

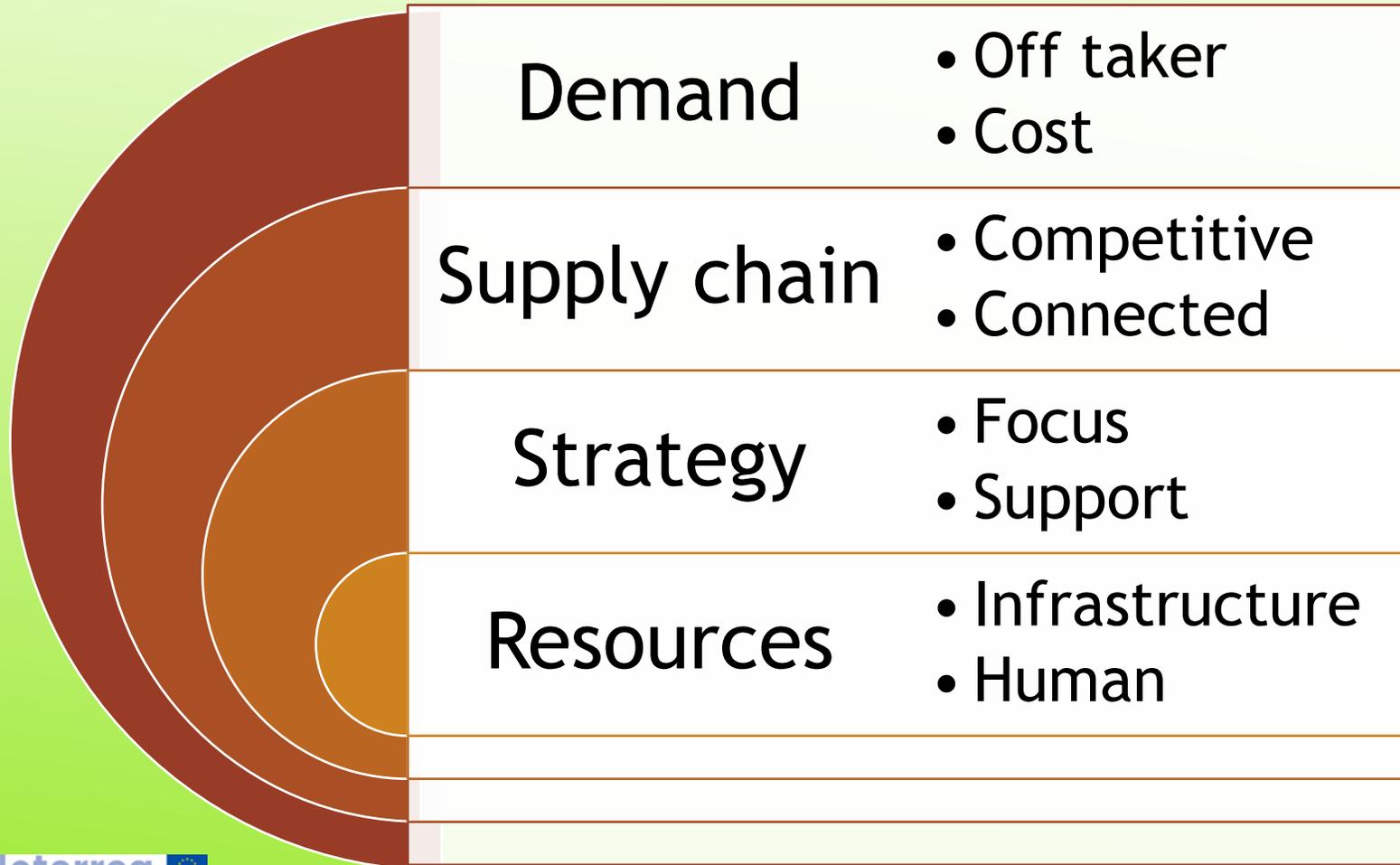
# HYDROGEN SKILLS FURTHER EDUCATION/HIGHER EDUCATION COHESION



