

Pilot Skills Mapping Exercise on Hydrogen

As part of the HyBRID-funded HyCymru Project



March 2022

ynni glân



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- Ynni Glân has been awarded funding by the Welsh Government's Smart Living HyBRID SBRI initiative to undertake a project which looks at Hydrogen Skills & Training in Wales.

- HyBRID (Hydrogen Business Research & Innovation for Decarbonisation) is a Small Business Research Initiative (SBRI) funded by Welsh Government Smart Living. The aim of the HyBRID scheme is to develop innovative and research solutions which support the ten objectives of the Welsh Government Wales Hydrogen Pathway which are incorporated into the second carbon reduction plan Net Zero Wales 2021-2025. These aim to accelerate the development of technologies and processes which enable the deployment of hydrogen as a key energy vector, which will be critical for meeting our national commitment to achieve net zero emissions by 2050.

- Smart Living is a Welsh Government initiative set up in 2015 to facilitate development of innovative solutions for place-based decarbonisation issues.

Diolch yn fawr i bawb am eich cyfraniadau gwerthfawr i'r gwaith ac yn enwedig i Huw Rees, Leanne Waring a Rob Jones o Goleg Caerdydd a'r Fro ac i Nick Tyson ac Ian Hogg o Goleg Cambria.

Many thanks to all for your valuable time and contributions towards this study and in particular to Huw Rees, Leanne Waring and Rob Jones from Cardiff and Vale College and to Nick Tyson and Ian Hogg from Coleg Cambria.

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Executive Summary

The results of this pilot skills mapping exercise on hydrogen have been very promising and exceeded expectations. A wide-range of consultations have been undertaken with stakeholders in the skills and training sector across Wales and these have extended beyond the original target audiences as momentum grew throughout the exercise and referrals were made by core stakeholders.

The support of the core stakeholders at Cardiff and Vale College and Coleg Cambria is greatly appreciated as they helped to steer and shape the outcomes of the study.

Consultations have been held with the following organisations who are either known to have hydrogen interests or who have come forward to provide their valued input and guidance towards this exercise. The list includes FE and HE institutions, accreditation bodies, skills networks, industry bodies, relevant hydrogen projects, specific examples of hydrogen education and training initiatives and the Department for Children, Education, Lifelong Learning and Skills (DCELLS) at the Welsh Government:

- Cardiff & Vale College
- Coleg Cambria
- Grwp Llandrillo Menai
- Industry Wales
- Regional Skills Partnerships
- City & Guilds
- Enginuity & EAL
- HyCERBYD/Hypermotive
- Cardiff Airport - Hydrogen Aviation Cluster
- Cardiff University, Gas Turbine Research Centre
- Chris Foxall/Riversimple
- Stephenson Harwood (Legal Firm)
- Pontarddulais Primary School
- Welsh Government (DCELLS)
- Cardiff Business School - Just Transition



The report details the relevant activities which are being undertaken by the above consultees. These activities are either directly related to hydrogen or which can complement the emergence of the hydrogen sector. They also include the mainstreaming of equality and a just transition in keeping with HyCymru's (Wales Hydrogen Trade Association) core values, as exemplified by our engagement with the global Women in Green Hydrogen network, see 3.14.

We recognise that there are many other actors in the hydrogen space in Wales which it has not been possible to reach as part of this pilot study which focuses on Cardiff & Vale College (CAVC) and Coleg Cambria. But the exercise provides a platform to engage with a much wider audience for the next stages.

The mapping exercise has also been introduced to members of the Welsh Government's Hydrogen Reference Group (via presentations), HyCymru's core network and at the Marine Energy Wales Annual Conference in Llandudno in March 2022.

The responses to the consultation exercise are collated in this report and which lead to a set of recommendations, see below. The responses include both general assessments and specific examples of hydrogen or hydrogen-related activities, in order to inform the mapping exercise and to also shape the recommendations. A core recommendation is the establishment of a *Hydrogen Skills and Training Group* for Wales.

Consultation questions are listed in the Methodology section. But a key starting point of all consultations has been to ask "*Is there such a thing as a national hydrogen skills and training group already in place in Wales?*", in order to avoid any duplication of effort going forward. The answer in all cases has been "No" and which supports the basis for recommending a strategic, efficient and co-ordinated approach to the delivery of skills and training in the hydrogen sector in Wales, whilst recognising that there are pockets of hydrogen training excellence already taking place.

Providing an evidence-based set of recommendations for the co-ordination and mainstreaming of hydrogen skills and training is the aim of this report. At a time when hydrogen now recognised as being fundamental to meeting net zero targets. This recognition is leading to a global boom in investment opportunities for hydrogen as a keystone technology in addressing climate change, air quality and for energy security.

The Welsh Government's Hydrogen Pathway provides the platform for the mainstreaming of hydrogen into the Welsh economy and, as an international example, the European Commission's March 2022 *REPowerEUH2* plan includes the large-scale acceleration of hydrogen.



Using Cardiff & Vale College and Coleg Cambria as the focus for this pilot mapping exercise, the purpose of this work has been to gather evidence of current activities and the appetite and need amongst identified stakeholders for a strategic, co-ordinated delivery of hydrogen skills and training which can connect to national and international activities. Current activities, of which there are many notable examples, can serve as the required platform towards a strategic and co-ordinated approach under the proposed *Hydrogen Skills and Training Group* for Wales.

It is important to note that because of its multi-sector, pan-economic application potential, hydrogen can feature front and central within the broader green skills agenda. The current work by the Welsh Government on the *Net Zero Skills Action Plan* is therefore very timely with respect to the development of hydrogen skills and provides a clear, live opportunity for the *Hydrogen Skills and Training Group* to help shape and inform the Welsh Government's strategic skills vision.

Consultees have expressed a ready willingness to participate in the *Hydrogen Skills and Training Group*. During this exercise, consultations were held (both through on-line meetings and via email) on an individual basis with organisations with the exception of the final meeting in the series, which was held as a combined meeting between DCELLS, CAVC and Coleg Cambria on March 24th, 2022. A briefing from this meeting is provided in Section 3.14. The grouping at this meeting provides the platform for the *Hydrogen Skills and Working Group*, which will now be organised in a formal setting with extended participants.

An opportunity for the first set of formal meetings of the *Hydrogen Skills and Training Group* is presented by the series of hydrogen expert workshops which will be held at both CAVC and Coleg Cambria in May and June 2022 and which are being organised as a direct outcome of this study and which HyCymru is set to support.

