop, deliver and operate critical and complex infrastructures mainly in Nuclear, Healthcare, Life Sciences and Transportation.

Assystem believes sustainable growth requires an energy mix favouring carbon free electricity. Nuclear power is the main reliable mid-term solution.

**KEY ELEMENTS**

- **50 years of expertise**
- **5000+ experts (including civil/design/mechanical/EC&I/ HVAC/safety engineers, R&D and digital specialists)**
- **56% of our staff have more than 5 years’ service, 43% have more than 10 years’ nuclear experience**
- **Expertise in remote handling, stress engineering, non-contact surface metrology and industry 4.0 expertise (BIM, digital asset engineering, etc.)**

**€500m**

- revenue

**More than 5,700**

- employees

**2nd nuclear engineering company in the world**

*Figures as of 2019*
challenges and opportunities for fusion

gianluca.pisanello@firstlightfusion.com
First Light Fusion

- University of Oxford spin-out, fusion energy pioneer
- Ground breaking R&D in many areas including: pulsed power; simulation; and fusion plant engineering
- $25m of funding in 2020 from both specialised cleantech and global institutions

Advanced capabilities

- World-class plasma simulation tools that are regularly validated against boundary-pushing experiments
- Machine 3’s advanced engineering accelerates our projectile from zero to >15 km/s in less than 1 cm.

Projectile-driven inertial fusion

- Sidesteps major known challenges of fusion engineering
- Offers a simpler route to a commercial power plant
- Has the potential to generate energy at very competitive LCOE

Cooperation is key

- Currently collaborating with UKAEA, academia and power plant engineering consultants
- Unique opportunities for collaboration in balance of plant and fusion island development
Some known challenges of the fusion sector

- Financial support
- Regulatory regime
  - How should fusion be regulated?
  - Who should the regulatory body be?
- Supply chain limitations
  - Lithium
  - Tritium
- Technical challenges
  - Breeding enough tritium
  - Withstanding the neutron flux
  - Withstanding the heat flux
  - Secondary activated materials
  - …
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First Light Fusion Ltd leverages an existing technology pool-type liquid metal coolant as used in fast breeder reactors.
Residual and newly introduced challenges for FLF

• Financial

• Regulatory
  • (how) should fusion be regulated?
  • Who should the regulatory body be?

• Technical challenges
  • Secondary activated materials
  • Liquid Li engineering
  • Rep rated projectile launch
  • …
Perspectives on North American Nuclear

Presentation to Westminster Energy Forum

February 2021
Content

- About Bechtel
- Bechtel & Nuclear
- Nuclear Power in the USA
- Exporting and Collaborating on Nuclear
We have shown, through the Channel Tunnel Rail Link, when people were sceptical as to whether it ever could happen, that it can happen, and there are not, quite frankly, many Prime Ministers, or indeed many Ministers, that launch an infrastructure project, or accept its completion in front of the words; “On Time and On Budget”. We have done that with the Channel Tunnel Rail Link.

British Prime Minister Tony Blair, 2003
Opening of HS1 - Section 1
Bechtel is a trusted global engineering, construction and project management partner to industry and government. Differentiated by the quality of our people and our relentless drive to deliver the most successful outcomes, we align our capabilities to our customers’ objectives to create a lasting positive impact. Since 1898, we have helped customers deliver more than 25,000 extraordinary projects—many first-of-a-kind—in 160 countries on all 7 continents.
Bechtel’s four global business units are trusted engineering, construction, and project management partners to industry and government. We align our capabilities to our customers’ missions with safety, quality, ethics, and integrity.

- **Nuclear, Security & Environmental**
  - 80% of nuclear plants in the U.S., and 150 worldwide designed, serviced, or delivered by Bechtel
  - Construction and operation of national security facilities
  - Building the world’s largest and most complex radioactive waste treatment plant

- **Oil, Gas & Chemicals**
  - 1/3 of global LNG capacity currently under construction
  - 275+ refinery expansions and modernizations
  - 50,000 miles (80,500 km) of pipeline systems
  - 380+ major chemical and petrochemical projects

- **Mining & Metals**
  - 200 million metric tons per annum of installed iron ore productions
  - 42 major copper projects
  - 30 aluminum smelter projects
  - 8 alumina refinery projects

- **Infrastructure**
  - 300 subway and rail projects
  - 17,200+ miles (27,700 km) of highways and roads
  - 6,200+ miles (10,000 km) of railroads
  - 390 individual power plants
Seven Decades in the UK

We are proud to have been chosen to support some of the nation's iconic projects, including the Channel Tunnel, Crossrail, West Coast Main Line, High Speed 1 and St. Pancras International Station, the Jubilee Line, Heathrow, Gatwick, London City Airport expansions and Sellafield.

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Our Commitment

- **Develop innovative solutions** to deliver the best engineering and construction services in rail, aviation, power, and digital infrastructure
- **Grow our partnerships** with the UK supply chain – building on a track record of billions of pounds invested in UK businesses and people
- **Promote a truly global Britain** by supporting the UK’s engineering and construction capability, as well as exporting domestic talent and suppliers on our projects worldwide
- **Actively encourage and grow a diverse engineering community**
Bechtel, a Global Leader in Nuclear Power

80% of nuclear plants in the U.S. designed, serviced, or delivered by Bechtel

150 Worldwide

75,000+ Total Megawatts
We are excited to work with the Bechtel-led team. They will bring a lot of design and construction experience to the VTR project. This is essential since it has been several years since we have built a test reactor in the United States.

Mark Peters, Idaho National Laboratory Director
Benefits of the Existing Fleet

- The USA is the world's largest producer of nuclear power, accounting for more than 30% of worldwide nuclear generation of electricity.
- Nuclear power supplies, circa 20% of US electricity
- Nuclear provides 55% of the US’s carbon free capacity.
- Existing plants prevent almost 500 million metric tonnes of carbon dioxide emissions each year.
- Two new generation 3+ reactors are under construction by Bechtel at Plant Vogtle.
The US Government is investing in the Versatile Test Reactor (VTR), a project led by Bechtel.

- Fast neutron test capability
- Materials and fuels performance testing
- Supporting future advanced reactor programmes

Advanced Reactor Demonstration Programme, the winning technologies are the:

- Xe100 Helium Gas Cooled reactor and the
- Terrapower/GE Hitachi Natrium, sodium cooled, fast reactor with innovative molten salt heat storage- Bechtel is the EPC Partner to Terrapower.
Exporting & Collaborating on Nuclear

“I can earnestly say that working with you and your team has been the best Contractor/Client collaborative experience that I have had during the 23 years I have been working in Nuclear.”

Commissioning Manager, James Dickaty, Sellafield Ltd

Sellafield PFCS, Project
- US Government supportive of exporting nuclear technology.

- Wylfa remains a highly attractive site for GWe nuclear development.

- Finance solutions, remain key to nuclear development.

- UK is a very important partner to the US on nuclear.

- COP26 presents a unique opportunity for the UK and the US to firmly position nuclear as key to achieving Net Zero.
Westminster Energy Forum