Clean Hydrogen In Europe Cities

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Issues of concern to external stakeholders and critics and pathways to their resolution

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0 Executive Summary

Some concerns have been expressed that while the performance of hydrogen fuel cell (H_2FC) powered vehicles has been steadily improving, many people in key decision making roles and organisations have poor, and in some cases inaccurate, knowledge about the readiness of the technology. The end result may well be a pool of critics and sceptics in some influential positions making decisions on inaccurate information.

This Report presents the results of a careful and extended engagement with a selection of individuals identified as critics or sceptics of hydrogen in transport. Extended, confidential, one-on-one interviews were conducted with fifty individuals within organisations external to the hydrogen world. Subsequently a Round Table was conducted in Berlin at which a sub group of the interviewees discussed key issues and concerns with selected members of the CHIC consortium along with some influential H_2 experts. The interviewees came from Government, supra Government agencies such as the OECD, IEA and EC, industry and research organisations, and a range of lobby groups including environmental organisations. Some specific individuals outside these organisations with views that were known to be critical or sceptical were also interviewed.

The objective of the interviews was to listen to and document the views of these key stakeholders in order to understand what systemic obstacles may exist to progressing H_2 powered transport, and ways to overcome them. Somewhat surprisingly, very few outright opponents to a future role for H_2 in transport were identified.

The majority of the interviewees held the view that H_2 would have some application in future transport. The main reasons given were that H_2 powered fuel cells had technological and environmental advantages, as well as the need to replace fossil fuels.

The reasons given by those who did not see a future for H_2 were that the costs involved were too high and the technological challenges involved were too great. Other transport technologies and fuels were seen to have advantages.

For all interviewees the greatest challenges seen for H_2 in transport were technological and cost. Most significantly not one respondent from an environmental organisation gave H_2 an enthusiastic endorsement. These are major challenges for the wide acceptance of H_2 as a transport fuel.

The subsequent Round Table discussions focused on four key issues identified through the interviews (see below) and some general agreements were reached.

- Is H_2 a practical, broad-scale possibility and must it be clean?
- Is the efficiency of H_2 production and use a show stopper?
- Are the costs of implementing a H_2 system too great?
- Where does Government fit in? What about alternatives to Government Support?

The strong positive outcome from this work is that there appears to be very few strong opponents to a future H_2 transport system. However there are many sceptics of the performance and cost of such systems, and the advertised time frames for introduction. It is clear that past "H_2 hype" has damaged the credibility of H_2 advocates.

There are also clear key messages for future work.

- H_2 production must be sustainable and based on renewable systems,
- H_2 transport business cases must
    - Be credible and preferably independent from the H_2 industry
    - Demonstrate phasing out of public funding support
    - Focus more on those areas where the technology has advantages, such as heavy duty and longer range vehicles,
- Policy development around H_2 in Transport must be inclusive of the role of H_2 within the broader energy system, and
- H_2 transport communication must be more targeted in its approach, include those outside the H_2 world and present accurate messages in formats that are meaningful to the target audiences.

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List of abbreviations

H_2	Hydrogen Gas
H_2FC	Hydrogen Fuel Cell

1 Objective(s) of the report

This report is based on the information gained from 50 interviews undertaken with influential individuals/organisations external to the Hydrogen world (see Appendix A for full summary) and the proceedings of a Round Table discussion between some CHIC partners and some of the interviewees (Del. 3.6) who were characterised as sceptics and critics.

The intention of this report is to make clear what concerns these influential 'others' have and how those involved in H_2 futures might go about addressing them.

The rationale for undertaking this project is that the researchers believe that, to date, much of the understanding of the positive future for H_2 has tended to come from the relatively small group of people who are already involved in H_2 projects, and/or are interested and knowledgeable on the subject. However, there are many important decision-makers in Government, Industry and Research who influence where transport energy futures are likely to lead us and who are outside this group. To understand their views and to have them express these in a face to face forum with H_2 experts was seen as a valuable conversation to have and a very useful contribution to the efficient shaping of future H_2 projects, both in technical and communication terms.

2 Who were the target group for Task 3.5.2?

The researchers sought to interview and engage with people well outside the hydrogen world and outside the group of individuals being targeted by the broad social acceptance study of technological innovation being undertaken in Task 3.5 by the CHIC Partner Spilett New Technologies GmbH. This is best characterised by Figure 1 below.

Figure 1 : Target Population for Social Acceptance Research

The red ovals in the above diagram represent the group targeted for this report. Potential interviewees were identified through a variety of methods:

- asking colleagues within Hydrogen circles to identify critics and sceptics,
- asking the interviewees themselves to identify others, and
- some individuals 'self selected' either because they were known to be critics of H_2 or because their organisation was influential outside the Hydrogen 'world'.

3 Issues of Concern to Critics and Sceptics

From the interviews, four questions were identified as the core areas of concern for the interview group. These were:

- Is H_2 a practical, broad-scale possibility and must it be clean?
- Is the efficiency of H_2 production and use a show stopper?
- Are the costs of implementing a H_2 system too great?
- Where does Government fit in? What about alternatives to Government support?

A group of the interviewees was brought together with CHIC partners and other key individuals very knowledgeable about H_2 use in transport and a carefully focussed discussion was held on where the road blocks exist to the use of H_2 in transport and whether they could be overcome.

Generally agreed responses to the themed questions were distilled from the proceedings of the Round Table by the authors and these are presented below together with the ramifications of these conclusions for future H_2 in Transport activities.

3.1 Is Hydrogen a Practical, Broad-scale Possibility? Is Clean Hydrogen Essential?

3.1.1 General agreements

- *The future use of H_2 in the transport system is feasible and practical.* The vehicle and infrastructure technology is working now and constantly improving. In such a future, H_2 would not be a 'silver bullet' but part of the future transport fuel mix which is likely to be a menu of options.
- *It is essential for H_2 to be 'green' – to be produced renewably.* However it is acceptable for the establishment phase to involve 'grey' hydrogen as long as there is no 'lock in' to this production method, and there is a clear path to renewable production.
- *It is essential that analysis of the possible energy futures must be done from a systems approach.* In this context the system being considered must be at least the broad energy system, stationary as well as transport, but also include broader community wide issues. The relative efficiencies of each renewable energy source should be part of the decision making.
- *The future of urban transport is electric and H_2 and fuel cells are part of this*. However," hyping" the role of H_2 must be eliminated.

3.1.2 Some agreement

- *Batteries are unlikely to be able do the full urban public transport task* alone. H_2FC hybrid technology will provide communities with greater flexibility.
- *Urban public transport futures need to be considered as a separate world from individual transport futures*. H_2 powered transport has distinct advantages in the urban public transport context, and offers greater flexibility than pure battery powered buses for the full range of tasks required.

3.2 Is the Efficiency of Hydrogen Production and Use a 'Show Stopper'

3.2.1 General agreement

- *Efficiency issues are important* when considering the role of H_2 as an energy carrier.
- *It is important to consider the range of public transport options* including Euro 6 buses, hybrid buses, and other forms of E-mobility such as trams, trolley buses and battery electric buses. It is important not to approach the issue as a black and white situation. There is room for many technologies – a menu of energies and drive trains.

3.2.2 Some agreement

- *Efficiency is not the only, or perhaps not even the dominant, issue*. A H_2 system does have drawbacks from the purely efficiency perspective, but has benefits from the energy storage and from some mobility perspectives.

3.3 Are the costs of implementing a Hydrogen transport system too great?

3.3.1 General agreement

- *Current costs for H_2FC technology are prohibitive for it to be commercially viable* without some kind of fiscal support.

3.3.2 Some agreement

- *There is a business case for a H_2 based transport system* once the scaling up of H_2FC vehicles/infrastructure occurs.
- *While future costs will decrease, there isn´t clear evidence as to how much* costs will decrease. A greater number of credible studies are required.
- *For the present, H_2FC cost discussions should concentrate on the public transport system.* In this context we should compare the H_2FC bus costs with other forms of electric transport now available – e.g. trolley buses/trams. H_2FC buses are more promising than pure battery electric and are close to competitive with trolley buses or trams.

3.4 Where does Government fit into this? With all the Government support for Hydrogen, what about the alternatives?

3.4.1 General agreement

- *Governments are seeking solutions* to the economic (cost of oil), political (lack of security of supply) and environmental (CO_2 and other emissions) problems that result from using fossil fuels as an energy source.
- *Electro-mobility in general and H_2 and fuel cells in particular are solutions* with potential to achieve Government goals for transport energy.
- *Governments can and do provide policy frameworks that provide incentives* for private investment in new fuels/technologies. They will however at some point, need to ensure a revenue stream from the new energies.
- *Private investors will need to have their investment de-risked* in some way in order for innovatory, non-carbon technologies and fuels to become commercial.

