



North Sea Transition Deal: People & Skills

GeoNetZero Centre for Doctoral Training (CDT):

Addressing the Role that Geoscience & Engineering play in
the low-carbon energy transition

John Underhill

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& Director of the CDT

UKRI CDT in Oil & Gas

- Originally awarded in 2013, through a £3 Million grant from UK Research & Innovation (UKRI) in response to a competitive tender;
- Represented the largest support for oil and gas from UK Government Research Council for decades;
- The UK Centre of Doctoral Training (CDT) in Oil & Gas subsequently attracted funding from academia, government and industry that led to it becoming a £17 Million PhD research and training initiative.

GeoNetZero CDT



- The success of the original CDT model, which saw 128 PhDs enrolled, led to a bid for further funding;
- Resulted in an award of £2.5 Million from NEO Energy in 2019 meaning it became self-sustaining, the only UKRI DTP or CDT to be so;
- GeoNetZero* CDT launched in November 2019;
- Match funded by a partnership of 12 academic institutions comprising Aberdeen, Birmingham, Dundee, Durham, Exeter (Camborne), Heriot-Watt, Keele, Newcastle, Nottingham, Plymouth, Royal Holloway (RHUL) and Strathclyde University;

***The Role of Geoscience in the Energy Transition and in meeting the challenge of net zero emissions targets.**

Mission & Ambition

- The Energy Transition is a key societal challenge with implications on a global, national and local level;
- Need to decarbonise and reduce emissions at a pace that ensures security of energy supply and alleviates fuel poverty;
- Investigate and critically test the geoscience and engineering technologies that can bring about the transition;
- The move away from fossil fuel dependence must not be a cliff edge and there remains a role for oil and gas in the interim;

PhD Research Projects



- The GeoNetZero program addresses the energy transition, in which oil and gas remain a crucial part;
- The £2.5 Mn was matched by the 12 Universities to create a £5 Mn scheme to support 48 fully funded PhDs in the GNZ CDT program;
- They address geoscience topics across the energy transition landscape:
 - UK Oil & Gas Exploration Opportunities;
 - CCUS
 - Hydrogen;
 - Nuclear Waste Disposal;
 - Geothermal;
- All the centrally funded projects have direct applications to the UK Continental Shelf;

Key Research Areas



- Critically evaluating subsurface storage options, be they for gas, carbon dioxide (CCUS) or hydrogen;
- Green and Blue Hydrogen dependencies;
- Geothermal energy generation (high-enthalpy – offshore wells; granites; and low-enthalpy systems - flooded coal mines);
- Reducing Methane Emissions;
- Competition for offshore “real estate” and optimal use of the subsurface;
- Law, Governance & Regulation;
- Sustainable Mining – just how green are EVs?
- Social impacts.
- Providing the critical evaluation of the components needed to deliver a just energy transition;
- Interdependencies mean the challenge is greater than any single discipline;
- Cross-sector to address the key global challenge;
- Extends to include wider Environmental Impacts, Economics; Regulation and the Social License to Operate;

Latest Round of Projects launched



CAREERS | MEETINGS | REPORTS | INTERVIEWS

UNEARTHED



Offshore wind farms limit our ability to utilise the seabed beneath them

"Geoscience is vital for meeting Paris Agreement obligations"

John Underhill discusses the criticality of geoscience for low-carbon sustainable solutions

IT'S A REALLY exciting time for the geosciences. Earth science has been instrumental in documenting climate change and is pivotal in finding solutions that address it. Put simply, it is no longer about diagnosis, but mitigation and cure. Geoscience is vital for meeting the obligations embedded in the Paris Agreement."

John Underhill, a Professor at Heriot-Watt University, UK, views geoscience and the people who study and practice it as absolutely crucial as we seek to introduce measures that enable us to decarbonise, move towards a low-carbon sustainable future and address the United Nations' Sustainable Development Goals.

"I have heard it said 'the time for geological studies has passed, it is simply an engineering issue and we should just get on and do it'. While engineering is undoubtedly a major part of the solution, the fact that carbon dioxide has quite different physical and chemical properties from long-chained, inert hydrocarbons because it is small, nimble and highly reactive in the presence of water (when

GEO Education

Geoscientists for the Energy Transition

The importance of geoscience research and training.

