

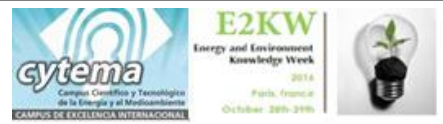


HYACINTH

FCH JU → SPI-JTI-FCH.2013.5.3
 HYdrogen ACceptance IN the Transition pHase
 Support & Coordinated Action



Energy and Environment Knowledge Week 2016
28th -29th October 2016, Paris. France
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This project has received funding from the Fuel Cells and Hydrogen Joint Undertaking (FCH-JU) under grant agreement N° 621228

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- The **transition phase of FCH** technologies is expected to happen within the next decades.

Implementacion process



- **Challenges**: higher cost and less comfortable infrastructure or lower reliability.
- **Benefits**: energy efficiency and environmental benefits (no local emissions)
- Advanced **hydrogen support** (Germany, UK), medium support (Spain) and low support.

- Among the **alternative technologies: residential fuel cells and hydrogen fuel cell vehicles (FCEV)**
- Both applications have **mass-market potential** and will have a **significant impact on reducing emissions** and **primary energy consumption**
- **Social acceptance** will likely play a role in the successful adoption of hydrogen and fuel cell applications.



HYACINTH: HYdrogen ACceptance IN the Transition PHase

- Funded by the **FCH-JU** in call 2013 (SP1-JTI-FCH.2013.5.3 Social acceptance of FCH technologies throughout Europe). Total cost: 999,383 €; EU contribution: 661,584 €.
- Coordinator: Nacional Hydrogen Centre (CNH2), **11 main partners from 5 different European countries.**
- Started in September 2014 with a duration of **30 months.**
- Aims to gain a **deeper understanding of the social acceptance of hydrogen technologies across Europe.**

HYACINTH: Specific objectives

- Identify and **understand awareness and acceptance** of hydrogen energy and FCH technology and perceive potential benefits in the general public and at selected stakeholders.
- Identify the main drivers of social awareness and acceptance** of FCH technologies in order to provide recommendations.
- Support stakeholders** by providing a social acceptance research **toolbox.**



HYdrogen ACceptance IN the Transition pHase Hyacinth

The main objective of HYACINTH project is to gain a deeper understanding of the social acceptance of hydrogen and fuel cell (HFC) technologies across Europe.

The social acceptance is widely recognized as a key dimension in the sustainable implementation of HFC technologies.

HYACINTH aims to:

- Identify and understand awareness and acceptance of hydrogen energy and HFC technologies,
- Identify the main drivers of social awareness and acceptance of HFC technologies, and
- Support stakeholders with a social acceptance management toolbox.

The HYACINTH project: Runs from September 2014 to February 2017 and the data collection is made in seven European countries with different level of support and implementation of HFC technologies: Belgium, France, Germany, Norway, Slovenia, Spain and United Kingdom.

The project will focus on the specific transition phase of market implementation, between demonstration and market. Combining specific qualitative and quantitative methods and samples of 7,000 surveys of European citizens and about 400 selected stakeholders.

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PARTNERS

- **Centro Nacional del Hidrógeno (CNH2) – Spain**
- **I PLUSF France – France**
- **Fraunhofer-Institut für System- und Innovationsforschung ISI– Germany**
- **Aberdeen City Council– United Kingdom**
- **University of Sunderland– United Kingdom**
- **Centre for Energy, Environment and Technology (CIEMAT) – Spain**
- **Sustainability Research Institute (SRI), University of Leeds - United Kingdom**
- **CIDAUT Foundation– Spain**
- **Razvojni Center za Vodikove Tehnologije (RCVT) – Slovenia**
- **NORSTAT Services GmbH (NORSTAT) – Germany**
- **I PLUSF España – Spain**



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WORK PACKAGES

– **WP1 “Project management”** includes meetings, reporting, deliverables, day to day work. The webpage design and development is here included.

– **WP2 “Context analysis”** is aimed to gather information that could be useful for the rest of the WPs.

