Innovation through Collaboration – A UK Perspective

Prospects for Development of Innovative Technology

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NATIONAL NUCLEAR LABORATORY

INTRODUCTION

- National Nuclear Laboratory – who we are, what we do
- The need for change
- Our value delivery model of continuous improvement
- Case studies
- The future for innovation

NATIONAL NUCLEAR LABORATORY

- NNL is the UK's National Nuclear Laboratory which operates on a commercial basis
- NNL is owned by the Government and has three roles given to it by the government
- NNL operates world leading facilities doing leading edge Science and Technology to address industrial and strategic challenges
- Six locations across the UK including high active laboratories
- Approx. 900 people in the organisation

UK NUCLEAR ESTATE

- Over 60,000 people employed
- More than £12 billion added to the economy
- 21% electricity supplied

Closure of Advanced Gas-cooled Reactor fleet
Cost of nuclear new build

Closure of reprocessing
Cost of waste management and decommissioning

BRINGING THE NUCLEAR SECTOR TOGETHER

Innovation through sector wide collaboration – both nuclear and non-nuclear organisations

FOCUS AREAS

1. Innovative technologies

2. Culture & leadership

3. Collaboration & supply chain

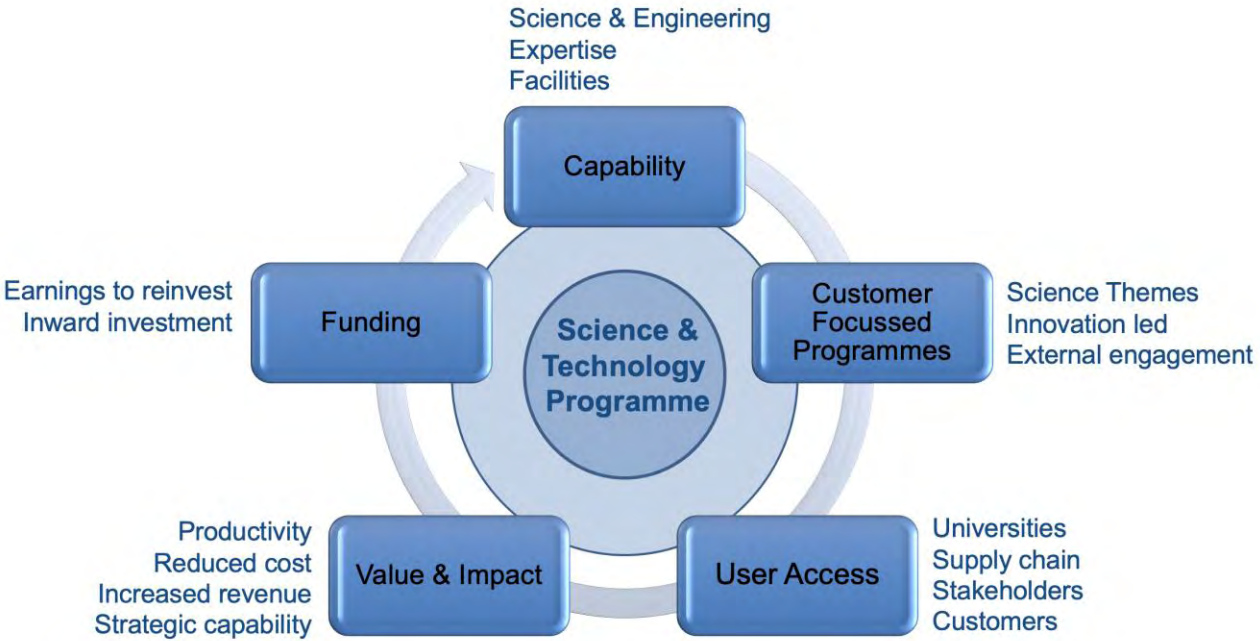
4. Programme & risk management

5. Financing & commercial models

6. Enabling Regulation

INNOVATIVE TECHNOLOGIES

Model for the delivery of value through technology



NNL Science Themes

Nuclear Safety
Structural Integrity
Materials Performance
Advanced Fuels
Recycle & Separation
Environmental Radiochemistry
Thermal Treatment
Decontamination Science
Reactor Chemistry & Corrosion

CASE STUDIES

GAME CHANGERS PROGRAMME

- A Sellafield sponsored initiative, delivered by NNL & FIS360
- Focus on encouraging innovation to help meet complex nuclear decommissioning challenges from across industry sectors
- Engage with industry and academia to enable commercialisation of waste management and decommissioning technology
- Develop a portfolio of de-risked early stage technologies for adoption and deployment by Sellafield and other interested parties

The Challenges

- Post Operational Clean Out
- Analytical Services
- Condition Monitoring and Inspection
- Plant Characterisation
- Waste Containers, Handling and Storage
- Surveillance and Maintenance
- Modelling and Knowledge Management
- Plant Dismantling
- Identifying Unknown Objects in Gloveboxes

www.gamechangers.technology/challenges/

GAME CHANGERS PROGRAMME

Game Changers Process

GAME CHANGERS .technology

A simple five stage process with support, guidance and feedback available throughout

STAGE 1

Game Changers work with Sellafield to identify, articulate and publish specific decommissioning challenges.

Events held to support challenges and invite interest from across industry sectors.

STAGE 2

Applications and poster presentations submitted.

Each appraised by review panel comprising Sellafield, NNL and FIS360 personnel.

STAGE 3

Applications of tangible interest invited to present business case and project plan (and possible technology demonstrations) to Sellafield.

Up to £10k awarded to projects with Sellafield support.

STAGE 4

Projects reviewed by leadership team with successful applications awarded Proof of Concept funding.

STAGE 5

Delivery and completion of the Proof of Concept project, with demonstrations and appraisal by Sellafield.

