An Amazing First Ten Years For The Nuclear Technology Education Consortium

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UK Nuclear Sites

DECOMMISSIONING
26 Magnox Reactors
2 Fast Reactors

OPERATIONAL
14 AGRs
1 PWR

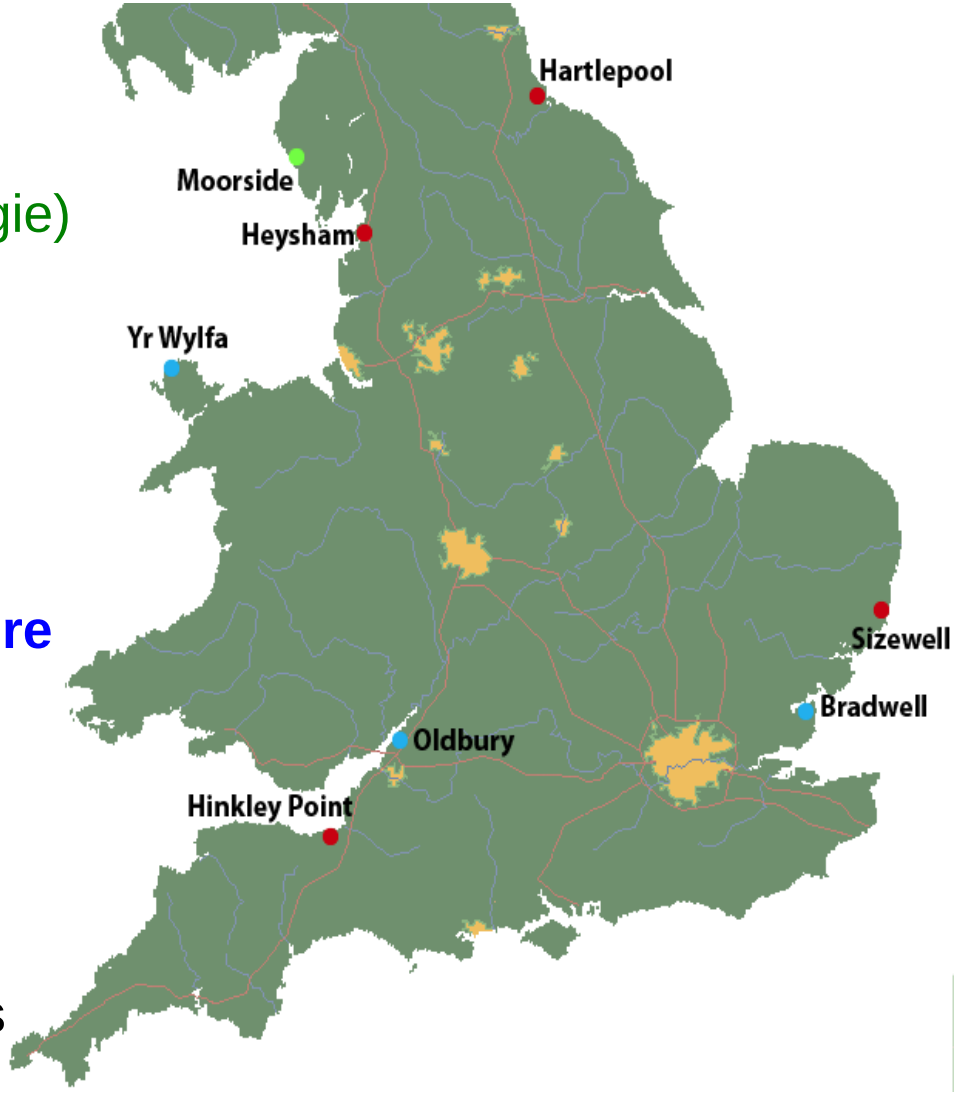
9.6 GWe Total Capacity

21st Century UK Reactors

EDF (Areva, CGN, CNNC)
Horizon (Hitachi)
NuGeneration (Toshiba and Engie)

Bradwell, Essex
Hartlepool
Heysham, Lancashire
Hinkley Point, Somerset
Oldbury, South Gloucestershire
Moorside, Cumbria
Sizewell, Suffolk
Wylfa, North Wales

~ 16 GW (?) of new capacity
~ 3 GW on each of the five sites
2 EPR or 3 AP1000 or ABWRs



Energy Review: new build of reactors

International collaborations such as GenIV and GNEP

Replacement of Royal Navy's Astute propulsion reactors

National Nuclear Laboratory

Nuclear education & training

Decommiss -ioning and clean-up

Operation and life extension of existing plant

Waste Disposal and possible repository

Fusion programme and ITER

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- **THE ISSUE in 2005**
  - A lack of highly educated scientists and engineers entering the UK nuclear industry
- **THE RESOURCES AVAILABLE**
  - Pockets of nuclear expertise within UK universities
  - High quality educational programmes
    - Science, technology and engineering
- **THE STAKEHOLDER ANALYSIS**
  - Modular courses suitable for full-time and part-time students
- **THE SOLUTION PUT FORWARD**
  - NTEC M.Sc. Nuclear Science and Technology

