Interreg North-West Europe
GenComm
European Regional Development Fund

H2GO NEWS

June 2022

Hydrogen Topography

The genesis of the GenComm project was to develop and demonstrate green hydrogen from differing renewable sources as a regional energy vector. This was a deliberate strategy to show how communities could build resilience and generate their own energy security from local renewable opportunities.

This geographical approach to developing zero carbon solutions for local use is referred to in our work as ***'Hydrogen Topography.'*** This approach empowers communities across Europe to access hydrogenewables – their own renewable opportunities wind, solar or bio and use these green sources to provide green solutions and end use on their specific journey to net zero. The GenComm research has demonstrated that there are many routes for green hydrogen to be produced and utilised on the transition to net zero. Europe as it assembles all of these routes into the Green Hydrogen Highway will benefit from the diverse use and optimisation of green Hydrogen as SMART H_2.

The harnessing of the outputs within the GenComm project of the three pilots, wind, solar and bio to hydrogen and hybrid uses of power, heating, transport and storage has been captured in the Decision Support Tool (DST).

The GenComm DST is an energy model, analytics platform which communities use to make informed green energy project development decisions and investments. The DST is an easy to use graphical tool enabling community stakeholders to take full commercial and environmental advantage of renewable data analytics to develop their own energy solutions. It is powering community driven transitions to a zero carbon footprint and enabling communities to plan their H_2-based energy solutions, decarbonise energy needs and plan their pathway to net zero.

The DST is currently being enhanced to becoming an Enabling Support Tool (EST) that is set to assist communities to accelerate the development and deployment of regional low-carbon technologies by providing reliable financial and technological data from renewable energy pilots. This tool empowers and supports accurate investment decision making in the most impactful technologies, contributing to the EU's transformation to a low-carbon energy system.

GenComm has also been the catalyst demonstrating how the Hydrogen economy can be developed and grown in each region and local community. Technologies including Hydrogen Vehicles (Double Deck Buses for Public Transport, Cars to operate as Taxis) and Gas Grid injection are examples of how the local market opportunities can be identified and built upon.

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Our partners and associate partners within the GenComm project and within our wider work with Hydrogen Ireland and others on the global hydrogen stage, have for many years championed the Hydrogen Topography approach that provides choice for each region to develop specific clean hydrogen opportunities based on geographical renewables energy opportunities and not a sectoral 'one size fits all' type approach. This geographical approach is preferable to a widespread sectoral approach, will lead to increased demand and be the catalyst to create regional clean hydrogen supply and demand models and assist the creation of national hydrogen strategies that will create a cohesive SMART H_2 European Clean Hydrogen Strategy.

It is wonderful to witness the 'Hydrogen Topography' strategy now recognised and included in all but name in the recently produced document 'How to deliver on the EU Hydrogen Accelerator.' This paper analyses the Hydrogen Accelerator proposed in the European Commission's REPowerEU common action plan and suggests concrete additional EU actions necessary to realise its '20-Mton-hydrogen-target-by-2030'.

