Creating a new hydrogen economy in the Midlands

Training needs analysis report

Hydrogen skills for the East Midlands (UK)

HyDEX.ac.uk

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EXECUTIVE SUMMARY

The hydrogen economy offers a transformative opportunity for advancing the UK's net-zero ambitions, with the East Midlands positioned to lead the way. Capitalising on its industrial heritage and renewable energy infrastructure, the region has the potential to become a cornerstone of the hydrogen supply chain. However, achieving this vision requires a skilled and adaptable hydrogen workforce capable of meeting the demands of this emerging sector. This report presents a comprehensive Training Needs Analysis (TNA), identifying key gaps, challenges, and opportunities in preparing the region's workforce for a hydrogen-powered future.

First of all, the findings reveal a pronounced demand for hydrogen-specific skills, particularly in areas such as safety, regulatory compliance, and infrastructure development. It also stated the need for strategic leadership skills to guide organisations in integrating hydrogen technologies effectively into their current businesses. Despite these demands, the report highlights significant shortcomings in the current educational landscape. There is a notable absence of hydrogen-specific content in T-levels and undergraduate programmes, limiting pathways for students to advance into specialised hydrogen roles. Furthermore, existing courses are often under-advertised and inaccessible to companies due to internal governance and funding barriers. Secondly, stakeholder engagement has further emphasised the importance of embedding hydrogen knowledge across sectors, from production to end-use applications. Industries highly value adaptable individuals with problem-solving skills but frequently struggle with misaligned job descriptions and unclear expectations for hydrogen-specific roles. The findings suggest a critical need to not only develop tailored training programmes but also raise awareness about the broader energy transition and its implications for businesses.

To address these challenges, this report proposes the development of structured educational pathways, including hydrogen-specific content in T-levels and higher technical qualifications, bachelor's degrees, and leadership programmes. It underscores the importance of integrating key modules such as safety, risk management, and hydrogen logistics across all training levels and improving access to these modules for upskilling the existing workforce. The report also highlights the need for enhanced collaboration between education providers, industries, and policymakers to ensure that training programmes remain dynamic and aligned with the evolving needs of the hydrogen economy. By implementing these recommendations, the East Midlands could potentially overcome its current workforce challenges and position itself as a leader in the UK's hydrogen economy. This approach will not only strengthen the region's role in advancing net-zero targets but also foster innovation, sustainability, and economic resilience for years to come.

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1. INTRODUCTION

1.1 Background

The next decade is critical for addressing climate change. To meet the targets set by the Paris Agreement – limiting global warming to 1.5°C and achieving net-zero emissions, the global decarbonisation rate, which was 2.5% per year as of 2022, must increase by at least seven times [1]. This means reaching an annual average rate of 17.2% to stay on track. However, in 2023, the world achieved only a 1.02% reduction in carbon intensity, the smallest decrease since 2011. As a result, the required annual decarbonisation rate has now risen to 20.4%, significantly higher than last year's estimate [2].

In this context, rapidly developing a low-carbon hydrogen economy can accelerate the transformation of the energy sector and play a crucial role in the overall process of energy conservation and emission reduction. This is because hydrogen offers unique advantages in decarbonising sectors that are difficult to electrify, such as heavy industry, transport, and energy storage. It can also serve as a replacement fuel where electrification is impractical or too costly. In fact, the UK has already recognised hydrogen's potential through its Hydrogen Strategy (published in August 2021), and most recently updated targets is 10GW of low-carbon hydrogen capacity by 2030 [3]. The East Midlands (UK), with its rich industrial history, renewable energy infrastructure, and ongoing hydrogen projects, is poised to become a key player in the UK hydrogen economy.

However, although hydrogen technologies have advanced, the entire hydrogen industry and supply chain remain in their early stages of development. This means establishing a low-carbon hydrogen economy requires not only technological innovation but also significant progress in workforce training and skills development, with a strong focus on end-use applications, safety standards, and skilled workers.

1.2 Project Objectives

The objective of this project is to assess the current and future workforce needs of the hydrogen economy in the East Midlands and the aim to:

- Identify gaps in current curricula and the hydrogen-specific skills required across the hydrogen supply chain.
- Guide the development of new curriculum modules (at T-levels and university levels) and adapt existing ones to include critical hydrogen-related competencies.
- Facilitate collaboration between education providers and industry to ensure the workforce is prepared for roles in hydrogen production, storage, distribution, and safety management and usage.
- Ensure the East Midlands is prepared to have the necessary skilled workforce to lead in the hydrogen sector as part of the UK's net-zero strategy.

1.3 Project Scope

This project aims to prepare education providers (mainly, universities and colleges) for the development and delivery of a regionally relevant hydrogen curriculum in the East Midlands (UK) in the context of supporting local Small-Medium-Enterprises (SMEs) to adopt hydrogen as a fuel or in their products and services. It builds on knowledge gathered from HyDEX[i] research and feasibility work funded by EMIoT[ii], focusing on skills necessary for hydrogen production, storage, management, and usage.

The project will guide the integration of hydrogen skills into existing curricula and create new educational offerings as needed, ensuring that the skills and education becomes a driver of hydrogen and green energy uptake in the region. To achieve this, the following key activities are included:

- **Review of Market Needs**: Analyse hydrogen-related workforce demand based on industry recruitment trends in the East Midlands (Section 2).
- **Industry Engagement**: Engage with hydrogen industry leaders to understand their role and future workforce needs (Section 3).
- **Review of Existing Training Programmes**: Assess current technical curricula for hydrogen-related content (Section 4).
- **Recommendations for Education Providers**: Develop recommendations to support education providers in delivering a hydrogen curriculum that aligns with regional industry needs (Section 5).

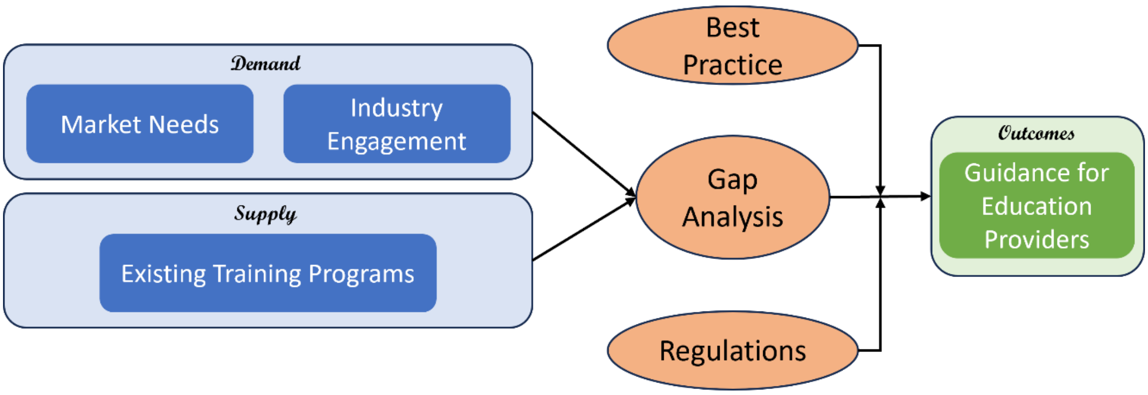

FIGURE 1: VISUAL REPRESENTATION OF THE RELATIONSHIP BETWEEN ACTIVITIES AND OUTCOMES

i – **HyDEX** stands for "Hydrogen Development and knowledge EXchange" which is a three-year programme with eight universities who are all associated with the Midlands-based Energy Research Accelerator (ERA). The ultimate goal for HyDEX is to address a market failure and challenge – How do you rapidly build a new business, industrial and manufacturing sector when very little exists already? Each partner within HyDEX is making their hydrogen facilities, research capabilities and expertise available to businesses in order to accelerate innovation in hydrogen.

ii – The UK Government created Institutes of Technology (IoTs) to tackle the skills gaps in high-level technical education in the UK. There are 21 IoTs across England, all delivering much-needed STEM (Science, Technology, Engineering, and mathematics) skills closely aligned to local economic growth and opportunity. The East Midlands IoT (**EMIoT**) is a partnership between Loughborough and Derby colleges and universities and coordinates the technical skills provision from T-Levels through to master's in engineering, digital, professional construction, and zero-carbon technologies.

2. MARKET OVERVIEW: HYDROGEN ECONOMY AND WORKFORCE NEEDS

2.1 East Midlands’ Role in the Hydrogen Economy

The East Midlands Freeport (EMF) was announced as a successful Freeport bid by the UK Government in March 2021. It is the UK's only inland Freeport and will drive economic regeneration across the East Midlands. There are three main sites within this region – (1) East Midland Airport and Gateway Industrial Cluster; (2) East Midlands Internodal Park; (3) Ratcliffe-on-Soar Power Station. Underpinning this is a unique and world leading combination of partners focused on creating tens of thousands of jobs, boosting skills and accelerating the region’s commitment to decarbonisation and Net Zero through low carbon energy investments.

Within the region, there is growing demand as well as great potential for hydrogen, especially for industries that cannot have some or all of their processes electrified, such as brickwork, automotive production and transportation, building materials, food & drink manufacturing and aviation. Overall, there are over 44 organisations who demonstrated an interest in bringing hydrogen into their existing business, of which 22 of them (see Appendix A for details) have signed the hydrogen connection MOU (Memorandum of Understanding) [4]. Collectively this group represents an in-region hydrogen demand exceeding 10TWh per annum – the largest single industrial hydrogen demand cluster in the UK.

2.2 Review of current Hydrogen-Skilled Workforce (UK)

In the UK, earlier studies have been conducted to assess the existing status of the current workforce that enables support for the commercialisation of the hydrogen economy, and they have revealed that there is a lack of skilled workers throughout the hydrogen supply chain. This section discusses three of the most well-referenced case studies.

2.2.1 Green and hydrogen jobs in the Midlands (2023)

This report that was produced jointly by HyDEX and Warwick Institute for Employment Research [5]. The study highlights several key outcomes regarding hydrogen jobs and green employment in the Midlands. The analysis for hydrogen green jobs uses an inclusive approach which considers a much broader range of jobs that support a hydrogen economy. The analysis indicates that employment in hydrogen-related occupations is mainly in skilled and technical occupational roles, with the most common hydrogen-related occupation in the LFS data being electricians and electrical fitters.

Additionally, 10.2% of all job vacancies in the Midlands are in industries that are linked to or complement the hydrogen sector, the majority of job vacancies are classified as administrative and support occupations in the hydrogen industry (8.4% of all vacancies in the Midlands, with the most common occupations being programmers and software development professionals).. This growth aligns with national objectives for green energy, and hydrogen is becoming a significant part of the regional job market. Within this study, green jobs have been categorised into three groups:

- ***New and Emerging*** Occupations or pure green jobs which are completely novel,
- ***Enhanced Skills and Knowledge*** Occupations which capture changing worker requirements in some existing jobs,
- ***Increased Demand*** Occupations which result when green economy activities increase employment demand for some existing occupations (e.g., administrative and support roles for the hydrogen industry)

The report indicated that green jobs are growing, with *New and Emerging* green jobs comprising 3.9% of all employment in the region in 2022. This represents approximately 189,500 jobs, showing the Midlands' shift towards the green economy. Green jobs in the Midlands are clustered in industries such as construction, engineering, manufacturing, and transport, where the share of green employment is higher compared to the rest of the UK. These findings indicate that green economic activities are impacting traditional sectors, transforming the skills required for existing jobs, and creating new roles as the region moves towards sustainability.

Throughout the report, the collective term "green hydrogen occupations" refers to green employment in occupations either related to the *production*, *utilisation*, or *advancement of hydrogen* (e.g., research and development), or in another green occupation which supports the hydrogen industry.

Of all vacancies that mentioned hydrogen in the UK since end-2020, on average, 17% of these were in the Midlands. However, compared to the total number of job vacancies in the Midlands, the share that explicitly mentioned hydrogen only accounts for 0.08%. In addition, Hydrogen employment was mainly in skilled and technical occupational roles, with about 50% of hydrogen jobs concentrated in the manufacturing, construction, and professional, scientific, and technical sectors.

2.2.2 Liverpool City Region green hydrogen vision (2023)

Liverpool City Region (LCR) and EQUANS have been collaborating to develop a strategic hydrogen vision for LCR [6], primarily aimed at replacing current fossil fuel consumption with hydrogen fuel. This initiative has proposed four distinct Hydrogen Hub Archetypes:

1) Mersey Travel Bus Depot as an anchor for wider mobility applications.
2) Hydrogen Hub located at a waste treatment centre.
3) Hydrogen Refuelling Station strategically situated at a distribution centre.
4) Anchor Industrial Demand with adjacent mobility offtake.

In their work, they have categorised the hydrogen value chain into four key groups:

a) Production
b) Storage
c) Distribution
d) Applications

The skills analysis of this project has identified a need to retrain the current workforce in terms of:

- Behavioural Changes
- Adapted Skills
- Specialist Skills

Furthermore, the analysis highlighted that certain job roles could be one-time labour needs, while others may require recurring labour when establishing hydrogen projects within each of the four groups of the hydrogen value chain.

To support the development of the four different archetypes, the report has clustered hydrogen jobs into the following sectors:

- Engineering
- Technician / Tradespersons
- Logistics
- Management
- Safety & Quality Control
- Specialists

This strategic approach not only addresses the immediate labour needs but also ensures a sustainable and skilled workforce capable of supporting the long-term growth and implementation of hydrogen technologies in the region.