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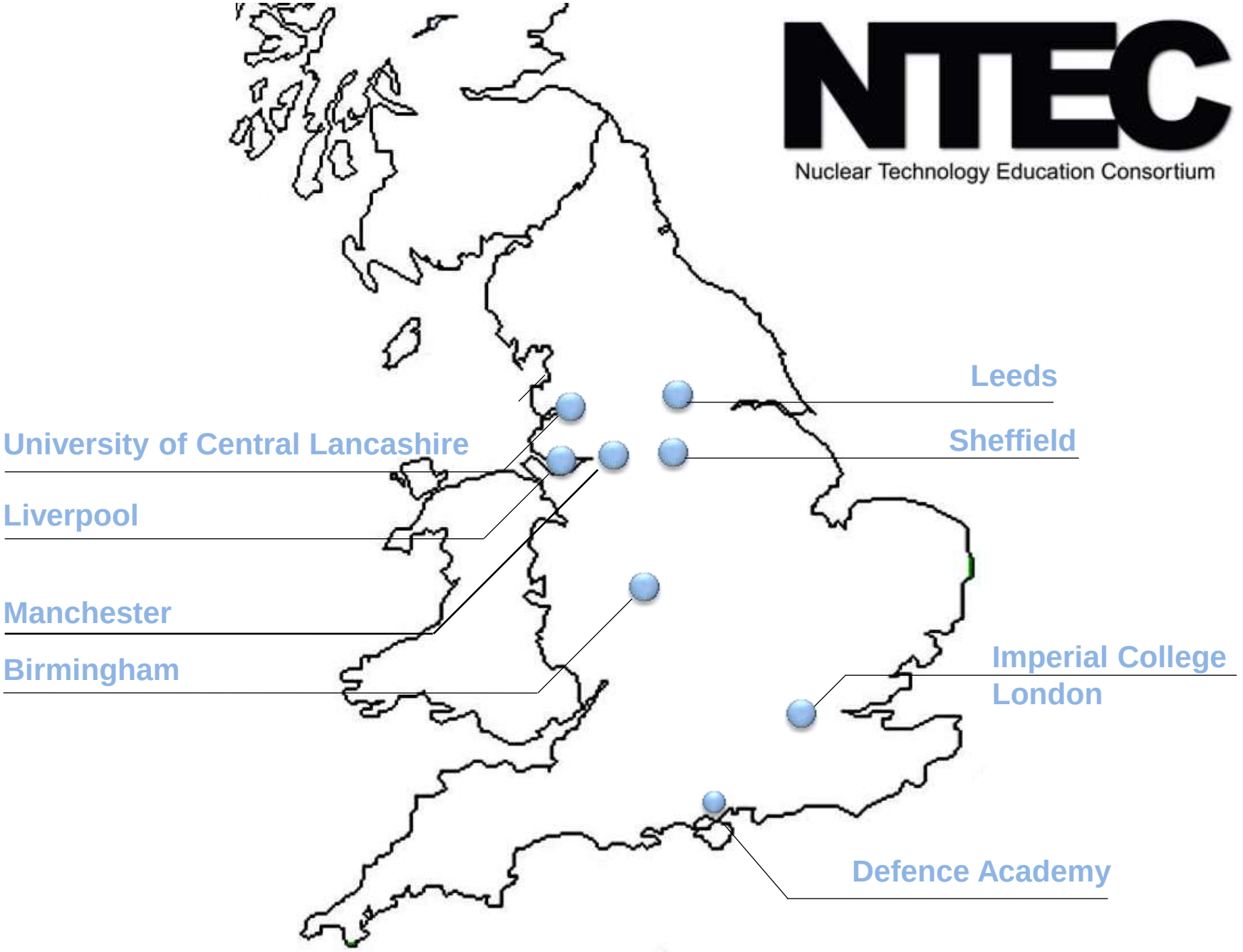


NTEC Modules

N01 Reactor Physics, Criticality & Design	***The University of Birmingham***
N02 Nuclear Fuel Cycle	***University of Central Lancashire***
N03 Radiation & Radiological Protection	***The University of Manchester***
N04 Decommissioning / Waste / Environmental Management	***University of Central Lancashire***
N05 Water Reactor Performance and Safety	Imperial College London
N06 Reactor Materials & Lifetime Behaviour	The University of Manchester
N07 Nuclear Safety Case Development	***Defence Academy***
N08 Particle & Colloid Engineering in the Nuclear Industry	University of Leeds
N09 Policy, Regulation & Licensing	The University of Manchester
N10 Processing, Storage & Disposal of Nuclear Waste	***The University of Sheffield***