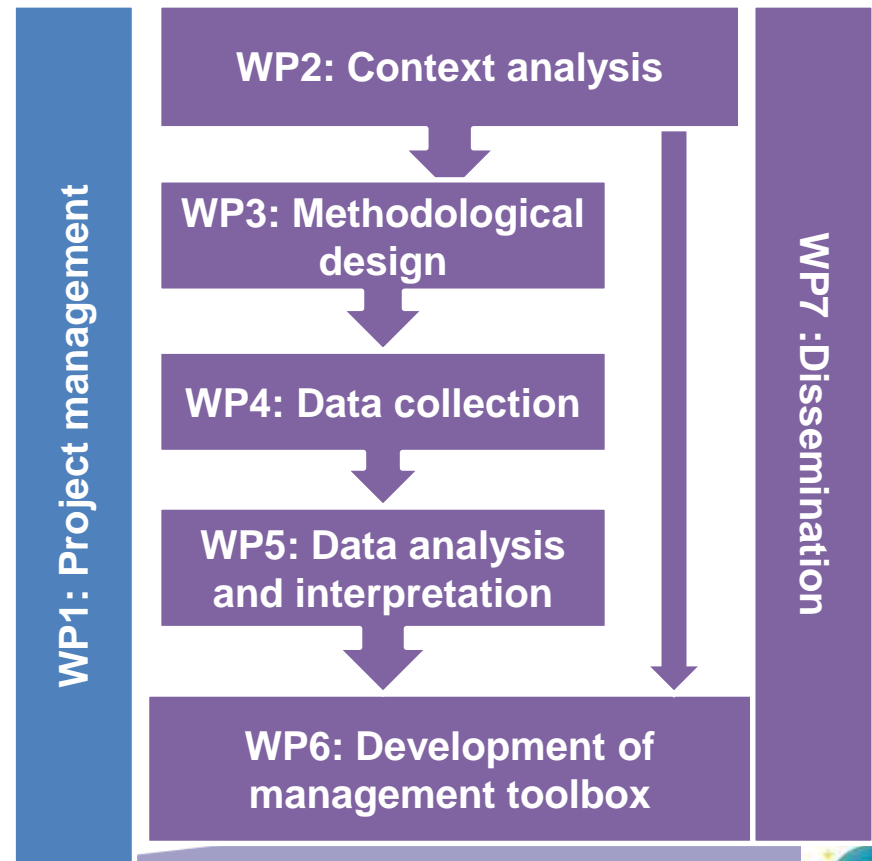
– **WP3 “Methodological design”** of the studies, **one for the general public** and two on–**stakeholders**. This WP includes the design of the **questionnaires** and **protocols** to be implemented in the Data Collection (WP4).

– **WP4 “Data collection”**, with three parts: personal **interviews with stakeholders**, **online questionnaires for selected stakeholders** and a **general public survey**.

– **WP5 “Data analysis and interpretation”**, will **analyse the information gathered** from WP4 alongside with information from WP2 to obtain **two studies**: one for the **general public awareness and acceptance** of hydrogen and fuel cell technologies and the second one for the **stakeholders awareness and acceptance**. The information obtained **will feed the information** treated in the **toolbox** (WP6).

– **WP6 “Development of management toolbox”** is aimed to present the final results of the project: **a social awareness report and a toolbox**. The toolbox should **help stakeholders to better communicate or target their products or services**.

– **WP7 “Dissemination”**: to engage stakeholders in the project and in the use and spreading of the results of the project (the two studies and the toolbox).