At this stage, there will inevitably be some overlap with other, existing skills and skills-related groups and activities in Wales, such is the broad reach of hydrogen. Hydrogen is central to the energy transition from fossil fuels to renewables and across all sectors of the economy - power, heat, transport, industry and agriculture. But this is only now being recognised therefore hydrogen is still finding its place in the overall skills space. Hydrogen can reinforce the work and activities of existing and complementary groups, be they national, regional or sector-specific, while also establishing a clear mandate to advance core hydrogen competencies.

Future evolution may lead to a streamlining of groups to avoid duplication of activities under the overall green/net zero banner, which is now a central pillar of Welsh Government economic strategy.



Consultees agreed that the *Hydrogen Skills and Working Group* for Wales should be a tight, representative group of no more than 10-15 members, with fairness, equality of opportunity and a just transition as fundamental to its purpose. Within the pyramid structure, sub-groups could be established according to geography, age-group and sectors.

This exercise has FE as its focus and evidence has been gathered from Grwp Llandrillo Menai and Gower College, in addition to the core stakeholders at CAVC and Coleg Cambria. But we recognise that hydrogen activity is increasing in FEs across Wales.

Activities have also been identified outside the FE sector to include the HE sector, schools, professional services and workplace. This represents but a snapshot of the wider activities, whose capture has been beyond the scope of this report, but which can be identified and co-ordinated as part of follow-on work, expanding from this pilot exercise. So establishing a vertically-integrated, through-the-ages delivery of hydrogen skills and training in Wales.

A sectoral example is the automotive skills assessment being undertaken within the parallel HyCERBYD project which is assessing the hydrogen vehicle supply chain and which is also HyBRID-funded. HyCERBYD is also yielding promising results especially in its engagement with some of Wales's largest employers in the automotive supply chain. The results of other HyBRID projects can also inform and influence the next-stage work.

An immediate result of this exercise has been the support which HyCymru is providing to CAVC and Coleg Cambria in organising "*Hydrogen Expert*" workshops for staff at the colleges in May and June 2022. (And the prospect of organising the first, formal meetings of the Hydrogen Skills and Training Group for Wales to co-incide with these workshops.)

Such workshops could be rolled-out across time and place in Wales. For example, a welcome highlight of the DCELLS meeting was a discussion on organising such workshops for DCELLS (and possibly other Welsh Government staff) to introduce hydrogen at this early stage of its high growth and far-reaching potential and on how it can complement other technologies in support of overall and mutually supportive climate change, clean air and economic policy aims.

The exercise has identified strong evidence and highlighted a strong appetite towards developing the hydrogen skills agenda in Wales and proposes a framework, being the *Hydrogen Skills and Training Group* to advance the work and which can help shape and inform the *Net Zero Skills Plan*.

There is evidently a very good platform to work from and whose success will be reliant on expanding the work from the pilot and assessment stage and by creating the capacity to meet the challenges and fulfil the purpose.



Recommendations

- Establish & support a **Hydrogen Skills and Training Group for Wales** for a strategic, co-ordinated delivery of hydrogen skills and training, which can connect international activities and which can help shape and inform the Welsh Government's **Net Zero Skills Action Plan**.
- Incorporate the findings of parallel studies e.g. **HyCERBYD and other HyBRID projects** into the work of the Hydrogen Skills and Training Group and towards the Net Zero Skills Action Plan.
- Hold pilot **Hydrogen Expert Workshops** at CAVC & Coleg Cambria in May and June 2022.
- **Expand the pilot workshops** to all FE Colleges and to education, skills & training development on hydrogen through the ages from schools through FE & HE to the workplace.
- Utilise **HyCymru's digital platform and 1-stop-shop service** to co-ordinate & signpost activities and to build a knowledge bank of resources, learning materials, webinars etc to support skills and training

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1 Introduction

This report on the Pilot Skills Mapping Exercise on Hydrogen has been prepared as supplementary, stand-alone evidence as part of the Welsh Government HyBRID-funded HyCymru project, whose overall findings are presented in a separate report.

Both internal discussions with HyCymru's supporting organisations and growing national and international commentary have highlighted the skills agenda as being crucial to the development of the hydrogen sector - and clean energy in general. To realise the sector's full potential and for Wales to gain competitive economic benefit there will be a need to have a conveyor belt of suitably qualified students and employees which can build on current activities in the green skills sector and which can be applied or re-trained to hydrogen from incumbent industries (e.g. automotive, oil & gas).

We have undertaken a pilot exercise which maps relevant current curriculum and training activities at an FE level with the co-operation of Cardiff & Vale College and Coleg Cambria; and which subsequently makes recommendations for strengthening the provision of skills and training provision through consultation with a wide-range of stakeholders both within the HyCymru group and amongst external interested parties.



2 Methodology

The study was undertaken by means of desktop research and direct consultation with key stakeholders across Wales.

The list of consultees being:

Cardiff & Vale College
Coleg Cambria
Grwp Llandrillo Menai
Industry Wales
Regional Skills Partnerships
City & Guilds
Enginuity & EAL
HyCERBYD/Hypermotive
Cardiff Airport - Hydrogen Aviation Cluster
Cardiff University, Gas Turbine Research Centre
Chris Foxall/Riversimple
Stephenson Harwood (Legal Firm)
Pontarddulais Primary School
Welsh Government (DCELLS)
Cardiff Business School - Just Transition

Consultees were asked:

"As part of the evidence-gathering, I would be very grateful if you could kindly send me brief details on the following:

- Your core role and activities*
- Your presence in and/or relationships with Wales including institutions*
- Your hydrogen-related activities (including UK-wide). This can mean both:*
 - 1. dedicated hydrogen activities or emerging plans in the field; and*



2. activities in conventional subject areas of energy, automotive etc and which transition to hydrogen

- Any international activities in hydrogen”

Direct contact was made with known individuals amongst core stakeholders who in turn made recommendations which broadened the list of consultees.

Promotion and awareness of the project was also carried out through presentations, attendance and mail-shots to:

- Welsh Government Hydrogen Reference Group
- Marine Energy Wales Annual Conference
- HyCymru Network



3 Mapping Exercise & Consultations

This section details the results of the mapping exercise and the consultations by detailing the hydrogen activities amongst the study's stakeholders.

