Hydrogen Ireland

The Association for Energy, Mobility, Industry & Community

Clean Air Strategy Public Consultation
Air Quality Division
Department of the Environment, Climate and Communications
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Submission by Hydrogen Ireland on draft Clean Air Strategy.

Hydrogen Ireland welcomes the opportunity to respond to the public consultation on the draft Clean Air Strategy. Hydrogen Ireland is an all-Island association, which aims to raise the profile of hydrogen and drive policy change, helping to secure clean sustainable energy for the island of Ireland. Further information can be found at: https://hydrogenireland.org/

The objective of this Response to Consultation on the draft Clean Air Strategy by Hydrogen Ireland is to consider policy coherence issues arising in the context of the need to improve air quality, and the need to mitigate and adapt to climate change. In particular, this response considers the role of Green Hydrogen as a vector in the "least burden and most opportunity pathways to decarbonisation" that can be developed and implemented, as one of a number of integrated measures, to assist in the meeting both the clean air strategy priorities and the challenging decarbonisation targets required by Ireland's contribution to climate change mitigation and adaptation within the EU and globally.

The Consultation Questions listed in Section 4 of the draft Clean Air Strategy are listed below. This response is relevant primarily to consultation questions 2 and 8, and to the strategic priority to **"Ensure the integration of clean air considerations into policy development across Government."** The strategic priorities of the draft Clean Air Strategy are reproduced in Appendix 1.

Consultation Questions

1. Do you agree with the five strategic priorities outlined in the draft strategy?
2. Do you feel there are additional strategic priorities which should be included?
3. How can pollutant emissions data be better used to inform actions at local and national levels?
4. What do you feel are the most important current and emerging air quality issues in Ireland that require further research?
5. How can we better increase awareness of the health impacts of air pollution?

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6. What issues might a national clean air awareness campaign encompass and how could its impact be measured?
7. What particular metrics or benchmarks do you think should be considered in tracking the progress of a Clean Air Strategy?
8. Are there any other comments you have in relation to the draft national Clean Air Strategy?

1. Introduction

The draft Clean Air Strategy notes that there is a clear correlation between the actions required to lower air pollution and those needed to reduce greenhouse gas emissions and help our fight against climate change. Three key air quality issues are identified as requiring action to enhance and protect air quality in Ireland, and a range of measures are detailed to address each of them:

1. Particulate Matter ($PM_{2.5}$ and PM_{10}) – associated mainly with residential burning of solid fuel;
2. Nitrogen Oxides (NO_x) – associated mainly with transport in urban areas;
3. Ammonia (NH_3) – associated mainly with agriculture.

This submission considers the contribution that green hydrogen could make in combination with other measures to address particulate matter emissions associated mainly with residential burning of solid fuel (buildings sector), and nitrogen oxide emissions associated mainly with transport in urban areas (transport sector).

2. Rationale for the identification of Green Hydrogen as a decarbonising vector

The carbon intensity of various production routes for hydrogen are shown in Figure 1. Hydrogen produced by electrolysis using hydropower, wind energy and solar energy is all classifiable as low carbon, defined in the current EU taxonomy as $<3kgCO_2/kgH_2$. Hydrogen produced by electrolysis using hydropower and wind energy is classified as ultra-low carbon $<1kgCO_2/kgH_2$ (Table 1, Figure 1).

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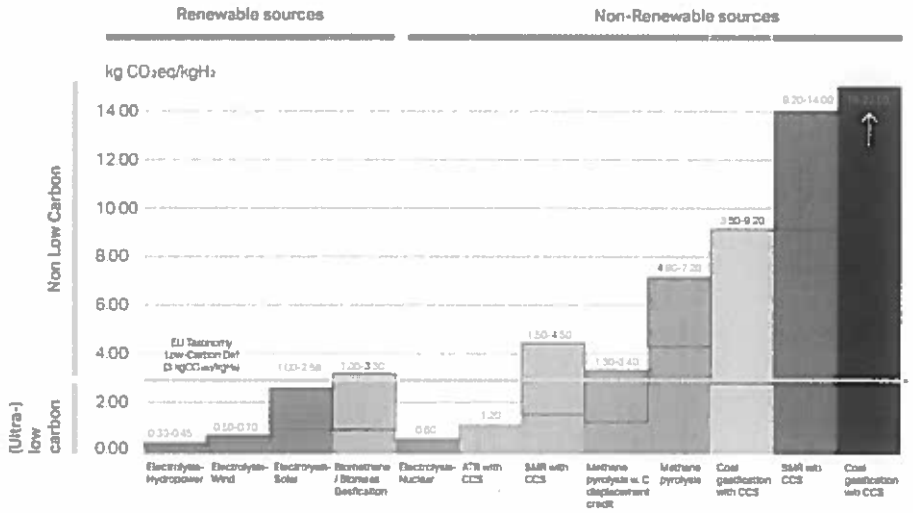

Figures and ranges include 2020 baselines and 2030 projections

Note the 2.58 intensity for solar (source: Ademe) is the estimated carbon intensity for hydrogen production by solar-powered electrolysis today; and it is estimated that by 2030 this number would decrease to 1 kg/kg (source: Hydrogen Council)

Figure 1. Carbon intensity of various production routes for hydrogen
Source: literature review; Hydrogen Council

Hydrogen produced by electrolysis with renewable energy is a zero carbon emission fuel, and is now regarded as a mature technology in the **International Energy Agency (IEA) Global Hydrogen Review 2021** (October 2021[1]). Table 1 gives a comparison of carbon emissions arising from fuel production; these are available for low carbon hydrogen, and for electricity generation in Ireland. Hydrogen and electricity are both zero carbon fuels when in use. Fuel production carbon emissions are not readily available for fossil fuels and peat but are noted as arising; carbon emissions arising from the use of these fuels is listed in Table 1. Data on carbon emissions arising from the production and use of different biofuels are not listed by SEAI currently.

Table 1. Carbon dioxide emission factors for fuels. In the case of hydrogen and electricity, CO_2 emissions arise during the production of the fuel

Fuel Type – EU Taxonomy Low carbon Hydrogen (Source: Hydrogen Council)	**Hydrogen production emissions $kgCO_2eq/kgH_2$**	**Fuel use emissions (gCO_2/kWh) (NCV)**
Hydrogen (electrolysis using hydropower, wind or solar)	< 3	0.0
Hydrogen (electrolysis using hydropower)	0.3 - 0.45	0.0
Hydrogen (electrolysis using wind)	0.5 - 0.70	0.0
Hydrogen (electrolysis using solar)	1.0 – 2.58	0.0

[1] https://www.iea.org/reports/global-hydrogen-review-2021

Fossil fuel; solid, liquid, gas (Source: SEAI, accessed 2.02.2022)	**Fuel production emissions**	
Coal	+	340.6
Milled peat	+	420.0
Sod peat	+	374.4
Peat briquettes	+	355.9
Liquid fossil fuel	+	
Gasoline / Petrol	+	251.9
Kerosene	+	257.0
Gasoil / Diesel	+	263.9
Residual Oil / Fuel Oil	+	273.6
LPG	+	229.3
Bottled LPG (Propane or Butane)	+	232.0
Natural Gas	+	204.7
Electricity generation in Ireland (Source: SEAI, accessed 2.02.2022)	**Electricity production emissions (gCO_2/kWh) (NCV)**	
Electricity 2018	375.40	0.0
Electricity 2019	324.50	0.0
Electricity 2020	295.80	0.0

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3. Contribution that green hydrogen could make in combination with other measures to address particulate matter emissions associated mainly with residential burning of solid fuel

Reducing both particulate matter emissions and greenhouse gas emissions in existing residential buildings in Ireland, including traditional buildings, can be achieved in two ways:

1. by using less energy combined with electric heat pumps (e.g. retrofit)
2. by using low carbon fuels (e.g. decarbonisation).

Current policy in Ireland is to link the reduction of particulate matter and greenhouse gas emissions in a single funding package for buildings using retrofit combined with electric heat pumps. There is a risk that the combined costs associated with having to carry out both energy efficiency retrofit and decarbonisation of home heating and energy systems simultaneously in order to receive partial grant aid is a disincentive / financial barrier to householders.
ESRI Research Bulletin 2021/23 notes that "hydrogen has a potential role to play in decarbonising the economy, particularly in instances where decarbonisation alternatives are challenging. In the example considered in Research Bulletin 21/23, where hydrogen is used for residential heating, carbon emissions from residential heating decline. In contrast to other policies such as home retrofits, there are no costs or hassle imposed on the residential sector thereby circumventing a critical barrier to reducing emissions in the residential sector.