2.2.3 Hydrogen Skills Alliance (2023)

The Hydrogen Skills Alliance (HSA) is currently engaged with Cogent Skills in a project to establish the foundations of a hydrogen skills framework. This framework aims to ensure that hydrogen employers can access the talent necessary to compete, innovate, and grow, as the UK strives to meet the demands of a changing energy landscape and achieve its net zero ambitions through increased hydrogen utilisation. In this study, the hydrogen value chain is divided into three high-level categories [7]:

a) Hydrogen Production

b) Hydrogen Distribution and Storage

c) Hydrogen Usage

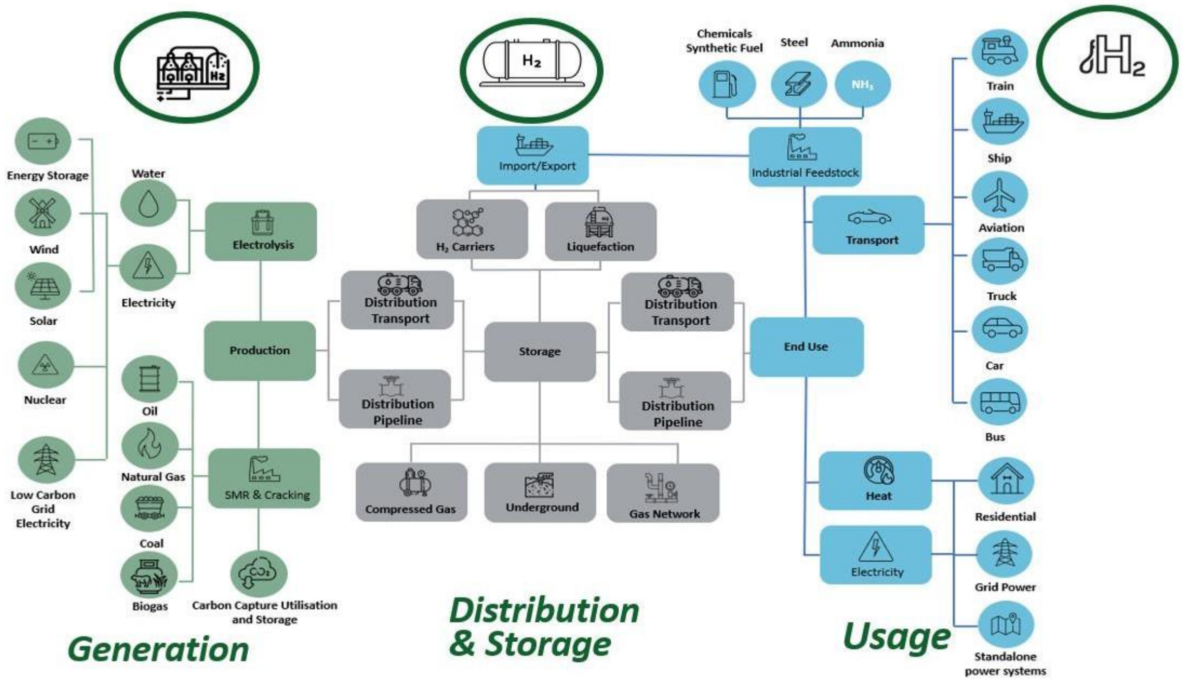

FIGURE 2: BREAKDOWN OF HYDROGEN ECONOMY BY HSA

Within these categories, numerous sub-categories are defined, providing detailed insights into the required hydrogen competencies, as shown in Figure 2. This structured approach highlights the specific skills and knowledge needed across the hydrogen sector. It shows that the skills and knowledge related to hydrogen storage have been integrated into the Hydrogen Distribution category, which contrasts with the recommendations of the LCR report. End-users are strategically divided into two groups: Mobility and Stationery (i.e., Heat & Electricity) applications. Additionally, hydrogen production is further clustered by specific generation mechanisms. This detailed categorisation helps to clearly identify the unique skills and knowledge required for each sub-category, thereby has the potential of enhancing recruitment accuracy and efficiency.

Furthermore, in May 2024, HSA and Cogent Skills published a “Hydrogen Workforce Assessment” that evaluates the current and future workforce requirements in the UK's hydrogen sector, identifying critical skills gaps and workforce challenges to support the UK's Net Zero Strategy by 2050. The report highlights that the UK’s Hydrogen Strategy (2021) aims to create 9,000 jobs by 2030 and 100,000 by 2050, but achieving these targets is hindered by limited current hydrogen production capacity. A substantial expansion of production infrastructure is needed, but workforce forecasting remains uncertain due to the early stage of the industry. The report indicated that the hydrogen sector faces significant skills and labour shortages, particularly in engineering and construction roles, many of which are already on the Skilled Worker Visa Immigration Salary List. Despite the overlap in skills with industries such as oil and gas, the hydrogen sector faces unique challenges in attracting qualified workers. A large majority (84%) of employers surveyed believe that the current workforce is inadequate to meet sector needs, creating barriers to growth and scalability. Specific challenges include an ageing workforce, high competition for talent, limited workforce diversity, and uncertainty around policy and investment timelines, which further complicate workforce planning. More details can be found in Ref. [8].

2.3 Analysis of Workforce Needed (via LinkedIn)

2.3.1 Online search design

This section presents the current demand for hydrogen-related workforce roles (in the East Midlands UK), identified through an online desktop search conducted on LinkedIn. The search criteria and initial categories were first established based on the review conducted in Section 2.2, as shown below:

Search criteria:

- The word "***Hydrogen***" should be included in either the ***Job Title*** or ***Job Description*** or ***Job Requirements***, when conducting online search.

Initial categories:

- Jobs associated with different sectors within the Hydrogen industry can be clustered into: ***Production, Storage, Distribution, Utilisation, R&D***.
- Hydrogen-related jobs can be viewed in terms of ***short-term*** (i.e., ensure hydrogen projects can be delivered) and ***long-term*** needs (i.e., Operation & Maintenance)
- Hydrogen jobs themselves can be divided into ***New, Enhanced***, and ***Admin & Support*** categories.

In April 2024, the first round of online searches was conducted on LinkedIn, using "*Hydrogen*" and "*East Midlands*" as the keywords to identify industry demand for hydrogen-related roles. A second round of searches followed six months later, in October 2024, using the same keywords to track changes in market demand. For these searches, the term "hydrogen" was required to appear in either the job title, job description, or listed skills. To focus on industry-specific needs, university-research positions were excluded from the results.

2.3.2 Results and insights [I]

In Round 1 of the search, 15 job vacancies were identified in the East Midlands region requiring hydrogen-related knowledge or skills. AECOM and Uniper were the primary recruiters, offering a variety of roles in the hydrogen sector (4 positions by AECOM, 3 positions by Uniper). In Round 2, conducted six months later, the number of hydrogen-related vacancies had decreased to 6 roles, with Uniper remaining the main recruiter, accounting for 3 out of the 6 positions. Detailed search outcomes are provided in Appendix B. The following part of this section summarises the key insights that support the understanding of emerging workforce needs in the hydrogen sector:

<u>Insight 1 – Hydrogen market engagement beyond MOU</u>

The first observed phenomenon is a potential disconnect between companies listed in the Memorandum of Understanding (MOU) for hydrogen development and those actively recruiting for hydrogen-related roles. The fact that all 21 identified positions (15 in the first round and 6 in the second) came from companies that did not sign the MOU suggests that the hydrogen job market is expanding independently of these formal partnerships. Hence, it suggests:

a) the demand for hydrogen-related skills may be more widespread across different sectors than previously anticipated.

b) an opportunity to engage more companies would be beneficial when considering the hydrogen skills training and development in the East Midlands regions – see section 3.

c) further outreach may be needed to explore why MOU companies have not yet advertised any hydrogen-related roles (e.g., what are the barriers – whether they are related to project funding, timeline delays, or other strategic factors) – see section 3.

Insight 2 – "Enhanced" roles are more urgently needed than "New" roles

The second observed phenomenon based on the online LinkedIn search results are listed as the following:

a) **Lack of Hydrogen-Specific Job Titles**: Among the 21 jobs identified, none of the advertised roles included the word "Hydrogen" in the job title. This suggests a trend where employers are not yet creating dedicated, hydrogen-specific positions but instead embedding hydrogen responsibilities within existing roles.

b) **Limited Mention of Hydrogen Skills**: Only 7 out of the 21 roles explicitly required hydrogen skills or knowledge in the associated job skill requirement. In these cases, the terminology used included "*H2*," "*Hydrogen*," and "*Hydrogen Production/Storage*." Note that there were no advertised roles requiring skills or knowledge regarding hydrogen *utilisation*, *distribution*, and *R&D* in the associated job skill requirement section, even though some of the advertised roles would involve working with hydrogen system or hydrogen-powered vehicles.

c) **General Engineering and Management Roles Involving Hydrogen Projects**: The remaining 14 jobs were traditional roles (e.g., Mechanical Engineer, Procurement Manager, QA Lead, Process Engineer, Mobile Support Engineer), which included hydrogen projects as part of the broader job responsibilities rather than the primary focus. This implies that employers are currently integrating hydrogen tasks into existing positions, rather than creating separate roles dedicated exclusively to hydrogen activities.

Overall, based on these findings, current employers appear to be adopting a flexible approach by integrating hydrogen-related responsibilities into traditional roles rather than investing in entirely new, specialised hydrogen positions. This strategy likely reflects the early stage of the hydrogen industry, where there may not be a consistent, high volume of hydrogen-related projects to justify hiring dedicated specialists. Instead, employers may prefer to upskill existing employees or recruit for versatile roles that can adapt to evolving business needs. In addition, the focus on generic roles with hydrogen project involvement suggests potential candidates are expected to bring a solid foundation in engineering, project management, or process design, along with a willingness to learn and apply new hydrogen-specific knowledge. This trend aligns with the broader need for transferable skills across industries, highlighting the importance of adaptability, a strong technical background, and the ability to step into hydrogen projects as needed.

Insight 3 – Essential hydrogen leadership

The third observed phenomenon based on the online LinkedIn search results are listed as the following:

a) **Need for a Two-Stage Transition Approach**: the online job search underpins that many organisations do not yet recognise hydrogen as a potential solution to their energy challenges/transitions. For companies unfamiliar with hydrogen technologies, acknowledging the broader need for an energy transition is the first critical step. Without this foundational awareness, organisations cannot effectively plan or execute a transition to hydrogen. Hence,

   Stage 1 (Awareness courses needed) - Companies must first understand and accept the necessity of transitioning their business to align with decarbonization goals via hydrogen-route. This involves acknowledging their current reliance on conventional energy sources and the risks this poses in a future net-zero economy as well as the potential benefits/redundancy from hydrogen.

   Stage 2 (Dedicated Hydrogen Leadership) - A significant majority (16 out of 21 roles) are advertised at the Mid-Senior or Director level, involving division leads or company directors responsible for strategic oversight and decision-making. The findings highlight the importance of having a dedicated leader to guide a company's transition into the hydrogen economy.

   Despite the importance of this role, the online job search also suggests that employers lack a clear vision of what an effective hydrogen leader should look like. Job descriptions do not consistently articulate the skills and competencies required for the proposed daily work and responsibilities, indicating a gap in employer understanding .

b) **Small Demand for Hydrogen-Specific Skills**: Only 5 positions are at the entry level, and these are predominantly within existing hydrogen-integrated power plants (e.g., Uniper) or hydrogen vehicle applications. This indicates a limited demand for entry-level talent outside of these specific sectors. Other sectors, such as manufacturing, food & drink, and general industrial applications, show minimal immediate demand for hydrogen-specific skills. These industries may require workforce training in hydrogen at a later stage, as their adoption of hydrogen technologies progresses.

Overall, based on these findings, it reveals a critical need for strong leadership during the transition to hydrogen. A capable hydrogen leader must be able to bridge the gap between existing business operations and new hydrogen projects, identifying opportunities and guiding the organisation through the complexities of the transition process. However, the lack of clarity in job descriptions suggests that employers may not fully understand the competencies required for this role. This gap highlights the need for a structured ***Hydrogen Leadership Development Course***, which would cover key areas such as strategic planning, stakeholder management, resource identification, and team building. Such a programme would be particularly valuable for upskilling existing senior managers who may not yet have expertise in hydrogen but possess the broader leadership skills needed to drive the transition.

3. STAKEHOLDER ENGAGEMENT ACTIVITIES

Considering the fact that limited hydrogen-related roles exist in the current job market, to gain a comprehensive understanding of the current and future hydrogen skills demand, a multi-faceted approach to engage directly with industry stakeholders was adopted. This included an online survey predominately targeting East Midlands industry participants, as well as a series of focused workshops (i.e., a HyDEX summer school, HyDEX Celebration Event, and Hydrogen Summit 2024) with key industrial experts and recruiters. The objective of these activities was to gather the missing insights from the "Job Search" (see section 2) on specific skill needs, identify existing gaps, and aligning training recommendations with industry requirements.

3.1 Industry Survey

3.1.1 Online survey design

An online survey was developed and distributed via HyDEX, Energy Research Accelerator (ERA), EMIoT, and EM Hydrogen channels, including companies involved in hydrogen production, storage, transportation, and utilisation. The survey is specifically aimed at East Midlands Industries with two key aspects: a) **Identify Current Skill Gaps** – participated companies were asked to provide feedback on the hydrogen-related skills currently lacking within their organisations; b) **Understand Future Skill Requirements** – The survey collected input on anticipated skills needed as the hydrogen economy grows, particularly in relation to emerging technologies and evolving industry practices. The survey questions can be found in Appendix C of this report.