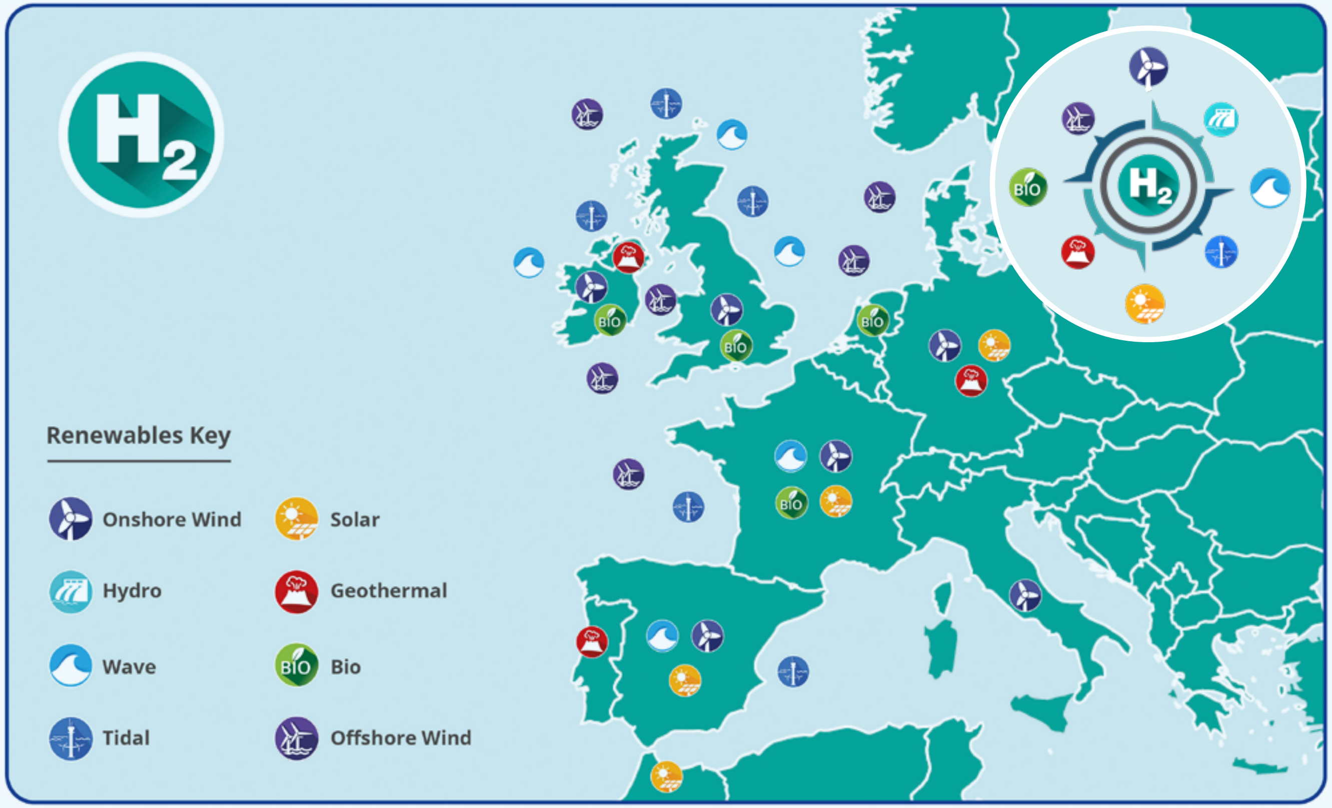

Illustration of EU Hydrogen Topography

The endorses and reinforces our Hydrogen Topography approach recognising the benefits in developing hydrogen demand per geographical area instead of a sectoral approach. This paper proposes the need for additional actions to deliver this including;

- **Converting regional 'corridors' that are scheduled to shift from low to high caloric gas to hydrogen instead.**
- **Fast-tracking the implementation of Important Projects of Common European Interests (IPCEI) and hydrogen valleys with the integrated conversion from gas to hydrogen.**
- **Connecting hydrogen valleys across Europe and expand geographically from these valleys while converting from gas to hydrogen.**

We fully believe that geographical Green H_2 specialisms dependant on the local renewables and availability is the way forward and represents a real opportunity to tackle our climate and energy crises. This will become more important when we look at the 'forgotten cousins' of renewables and extend our research base to include clean hydrogen production and storage from offshore wind, wave & tidal and geothermal renewable opportunities.

GenComm has demonstrated that this geographical approach in developing, generating, storing, distributing and use of green hydrogen is preferable to a widespread sectoral approach and leads to increased demand, increases energy innovation, develops new technical opportunities on the EU Hydrogen Highway and stimulates the growth of the green economy.

Paul McCormack,
GenComm Programme Manager

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Can Hydrogen Fuel Ireland's Green Future?

Clean Hydrogen Partnership Director Bart Biebuyck discusses the opportunity for Ireland to become a 'hydrogen valley' in the EU and the fuel's potential when it comes to energy storage to 'balance the grid'.

Using hydrogen as a form of clean fuel has been discussed for years, with supporters describing it as the future of energy. But has hydrogen technology reached the point where it's a feasible option as a green fuel source?

In 2020, the European Commission **launched a new strategy** to aid the efforts of European industry to rapidly decarbonise. This included the formation of the European Clean Hydrogen Alliance, which aims to support the large-scale deployment of clean hydrogen tech, promoting investments and stimulating the roll-out of clean hydrogen production.

There are many ways to produce hydrogen fuel. One is through a process called electrolysis, which uses electricity to split water into hydrogen and oxygen. When renewable electricity is used for this method, it is known as green hydrogen. But there are issues associated with commercialising this process, including the costs and the vast amount of renewables required to make it a clean energy source.

Bart Biebuyck is the Director of the Clean Hydrogen Partnership, set up last December to support research, technological development and demonstration activities in hydrogen energy in Europe. The public-private partnership is a successor to the Fuel Cells and Hydrogen joint undertaking.

Biebuyck told SiliconRepublic.com that hydrogen fuel cells have seen rapid technology improvements over the last decade.

"We went from 100kW to 100MW in just 10 years," Biebuyck said. *"This is the achievement and now we can go to mass production and really try to decarbonise our gas system now by using hydrogen. So there's huge potential now.*

Bart Biebuyck, Clean Hydrogen Partnership Director

"We needed to go through this research, 10 years of research and demonstration projects, but now it's starting to become commercial," he added.

Biebuyck said industry leaders in Europe are taking notice of hydrogen as a potential clean fuel source, particularly in transport. In 2020, Airbus said it's developing three **zero-emission aircraft models** that could take to the skies by 2035 using hydrogen fuel.