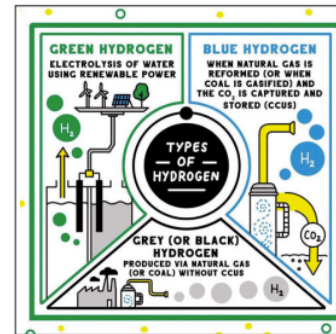
JOHN UNDERHILL; Heriot-Watt University

The industrial revolution was initially fueled by coal and the subsequent development of modern society was underpinned by oil and gas. Their use led to unprecedented economic growth and a rise in the quality of life, but it has also come at the cost of creating a carbon-intensive economy. The challenge before us now is to decarbonize, reduce greenhouse emissions and tackle climate change while simultaneously alleviating fuel poverty, meeting the energy needs of global population growth, and maintaining a prosperous, just and fair society that does not hinder developing nations. While the United Nations did not name any specific discipline, geoscience is a red thread that runs through their Sustainability Goals and has an essential role to play in delivering on these commitments.

How Geoscience will Help us to Decarbonize

Major strides have already been made in some countries to decarbonize the electricity sector with renewable sources superseding coal. There has been a drive toward hybrid and battery power replacing petrol and diesel vehicles. Doing so leads to an increased demand for a suite of raw materials (e.g. minerals and rare earth elements) for the batteries to store the energy. There is a similar need for them in the construction of the solar panels and wind turbines in power generation. Yet more are required for smartphones and other applications. Given that demand cannot be met through existing operations or recycling of materials currently in circulation, there is a need to identify new sources of critical elements, metals and minerals. Some estimates suggest that the need for metals like lithium will lead to a five- to ten-fold increase in production. The intensity of operations will mean extraction issues will have to be addressed if sustainable mining is achievable.

Parts of the energy sector like heavy industry, other forms of surface transportation, heating, cooling and aviation are far harder to decarbonize than electricity. The need to decarbonize industrial hubs is especially acute and requires the capture of emissions, transportation and their sequestration in safe and secure sites. Sedimentary basins represent obvious storage opportunities through the use of depleted oil and gas fields and saline aquifers in which fluids are trapped and transported. Inert, long-chained hydrocarbons have very different properties to carbon dioxide and the highly corrosive carbonic acid that results from its reaction with water. There is a need to test subsurface storage sites, since poor choices would undermine confidence and may lead to a promising technology not being adopted. Use of technical methods and the data acquired, processed and interpreted in the pursuit of oil and gas (e.g. seismic reflection,



The different sources of black, grey, blue and green hydrogen. (Graphic credit: BP)

petrophysics, core description and pressure data etc.) are the same needed to characterize and monitor the carbon stores, meaning expertise gained in petroleum studies are well-aligned with the energy transition.

Hydrogen is being touted as an alternative fuel for domestic gas supplies and surface transportation. While some demonstrators are testing whether hydrogen can be blended into gas networks, others seek to replace the whole grid. Hydrogen is also being trialled in buses and trains as an alternative to petrol and diesel (e.g. in Aberdeen).

Historically, hydrogen needs have been met from coal or methane sources, known as Black and Grey Hydrogen respectively with their carbon emissions vented or flared. While the aspiration is to use electrolyzers to convert the electricity from wind farms to hydrogen (Green Hydrogen), the process is in its infancy and does involve putting energy in to get hydrogen out, meaning it is less efficient. Given those challenges, the transitional step being proposed is to obtain hydrogen through steam reformation of methane, which also leads to a carbon dioxide by-product (Blue Hydrogen).

Blue Hydrogen requires a close spatial association between a gas field, a safe carbon store, a hydrogen export route and hydrogen storage site, an interdependency that demands a critical evaluation of the subsurface. Blue Hydrogen as a transition fuel also underlines the continued role for indigenous gas, because local sources have a lower carbon footprint than

NEW GEONETZERO CENTRE OF DOCTORAL TRAINING PROJECTS LAUNCHED AT COP26



The crucial role that Geoscience plays in the Energy Transition and the quest to reduce carbon emissions was underlined with the launch of PhD projects for the GeoNetZero Doctoral Training program in conjunction with the COP26 meeting in Glasgow.

