C-NET: The Centre for Nuclear Energy Technology

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Abstract

The Centre for Nuclear Energy Technology was established as part of the Dalton Nuclear Institute at The University of Manchester in 2009 to focus the UK research on front-end nuclear technologies. This includes plant-life extension, new build, naval propulsion and next generation reactors. Building on £4M of government funding through the North West Development Agency (NWDA), C-NET will act as a hub for nuclear research in the North West of England collaborating with both universities and industry.

1. Introduction

The UK Nuclear Decommissioning Authority was established in 2005 as a direct consequence of the 2004 Energy Act with the remit of decommissioning the civilian public sector nuclear licensed sites in a safe, secure and cost effective manner. To enable them to carry out this remit they were also responsible for maintaining the skills base in the UK through support of educational and research programmes. As a consequence, research on the back end of the nuclear fuel cycle received a significant funding boost. With a prospect of a new nuclear build programme becoming more likely it was recognised that a similar focus was required on front end research, which was in danger of not receiving the funding necessary to support the existing nuclear reactors, or any possible new build. Coupled to the recent decline in university nuclear research and staff, and a closure of many of the industrial laboratories urgent action was required to reverse the trend and enable the university sector to once again meet the demands of industry.

2. Dalton Nuclear Institute and the North West of England

Within The University of Manchester nuclear energy had recently again been recognised as a key area for education and research with the establishment of the Dalton Nuclear Institute in 2005. Instead of creating a School of Nuclear Sciences or Engineering it was felt that there more value to be gained from having the nuclear experts remain in their various Schools such as Physics, Chemistry, Materials, Mechanical Engineering etc with Dalton acting as a central Institute to co-ordinate the education and research, and to help facilitate both internal and external collaborations. Dalton built on the successful BNFL University Research Alliances in Radiochemistry and Materials Performance that had been established in 1999 and 2002 respectively. Mainstream nuclear education had been restarted with the Nuclear Technology Education Consortium Masters programme in 2005. A strategic initiative was therefore required to re-establish front end nuclear research on reactors and fuels.

Over 45,000 are employed in the nuclear industry in the UK with over 50% of the workforce in the North West of England. The area has a rich nuclear heritage tracing its roots all the way back to 1911 and the seminal experiments conducted by Ernest Rutherford and his team at The University of

Manchester that established the nuclear theory of the atom. Apart from mining all aspects of the nuclear fuel cycle take place in the North West –

- Uranium conversion and fuel manufacturing at the Westinghouse plant in Springfields, near Preston
- Uranium enrichment at the Urenco plant at Capenhurst, near Chester
- Nuclear Reactors at Heysham, near Lancaster
- Reprocessing and Waste Management at the facilities at Sellafield, West Cumbria
- A UK Geological Disposal Facility site has not yet been identified but discussions are taking place with councils in the West Cumbria area

With such significant presence in the North West the government funded Regional Development Agency (NWDA) understands the strategic importance of the nuclear sector to the region. To support the NW nuclear activities the NWDA established a Nuclear Working Group with representatives from industry and universities. From this Group emerged the idea of a central hub and spokes model to support the industrial sector through the establishment of a Centre at The University of Manchester that would link with the other universities in the NW at Lancaster, Liverpool, Salford and Central Lancashire. The Centre for Nuclear Energy Technology was therefore established with £4M of NWDA funding over four years from October 2009.

3. Research Themes

The C-NET research themes are primarily focused on

- **Support to existing reactors:** providing R&D support to extend the life time of existing plants
- **New nuclear build:** supporting the deployment and operational performance of UK new build
- **Naval propulsion:** supporting the R&D requirements of next generation systems
- **Advanced reactor development:** collaborative international research on future reactor systems

All aspects of the front end of the nuclear fuel cycle are considered as possible research themes with the exception of enrichment. Examples of typical current research areas are

- Reactor Systems and Engineering,
- Materials Performance
- Mechanical Engineering
- Society and Sustainability

Each area can be sub-divided as shown in Figure 1.

The NWDA funding for C-NET has allowed the Dalton Nuclear Institute and The University of Manchester to expand its nuclear research capability through the purchase of exceptional quality equipment such as

- FIB microscope and ancillary equipment
- HPC computer node and reactor physics software
- Thermal-hydraulic test loop
- CVD furnace upgrades to support advanced coatings work
- High temperature nano-indenter
- Fuel and materials characterisation equipment

The equipment was chosen to fill specific capability gaps with the current University nuclear research infrastructure but to be flexible enough to meet a wide range of possible future demands.

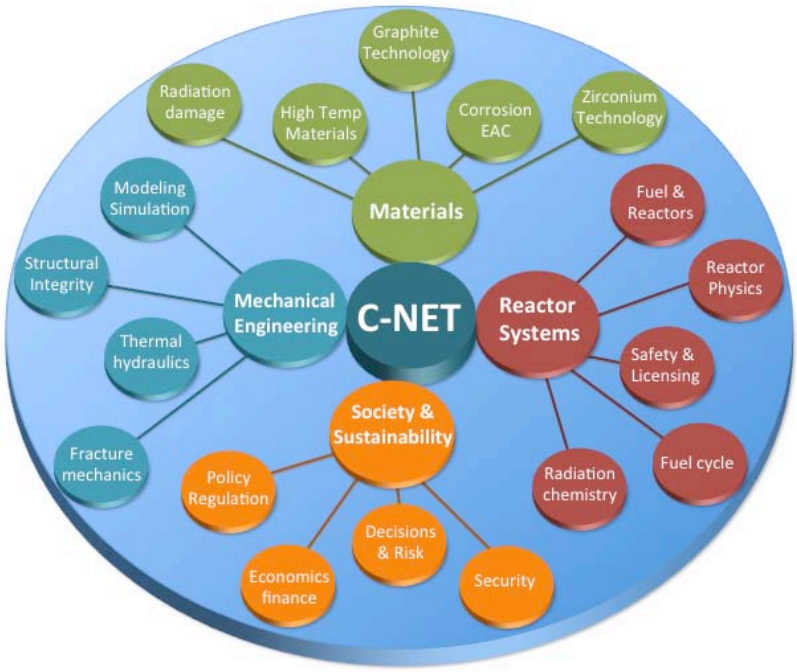

Figure 1 The C-NET Research Areas

4. Education and Training

While nuclear research is the core activity of C-NET it is recognised that for any new build programme to be successful, or indeed to maintain operation of the current fleet, a comprehensive educational and training programme is required to provide the nuclear scientists and engineers of the future. To facilitate this C-NET is supporting the development of new undergraduate nuclear modules and courses as well as developing bespoke CPD (continual professional development) for the nuclear industry. These include courses on reactor simulations as well as executive level training for the nuclear leaders of the future.

An important additional advantage of the training programme is knowledge transfer from C-NET to industry. This can be done either through the CPD training programme or through one of three levels of business assists. These are being developed to facilitate new companies to join the nuclear sector and also more established companies to expand their nuclear provision through the establishment of Memorandums of understanding between C-NET and the companies, which will allow closer collaboration.

4. Conclusion

Through diligent planning and the support off the NWDA and The University of Manchester C-NET has now been established. Regionally the aim of C-NET is to be an integrator of the wide capability found in the North West of England and to support nuclear organisations, both industry and universities, that need access to nuclear expertise and experimental equipment. Nationally it aims to

be an important UK asset and a significant reason why further investment should be made in the North West. Nuclear though, is a global industry, and the aspirations of C-NET are to be an internationally acknowledged world-class source of front end nuclear research and education.