Despite the advances in technology, hydrogen still has a long way to go until it can be classified as a clean fuel. The EU currently uses **around 10m tonnes** of hydrogen annually. However, Biebuyck said around 96% of this is **produced through fossil fuels** such as coal or gas, as this remains the cheaper option.

HYDROGEN IN IRELAND

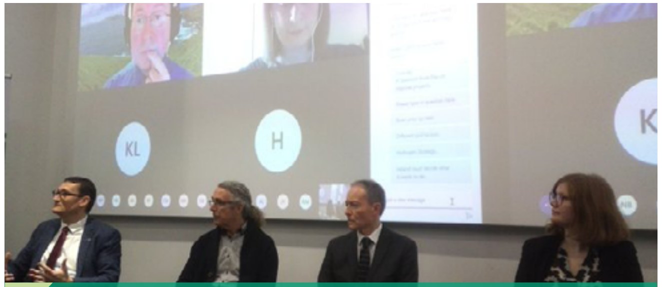
In order to increase the development of clean hydrogen in Europe, Biebuyck said the industry needs access to more cheap, renewable energy to make green hydrogen cheaper. He added that Ireland is in a unique position to become an exporter of renewable energy to the EU through the development of offshore wind farms.

"You have the luck or the benefit of having access to a lot of wind, so you can build a lot of offshore wind parks. Recently the price of offshore wind parks is really going down fast. So you can start to produce very cheap renewable electricity," Biebuyck said.

While Ireland may be a latecomer to the hydrogen table in Europe, Biebuyck has noticed a growing momentum in the country, with hydrogen being looked at more seriously by academics and some industry members.

He visited Ireland in February to attend a Partner Meeting of the GenComm renewable hydrogen project. GenComm, led by Belfast Met, is focused on showing the feasibility of hydrogen technology and helping communities develop roadmaps to renewable hydrogen-based energy models.

GenComm programme manager Paul McCormack said Ireland is at the *"epicentre of the hydrogen revolution"* with a number of national and international projects working in this area. *"Ireland is playing a central role in transforming Europe's energy structures and in building a hydrogen economy that will deliver sustainable environmental, economic, academic and social benefits,"* McCormack said.



Bart Biebuyck at the GenComm Partner Meeting in Dublin on February 25, 2022.

Biebuyck added that Ireland had the potential to become a "hydrogen valley" within the EU. These are regions that merge industry and research initiatives to carry out pilot projects across the complete hydrogen value chain, from production to end use.

Last year, European Commission president Ursula von der Leyen said it was part of a coalition of countries pledging to create 100 hydrogen valleys around the world. She pointed to the Groningen area of the Netherlands, which is working on a green hydrogen value chain, and said there are many areas that want to follow. *"This is how we can accelerate the hydrogen economy on a local scale, on our way towards a European hydrogen economy as a whole,"* she said.

For Ireland, Biebuyck said the first priority should be to create a hydrogen strategy, after which time the country can focus on the potential of creating a hydrogen valley or exporting energy to the EU.

Earlier this year, the representative group for the Irish wind energy industry also **called on the Government** to create a hydrogen strategy with a focus on green hydrogen development. Wind Energy Ireland CEO Noel Cunniffe said this strategy would help the country plan for a long-term replacement of the existing gas generator fleet and *"long-duration storage over the next decade"*.

"Ireland is one of a handful of EU member states without a hydrogen strategy," Cunniffe added. *"The Government must accelerate the development of a robust hydrogen strategy so that by the middle of this year we are setting out targets for green hydrogen use across industry, heavy road transport, shipping, aviation and power generation."*

"Ireland is ready for green hydrogen, but we need a clear signal from Government that they are committed."

In January, Junior Minister at the Department of the Environment, Climate and Communications Ossian Smyth, TD, said a public consultation on a green hydrogen strategy will be launched **later this year**.

A SOLUTION TO ENERGY STORAGE?

With the rise in renewables, energy storage is something that needs to be considered. Unlike fossil fuels, many forms of renewable energy such as wind and solar are weather dependent, which means excess energy can be lost in high-production periods. A lack of cheap storage means this energy can't always be used during low-production times.

Among the other potential benefits hydrogen can play for the environment, Biebuyck said it can also help the energy storage issue. *"We have this imbalance between winter and summer. In summer you have a lot of sun, so you can produce a lot of renewable electricity. But we don't use a lot of electricity in summer, the majority we need in the winter.*

"So that's where you need to store and basically balance the grid. We call it storage, but balancing the grid is something where hydrogen will play a very important role in the future," Biebuyck added.

Once hydrogen is created through electrolysis, it can be stored in fuel cells. These cells can be used in applications such as power generation, vehicle fuel or injected into natural gas pipelines to reduce their carbon intensity. Hydrogen can also be stored as a compressed gas or cryogenic liquid for later use, which could be useful to help maintain electrical grid stability during periods of low wind or solar energy.