3.1 Cardiff and Vale College (CAVC)

<https://cavc.ac.uk/en>

Mapping Exercise

CAVC's courses are predominantly not categorised as 'Hydrogen' but CAVC recognises that many of its existing courses will in the near future need to include hydrogen in the provision. This is particularly the case in the following subject areas and the specific courses listed under each subject:

- **Building Services Engineering:**

Heating and Plumbing provision, Air conditioning and ventilation, Refrigeration, Electrotechnical, Heating and Electrical building services design, heat recovery, domestic hydrogen.

- **Engineering:**

Vehicle technology (LV and HV), Circular Economy, hydrogen as a future fuel source

- **Aerospace:**

Advanced fuel systems, Manufacturing

- **Construction:**

Planning, design, infrastructure, Civil Engineering, heat store





Staff development

As part of a Knowledge Transfer Fund project, CAVC is bringing in industry experts to deliver Masterclass workshops and case studies to support staff and learner development on hydrogen in May 2022. These masterclasses have flowed from this study and will benefit from HyCymru's guidance and involvement in identifying industry expertise.

CAVC also manages the *Centre for Industrial Excellence*, which is a partnership working with four Welsh FE colleges to jointly develop staff development resources, industrial placements and professional *teachmeets* and a remote lab to help up-skill staff.

Awarding Bodies

CAVC have introduced this study to colleagues at awarding bodies City & Guilds and EAL whose activities and views are provided in this section.

CAVC is also currently working with Agored Cymru to write and gain approval for an Introduction to Green Technology and Sustainable Engineering course at L3.

Resource Development

CAVC are opening a '*Green Academy*' in April 22 for the delivery of the design, installation and maintenance of heat recovery systems, PV, vehicle charging and hydrogen-ready boilers to help address the UK Government's 10 point green industrial revolution and which can support Welsh ambitions to be early adopters of these technologies as a platform for rUK, so reaping economic benefits from first-mover advantage.

CAVC have developed a Net Zero on-line resource for all full-time L3 learners. CAVC are also supporting the review of *National Occupational Standards for Advanced Manufacturing and Apprenticeship Frameworks for Building Services and Utilities sector*.

Industry links

Companies with which CAVC collaborate include **Wales and West Utilities** and their plans for a carbon free future and H21 project; **Bosch Theromtechnical** (Worcester / Bosch); **Celsa**; **CITB**; **ECITB**.

CAVC are also interested in the recent announcement of a 'green energy hub' at the former **Aberthaw Power Station**.



Hydrogen Skills & Training Group

CAVC support the need for a Hydrogen Skills and Training Group for Wales and have also suggested that the following are represented on the Hydrogen Skills and Training Group:

- DCELLS
- Sustainable Energies Wales Skills Advisory Forum (SEWSAF)
- Cardiff Circular Economy Network (CCEN)
- Employer representatives to include WWU, Celsa, Bosch Thermotechnical, Industry Wales, MakeUK
- Coleg Cambria, CITB and ECITB



3.2 Coleg Cambria

<https://www.cambria.ac.uk>

Mapping Exercise

In terms of further education and training, the knowledge around Hydrogen technology will be included in the new **Level 2 Foundation in Construction & Building Services qualification (Unit 106: Emerging Technologies)** which all Coleg Cambria full-time students will be enrolled on in September.

Hydrogen will also be included in the new **'Level 3 Building Service Engineering - Plumbing and Heating' qualification** which will be the qualification for apprentices from September.



Coleg Cambria has contacted **Worcester Bosch** and **BAXI** with regards to their developments on their central heating boilers and their plans on adapting their boilers to work on a blend of hydrogen and natural gas.

A visit from BAXI to Coleg Cambria's Deeside site is set for May 2022, BAXI has been a big supporter of the college in the past with donations and judging SkillPLUMB competitions at Deeside.

Coleg Cambria also has a good relationship with Worcester Bosch who have used the college's Gas Assessment centre on an annual basis for providing updates to their engineers.

Coleg Cambria envisages that in the not too distant future boiler manufacturers such as Worcester Bosch and BAXI will look to FE colleges to provide centres for training skilled plumbing and heating engineers on the requirements of installing and maintaining hydrogen adapted boilers.



Staff development

Like CAVC, Coleg Cambria is also bringing-in industry experts to deliver Masterclass workshops to support staff and learner development on hydrogen in June 2022. These workshops have also flowed from this study and will benefit from HyCymru's guidance and involvement in identifying industry expertise.

Resource Development

Coleg Cambria's Bersham Road site in Wrexham is developing an innovative training facility that will help meet an anticipated surge in demand for zero emission vehicles.

Students can sign up for an IMI (Institute of the Motor Industry) Hybrid/Electric Vehicle Repair Level 3 qualification in a cutting-edge facility combining the latest technology and equipment with interactive learning.

<https://www.cambria.ac.uk/coleg-cambria-is-motoring-towards-the-launch-of-a-revolutionary-electric-and-hybrid-vehicle-training-centre/>

Coleg Cambria recognises that *"from an engineering point of view, we need to highlight in all our skills training is hydrogen's potential in Wales and the UK to contribute to net zero"*. In Coleg Cambria's opinion, hydrogen *"should form a part of all development and innovation linked to skills and training"*.

Coleg Cambria envisages the need to develop training materials specifically in **Engineering L3+** for both full-time and apprentice learners eg a module of the **BTEC L3 Mech/Elect diploma** could be focussed on net zero applications.

Other Industry Links

Coleg Cambria has links with the following major local employers, operating across a variety of sectors:

- **Airbus (Aero)** - re: Future flight and H2 powered aircraft, envisaging *"the future need to train all the Airbus apprentice population in this technology"*.
- **Toyota* (Auto)** - Strong relationship in terms of innovation and a key part of R&D at the Deeside engine manufacturing plant, linking with Toyota's hybrid hydrogen/electric vehicle platform.
- **Eren (Cardboard)** (was UPM) - a brand new centre is being developed for 'cardboard' manufacturing and a complete set of workforce skills is required to enable this plant (powered by H2) to be functioning by 2025.
- **Essity / Kimberly Clark / Nicepak (Papermaking)** - re: plant and product development using H2.



Coleg Cambria also benefits from a strong relationship with **AMRC Cymru**, which has excellent facilities at Broughton adjacent to the Airbus site.