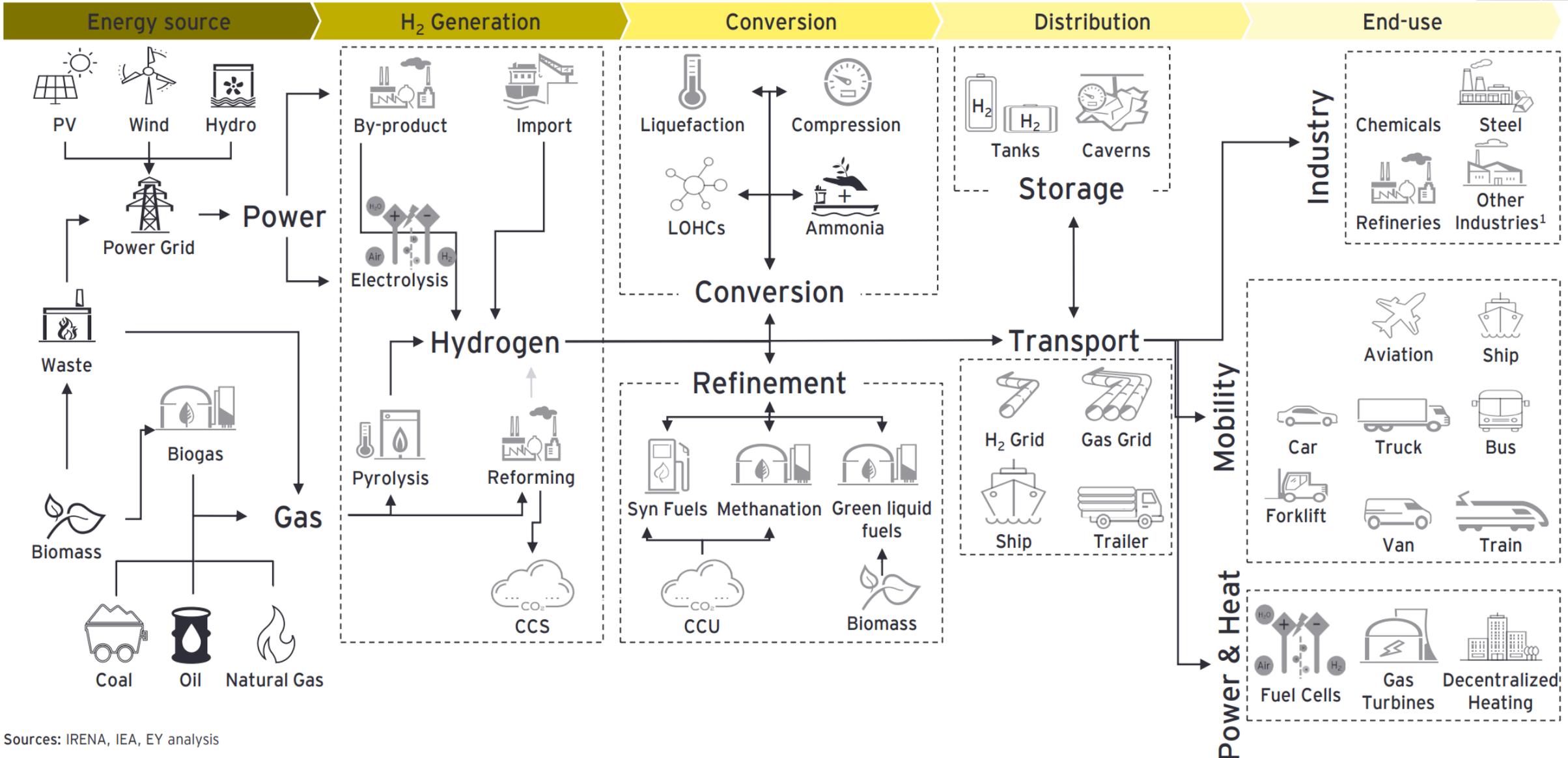
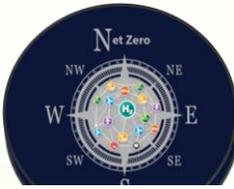
DAVID ROONEY QUB