Table 2. Comparative information on the supporting role zero emission green hydrogen could play in reducing particulate matter emissions and in meeting carbon bugets:
home heating

Annual fossil fuel use[1]	Annual CO2 emissions (kg)	Equivalent hydrogen consumption (kg)	Number of buildings heated by a 20 MW electrolyser[2]
Gasoil / kerosene: 1,000 l	2,600	300	9,000
Gasoil / kerosene: 1,500 l	3,900	450	6,000
Gasoil / kerosene: 2,000 l	5,200	600	4,500
Gasoil / kerosene: 3,000 l	7,800	900	3,000

Gasoil / kerosene: 10,000 l	**26,000**	**3,000**	**900**
Gasoil / kerosene: 50,000 l	**130,000**	**15,000**	**180**

[1]Diesel and Kerosene CO2 emissions per litre assumed to be the same.
[2]Assumes an electrolyser efficiency of ~75% and a capacity factor of 80%. Compression & transmission losses not included. A 20MW electrolyser produces 2,680 tons H2 per year/

In Ireland, it is proposed that regulation of the smoke, sulphur and moisture content of domestic solid fuels will start to be introduced before September 2022, so that the most polluting solid fuels will no longer be available for sale on the Irish market. These regulations could be seen as providing a policy coherence and just transition opportunity to offer support for decarbonising home heating. Older and traditional housing stock often relies on open fires with back boilers for water and space heating, while stoves and ranges may be in use for cooking as well as water and space heating. Supported provision of hydrogen ready central heating boilers and cookers at these and at other older housing stock currently relying on fossil fuel or solid fuel for heating and cooking would accelerate the decarbonisation of home heating and help in meeting or potentially improving on the proposed carbon budgets. This measure would also assist in reducing particulate matter emissions. Any existing radiators in a house could be re-used, consistent with circular economy objectives and maximising use of existing infrastructure.

If the correct initiatives and green hydrogen supplies and price supports are put in place in Ireland, it might be a cheaper and more convenient option for people to avail of in order to reduce or eliminate their use of solid fuels in a relatively short time frame. This would assist in reducing particulate matter emissions as well as meeting the first and second carbon budgets for the Buildings sector. Insulation and other energy efficiency retrofit could be carried out later, on a phased basis; this approach would take account of the current shortages in building materials, technical expertise and the availability of contractors.

Methods and equipment for Hydrogen gas storage and delivery to individual properties that are not located in the vicinity of a gas network, via compressed hydrogen gas cylinders and tanks, are under investigation in Ireland currently.

Highly efficient hydrogen fuel cell heating systems have been in use in Germany since 2016, in both residential and commercial buildings.

Buildings, including traditional buildings and protected structures that may be unsuitable for deep retrofit that are on the existing natural gas grid can be decarbonised by the progressive addition of green hydrogen to the natural gas distribution network.

Residential gas appliances (cookers, boilers) in Ireland are already configured to run on natural gas with blends of up to 20% hydrogen. Trials are now in progress to test various blends of hydrogen / natural gas on Ireland's gas network, the results of which will inform

policy development and the regulatory framework for hydrogen blending and in future potential gas network repurposing to transport 100% hydrogen.

Recommendations:
Policy and grant supports for decarbonised domestic and commercial heating should target zero emission technology, and should include supports for green hydrogen ready central heating boilers for use in domestic and commercial heating, together with supports for the early provision and affordable price of a guaranteed green hydrogen fuel supply. Pilot projects should be advertised, promoted and initiated throughout Ireland, including in areas not served by the existing natural gas grid
Retrofit actions to improve the insulation and thermal efficiency of 100% hydrogen heated buildings should be de-coupled from grant supports for boiler installation, but could follow as separate stand-alone work packages on a phased basis if necessary.

4. Contribution that green hydrogen could make in combination with other measures to address nitrogen oxide emissions associated mainly with transport in urban areas (transport sector).