3.4.2 Some agreement

- *Government funding support for technology introduction can only be limited.* Private investment is essential.
- *There are lessons that can be learnt from the introduction of natural gas vehicles* and there are synergies to be had in terms of use of the same distribution networks and producing synthetic, cleaner fuels for heating etc.

4 What are the important findings for Hydrogen Energy Futures?

4.1 Hydrogen will be part of the energy future

It is hard to find 'hard line' critics of a future H_2 transport system However, it is easy to find sceptics – especially on issues of

- Timeframe
- Cost
- Performance

H_2 is seen by many as having the potential to be part of the future menu of options

- But it is no silver bullet and we must stop the "H_2 hype".
- And there are some very significant conflicting views among key groups with important spheres of influence

4.2 Developers of Hydrogen energy solutions can do things better

Messages from the interviews and the Round Table are clear. They are:

- *H_2 Transport Planning must be for green H_2* in short to medium term and show a clear path and timeline how this will be achieved.
- *H_2 Transport Planning must work to the strengths of H_2* (heavy duty/long range/regional economics) and show how it fits into a broad system of alternative energies (not just in transport), rather than competing with them.
- *H_2 Transport Policies should not ignore efficiency arguments* but make a case for why conversion efficiency is less important in certain circumstances.
- *H_2 Transport business cases are of paramount importance* but must
    - be credible (independently refereed as a possibility)

- show phasing out of Government support towards profitable returns to industry & State (monetising)
- make useful comparisons e.g. light rail initiatives, bike rental, trolley buses

- *H_2 Transport projects and technological activity should focus on the "have to" advances* e.g. green H_2; accurate metering; independently refereed cost and technological reviews.
- *H_2 Transport projects must tailor communications for Acceptance.*
  - Visibility of the H_2 product is too narrow at present
  - Stay credible and deliver on promises
  - Targeting audiences and delivering accurate, current information outside the H_2 sympathetic groups
  - Ensuring and promoting the H_2 'fit' with values and behaviours of influential community groups (e.g. Environmental NGOs, Government Ministries)
  - Letting the broader public know what's "in it" for them. This needs to be done where the technology is actually in use or being thought about.

5 APPENDIX A: Summary Report of the Interviews with Sceptics and Critics

Clean Hydrogen In Europe Cities

Grant agreement No: 256848

Deliverable No. 3.8 – Appendix A

Scepticism and Criticism of the Use of Hydrogen in Transport

Views of influential players outside the Hydrogen World

Status: F

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0 Executive Summary

This report presents an analysis of 50 interviews conducted as part of Task 3.5.2 within the CHIC project. The overarching Task (3.5) is a comprehensive consideration of the societal/stakeholder issues and aspects of introducing H_2 as an energy source for Transport.

Potential interviewees for this study were identified by asking colleagues within Hydrogen circles to identify critics and sceptics, by asking the interviewees themselves to identify others, and some individuals self selected either because they were known to be critics of H_2 or because their organisation was influential outside the Hydrogen 'world'.

Once having this broader view, the information was used to bring together critics and sceptics with CHIC partners and known advocates to have a carefully focussed discussion on where the road blocks exist to the use of H_2 in transport and whether they could be overcome (See Appendix B of Deliverable 3.8) This discussion then formed the basis of the final deliverable (3.8) to which this report is an Appendix (Appendix A).

Interviewees were asked 10 questions regarding their perspectives on Hydrogen and its future. The raw data are summarised below in a table. To understand the meaning of the numbers however, it is important in most instances to go to the section to read the comments around the data.

Is there a role for H_2 in Transport?	Yes – 62% responses	Maybe – 32%	No - 6%
If yes to Q1 – what type of vehicle?	The largest proportion of interviewees saw H_2 as having a niche application in transport		
Why do you believe H_2 has a future?	• Technological Advantages - 27% responses • Environmental Advantages – 25% • Need to replace fossil fuels – 17%		
Why do you believe H_2 does NOT have a future?	• Cost of H_2 transport system too great –26% responses • Major technological challenges – 21% • Competition from other (more efficient) alternative energies –16%		
What are the most significant challenges for H_2 Infrastructure?	• Production of clean H_2 – 42% responses • Cost – 27%		
When do you believe H_2 will have broadscale introduction?	• Post 2030 – 40% responses • Post 2020 – 32%		

Who are the advocates of H_2?	• Car & Bus Manufacturers (OEMs) – 34% responses • Energy Companies – 28% responses
Who are the sceptics/critics of H_2?	• Governments/officials – 26% responses • Current energy producers – 23% • Environmental Groups - 18%
What are the most influential factors in determining whether H_2 has a future role in transport energy?	Most frequently mentioned: • Governments attitude to and policies on the environment and energy • Ability to monetise the technology • Community views and pressures to acquire H_2 /clean technology

It became clear to the interviewers during the conduct of the interviews that there are few individuals who see absolutely NO role for H_2 in transport into the future. However, it was equally clear that for a majority, it was a technology still in the '20 years to implementation' timeframe and, as one interviewee noted, this is a timeframe that is not credibly foreseeable in terms of what is likely to happen. It was also notable that for some very significant institutions, H_2 was simply not on any immediate agenda (e.g. parts of the OECD; environmental groups).

In terms of the **Model of Acceptance** which underpins the work of Task 3.5, this review of the views of critics and sceptics indicated a number of areas that might be addressed.

1. **Visibility** remains low among some very important national and supra-national bodies. Having said this, the Acceptance Model when applied to the interview responses makes it clear that dissemination activities are very important and must be continued. The message is simply that working solely with "friends of H_2" and/or Brussels Institutions is not enough.

2. It is clear too that **creating false expectations** about the future of H_2 by "over-hyping" results has led, already, to un-useful levels of cynicism. The visibility of the technology must be accompanied by credible reporting of achievements and projections into the future.

3. The **lack of depth and currency of knowledge** about Hydrogen and the state of the technology among some influential organisations does need to be addressed.

4. **Better connecting to the values and attitudes of** influential environmental organisations is another area that might be addressed. Moving to 'green' H_2 production sooner rather than later is therefore not an option for it to achieve acceptance – it is an imperative.

5. Related to this is the fact that for the broader community to change their fossil fuel **habit** in favour of H_2FC vehicles, it will require H_2 to be seen as offering some real gain. One such gain it could offer but is currently missing out on is its clean

environmental image. Not one respondent from an environmental organisation among those interviewed gave H_2 an enthusiastic endorsement. This is a major challenge for the acceptance of H_2 as a source of energy in transport.

In conclusion, it appears that there is still much work to be done in convincing the European political sphere of the “here and now” of H_2; of the sophisticated status of the technology; of its potential economic and social value and of the intention of industry to produce it cleanly in the short to medium term.

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List of abbreviations

BEV	Battery Electric Vehicle
CO_2	Carbon Dioxide
EC	European Commission
FC	Fuel Cell
H_2	Hydrogen Gas
H_2FC	Hydrogen Fuel Cell
ICE	Internal Combustion Engine
IS	Infrastructure
NG	Natural Gas
OEM	Original Equipment Manufacturer
PT	Public Transport

1 Objective of the report

This report is intended to provide an analysis of interviews undertaken with a range of individuals (50) in Europe, the U.S.A. and Australia. The interviews focussed on the interviewees views about the future of H_2 and its use as an energy source for transport.

In the vast majority of cases, the interviewees were approached because they were inside influential organisations that were not identified as promoters of Hydrogen use in transport. In a few cases, interviewees had been identified as clear critics of H_2 use or as persons who were sceptical of the possibility of its usefulness as an alternative energy source to fossil fuels.

The intention of this research was to listen to the views of interviewees without judgement or argument in order to try and understand the broader view among influential policy making/opinion former organisations and institutions of the essential question: "Does H_2 in Transport have a future"? .

2 Methodology and Background information on the 50 Interviewees [1]

Potential interviewees were identified through a variety of methods:

- asking colleagues within Hydrogen circles to identify critics and sceptics,
- asking the interviewees themselves to identify others, and
- some individuals 'self selected' either because they were known to be critics of H_2 or because their organisation was influential outside the Hydrogen 'world'.

Thirty three of the fifty interviews were carried out face to face at a venue decided by the interviewee. The remaining 17 interviews were undertaken by telephone. The interviews took around 45 minutes on average. The same two interviewers attended each interview with written notes of the interview being taken by both interviewers.

Interviewees were sent information on the CHIC project prior to the interview and then briefed further on the context at the commencement of the interview (see Appendix 5.3) . Each interviewee was asked 10 questions regarding their perspectives on Hydrogen and its future (see Appendix 5.3) and subsequently completed a brief written questionnaire (see Appendix 5.1). Interviewers did not engage in discussion about the responses of the interviewees as the interviews were intended solely as a listening exercise.

The background data below came from two sources: the interviewers who were aware of the work role of interviewees[2] and the post-interview questionnaire (to be returned in the interviewees' own time)[3]. A 75% return of the post-interview questionnaires was achieved.

This questionnaire was intended to

- get an idea of the "beliefs" of the interviewees in relation to alternative energies to fossil fuels;
- ascertain levels of knowledge about Hydrogen use in Transport; and
- elicit a focused, forced choice response to their views on the future for H_2 as an energy carrier.

2.1 Current role

Government (Agency/Elected Representative/International Policy)	30%
Industry (Energy Company/OEM/Transport Company)	22%
Lobby or Peak Group (Transport & Environment/Industry/Environmental)	38%
Research (Institute/University/Consultancy)	10%

[1] Due to an agreement to preserve individual anonymity, Appendix 5.2 lists only the Organisations / background from which interviewees were drawn.
[2] Current Role of Interviewees N=50
[3] Post-Interview Questionnaire completed by respondents N=40 (75% return rate)

2.2 Understanding of hydrogen in transport

Knowledge of H_2 as an energy source for Transport self rated as very good to excellent	77%
Believed there was an urgent need to find a replacement energy source for transport within **10** years	65%
Ridden on some form of H_2 powered transport	83%
Had at least slight contact with an H_2 in transport related project	55%

2.3 View of urgency of need to replace oil

Immediately	20%
Within 5 Years	15%
Within 10 Years	20%
Within 20 Years	32.5%
> 20 Years	12.5%

2.4 Seen or had a ride in a hydrogen powered vehicle		2.5 Participated in a H_2 Project	
Yes	82.5%	Yes	55%
No	17.5%	No	45%

2.6 Views on what is the single most important change needed if the role of H_2 in transport is to increase.

Government Respondents	**Industry Respondents**	**Lobby Group Respondents**	**Research Respondents**
Reduced costs of infrastructure	Infrastructure ramp up across the board	Availability of infrastructure using clean H_2.	Decrease in costs of technology across the board
Sustainability of infrastructure	Increased investment in dollar terms and in incentive terms	Decrease cost across the board	Information availability and more trials
Focus on public transport	Reduced costs across the board	Information availability and penetration of trials of the technology	Regulations and safety issues addressed
Technology improvement	Technology improvement	Price of oil and price of carbon to rise	Greater focus on H_2 niche

	Regulatory framework and detail	Greater investment	
		Regulatory framework and detail	

Quotes from the respondents:

< …. the real challenge which seems (at least to me) to be getting insufficient attention/investment is how to make commercial manufacture and distribution of hydrogen viable. >

<The R&D of alternative fuels/engines must be accompanied by a broad set of public measures that make their usage attractive, e.g. separated waiting lines for taxis with alternative engine concepts, access to inner cities … >

<I don't believe there will be ONE broad scale replacement. Clarity on well-to-wheel emissions and focusing on those modes/applications/regions where those are lowest>

3 Results[4]: Analysis of Interview Content

(See Appendix 5.3 for Interview Schedule)

3.1 Question 1: Is there a role for H_2 (Hydrogen) in Transport

Yes	29	**62%**
Yes in the long term	2	
Unsure	8	**32%**
Maybe	7	
Depends	1	
No	1	**6%**
Not Really	2	

Table 1: Is there a role for Hydrogen in Transport?

No appreciable difference between the background of the individuals who said yes and those who were unsure.

3.2 Question 2: If you said yes to a role for H_2 – would there be a role in your country/in the European Union?

3.2.1 Some felt wide distribution would occur.

- Europe; Japan; USA – first; 2030 - China; 2050 - Rest of World.
- Yes - throughout the EC - particularly in cities and maybe as inter-regional buses.
- Everywhere provided costs and reliability are addressed
- Worldwide but not in short term (<2030)

3.2.2 Some felt the presence of a large OEM with H_2 technology would be influential.

- Yes - and other places where Honda sells.
- Yes - more likely in countries with established committed OEMs.
- Toyota/Japan right behind this technology. Green production of H_2 gives some countries (eg Iceland) natural advantages

3.2.3 Some saw the use of H_2 in Transport as highly regional.

- Uneven distribution of H_2FC across world. Possibly in Eastern Europe because of the "dirty" grid making electrification less attractive. There will be regional differences in fuel usage and a mixture of energy sources to reduce dependency.
- Maybe in Italy - already working with Hythane liquid.
- In Germany, the North has more RE - but can pipe H_2 possibly.

[4] Based on Interviews with 50 individuals identified by authors as having some concerns with H_2 as a Transport Energy Source

- In Europe … as part of a menu of alternative, low emission fuels. More H_2 vehicles where there is more H_2 produced
- BEV's have problems in cold countries so maybe a place for H_2FC
- Developing countries
- For countries with "free" "clean" energy

3.2.4 Some felt it would be applied how and where it is most useful.

- Firstly as a means of storing energy (input). Then as a niche fuel in certain areas of transport. Certainly in Germany and in other regions that have access to RE and because there are limitations in bio-Mass, bio Fuels etc
- Yes - certainly has potential for storage of stationary energy.

3.2.5 The concept of a "menu" of fuels was a recurring theme.

- Part of a menu of fuels, deployed according to what suits both the region and the type of transport best. NG/LPG; Bio-fuels; H_2/Electricity. All new vehicles have to be carbon neutral by 2050 (UK).
- Need a menu of fuels.
- We saw remarkable developments in vehicle technology but this was not matched by advances in the IS. And certainly different countries will choose a different menu of fuels.

3.2.6 Some felt France is a special case in Europe.

- Yes - but France is behind others. Most decisions in France seem to emanate from Govt - not from Industry. France is highly centralised in its decision making
- France - historically sceptical - Nuclear energy makes BEVs' a more obvious choice; also no regulatory or infrastructure framework for gaseous fuels generally.
- Maybe in France for Stationary applications and now looking at all levels of H_2 application but only with FC

3.2.7 Some saw only a very limited role and well into the future.

- A minor role but we would like to see less individual transport and more public transport use/smaller cars and less fuel consumption overall. Big regional difference in transport modes however (c/f Berlin - good PT and people used to using it. Higher status NOT to have a car).
- Yes - but disagree with EC about the role for H_2 as a full alternative energy system for oil. It is only an energy carrier and has problems inherent in its production and distribution
- Yes - although oil will be the fuel for some time yet. Policy requirements (CO_2 emission constraints), hybrids and bio-fuels will all play a part. H_2FC vehicles have much better range
- Germany needs to reduce its dependency on individual transport. 70% of German emissions are from this sector (c/f 30% Europe) and is projected to grow. E-Cars only solve 1 of 5 transport problems: Lifecycle not green; road death toll; costs are high and space is being lost to car parks etc.

3.3 Question 3: if you think there is a role for H_2 in Transport – what type of vehicle was it most likely to be used in?

The answers in this section provided a range of views that were distributed in a skewed bell curve from very limited application to very broad application of Hydrogen technology. We have therefore presented some sample comments in this way (see next page). It should be noted that none of the interviewees who answered this question saw absolutely no application for Hydrogen technology in transport while a very few saw the application across all transport modes.

3.3.1 Application of Hydrogen Technology in Transport: What Type of Vehicles?

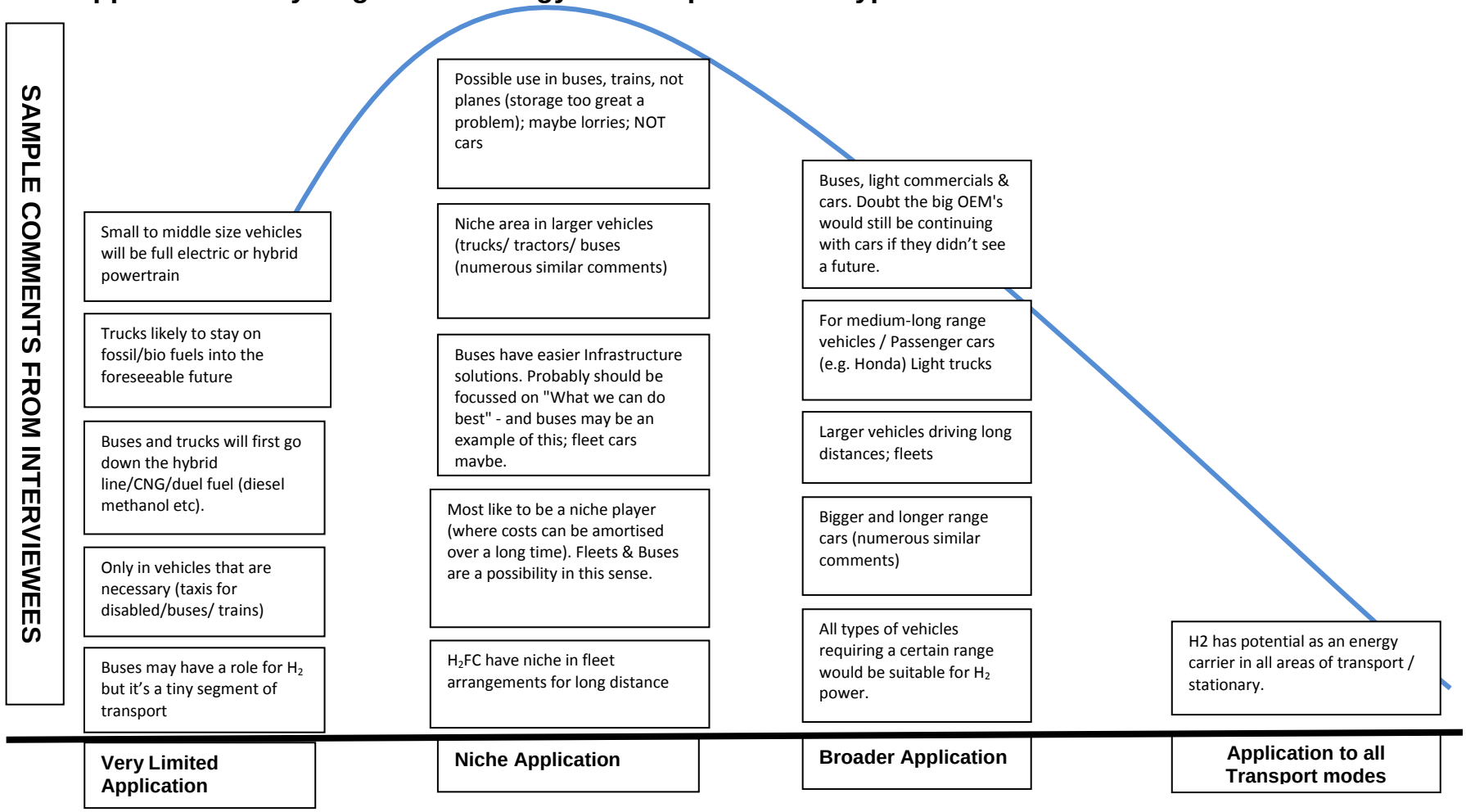


Table 2: What type of application will Hydrogen have in Transport?

3.4 Question 4: Why do you believe that H_2 has a future in transport?

Responses to this question came from the 48 of the 50 people interviewed (94%) who believed there is, or could be a role for H_2 in transport into the future. Their comments have been grouped into 6 categories as follows[5]:

Response	Proportion of All Responses	Percentage of Respondents who mentioned the Response
Technological Advantages of H_2	27%	42%
Environmental Advantages of H_2	25%	40%
The fact that a replacement for oil must be found	17%	27%
H_2 can be utilised in other, non-transport applications	16%	25%
Economic potential of H_2	9%	15%
Governmental policy support for H_2	7%	10%

Table 3: Why does H_2 have a future in Transport Energy?

3.4.1 The Technological Advantages of H_2

FC challenges more likely to be overcome than battery challenges of BEVs; vehicles have greater range and not dependent on a dirty grid; has high energy density as an energy carrier (better than battery); synergies between hybrid technology for Hydrogen powered transport and others; buses already performing reliably in a normal environment; storage and distribution of H_2 for centrally re-fuelled vehicles not a problem; can power heavy vehicles (e.g trucks); it is a flexible energy source; can be produced renewably; vehicle technology advanced; nano-technology (hydride tablets) showing promise for decreasing the weight of H_2 fuel load.

3.4.2 Environmental Advantages of H_2

Zero emissions at tailpipe – clean in city environment; renewably produced hydrogen has a role to play in replacing bio-fuels in the future; mixed with Natural Gas or bio-methane (e.g. fed into the pipelines) it makes the gas cleaner; H_2 powered vehicles are silent and emission free; is a clean energy source in other applications; can be produced cleanly & renewably; does not add to the CO_2 burden (climate change mitigator); does not affect the air quality;

3.4.3 Need for a Replacement for Oil > Menu of Fuels

Humans addiction for mobility means a replacement will be pursued and will be found in many solutions i.e. a menu of fuels rather than just the one (H_2 being one); we need to find a solution to the "oil problem"; we are definitely moving towards oil replacement and

[5] Note that interviewees gave multiple responses.

therefore alternative/substitute fuels must be found; IEA report suggests peak oil occurred in 2007…OEM's and Oil companies need to diversify their energy sources; Greens platform is to change mobility patterns (including speed limits) and find alternatives to fossil fuels. There is room for all different types of transport energy; H_2 part of a menu of fuels; after 2020 likely to go to Natural Gas (NG), BEV's and then H_2FC vehicles; H_2 a possible replacement for Bio-fuels – need a scaling up approach; EC supports the notion of a cascading menu of fuels; H_2 has been a "darling" fuel of the EC but that may have been the past.

3.4.4 H_2 can be utilised in other, non-transport applications

H_2 has a future in helping equalise the load on the electricity grid; also in mixing H_2 with Methane (NG) producing Hythane; (there is) an energy storage problem (of) excess renewable energy; maybe (H_2) has a very limited future as an energy buffering agent…it is an energy carrier not a fuel. Even here…good alternatives – hydropower, bio-mass, bio-gas; its (H_2) use in the stationary energy may come first because of the pressure from closing down the nuclear sector; (H_2) provides cleaner stationary energy than others;(H_2) more likely to be good for small stationary energy projects; I think it will be used for energy storage in the first place. If there is enough for transport after that – then maybe transport.

3.4.5 Economic Potential of H_2

Amortised over time the costs of deployment of an H2FC system are actually not that bad; it (H2) can deliver economic values (employment etc); as the price of oil goes up, alternatives will become more attractive; oil price will make H2 affordable; operators (of buses) are aware of whole of life costing through requirements of EC; (H2 as a buffering agent) jury still out as the capital expenditure is huge although H2 cheaper perhaps.

3.4.6 Governmental policy support for H_2 (includes energy security issues & availability)

OECD recognises that there can be little return for innovators – case for some support (for H_2) there; Our Company until a few years ago was just taking a watching brief – now we have decided to be active where the policy settings are the best; there is plenty of H_2 already being produced in refineries - CCS is a possibility but unproven; European and local requirements for lower emissions will drive this (green technology) too; energy security is an issue.

3.5 Question 5: Why do you believe H_2 does not have a future or will have difficulty being realised in transport?

Responses to this question came from 43 of the 50 people interviewed (86%). While only 2 people interviewed did not believe that H_2 could or should be an energy source for transport into the future, everyone believed there were significant obstacles to be overcome. Their comments have been grouped into 7 categories as follows[6]:

[6] Note that interviewees gave multiple responses.

Response	Proportion of All Responses	Percentage of Respondents who mentioned the Response
Cost of a H_2 based transport system	26%	53%
Major technological and other challenges[7]	21%	44%
Competition from alternative energy sources	16%	33%
Efficiency of H_2 as an energy source	12%	26%
H_2 has not fulfilled potential nor is it a short term 'fix'	12%	26%
Lack of understanding of and communication about H_2 potential	7%	14%
Safety concerns about H_2	6%	12%

Table 4: Why does H_2 NOT have a future in Transport Energy?

3.5.1 Cost of a H_2 based transport system

Cost is high; cost risk if battery technology takes off and (given) the increased efficiency of ICE; investment needed very high; business case needs to be done on this; currently very reliant on public funding for resolving technical issues; H_2 is very costly and most (companies) want return as soon as possible; no guarantee that large investment will be rewarded with success; cost of infrastructure; business case for H_2 in stationary energy needs to be made before a similar one is made for transport; doubtful will get the injection of investment needed and we are unlikely to see subsidies supporting particular technologies – no repeat of the natural gas subsidy; (Distribution of H_2) to even 10% of the 14,000 filling stations in Germany would be very costly; cost is high – who will pay?; from infrastructure perspective costs must come down; cost is a major issue for transport companies; there is nothing to suggest costs of the Fuel Cell will come down; cost is a huge problem - 1.5 million for FC bus compared with 250,000 for a natural gas bus).

3.5.2 Major technological and other challenges to be overcome

In this area there were some sub-categories as follows:

- *Infrastructure Issues:* Centralised or decentralised (distribution); willingness of industry to put in infrastructure; H_2 distribution to the 14,000 (filling) stations in Germany would be impossible; storage losses; cooling H_2 take energy; lack of Infrastructure – (took 10 years to get 800 NG filling stations (6% of all stations) in Germany).

- *Regulation frameworks:* 1415 & 1416 (in France) prohibit production and storage of H_2 without authorisation. (The latter) is an expensive process and prohibitive for all but the large companies; regulations need to be drafted.

[7] The issues of **cost**, **efficiency** and **safety** of H_2 as an energy source could have been placed under this category. However, they were mentioned so many times in themselves we have chosen to put them in their own category.

- *Clean H_2 production:* flexible productions paths (low CO_2); clearly life cycle studies show that H_2FC are no better environmentally unless H_2 is produced renewably; cleanness of H_2 production, storage distribution; major dilemma with sustainable production of H_2; (H_2) not clean enough yet on a well – wheel basis.
- *On Vehicle:* Storage can be very heavy; interface with vehicle still a problem (e.g. metering); reliability of the Fuel Cell stack needs to be addressed; operators need reliable technology; in light (passenger) vehicles storing enough H_2 is problematic; significant progress needed in clean sourcing (of H_2); applicability of H_2 (in the transport sphere)?; durability still a challenge.
- No change to *unsustainable transport culture*: (new fuels) allow the transport culture to continue.
- *Training:* need to get our mechanics trained on this technology so we don't need specialist help.

3.5.3 Competition from alternative energy sources (including enduring availability of oil)

H_2FC vehicles are more of a substitute for (battery) electric vehicles (BEVs); can meet reduction in emissions by 50% through fuel efficiency more easily than decreasing H_2FC costs by 50%; competition for existing H_2 production through refining of heavier oils; CNG has a bigger future in the near term – bigger than H_2; big surge of BEVs on the market in the next 2 years – need to see how they are received and the affect of the subsidies; short term – electrification and bio-fuels may provide a carbon negative alternative; urban areas will be more efficient ICEs and BEVS; big role for bio-fuels in aviation and heavy duty vehicles; we are looking at a higher blend of 2nd generation bio-fuels – we are very confident about this; likely to have BEVs or plug-in hybrids with diesel extender (ICE +battery) for city passenger cars; "Plugged IN" by Gary Kendall shows us why BEVs are superior to H_2FC vehicles; not convinced – very little sign of IS build up – other alternatives better (e.g. wind to methane for pipeline distribution); eventually the whole transport system will go to electric power with trains replacing truck transport; mineral oil is actually cheaper than it was in 1970 – we challenge the notion of peak oil and the 'fact; that oil will become scarce – we have at least 200 years supply of unconventional oils; physical characteristics of H_2 (not as attractive) as NG.

3.5.4 Efficiency of H_2 as an energy source

Low energy density of H_2; (need) greater conversion efficiency (of H_2); high energy losses are the main disadvantage (of H_2); H_2 is the "bucket" not the water in terms of energy allegory. H_2 has 2 fundamental problems: 1) it has an imbalance of mass use (water for H_2 - not enough water to feed the need that would be there if it was a mass energy provider; has a 9-1 ratio of water to output of hydrogen); 2) imbalance in energy requirements - only 25% of energy of H_2 will be converted to "fuel" c/f direct energy to electric vehicles- 100% conversion; lower efficiency in well – wheel; more efficient to use electricity directly into transport.

3.5.5 H_2 has not fulfilled potential nor is it a short term 'fix'

Barriers (to H_2 use) cannot be overcome quickly; (H_2) one of many (fuels) that might become useful – really don't care whether it does or doesn't - really so far on the horizon; SET plans have not delivered – H_2 promised the world and has not delivered; people may be cautious because expectations were not fulfilled during the H_2 hype; we are looking for something for the near term – right now; H_2 is some sort of dream scenario into the future - politicians want a short term "fix".

3.5.6 Lack of understanding of and communication about H_2 potential

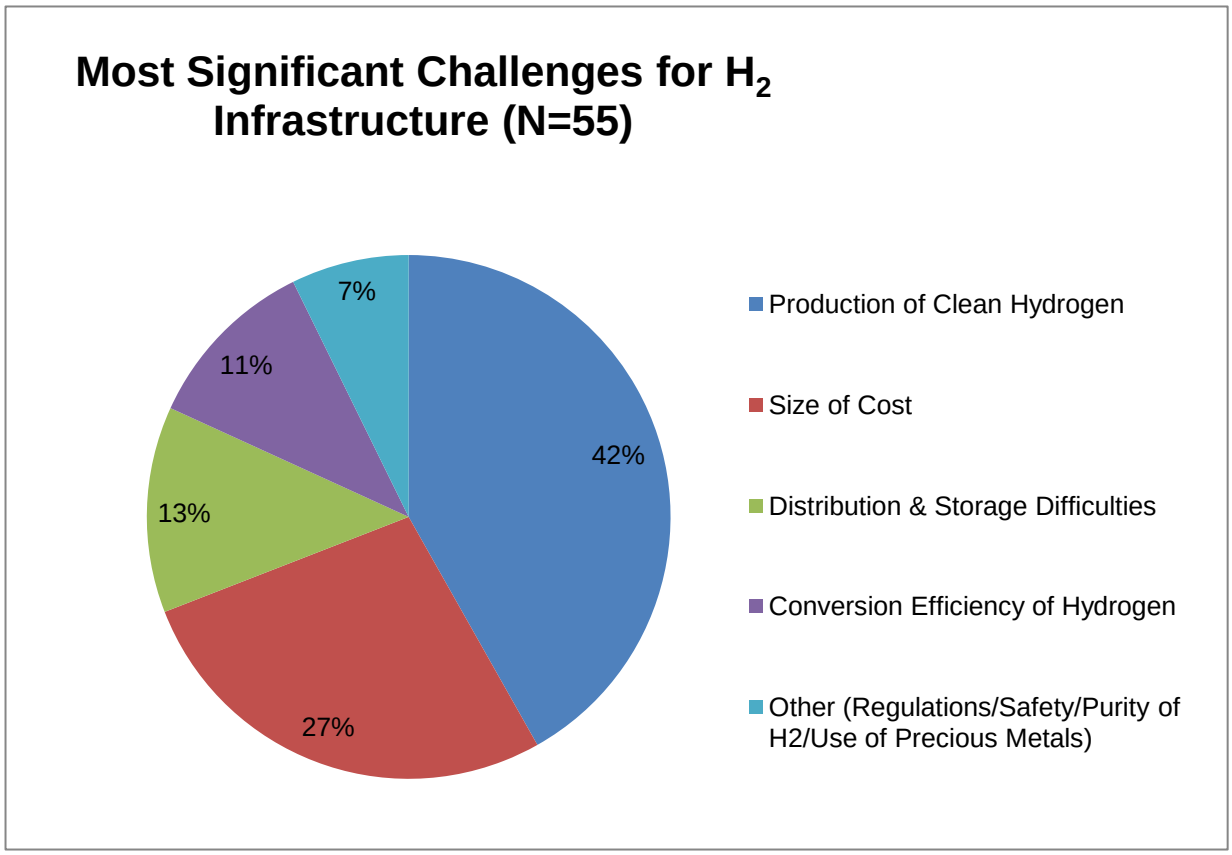
What is the applicability of H_2?; the potential of H_2 is not known to the vast majority of people; people do not want to change from their preferred supplier (of energy); H_2 seems to be rather opaque to the public; seems little integration of H_2 activities within the community; not convinced – other alternatives seem better; to the extent that the policy community is captured by fashions – H_2 is not in fashion at the moment – electricity is; H_2 represents a switch of technology – while BEVs are more incremental change.

3.5.7 Safety concerns about H_2

Problem for H_2 as an energy source when in a tunnel – i.e. safety is an issue; safety (of H_2) is questionable; safety concerns – particularly in tunnels – this may be a fatal flaw.

3.6 Question 6: What are the main concerns/difficulties you see for H_2 Infrastructure?

The comments received from this question were categorised into 5 areas. The frequency of comments within the categories was then charted as per Figure 1 below.



The challenge of producing H_2 cleanly (explicitly renewably) and/or the costs involved in implementing a widespread, Hydrogen based transport fuel dominated responses to this question. Other issues were mentioned as noted in the pie chart above, but were subsumed by interviewees concern about "cleanliness" and cost?

3.7 Question 7: If you believe H_2 to have a future in Transport, when do you expect it to be widespread?

Some interviewees were prepared to comment about the timescale for the broad scale use of H_2 in Transport (see Figure 2 below)

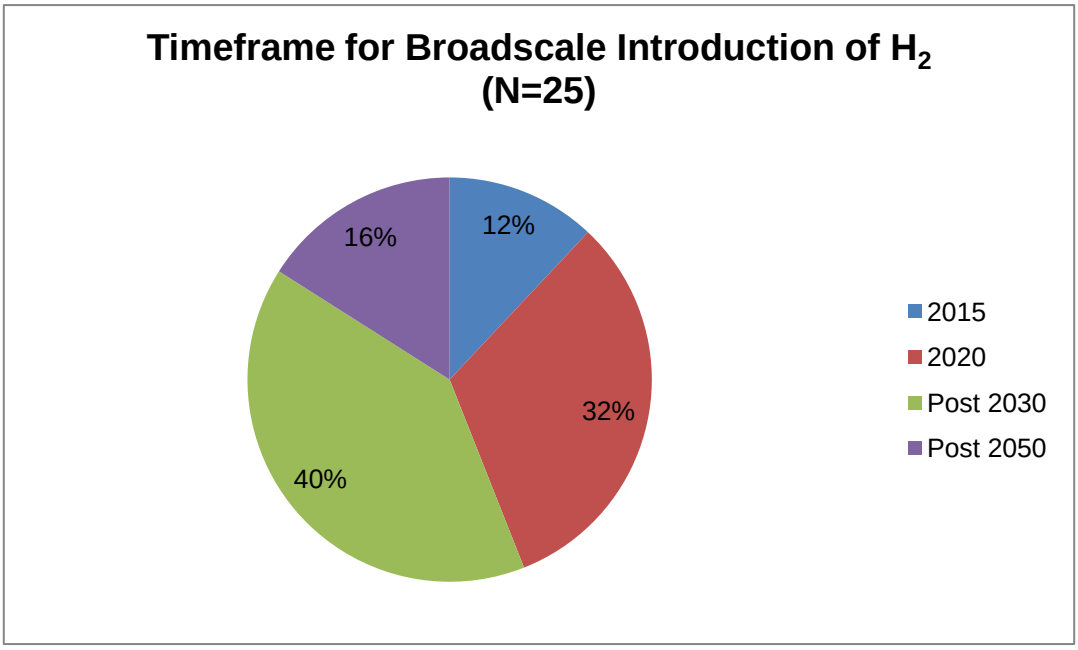


Figure 3: Timeframe for broadscale introduction of H_2

It is worth noting that while over 40% saw H_2 use becoming broadscale within 15 years, only half of the interviewees gave a prediction. In addition, well over half the respondents put its introduction in the >20 years category…a timescale which one of our respondents said meant very little in terms of any sort of accuracy.
The message that came through from this question is that H_2 is still a fuel of the distant future and may still suffer from the "in 10 years" syndrome which has led to dashed expectations and consequently reduced credibility.

3.8 Question 8: Who do you believe to be the Advocates of H_2 Powered Transport and Why are they Advocates?

It is worth noting that of the 50 individuals interviewed, 3 suggested there were no real advocates for H_2 use in transport. Additionally, only one person nominated Environmental Groups/Lobby as advocates. This would seem a genuine concern when it is generally believed there is a perception of H_2 as an environmentally friendly fuel.

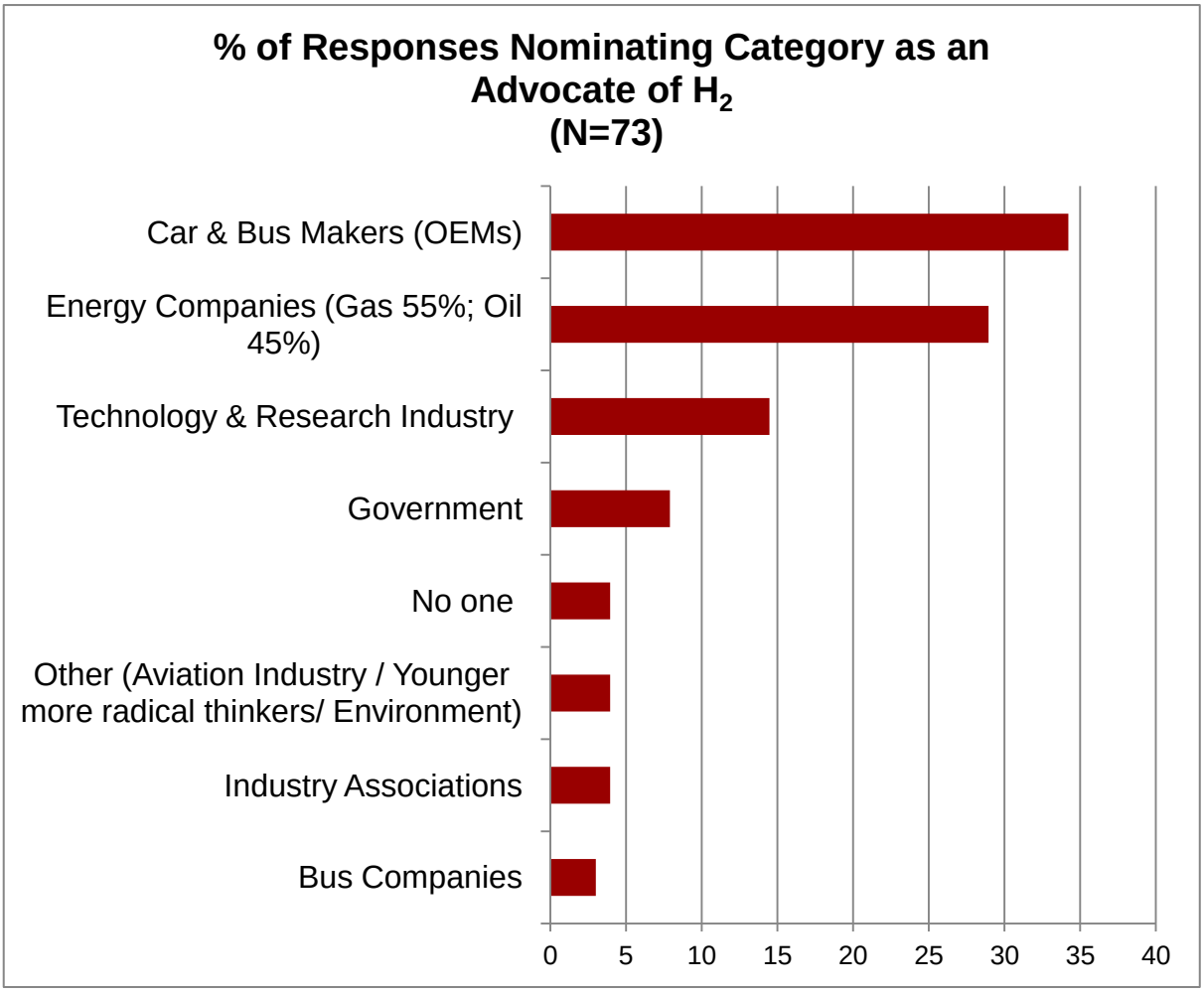


Figure 4: Categories of advocates by frequency of nomination

3.8.1 Reasons for Advocacy of H_2

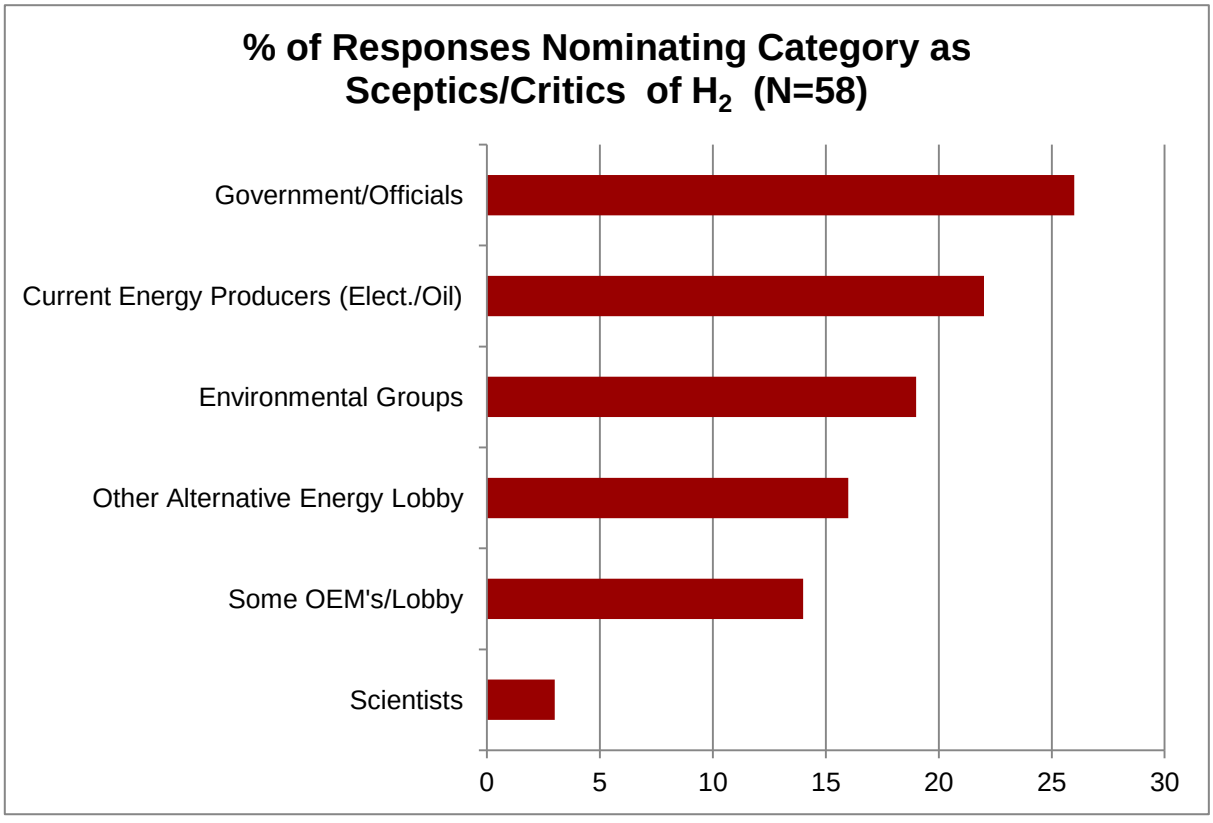
In answering the question, why did the respondent think a certain category was an advocate of H_2 use in transport, there were a number of reasons that stood out because they were repeated. A brief summary is as follows:

- Commercial interest (OEM's; Energy Companies; Technology & Research Organisations.)

- Economic Interest [Government – extract economic benefit for the (Supra) National good; OEM's/Energy Companies extract conomic benefit from subsidies]
- "Greenwash" – promotional benefits (OEM's; Energy Companies; Government)
- Environmental Benefits/ Energy Security benefits - oil production on the decline; need for low emission fuel (Energy Companies)
- Technology of least disruption -allow bigger vehicles; capture of distribution points (OEMs; Energy Companies)

3.9 Question 9: Who do you believe to be the Critics/Sceptics in relation to H_2 Powered Transport and Why are they Critics/Sceptics?

In an effort to broaden the base of individuals interviewed, interviewees were asked to nominate others whom they saw as critics and sceptics of the use of H_2 in transport. It was noteworthy that some of the individuals/organisations that were nominated, when interviewed, did not see themselves as either critics or sceptics and were surprised to hear they had been identified as such.



that in the view of the interviewee there were no real opponents to the use of H_2 in transport. While the reasons for this are noted below, they generally fell into two basic categories… apathy towards H_2 because it was seen as too far in the future or H_2 was simply not on the agenda.

3.9.1 Reasons for Scepticism about Hydrogen

In answering the question, why did the respondent think a certain category was a critic or sceptic of H_2 use in transport, the responses fell into four categories. A brief summary is as follows:

- Barriers to the use of H_2 are too great: e.g. difficulties in commercialising H_2 as a product; cost; low energy efficiency; the lack of clean H_2; lack of regulations for the use of H_2; safety concerns.
- Politics of H_2 introduction: e.g. has not met previous expectations; Governments are by nature cautious and not risk takers; Governments do not to like to 'pick winners'; the reality and differences in regional economic needs; the difficulties associated with claiming tax revenue from H_2 use; the desire from industry to maintain the status quo in transport energy; the desire from environmental groups to change the mobility paradigm.
- H_2 use as a broad scale energy vector is too far in the future. Not on the 10 year horizon.
- Competition for the "alternative energy" space: e.g. Governments are favouring battery electric vehicles; Natural Gas is a good interim solution; Industry is forced to choose or to "guess" at the technology of the future.

3.10 Question 10: In your view, what are the most influential factors in determining whether H_2 had a future role in transport energy?

The answers to this question were many and varied. Below they have been categorised and are in the order of most frequently mentioned to least frequently mentioned. Any statistics on these would be meaningless, but the answers give a flavour of what the interviewees thought.

Most Influential Factors:

1. Governments' attitudes to and policies on the environment and H_2 as a fuel including: emission control measures; level of investment in CO_2 emission reduction activities; appropriate regulations.
2. Ability to monetise the technology including: taxing regimes; capturing private profits.
3. Community views and pressures to acquire new technologies including: environmental NGO's and their supporters desire for a modal shift; level of comfort with the safety of new technology; willingness to pay more (both directly and through taxes) to achieve "clean" transport.

Other Influential Factor: (in order of number of mentions)

1. Cost of the technology in monetary terms.
2. Competition from other clean technologies (in particular BEV's)
3. Technological Barriers: production of clean H_2; Efficiency of the H_2.

4. Price of fossil fuels, in particular crude oil.
5. Energy security concerns.
6. What happens in China.
7. Penetration of information and understanding of the technology.

3.11 Common misunderstandings about H_2

As the interviews were conducted a note was kept of misapprehensions held by the interviewees in regard to H_2 and its use in transport. These are listed below in no particular order. It should be said however, that while the majority of interviewees rated their understanding of the technology as very good or above average and many had experienced some form of H_2 transport, the depth and/or currency of understanding was often low.

1. Driveability of BEV's is better than H_2FC vehicles
2. H_2 is unsafe, particularly in confined spaces. More easily combustible. Can't be used in aviation for this reason.
3. Can H_2 be used widely in transport?
4. Use of H_2 in lorries is a problem because of the constrained range of H_2 vehicles.

4 Discussion: Interview Results and the 'Acceptance' Model

The interviews reported above are a deliverable of Task 3.5.2. The overarching Task 3.5 focuses on a social assessment of the causative drivers behind the different attitudes and perceptions of people to the introduction of hydrogen powered public transport buses. A sample of people from seven target groups have been surveyed. Critics and sceptics are one of these groups.

It was agreed the findings would be analysed according to a change management model for the introduction of technological innovation. This model considers seven parameters that might influence societal acceptance of an innovation: Habits, Expectations, Visibility, Level of Knowledge, Contribution/Participation, Level of Impact, and Life Style.

How then do the comments reported above "fit in" to this model. Rather than examining each set of question responses in relation to this model, it was decided to consider each parameter of the model and make a judgement about how relevant this influencing factor appeared to be within the responses received. This analysis is laid out in tabular form below.

4.1 Parameters Influencing Acceptance	***4.2 Relevance of Parameters to Interview Responses***
4.2.1 Habits: Tendency to stick to the status quo	Respondents did refer to the lack of immediate uptake of alternative energy vehicles such as BEVs as a concern for decision-makers. To fully commit to a new technology, decision-makers want to know that the public will change the habits of a life time to be prepared to refuel by plugging in or using a gaseous fuel. To facilitate this change, they want to see the new technology using systems as close as possible to the systems the public are habituated to (de-centralised refuelling; quick re-fuelling; quick maintenance etc)
4.2.2 Expectation: Anti-climax leads to disappointment and decreased acceptance	The issue of failure to meet expectations was mentioned frequently in interview responses. The early "Hydrogen Hype" was seen as having had a negative effect on how H_2 was seen in our interviewees' circles. Cynicism about the ability of H_2 to deliver had replaced early optimism about its potential. This had resulted in it being left off the short to medium term agenda of future fuels in some influential bodies (eg WWF/OECD)

4.2.3 Visibility: Presence of the innovation in people's daily lives	Interviewees reported a high level of experience with H_2 powered transport (83%). However, many were concurrently unsure as to where the development of the technology had got to, requesting this information from the interviewers. In one instance, an influential policy group were unaware that a H_2 bus was on display near their own headquarters. Others did not know their city/country was involved in H_2 demonstration projects.
4.2.4 Level of knowledge: Understanding of H_2 in transport and reaction to negative news	Again, interviewees self-reported an above average to high level of knowledge about H_2 use in Transport. This was not always borne out by their responses. A number drew on examples of negative images of H_2 (eg safety) as a barrier to its use. Probably an example of not knowing what you don't know.
4.2.5 Participation: Involvement in decision-making about the new technology	Numerous respondents saw the participation and investment of Governments in H_2 in transport as a reason for why it will have a future. Indeed, Governments have been not just a participator but a driver, along with industry, in the progress of H_2 technology.
4.2.6 Impact: Degree to which the new technology impacts people directly.	The level of penetration of the new technology is still at a "demonstration" level and for most of the interviewees barely touches their world except in terms of its potential. The fact that to explore/experience the technology personally takes a considerable effort certainly contributes to H_2 being seen as a "back burner" idea rather than an imminent or even medium term prospect
4.2.7 Lifestyle: Does the new technology "fit" with people's values/ attitudes /patterns of behaviour	This is a most interesting parameter in terms of the environmental attributes ascribed (or not) to H_2 use in Transport. Numerous interviewees noted the "greenwash" value of H_2. That is to say, they believed H_2 was being pursued by Governments and Industry (in particular OEM's) as a way of promoting their environmental credentials without any real intention of making it a mass market item (investment too low and progress too slow). However when it came to the interviewees from environmental lobby groups, they believed the H_2 supply chain did not measure up in terms of providing a clean, renewable fuel. In addition, some environmental advocates saw the search for alternatives to fossil fuels

	was driven by the desire to keep people in their cars – also an unsustainable prospect by their reckoning. In this analysis H_2 is both 'damned by faint support' from one important sector of the community (elements of Industry) and just simply 'damned' by another equally important sector (environmental advocates), a sector that would have been thought to provide a supporter base.