While hydrogen is currently produced largely from fossil fuels, it has the potential to become a clean fuel source as other forms of renewable energy develop. With many organisations and research groups focused on development, the technology is also likely to improve further in the years ahead.

"Europe is leading in electrolyser technology worldwide. The US, China, Japan, they're all looking to Europe to buy electrolysers because we have very high technology for that, which is very efficient as well," Biebuyck said. *"This is recognised, so we should support that further and make sure that our European companies can also scale up and get the orders that they need."*

Leigh McGowran,
Silicon Republic website journalist

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Ireland's First Hydrogen Valley Welcomed

GenComm Partners welcomed the news on April 14, 2022, of Ireland's first hydrogen valley being unveiled by An Taoiseach, Micheal Martin, TD during a conference on the Renewable Energy Opportunity in Western Ireland held by the Port of Galway.

The Galway Hydrogen Hub (GH_2) is a cooperation comprised of seven members: NUI Galway, Galway Port, CIÉ Group and Bus Éireann, Aran Islands Ferries, Lasta Mara Teo, Aer Arann Islands, and SSE Renewables.

GH_2 proposes to establish a Hydrogen Valley in Galway, similar to ones already established in other European nations. A Hydrogen Valley is a regional ecosystem that connects hydrogen research, manufacturing, distribution, and transportation to a variety of end customers in the transportation and industrial sectors. Utilizing indigenous renewable hydrogen in Hydrogen Valleys is regarded as a critical first step towards enabling the creation of a new hydrogen economy.

GH_2 will establish Galway as Ireland's first Hydrogen Valley, supplying clean hydrogen for use in transportation, industry, and local communities throughout the greater Galway region.

Taoiseach **Micheal Martin** with **Conor O'Dowd**, CEO, Galway Harbour Company and **Maurice O'Gorman**, Chair, Galway Harbour Company.

The GH_2 consortium's initial flagship demonstrator project at Galway Harbour will focus on the indigenous generation and supply of pure green hydrogen fuel for public and private vehicles. This will comprise buses and trucks and will result in a multi-modal, zero-emission, renewable hydrogen transportation hub that can be reproduced easily throughout Ireland.

The projected hydrogen transport hub is expected to be completely operational by the second half of 2024, and the April 14 announcement represents a big step forward in terms of the potential for indigenous renewable fuel production and delivery for both domestic and export markets. This would demonstrate Ireland's potential as a significant hydrogen producer and exporter.

The establishment of Ireland's first Hydrogen Valley is another step forward in the country's strategic positioning as a hub for renewable energy generation and energy sector integration. Green hydrogen can contribute significantly to Ireland's greenhouse gas reduction efforts by ensuring energy supply stability, mitigating long-term energy price fluctuations, and assisting in mitigating long-term energy price volatility.

Lorcan O'Connor, Group Chief Executive, CIÉ said: ***"Sustainability and decarbonisation are at the heart of public transport. As the CIÉ Group is by far the country's largest public transport provider, we are delighted to work with our partners in the GH_2 consortium to ensure we are at the forefront of the opportunity hydrogen fuel will provide in meeting both our own decarbonisation targets, and those of the State. It will ensure we have explored a complementary mix of zero emissions technologies, with the current focus on electrification, to power low carbon transport and meet our 2030 targets and net zero target by 2050. What we develop and learn in this innovative partnership in Galway could be transformative for sustainability in the transport sector as a whole."***

From left to right: **Dermott Crombie**, Aran Ferries, Lasta Mara Teoranta, **Rory Monaghan**, NUIG, **Stephen Kent**, CIE, **Conor O'Dowd**, Port Galway, Taoiseach **Micheal Martin**, **Louise Glennon** SSER, **John O'Sullivan**, SSER, **Jarlath Conneely**, Aer Arrann, **Maurice O'Gorman**, Port of Galway.

John O'Sullivan, SSE Renewables' Project Manager for GH_2 said: ***"Our consortium has come together with the objective of not only using green hydrogen to realise new renewable energy solutions for Ireland but to also deliver the country's first Hydrogen Valley. Green hydrogen is gaining global recognition as a means of decarbonising heavy duty and long-distance transport as well as industry. The development of Ireland's first Hydrogen Valley in Galway Harbour will allow us to utilise indigenous renewable energy to produce green hydrogen for use by local air, sea, road and rail transport alongside industry. As part of the integrated SSE Group, SSE Renewables has a view across the whole energy value chain and so is uniquely positioned to deliver this green hydrogen solution for the consortium, helping to kickstart the development of a new hydrogen economy in the West of Ireland."***

GenComm Partner representative, Dr Rory Monaghan, Senior Lecturer of Energy Systems Engineering at NUI Galway, said: ***"The future sustainable growth of our region will depend in large part on the availability of secure indigenous renewable energy. We are witnessing huge strides in the greening of our electricity grid with wind, but we use twice as much energy for transport, almost all of which is imported fossil fuel. The key innovation of GH2 is the use of wind to drive a zero emission, multi modal transport sector."***

Green hydrogen is created when renewable electricity is used to electrolyze water and separate it into its component elements of oxygen and hydrogen. While other fuels such as gasoline, diesel, or natural gas leak toxic carbon dioxide into the atmosphere when burned, hydrogen emits solely water vapour. Once created, it may be compressed or liquefied, allowing significant amounts of renewable energy to be transported long distances and stored for months at a time, possibly altering the future for renewable energy-rich countries such as Ireland.