Modules available in eLearning format in blue

NTEC Modules

• N11 Radiation Shielding	The University of Liverpool
• ***N12 Reactor Thermal Hydraulics***	***Defence Academy***
• ***N13 Criticality Safety Management***	***Defence Academy***
• N21 Geotechnical Aspects of Radioactive Waste Disposal	University of Central Lancashire
• N23 Environmental Impact Assessment	The University of Manchester
• ***N29 Decommissioning Technology & Robotics***	***TBD***
• ***N31 Management of the Decommissioning Process***	***The University of Birmingham***
• N32 Experimental Reactor Physics	The University of Manchester (Atomic Institute of the Vienna University of Technology or Czech Technical University, Prague)

Modules available in eLearning format in blue

NTEC Programme Structure

Example Marking for Each Module

- Pre-module work 10%
- Post-module assignment 50%
- Exam 40%

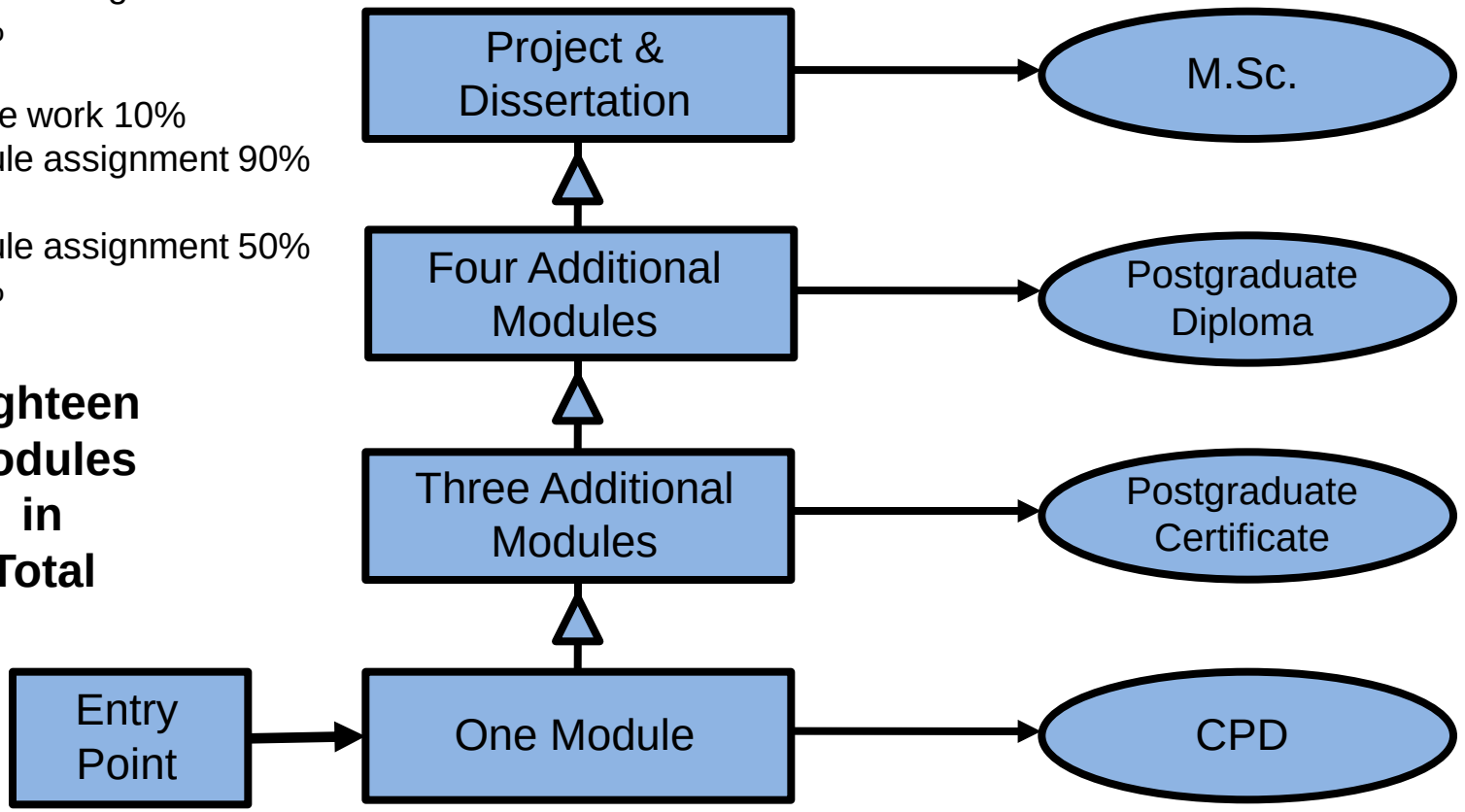
or

- Pre-module work 10%
- Post-module assignment 90%

or

- Post-module assignment 50%
- Exam 50%

MSc Nuclear Science and Technology
Full time: 12 months
Part time: 3 years



Eighteen Modules in Total

35 hours at University
One week Monday - Friday
150 hours of study

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Distance Learning / Residentials