3.1.2 Results and insights [II]

The survey received **17** responses across **15 companies/organisations**, reflecting a wide range of perspectives across different sectors. Table 1 below summarise the key characteristics of these 17 participants.

TABLE 1: SUMMARY OF SURVEY RESULTS

Category	Summary of Responses
Company Size Distribution	- Small Companies (1 - 50 employees): 9/15 - Medium Companies (51 - 500 employees): 2/15 - Large Companies (More than 500 employees): 4/15
Primary Hydrogen Activities	- Using Hydrogen: 6/15 - Producing Hydrogen: 4/15 - Distributing Hydrogen: 3/15 - Storing Hydrogen: 4/15 - Other: 4/15

i – there were 3 participants from the same company "*Cadent Gas*". There were some inconsistencies in the answers to some questions provided by them, even within the same company. This suggests that there may be diverse perspectives on the required hydrogen skills among different departments. These differences likely come from varying levels of exposure to hydrogen projects, differing responsibilities, or access to information about the company's strategic direction regarding hydrogen, which needs to be validated by further work. *However, it would be still reasonable to highlight the importance of cross-departmental communication and alignment when planning for future skills development.*

Recruitment Practices	- Past Recruitment: 6/15 - Future Recruitment Plans: 10/15 - Currently Recruiting: 2/15 - Explicit Use of "Hydrogen" in Job Titles: Yes (47%), Maybe (35%), No (18%), n=17
Most Important Technical Skills	- Safety Protocols and Risk Assessment: Rated important by 11/15 companies - Regulatory Compliance: Highly valued, especially by larger firms - Hydrogen Production and Storage Knowledge are commonly referred
Most Important Soft Skills	- Adaptability and Problem-Solving: Needed due to the dynamic nature of the hydrogen industry (i.e., 14/15 companies) - Leadership and Project Management: Crucial for guiding hydrogen projects
Educational Requirements	- Bachelor's Degree: Most common requirement - Higher Qualifications (Master's, PhD): Preferred for specialised or research roles - Technical/Vocational Qualifications: Important for hands-on technical roles
Professional Development Needs	- On-the-Job Training - Technical Workshops and Seminars - Industry Certifications - Mentorship Programs

Insight 4 – Misalignment between job descriptions and candidate expectations

The result reveals that "*administrative and support*" roles within the hydrogen sector are limited in both the number of available positions and the technical requirements. Among the surveyed companies, four companies stated their primary focus as "Other" within the hydrogen economy, meaning they are not directly involved in hydrogen production, distribution, storage, or utilisation. Of which, three companies are focused on hydrogen research and development (R&D), while only one is engaged in administrative and support functions. This latter company's role centres on improving relationships between public and private sectors and providing academic support to promote hydrogen adoption. Note that, for this single identified Admin & Support opportunity, the employer indicated that the word "Hydrogen" would not appear in their job titles. However, they still expect candidates to possess significant technical knowledge and competencies, including:

- Knowledge of hydrogen production technologies
- Experience with hydrogen storage solutions
- Understanding of hydrogen transportation and utilisation
- Regulatory compliance and Safety standards

This trend is not limited to this company. Two additional companies, which also chose not to include "Hydrogen" in their advertised job titles, expressed similar expectations for candidates to possess strong technical competencies. The difference between the lack of hydrogen terminology in job titles and the high technical requirements for these roles could potentially increase recruitment difficulties, as it may create misalignment between job descriptions and candidate expectations.

Insight 5 – Candidate capability prioritisation

The survey results indicate that "***Safety*** Protocols and ***Risk*** Assessment" and "***Regulatory*** Compliance" are the most highly prioritised factors during recruitment across the majority of companies, even surpassing technical knowledge of specific hydrogen technologies. This highlights the industry's emphasis on managing risks and adhering to standards as foundational requirements for hydrogen-related roles. Additionally, many of these companies that prioritise safety and regulatory compliance see the "on-the-job" training as a valuable professional development opportunity to further boost their employees' skills and competencies. Hence, it is suspected that employers are confident candidates can quickly acquire technical knowledge and sector-specific skills once they start their roles.

Given the hydrogen economy's current stage (i.e., early market penetration) employers are generally looking for a consistent set of competencies across all sectors of the industry. The emphasis is less on deep hydrogen-specific expertise and more on ***problem-solving*** abilities, which are seen as critical to navigating the challenges of a developing hydrogen market. Adaptability and flexibility, while often mentioned as key traits, are arguably characteristics of individuals who are effective problem solvers. This reveals the importance of hiring individuals who can think critically and address complex issues as they arise.

Also, it is interesting to note that the importance of ***leadership*** and ***project management*** skills varies by company size. These competencies are highly valued by both small companies (less than 50 employees) and large companies (500+ employees). It is suspected that this is because the leaders often take on versatile roles in small companies and require structured leadership to manage large-scale projects and operations (project management role) when working at large companies. This highlights the growing need for leadership and multidisciplinary capabilities to support the hydrogen transition, which is in line with "*Insight 3*" derived from the Market Need Analysis in Section 2.

Insight 6 – Industry vision for desired skills and knowledge

The result reveals a diverse view of the industry's expectations for the future hydrogen workforce based on the responses of the following three survey questions.

Question 17: *What are the gaps in knowledge and skills in your current workforce that will need to be filled in order to adopt hydrogen technologies in the future?*

Question 19: *What new skills or knowledge areas do you anticipate will be important for the hydrogen-related roles within your company in the future?*

Question 20: *Do you have any additional comments or suggestions regarding skill sets and knowledge requirements for the hydrogen workforce in the future?*

Section A: Foundational Technical Expertise

The hydrogen industry expects a workforce equipped with core technical skills that are critical for supporting the safe and efficient development of hydrogen technologies, on top of the sector-specific hydrogen knowledge (e.g. production, vehicle). These include but not limited to:

- **Health, Safety, and Regulatory Compliance** – Strong emphasis on safety protocols, risk mitigation, and adherence to regulatory standards is universal across sectors. Companies highlight the importance of understanding explosive atmospheres, purging methods, and gas detection systems, and the differences between existing framework (e.g., natural gas) and hydrogen-specific frameworks.

- **Hydrogen Properties (Advanced)** – In addition to general physical and chemical properties of hydrogen, a deep understanding of hydrogen's behaviour, such as its impact on materials (e.g., embrittlement), flame propagation, and knowledge of storage and handling requirements is critical.

- **Materials Science** – Expertise in material selection for hydrogen infrastructure, especially components like pipelines and storage tanks, is increasingly important.

Section B: Skills for Cross-Sector Adaptation

The workforce needs to adapt existing skills to meet the unique demands of the hydrogen economy, including but not limited to:

- Adaptation from **Natural Gas** Expertise – Many companies see the current natural gas workforce as a foundation for hydrogen roles, with an additional "top-up" of hydrogen-specific training, such as handling hydrogen-only networks or blended systems.

- Adaptation from **Engineering** Expertise – Similar trends also apply to the current engineering workforce, especially Mechanical Engineering and Chemical Engineering. An additional "top-up" of hydrogen-specific training associated with the required sector is considered as a feasible solution to address skills shortage.

- Adaptation from **Safety and Risk Management** Expertise – Many professionals already work with dealing the risk of dangerous and explosive fuels, safety in both natural gas and nuclear sectors is vital and similar to hydrogen and so a "top-up" hydrogen training is a viable solution to the skills shortage.

This finding is in line with "*Insight 2*" derived from the Market Need Analysis in Section 2.

Section C: Hands-On Experience

The response also indicates that Roles such as technicians and maintenance engineers require hands-on experience with hydrogen systems. This includes training in system safety, troubleshooting, and testing (e.g., SAT/FAT). Note that, at the moment, companies need to train candidates from scratch, especially for roles like test engineers working with fuel cells. Hence, it is expected that there is a critical need to establish hydrogen-focused engineering apprenticeships and create structured pathways for upskilling existing workers, this is the priority at present with Health Safety and Risk management being those who need to be upskilled first.

3.2 Targeted Workshops

3.2.1 Workshop design and arrangement

To ensure the collected data accurately reflects the diverse needs for a hydrogen-skilled workforce, two targeted workshops were designed and organised. These workshops aimed to engage representatives from organisations and institutions that are often hard-to-reach via traditional online surveys but also play a crucial role in the hydrogen supply chain. This included regional education providers, policymakers, and local government authorities. While these stakeholders may not directly interact with hydrogen products or services, they contribute indirectly and are often underrepresented in previous studies, such as those people who train skilled workers or grant planning approvals. These two workshops were integrated into two distinct events in order to engage this unique group of attendees. The details of each event are as follows:

1) **HyDEX Summer School** – ran from 9th – 13th September 2024 and consisted of a one-week programme of lectures from the HyDEX partner university academics, and site visits to world-leading hydrogen research and demonstration facilities across the university partnership. Registered delegates for this event are predominately from universities across the UK and South Korea.

2) **EM Hydrogen Summit 2024** – On the 8th November 2024, over 130 business representatives, politicians, academics and policy makers came together for the East Midlands Hydrogen Summit 2024 at Loughborough University. The theme of this workshop is: "*Grow our Hydrogen education and skills offering – East Midlands Institute of Technology"* (Note: not all of them participated in this workshop).

3.2.2 Results and insights [III]

During the first workshop, held as part of the HyDEX Summer School, over 30 participants attended and were divided into 6 different discussion groups. Each group focused on a specific industry sector, enabling targeted discussions on the shortfalls and challenges faced by SMEs within their respective domains. This structured approach allowed participants to collaboratively explore sector-specific barriers and propose solutions tailored to the unique needs of SMEs in the hydrogen economy. Table 2 below summarises the findings from this workshop:

TABLE 2: SUMMARY OF FINDINGS FROM HYDEX SUMMER SCHOOL WORKSHOP

Domain	Discussion Focus	Skills and Knowledge Identified
1) Energy	**Physical and Cyber Security**: Emphasis on protecting physical assets (e.g., gas banks, equipment) and importance of cyber security for record-keeping and operational systems. **Qualifications and Accreditation**: Additional costs for achieving qualifications must be integrated into pricing structures. Qualifications should be accredited/nationally recognised, especially for SMEs relying on reputation. **Insurance Costs and Risks**: High insurance costs due to the risks associated with hydrogen technologies. Meeting insurance requirements involves ensuring compliance with specifications and safety standards.	- ***Cyber and physical security*** skills for assets and record-keeping. - Ability to navigate ***accreditation*** and ***certification*** processes. - ***Risk management*** and ***Cost modelling*** for insurance and ***Regulation compliance***. - Collaboration skills to gain trade body support.

2) Food and Beverage	**Energy Transport and Logistics**: Large costs associated with energy transport, handling, and distribution. Supply chain logistics is a critical component for hydrogen deployment. **Storage and Handling**: Forklift operation and service boiler skills identified as important. Hydrogen storage systems need to satisfy the cost and safety requirements. **Food Waste**: *Is possible to make hydrogen from food waste?* **National Infrastructure Integration**: Hydrogen should be part of the critical national infrastructure, requiring collaboration and systemic planning. **Business Planning**: Need for clear business plans to ensure hydrogen adoption aligns with operational and financial objectives.	- Skills in ***supply chain*** logistics and transportation. - Knowledge of ***hydrogen integration*** into national energy systems. - Knowledge of ***hydrogen storage*** and ***hydrogen handling*** - ***Business planning*** and strategy for hydrogen implementation.
3) Transport	**Transport** Hydrogen transport requires specific design skills to support safe and efficient systems. **Handling, Repair, and Maintenance**: Safe handling, repair, and maintenance of hydrogen systems are critical for operational success. **Safety Standards**: Compliance with safety standards is a priority in hydrogen-related operations. **Infrastructure**: Civil engineers are needed to design and implement hydrogen refuelling and storage infrastructure. **Storage Systems**: Expertise in managing hydrogen storage systems is necessary to ensure safety and operational efficiency. **Emergency Services**: Emergency service staff need hydrogen-specific training to handle incidents safely and effectively.	- Expertise in ***hydrogen transport***, ***design***, and ***maintenance***. - ***Safety*** training and ***Emergency preparedness*** skills. - Civil engineering for hydrogen refuelling infrastructure. - ***Storage management*** and ***Safety standard compliance***.
4) Construction	**Market Analysis**: Analysis of the hydrogen market, specifically when and where it is most needed. **Hydrogen Storage**: Safety and handling are critical for hydrogen storage systems. Focus on risk assessment, COSHH, and safety standards. **Hydrogen Transport**: Transportation of hydrogen is essential both to-site and within-site logistics.	- Skills in ***Risk assessment*** and ***COSHH*** compliance**.** - Expertise in ***hydrogen storage***, ***handling*** and ***logistics***. - ***Safety protocol*** adherence and operational efficiency in transportation processes.
(5 & 6) Health and Beauty	**Hydrogen Handling:** Safe handling of hydrogen fuel within the laboratories or factory facilities. **Financial and cost analysis**: A clear understanding of the cost and difficulties when replacing current energy source with hydrogen is very important.	- Knowledge of ***hydrogen handling*** - ***Financial analysis*** for hydrogen implementation.