# THE NEED FOR A SKILLS PIPELINE



# HYDROGEN – MANY PATHWAYS NEED SKILLS



Sources: IRENA, IEA, EY analysis

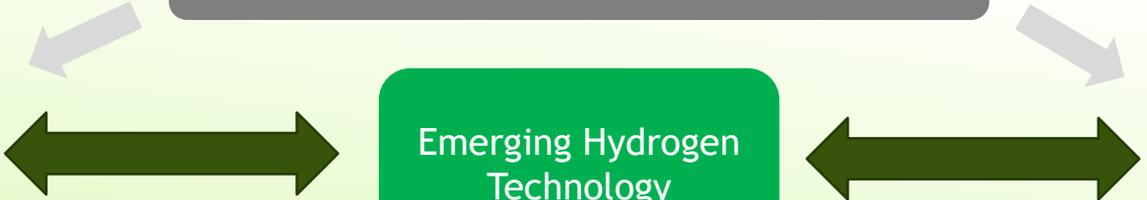


POLICY DRIVERS

INDUSTRY INNOVATION

Emerging Hydrogen Technology

ACADEMIA

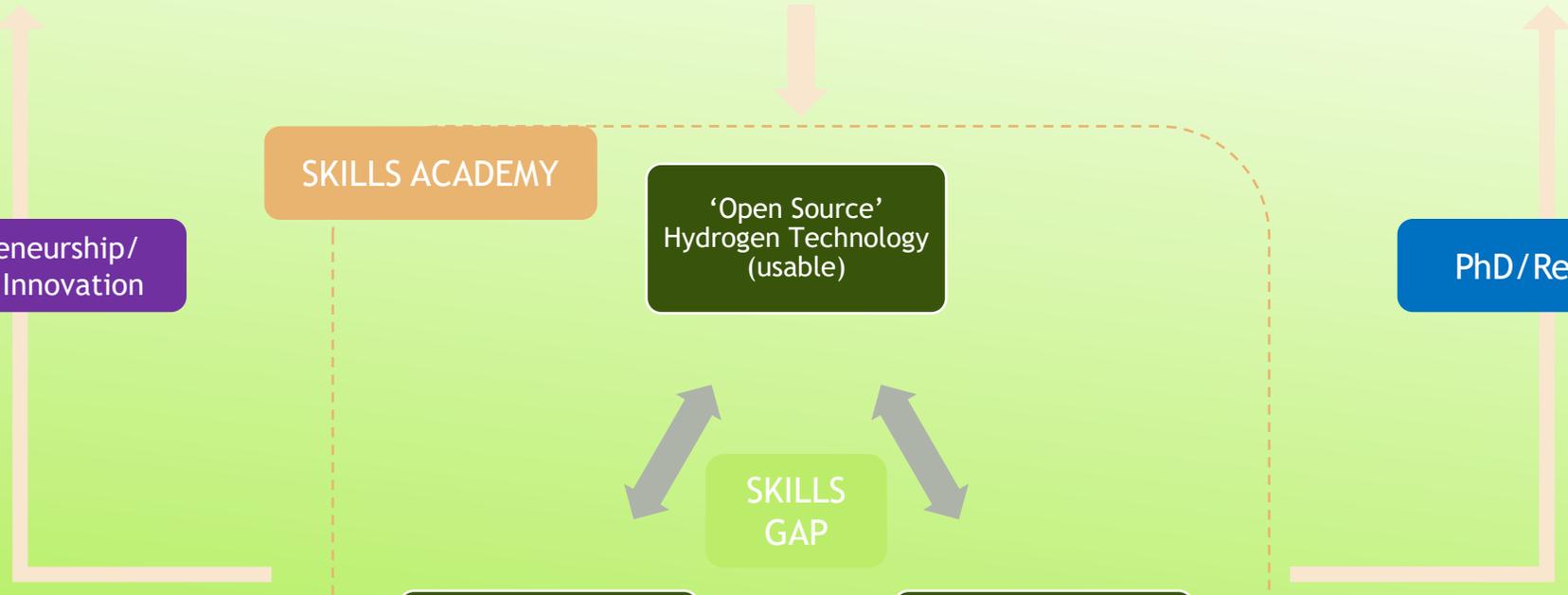


Intreprenurship/  
Service Innovation

SKILLS ACADEMY

'Open Source'  
Hydrogen Technology  
(usable)