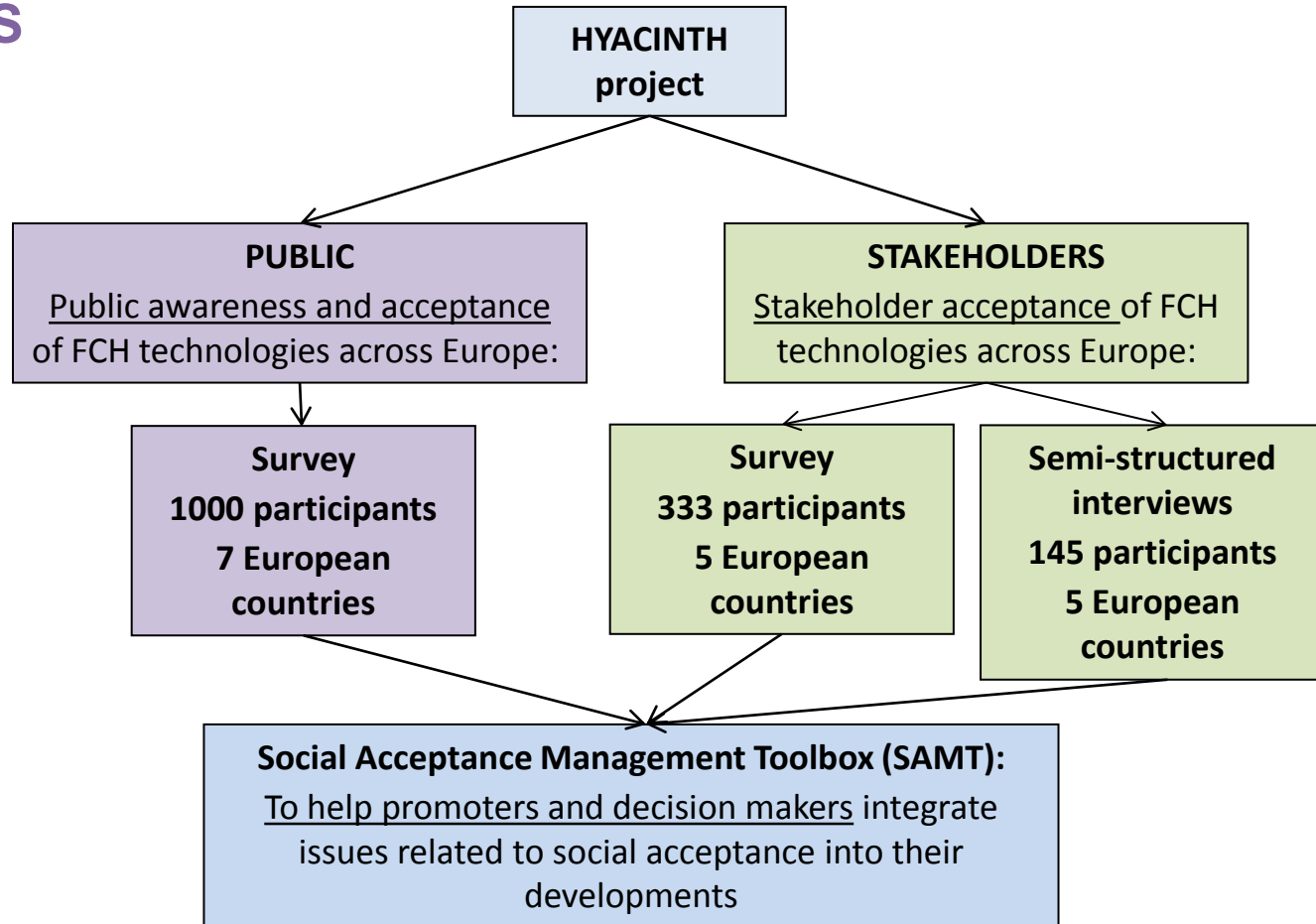
DESIGN METHODS

Studies:

1. Public awareness and acceptance of FCH technologies across Europe.
2. Stakeholder acceptance of FCH technologies across Europe

Toolbox:

To help promoters and decision makers integrate issues related to social acceptance into their developments