Module	Residential Day	Residential Location
N01 Reactor Physics, Criticality & Design	N/A	N/A
N02 Nuclear Fuel Cycle	12 Nov 2014	UCLan Preston
N03 Radiation & Radiological Protection	11 Sept 2014	Manchester
N04 Decommissioning, Radioactive Waste and Environmental Management	18 Sept 2014	UCLan Westlakes
N12 Reactor Thermal Hydraulics	16 Oct 2014	Manchester
N07 Nuclear Safety Case Development	30 Apr 2015	Manchester
N10 Processing, Storage and Disposal of Nuclear Wastes	14 Apr 2015	Sheffield
N13 Criticality Safety Management	5 Feb 2015	Manchester
N29 Decommissioning Technology & Robotics	25 Feb 2015	Lancaster
N31 Management of the Decommissioning Process	18 Mar 2015	Birmingham

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NTEC Delivery Structure

Full Time	One Year	Part Time	Year 1	Year 2	Year 3
September		September			
October		October			
November		November			
December		December			
January		January			
February		February			Project
March		March			
April		April			
May		May			
June	Project	June			
July		July			
August		August			

Communication
Assessment

Learning Resources
Course Contacts
Staff Area
eLearning Support

COURSE MANAGEMENT
Control Panel
Content Collection
Course Tools
Evaluation
Grade Centre
Users and Groups
Customisation
Packages and Utilities

This section analyses the basic properties of gamma rays using a high-resolution germanium detector and Multi-Channel Analyser (MCA).
These detectors are relatively expensive and must be kept cold in operation.

1.2 Basic operation of a germanium detector

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Energy values of various fuels

Table 3: Energy conversion: the heat values and carbon coefficients of various fuels

	heat value		% carbon	CO_2
Hydrogen	121	MJ/kg	0	0
Petrol/gasoline	44-46	MJ/kg		
Crude oil	45-46	MJ/kg	89	70-73 g/MJ
	37-39	MJ/L		
Methanol	22	MJ/kg		
Liquefied petroleum gas (LPG)	49	MJ/kg	81	59 g/MJ
Natural gas (UK, USA, Australia)	38-39	MJ/m³	76	51 g/MJ
(Canada)	37	MJ/m³		
(Russia)	34	MJ/m³		
as LNG² (Australia)	55	MJ/kg		
Hard black coal (IEA definition)	>23.9	MJ/kg		
(Australia and Canada)	24-30	MJ/kg	67	90 g/MJ
Sub-bituminous coal (IEA definition)	17.4-23.9	MJ/kg		
(South & West Australia)	13.5-19.5	MJ/kg		
Lignite/brown coal (IEA definition)	<17.4	MJ/kg		
(Australian average)	9.7	MJ/kg	25	
(Loy Yang, Australia)	8.15	MJ/kg		1.25 kg/kWh
Firewood (dry)	16	MJ/kg	42	94 g/MJ
Natural uranium, in LWR	500	GJ/kg	-	-
in LWR with U & Pu recycle	650	GJ/kg	-	-
in FBR³	28,000	GJ/kg	-	-
Uranium enriched to 3.5%, in LWR	3900	GJ/kg	-	-