During the second workshop, held as part of the East Midlands Hydrogen Summit 2024, over 40 delegates had signed up for this workshop. However, only representatives from local councils/authorities, government bodies, education provider, and other two industry bodies eventually participated. Table 3 below summarises the findings from this workshop:

TABLE 3: SUMMARY OF FINDINGS FROM EM HYDROGEN SUMMIT 2024 THEME 6

Topic	Findings
Handling Hydrogen (H_2)	Skills need to focus on those involved in ***building*** and ***designing hydrogen systems***.
Risk Assessment and Regulation	Need for fundamental knowledge to ***assess risks*** in the absence of regulations or to inform regulatory development. ***Related*** and ***transferable regulatory frameworks*** should be incorporated for hydrogen applications
Strategic Leadership and Public Awareness	***Leadership*** and ***planning*** skills are critical for building hydrogen infrastructure. ***Public*** and community **education and awareness** are essential.
End-Use Specific Knowledge	Specialised skills required for ***hydrogen applications*** in: - Aviation/propulsion - Combustion (heat) - Electricity generation - Hydrocarbon creation (fossil fuel replacement).

Insight 7 – Skills in high demand derived from workshops

Based on the workshop result summaries, the following skills are considered as highly-in-demand ones:

- **Safety and Regulation** – Participants from both workshops emphasise the importance of risk assessment, safety protocols, and regulatory compliance. Participants from workshop 1 specifically mentions COSHH compliance, whereas participants from workshop 2 highlights the need for risk assessment, even in the absence of regulations, and transferable regulatory frameworks.

- **Infrastructure Development** – Participants from both workshops identify the need for skills in hydrogen system design and infrastructure building. Participants from workshop 2 specifically discussed skills for designing hydrogen systems and leadership for infrastructure development.

- **Public Awareness and Leadership** – Participants from both workshops recognise the importance of strategic leadership and engaging with stakeholders. Participants from workshop 1 highlights collaboration with trade bodies and business planning for hydrogen adoption. Participants from workshop 2 stresses public education, awareness, and strategic leadership which also links the planning permission granting processes.

- **End-Use Applications** – Participants from both workshops mention specialised knowledge for hydrogen applications across various sectors, especially those who may interact with hydrogen passively as part of their responsibilities (e.g., emergency responders, planning inspectors).

- **Hydrogen Storage** – Skills and Knowledge regarding hydrogen storage should be marked as a compulsory element throughout the hydrogen supply chain as it is needed for all kind of hydrogen projects/applications.

4. CURRICULUM OVERVIEW: EXISTING HYDROGEN TRAINING PROGRAMMES (UK)

Hydrogen-related competencies can be effectively categorised into two primary sectors: ***Skills*** and ***Knowledge***. The skills sector encompasses the practical abilities required to handle hydrogen safely and efficiently, including the installation and maintenance of hydrogen equipment and systems. The knowledge sector pertains to the theoretical understanding necessary for making informed decisions within the hydrogen industry. This includes a comprehensive awareness of hydrogen properties, safety protocols, and regulatory standards, as well as strategic insight into when and how to apply specific skills.

At the time of writing this report, the following course are available (based-on UCAS & Google search using keyword "Hydrogen"). ***Note that****: the training courses listed in this section represent only a subset of the available offerings. Many additional university programmes, not explicitly covered here, also provide valuable hydrogen-related knowledge/skills as part of their degree courses. Due to the scope and objectives of this study, this report has excluded a) CDT (Centre for Doctoral Training) programmes (e.g. EnerHy CDT lead by Loughborough University, Cranfield University and University of Strathclyde) and b) courses with hydrogen modules embedded in broader degree programmes but have not explicitly mentioning hydrogen in their titles (such as those engineering courses delivered by Loughborough University, see Appendix E).*

4.1 Hydrogen Degree Courses

Due to the scope of this study, this section will exclusively focus on reviewing degree programmes that explicitly include the word "*Hydrogen*" in their course titles. These programmes are most likely structured around hydrogen technologies and are designed to train candidates as hydrogen specialists. It is important to note two key points: a) while there are numerous other degree programmes that incorporate hydrogen-related modules, a comprehensive analysis of these programmes falls outside the current scope of this study; and b) Research-orientated Masters (MRes.) and non-CDT PhDs are excluded from this review.

TABLE 4: LIST OF HYDROGEN DEGREE COURSE (UK)

University/College	Course Title	Course Type	Focus Areas	Special Features
University of Nottingham [9]	Sustainable Hydrogen CDT	PhD (4 years, CDT)	Hydrogen research, sustainability, energy systems	Doctoral research focus, aligns with industry and policy needs
University of Birmingham [10]	Fuel Cell and Hydrogen Technologies	MSc (1 year, FT)	Hydrogen safety standards, fuel cells, hydrogen production, business/project management	Includes hydrogen regulations and safety standards; strong industry alignment for employability
Brunel University London [11]	Advanced Chemical Engineering (Hydrogen and Low Carbon Technologies)	MSc (1 year, FT)	Hydrogen production, low-carbon technologies	Integrates hydrogen into advanced chemical engineering frameworks

i – **PgCert** (Postgraduate Certificate) which serves as a stepping stone for further education or career advancement, making it a versatile qualification. In this report, since it is a postgraduate qualification, it is considered as part of a degree pathway.

Ulster University (Belfast) [12]	Hydrogen Safety	PgCert[i] (1 year, PT)	Hydrogen safety engineering, safety technologies	Emphasises hydrogen safety science, regulatory standards, and engineering practices
Queen's University Belfast [13]	Hydrogen Energy Systems	PgCert (12 weeks, FT)	Hydrogen production, system integration, sustainability	Prepares students for sustainability-focused roles a wide range of engineering and manufacturing sectors in relation to hydrogen energy

4.2 Upskilling Courses

Apart from the above-mentioned degree course, there are several institutions offering upskilling courses designed to equip the current workforce with practical hydrogen competencies. These courses range from short-term training to certified courses, ensuring that professionals can transition into hydrogen roles or enhance their skills in the context of hydrogen use. Again, due to the scope of this study, this section will also exclusively focus on reviewing upskilling course that explicitly include the word "*Hydrogen*" in their courses' titles.

TABLE 5: LIST OF UPSKILLING COURSES (UK)

Course Provider	Course Title	Course Type	Focus Areas	Special Features
Cranfield University [14]	Hydrogen: fundamentals and materials challenges	Short Course[i] (4 days)	Hydrogen fundamentals, materials science	Focuses on material challenges in hydrogen systems
Coventry University [15]	Hydrogen Energy School	Short Course (3 days)	Hydrogen production, storage, safety, fuel cells	Hands-on activities in the Hydrogen Energy Applications Lab, focus on propulsion systems
HyDex via University of Birmingham [16] (TBC)	L5 Train-the-Trainer course in fuel cells and hydrogen fuel	Short Course (4 weeks, PT)	Fuel cells, hydrogen safety, generation, storage	Online course with practical session; focuses on fuel cell systems for technical trainers
HSE Solutions [17]	Hydrogen: The Fundamentals	Short Course (2 days)	Hydrogen properties, safety risks, regulations, risk mitigation	Focuses on hydrogen's behaviour, safety regulations (DSEAR), HAC, and emergency procedures. Available online
TÜV SÜD [18]	Training for component manufacturers	Short Course (1 day)	Hydrogen damage mechanisms, material selection	Geared toward component manufacturers, covers material resistance, and hydrogen-specific damage mechanisms
Institution of Chemical Engineers [19]	Hydrogen Workshop	Short Course (9 hours)	Hydrogen production, storage, risk assessment, supply chain	Includes SWOT analysis, mock HAZOP, and focuses on the global hydrogen industry, compression, and fuel cells

i – **Short Course**: focused on specific skills or knowledge, often non-credit-bearing.

Robert Gordon University (Aberdeen) [20]	Hydrogen Energy Systems	SCQF[i]-certified (10 weeks, online)	Hydrogen production, storage, safety, environmental impact	Emphasises sustainable development goals, and provides business development skills
University of the Highlands and Islands (Scotland) [21]	Hydrogen: An Introduction for Technicians	SCQF Lv7 (5 months, PT)	Safe handling of hydrogen, operation/design of hydrogen systems	Only nationally recognised Hydrogen PDA (Professional Development Awards) in Scotland
Blackburn College [22]	Hydrogen Vehicle Awareness	IMI[ii] Lv 1 Award (1 day, PT)	Hydrogen vehicle safety, hazards, refuelling	Provides entry-level awareness for handling hydrogen vehicles, suitable for non-technical staff
The Renewable Energy Institute [23]	Hydrogen Energy Course	GMC[iii] (30 hours)	Hydrogen economy, technologies, project management	Covers global hydrogen policies
Hydrogen Safe [24]	Level 1: Introduction to Hydrogen Safety Practices	Ofqual[iv]-regulated course (2 days)	Hydrogen production, safety practices, storage/transportation	Covers hydrogen safety fundamentals, risk assessment, and manual handling
	Level 2: Introduction to Hydrogen Safety Practices	Ofqual-regulated course (3 days)	Hydrogen production, safe storage, transportation, safety risks	Advanced modules, covers risk assessments, and safe hydrogen handling procedures
	Level 3: Introduction to Hydrogen Safety Practices	Ofqual-regulated course (5 days)	Hydrogen production, risk assessment, safety in hydrogen handling	Covers advanced hydrogen safety practices, UK policies, and includes comprehensive final assessment
Kiwa [25]	Hydrogen and the Natural Gas Network	IGEM[v]-accredited course (2 days)	Hydrogen safety, transportation, infrastructure, legal issues	Includes site tours, appliance testing labs, and discussions on hydrogen's role in decarbonisation
Burton and South Derbyshire College [26]	Level 3 in Hydrogen Fuel Cell Electric Vehicle Systems	City & Guilds[vi]-accredited (3 days)	Hydrogen fuel cell systems, testing, vehicle safety	Includes training on FCEVs like the Toyota Mirai

i – **SCQF** (Scottish Credit and Qualifications Framework) cover a broad range of qualifications in Scotland, credit-bearing. **Level 7** is equivalent to an Advanced Higher, Higher National Certificate, or first year of a degree programme.
ii – **IMI** (Institute of The Motor Industry) that specialised automotive industry training and certification, varying in duration and level, recognised within the automotive sector.
iii – **GMC** (Galileo Master Certificate) is an internationally recognised credential awarded by the Renewable Energy Institute (REI).
iv – **Ofqual** (The Office of Qualifications and Examinations Regulation) who regulates qualifications, examinations and assessments in England. **Level 1** to **3** are all entry levels.
v – **IGEM** (The Institution of Gas Engineers and Managers) is a UK-based professional body that promotes standards and safety in the gas industry. It supports individuals and organisations in the gas sector through professional development, accreditation, and the creation of technical standards.
vi – **City & Guilds** accreditation ensures that training programmes meet global quality standards, enhancing their credibility and value.

Riverside College [27]	Modern Engineering Maintenance: Industrial Maintenance and Repair of Hydrogen Network	Evening course (24 weeks, PT)	Hydrogen system maintenance, mechanical/electrical repair	Covers maintenance/repair for hydrogen systems, with focus on the Liverpool hydrogen network.
	Modern Pipe Welding: Industrial Hydrogen Systems		Pipe welding, fabrication, hydrogen safety, non-destructive testing	Focuses on welding and fitting for hydrogen networks, covers MIG/TIG/MMA welding, robot welding, and safety in the hydrogen sector
	Hydrogen Fuel Cells	Unknow yet	Basics of hydrogen, fuel cell technology, electrolysis, CO2	Includes lessons on fuel cell components, electrolysis, climate change, and hydrogen safety

***Note that**: In addition to the hydrogen-related courses provided by colleges and universities that have been listed in this report, it is important to acknowledge the contributions of professional organisations to hydrogen training. Organisations such as the National Composites Centre, Institute of Mechanical Engineering (IMechE), and the Energy Institute offer hydrogen-related training materials that are often designed as online awareness courses. These self-learning modules are typically open access and provide foundational knowledge for those seeking to familiarise themselves with hydrogen technologies. Another important consideration is the availability of the courses listed. The courses included in this report are those actively advertised and promoted at the time of conducting this study. It is worth noting that many training courses in hydrogen are not consistently delivered every year. Some of these courses may have been designed and delivered in the past but are no longer available, while others may have been temporarily paused or discontinued. For proportionality reasons, this study does not account for courses that were unavailable or inactive during the research period.*

4.3 Results and insights [IV]

The table of hydrogen degree courses (Table 4) reveals several key insights. First, these courses predominantly target ***postgraduate students*** and aim to provide advanced expertise in hydrogen technologies, safety, and sustainability. Courses like the PhD at the University of Nottingham and MSc at the University of Birmingham strongly align with industry needs, positioning graduates for employability in green energy sectors. Second, hydrogen safety is a significant theme, particularly in courses at Ulster University and Queen’s University Belfast, reflecting the growing importance of safe hydrogen use in industrial applications.

The analysis of the UK's hydrogen upskilling courses (Table 5) reveals that there is a diverse range of courses available, covering fundamentals, advanced technologies, and niche applications like fuel cells and industrial pipe welding. Most courses are ***short-term*** and ***modular***, allowing professionals to quickly address industry needs. The courses are suitable for both ***novices*** and experienced ***professionals***, aligning closely with the UK's decarbonisation goals.

