Good Energies Alliance Ireland

**Submission by Good Energies Alliance Ireland**

**to the**

**Consultation on developing a hydrogen strategy for Ireland**

**From Department of the Environment, Climate and Communications**

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**Background**

Good Energies Alliance Ireland (GEAI) is an environmental NGO, founded in 2011, situated in County Leitrim in 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.

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 communities of Ballinaglera and wider areas and develop Ballinaglera Community Hall as an environmental and community resource centre.

Being one of our main objectives developing a more sustainable energy system for the green transition, GEAI sees the Green Hydrogen Strategy as an opportunity to make progress in decarbonizing the economy and meeting proposed climate goals, while replacing fossil fuel sources in favor of the expansion of renewable ones. Ireland is a country with substantial renewable energy production, that combined with the expansion of the Green Hydrogen market could turn the country into a reference for green industrialization. Thus, attracting investment and sustainable industries. A big step towards enhancing the independence and flexibility of the energy system (IREA, 2021).

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 encounters a magnificent opportunity to reduce GHG emissions and increase energy security.

Some of the submissions in which GEAI already participated are the Design of a new Renewable Electricity Support Scheme (RESS) launched in September 2017; the Public consultation on the National Adaptation Framework on climate change on December 2017 to the Department of Communications, Climate Action and Environment; among others.

**Energy security**

***Q1. What contribution could domestic green hydrogen supply make towards Ireland energy security?***

*Focus: energy efficiency, diversification, social perspective.*

The strong development of wind energy in Ireland and its future growth prospects, as well as the low cost of renewable energy projects, gives Green Hydrogen an advantage in the arena of energy security. However, the development of Green Hydrogen projects, especially for domestic use, requires a high level of political commitment and a combination of variables to make it feasible such us the expansion of renewable energies, an objective already targeted by multiple national regulations, and the development of specific infrastructure, not only for distribution and generation of hydrogen, but also for end-use.

Beyond these two essential variables, to consolidate energy security in Ireland three things must be achieved: energy efficiency, saving and diversification.

First, the energy efficiency of Green Hydrogen. It has been studied that the efficiency of fuel cells is as high as 60%, and the efficiency of thermal power plants is as high as 35-60%; Electrolysis of water has an efficiency of 60-80 % meaning that more than half of the energy is lost by converting electricity to hydrogen and back again to electricity (EPRS, 2021). More research and actions to improve efficiency and deliver cost-effective electrolysers at gigawatt (GW) scale and make renewable hydrogen cost-competitive are needed, as well as upgrades in the infrastructure, already stated previously (Hughes, 2009).

Second, the diversification of the energy supply. Incorporating Green Hydrogen to the supply, being it blended or produced by different sources of renewable energy, will ensure the diversification of Ireland's energy supply helping avoid energy disruptions and strengthening the security.

Lastly, achieving lasting energy savings through conservation measures, which requires psychological and structural strategies to address issues such as education, infrastructure again and pricing (Steg, 2008).

For example, at a household level, actions such as funding or statutory support to adapt pipes, boilers and burners to use Green Hydrogen at a domestic level would improve the resilience of households and their independence from fossil fuels. At a transportation level, promotion of its use in this area considering its generation power capacity, in order to foster sustainable mobility not dependant on exported gas. Either way, farms can use hydrogen to fuel equipment and machinery such as tractors and combines, and to make ammonia (NH3) for fertilizer reducing independence on imported products (Charles, 2021).

From a social perspective, Green Hydrogen could be link with strategies like the energy poverty one, to secure that resource-poor households switch to clean heating, due to a real risk of being left behind by increasingly expensive fossil gas. The Economic and Social Research Institute found an estimated level of energy poverty affecting approximately 29 % of households, compared with a peak of 23 % in 1995 (ESRI, 2022). The new Hydrogen Strategy could tackle this problematic if a social perspective is introduced.

***Q2. What role could hydrogen storage play regarding security of supply?***

*Focus: community, democratisation of power supply.*

Green Hydrogen also has the potential to be stored for short and long periods of time, helping to offset the variable production of renewable energies (IEA, 2019). Coupled with Ireland's ability to produce Green Hydrogen from renewable sources, it reduces its dependence on imports and possible changes in the geopolitical landscape and the impact of rising fossil fuel prices. This increases the democratisation of power supply.

Production as it is done so far, requires a way to store hydrogen, or use of the product on-site. 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.

**Energy research**

***Q1. Which areas of hydrogen require further examination?***

*Focus: production, mature technologies, storage.*

When talking about green hydrogen, the hydrogen produced with energy sourced by renewables, in the last decade there has been extensive research to optimize the process of production. Three processes have shown greater proximity to optimal results (Kovač et al. 2021):

- Hydrogen produced from alkaline water electrolysis;
- Proton exchange membranes;
- Solid oxide electrolysis.

Alkaline water electrolysis has been developed enough that it presents competitive efficiencies, and there are already megawatt installations available commercially. Within this process the development needed is to include only renewables as a source of energy to the production.

All the processes described have not reached a competitive production cost, as well as the scale to which they are economically viable and applicable to all end-use demand. Building the infrastructures needed for the production of hydrogen from exiting non-renewable facilities might aid in the direction of reducing these costs.

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[1], photodecomposition[2] and

[1] Fermentation - process carried out by bacteria, hydrogen is released by hydrogenase in order to eliminate excess electrons generated during the degradation of carbohydrates.

[2] Photodecomposition - biological process in which photosynthetic bacteria produce hydrogen in the constant presence of light. These bacteria have the ability to fully convert glucose to carbon dioxide and hydrogen.

water bio photolysis[3] 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, that are suitable for smaller scale applications (Wong and Yin, 2018).

There are other problematics associated with hydrogen, mainly storage and distribution. There are two types of storage: physical based and material based (Energy Gov, 2022). GEAI believes both should be considered. 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 sources these technologies must be renewable. Material based storage presents the obvious advantage of reducing leakage risk as well as energy consumption during the transformation process (Li and Cao, 2022). 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. (Principi, 2009) GEAI believes that this is a field of research that still has potential.

Considering the need to develop the technology for production, storage and distribution even further in parallel with a transition to a carbon neutral society, GEAI does not agree that other types of hydrogen from non-renewables such as grey, blue, turquoise and pink should be part of the discussion. For their respective end-use, other emission neutral alternatives should be proposed. Blue hydrogen has indeed been seen as an alternative considering it produces less carbon. However, methane emissions are greater. Studies have shown that in recent decades, 25 % of the net warming was due to methane emissions (Howarth and Jacobson, 2021).

### *Q2. What can an Irish hydrogen strategy could do to drive innovation?*

*Focus: research support.*

The possibility of furthering the research of other means of hydrogen production previously mentioned could distinguish the Irish hydrogen strategy. Including and supporting researchers from national universities could set Ireland to find innovative alternative technologies that will no doubt contribute to a faster energy transition.

[3] Water bio photolysis - process of converting solar energy into stored chemical energy, useful for the cell. In the process, the biological system is subjected to the action of sunlight, resulting in the decomposition of a substrate, usually water, and the production of hydrogen.

**Final conclusion**

GEAI believes **green hydrogen promises to be a truly vital player in the global transition to sustainable energy models and decarbonising economies**. To achieve all this requires greater political commitment at all levels to develop roadmaps, action plans and schemes that make it easier for the third sector to develop such technologies and for communities to be included and enjoy clean energy.

**References**

Charles, P (2021). The hydrogen fuelled farm of the future. Washington State University. School of Mechanical and Materials Engineering. Retrieved from: https://hydrogen.wsu.edu/2021/08/04/the-hydrogen-fueled-farm-of-the-future/

Economic and Social Research Institute [ESRI] (2022). Energy poverty and deprivation in Ireland. Research series number 144, June 2022. https://doi.org/10.26504/rs144

Energy.gov. (2022). Hydrogen Storage. [online] Retrieved from: https://www.energy.gov/eere/fuelcells/hydrogen-storage

European Parliamentary Research Service [EPRS] (2021). EU Hydrogen Policy: Hydrogen as an energy carrier for climate-neutral economy. Retrieved from: https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/689332/EPRS_BRI(2021)689332_EN.pdf

Howarth, R. and Jacobson, M., (2021). How green is blue hydrogen? . Energy Science & Engineering, 9(10), pp.1676-1687.

Hughes, L. (2009). The four Rs of energy security. 37(6), 2459–2461. doi:10.1016/j.enpol.2009.02.038

International Environment Agency [IEA] (2019). The Future of Hydrogen. Technology report. Retrieved from: https://www.iea.org/reports/the-future-of-hydrogen

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

Kovač, A., Paranos, M. and Marciuš, D. (2021). Hydrogen in energy transition: A review. International Journal of Hydrogen Energy, 46(16), pp.10016-10035.

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.

Principi, G., Agresti, F., Maddalena, A. and Lo Russo, S. (2009). The problem of solid state hydrogen storage. Energy, 34(12), pp.2087-2091.

Steg, L. (2008). Promoting household energy conservation. Energy Policy 36, 4449–4453.

Wang, J. and Yin, Y. (2018). Fermentative hydrogen production using pre-treated microalgal biomass as feedstock. Microbial Cell Factories, 17(1).