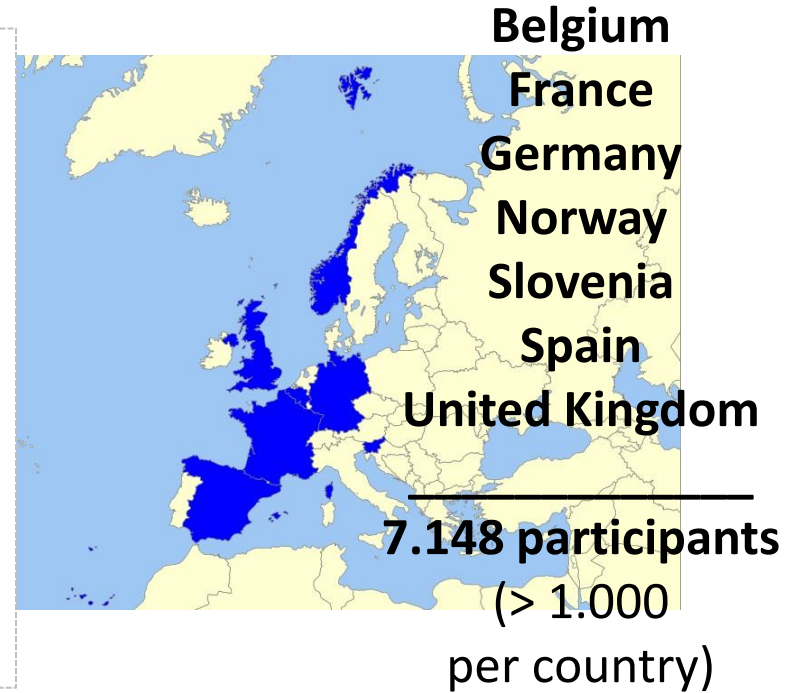
DESIGN METHODS

	PUBLIC SURVEY	STAKEHOLDERS SURVEY	SEMI-STRUCTURED INTERVIEWS
Participant countries	Belgium, France, Germany, Norway, Slovenia, Spain and United Kingdom	France, Germany, Spain, Slovenia, and United Kingdom	France, Germany, Spain, Slovenia, and United Kingdom
Data collection	April 2016	March 2016 to June 2016	November 2015 to June 2016
Total sample	7148 participants	333 participants	145 interviews
Recruitment	Recruitment through Norstat panel.	Invitations sent out by the project partners	Interviews were conducted by the project partners
Sampling	General population (aged 16 and more)	Energy stakeholders and hydrogen experts	Professionals involved in hydrogen demonstration projects
Procedure	Online questionnaire provided by Norstat	Online questionnaire provided by Norstat	Conducted by phone or in person by project partners Duration ca. 30 min
Data Analysis	The data was analysed using SPSS software.	The data was analysed using SPSS software.	Qualitative data has been coded with MaxQDA.

PUBLIC ACCEPTANCE STUDY

Objectives of the public study:

- To examine public awareness, familiarity, perception of benefits and costs, global attitude and acceptance of FCH technologies.
- To identify key individual and social determinants of public awareness and acceptance of FCH technologies;
- To report on cross-country comparisons in public awareness, attitudes and acceptance towards FCH technologies



Survey Method: Survey data collected in 7 European countries

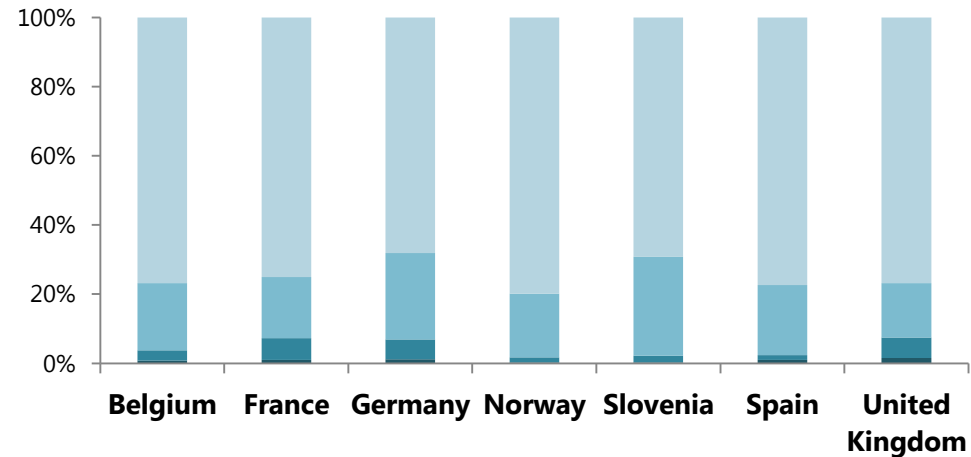
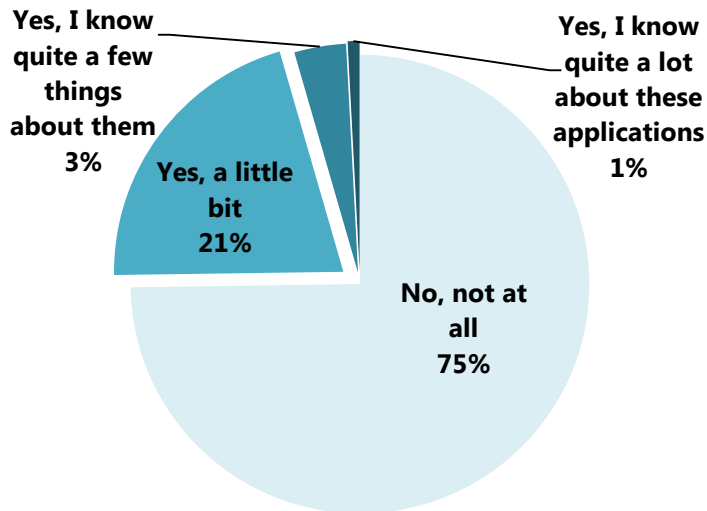
Participants: around 1000 members of the general population aged 16 and over.
Nationally-representative samples.