In terms of ***qualifications***, 9 out of the 18 identified courses are accredited by respected bodies such as City & Guilds, Ofqual, and IGEM, ensuring industry recognition and clear progression pathways for learners. The remaining 9 courses are only able to provide certification of completion from the education providers.

Insight 8 – Commonly covered area by most courses

Based on the course information identified in sections 4.1 and 4.2, the following topics are considered as the cores areas that are frequently mentioned within different hydrogen courses:

- **Hydrogen Fundamentals** – Basic knowledge about hydrogen properties, its behaviour, and its role in energy systems is a foundational component of many programmes, especially introductory courses.

- **Hydrogen Production and Storage** – Nearly every course includes an overview of hydrogen production methods (e.g., electrolysis, steam methane reforming) and storage techniques (compressed gas, liquid hydrogen).

- **Hydrogen Safety** – Safety practices, risk assessment, and handling procedures are consistently emphasised, particularly in courses focused on hydrogen integration, transportation, and usage.

Insight 9 – Specialised areas covered by some courses

Based on the course information identified in section 4.1 and 4.2, UK education providers offer a list of specialised courses dealing with the following specific hydrogen areas:

- **Vehicle-Specific Training** – includes Fuel cell electric vehicles (FCEVs), Vehicle safety, Refuelling systems.

- **Infrastructure and Networks** – includes Pipeline systems, Network maintenance, Integration with existing gas network.

- **Materials Science** – includes Material selection, Hydrogen damage mechanisms.

- **Business and Project Management** – Birmingham MSc course incorporate business/project management skills, targeting employability and industry alignment (i.e., health & safety aspect).

- **Advanced Technical Topics** –including Fuel Cell components, design, and applications in both vehicles and stationary systems. Electrolysis, non-destructive testing, and system integration are also included in some particular courses.

Insight 10 – Rarely covered areas

Based on the course information identified in sections 4.1 and 4.2, there are some rarely mentioned areas in those course offerings and are listed as the following:

Section A: Hydrogen-related skills and knowledge

- **Regulations and Compliance** – Although a few courses have touched hydrogen safety regulations, UK policies, and compliance standards (e.g., DSEAR), especially in courses targeted at engineering and safety professionals, there is still a limited comprehensive coverage of international and domestic regulations and Gap in policy development and implementation.

- **Hydrogen Utilisation Beyond Vehicles & Pipelines** – While hydrogen vehicle safety and pipeline system are covered, there is limited focus on other aspects of hydrogen utilisation (e.g., industrial applications, power generation, or residential heating).

- **Hydrogen Integration in Non-Energy Sectors** – Currently, there are no specific courses designed to address hydrogen integration within sectors such as manufacturing, food & drink, or pharmaceuticals, where the potential for hydrogen use is growing.

Section B: Transferrable skills and knowledge applied in the hydrogen sector

- **Digital Skills** – The use of digital tools (e.g., data analytics, digital twins, and automation and control systems for hydrogen systems) is not widely integrated into current training programmes, despite their growing importance in engineering and operational contexts.

- **Economic Analysis** – there is a limited coverage of hydrogen economy and lack of detailed cost analysis training in the context of current and upcoming hydrogen market situation and development.

- **Supply Chain Management** – there is limited coverage of hydrogen supply chain specifics and missing focus on logistics optimisation which provide extra barriers to the company decision-making team(s) on top of ordinary technical difficulties (hydrogen-related).

- **Environmental Impact Assessment** – In some extreme case, a hydrogen product/service/facility may need to conduct a sufficient Environmental Impact Assessment (EIA). However, there is a limited detailed coverage of lifecycle analysis and missing focus on environmental monitoring in the context of hydrogen sector within existing courses.

<u>Insight 11 – Current education challenges</u>

Based on the course information identified in section 4.1 and 4.2, the current hydrogen education landscape in the UK lacks a clear, structured pathway for young people aged 16-18, and therefore could potentially create several challenges:

- **Visibility Problem** – Young people cannot easily visualise their potential career trajectory in the hydrogen sector.

- **Entry Barriers** – Without clear T-level courses, there's no standardised entry point for students interested in hydrogen technologies.

- **Progression Uncertainty** – Students don't know how their current educational choices will translate into future career opportunities.

5. RECOMMENDATIONS FOR HYDROGEN CURRICULUM DEVELOPMENT

5.1 Identified Gaps in Hydrogen Training Courses

This section summarises the findings from the market research activities, stakeholder engagement activities, and curriculum search activities. Table 6 below summaries all the identified gaps at a high-level and some of them are discussed in detail in the following texts.

TABLE 6: SUMMARY OF IDENTIFIED GAPS

Topic Emerged	Industry Demand	Existing Curriculum Supply	Gap Identified
Hydrogen Fundamentals	Companies require foundational knowledge of hydrogen properties and handling.	Frequently covered in most courses.	No major gap. ***But*** such courses are not widely noticed by most companies.
Hydrogen Production and Storage	Critical for infrastructure development and projects.	Commonly covered in existing courses.	No major gap. ***But*** hydrogen storage should be a standalone module for all sectors instead.
Safety and Regulatory Compliance	High priority for risk assessment, safety protocols, and regulatory knowledge.	Safety assessment and regulation are barely covered as part of some modules within certain courses regarding to specific case needs	Comprehensive training on international/domestic hydrogen regulations and compliance development is missing.
Advanced Hydrogen Fundamentals	Emphasis on understanding hydrogen damage mechanisms and material selection for infrastructure.	Some courses address material science topics, but they remain specialised.	Broader inclusion of damage mechanisms, impacts, and material science in general hydrogen courses is needed.
Hydrogen-Specific Leadership	A structured leadership program for hydrogen transition is crucial.	-	No hydrogen-specific leadership training is available. Urgent need for Hydrogen Leadership Development Courses.
Digital and Analytical Skills	Increasing relevance of digital tools, data analytics, and automation in hydrogen applications.	-	Development of courses that integrate digital and analytical tools for hydrogen systems is needed.
Hydrogen Utilisation in Industries	Focus on end-use applications, such as industrial heating, residential use, and energy storage, remains limited.	Courses on hydrogen utilisation beyond vehicles and pipelines are rare.	Increased coverage of industrial hydrogen utilisation and sector-specific integration is necessary.
Public Awareness	Engagement with the public and stakeholders for hydrogen adoption.	-	Courses that integrate communication and community engagement skills for hydrogen projects are required.

Environmental Impact Assessment	Hydrogen project developers need lifecycle analysis and environmental monitoring skills.	-	Lacking in current training offerings.
Hydrogen Supply Chain and Logistics	Strong demand for skills in hydrogen-specific logistics optimisation and supply chain management.	Minimal coverage of supply chain management in current education offerings.	Increased focus on hydrogen supply chain logistics in training programs.

5.1.1 Accessibility and adoption barriers to hydrogen courses

There is a significant lack of communication and collaboration between course providers and companies in the hydrogen sector. While a variety of hydrogen-related courses have been developed by different organisations and providers, they often remain unnoticed by companies that could benefit from them. This lack of visibility hinders the ability of companies to plan and access relevant training for their workforce.

In addition, even when companies become aware of existing courses, delays in internal approval processes can prevent timely participation. By the time approval is secured, the course may no longer be available, leaving the company unable to meet its training needs. This issue is compounded by the fact that companies may not prioritise immediate investment in training due to the uncertain timeline and profitability of the future hydrogen market. With the hydrogen market still in its early stages and subject to fluctuations, companies are often hesitant to allocate limited resources to workforce training. This hesitancy further exacerbates the skills gap.

Last but not least, course providers face their own challenges in sustaining their programmes. Many rely on government funding to make courses accessible to a broader audience. Without such funding, the full cost of the course falls on participants or their employers, making it financially prohibitive for many companies. This creates a cycle where course providers struggle to attract enough candidates, further threatening the viability of their offerings.

5.1.2 Integrating hydrogen storage into all sectors

Currently, hydrogen storage skills and knowledge are often coupled with hydrogen production or distribution roles. While specialist expertise is essential for projects specifically focused on hydrogen storage facilities, it is important to recognise that hydrogen storage is a critical component across all stages of the hydrogen supply chain. It should not be confined to roles explicitly titled "Hydrogen Storage" or "Hydrogen Distribution & Storage." Instead, it should be incorporated as a core module in all hydrogen-related training programmes, regardless of the specific role. This ensures that professionals across the sector (i.e., from production to end-use) have a fundamental understanding of hydrogen storage principles, enabling them to contribute effectively to the industry's growth. For example,

- **Hydrogen Production Facilities**: Continuously generated hydrogen needs to be stored before distribution, whether in a desired form awaiting collection by distribution lorries or through pipelines. Even with direct pipeline transport, experts with sufficient hydrogen storage knowledge are crucial for maintaining pipeline operations, as pipelines act as large storage devices requiring proper management.

- **Hydrogen Distribution Sector**: the need for hydrogen storage knowledge in this sector has already been highlighted by the HSA & Cogent Skills study.

- **Hydrogen applications** Various storage requirements exist for hydrogen applications. For instance, hydrogen storage tanks are installed in every HFCV, and much larger onboard storage tanks are required for hydrogen-powered trains, aircraft, and ships. Skilled individuals (inc. emergency responders) are essential for the operation and maintenance of these onboard storage systems.

By embedding hydrogen storage knowledge into training programmes at all levels, the workforce will be better equipped to address the diverse challenges of the hydrogen economy, ensuring seamless integration and operation across the supply chain.

5.1.3 Recommendations: a comprehensive "Hydrogen Transition Leadership" programme

Based on the gap analysis, it is reasonable to propose that there is a need to create a dedicated curriculum that integrates the following topic areas in order to support the successful adoption of hydrogen technologies in businesses:

- ✓ Hydrogen-Specific Leadership
- ✓ Safety and Regulatory Compliance
- ✓ Digital and Analytical Skills
- ✓ Public Awareness and Relationship
- ✓ Environmental Impact Assessment
- ✓ Hydrogen Supply Chain and Logistics

This programme should equip candidates with the skills and knowledge necessary to effectively navigate the complexities of the hydrogen economy and lead their organisations through a well-planned hydrogen transition, especially those in the senior leadership teams. The key objectives of this proposed programme should be:

- o Enable leaders to assess their company's specific requirements for hydrogen adoption and provide tools to identify hydrogen projects that align with their existing business workflows and strategic goals.

- o Teach leaders how to form and manage cross-functional teams (inc. safety culture) dedicated to hydrogen projects and ensure effective coordination between technical experts, operational staff, and external stakeholders (inc. the public and regulatory bodies).

- o Train leaders to identify potential risks associated with hydrogen projects, including technical, financial, and operational challenges and provide tools for proactive risk management, including strategies for mitigating identified risks and addressing uncertainties in project implementation.

- o Equip leaders with a deep understanding of hydrogen-specific safety standards and regulations (e.g., DSEAR, COSHH, ISO 19880, ISO 14687 etc.), and emphasise the importance of compliance to avoid legal and operational risks. *[**Note that** navigating to the appropriate set of Regulations, Codes, and Standards is extremely difficult and challenge. Appendix D demonstrates such complexity and difficulty by providing a minimum set of RCSs that applies to HFCV industry].*

- Foster predictive thinking to anticipate potential future risks and unknown issues in hydrogen integration.

5.2 Identified Gaps in Hydrogen Training Pathway

Based on survey results and an analysis of current training offerings, there is a notable misalignment between industry expectations and the availability of structured hydrogen-related education and training programmes. This misalignment poses challenges for both companies/organisations seeking skilled employees and individuals aspiring to build careers in the hydrogen sector.

5.2.1 Gaps identified to be addressed

Survey findings (Figure 1 below) reveal that the majority of companies value prior hydrogen-related experience when recruiting candidates, particularly for hands-on technical roles such as field test engineers and service engineers. These positions often require practical expertise in handling hydrogen systems, making experience a critical factor for employability. However, there is a lack of clear pathways for individuals to gain this experience before entering the job market.

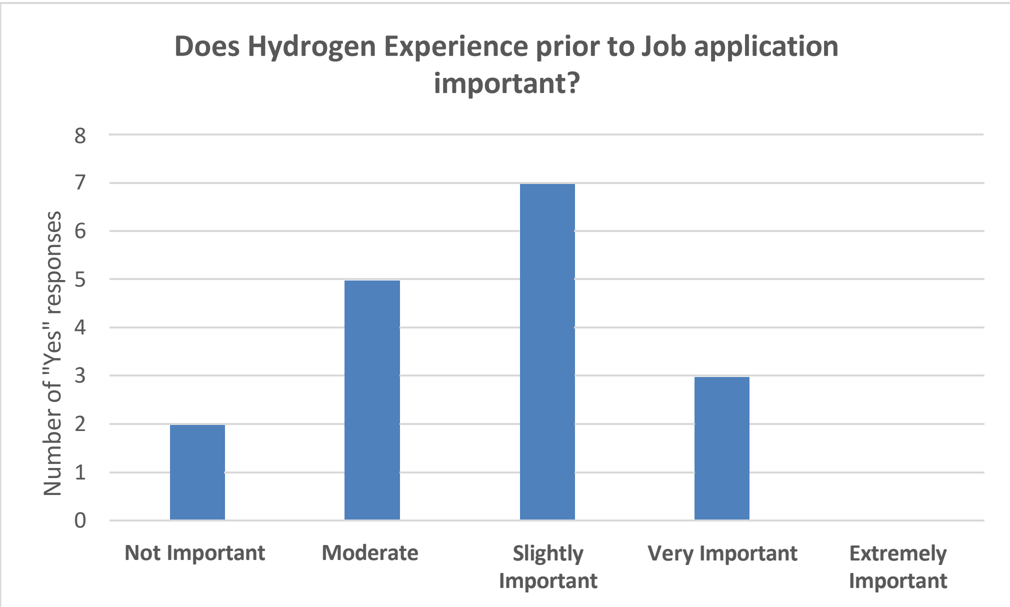

FIGURE 3: HYDROGEN EXPERIENCE PRIOR JOB APPLICATIONS

Currently, there is a significant gap in hydrogen-related education across different academic levels, for instance: The University of Birmingham and Brunel University London offers a hydrogen-related Master's degree, while the University of Nottingham has a PhD programme in hydrogen technologies. These are the only higher-level academic options (in England) explicitly focused on hydrogen. Therefore, there is an absence of dedicated hydrogen-related undergraduate programmes (Bachelor level). Also, there is no clear progression from T-Level programmes

(Technical Levels) (i.e., designed to prepare students for careers in technical industries) into bachelor's or master's hydrogen-related programs. Young people are unsure which T-Level courses would best position them for a career in the hydrogen industry.

