



Growing skills for **R**eliable **E**conomic **E**nergy for **N**uclear

The **GREEN** Centre for Doctoral Training

Professor Scott Heath, University of Manchester



Engineering and
Physical Sciences
Research Council



Overview



Building on the success of predecessor CDTs Nuclear FIRST and NGN, the mission of GREEN is, in collaboration with industry, to provide high quality research training in the science and engineering underpinning nuclear technologies (primarily TRLs 1-3), developing the subject matter experts of tomorrow

2019-2027: target of 90 PhD students – **Final total 107 students**

£6M from EPSRC, £4.1M from Industry, £2.8M from HEIs

75% of Nuclear FIRST, NGN, first cohort of GREEN graduates in nuclear
90% in technical careers



16 Industry partners



Model



Based on the full 5 cohorts of project proposals

- Based on half studentships
- Halves funded by UKRI/EPSRC, industry partners or Universities
- Driven by project needs, halves are matched to make whole studentships
- **Resulting in leverage of 2:1 with respect to EPSRC funded studentships**

Management structure

- **GREEN Strategy via Industrial Advisory Board:** Meetings of all HEI & non-HEI partners as required and annually at Winter School
- **GREEN Management via GREEN Management Board:** Meetings of 5 HEIs every 6 weeks by conference call and face-to-face every quarter
- **Oversight of GREEN student experience:** panel of 3 externals (B'ham, Strathclyde, NNL)

Structure



Full time and part time routes available

University & Industry-based projects (“EngD” route) available

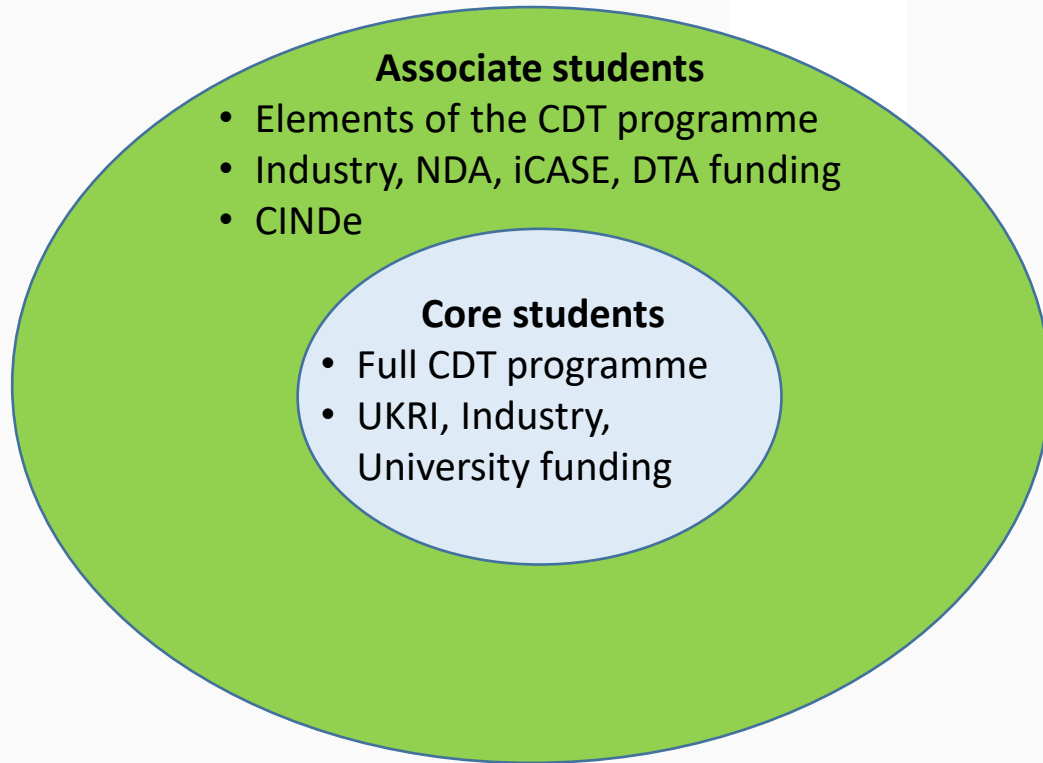
Timetable:

4 Months Bespoke Taught Programme, Sept-Dec

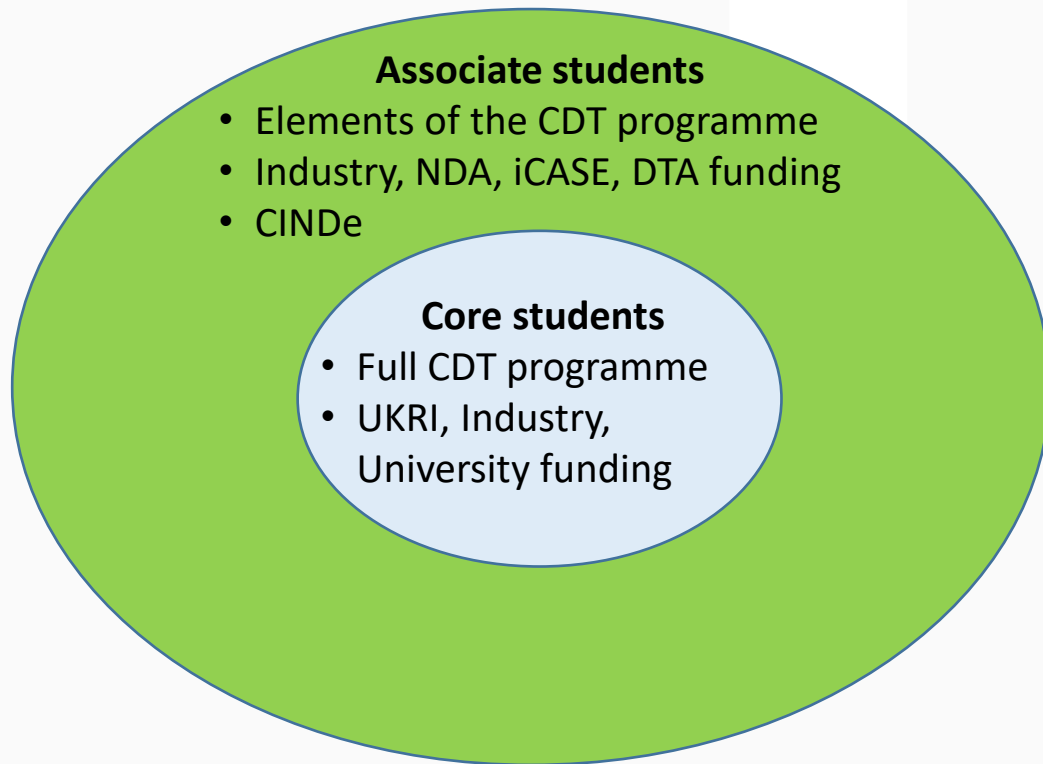
- 12 week ‘Introduction to Nuclear Energy’
- No specific nuclear background required
- Business Games, Exercises, Case Studies
- Strong ‘real life’ contribution
- Site visits – Sellafield, Springfields, Heysham
- **visit to Research Reactor, NTHU Taiwan**

Winter School, January

- 3 day residential, >200 attendees



Structure



6 Months Student Specific Training (SST) – Feb-Jul

- SST1 – Literature review and report
- SST2 - Project specific training and report
- Presentation and poster days
- End-of-year student conference

36 Months PhD Research

- Host HEI PGR QA system
- Co-supervision
- **EngD Route**
- Ongoing CPD and steps towards SQEP status
- Training - Responsible Research and Innovation; Risk awareness; International Nuclear Law; Careers