Sources: OECD/IEA Electricity Information 2004, for coal

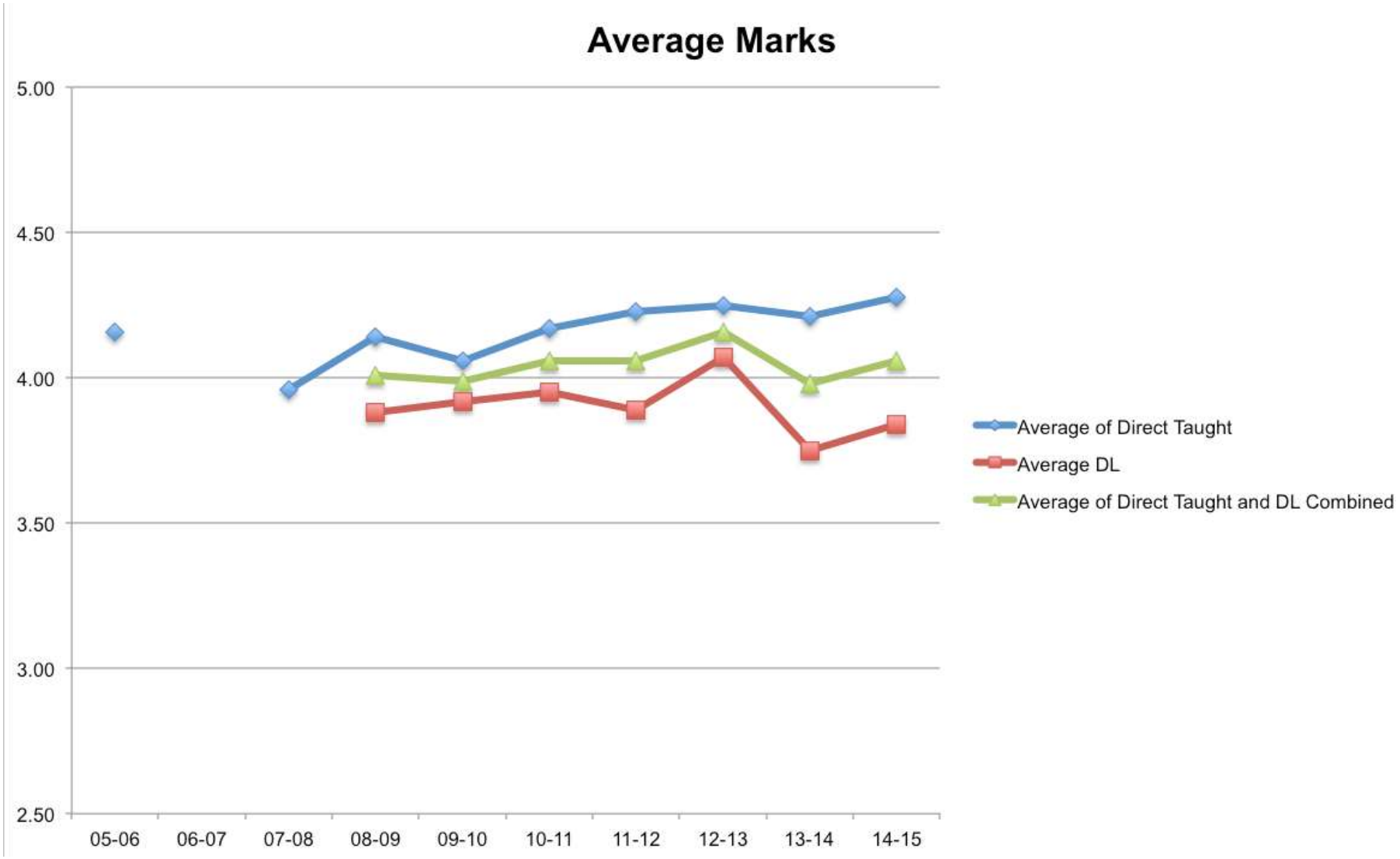
Australian Energy Consumption and Production, Historical trends and projections, ABARE Research Report 1999

uclan

University of Central Lancashire

QuickTime Play

Distance Learning Comparison



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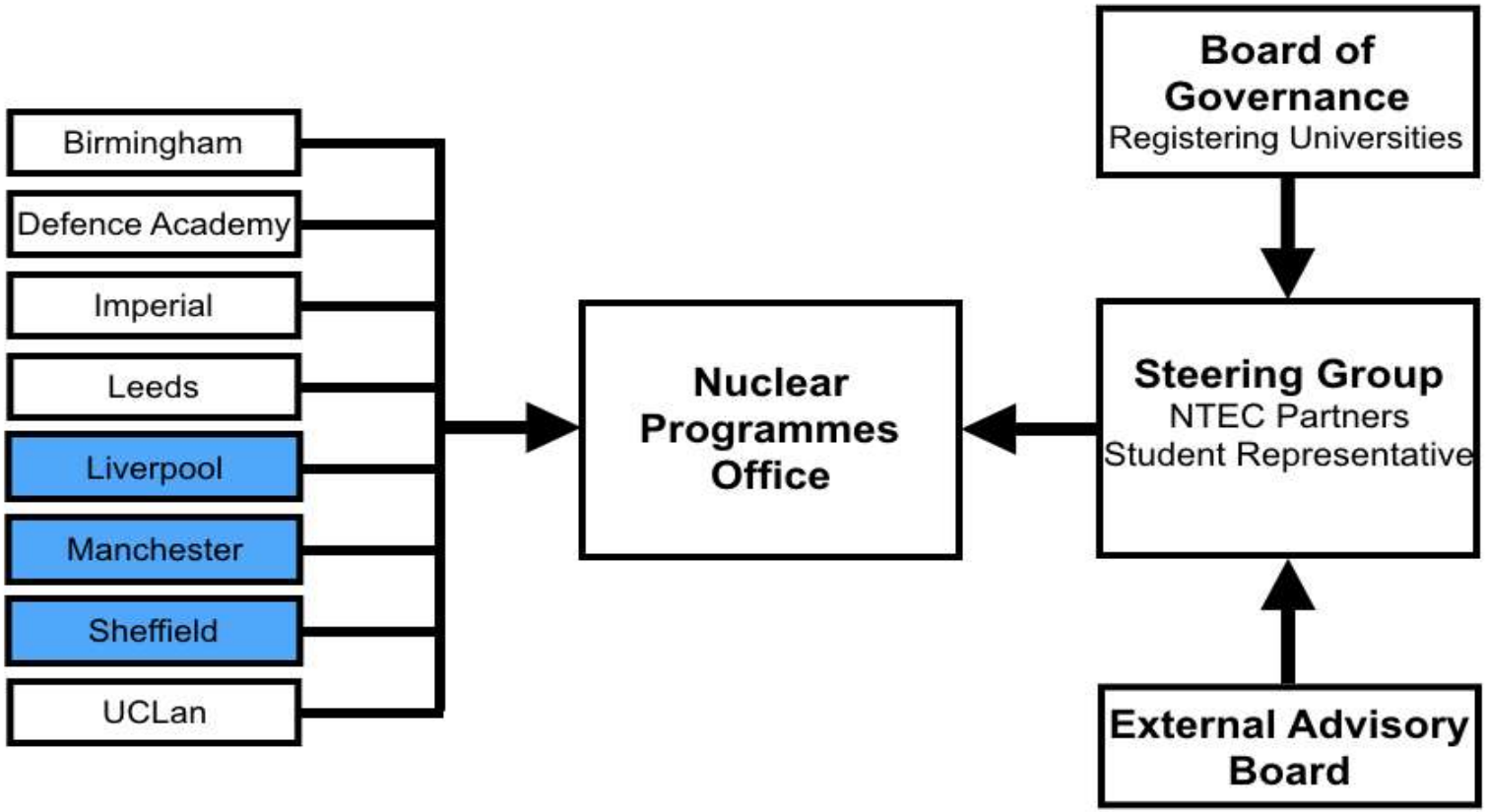
Quality Control

- Comprehensive Student Feedback
  - Module Leaders have to respond
  - Feedback Analysis and Interpretation
- Part-time students also feedback through their company representative on the External Advisory Board
- Module Review
  - Each module is reviewed by a lecturer from one of the other partner universities
- Board of Governance

Management Structure



Registering Universities

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Accreditation

- The NTEC MSc is accredited by
  - Institution of Engineering and Technology (IET)
  - Institution of Mechanical Engineers (IMechE)
  - Energy Institute (IE)
  - Institute of Materials, Minerals and Mining (IoM^3).

- Accreditation Process with the IOP has started

- Endorsed by the Nuclear Institute

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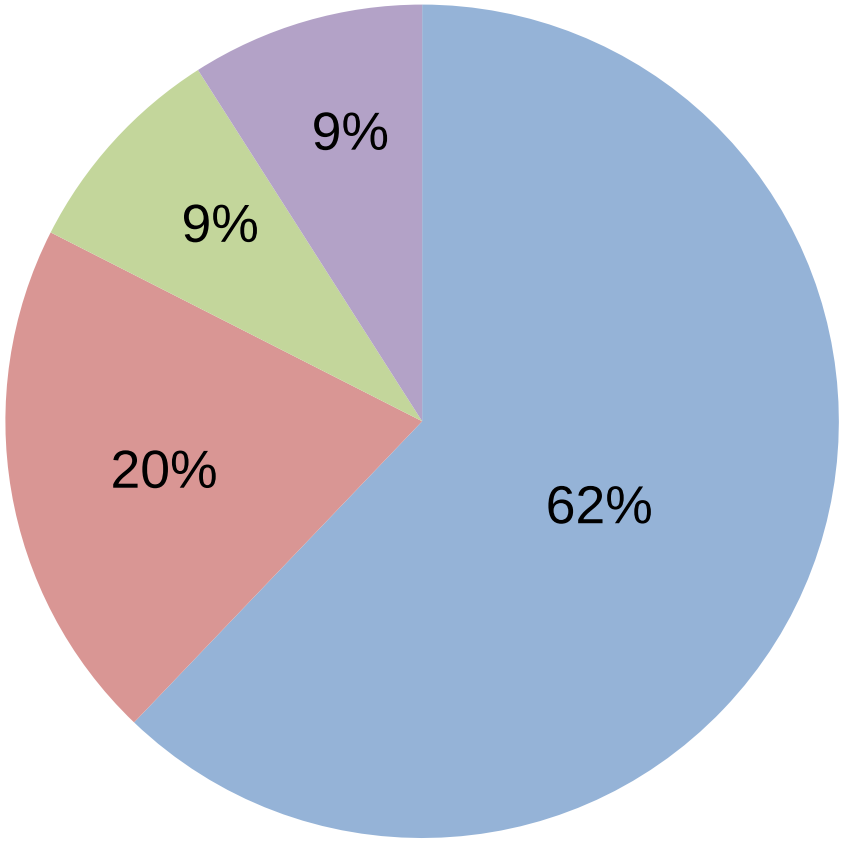
Partnership with Industry

- Modules designed in partnership with industry
- External Advisory Board
- Industry location for projects
- Short-course format optimised for industry
- Industry lecturers support the programme
- CPD income supports full-time students
- Industry recruitment of NTEC students is the real test

NDA Nuclear Decommissioning Authority
Rolls-Royce
ATKINS
EDF ENERGY
amec foster wheeler
AWE
Sellafield Ltd
Magnox
Westinghouse
urenco
LLW Repository Ltd

Full-time Student Destinations



177 full time students;

- 110 Employment - Nuclear
- 36 Nuclear Related Research
- 15 Employment - Other
- 16 Unknown/did not respond

Student Destinations

Since 2005

62% nuclear industry

20% further education

9% other professions

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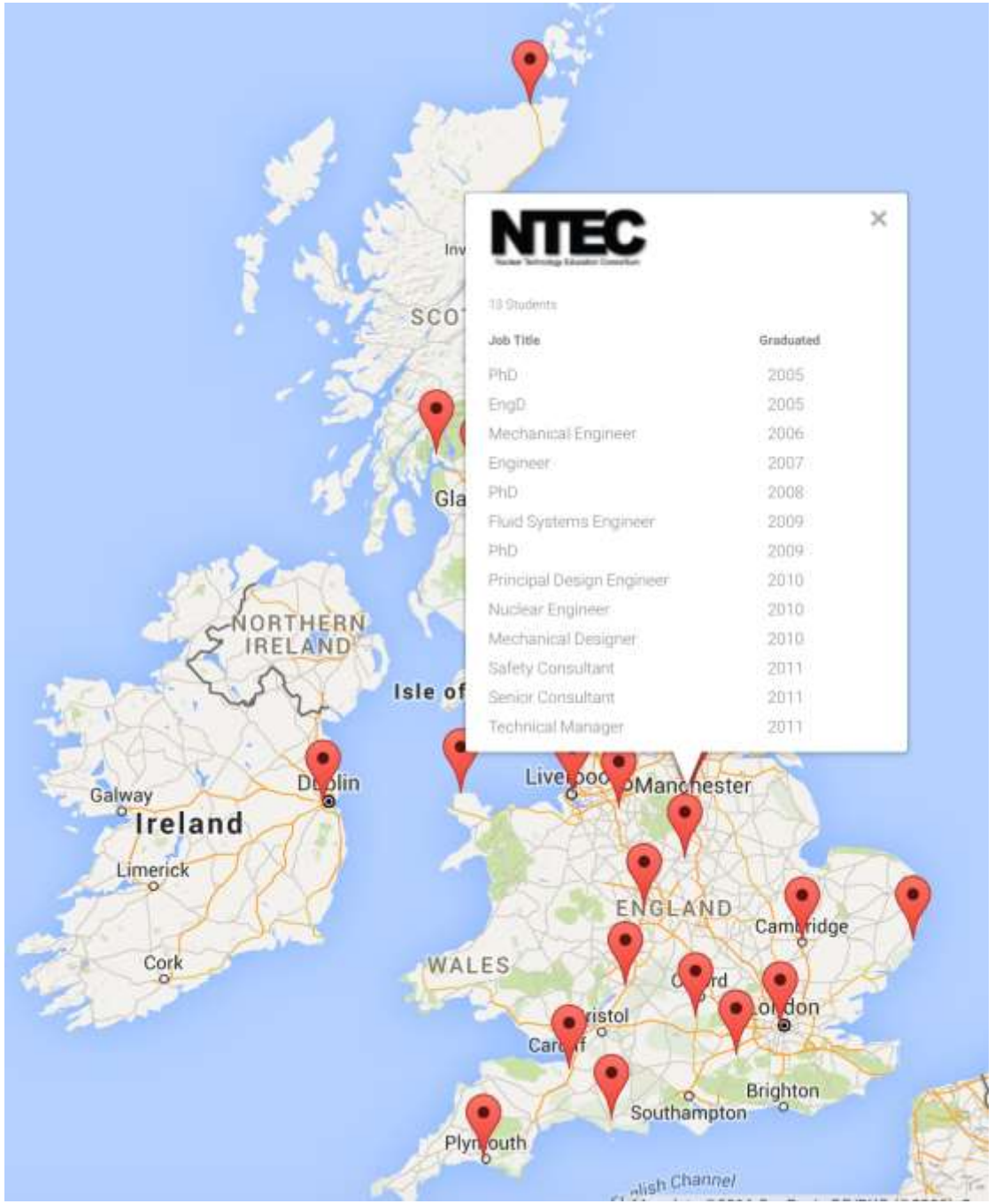
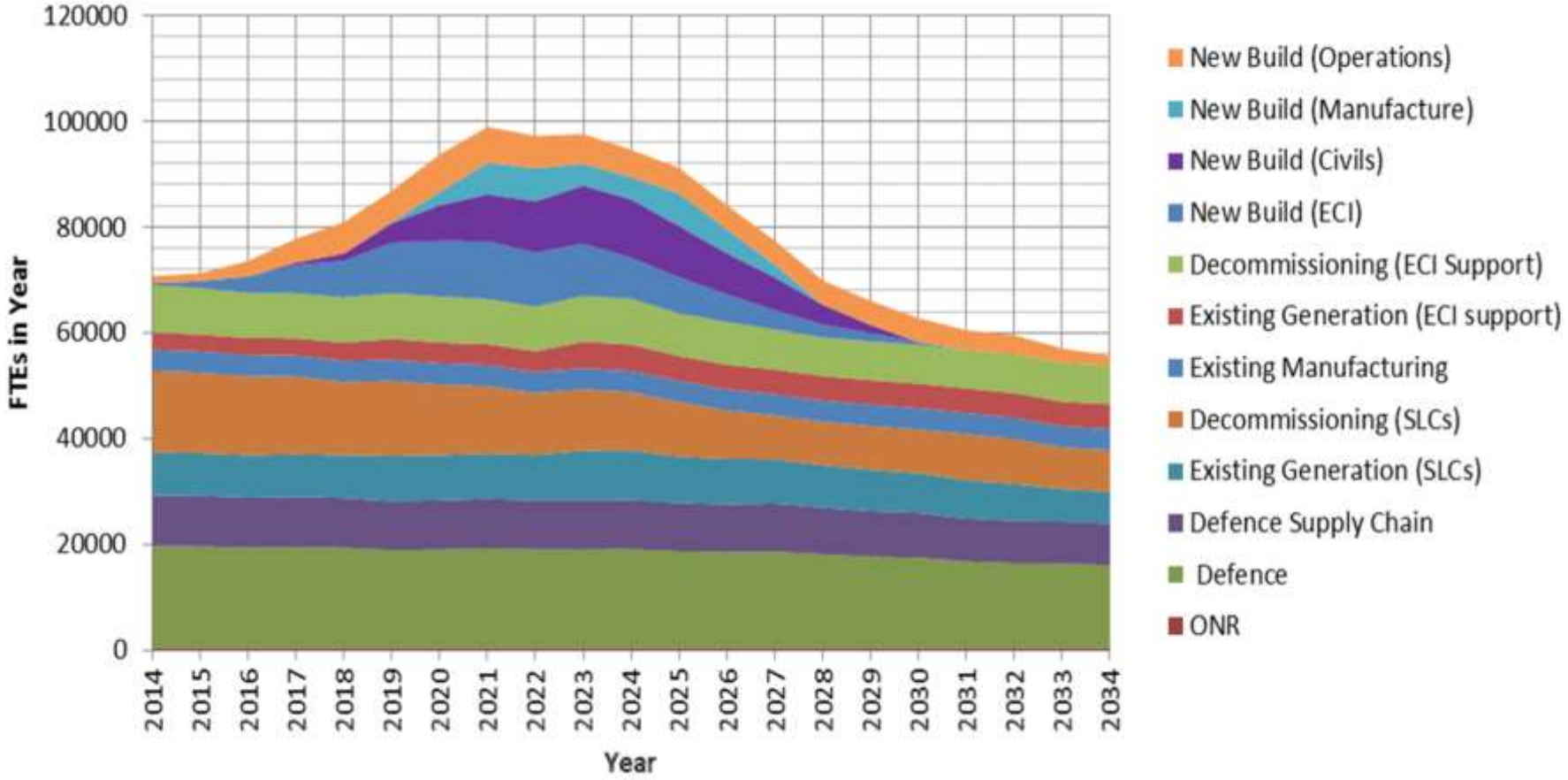


Civil and Defence Nuclear Workforce Demand



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