5.2.2 Recommendations: a clear hydrogen-specific progression path

To address these issues, it is critical to establish clear and identifiable hydrogen-related education pathways. These pathways should include:

- ✓ **Hydrogen-Specific T-Level Courses** – Introducing T-Level programmes explicitly labelled with "Hydrogen" in their titles would attract students interested in renewable energy and sustainable technologies early in their education. These courses should include foundational modules in hydrogen production, storage, safety, and applications, providing a clear entry point for further hydrogen-specific studies.

- ✓ **Hydrogen-Specific Bachelor's Degrees** – Similarly, creating bachelor's programmes with titles like "Hydrogen Engineering," "Hydrogen Energy Systems," or "Hydrogen Technologies" would signal to students and employers alike that these degrees are tailored to the hydrogen sector. Clear branding and specialised content would encourage students to commit to hydrogen-related careers and prepare them with the skills required by the industry.

5.3 Recommended Success Criteria

The programme's success should be evaluated using a combination of process and outcome metrics. Process metrics assess the implementation of the training, such as enrolment numbers, attendance rates, and the extent to which the curriculum addresses key topics. Outcome metrics measure the impact of the training, including participants' knowledge improvement and organisational performance improvements. To ensure accurate evaluation, the programme should implement both short-term and long-term assessment. Short-term impacts can be evaluated through post-training surveys and knowledge assessments, while long-term outcomes should be revisited after 1-2 years to determine the training's sustained influence on companies, organisations, and the industry.

5.3.1 Short-term criteria (individual level)

The short-term goals of the programme should focus on its design, delivery, and immediate impact on candidates. Firstly, the programme must be fully developed and delivered on time, covering key topics identified and discussed in previous sections. It is essential to ensure that the course content aligns with industry standards, including ISO and IGEM guidelines, and is ideally accessible in both online and in-person formats to accommodate diverse learning preferences.

Secondly, participant engagement is another crucial metric. The programme should attract sufficient enrolment, particularly from SMEs' senior leadership teams, with at least X% (e.g., 70%+) of candidates completing the training. Feedback from them should reflect a high level of satisfaction, with at least X% (e.g., 70%+) rating the course content, structure, and delivery as meeting or exceeding their expectations.

Finally, in terms of knowledge acquisition, the programme should provide measurable improvements. At least X% (e.g., 70%+) of candidates should report increased confidence in their understanding of hydrogen fundamentals and their ability to evaluate their company's readiness for hydrogen integration.

5.3.2 Long-term criteria (organisational level)

Long-term goals should emphasise the programme's impact on participating organisations and its contribution to the broader hydrogen industry. For instance, the training should enable participating companies to build their internal capacity for hydrogen adoption. At least X% (e.g., 50%+) of organisations involved in the programme should initiate hydrogen-related projects within X (e.g., 3 or 5) years. Moreover, these organisations should demonstrate an enhanced role in the hydrogen supply chain, such as engaging in hydrogen production, storage, or utilisation.

Furthermore, the programme should also establish itself as a recognised benchmark for hydrogen leadership training. This includes maintaining dynamic content to meet evolving industry needs and attracting a growing number of candidates each year. In the meanwhile, financial sustainability is equally important as the programme should secure stable funding through government grants, industry partnerships, or other channels, reducing dependency on course fees.

Last but not lease, in the most ideal case, course candidates should demonstrate the ability to lead hydrogen-related initiatives within their organisations. Organisations should report that programme graduates have played a significant role in fostering internal hydrogen capabilities and mentoring team members.

6. CONCLUSION AND FUTURE WORK

6.1 Conclusion

The hydrogen economy represents a transformative opportunity for the East Midlands, but its success relies on aligning educational offerings with industry needs and addressing systemic barriers to workforce development. This report serves as a foundational resource to guide strategic actions that will strengthen the region's role in the UK's hydrogen strategy.

Within this report, it has systematically examined the current and anticipated needs of the hydrogen economy in the East Midlands. By conducting industry surveys, job market analyses, and stakeholder workshops, it identified significant gaps in hydrogen skills and knowledge across all stages of the hydrogen supply chain. The findings highlight critical areas, including the need for specialised leadership training, comprehensive regulatory compliance programmes, and clearly defined educational pathways from T-levels to postgraduate degrees. To address these gaps, it has provided actionable recommendations for curriculum development and industry collaboration. These measures aim to empower education providers, industries, and policymakers to prepare a skilled workforce capable of driving the hydrogen transition.

In particular, this report reveals that one of the key areas for local training development is hydrogen-specific technical skills – providing education on hydrogen storage and handling, with a focus on safe practices, effective storage system management, and adherence to safety standards. Additionally, there is a pressing need for courses that emphasise hydrogen safety and risk assessment, ensuring technicians and operators are well-versed in regulatory compliance, hazard identification, and emergency response procedures. Training in the design, installation, and maintenance of hydrogen infrastructure, including production, storage, and refuelling facilities, should also be prioritised, particularly for civil and mechanical engineers.

Last but not least, there is an urgent need for the development of leadership and strategic transition skills as well as a course on awareness of energy transition. Energy transition awareness programmes provide the business/company with foundational knowledge of the broader energy landscape and the role of hydrogen in achieving long-term sustainability goals. Whereas, senior leaders require tailored training programmes to guide their organisations through energy transitions, helping them identify hydrogen opportunities, build and manage internal hydrogen-focused teams, and navigate associated risks.

6.2 Future Work Actions

To address the limitations of this report (i.e., limited sample size during engagement activities) and ensure continued progress in aligning workforce development with the needs of the hydrogen economy, the following future work actions are proposed:

- **Expand Stakeholder Engagement** – Conduct additional surveys and workshops targeting underrepresented industries and organisations to refine insights and validate findings.

- **Pilot Programmes** – Develop and evaluate pilot training programmes, such as hydrogen-specific T-levels and leadership courses, to assess their effectiveness and scalability.

- **Collaboration with Policymakers** – Work closely with government bodies to ensure adequate funding and policy support for hydrogen education and workforce development initiatives. Also, ensure the developed training course suits their needs.

- **Exploration into Geographical Training Gaps** – Access to training for low-level roles may be hindered by travel costs or time constraints. Therefore, exploring the localisation of nationally available training courses is essential to ensure accessible low-level training for hydrogen-related jobs in key areas.

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APPENDIX A: LIST OF COMPANIES WHO HAVE SIGNED THE MOUS

TABLE 7: LIST OF MOU SIGNED COMPANIES

ID	Company Name	Industry Sector
1	Mercia Power Response	Power & Energy
2	2 Sisters Food Group	Food & Drink
3	Nestle Tutbury	Food & Drink
4	University of Nottingham	Education
5	Toyota Manufacturing UK	Automotive
6	Conrad Energy	Power & Energy
7	British Sugar	Food & Drink
8	NHS England (LRI)	Healthcare
	NHS England (City Hospital)	
	NHS England (Queens Medical Centre)	
9	Forterra	Building & Construction
10	Boots	Health & Beauty
11	East Midlands Airport	Transport
12	Samworth Brothers	Food & Drink
13	Soufflet Malt	Food & Drink
14	Carlsberg Marston	Food & Drink
15	Aggregate Industries	Building & Construction
16	Sofidel	Hygiene (Tissue)
17	R&R	Power & Energy; Transport; Defence
18	PepsiCo (Walkers)	Food & Drink
19	Loughborough University	Education
20	Saint-Gobain (British Gypsum)	Building & Construction
21	Hanson (HeidelbergCement Group)	Building & Construction
22	Molson Coors	Food & Drink

APPENDIX B: ONLINE SEARCH OUTCOMES

TABLE 8: ROUND 1 SEARCH RESULTS

ID.	Role Name	Role Level	Company name	Location	10 Skills		Job description
1	**Associate Director - Estimating-Nuclear/Renewables**	Director	Turner & Townsend	Nottingham	Hydrogen	Oil and Gas	"Due to the nature of the work, we are keen to speak with candidates who have experience in energy across one or more of the following - offshore wind, ***hydrogen***, solar, CCUS, Oil & Gas and Mining."
					Construction Engineering	On-Screen Takeoff	
					Magnitude	Quantity Surveying	
					Marketing	Strategy	
					Negotiation	Surveying	
2	**Process Engineer - Low Carbon**	Entry level	Uniper	Nottingham (Ratcliffe)	CO2-EOP	Plants	Conceptual and basic design of plants for generation, transport and storage of low carbon fuels (i. e. green ***H2***/NH3) and/or CO2. Relevant experience in engineering / owners engineering of gas or ***hydrogen infrastructure*** / plants / gas storage facilities.
					Gas Storage	Process Design	
					H2	Process Engineering	
					Low Carbon	Process Equipment	
					P&ID	Process Flow Diagram (PFD)	
3	**Boiler & Pressure Systems Engineer**	Mid-Senior level	Uniper	Nottingham	Hydrogen Production	Piping	Experience relating to power plant water/steam system interfaces with low carbon technologies, especially carbon capture/use/storage and ***blue hydrogen production***.
					Technical Reviews	Pressure Systems	
					Boilers	Site Inspections	
					Information Technology	Steam Generators	
					Low Carbon Technology	Technical Reports	
4	**Procurement Business Partner Steam, Gas & Storage**	Mid-Senior level	Uniper	Nottingham	Hydrogen Storage	Procurement	This role involves intense collaboration with business stakeholders across relevant countries, focusing on the three energy assets Steam (coal and biomass fired power plants), Gas (gas fired power plants) and Storage (Gas and ***Hydrogen storage facilities***).
					Business Requirements	Supplier Engagement	
					Cultural Diversity	Supplier Evaluation	
					Negotiation	Supplier Management	
					Operational Requirements	Supplier Relationship Management	
5	**QA Lead**	Mid-Senior level	National Gas	Ambergate	Communication	Regression Testing	We fuel growth and innovation, whilst transitioning our network to ***hydrogen***, to play our part in the journey to net zero
					Leadership	Software Quality Assurance	
					ISO Standards	System Testing	
					Manual Testing	Test Cases	
					Quality Assurance	Test Planning	

6	**Principal Mechanical Engineer**	Mid-Senior level	Energy Jobline	Newark-On-Trent	Communication	FEA	The Principal Mechanical Engineer role is focused on ***hydrogen fuel production*** and is near Newark-on-Trent. Mechanical design responsibility for multiple ***green electrolytic hydrogen*** projects
					CAD	Front End Engineering Design	
					Mechanical Engineering	Front-end Engineering	
					Boundaries (Land)	Problem Solving	
					Engineering Design	Process Flow Diagram (PFD)	
7	**Real Estate Legal Director Energy**	Mid-Senior level	Unknown Legal firm via a recruiter	Nottingham	Presentation	Legal Advice	You will have access to a range of complex, interesting and high value Energy Development projects across Renewables (Solar, ***Hydrogen***, Battery, Wind and Waste).
					Research Skills	Legal Compliance	
					Corporate Law	Litigation	
					Dispute Resolution	Mergers & Acquisitions (M&A)	
					Intellectual Property	Sociability	
8	**Mobile Support Engineer**	Entry level	Unknown Bus Manufacturer via a recruiter	Derby	Communication		Perform regular ***maintenance*** checks and software updates on ***hydrogen and electric vehicles*** to ensure optimal performance and compliance with industry standards. Provide technical ***training*** and guidance to clients and internal stakeholders on ***hydrogen and electric vehicle*** technologies, maintenance best practices, and safety protocols. Proven experience in ***hydrogen and electric vehicle*** systems is essential
					Problem Solving		
					Software Updates		
					Technical Support		
9	**Mechanical Design Engineer**	Entry level	Marcus Webb Associates Limited	Foston	Mechanical Engineering	Level Design	In this role, you will be responsible for designing complex mechanical systems for use in high-volume applications (such as automotive engines - diesel, hybrid and ***new automotive hydrogen engine technology***).
					Product Design	Mechanical Systems	
					Combustion	Motors	
					Failure Mode and Effects Analysis (FMEA)	Product Development	
					FEA	Product Requirements	
10	**E&I Manager**	Mid-Senior level	Unknown Engineering Consultancy via a recruiter	Nottingham	Bid Processes	Key Performance Indicators	Develop and implement project plans, schedules, and budgets for the E&I aspects of client projects across ***Hydrogen***, Decarbonisation, Oil and Gas, and Renewables sectors, for both FEED and full project lifecycles.
					Distributed Control System (DCS)	Oil and Gas	
					Electrical & Instrumentation	Onshore Oil and Gas Operations	
					Engineering, Procurement, and Construction (EPC)	Petrochemicals	
					Front End Engineering Design (FEED)	Project Plans	