GeoNetZero (GNZ) Centre for Doctoral Training (CDT) – Geoscience and its role in the low-carbon energy transition and challenge to meet net zero emission targets – is a major £6 million, UK-wide collaborative research and training partnership between 12 Universities.

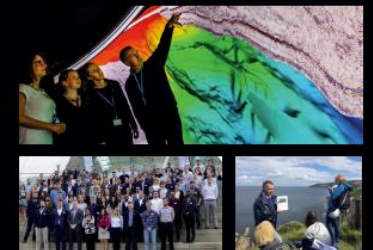
As well as undertaking bespoke PhD research, the GNZ CDT students undertake a Geological Society accredited 20-week, 100-day training programme delivered by world-leading academics, policymakers, regulators and industry practitioners.

The 27 approved projects are open for applications and 17 fully funded 4-year scholarships are available, each of which is worth £100k and represent an investment of £1.7 Million in the GeoNetZero CDT. The successful candidates will begin their research studies in September 2022.

In addition to the natural focus on the research, the new geoscience projects address and integrate key technical, regulatory and social science themes relevant to and facing carbon, hydrogen and nuclear waste storage, wind power and geothermal energy.

Applications welcomed for PhD projects starting in Q3 2022

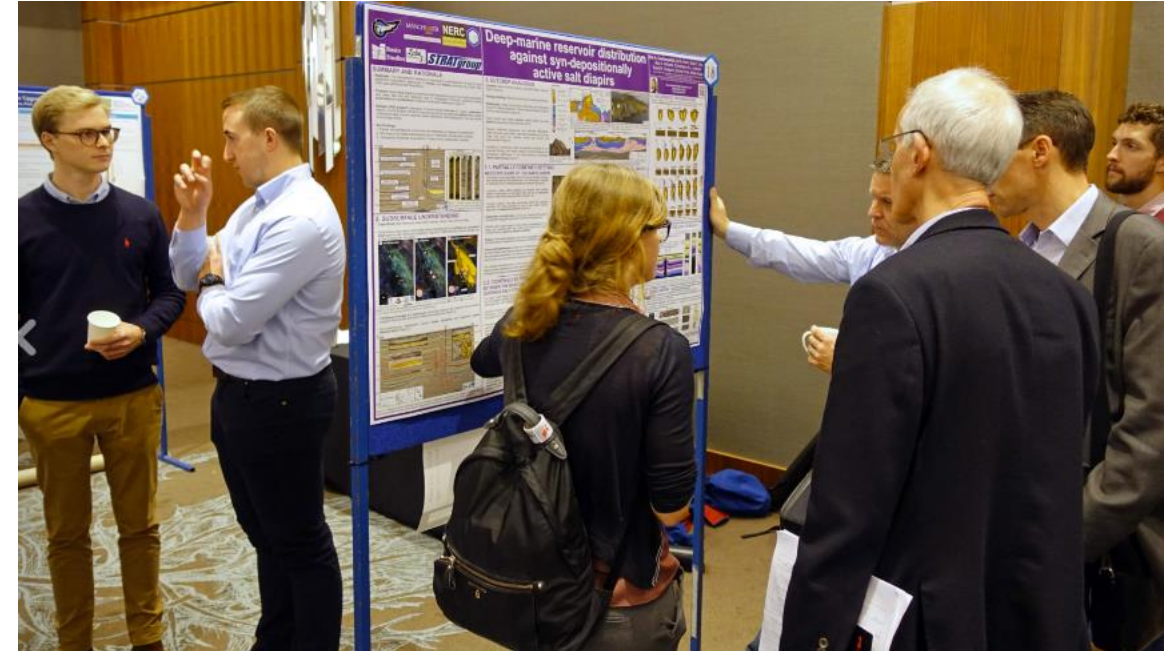
To find out more and apply for one of these funded PhD projects, please visit: www.geo-net-zero.hw.ac.uk/phd-opportunities



CDT Annual Conference



- Attended by all students and their supervisors;
- Technical program of talks and posters;
- Plenary session involved leading politicians, policy makers and regulators;
- CDT has huge convening power as demonstrated by attendance of >200;
- Has become a major fixture in the annual calendar, the next will be held on 31st October;



