Clean Energy, Safe World

To serve the national interest, by pushing the boundaries of science, technology and innovation.



NNL SUPPORTS ALL ASPECTS ON THE UK CIVIL NUCLEAR FISSION PROGRAMME

- Continued operation of existing reactors
- Legacy waste management / decommissioning
- New nuclear build
- Geological disposal
- Plutonium stockpile disposition
- Naval propulsion support programme
- Advanced reactor (Gen IV) and fuel cycle development
- Space Power systems
- Security, non-proliferation & safeguards





PROGRESS ON CLEAN NUCLEAR ENERGY

- Energy Unit established, subsequent consultations on new nuclear
- KNOO programme launched
- Close work with Roy Soc and RAEng
- Engagement with House of Lords
- Engineered establishment of NIRAB, NIRO
- Progress on Gen III reactors
- Recognition of SMRs
- Recommendation for advanced fuel & reactor systems work



SCENARIOS FOR UK DEPLOYMENT





UK FUEL CYCLE KNOWLEDGE

- Balance of number of parameters including:
 - Economics
 - Finance
 - Regulation
 - Safeguards
 - Technology readiness
 - Engineering support
 - Fuel supply
 - Use of nuclear energy
 - Spent fuel storage
 - Disposal
 - Sustainability
 - Manufacturing
 - Education, training and R&D





NUCLEAR INNOVATION PROGRAMME



Future Fuels Making more efficient and safer fuels for current and future reactors

Advanced Manufacturing and Materials

State of the art techniques embedded in the supply chain, reducing the cost of nuclear projects

Reactor Design

Digital tools to design and build future generations of reactors in an accelerated and cost effective way

Recycling Fuel for Future Reactors Sustainability through fuel recycling and

waste minimisation

Advanced Modular Reactors Moving next generation technologies towards commercialisation

The UK's Strategic Toolkit Tools to critically assess emerging technologies, providing a policy evidence base





















EXPERIENCE IN ADVANCED REACTOR SYSTEMS

- UK experience with advanced fast and thermal reactors:
 - Gen III, III+, IV
 - Fast Reactors
 - HTGRs
 - SMRs
 - Molten Salt Reactors
 - Th fuelled based systems
- Long history of participation in international projects
 - European Fast Reactor development
 - Numerous European Framework 5, 6 & 7 projects
 - South African PBMR project
 - Generation-IV VHTR, SFR, and GFR systems





FUELS & FUEL CYCLE TECHNOLOGY

- Experience with a range of different fuels:
 - metallic, UO₂, MOX, carbides, nitrides, coated particles



- UK playing a leading role in EU advanced flowsheet
 - GANEX flowsheet for actinide separation developed at NNL
 - Leading work on centrifugal contactors







EXAMPLE ORION 75 GWE SCENARIO







FACILITIES- CENTRAL LABORATORY



An investment of over £500M in world-leading nuclear R&D facilities

- •Dedicated Mixed Oxide (MOX) Fuel Development Laboratories
- •High-active modular cells
- •Active & Inactive solvent extraction labs





UNIVERSITY NETWORK







CRITICAL SKILLS

- Significant replenishment of skill base needed to support UK's forward nuclear programme
- Generation of subject matter experts essential in many disciplines
- Strong link between SMEs, R&D and facilities
- Academic through to industrial experience is required





- UK policy on nuclear has changed 180° within 15 years
- Legally binding CO₂ targets drives the energy-mix
- Government support long-term policy on nuclear
- R&D has a crucial role to play
- Significant opportunity for international collaboration on Gen III deployment, MOX and Advanced Fuels and ultimately Fast Reactors and Advanced Fuel Cycles
- Success requires shared:



