Policy statement

Green Hydrogen in Ireland

What is Good Energies Alliance Ireland?

Good Energies Alliance Ireland (GEAI) is an environmental NGO, founded in 2011, situated in County Leitrim in the Northwest of Ireland, who aims to ensure the wellbeing of people and communities on the island of Ireland and elsewhere through the protection and sustainable development of our environment, natural resources and our communities.

Green Hydrogen has positioned itself as the best option for storing and transporting the energy produced by electrolysis or renewable power, overall, from wind turbines and solar PV. Seeing the major presence of onshore and offshore wind farms in Ireland, and their utility for generating Green Hydrogen, GEAI believes this possibly presents a magnificent opportunity to reduce GHG emissions and increase energy security.

Our main objectives are:

- To carry out the activity of promotion of environmental and climate protection and monitoring of energy production and use on the island of Ireland and its territorial waters and elsewhere and any other related activities.
- To establish, promote and operate programmes and services with a view to fostering the economic, personal, cultural, recreational, and social well-being of the local communities and wider areas.

Background

Green Hydrogen (GH) is produced by splitting water into hydrogen and oxygen using renewable electricity. In addition, resources such as hydropower and wind power are used to generate clean, renewable energy, which is fed to electrolysers along with water. The electrolyser splits water molecules to produce hydrogen and oxygen[1]. The gas produced is compressed and stored, from where it can be transported and used in homes and industry. The technologies supporting this process are focused on hydrogen-based fuels and electrolysers (technologies that produce hydrogen from water)[2].

According to WHO, green hydrogen is the best choice for storing and transporting energy generated by electrolysis and renewable energy. Substituting fossil fuels with green hydrogen could do a lot to achieve emission reductions and mitigate the variability of supply and storage issues associated with renewable energy[3].

In addition to Green Hydrogen, there are different labels of hydrogen production; blue and grey which are primarily made from fossil fuel reforming and gasification processes, except that blue works through carbon capture. However, both technologies are based on fossil fuels and therefore generate carbon dioxide emissions. Blue hydrogen production involves capturing carbon dioxide using natural gas as a fuel, resulting in a methane leak that has a higher carbon footprint than burning coal[4].

[1] Hydro Tasmania (2019). Tasmania's 'green hydrogen' opportunity Tasmania's unique advantage as a 'green hydrogen' development zone Link.

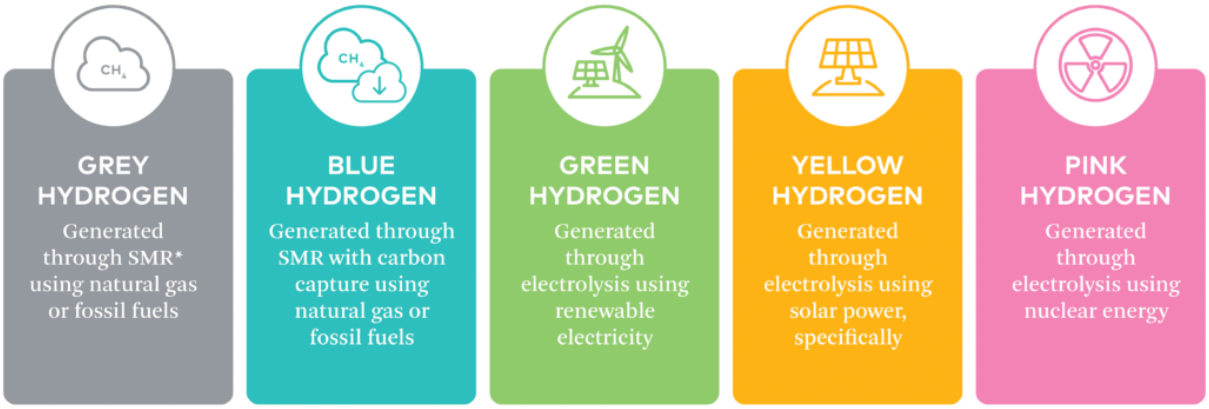
[2] International Energy Agency [IEA] (2019). The future of Hydrogen. Seizing today's opportunities. Technology report — June 2019. Link.