PhD/Research



Reskilling/Upgrading  
existing workforce  
(Just Transition)

Newly Skilled  
Graduates (Level 7)



Entrepreneurship

Innovation  
Money ↔ Knowledge  
Research



# SKILLS ACADEMY

## ACADEMIC CONTENT OPTIONS (NON-EXHAUSTIVE)

MATRIX EDUCATION WITH VERTICAL THEMES WITH HORIZONTAL CROSS CUTTING EDUCATION.

UNLIMITED THEMES, REACTING TO SPECIFIC NEED OR DEMAND.



FE DELIVERY PARTNER

HE DELIVERY PARTNER

Theme 1 - Hydrogen (example)

Theme 2

Level 2 Qualification (Essential Skills, etc)

Level 3/4/5 Qualification

Level 6 Qualification (Degree)

Level 7 Qualification (PG CERT)

Level 8 Qualification (PHD)

Chemistry and Chemical elements	Physics, Maths	Academic content option	Academic content option	Academic content option	Academic content option
Hydrogen Applications and Technologies	Gas engineering	Academic content option	Academic content option	Academic content option	Academic content option
Process technologies	Transport Phenomena		Academic content option	Academic content option	Academic content option
PG Cert Hydrogen Energy Systems	PG Cert Hydrogen Safety		Academic content option	Academic content option	Academic content option
Projects			Academic content option	Academic content option	Academic content option

## About Hydrogen Safety Engineering and Research

Hydrogen Safety Engineering Research at Ulster University.



Skills focused on the development of breakthrough safety strategies and innovative engineering solutions for hydrogen.



## Hydrogen safety (PgCertPD)

This fully online program consists of two modules : (ENE821): Principles of Hydrogen Safety and (ENE825): Hydrogen safety technologies

**NORTHERN**  
Regional College

NORTHERN REGIONAL COLLEGE: NEW HYDROGEN COURSE A FIRST IN UK AND IRELAND



Modules in hydrogen skills

The logo for Queen's University Belfast, featuring a red shield with a white cross and the text "QUEEN'S UNIVERSITY BELFAST ESTD 1845". Below the logo is a photograph of the Queen's University Belfast building.

PgCert | Postgraduate Taught

## Hydrogen Energy Systems

# Hydrogen Training Academy – Pilot Programme

Funders and sponsors include ;

A partnership led by Mid and East Borough Council to develop a **continuous learning pathway** to create a **state-of-the-art learning environment** and deliver **essential training on hydrogen skills**.

*Developing skills training to support a greener future*



UK Government



EP UK Investments



Fuel Cells Demo @ NRC



H2 Gas Safe Lab @ Silverwood



Fuel Cells Demo @ NRC



Led by  
**Mid & East  
Antrim**  
Borough Council

**NORTHERN**  
Regional College



UNIVERSITY OF  
BIRMINGHAM



# MSc NET ZERO ENGINEERING: *COURSE OVERVIEW*

**Nathan Skillen**  
*Programme Director*

 [n.skillen@qub.ac.uk](mailto:n.skillen@qub.ac.uk) 31st May 2023, Belfast

News story

## UK becomes first major economy to pass net zero emissions law

New target will require the UK to bring all greenhouse gas emissions to net zero by 2050.