* Deep engagement is also on-going with Toyota as part of the parallel HyBRID-funded HyCERBYD project by Ynni Glân and Hypermotive, see section X.

Hydrogen Skills & Training Group

Coleg Cambria *"do see the need for a skills cluster group asap, so they can lead on these developments in L3 + modules up to Master programmes"*.

Coleg Cambria has strong links to all areas of Aviation, Automotive and power for buildings.



3.4 Grwp Llandrillo Menai

<https://www.gllm.ac.uk>

The pilot exercise has Cardiff & Vale College and Coleg Cambria as its focus but hydrogen-related activities will extend to FE colleges across Wales. Mapping activities across the whole of Wales is beyond the scope of this exercise but can follow-on as a result.

However, notable engagement has been held with Grwp Llandrillo Menai who were known to have published a Hydrogen Strategy and who are a stakeholder on the Holyhead Hydrogen Hub.

Grŵp Llandrillo Menai has set out ambitious plans to become a Hydrogen Energy Centre of Excellence.

Working with regional and national partners as well as key industry players, the Grŵp aims to establish specialist training facilities and programmes to support companies and the workforce to embrace the opportunities presented by hydrogen energy.

The newly launched Hydrogen Strategy also proposes to:

- *Deliver training on the installation of domestic and commercial hydrogen systems in partnership with Worcester Bosch at the new Zero Carbon Training centre at CIST in Llangejni*
- *Develop expertise on the use of hydrogen for heavy and domestic vehicles.*
- *Use hydrogen to decarbonise its farm at Coleg Glynllifon*
- *Investigate fully powered hydrogen heating on some of the Grŵp's main buildings*
- *Future skills programmes for storing, managing, and transporting Hydrogen*

<https://www.gllm.ac.uk/news/grŵp-llandrillo-menai-announces-new-hydrogen-strategy>

A specific hydrogen activity which is already taking place at the Agricultural Engineering department involves running two tractors fitted with a hydrogen system. The system is installed on a diesel fuel engine with the aim of reducing the engine's environmental impact.

The department is also looking at developments in agriculture to power other agricultural machinery in the future.

The department recognises that hydrogen appears to be an important element for the agricultural industry but at present no engineering has developed into a commercial situation.



3.4 Industry Wales

<https://www.industrywales.com>

Supported by the Welsh Government, Industry Wales has specialist aerospace, automotive and electronics, software and technology forums which help grow Welsh technology and manufacturing businesses. *"The forums, with a combined membership of approaching 400 leading Welsh companies, provide a range of services to support companies already established within Wales and to attract and support companies that are seeking a world class location for their business."*

Industry Wales is also providing support for the South Wales Industrial Cluster, SWIC, <https://www.swic.cymru>, which is a consortium to decarbonise a group of large industrial companies from Pembrokeshire to the Severn Bridge.

Industry Wales is therefore a key stakeholder in developing the skills agenda for a large proportion of Wales' employers including those at the forefront of the energy transition, many of whom have dedicated hydrogen plans. This work is led by Industry Wales' Project Leader on Skills Development.

Industry Wales work closely with the Regional Skills Partnerships, see next section 3.5.

Industry Wales are keen to be represented on the Hydrogen Skills and Training Group.



3.5 Regional Skills Partnerships

Supported by the Welsh Government, the Regional Skills Partnerships are in place to drive investment in skills by developing responses based upon local and regional need.

The Regional Skills Partnerships are:

- North Wales Regional Skills Partnership (NWRSP)
<http://www.rspnorth.wales>
- South East Wales Cardiff Capital Region Skills Partnership (CCRSP)
<https://www.cardiffcapitalregion.wales/news-events/latest-news/the-latest-in-skills-talent-across-southeast-wales-12/>
- South West Regional Learning and Skills Partnership (RLSP)
<http://www.rlp.org.uk/eng/home>
- Mid Wales Regional Skills Partnership
<http://www.growingmid.wales/Aboutus>

The Skills Partnerships produce Regional Employment and Skills Plans to analyse and influence the provision of skills based on regional economic need, to support growth and key infrastructure projects in each region. The Regional Employment and Skills Plans build on and support priorities identified by Enterprise Zones, City Deal, City Regions and cross border collaborations.

The plans are refreshed every three years and provide recommendations to Welsh Government to influence the prioritisation and deployment of skills funding including Apprenticeship and Further Education allocations.

A meeting was held with representatives of all four Skills Partnerships to introduce the study and to discuss how the development of hydrogen skills can complement their work programmes.

The Regional Skills Partnerships are keen to be represented on the Hydrogen Skills and Training Group.



3.6 Enginuity & EAL

<https://enginuity.org>

Enginuity (formerly SEMTA) is a not-for-profit organisation, with over 60 years of experience supporting engineering and manufacturing employers with their current and future skills needs across the UK. The Enginuity group includes EAL, the specialist awarding organisation for Engineering & Manufacturing, <https://enginuity.org/eal/>.

"Enginuity creates practical solutions for today's skills challenges for individuals, educators, and manufacturing and engineering employers. Enginuity is the sector connector working together with employers, educators and policymakers. Blending technology with our deep engineering skills knowledge, to develop disruptive and innovative solutions to help employers find new and diverse talent, retain, upskill and reskill their existing workforce."

This is illustrated by Enginuity's core focus on green skills and by also developing engaging, innovative learning platforms around gaming such as Minecraft, which has had such an impact in engaging young person's minds.

Enginuity Green Skills

FEEL THE IMPACTGREEN WORKFORCEENGINUIT Y WEBSITE


Skills Minor Home Energy

Minecraft is the most played game in the world. We are using it to inspire the next generation of greener engineers


At the start of 2020 we set out to explore how gameplay could help discover a young person's aptitude for engineering.

Working with the education edition of Minecraft we have created four Skills Minor games and our latest – launched to coincide with COP 25 – brings the challenge of creating greener homes to life.

[Read more](#)




What's behind the game?



Skills Minor

Using gaming to challenge outdated perceptions of engineering


[Read more](#)



Skills Minor

Working with experts

[Read more](#)



Skills Minor

Winning an award & creating our Home Energy game

[Read more](#)



EAL is the specialist skills partner and awarding organisation for industry. Through industry partnerships and years of experience supporting core sectors, EAL has built knowledge and understanding of employer skills needs. As a result, EAL's skills solutions and qualifications are respected and chosen by employers to deliver real career benefits for all learners.

In the last ten years, 1.3 million people in the UK embarked on an EAL qualification in schools, academies, university technical colleges (UTCs), colleges, universities, private training facilities and workplaces across the UK.

EAL works to:

- quality assure delivery and assessment
- develop qualifications
- represent employers
- obtain accreditations
- promote qualifications

Hydrogen-related activities

Enginuity has not yet been involved in any direct activity on hydrogen apart from conversations with **Technology Connected** as part of their consultation work on TEMASC and also work with the **SW England Hydrogen Skills Partnership** in the Bristol area.

EAL is in the process of scoping the need for hydrogen related qualifications and learning materials and mapping to existing qualifications to identify gaps.

Our recent **Skills Miner** development included a game covering sustainable fuels which references hydrogen <https://enginuity.org/innovation-lab/skills-miner/aerospace/>

Both Enginuity and EAL are involved in numerous activities across the Engineering & Manufacturing sector with both Qualification Wales and Industry Wales as well as working with outreach partners such as Careers Wales, Cardiff Commitment, Techniquet and Prodigy.

Enginuity and EAL do not currently have any international activity on hydrogen.

Enginuity in Wales

Enginuity works across the 4 nations of the UK but has a strong history and presence in Wales. Enginuity works with numerous partners including **Industry Wales** and **Qualifications Wales**.



EAL accredits 70 centres across Wales and works closely with Qualification Wales to develop and deliver qualification across the sector.

Enginuity works with partners to develop National Occupational Standards and Apprenticeship frameworks in Wales and recent work has included liaison with:

- Wales and West Utilities
- Kontroltek
- Celsa Manufacturing
- IQE
- Cotton and Brookes
- ECube
- Dow Chemicals
- Dawson and Shanahan
- Megellan
- Airbus
- Prysmian
- Kronaspan
- TATA
- Toyota
- DECA
- West Bridge Furniture
- Ceramtech



3.7 City & Guilds

<https://www.cityandguilds.com>

City and Guilds' Industry Manager for Transport, which includes Rail, Automotive, Logistics and Marine is responsible for ensuring that the knowledge and skills required for the transport sector now and in the future are kept up to date and aligned to the emerging skills of the transport industry.

City and Guilds fully recognises that the green transition demands that the existing workforce are up-skilled or re-skilled, depending on their starting point.

Hydrogen-related activities

To prepare for the emerging skills required within the transport sector and with a specific focus on hydrogen, City and Guilds have developed a suite of qualifications to support the up-skilling of the approximate 180,000 technicians across the UK.

The Qualifications developed and in development to date are listed below:

There are two specific Hydrogen Qualifications:

- Level 3 Remove and Replace Hydrogen Fuel Cell components; and
- Level 4 which is a Diagnose and Rectify Hydrogen related faults.

The Electric Vehicle qualifications are also an integral part of the Hydrogen technicians tool kit, as Hydrogen Vehicles incorporate the use of High voltage Batteries, Electric Motors, and Control units.

The new hydrogen qualifications will be delivered by City and Guilds Centres throughout the UK and other countries around the World.

City and Guilds also working in collaboration with heavy vehicle and rail sector training providers to understand their knowledge and skills requirements to ensure their workforce is ready for the hydrogen and EV transition.

City and Guilds in Wales

City and Guilds have been working in collaboration with Steering Groups made up of **employers** (e.g. Bosch UK), **providers** (e.g. Coleg Cambria, Coleg Sir Gar, Gower and Cardiff & Vale College) and **Qualifications Wales** representatives over the past 12 months in the development of the new Hydrogen and Electric Vehicle qualifications.

The Welsh colleges will be delivering the Level 1 to level 3 Electric Vehicles Qualifications from September 2022.



Further research will explore City and Guilds activities in other sectors beyond transport.



3.8 HyCERBYD/Hypermotive

The complementary HyBRID-funded HyCERBYD project, by Ynni Glân and hydrogen vehicle specialists Hypermotive, on the hydrogen vehicles supply/value chain in Wales has the following work package on skills in the hydrogen automotive sector.

WP4 - Skills required for hydrogen fuel cell and hydrogen fuel cell vehicle development

- *As identified in the Welsh Government's Hydrogen Road Map for Wales, Wales does not currently have domestic fuel cell engineering capability or capacity.*
- *Companies like Arcola, Hypermotive, AVL, Ricardo have the skills to develop fuel cell systems and integrate them into vehicles.*
- *This WP will assess the key skill required in Wales to be able to develop, integrate, deploy and maintain fuel cell systems.*
- *The WP will also suggest potential partnerships, or initiatives to attract these skills to Wales, like the Scottish Government has done with Arcola/ScotRail project.*

The HyCERBYD report will be published in April 2022 to inform the overall aims of the Hydrogen Skills and Training Group.



3.9 Cardiff Airport - Hydrogen Aviation Cluster

Sustainability consultancy Afallen and hydrogen developer Protium are leading a hydrogen aviation cluster project based around Cardiff Airport and St Athan part of the Future Flight programme.

The project involves Cardiff University's School of Engineering who are developing an aeronautical centre of excellence extending to hydrogen technologies at St Athan.

The project aims to explore the potential opportunities and challenges of a commercial hydrogen-powered flight and hydrogen refuelling in the Vale of Glamorgan and across South Wales. Skills development will be a key factor in the success of the project which presents opportunities to co-operate with Cardiff and Vale College.

Project partners expressed a keen interest in co-ordinating skills development co-ordination within emerging hydrogen projects across the Cardiff region with the involvement of CAVC, Cardiff University and others.



3.10 Cardiff University - Gas Turbine Research Centre

<https://www.cu-gtrc.co.uk>

A presentation to the Welsh Hydrogen Reference Group on up-skilling the workforce in relation to using hydrogen led to an approach from Cardiff University's Gas Turbine Research Centre.

The Centre has been working with hydrogen for over 10 years and has accumulated strong knowledge regarding the critical issues of hydrogen combustion and safety. The Centre has also delivered face-to-face and on-line training courses to businesses and industry on many subjects relating to combustion and safety. Most successful has been their basic combustion and safety course which we have delivered to over 200 Tata Steel employees.

The Centre is currently running a project funded by IDRIC called *"Ammonia and hydrogen use for industrial heat and power"* where one of the work packages requires the up-skilling of South Wales Industrial Cluster members on zero carbon fuel safety and utilisation through bespoke training.