11	**Field Service Engineer**	Entry level	Alexander Dennis	Midlands	Hydrogen Fuel	Field Service Management	You'll get to work on and learn about various ***vehicle*** drivelines, including battery electric, ***hydrogen fuel cell***, diesel and diesel hybrid
					Microsoft Products	Maintenance and Repair	
					Compressed Air	Motors	
					Computer Literacy	Preventive Maintenance	
					Customer-Focused Service	Transmission	
12	**EIA Associate Director**	Director	AECOM	Nottingham	Budget Management	Managing Project Budgets	Energy generation projects, including those that include carbon capture and storage, ***hydrogen*** and renewables (including solar and offshore)
					Chartered Environmentalist	Real Estate Development Projects	
					Customer Engagement	Report Writing	
					Delegation	Staff Mentoring	
					Environmental Impact Assessment	Technical Reviews	
13	**EIA Principal Consultant**	Mid-Senior level	AECOM	Nottingham	Project Management	Proposal Writing	Energy generation projects, including those that include carbon capture and storage, ***hydrogen*** and renewables (including solar and offshore)
					Business Development	Report Writing	
					Business Process	Resource Management	
					Environmental Impact Assessment	Staff Mentoring	
					Management Consulting	Technical Reviews	
14	**Senior EIA Consultant**	Mid-Senior level	AECOM	Nottingham	Research Skills	Marketing	Energy generation projects, including those that include carbon capture and storage, ***hydrogen*** and renewables (including solar and offshore)
					Teamwork	Negotiation	
					Business Process Improvement	Proposal Development	
					Environmental Impact Assessment	Regenerative Design	
					Management Consulting	Technical Reviews	
15	**Senior Air Quality Consultant**	Mid-Senior level	AECOM	Nottingham	Communication	Dispersion Modeling	A selection of current projects, includes: Permit applications for carbon capture and ***hydrogen production facilities***
					Hydrogen Production	Emission Inventories	
					Air Monitoring	Quality Assurance	
					Air Quality	Quality Control	
					Construction Monitoring	Report Writing	

TABLE 9: ROUND 2 SEARCH RESULTS

ID.	Role Name	Role Level	Company name	Location	10 Skills		Job description
1	**Fire Safety Engineer**	Mid-Senior level	Frazer-Nash Consultancy	Oakham	Safety Engineering	FDS	It is to your advantage if you meet any or all the following additional requirements: Knowledge of clean energy systems such as ***hydrogen***, and lithium battery ***storage***.
					Safety Management	Fire Alarm	
					Background Checks	Fire Protection	
					Computational Fluid Dynamics (CFD)	Fire Protection Engineering	
					DSEAR	Fire Safety	
2	**Team Lead Infrastructure & Plant Engineering**	Mid-Senior level	Uniper	Nottingham	Communication	Process Engineering	Providing the process and mechanical engineering required for the development of Uniper's growth projects (CCGT, CCS, ***H2 generation & storage***, …).
					Presentations	Resource Planning	
					H2	Team Management	
					Mechanical Engineering	Technology Evaluation	
					Microsoft Exchange	Training	
3	**Process Engineer - Low Carbon**	Entry level	Uniper	Nottingham (Ratcliffe)	CO2-EOP	Plants	Conceptual and basic design of plants for generation, transport and storage of low carbon fuels (i. e. green ***H2***/NH3) and/or CO2. Relevant experience in engineering / owners engineering of gas or ***hydrogen infrastructure*** / plants / gas storage facilities.
					Gas Storage	Process Design	
					H2	Process Engineering	
					Low Carbon	Process Equipment	
					Piping and Instrumentation Drawing (P&ID)	Process Flow Diagram (PFD)	
4	**Gas Turbine Combustion Engineer**	Mid-Senior level	Uniper	Nottingham	Combustion	Gas Turbines	Low-carbon developments of gas turbine combustion systems including ***hydrogen*** and biofuels.
					Combustion Systems	Multi-disciplinary Teams	
					Attention to Detail	Power Plants	
					Central Heating	Technical Reports	
					Environmental Law	Technical Spec	
5	**Senior Associate/Managing Associate in Clean Energy Projects**	Mid-Senior level	Freeths	Leicester	Communication	Optimization	Familiarity with technologies including solar PV, wind, hydro, battery storage, energy-from waste, biogas, ***hydrogen***, EV charging infrastructure and/or district heating would also be an advantage.
					Energy Industry	Purchase Agreements	
					Energy Supply	Renewable Energy	
					Grid Connection	Tolling	
					Low Carbon	Transactional Legal Services	

6	**Senior Safety Engineer**	Mid-Senior level	Matchtech	Loughborough	Audiometry Data Analysis Microsoft Office Accident Investigation Fire Safety	First Aid HSE Management Systems Occupational Health Risk Assessment Risk Management	What We're Looking For: …… Proficiency in RAMS planning, assessment, and safety case development. Experience in the ***Hydrogen*** sector is desirable.

APPENDIX C: SURVEY TEMPLATE

Understanding Hydrogen-related Skills & Knowledge Requirements in UK companies

Thank you for participating in this survey. We aim to understand the skills and knowledge that ***East Midlands & UK*** companies and employers prioritise when recruiting individuals for hydrogen-related work. Your responses will help us tailor educational programs and training to better prepare the workforce for this growing sector. The survey should take about 10-20 minutes to complete.

***Note**: Your responses will be kept confidential and used solely for research purposes. Only the HyDEX team will have access to information that personally identifies you, and this will not be shared with anyone else. You can withdraw your data from this research at any point. Anonymised and aggregated responses and may be published by HyDEX and we may use the information in other reports on related issues, or in communications but your information and responses will always remain anonymous.*

* Required

1. What is the name of your company? *

2. What is the size of your company? *

- ○ 1 - 10 employees
- ○ 11 - 50 employees
- ○ 51 - 100 employees
- ○ 101 - 500 employees
- ○ More than 500 employees

3. What is the primary focus of your company if participating in the Hydrogen Economy? *
*Select all that apply

- ☐ Producing Hydrogen
- ☐ Storing Hydrogen
- ☐ Distributing Hydrogen
- ☐ Using Hydrogen
- ☐ Other

4. If answered "Other" to **Question 3**, could you please specify using the space below?

5. Are you currently recruiting for hydrogen-related roles ? **OR** you have done hydrogen-related recruitment in the past **OR** are you planning to do so in the future? (**tick all applied*) *

- ☐ In the past
- ☐ Currently
- ☐ In the future

6. When recruiting for hydrogen-related roles, do you intend to have the word "hydrogen" as part of the advertised job title? *

- ○ Yes
- ○ No
- ○ Maybe

7. If answered "Yes" or "Maybe" to **Question 6**, then please propose at least 1 job title that you think you are likely to use in the *future advert* **or** already used in your *current recruitment advert*?
If answered "No", then please put "N/A" to this question.

8. Rate the importance of the following technical skills when hiring for hydrogen-related roles: *

	Not Important	Slightly Important	Moderate
Knowledge of hydrogen production technologies	○	○	○
Experience with hydrogen storage solutions	○	○	○
Understanding of hydrogen transportation methods	○	○	○
Familiarity with hydrogen utilisation technologies	○	○	○
Safety protocols and risk assessment	○	○	○
Regulatory compliance and standards	○	○	○
Competencies to lead hydrogen transition	○	○	○

9. Rate the importance of the following soft skills when hiring for hydrogen-related roles *

	Not Important	Slightly Important	Moderate
Communication skills	○	○	○
Teamwork and collaboration	○	○	○
Problem-solving abilities	○	○	○
Adaptability and flexibility	○	○	○
Project management	○	○	○
Leadership skills	○	○	○

10. What level of education do you likely or typically require for hydrogen-related roles? *

- ○ GCSEs or A-Level
- ○ Bachelor's degree
- ○ Master's degree or above
- ○ Technical vocational qualifications/Apprenticeships Level 2 or 3
- ○ Technical vocational qualifications/Apprenticeships Level 4 or 5 (HNC or HND equivalent)
- ○ Others

11. If answered "Others" to **Question 10**, could you please specify using the space below?

12. Which fields of study do you look for when recruiting for hydrogen-related roles? *

*Select all that apply

- ☐ Chemical Engineering
- ☐ Mechanical Engineering
- ☐ Electrical Engineering
- ☐ Environmental Science
- ☐ Physics
- ☐ Business Administration/Management
- ☐ Renewable Energy/Sustainable Development
- ☐ Technical Specialists (e.g., welder, plumber...)
- ☐ Others

13. If answered "Others" to **Question 12**, could you please specify using the space below?

14. How important is it for candidates to have prior experience in hydrogen? *

- ◯ Not important
- ◯ Slightly important
- ◯ Moderate
- ◯ Very important
- ◯ Extremely important

15. What types of professional development opportunities do you believe are necessary to advance the hydrogen-related workforce in the future? *

*Select all that apply

- ☐ Technical workshops and seminars
- ☐ Industry certifications
- ☐ On-the-job training
- ☐ Mentorship programs
- ☐ Online courses and webinars
- ☐ Accredited education trainings/courses
- ☐ Others

16. If answered "Others" to **Question 15**, could you please specify using the space below?

17. What are the gaps in knowledge and skills in your ***current workforce*** that will need to be filled in order to adopt hydrogen technologies in the future? *

18. How do you see the demand for hydrogen-related skills and knowledge evolving within your company in the next 5-10 years? *

- ◯ Increasing significantly
- ◯ Increasing slightly
- ◯ Staying the same
- ◯ Decreasing slightly
- ◯ Decreasing significantly

19. What new skills or knowledge areas do you anticipate will be important for the hydrogen-related roles within your company in the future? *

20. Do you have any additional comments or suggestions regarding skill sets and knowledge requirements for the hydrogen workforce in the future?

21. If you are happy to participate in a follow-up online chat about this survey, our research, your concerns and your vision, then please leave a contact email or telephone using the space below.

APPENDIX D: SAMPLE REGULATIONS, CODES, AND STANDARDS IN HFCV SECTOR [28]

International Electrotechnical Commission (IEC)
IEC 61851-1 Electric Vehicle Conductive Charging System – Part 1: General Requirements

IEC 61851-21 Electric Vehicle Conductive Charging System – Part 21: Electric Vehicle Requirements for Conductive Connection to an ac/dc Supply

IEC 61851-22 Electric Vehicle Conductive Charging System – Part 22: Electric Vehicle Charging Station

International Organisation for Standardisation
ISO/FDIS 6469-1 2009(E) Electrically propelled road vehicles - Safety specification - Part 1 Onboard Rechargeable Energy Storage System (RESS)

ISO/FDIS 6469-2 2009(E) Electrically propelled road vehicles - Safety specification - Part 2 Vehicle Operational Safety Means and Protection against Failures

ISO/CD 6469-3.3 Electrically propelled road vehicles - Safety specification - Part 3 Protection of Persons Against Electric Shock

ISO/CD 12405-1 Electrically propelled road vehicles - Test specification for lithium-ion traction battery packs and systems - Part 1 High Power Applications

ISO/WD 23274-2 Hybrid-electric road vehicles - Exhaust emissions and fuel consumption measurements - Part 2 Externally Chargeable Vehicles

National Fire Protection Association
NFPA 70 National Electrical Code (NEC), Article 625, Electric Vehicle Charging System Equipment

NFPA 70 National Electrical Code (NEC), Article 626, Electrified Truck Parking Spaces

Society of Automotive Engineering
SAE J1634 Electric Vehicle Energy Consumption and Range Test

SAE J1711 Recommended Practice for Measuring the Exhaust Emissions and Fuel Economy of Hybrid-Electric Vehicles

SAE J1715 Hybrid Electric Vehicle (HEV) and Electric Vehicle (EV) Terminology

SAE J1766 Recommended Practice for Electric and Hybrid Electric Vehicle Battery Systems Crash Integrity Testing
SAE J1772 SAE Electric Vehicle Conductive Charge Coupler

SAE J1773 SAE Electric Vehicle Inductively Coupled Charging

SAE J1797 Recommended Practice for Packaging of Electric Vehicle Battery Modules

SAE J1798 Recommended Practice for Performance Rating of Electric Vehicle Battery Modules

SAE J2288 Life Cycle Testing of Electric Vehicle Battery Modules

SAE J2289 Electric-Drive Battery Pack System, Functional Guidelines

SAE J2293 Part 1 Energy Transfer System for EV Part 1, Functional Requirements and System Architecture

SAE J2293 Part 2 Energy Transfer System for EV Part 2, Communications Requirements and Network Architecture

SAE J2344 Guidelines for Electric Vehicle Safety

SAE J2380 Vibration Testing of Electric Vehicle Batteries

SAE J2464 Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System (RESS) Safety and Abuse Testing

SAE J2711 Recommended Practice for Measuring Fuel Economy and Emissions of Hybrid-Electric and Conventional Heavy-Duty Vehicles

SAE J2758 Determination of the Maximum Available Power from a Rechargeable Energy Storage System on a Hybrid Electric Vehicle