Green hydrogen can be utilized as a zero-emission fuel in applications that are now too complex to electrify directly, such as buses, trucks, planes, and ships, as well as energy-intensive sectors such as steel, cement, fertilizer, and chemicals manufacturing. Green hydrogen, according to the majority of energy analysts, is critical for achieving the necessary reductions in greenhouse gas emissions to avert the worst effects of climate change while also reducing the need to import fossil fuels.

The project's full specifics will be released in the coming weeks, along with information about a public consultation that will take place as part of the project's development phase.

Eugene McCusker
GenComm Communications Officer

Queen's University Belfast Students Visit Energia's Long Mountain Wind Farm Hydrogen Project

In March, a group of second-year students from QUB's School of Natural and Built Environment visited Energia's Long Mountain Wind Farm in North Antrim. These students are the policy makers and planning decision-makers of the future.

For many of them, this was their first time visiting an operational wind farm and they were keen to find out more about wind energy and green hydrogen production.

Energia Renewables' Project Manager, Richard Henderson shared his insights into the complexities involved in developing wind and hydrogen projects. He explained in detail the process involved in developing a wind farm project from planning through to construction and operation. He also shared his recent experience of developing a green hydrogen production facility at the site.

Richard told the students, ***"I find real purpose and enjoy working on renewable energy projects that are critical in combating the challenge of climate change. It's great to welcome students here to Long Mountain Wind Farm and share some insights, knowledge, and experience from my years in the renewables industry."***

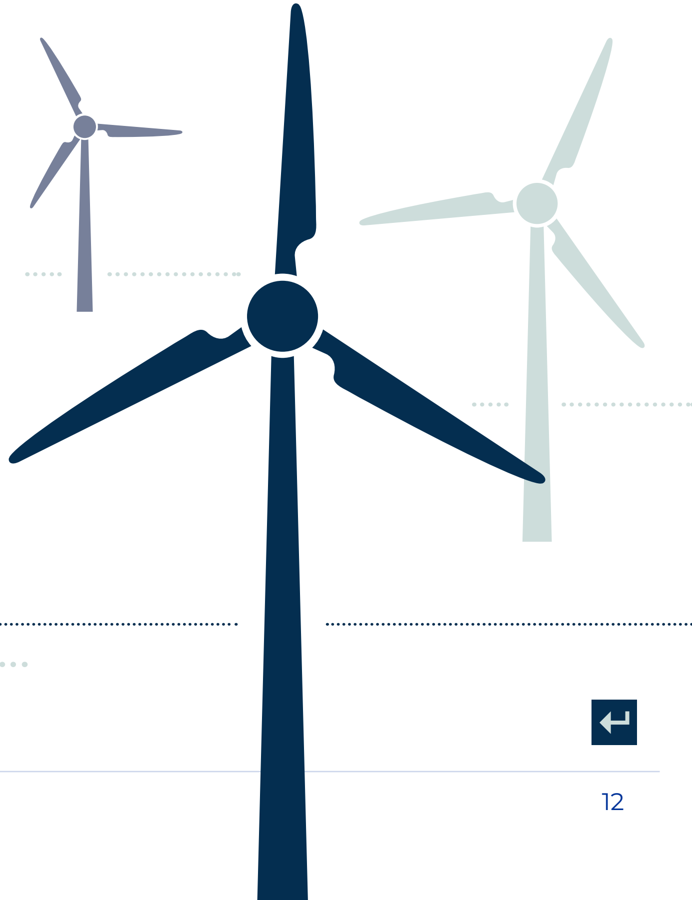
Energia Group is delivering renewable projects that will help to decarbonise the energy system across the island of Ireland. One such project, is the Group's hydrogen refuelling station in Belfast, the first of its kind on the island of Ireland. The refuelling station has dispensed over 2000 kgs of hydrogen since it was installed in June 2021. By the end of January 2022, the three hydrogen buses have offset approximately 24,000 kgs of carbon dioxide over 17,000 miles when compared to diesel buses since they became operational. Since then, an additional four hydrogen buses have been put into service. In total the seven hydrogen buses can now be seen all over Belfast transferring passengers emission free.