Such expertise delivering specific activities in Wales aligns perfectly with the findings of this study and the recommendation to establish a platform for the roll-out and co-ordination of both existing and new hydrogen skills and training activities through the Hydrogen Skills and Training Group.



3.11 Chris Foxall/Riversimple

<https://www.riversimple.com>

Chris Foxall, Riversimple's Financial Director and a key supporter of HyCymru has provides this valuable insight into several hydrogen training activities in Wales.

Riversimple are the *Made in Wales* hydrogen fuel cell car manufacturer based in Llandrindod Wells.

Riversimple are working with the NPTC Group of Colleges to help develop skills in hydrogen including teaching technician apprentices to about hydrogen safety. Riversimple will work with NPTC to develop courses as their own skills requirements develops to include the potential for using NPTC's Newtown site for their first factory.

Chris has also highlighted the Swansea Bay City region's regional learning partnership which will support and administer the city deal skills project valued at £26m. The exact content of which has not yet been finalised but the project will also support the skills requirements of the other city deal capital projects. A low carbon project in Neath has a hydrogen component to it which will form part of the requirement.

Also, Chris has highlighted Gower College Swansea's work with Oil4Wales, Wales leading independent fuel distributor, by providing up-skilling to its technicians in its move to green fuels including hydrogen.



3.12 Stephenson Harwood (Legal Firm)

Hydrogen Education

A panel discussion at the marine Energy Wales annual conference led to an approach by legal firm Stephenson Harwood, who are London-based but undertaking specific hydrogen-related training sessions in Wales.

Specific hydrogen sector content from Stephenson Harwood includes :

- Roadmap for UK projects: [Regulation & Licence Highway - Key milestones in UK hydrogen projects \(shlegal.com\)](#)
- UK market update: [Hydrogen quarterly insight - December 2021 \(shlegal.com\)](#)
- Educational hydrogen seminars:
 - [Why is everyone talking about hydrogen? - YouTube](#)
 - [Hydrogen projects – from the developers’ perspective - YouTube](#)
 - [The green-tech debate; how hydrogen and battery powered energy are driving a sustainable future - YouTube](#)

All hydrogen experience and updates can be found here: [Hydrogen \(shlegal.com\)](#) and the firm publishes a UK market update every quarter.

Lecturing at Swansea University

Stephenson Harwood have been I have been providing guest lectures on renewable energy from a legal perspective to Swansea University.

The aim of these sessions is to introduce students to the technology (session 1: offshore wind / session 2: offshore vessels) and major contractual issues which they need to be aware of when entering into contracts (i.e. liability, contract interpretation, payment of invoices). The idea is to provide students with real life scenarios and updates on the legal issues which they will come across if they go into the renewable sector. The lectures are also aimed at giving them something to talk about in interviews when discussing commercial realities and things they can bring to the role. The launch announcement is here: [Stephenson Harwood launches Swansea University partnership \(shlegal.com\)](#).

Stephenson Harwood make the point that these sessions can be easily adapted to hydrogen (or any other technology for that matter).



3.13 Pontarddulais Primary School

Hydrogen learning can start from the very early ages, as a key technology for combatting climate change, delivering clean air and for the wellbeing of future generations. A classroom of Stemgineers at Pontarddulais Primary School, representing the current younger generation, is seeking video answers from HyCymru to the following searching questions on hydrogen. The school is also seeking support from Swansea University for its Summer 2022 activities on hydrogen.

Dear Mr. Owen

We are stemgineers from Pontarddulais primary school and we are learning about renewable energy. Our teacher told us that you work with hydrogen energy and we would like to learn more about it. Is it all right if we ask you a few questions about hydrogen energy.

- Can hydrogen energy be dangerous?
- Who discovered hydrogen energy?
- Why aren't there more hydrogen cars?
- Are there any negatives about hydrogen energy?
- How does hydrogen energy work?
- Which renewable energy source do you think will be used in the future?
- What does your job involve?
- Why did you choose to study hydrogen energy?
- How long has renewable energy been around for?

We really hope you can get back to us and answer some of our questions.

Yours Sincerely,

Year 6 Stemgineers

Such learning could be co-ordinated and standardised across Wales with supporting materials prepared as part of a through-the-ages educational programme on hydrogen skills, training - and learning.

For example, M-Sparc, part of Bangor University, is a notable champion of STEM-based learning on Ynys Môn which provides a ready-made platform to expand on any existing hydrogen-learning - and for co-ordination across Wales.



Supporting material should be mapped against Curriculum Wales to inspire students for further learning in colleges and universities and which prepares them for the workplace - and the booming opportunities which can emerge in the hydrogen economy. Technology showcases - of vehicles, renewables and more - which visit schools and colleges can support this aim.



3.14 DCELLS, Welsh Government & Net Zero Skills Action Plan

Culminating the series of consultations, a meeting was held with Welsh Government DCELLS officials at the end of March 2022 to discuss how the study and its findings could complement the Net Zero Skills Action Plan, which is in preparation and which is set for publication in Autumn 2022. Colleagues from CAVC and Coleg Cambria, as the key stakeholders in this pilot study, also attended the meeting.

DCELLS emphasised the importance of mainstreaming equality and a just transition, which is also core to HyCymru's (Wales Hydrogen Trade Association) principles. As an emerging technology and operating from "a blank sheet of paper", such principles can be hardwired into the developing hydrogen skills (and wider) agenda in Wales, to complement overall Net Zero goals.

A practical example and which can be formally connected with Wales is the global **Women in Green Hydrogen** network, <https://women-in-green-hydrogen.net>, which is supported by the Federal German Government. Women in Green Hydrogen's vision is "to increase the visibility and amplify the voices of women working in green hydrogen" providing a platform "to connect, empower, and change". HyCymru is making those connections with Women in Green Hydrogen, who are demonstrating that ingrained perceptions can be dispelled and how hydrogen's appeal can reach all in society.

DCELLS also introduced Cardiff University's work on *Mainstreaming Equality and a Just Transition* led by Cardiff Business School, which resulted in a further consultation, as detailed in the next section.