SAE J2836 Part 1 Use Cases for Communications between Plug-In Vehicles and the Utility Grid

SAE J2836 Part 2 Use Cases for Communications between Plug-In Vehicles and the Supply Equipment (EVSE)

SAE J2836 part 3 Use Cases for Communications between Plug-In Vehicles and the Utility grid for Reverse Flow

SAE J2841 Utility Factor Definitions for Plug-In Hybrid Electric Vehicles Using 2001 U.S. DOT National Household Travel Survey Data

SAE J2847 Part 1 Communications between Plug-In Vehicles and the Utility Grid

SAE J2847 Part 2 Communication between Plug-in Vehicles and the Supply Equipment (EVSE)
SAE J2847 Part 3 Communication between Plug-in Vehicles and the Utility Grid for Reverse Power Flow

SAE J2889 Measurement of Minimum Sound Levels of Passenger Vehicles

SAE J2894 Part 1 Power Quality Requirements for Plug-In Vehicle Chargers - Requirements

SAE J2894 Part 2 Power Quality Requirements for Plug-In Vehicle Chargers – Test Methods

SAE J2907 Power Rating Method for Automotive Electric Propulsion Motor and Power Electronics Sub-System

SAE J2908 Power Rating Method for Hybrid-Electric and Battery Electric Vehicle Propulsion

APPENDIX E: SAMPLE HYDROGEN MODULES EMBEDDED IN OTHER ENGINEERING COURSES (PROVIDED BY LOUGHBOROUGH UNIVERSITY)

Subject Area	Department or School	Couse Title	Lv.	Qualification	Duration	Relevant Modules *(compulsory if not otherwise stated)*
Chemical Engineering (x4)	Chemical Engineering	Advanced Chemical Engineering MSc	PG	MSc	1 yr FT	Clean Energy, Materials and Sustainability (optional)
		Advanced Chemical Engineering with Information Technology and Management MSc	PG	MSc	1 yr FT	Clean Energy, Materials and Sustainability (optional)
		Chemical Engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Process Design and Safety, Reaction Engineering I and II, Plant Engineering, Process Systems Engineering, Chemical Process Control, Biochemical Engineering (optional)
		Chemical Engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	Process Design and Safety, Reaction Engineering I and II, Plant Engineering, Process Systems Engineering, Chemical Process Control, Biochemical Engineering (optional), Advanced Process Design and Optimisation, Advanced Biochemical Engineering (optional), Clean Energy, Materials and Sustainability (optional)
Materials Science and Engineering (x6)	Materials	Advanced Materials Science and Engineering MSc	PG	MSc	1 yr FT, 2-5 yrs PT	Clean Energy, Materials and Sustainability (compulsory)
		Polymer Science and Engineering	PG	MSc	1 yr FT, 2-5 yrs PT	Clean Energy, Materials and Sustainability (optional)
		Automotive Materials	UG	BEng	3 yrs FT, 4 yrs FT with placement	Clean Energy, Materials and Sustainability (compulsory)
		Automotive Materials	UG	MEng	4 yrs FT, 5 yrs FT with placement	Clean Energy, Materials and Sustainability (compulsory)

		Materials Science and Engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Introductory Materials Science and Processing, Thermodynamics and its Applications, Materials Applications and Engineering Design, Materials Modelling, Materials Processing, Materials in Service, Introduction to Chemical, Biochemical Processes and Sustainability (optional), Plant Engineering, Fracture Mechanics of Materials, Materials Characterisation, Surface Engineering, Advanced Principles of Materials, Advanced Processing Methods, Sustainability, Recycling and Environmental Issues (optional), Composite Materials, Functional Materials
		Materials Science and Engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	Introductory Materials Science and Processing, Thermodynamics and its Applications, Materials Applications and Engineering Design, Materials Modelling, Materials Processing, Materials in Service, Introduction to Chemical, Biochemical Processes and Sustainability (optional), Plant Engineering, Fracture Mechanics of Materials, Materials Characterisation, Surface Engineering, Advanced Principles of Materials, Advanced Processing Methods, Sustainability, Recycling and Environmental Issues (optional), Composite Materials, Functional Materials, Advanced Materials Characterisation, Materials Modelling (optional), Clean Energy, Materials and Sustainability (optional)
Mechanical, Electrical and Manufacturing Engineering (x19)	Mechanical, Electrical and Manufacturing Engineering	Advanced Manufacturing Engineering and Management	PG	MSc	1 yr FT, 2-6 yrs PT	Engineering for Sustainable Development (compulsory)
		Electrical and Electronic Engineering	PG	MSc	1 yr FT, 3 yrs PT	Electrical Power and Energy Engineering, Engineering for Sustainable Development, Advanced Electronic Engineering Applications (optional)
		Engineering Design	PG	MSc	1 yr FT, 2-6 yrs PT	Engineering for Sustainable Development, Engineering Design Methods
		Engineering Management	PG	MSc	1 yr FT, 3 yrs PT	Principles of Project Management, Applied Systems Thinking

		Mechanical Engineering	PG	MSc	1 yr FT, 2-6 yrs PT	Engineering for Sustainable Development, Engineering Design Methods, Simulation of Advanced Materials and Processes, Thermofluids, Experimental Mechanics (optional), Advanced Dynamics (optional)
		Renewable Energy Systems Technology	PG	MSc	1 yr FT, 2-6 years PT	Renewable Energy Technologies, Economics and Policy, Bioenergy, Integration of Renewables, Energy Storage (optional), Renewable Energy for Development (optional), Energy System Economics, Markets, Policy and Risk (optional)
		Systems Engineering	PG	MSc	1 yr FT, 3 yrs PT	Applied Systems Thinking, Mechatronic System Design (optional), Systems Design, Modelling, Simulation and Visualization for Engineering (optional)
		Systems Engineering Level 7 Apprenticeship	PG	MSc	40 months PT	Applied Systems Thinking, Mechatronic System Design (optional), Systems Design (optional), Engineering for Sustainable Development (optional), Engineering Design Methods (optional), Manufacturing Processes and Automation (optional), Modelling, Simulation and Visualization for Engineering (optional)
		Computer and Electronic Engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Digital Systems, Embedded Systems Programming, Control System Design 1 and 2 (optional), Embedded Systems Design and Implementation, State Space Control (optional), Digital Control (optional)
		Computer and Electronic Engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	Digital Systems, Embedded Systems Programming, Control System Design 1 and 2 (optional), Embedded Systems Design and Implementation, State Space Control (optional), Digital Control (optional)
		Electrical and Electronic Engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Digital Systems, Control System Design 1 and 2, Power Conversion and Networks, Renewable Energy Systems (optional), Embedded Systems Design and Implementation (optional), Power Electronics (optional)

		Electrical and Electronic Engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	Digital Systems, Control System Design 1 and 2, Power Conversion and Networks, Renewable Energy Systems (optional), Embedded Systems Design and Implementation (optional), Power Electronics (optional), Advanced Electronic Engineering Applications (optional), Integration of Renewables (optional)
		Energy engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Engineering Science 1 and 2, Energy, Technology and Society, Simulation and experimentation of Energy Engineering, Energy Project Design and Management, Control System Design 1 and 2, Renewable Energy Technologies, Electrical Power and Machines, Energy Storage Technologies, Power Systems and Renewable Energy Integration, Sustainability, Recycling and Environmental Issues (optional), Sustainable Engineering (optional), Energy Systems Analysis (optional), Power Electronics, Digital Control, Metrology
		Energy engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	Engineering Science 1 and 2, Energy, Technology and Society, Simulation and experimentation of Energy Engineering, Energy Project Design and Management, Control System Design 1 and 2, Renewable Energy Technologies, Electrical Power and Machines, Energy Storage Technologies, Power Systems and Renewable Energy Integration, Sustainability, Recycling and Environmental Issues (optional), Sustainable Engineering (optional), Energy Systems Analysis (optional), Power Electronics, Digital Control, Metrology, Project Engineering - Total Product Design, Advanced Energy System Technologies, Engineering Design Methods, Energy System Economics, Markets, Policy and Risk

		Engineering Management	UG	BEng	3 yrs FT, 4 yrs FT with placement	Engineering Science 1, Materials and Manufacturing Processes, Manufacturing Management, Electronics & Electrical Technology 1, Manufacturing Process Technology, Engineering and Management Modelling, Manufacturing Design, Manufacturing Technology, Manufacturing Planning and Control, Sustainable Product Lifecycle Engineering, Metrology
		Mechanical Engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Engineering Principles and Professional Skills, Materials and Manufacturing Processes, Thermodynamics and Fluid Mechanics, Electronic Systems, Mechanics of Materials 1 and 2, Engineering Dynamics 2, Control System Design 1, Thermodynamics 2, Electrical Power and Machines, Fluid Mechanics 2, Energy Systems Analysis (optional), Sustainable Engineering (optional), Materials in Service (optional), Fracture and Failure (optional), Energy Vectors for Transport (optional)
		Mechanical Engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	Engineering Principles and Professional Skills, Materials and Manufacturing Processes, Thermodynamics and Fluid Mechanics, Electronic Systems, Mechanics of Materials 1 and 2, Engineering Dynamics 2, Control System Design 1, Thermodynamics 2, Electrical Power and Machines, Fluid Mechanics 2, Energy Systems Analysis (optional), Sustainable Engineering (optional), Materials in Service (optional), Fracture and Failure (optional), Energy Vectors for Transport (optional), Computational Fluid Dynamics 2 (optional), Mechatronics and Machine Control (optional), Industrial Sustainability (optional), Optical Diagnostics for Fluid Mechanics (optional)
		Robotics, Mechatronics and Control Engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Control Systems Design 1 and 2, Manufacturing Automation and Control (optional)

		Robotics, Mechatronics and Control Engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	Control Systems Design 1 and 2, Manufacturing Automation and Control (optional), Advanced Methods for Control (optional), Mechatronic System Design (optional), Systems Design (optional)
Aeronautical and Automotive Engineering (x5)	Aeronautical and Automotive Engineering	Automotive Engineering MSc	PG	MSc	1 yr FT	Hybrid and Electric Vehicles (compulsory)
		Aeronautical Engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Fuel cell technology (optional), Propulsion Design for the Environment (optional)
		Aeronautical Engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	
		Automotive Engineering	UG	BEng	3 yrs FT, 4 yrs FT with placement	Advanced Powertrain Systems (compulsory)
		Automotive Engineering	UG	MEng	4 yrs FT, 5 yrs FT with placement	Advanced Powertrain Systems (compulsory), Fuel cell technology (optional)
Chemistry	Chemistry	Chemistry	UG	BSc	3 yrs FT, 4 yrs FT with placement	Energy, Molecules and Applications
		Chemistry	UG	MChem	4 yrs FT, 5 yrs FT with placement	Energy, Molecules and Applications
		Chemistry with Computing	UG	BSc	3 yrs FT, 4 yrs FT with placement	Energy, Molecules and Applications
		Chemistry with Computing	UG	MChem	4 yrs FT, 5 yrs FT with placement	Energy, Molecules and Applications
Physics (x8)	Physics	Engineering Physics - Electrical Engineering pathway	UG	BSc	3 yrs FT, 4 yrs FT with placement	Control System Design 1, Electrical Power and Machines
		Engineering Physics - Electrical Engineering pathway	UG	MPhys	4 yrs FT, 5 yrs FT with placement	Control System Design 1, Electrical Power and Machines, State Space Control
		Engineering Physics - Materials Engineering pathway	UG	BSc	3 yrs FT, 4 yrs FT with placement	Materials Modelling

		Engineering Physics - Materials Engineering pathway	UG	MPhys	4 yrs FT, 5 yrs FT with placement	Materials Modelling, Advanced Processing of Materials
		Engineering Physics - Mechanical Engineering pathway	UG	BSc	3 yrs FT, 4 yrs FT with placement	Manufacturing Technology, Mechanics of Materials 1 and 2
		Engineering Physics - Mechanical Engineering pathway	UG	MPhys	4 yrs FT, 5 yrs FT with placement	Manufacturing Technology, Mechanics of Materials 1 and 2, Additive Manufacturing and Reverse Engineering
		Engineering Physics - Systems Engineering pathway	UG	BSc	3 yrs FT, 4 yrs FT with placement	Manufacturing Process Technology, Control Systems Design 1 and 2
		Engineering Physics - Systems Engineering pathway	UG	MPhys	4 yrs FT, 5 yrs FT with placement	Manufacturing Process Technology, Control Systems Design 1 and 2, Mechatronic System Design, Systems Architecture
Geography and environment (x2)	Geography and Environment t	Climate Change Politics and Policy MA	PG	MA	1 yr FT, 2 yrs PT	Climate Futures (compulsory), Climate Science into Practice (compulsory)
		Climate Change Science and Management	PG	MSc	1 yr FT, 2 yrs PT	Climate Futures (compulsory), Climate Science into Practice (compulsory)
Architecture, Building and Civil Engineering (x2)	Architecture, Building and Civil Engineering	Construction Project Management with Sustainability	PG	MSc	1 yr FT, 2 yrs PT	Net Zero Building Design
		Net Zero Building Services Engineering	PG	MSc	1 yr FT, 2-5 yrs PT	Electrical Systems: Buildings and Renewable Energy, Building Energy Supply Systems and District Energy Networks, Net Zero Building Design

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