Canadian PhD student, Alex Miller, is researching renewable energy policy and the link to the public acceptance of wind energy. He said, ***"Compared to some parts of Canada, public acceptance for wind farms is much higher here in Northern Ireland. That's because some Canadian provinces implemented policies which ignored the concerns of local communities and didn't fully consider the impact of their policies. Policy making is an essential part of the energy transition and it's great to see the Northern Ireland Assembly setting a goal of 80% renewables by 2030."***

As we look forward, Energia Group will be producing the first green hydrogen on the island of Ireland by the end of summer 2022 at Long Mountain Wind Farm. This is the first step on a busy and exciting journey to develop green hydrogen projects within Energia Group. The key learnings from this project will accelerate the introduction of further hydrogen projects helping to achieve our climate targets quicker, cheaper, and more successfully going forward.

The need for hydrogen is growing at an outstanding pace. Energia Group have invested in several universities to help develop the skills and knowledge required to meet the growing demands within the industry.

Andrew Morrison,
Energia



New Professor working on hydrogen materials and technologies at the University of Luxembourg

Prof. Dr. Bradley Ladewig recently joined the University of Luxembourg as the Paul Wurth Chair in Energy Process Engineering, with a major focus of his work to be in the area of green hydrogen.

Professor Ladewig will establish new laboratory facilities at the Belval Campus of the University, custom-designed for a range of different experimental research facilities relating to hydrogen materials and technologies. In particular, the lab will have significant space available for design, construction and operation of small-medium scale technologies (floor mounted with electrical, gas and exhaust connections), as well as more conventional laboratory facilities for synthesis and characterization of materials such as gas sorbents and membranes. The new laboratories should be ready by the middle of 2023.

The Chair is supported by the Paul Wurth Company, part of the SMS Group, both with financial support for the first five years, but also extensive project and networking support to help integrate the work of the Chair into local, regional and international industries.

Of course, the Chair also has a major role in expanding the educational offering relating to hydrogen and clean energy technologies more broadly in the Department of Engineering, and will contribute to Bachelor and Master teaching programs, as well as helping to design and install new laboratory teaching facilities relating to hydrogen (such as fuel cells, electrolysers and combustion experiments).

Prof. Ladewig has a highly international background, having studied in the UK and Australia, worked as an academic at Monash University (in Australia), Imperial College London (UK), KIT Karlsruhe (Germany) before taking up the Paul Wurth Chair at the University of Luxembourg. He is already travelling and meeting with many academic and industrial partners to establish the first set of projects and activities within the Chair, and aims to make a particular effort in activities involving partners in the Greater Region.

Prof. Dr Bradley Ladewig,
University of Luxembourg

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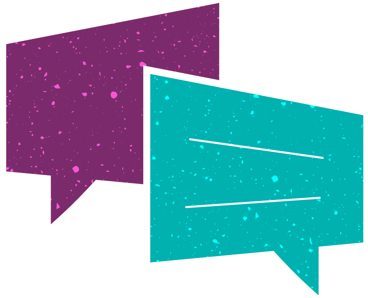

GenComm Partner NUIG Lead Authors Of New International Energy Agency Report

NUI Galway researchers were the lead authors in a major new IEA study of the national policies, technological market readiness and regional drivers relevant to the deployment of hydrogen and power-to-methane.

The NUI Galway team consisted of PhD Candidate Fabio Bozzolo Lueckel, Masters Student Mawini Chanika, Energy Systems Engineering Student Caoimhe Boyce, and Senior Lecturer Rory Monaghan. Their co-authors were Stefan Majer of the German Biomass Research Centre (DBFZ), and Uwe Fritsche and Hans Werner Gress of the International Institute of Sustainability Analysis and Strategy (IINAS).

Non-biogenic renewable gas (NBRG), encompassing hydrogen produced by electrolysis powered by renewable electricity and potential subsequent methanation with capture CO_2 are potentially important routes to decarbonisation energy and chemical feedstock use, especially in the hard-to-abate sectors. A growing number of countries have released national hydrogen strategies that seek to position hydrogen in their decarbonisation plans.

Finally, the report explores the most suitable technologies and concepts to produce NBRG. It then determines how different sources of electricity and CO_2 influence the economic feasibility and GHG abatement costs of NBRG. It achieves this using a survey and workshop for key stakeholders to focus attention on the core issues of production costs, technology commercial readiness, environmental sustainability aspects, and challenges presented by regulations. This leads to a review of the scientific, technical, policy and regulatory publications relevant for NBRG. Finally, the repot explores how regional characteristics impact the economic and environmental performance of these hydrogen pathways.

The findings of the survey, workshop, and review highlight that, while no countries have developed explicit NBRG strategies, a significant and growing number have developed hydrogen strategies, some of which, such as Germany, incorporate non-biogenic renewable methane, as defined in this study and shown in Figure 1.