Throughout - Outreach

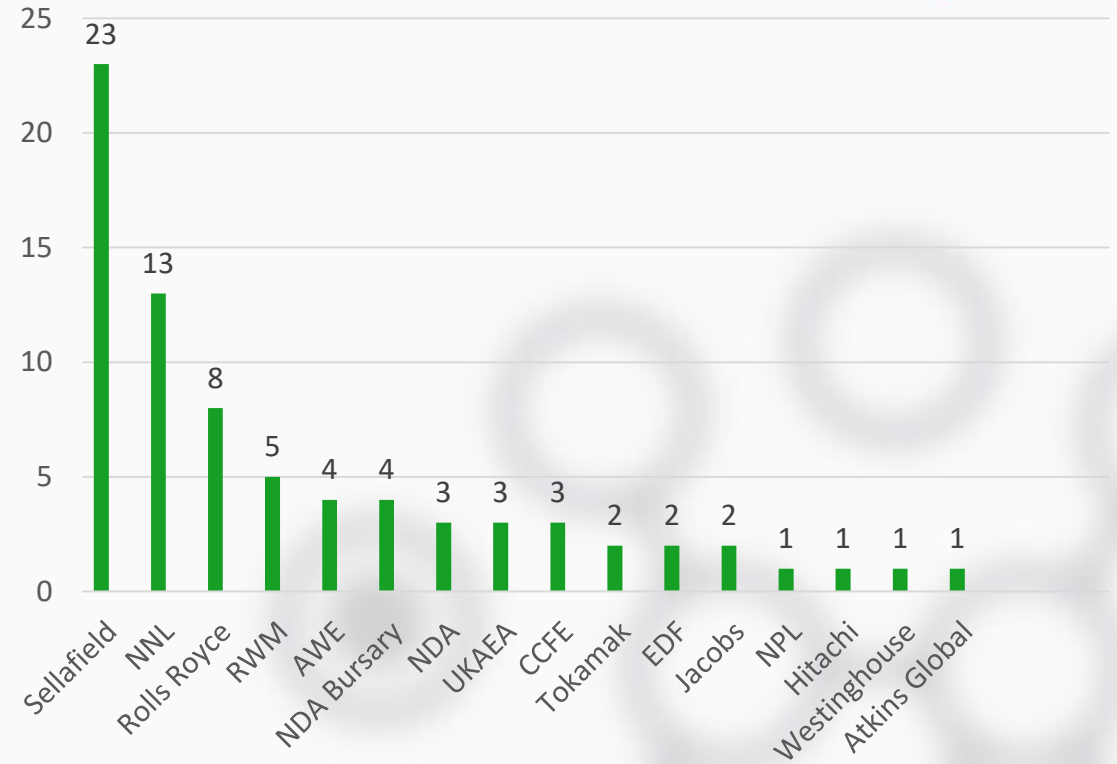
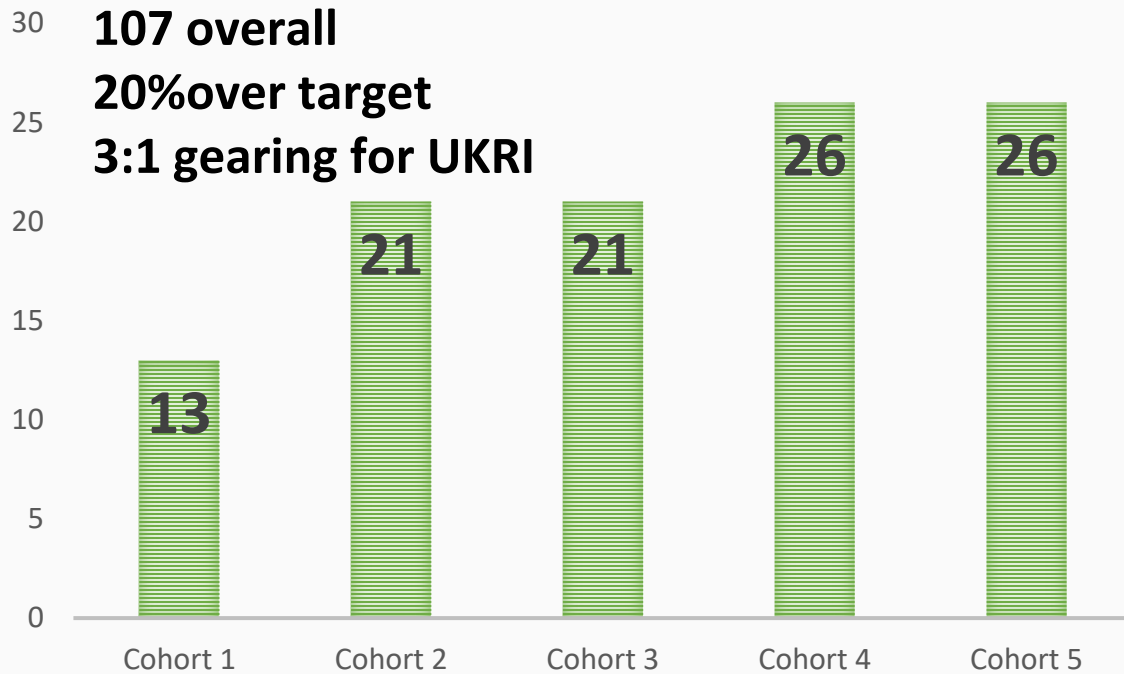
- Public engagement training and events – MOSI, Jodrell Bank, Bluedot, ScienceX at Trafford Centre, Schools