# We've been here before so why is it different this time?



**Global carbon budget:** 6 years (+5 months) left to achieve the 1.5 °C target



**Net Zero Emissions:** ~93 countries have announced net-zero emissions targets with more being developed



**National Strategies:** 17 governments have released hydrogen strategies with an additional 20 announced they're working on theirs



**Cost of renewables:** the cost of global renewable energy prices has decreased by 80 % since 2010



**Financial Backing:** major investments across numerous sectors including >30 globally since 2017



**Global Engagement:** treaties forming and the Hydrogen Council now has 129 members, increasing from 60 in 2020

# COURSE STRUCTURE

## Six Taught Modules:

1. *Sustainability and net zero carbon criteria*
2. *Tools for quantifying energy and carbon*
3. *Applied renewable energy and low carbon technologies*
4. *Fundamental principles in hydrogen generation and use*
5. *Hydrogen system integration*
6. *Hydrogen system design and practice*

*PGCert in Zero Carbon Engineering*

*PGCert in Hydrogen Energy Systems*



**MSc Net Zero Engineering**

## Research Project in Net Zero (3 months)



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# COURSE STRUCTURE

## Timeline for course development...



**2021:** PGCert in Zero Carbon Engineering Launched (NI residents only)

**2022 (Jan):** PGCert in Hydrogen Energy Systems Launched (NI residents only)

**2022 (Sept):** MSc in Net Zero Engineering Launched:

- 4 students progressing from 2021/22 PGCerts

**2023:** Simultaneous courses running:

- MSc Net Zero Engineering (F/T and on-site)
- MSc Net Zero Engineering (P/T and distance learning)
  - Both MSc pathways can be coupled with an industry placement
- PGCerts in Hydrogen Energy Systems and Zero Carbon Engineering:
  - Online delivery
  - Now open to UK and International students



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# COURSE STRUCTURE

## MSc Net Zero Engineering



### Full-time & on-site teaching (Belfast)

- Duration: 1 year (Sept to Sept)
  - Semester 1 – Zero Carbon Engineering
  - Semester 2 – Hydrogen Energy Systems
  - Semester 3 – Research project
- Optional 1 year industry placement

### Part-time & distance learning (Online)

- Duration: 2-3 year (Sept to Sept)
  - Year 1 (Sept to May) – Zero Carbon Engineering
  - Year 2 (Sept to May) – Hydrogen Energy Systems
  - Research project – 2 options:
    - F/T and industry aligned project – Year 2 June to Sept
    - P/T – Year 3 Sept to May
- Exit routes:
  - PGCert in either Zero Carbon Engineering or Hydrogen Energy Systems
  - PGDip in Net Zero Engineering (both PGCerts)



QUEEN'S  
UNIVERSITY  
BELFAST

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AND CHEMICAL  
ENGINEERING

# MSc Net Zero Engineering

## *Research projects*



- *Following the completion of both PGCerts, four students are currently undertaking research projects as part of their MSc degree in Net Zero Engineering*
- *They will be some of the first graduates from the MSc and will demonstrate the how the PGCerts can be utilised to achieve this*



*Sizing hydrogen  
infrastructures  
needed for FCEV  
(Wrightbus)*



*The role of  
hydrogen for HGVs  
in NI*



*Biomethane  
injection into the  
NI grid (Phoenix)*



*Technology for  
GHG direct air  
capture in NI*

- ***Building on this...**Currently 15 students from 2022/23 PGCerts stated an interest in progressing to complete the MSc*

# SKILLS DEVELOPMENT ON THE MSC



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## Fundamental Understanding

Core understanding of operational and emerging low-carbon technologies and their environmental impact.

## Innovation

Design low-carbon energy systems and conduct research into areas like energy storage, gas separation, hydrogen production and advanced materials.

## Driving Sustainability

Gain expertise in tracking and assessing net-zero goals such as safety protocols and greenhouse gases emissions.