Such embedding of core principles extend to those of the Circular Economy and Foundational Economy, which match-up with green hydrogen and its end-use technologies and applications. This has become evident from the parallel HyCERBYD study (on hydrogen vehicles) undertaken by Ynni Glân and Hypermotive which has identified a strong appetite from the likes of Toyota, which has a large manufacturing plant on Deeside, to shift from globalisation to localisation. This means making and recycling products and the materials/components which go into them as closely as possible to markets, for both environmental benefits and supply chain resilience, leading to increased local job opportunities. The final draft of the HyCERBYD report will be available by May 2022 and will contain a section on the vital development of skills in the hydrogen vehicle sector to meet the demand and to maximise economic opportunities for Wales.

The discussion with DCELLS underlined the importance of co-ordinating activities within the emerging hydrogen space and to avoid any duplication of effort with activities amongst other, complementary technologies. This can be achieved by *piggy-backing* hydrogen onto existing activities (e.g. STEM-based learning & skills development) and through the support of existing networks (e.g. Regional Skills Partnerships), within the pyramid of Net Zero and with a strong steer from a dedicated Hydrogen Skills and Training Group.



DCELLS also expressed an interest in hosting in-house training and workshops on hydrogen for staff, of a kind which are set to be held at both CAVC and Coleg Cambria in May and June 2022, see section 5.

Because of its potential reach across all sectors of the economy, across all of Wales' geographies and through the ages of learning, hydrogen can take a central and far-reaching role within the overall pyramid of net zero skills development. A co-ordinated approach, with the steer of the Hydrogen Skills and Training Group, can clearly define this role whilst allowing for flexibility as hydrogen's reach evolves.

This approach builds on the excellence and the regional spread of activities which has been identified in this study (but which is still recognised as being just a snapshot); as well as the evident appetite, which has been one of the main findings of this work, for putting into place a framework for the co-ordination and roll-out of hydrogen skills and training within the Net Zero pyramid.

The Net Zero Skills Action Plan timescale (by Autumn 2022) is therefore very opportune for hydrogen - allowing for the findings of this study and the follow-on work through the establishment of the Hydrogen Skills and Training Group to help shape and inform the Plan.



3.15 Cardiff Business School - Just Transition

Cardiff Business School is advising the Welsh Government on *Mainstreaming Equality and a Just Transition* into policy making. An Evidence Panel is currently gathering advice and opinion from experts by experience, from education, learning and skills providers and policy think tanks in order to inform their learning. The Panel is due to report in July 2022.

A meeting was held with Cardiff Business School in early April 2022 to share notes on the respective projects and how equality mainstreaming should be embedded into hydrogen skills development. The Women in Green Hydrogen network, see previous section, network being a notable example of mainstreaming hydrogen's appeal.

Cardiff Business School kindly supplied the following information sheet on the project and the timetable (of reporting by July 2022) allows for the findings of this pilot mapping exercise and the establishment of the Hydrogen Skills and Training Group to complement the Panel's work and so feed into the Welsh Government's Net Zero Action Plan.

Information Sheet

“The Welsh Government is committed to embedding an equality mainstreaming approach into policy making. This proactive approach is needed to fulfil the Welsh Government's commitment to mainstreaming equality of opportunity for all (GOWA 2006). The Welsh Government pioneered a model for intersectional mainstreaming in 2008, and the government has accepted the recommendation of the Gender Equality Review that this model should be thoroughly tested on a live policy issue.

The transition to net zero also provides us with the opportunity to assess how to adapt the model so that we promote equality and a just transition in the education, skills, retraining, and upskilling that will be needed to achieve a new low-carbon economy. Our ambition is no less than to prevent existing labour market inequalities being carried through into the new net zero and digital economies. We will also be testing and adapting the model as we learn, so that it operates effectively in future policy making.

Working on the Net Zero Strategy to embed the promotion of equality, well-being and a Just Transition will enable the outcomes to influence all the policies and programmes that subsequently flow from the strategy: for example, designing new occupational classifications and accredited training programmes, the employability programme, the Youth Guarantee, and Apprenticeship programmes.



The model operates by creating an Evidence Panel to share the knowledge of equality organisations and policy makers - ‘equality makers and policy makers’ working together to identify and deliberate on evidence of inequality across the equalities grounds, and to create and test solutions that will actively make a significant change to systems, policies, and programmes.

The Evidence Panel will call in experts by experience, from education, learning and skills providers and policy think tanks to inform our learning. The panel will convene in January 2022 and report in July 2022.”



4 Hydrogen Skills & Training Group

This pilot skills mapping exercise on hydrogen, with the support of Cardiff and Vale College, Coleg Cambria and a host of other stakeholders involved in the skills agenda has highlighted pockets of excellence in hydrogen provision and a strong appetite for a strategic, co-ordinated approach to developing hydrogen skills in Wales. This can be delivered by a national Hydrogen Skills and Training Group which can sit within the HyCymru umbrella of working groups and which can reflect the diversity, geography, sectors and all ages of Wales.

Such a strategic approach will dovetail - and can, in some cases, lead - hydrogen skills development across the UK and it can also learn from the experience of other countries such as Denmark who further along the journey, see Section 6.

It will also have equality and a just transition hardwired into its delivery, taking a lead from the *Women in Green Hydrogen* network, for example.

Hydrogen can reach across all sectors of the economy: power, heat, industry, transport and agriculture. It can also reach across all of Wales' geographies: on land and in the marine environment; rural and urban. And it is relevant through all ages of learning: from school through FE and HE and on in to the workplace. Hydrogen can, therefore, take a central and far-reaching role within the overall pyramid of net zero skills development.

The Hydrogen Skills and Training Group can shape and co-ordinate the delivery of hydrogen skills and its policy development in a clearly defined role, complementing existing skills activities and networks whilst allowing for flexibility as hydrogen's reach evolves and likely spreads across the economy.

Consultees to this pilot skills mapping exercise have expressed an interest in participating in the Hydrogen Skills and Training Group. The Group will be a representative body with an expected core membership of 10 - 15 individuals. Sub-groups according to region, for example, may also evolve from the core Group. The composition and representation of the Group will evolve during 2022 but an opportunity to establish its first members and the terms of reference will be at the Hydrogen Expert Workshops which will be held at CAVC and Coleg Cambria in May and June 2022.

This evolutionary approach allows for capturing wider skills interest and representation beyond this pilot exercise and for the results of other HyBRID projects and the HyCymru network and Hydrogen Reference Group, amongst others to feed into the process. The process can, however, ground itself swiftly with Terms of Reference for the Group which reflect national aspirations, regional interests, sectoral impact and through-the-ages delivery, with equality, just transition, circular economy and foundational economy principles hardwired into the modus operandi.