National strategies can be defined as being focused on Imports (Japan, Germany, Netherlands) or exports (Australia, Canada); and green hydrogen (most European countries) or mixed green-blue hydrogen (UK, USA, Canada). Most strategies focused on green hydrogen have common themes including: an expectation that the first deployment of green hydrogen will be in industries that already consume fossil-derived hydrogen such as oil refining, and fertilizer and chemicals production; a focus on heavy duty transport such as buses and trucks; a focus on the co-benefits of hydrogen use including reduced GHG emissions, improved air quality, reduced reliance on fossil fuel imports. Japan's strategy foresees important roles for hydrogen in personal mobility, i.e., fuel cell electric vehicles. Some, notably, the UK, Germany, and the Netherlands, intend to repurpose the natural gas grid and associated infrastructure for large scale distribution and storage of hydrogen.

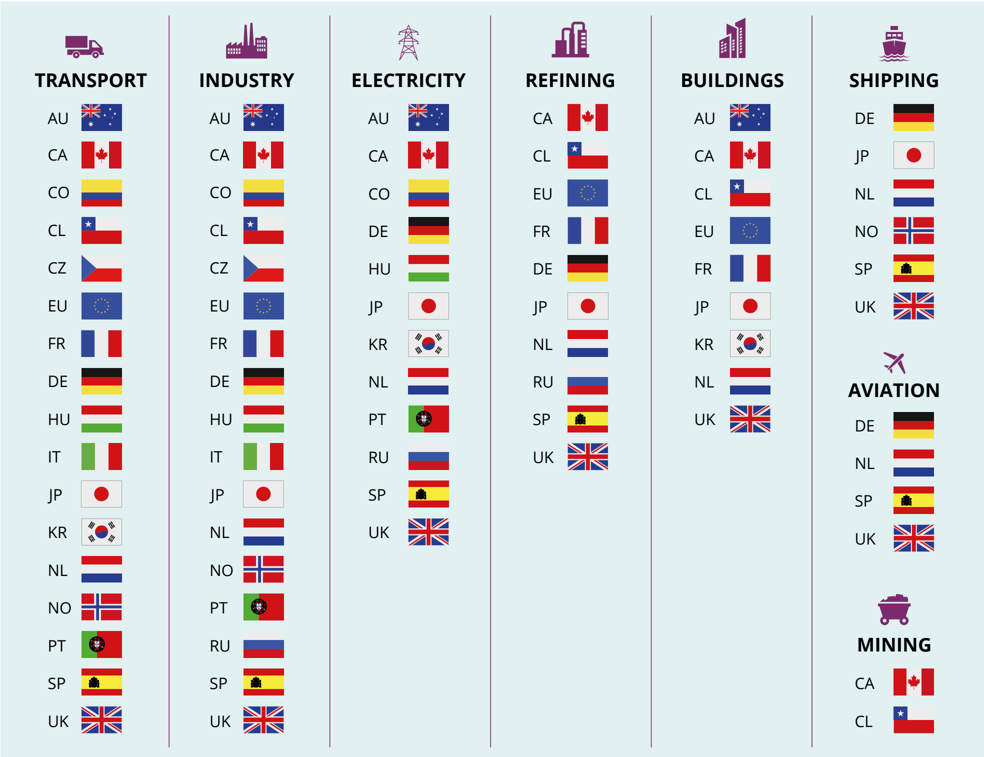

Figure 1: Proposed hydrogen uses adapted from International Energy Agency (2021a).

The analysis conducted in this report considers three regional case examples in the North Sea, Texas, and Brazil to illustrate how local factors such as renewable electricity resource, electricity grid GHG intensity, potential CO_2 source type, and other factors affect NBRG economic feasibility, measured by levelised delivered cost of gas, environmental sustainability, measured by GHG intensity of gas, and the cost of abating CO_2 emissions using NBRG. Some of the key findings of the analysis are summarized below.

The use of excess electricity as the sole power source for electrolysis is shown to be cost ineffective due to the low electrolyser capacity factors caused by the infrequency of excess electricity availability. On the other hand, the economic and environmental feasibility of using grid electricity to maintain high electrolyser capacity factor show strong dependences on regional factors including the price of grid electricity, its GHG intensity and the relative price of renewable electricity generation. In the North Sea, hydrogen produced from grid electricity has the lowest carbon abatement cost in 2030 (170 USD/tCO_2), but by 2050 is overtaken by hydrogen produced by dedicated offshore wind (140 USD/tCO_2), as shown Figure 2. This is mostly due to the expected decrease in offshore wind electricity price and simultaneous increase in grid electricity price.