[3] Wind Energy Ireland (2022) Hydrogen and Wind Energy. The role of Green Hydrogen in Ireland's energy transition. Link.

[4] Howarth, R.W and Jacobson, M.Z. (2021). How green is blue hydrogen? Energy Science and Engineering July 2021

However, Green Hydrogen could be critical for the transition to a more sustainable model, as it may be integrated into existing building gas networks, used as a transport fuel or to add flexibility to power systems.

Classification of Hydrogen types



Source: Mayer, C. (2022). Hydrogen production: exploring the various methods and climate impact. Link.

The United Nations have launched the **Green Hydrogen Catapult Initiative**, and the European Commission has included hydrogen in various legislative proposals to meet the goals of the Green Deal. In addition, the EU has adopted a specific **Hydrogen Energy Strategy** in 2020, which envisages the creation of a European hydrogen energy ecosystem and encourages innovation and expansion of infrastructure for its production[5]. This strategy was later completed by the REPowerEU program in 2022 to adjust to the new geopolitical context (Russian-Ukrainian war).

In contrast to other European countries, the Republic of Ireland currently does not have a Green Hydrogen strategy. Discussions on a possible Green Hydrogen Strategy Act 2022 have begun this year[6], but no deadline for a report on this strategy has been proposed as yet.

Benefits of Green Hydrogen

- Green Hydrogen is proposed as a long-term sustainable solution to decarbonise economies and to achieve proposed climate targets. The prioritisation of Green Hydrogen production could favour the decarbonisation of the heating sector due to its suitability for storage and transport.
- The expansion of its use would result in the displacement of fossil energy sources, such as Liquified Natural Gas. In the medium-term substitute gas turbines with Green Hydrogen and the long-term heating fuels.
- Well-developed technologies for the storage and distribution of hydrogen could translate into more isolated communities having access to cheap and clean sources of energy and fuel. Hydrogen storage and distribution, done right, is the missing link needed to transition completely away from fossil fuels.

[5] European Commission. Hydrogen – Energy. Link.

[6] Houses of the Oireachtas (2022) Green Hydrogen Strategy Bill 2022: First Stage. Dáil Éireann debate. Wednesday, 9 Feb 2022 Vol. 1017 No. 6. Link.

- Incorporating Green Hydrogen in energy supply, produced by different sources of renewable energy, will ensure the diversification of Ireland's energy supply, helping to avoid energy disruptions and strengthening security.
- Green Hydrogen also has the potential to be stored for an indefinite period of time, helping to offset the intermittent nature of renewable energies[7].
- Green Hydrogen has different uses, these can include:
  - ✓ Hydrogen boilers or fuel cells for buildings that already have a natural gas network. Green Hydrogen can be blended into these grids
  - ✓ Can contribute to power generation
  - ✓ Could be used in public transportation to promote sustainable mobility.
- Ireland is a country with substantial renewable energy potential, something that combined with the expansion of the Green Hydrogen market could turn the country into a leading example of green industrialization, thus attracting investment and sustainable industries. This will be a big step towards energy security and combating price volatility and reliance on imports[8].

GEAI's concerns

With a lack of strategy and low penetration of Green Hydrogen in the Irish market, there are a few possible concerns regarding existing infrastructure. So, we are looking at fairly minor concerns and expectations related to this new strategy that the government is developing.