Student numbers: Cohorts 1-5 107 FTE



| | | |
|-----------------------------------|--|----|
| Current Nuclear Programmes | • Spent Nuclear Fuel and Nuclear Materials Management | 34 |
| | • Decommissioning and Clean-Up | 36 |
| | • Geological Disposal | 13 |
| | • Current Operating Reactors | 9 |
| | • New Build Reactors | 12 |
| | • Nuclear Security | 4 |
| Future Nuclear Energy | • Fusion | 12 |
| | • Future Fuel Cycles | 11 |
| | • Advanced Reactors: Liquid Metal, Molten Salt, Gas Cooled | 16 |
| | • Co-generation | |
| Nuclear Energy in a Wider Context | • Regulation | 4 |
| | • Manufacturing | 9 |
| | • Interaction of Infrastructure and Environment | 9 |
| | • Societal Issues including Economic & Finance | 5 |
| | • Management | 6 |

GREEN in partnership



■ On programme



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Cohorts 1-5: EDIA & COVID impacts



| Gender | All Cohorts |
|--------------------|-------------|
| Male | 65 |
| Female | 38 |
| Non-Binary | Numbers |
| Transgender | 6 or less |
| Home International | |
| Home | 89 |
| EU/International | 16 |
| Age | |
| 21-24 | 58 |
| 25-29 | 29 |
| 30-39 | 11 |
| 40+ | 6 or less |

2019 Intake – Cohort 1

Winter School held, then COVID. CDT office operating remotely; Redesign of SST2 and PhD phase; UKRI extensions managed by home HEIs

2020 Intake – Cohort 2

Winter School cancelled, replaced with virtual sessions. Taught programme & SST1 on-line; SST2 socially distanced; Poster session by Mozilla Hubs

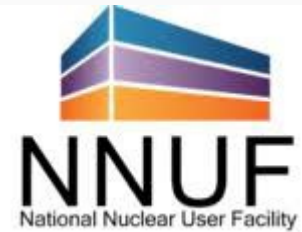
2021 Intake – Cohort 3

In person teaching resumed – but no site visits. Winter School returned; Summer School created

2022 Intake – Cohort 4

All normal activities resumed, caught up with the site visits backlog

Use of National Facilities



Manchester

- RADioactive waste management & Environmental Remediation (RADER), CRR, DCF; NFCE

Lancaster

- ADRIANA; Lancaster Accelerator Mass Spectrometer; UTGARD Phase I & 2

Leeds

- MUFFIN (MULTiphase Fluid Flow In Nuclear systems)

Sheffield

- MIDAS, HADES (High Activity Decommissioning Engineering Science)



Skills **A**nd **T**raining **U**nderpinning a **R**enaissance in **N**uclear

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MANCHESTER
1824

The University of Manchester

Lancaster
University



UNIVERSITY OF LEEDS



UNIVERSITY OF
LIVERPOOL



The
University
Of
Sheffield.



University of
Strathclyde
Glasgow

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2024-2033: target of 140 PhD
£10.4M from EPSRC, £13.8M from Industry, £6.9M from HEIs
19 Industry partners
Cohort of 26-30 due to start Oct 24

Sellafield Ltd
NDA Nuclear Decommissioning Authority
EDF ENERGY
CCFE CULHAM CENTRE FOR FUSION ENERGY
Environment Agency
copenhagen atomics
Nuclear Waste Services
NATIONAL NUCLEAR LABORATORY
LUCIDEON Materials Development and Commercialization
framatome****
NPL National Physical Laboratory
ONR Office for Nuclear Regulation
AWE
JACOBS
UKAEA
FRAZER-NASH CONSULTANCY A KBR COMPANY
cavendish nuclear part of Babcock International Group
NRS Nuclear Restoration Services
UKRI Engineering and Physical Sciences Research Council
MANCHESTER 1824 The University of Manchester
Lancaster University
UNIVERSITY OF LEEDS
UNIVERSITY OF LIVERPOOL
The University of Sheffield
University of Strathclyde Glasgow

SATURN – Key changes



- New University Partner - Strathclyde
- Expansion of Industry partners
- Reduction of taught element from PGDip to PG Cert
- Increased leaderships and soft skills training components
- Inclusion of NNUF tours



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