So what does this analysis add to the conclusions of this report in relation to the views of the sceptics and critics about H_2 and its use in transport?

4.3 Concluding Remarks.

In some very important ways it points to areas in which those who are active in promoting H_2 as a sustainable alternative to fossil fuels can do better in terms of garnering acceptance among decision-makers.

1. **Visibility** remains low among some very important national and supra-national bodies. Even in Brussels where pan-European policy is leading the way for the introduction of H_2 among a menu of alternatives, there is less penetration of understanding and experience than would be ideal.

   Outside Brussels, with the possible exception of Germany, there is much to be done particularly in relation to international bodies such as OECD and national governments such as the Government of France.

   Having said this, the Acceptance Model when applied to the interview responses makes it clear that dissemination activities are very important and must be continued. The message is simply that working solely with "friends of H_2" and/or Brussels Institutions is not enough.

2. It is clear too that **creating false expectations** about the future of H_2 by "over-hyping" results and reporting only good news has led, already, to un-useful levels of cynicism. The visibility of the technology must be accompanied by credible reporting of achievements and projections into the future.

3. Having said this, the **lack of depth and currency in knowledge** about Hydrogen and the state of the technology among some influential organisations does need to be addressed. Some form of regular road show/information sessions providing more technical updates to targeted influential organisations (Government and Industry)

throughout Europe may be a useful activity. This of course includes new member states.

4. **Better connecting to the values and attitudes (Lifestyle in the Model)** of certain influential organisations is another area that might be addressed. Not to have the full support of Environmental policy makers (be they Government or non-Government) is having a severe curtailing affect in the advancement of H_2 in transport. Given the concerns that some have about the efficiency of H_2 as a source of energy, no to be in a position to show a clear intention (and preferably timeline) to the production of 'green' hydrogen relegates the H_2 option to the 'not any time soon' section of Environmental groups' policy thought. Moving to 'green' H_2 production sooner rather than later is therefore not an option for it to achieve acceptance – it is an imperative.

5. Related to this is the fact that for the broader community to change their fossil fuel **habit** in favour of H_2FC vehicles, it will require H_2 to be seen as offering some real gain. One such gain it could offer but is currently missing out on is its clean environmental image. Not one respondent from an environmental organisation among those interviewed gave H_2 an enthusiastic endorsement. This is a major challenge for the acceptance of H_2 as a source of energy in transport.

5 APPENDICES

5.1 Written Questionnaire to accompany Interviews

Short questionnaire to accompany the discussion on the role of Hydrogen in Transport.
All information will be confidential and no identification of the views of individuals or organisations will be released without specific permission.

1. Please indicate your level of knowledge on a scale of 1 to 5 about Hydrogen and its use as an energy source for transport where

   1 = Poor (I can spell the word hydrogen and that is about all)
   5 = Excellent (I understand the technology well and the issues of broad scale use in transport) ☐

2. Please indicate on a scale of 1 to 5 how urgent you believe it is to find a broadscale replacement for oil as an energy source for transport where

   1= Immediately
   2= Within 5 years
   3= Within 10 years
   4= Within 20 years
   5= >20 years ☐

3. Have you ever seen or had a ride in a hydrogen powered vehicle (Y or N)? ☐

4. Have you ever participated in a Hydrogen in Transport Project -even if in a small way (Y or N)? ☐

5. In your view, what is the single most important (set of) change(s)/improvement(s) needed if the role of H_2 in transport is to increase?

5.2 List of Organisations/Companies/Individuals who were interviewed

ABB Group	Italy
Air Liquide	France
Aston University	U.K.
Bellona Foundation	International
BMU - Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Federal Ministry of Environment. Nature Conservation and Nuclear Safety)	Germany
Breakthrough Technologies	U.S.A.
Bureau du Premier Ministre (Prime Minister's Department)	France
CEA-Commissariat à l'énergie atomique et aux énergies alternatives (Atomic & Alternative Energy Commission)	France
Confederation of Public Transport	U.K.
DENA -Deutsche Energie-Agentur (Federal Energy Agency)	Germany
European Commission Directorate for Climate Change and Transport	Pan-European
European Commission Directorate for Enterprise	Pan-European
erdgas mobil	Germany
FAST-Federazione delle associazioni scientifiche e tecniche (Federation of Scientific and Technical Associations)	Italy
FIA Foundation	International
Former Fuel Cell Bus Project Leader	Luxembourg
Former Minster for Transport in the West Australian Government	Australia
Former Senior Federal Government Environmental Agency Official	Germany
Friends of the Earth, Deutschland	Germany
Germanwatch	Germany
Greenpeace UK	U.K.
Honda	Europe
INERIS - L'Institut National de l'Environnement Industriel et des Risques (French National Institute for Industrial Environment and Risks)	France
IFEU - Institut für Energie und Umweltforschung Heidelberg (Institute for Research into Energy and the Environment)	Germany

International Council on Clean Transportation	U.S.A.
International Energy Agency (OECD)	International
International Transport Forum (OECD)	International
Low Carbon Vehicles Partnership	U.K.
MAN Nutzfahrzeuge	Germany
Member of the European Parliament (Green Party)	Pan-European
Member of the German Federal Parliament (Green Party)	Germany
Mineral Oil Association	Hamburg
Natural Gas Vehicle Association	Pan-European
Office of Environmental Economics (OECD)	International
Renault	France
Ricardo	U.K.
Public Transport Authority of Western Australia	Australia
Stuttgarter Straßenbahnen (SSB)	Germany
Sustainable Energy Consultant	Switzerland
TOTAL	France
Transport & Environment	Pan-European
TMB -Transports Metropolitans de Barcelona (Barcelona Transport Company)	Spain
Verband der Automobilidustrie (German Automobile Industry Association)	Germany
Volvo Buses	Sweden
World Energy Council	International
WWF Deutschland	Germany
WWF-European Policy Office	Pan-European

5.3 Interview Introduction & Schedule

Introduction

- Thankyou for meeting/talking with us
- Name is SW / NW and we are part of CHIC project
    - EC funded
    - Commercialisation of FC buses
    - Follow on from previous projects
- Background of SW
    - Working on H_2 Public Transport for last 10 years
    - Western Australian Government and in EC projects / WP leader on dissemination and communication
- Background of NW
    - Worked on H_2 public transport for last 5 years
    - Former public / civil servant with background in public policy and statistics
- Our Task
    - Understand issues and beliefs around H_2 in transport
        - Especially those people and organisations who don't see a role for it
        - Document and provide to stakeholders – EC and industry
    - WHY?
        - Little communication / outreach / discussion beyond a relatively small group
- FORMAT OF DISCUSSION
    - Open ended questions → discussion
    - NW to document
    - Very brief closed questionnaire at end of interview (by email) to provide some background context.
- CONFIDENTIALITY
    - No identification of individuals or their views in any reports (internal or public)
    - Information to be aggregated
    - No passing on of individual contacts
    - **REQUEST PERMISSION TO ID ORGANISATIONS AS PART OF REPORTS e.g. list of participating organisations in appendix of reports.**

Questions

1. Do you see a role for H_2 in transport?
    a. YES
        i. What role
        ii. Why
        iii. When
    b. NO
        i. Why
        ii. Fatal flaw or not
    c. Your country / EC
    d. Differentiate between
        i. Passenger vehicles
        ii. Commercial
            1. Light
            2. Heavy
        iii. Public transport
        iv.
2. Do you see a role for H_2 in public transport

3. Can you give me
    a. 3 main reasons why H_2 in transport may have a future
    b. 3 main reasons why H_2 in transport may not have a future

4. Do you see any significant issues in relation to H2 production

5. Who do you see as the
    a. advocates of H_2 and why
    b. the critics of H_2 and why