## Tools for Design

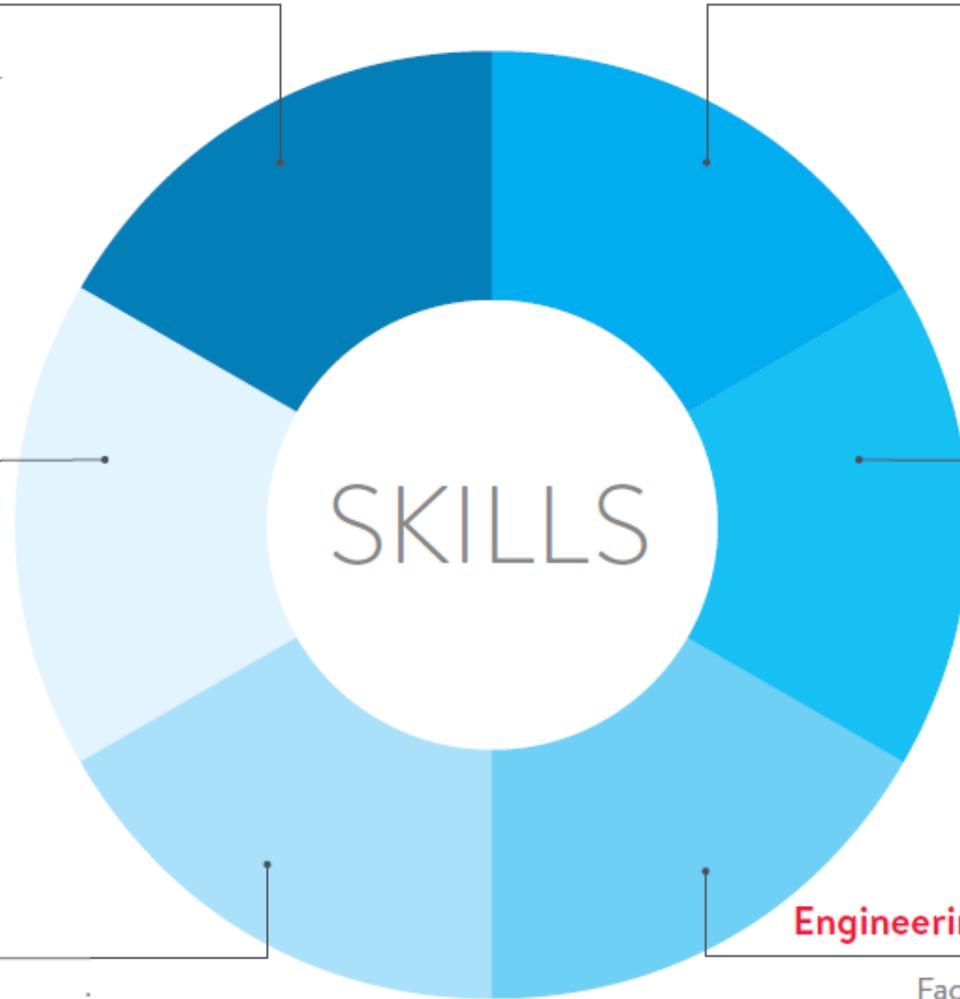
Modelling and Simulation – From energy and mass balance calculations, to modelling the behaviour of low carbon technologies and energy systems.

## Communicate Opportunities

Engage with key stakeholders to explore the impact and drivers behind low-carbon technologies.

## Engineering Systems Integration

Facilitate the design and deployment of whole energy systems and sub-components from concept to integration.



# WHAT WILL THE COURSE DO

## Develop a professional portfolio in renewable energy:

- Addressing current and emerging challenges and opportunities in the renewable energy sector
- Achieving sustainability and growth of *'low-carbon societies'*
- Enhanced understanding of core scientific and engineering principles underpinning net zero engineering
- Dissemination and communication of key findings to improve public perception of renewable energy
- Experience in designing and researching low-carbon energy systems



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ENGINEERING



# WHAT WILL THE COURSE DO

## Skills and profile desirable for multiple sectors and industries:

- **Manufacturing** – key components within low-carbon systems and sub-components
- **Research** – emerging technology in production, use and storage of low-carbon energy
- **Consultancy** – working with companies to deliver and meet low-carbon initiatives and targets
- **Policy development** – engaging with stakeholders in industry, government and research to facilitate advancement
- **Safety** – apply protocol and strategies to current and future infrastructure
- **Renewable energy strategies** – compliance and management



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