Informing Policy

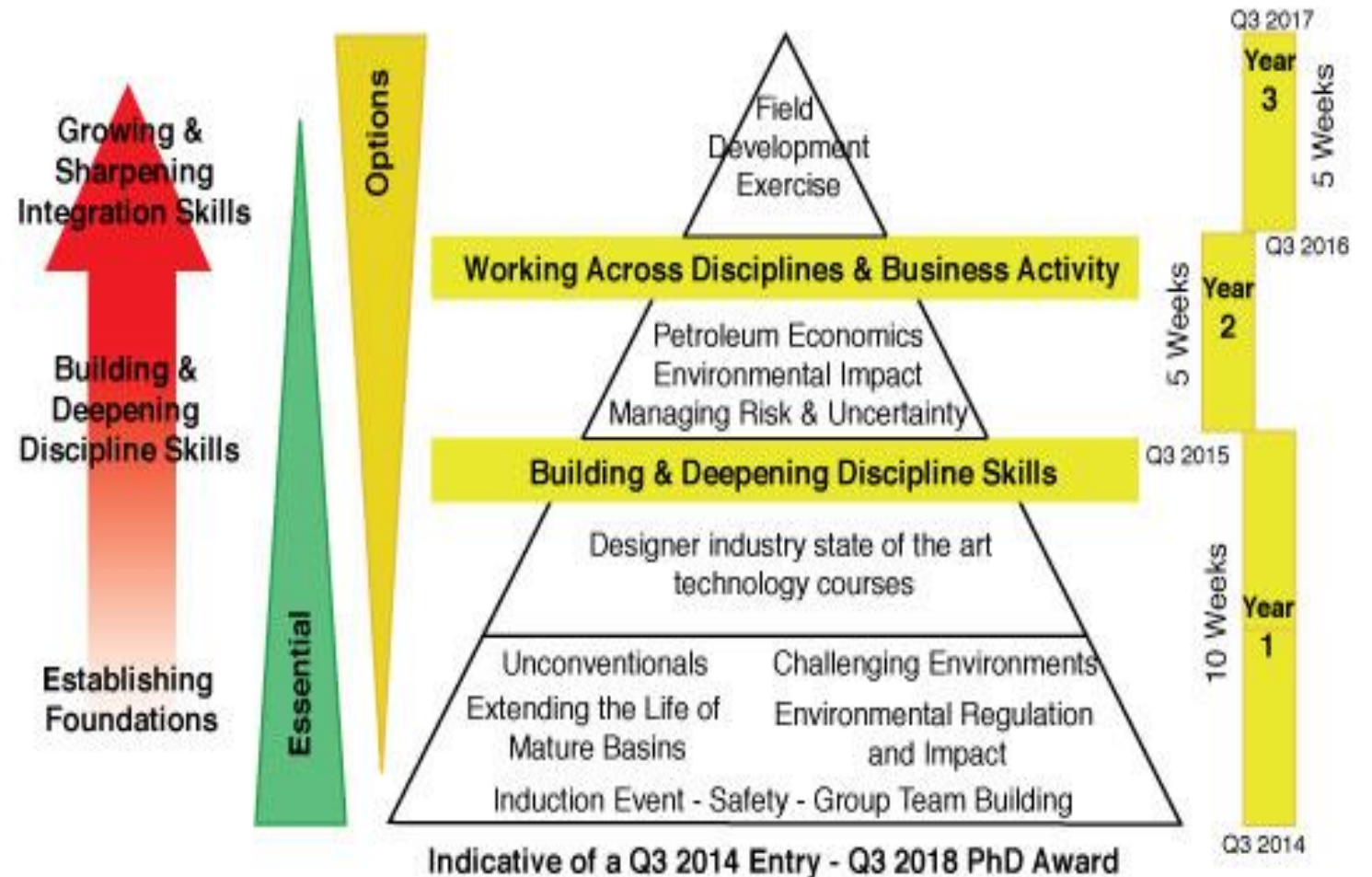
- CDT has enormous convening power;
- Research outputs attracted the attention of politicians and policymakers.