The draft Clean Air Strategy notes that over the coming decade, a greater focus will be placed on reducing the number of journeys, transitioning to cleaner, less polluting vehicles, increasing the frequency and accessibility of public transport and encouraging active travel i.e. walking and cycling. Additionally, in recognition that all forms of transport will have to move away from the use of fossil fuels, co-ordinated actions at the EU and international level will need to be taken in the maritime and aviation sectors to reduce air pollutant emissions. The proposed pathway to reducing carbon and air pollutant emissions in transport is focused on accelerating the electrification of road transport, the use of biofuels, and a modal shift to transport modes with lower energy consumption (e.g. public and active transport). Measures to deliver these results are listed in Section 9.3 of the draft Clean Air Strategy.
Supports for the electrification of vehicles and the transition from fossil fuels are detailed in Section 9.3.1. It includes supports for private car owners to switch to EVs, and more recently a national Electric Small Public Service Vehicle (SPSV) Grant Scheme was established in 2018 to support the electrification of the taxi, hackney and limousine fleets. Section 9.3.1 also makes reference to the Alternatively-Fuelled Heavy Duty Vehicle (AFHDV) Purchase Grant scheme, introduced by the Department of Transport in March 2021. The AFHDV Grant was introduced to accelerate the decarbonisation of the disproportionately high-emitting heavy-duty transport sector, which includes trucks, buses and coaches. €2 million was allocated to this fund in 2021, of which over €1.96m

was committed by 1st July 2021[2], a further €1m was subsequently allocated to the fund in 2021. The scheme is administered by Transport Infrastructure Ireland (TII) and reopened for applications on 14th April 2022. The scheme currently includes supports for a number of fuel types including LNG, biofuels and FCEVs.

A public consultation on the renewable fuels for transport policy opened in April 2022, as part of a Department of Transport study reviewing the profile, sustainability, and supply of renewable transport fuels in Ireland, such as biofuels, advanced biofuels, e-fuels, synthetic fuels, biogas, and green hydrogen, and to complete a research report including recommendations for sustainable biofuels policy development, due to be published in Q2 2022.

The Department of Transport Renewable Fuels for Transport Policy Statement November 2021[3] notes that green hydrogen can also be produced through electrolysis which extracts hydrogen from water using renewable electricity. It will be supported through quadruple credits, as set out in Sections 13 and 14 of the Transport Policy Statement.

Section 13 of the Transport Policy Statement: Inclusion of Renewable Fuels of Non-Biological Origin, proposes to extend credits for renewable fuels (previously applied to biofuels), to the new fuel category Renewable Fuels of Non-Biological Origin (RFNBOs), i.e. renewable fuels which are not produced from biomass and are not therefore biofuels. Fuels such as green hydrogen (produced using renewable electricity) and synthetic fuels produced from green hydrogen will be eligible for credits. Subject to enabling legislation, RFNBOs will become eligible for credit under the scheme from 1 January 2023.

Section 14 of the Transport Policy Statement: Treatment of Development Renewable Fuels refers to a category for certain renewable fuels called 'Development Renewable Fuels' will be added to the scheme and multiple credit will be awarded to incentivise their deployment. Subject to enabling legislation, the highest level of credit proposed among the fuels in question applies to Green Hydrogen, and the credit multiplier to apply from 1 January 2023 is x4.

While the credit level to which the multiplier will apply remains to be determined, this Transport Policy initiative is welcomed by Hydrogen Ireland as indicating an important commitment to facilitating and supporting the production and use of green hydrogen in Ireland. It is noted that the proposed credits would usefully be considered with regard to the production, fuelling infrastructure and end users of green hydrogen, not only in public, commercial, and private transport, but also in other Group 1 sectors of the economy including Electricity, Buildings, Industry/Enterprise, and Agriculture.

Against the backdrop of the requirement to meet RED II obligations, hydrogen refuelling infrastructure is required by the European Commission's proposal on a Regulation for Alternative Fuels Infrastructure. Part of the Fit for 55 package, Article 6 contains

[2] https://www.oireachtas.ie/en/debates/question/2021-07-01/194/
[3] https://www.gov.ie/en/policy-information/168c6-renewable-fuels-for-transport-policy-statement/

provisions for Member States to ensure publicly accessible refuelling points for hydrogen dedicated to heavy and light-duty vehicles every 150km on the TEN-T network. Comparative information on the supporting role green hydrogen could play in fuelling transport in fuel cell electric vehicles (FCEVs) is presented in Tables 3 and 4 below.

Table 3. Comparison of fossil fuel use and carbon emissions with zero emission hydrogen fuel cell electric vehicle (FCEV)

Vehicle type	Annual average distance travelled	Annual diesel consumption (l)	Annual CO2 emissions from diesel	Equivalent hydrogen consumption (kg)[3]
HGV	200,000	100,000	260,000	20,000
Bus	60,000	18,000	65,000	5,000
Taxi	45,000	3,000	7,800	450
Private car	15,000	1,000	2,600	150

[3]Assumes the following hydrogen fuel consumption: car/taxi 1kg/100km, bus 8.33kg/100km, HGV 10kg/100km

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Table 4. Number of zero emission hydrogen fuel cell electric vehicles (FCEVs) that can be fuelled by different capacity electrolysers powered by wind or solar power

Vehicle type	Annual km travelled	Number of vehicles fuelled annually by different capacity electrolysers (wind, solar)[5]				
		1 MW	5 MW	10 MW	20 MW	50 MW
HGV	200,000	7	35	70	140	350
Bus	60,000	27	135	270	540	1,350
Taxi	45,000	300	1,500	3,000	6,000	15,000
Private Car	15,000	900	4,500	9,000	18,000	45,000

[5]Assumes ~75% electrolyser efficiency and an 80% annual load factor. Compression & transmission losses not included. 134-ton H2 per MW electrolyser installed, per year.

5. Climate change adaptation

It is recommended that air quality measures and climate change mitigation measures should also take climate change adaptation into account. The development of policies and strategies to enhance the resilience of individuals and communities to climate change should consider what happens as a result of the more intense storms that are predicted to occur. During December 2021, storm Barra resulted in power outages of up to three days duration in Ireland. Storm Arwen, followed by storm Barra, resulted in power outages of more than 10 days in parts of Scotland and northern England. Over-reliance on electricity in these circumstances potentially leaves households and businesses in affected areas without heat, cooking facilities, communications, or a means of transport to leave the area. The availability and use of green hydrogen would assist in enhancing resilience, not as an either or scenario, but as a both electricity and green hydrogen energy supply and use.

Appendix 1. Strategic priorities and key actions of the draft Clean Air Strategy

Overview of Strategic Priorities	Key Actions
Ensure continuous improvements in air quality across the country	• Ireland will commit to setting more stringent legal limits for ambient air quality by 2025 taking into consideration the new WHO guideline limits • Prioritise action in relation to key air quality issues
Ensure the integration of clean air considerations into policy development across Government	• Establish Cross-Government Air Quality Implementation Group • Each Department will report annually on progress in reducing air pollution • Ensure air quality is integrated in the development or review of national plans and policy documents • UTRAP Group to publish final report • UTRAP to become a forum for continued engagement between the key transport stakeholders
Increase the evidence base	• Continued funding to complete the EPA AAMP expansion (to 2022) • Support the requirements of maintaining the AAMP beyond 2022 • Fund and support EPA LIFE Emerald Project • Establish Clean Air Research Forum • Publish calls for evidence on specific air quality issues as required
Enhance regulation and enforcement	• Review of Air Pollution Act (1987) • Development of Clean Air Act • Review of all Clean Air legislation • Development of new Solid Fuel Regulations • Establish Air Quality Enforcement Regional Support Structures • Strengthen multi-agency enforcement
Promote and increase awareness of the importance of clean air	• Establish Clean Air Communication Strategy Group • Support EPA AAMP Citizen Science

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	• Work with key stakeholders to increase citizen engagement and better public engagement in the policy process • Hold annual National Clean Air for Blue Skies Day • Host biennial Clean Air Conference • Establish Clean Air Forum
Oversight	• Progress report of CAS to be completed in Q2 2023 and submitted to Government • Prepare annual Clean Air Progress report to Government • Review of NAPCP to be completed by Q2 2023

We look forward to hearing from you,

Yours sincerely

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