- If there are not clear codes of practice or regulations, the development of infrastructure and logistics for Green Hydrogen could lead to the use of hydrogen coming from fossil fuel such as grey hydrogen. Clarity and care is needed in the accepted forms of hydrogen production, so as not to open the door to unsustainable forms of energy.
- Although the Irish government is developing a new strategic approach, efforts to develop this strategy must be stepped up if we are to truly displace the use of fossil fuels. European countries have had roadmaps and strategies in place for some time, Ireland must not lag behind.
- Even though the environmental impact of hydrogen is lower than that of fossil energy systems, hydrogen is still an indirect greenhouse gas with global warming potential. This will vary according to the leak rate during its synthesis, storage and use[9]. Therefore, attention needs to be paid to such leaks to minimize its impact as much as possible.
- There are other issues associated with hydrogen, mainly storage and distribution. There are two types of storage: physical based and material based[10]. Physical based storage includes hydrogen stored as a compressed gas, cryogenic compressed gas or as liquid hydrogen. The challenges associated with this type of storage is the low volume density of hydrogen as a gas, and safety concerns regarding high pressure gas leaking, respective combustion probability and impact it could have in surrounding communities. Compressing and liquifying hydrogen is energy demanding, one of the reasons why the energy that

[7] International Environment Agency (2019) The Future of Hydrogen. Technology report. Link.

[8] International Renewable Energy Agency (2022) Hydrogen Economy Hints at New Global Power Dynamics. Link.

[9] European Commission (2006) Environmental Impacts of Hydrogen-based Energy Systems. Science for Environment Policy. Link.

[10] Energy.gov. (2022). Hydrogen Storage. Link.

sources these technologies must be renewable. Material based storage (e.g., stored as ammonia) presents the obvious advantage of reducing leakage risk as well as energy consumption during the transformation process[11].

Actions GEAI believes must be considered

- Local resilience and community empowerment: Local resilience includes three drivers such as (I) society and politics, (II) energy systems and (III) technology and finance, necessary for a sustainable energy transition[12]. While community empowerment refers to the capacity of these communities to make their needs visible and decentralise decision-making[13]. Both can be facilitated by legislation such as this if community strategies were included. As well as with wind and solar farms, plans for community engagement or ownership, such as hydrogen cooperatives, could be probed. Therefore, gaining access to sustainable, flexible and economical energy production.

- In the same vein, creation of schemes for households' use of Green Hydrogen. The majority of energy used in Ireland (79 %) is for residential and industrial use[14]. Allowing funding or support to adapt pipes, boilers and burners will help in the transition to renewables. The cost of a hydrogen boiler is almost the same as a normal boiler. It can also be used for central heating without the need for expensive modifications to the house structure. Using Green Hydrogen would reduce the carbon footprint of households and their dependency on fossil fuels.

- If a social perspective is included in the new Green Hydrogen Strategy Bill, this may be linked to the Strategy to Combat Energy Poverty. There is no universal definition of fuel poverty, but the Irish government defines it as "the inability to provide adequate heating or electricity to households[15]." The Economic and Social Research Institute (ESRI) found that an estimated 29 % of households were affected, compared with a peak of 23 % in 1995. We need to allocate funds to switch resource-poor households to clean heating, because there is a real risk for them to fall behind on increasingly expensive fossil gas.

- Promotion of the application of Green Hydrogen energy in agriculture and farming. GEAI supports chemical and synthetic fertiliser free farming and food production. We would like to see the potential of Green Hydrogen energy explored in agriculture and farming. For example, to explore the use of hydrogen to fuel equipment and machinery such as tractors and combines, and explore the use of hydrogen energy to process slurry, reclaiming valuable nutrients, etc.

  We acknowledge Green Hydrogen can be used to make ammonia (NH3) for synthetic fertiliser, allowing a shift away from its current mode of production which is methane[16]. Where synthetic ammonia is still used, domestic production using Green Hydrogen would offer the possibility of reducing dependence on imported fertiliser, reduce purchase costs and lower the CO2 emissions from transportation of imported fertiliser[17].

[11] Li, H., Cao, X., Liu, Y., Shao, Y., Nan, Z., Teng, L., Peng, W. and Bian, J. (2022). Safety of hydrogen storage and transportation: An overview on mechanisms, techniques, and challenges. Energy Reports, 8, pp.6258-6269.