Postgraduate Training Program



- The PhD research runs alongside a 20-week (100-day) accredited industry-supported training program & internships with industry;
- Establishing Foundations thru' to sharpening skills;



Training Program

- Mixture of mandatory and elective modules delivered by industry, leading training providers, policymakers and academics;
- Funded by industry donations that amounted to >£300k p.a.;
- Led to Geological Society Accreditation and the award of an academic diploma;



Industry Engagement



- The CDT vision has led to companies coming in to support the Training Academy:
- 9 current sponsors supporting Training Academy activities;

BP, Capricorn (Cairn Energy), CNOOC, Equinor, Harbour Energy (Chrysaor), NEO Energy (Verus Petroleum), Shell, Spirit Energy and TotalEnergies;



- BG Group, E.ON, Maersk Oil, OMV & Woodside;
- Engagement through the Industry Advisory Board;



Industry Employment and Relevance



- Over 70 PhD students have now completed their studies;
- All have been employed in a relevant discipline thus demonstrating the value of the training, quality of the students and their relevance for the oil and gas business at a time when recruitment and retention was challenged;
- CDT students sought after as interns and recruitment is highly competitive;

But don't just take my word for it...

"I like the CDT because it offers the possibility to gain additional knowledge, meet a lot of very interesting people and get an idea how industry works and how it interlinks with academia."

Ulrike Sonnenblume - Birmingham Uni.

"It has been a great networking platform, being able to meet and build relationships with not only current industry professionals but contemporaries who together will likely be part of the future of geoscience within industry."

Ross Grant - Heriot Watt University

"You gain a lot of new and interesting view points that enhance your personal development."

Amy Bode - Aberdeen University

"The CDT has given me a wide range of valuable skills and experiences that I would not have been able to gain elsewhere having joined the CDT and geology as a whole from a pure physics background."

"The CDT is an academic experience that is second to none. Not only does it allow us to obtain the essential skills and knowledge for a successful career in the petroleum industry but it also provides an unrivalled opportunity to meet academic experts. And very importantly, it allows us to build friendships and networks that will hopefully last beyond PhD studies."

Aleksandra Svalova - Newcastle University



NERC CDT in Oil and Gas 2014 Cohort: French Alps Field course

"I have learnt a great deal of new skills and been exposed to exceptional science along the way. In addition to this, the CDT has been the platform for plenty of stimulating debate and the forging of strong friendships!"

"The variety of CDT training courses means you are offered the chance to obtain skills and knowledge that you would probably not get the chance to learn outside of the CDT"

Jamie Hizzet – NOC Southampton Uni.

"The CDT has given me access to a network of friends and colleagues across the UK. Through this it has greatly enriched my PhD"

Jonathan Hardman -Aberdeen University

"The CDT has been eye opening. It's provided a vast array of avenues I didn't realise I wanted to or even could go down."

Katy Oakes - University of Dundee

"The field trip to the Cleveland Basin was probably the best field trip I have ever been on. It allowed me to apply and test theories that I am using throughout my PhD in the field, in an area I would have not visited otherwise. Plenty of singing."

**Nathaniel Forbes-Inskip
Royal Holloway, University of**

Application to the North Sea

- Further support for the GeoNetZero CDT has been provided by its inclusion in the **North Sea Transition Deal**, the only academic entity to be part of the skills and training piece;
- The CDT is also named in the OGA offshore license round application documents;
- Support for the CDT allows companies to meet one of the criteria for which points are awarded in the competitive bidding process;

North Sea Transition Deal



The CDT's future



- Providing the skills and training for a pipeline of talent;
- Producing the next generation of geoscientists and engineers;
- But being as successful as the CDT has been is no guarantee that it has a future;
- Nor does being an integral part of the North Sea Transition Deal;
- To continue, there is a need for a commitment to fund;
- If the promise of the NSTD translates into money, matched funding will be unlocked thus, enabling the program to continue;
- We welcome industry operator and contractor support for the GeoNetZero CDT;

Summary

- The GeoNetZero CDT is a world-leading program that is recognised as the natural go-to place for research and training for the energy transition;
- Created meaningful partnerships between industry, academia, policymakers, Government to deliver the transition;
- Included in the NSTD, the only entity under the Postgraduate Training section of the Deal;
- Seeks funding to continue the successful program;



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