A schematic will be prepared before the May/June workshops which illustrates the potential Terms of Reference for the Hydrogen Skills and Training Group.



5 May & June 2022 Hydrogen Expert Workshops at CAVC & Coleg Cambria

Engagement with Cardiff & Vale College and Coleg Cambria has led to the organising of expert workshops on hydrogen at both FE colleges in May and June 2022.

The workshops will provide learning opportunities on hydrogen for staff and students at the colleges by enlisting the support of expert speakers and practitioners on hydrogen, co-ordinated by HyCymru.

The CAVC workshop will take place during w/c 25th May and the Coleg Cambria workshop in June 2022. Where possible, local experts will be enlisted but a broad range of expertise will be delivered to communicate the wide and strong reach of hydrogen.

The workshops will be pilots in themselves, which can be readily replicated to other FE colleges and can also dive into detail on specific topics in further sessions. They can also be replicated in other work settings including the workplace and HE to raise general and specific knowledge on hydrogen.

While final details are still to be confirmed for both CAVC and Coleg Cambria workshops, the following table illustrates the expertise which has already been identified for participation in the CAVC workshop.

Experts for Hydrogen Skills & Training Workshops - CAVC May 2022

	Name	Surname	Company	Expertise
1	Mike	Dolman	Element Energy	Transport sector
2	Martin	Kenzie	2G	Large CHP
3	Chinnan	Dikwal	KBR	Market trends, production, economics, end use applications
4	Henry	James	Wales & West Utilities	Gas grid and end use applications
5	Eleri	Davies	RWE	Production
6	Rebecca	Pike	RWE	Production
7	Steffan	Cook	Bia Consulting	Micro-CHP
8	Guto	Owen	Ynni Glân	Hydrogen Hubs (production, storage and end use)
9	Steven	Morris	Cardiff University	Hydrogen safety



6 International Learning

Hydrogen is central to the clean energy transition in countries across the world. A brief selection of initiatives is included here for illustrative purposes.

REPowerEU

The European Commission published its REPowerEU plan to make Europe independent from Russian fossil fuels well before 2030 in March 2022.

The plan includes a hydrogen accelerator to develop infrastructure, storage facilities and ports.

REPowerEU: Joint European action for more affordable, secure and sustainable energy
MARCH 2022

In recent months Europe has been facing high and volatile energy prices. After Russia's unprecedented military attack on Ukraine, security of supply concerns exacerbate the situation.

Providing companies and households with affordable, secure and clean energy requires decisive action, starting immediately with price mitigation and storing gas for next winter.

The case for a rapid clean energy transition under the European Green Deal has never been stronger and clearer. Terminating our dangerous overdependence on fossil fuels from Russia can be achieved well before 2030.

REFILLING GAS STORAGE FOR NEXT WINTER

- A legislative proposal by April on minimum gas storage so Europe better controls its supply, establishing a 90% filling target by 1 October, designating gas storage as critical infrastructure, and allowing incentives for refilling.
- Support to coordinated gas refilling operations, for example through joint procurement, collecting orders and matching supplies.
- Continued investigation into behaviour by operators, notably by Gazprom.

REPOWEREU TO CUT OUR DEPENDENCE ON RUSSIAN GAS

- More rooftop solar panels, heat pumps and energy savings to reduce our dependence on fossil fuels, making our homes and buildings more energy efficient.
- Decarbonising industry by accelerating the switch to electrification and renewable hydrogen and enhancing our low-carbon manufacturing capabilities.
- Speeding up renewables permitting to minimise the time for roll-out of renewable projects and grid infrastructure improvements.
- Doubling the EU ambition for biomethane to produce 35 bcm per year by 2030, in particular from agricultural waste and residues.
- Diversifying gas supplies and working with international partners to move away from Russian gas, and investing in the necessary infrastructure.
- A Hydrogen Accelerator to develop infrastructure, storage facilities and ports, and replace demand for Russian gas with additional 10 mt of imported renewable hydrogen from diverse sources and additional 5 mt of domestic renewable hydrogen.

URGENT ACTION ON PRICES

- Keeping retail energy prices in check by confirming the possibility of price regulation to help protect consumers and our economy.
- State Aid measures: consultation with Member States on a potential Temporary Framework to grant aid to companies facing high energy costs.
- Guidance on temporary tax measures on windfall profits and use of emissions trading revenues, so governments can ease the pressure on household consumers.
- Market actions assessing options to improve the electricity market design.

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Denmark

Denmark published a new hydrogen strategy in March 2022 and views green hydrogen as the natural partner for the wind energy industry, whose development has been central to the success of the Danish economy over the last 20 years.

Hydrogen Denmark (Brintbranchen), the Danish hydrogen trade association published its VE 2.0 report on hydrogen and power-to-X technologies in November 2020 which forecasts 53,000 new jobs in Denmark by 2030 in the industry.





Ireland

Ireland has huge green hydrogen production potential and potentially in partnership with Wales given the shared resource and infrastructure.

A January 2022 report *Hydrogen and Wind Energy: The role of green hydrogen in Ireland's energy transition* by Wind Energy Ireland and Green Tech Skillnet (a business network facilitating the workforce and talent development needs of the Irish renewable energy industry) has highlighted the need to address the skills gap in order to fully develop the hydrogen industry in Ireland and presents opportunities for co-operation between Wales and Ireland on skills.

<https://windenergyireland.com/images/files/final-hydrogen-and-wind-energy-report.pdf>



7 Recommendations

- Establish & support a **Hydrogen Skills and Training Group for Wales** for a strategic, co-ordinated delivery of hydrogen skills and training, which can connect international activities and which can help shape and inform the Welsh Government's **Net Zero Skills Action Plan**.
- Incorporate the findings of parallel studies e.g. **HyCERBYD and other HyBRID projects** into the work of the Hydrogen Skills and Training Group and towards the Net Zero Skills Action Plan.
- Hold pilot **Hydrogen Expert Workshops** at CAVC & Coleg Cambria in May and June 2022.
- **Expand the pilot workshops** to all FE Colleges and to education, skills & training development on hydrogen through the ages from schools through FE & HE to the workplace.
- Utilise **HyCymru's digital platform and 1-stop-shop service** to co-ordinate & signpost activities and to build a knowledge bank of resources, learning materials, webinars etc to support skills and training