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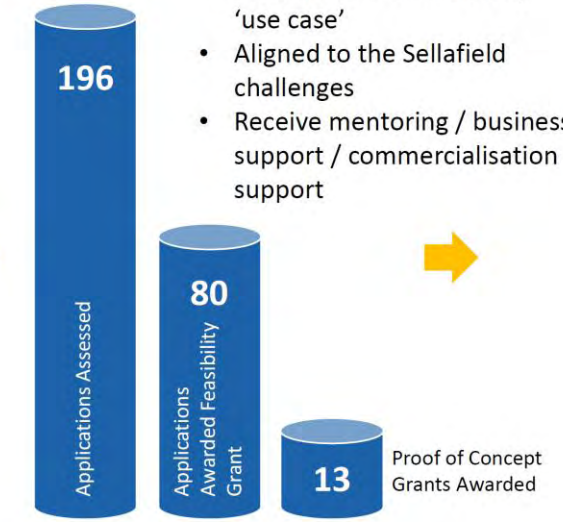
GAME CHANGERS PROGRAMME

The story so far…

10
Challenge statements published and promoted

260+
Companies registered for briefing events

400+
Cross-sector delegates attended events



All Proof of Concept projects:

- Have strong Sellafield buy-in
- Demonstrate clear value / 'use case'
- Aligned to the Sellafield challenges
- Receive mentoring / business support / commercialisation support

- Value to Sellafield already has the capability of saving £100s millions
- Different way of working which accelerates technology development
- Commercialisation support to translate into nuclear
- Collaboration between companies (SMEs, Tier 2s)
- Leverage significant funding - InnovateUK over £1m to-date

H2020 - DECOMMISSIONING ROADMAP

NFRP-2018-5: "Development of a roadmap for decommissioning research aiming at safety improvement, environmental impact minimisation and cost reduction"

SHARE **S**take**H**older based **A**nalysis of **RE**search for Decommissioning

- Increasingly difficult for Individual countries to justify expenditure on new technologies for innovative decommissioning – proven technology reduces risk
- Significant redundancy and duplication in current Research programmes
- Few ways at present to organize multinational projects with co-financing by stakeholders facing common challenges
- **SHARE will provide a Strategic Research Agenda and Inclusive roadmap in the near future for stakeholders jointly to improve safety, reduce costs and minimize environmental impact in the decommissioning of nuclear facilities**

Country	Organisation
France	**CEA**, EI
Spain	ENRESA
USA	EPRI
Norway	IFE
Europe	JRC
Germany	KIT
United Kingdom	NNL
Belgium	SCK-CEN
Italy	SOGIN
Finland	VTT
Lithuania	LEI

Establishing SHARE Decommissioning Roadmap

Stakeholder's Needs

Current Available Solutions

Questionnaire

Questions grouped in themes
Collect opinion of stakeholders
Rank needs to importance and urgency

Gap Analysis

Weighted Decision Matrix

- ✓ List of drivers to evaluate and rank current available solutions (cost, safety, time durations, sustainability, availability of waste routes, access to expertise and competence, maintenance and development of knowledge, regulations, guidelines, TRLs, SRLs)
- ✓ establish weighting factor (paired comparison analysis)
- ✓ WDM with seven-point rating scale

Strategic Research Agenda (SRA)

List of activities prioritised and grouped in thematic areas to close the gap (knowledge production, knowledge transfer, standardization and guidance, strategic studies, technological transfer, cross-cutting activities)

SRA

Strengths
Reduced Costs
Automated
TRL

Weaknesses
Insufficient funds
Waste production
No demonstration

S W O T

Opportunities
Added value
Knowledge management access
Sharing costs

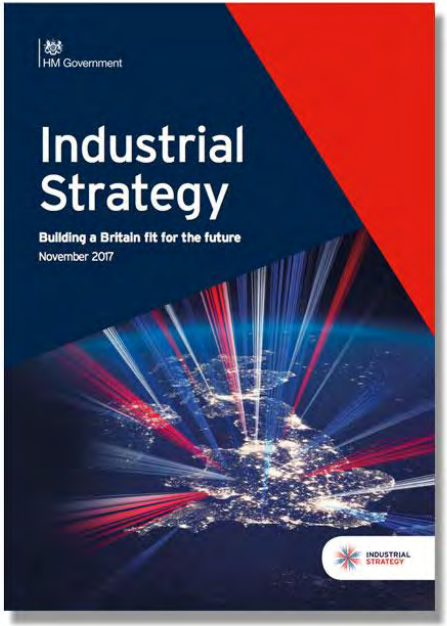
Threats
Public acceptance
Regulation changes
Waste disposal routes

Roadmap

Analyse SRA for implementation qualifiers (willingness to commit and share resources, regional distribution, inclusiveness of actors and instruments (working groups, information exchange platforms, technical project, co-funding, technological transfer)

INNOVATION SUPPORTED BY GOVERNMENT

- Enabling government policy
  - Clean Growth and Industrial Strategy
  - Nuclear Sector Deal
- Government support for
  - Advanced manufacturing
  - Developing supply chain competitiveness
  - Feasibility & development funding for Advanced Modular Reactor Competition
  - National Fusion Technology Platform
  - Thermal hydraulics facility in North Wales
  - Nuclear Research and Innovation – BEIS Nuclear Innovation Programme



SUMMARY

- Both R&D and deployment of technology in nuclear is expensive
- The pace of change is slow and needs to be accelerated
- Collaboration across industries, academia and nations is a means by which we can lower costs, accelerate delivery and make best use of facilities, people and expertise
- We don’t need to invent everything
- Learning from each other and adopting best practise from the global sector is crucial to success
- Government have a key role to play in creating the right environment for innovation to flourish
- Industry working with academia has a key role in delivery of appropriate solutions