[12] World Economic Fortum (2021) Fostering Effective Energy Transition. Insight Report, April 2021.

[13] Coy, D.; Malekpour, S.; Saeri, A., and Dargaville, R. (2021) Rethinking community empowerment in the energy transformation: A critical review of the definitions, drivers and outcomes. Energy Research & Social Science. doi: 10.1016/j.erss.2020.101871.

[14] Energy Ireland (2021) Heating and cooling in Ireland. Link.

[15] Government of Ireland (2016) A Strategy to Combat Energy Poverty.

[16] The Royal Society (2020). Ammonia: zero-carbon fertilizer, fuel and energy store. Policy Briefing. Link.

[17] Charles, P (2021) The hydrogen fuelled farm of the future. Washington State University. School of Mechanical and Materials Engineering. Link.

- Other advantages of ammonia produced from Green Hydrogen are: (I) storage, as it can be stored in bulk as a liquid and transported via ships, pipelines or tankers, which is a breakthrough in chemical storage of renewable energy and efficiency, as ammonia storage is cheaper; and (II) ammonia can be burned and produced in a fuel cell to produce electricity. One of its uses could be on marine engines[18, 19].

- The national Green Hydrogen Strategy Act 2022 must be followed by support from local authorities. Currently the County Leitrim Development Plan 2023 - 2029 is in draft form, with no mention of the potential of Green Hydrogen. Once the new national strategy is developed and approved, local authorities will have to commit to creating complementary strategies to promote and facilitate the use and development of Green Hydrogen projects.

- Small and medium-sized enterprises are mentioned already on the Consultation Paper, and GEAI agrees with their importance. SMEs should be included in the research, development and implementation process. They are essential actors that can contribute significantly to local economic growth, to local employment of communities and the rapid expansion of green energies which can compete with fossil fuels.

- Incentivisation of renewable energies, both on a small and large scale, to secure the supply of Green Hydrogen and make it cost-effective in the long term.

- Investment in Research and Development (R&D) to analyse possible environmental impacts and ways to minimize them. The possibility of furthering the research of other means of hydrogen production could distinguish the Irish hydrogen strategy. Research should focus on the technologies that are already mature, but there is also a need to redistribute funds to explore more means of production.

  Fermentation, photodecomposition and water bio photolysis are processes that have been studied for years, but due to the complexity of the microbiological cultures, have not been given much attention. GEAI suggests funds to be redistributed within universities, relevant industry and research and development projects, so that parallel research can be conducted with the aim of finding alternative renewable processes, which are suitable for smaller scale applications[20].

- In the line of research and to tackle the issues associated with hydrogen on storage and distribution, mentioned before another field of research with potential is the solid storing of hydrogen. Solid storing hydrogen alternatives include absorbents, liquid organics, hydrides, and chemical hydrogen. For the last almost two decades studies have been conducted to better understand the thermodynamic aspects of these solutions[21].

Final conclusion

GEAI believes that Green Hydrogen promises to be a truly vital player in the global transition to sustainable energy systems and decarbonising economies. In the medium-term, substitute gas turbines with Green Hydrogen and in the long-term,

heating fuels. To achieve all of this requires greater political commitment at all levels to develop roadmaps, action plans and funding programmes that make it easier to develop such technologies and for communities to be included and to have access to clean energy.

[18] The Royal Society (2020). Ammonia: zero-carbon fertilizer, fuel and energy store. Policy Briefing. Link.
[19] Ecuity, Engie, STFC, Siemens (2020). Ammonia to Green Hydrogen Project Feasibility Study. Link.
[20] Wang, J. and Yin, Y. (2018). Fermentative hydrogen production using pre-treated microalgal biomass as feedstock. Microbial Cell Factories, 17(1).
[21] Principi, G., Agresti, F., Maddalena, A. and Lo Russo, S. (2009). The problem of solid-state hydrogen storage. Energy, 34(12), pp.2087-2091.