In Texas, which possesses abundant wind and solar resources with high combined capacity factor, hydrogen produced from dedicated renewables achieves abatement costs of 180 USD/tCO_2 in 2030 and 110 USD/tCO_2 in 2050. Similar trends are seen in Brazil, with hydrogen produced from dedicated biomass electricity achieving abatement costs of 130 USD/tCO_2 in 2030 and 100 USD/tCO_2 in 2050. Expected ranges of levelized costs of delivered hydrogen by region and year are: 4-7 USD/kg in 2030 and 3-6 USD/kg in 2050 for the North Sea (see Figure 3); 4-10 USD/kg in 2030 and 3-8 USD/kg in 2050 for Texas; and 8-12 USD/kg in 2030 and 6-12 USD/kg in 2050 for Brazil.

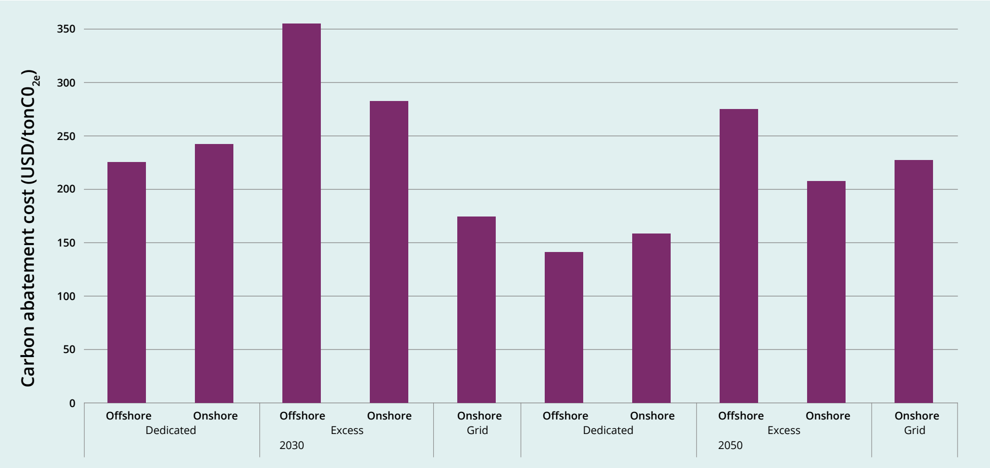

Figure 2. *Carbon abatement cost of delivered hydrogen in North Sea case example scenarios.*

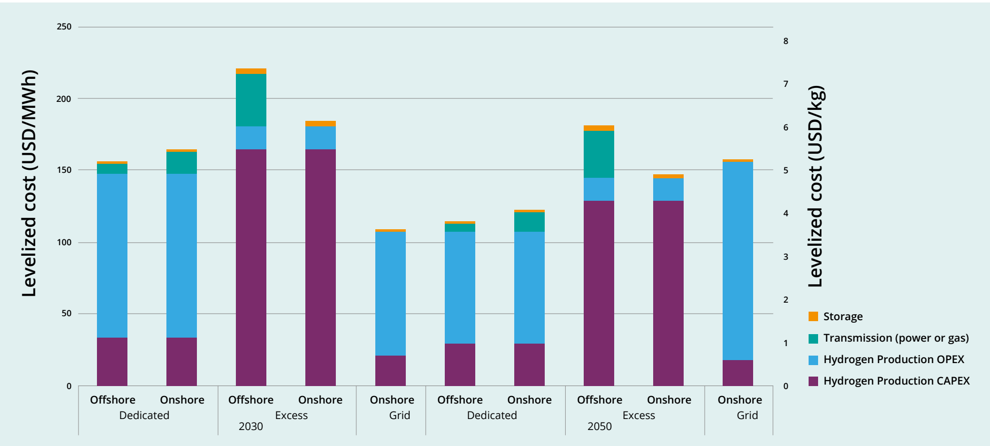

Figure 3. *Delivered cost of hydrogen for scenarios in the North Sea case example.*

In all cases, methanation of hydrogen using captured CO_2 to renewable methane (RM) significantly increases abatement costs, but this must be balanced against the benefits of being able to use existing natural gas infrastructure and appliances. In the case of methanation using CO_2 from industrial sources, this high abatement cost is due to the GHG intensity of the CO_2, which is of fossil fuel origin. For methanation using CO_2 sourced from direct air carbon capture (DACC), the high capital and operating costs of DACC itself lead to high CO_2 prices and therefore to high abatement costs for RM. The lowest abatement costs for RM are seen for CO_2 captured from biomethane and bioethanol plants, which combine CO_2 of renewable origin with relatively low CO_2 capture price due to high CO_2 concentration in off-gases.

Other findings show that situating electrolysers close to the sources of renewable electricity is more cost effective, than situating them close to hydrogen demand centres since it is cheaper to move energy via new hydrogen transmission pipelines than by new electricity transmission lines. Finally, the analysis shows that the lower ends of carbon abatement cost ranges are similar to carbon tax proposals in a number of countries, indicating the feasibility of NBRG in national decarbonisation strategies.

Dr Rory Monaghan,
Senior Lecturer, NUIG

For more information

on the GenComm Project and our work in the green hydrogen arena contact

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