Studied applications:

1. Hydrogen fuel cell stationary residential applications
2. Hydrogen fuel cell transport applications and related infrastructures

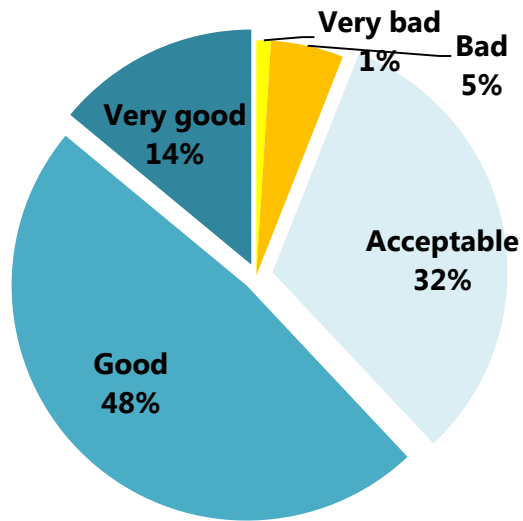
Awareness of residential hydrogen fuel cells

The level of public awareness about home HFCs is very low in the seven studied populations. **Only around 25% of respondents report having heard about residential fuel cell micro-CHP** (this is 15 percentage points lower than the level of awareness of HFCs in general). And less than 5% consider themselves knowledgeable about this application.



- No, not at all
- Yes, a little bit
- Yes, I know quite a few things about them
- Yes, I know quite a lot about these applications

Informed evaluation/global attitude of home HFCs

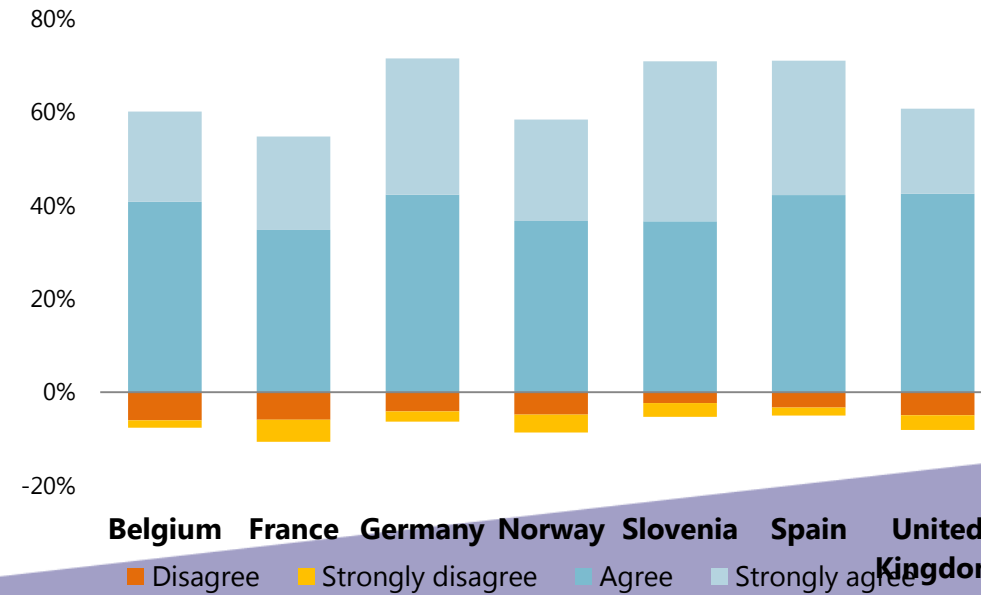


In all the countries surveyed we find that **the majority of the population rates the technology as a good option** (percentages range from 40% and 53%), followed by those who rate it as acceptable (from 27% to 36%)

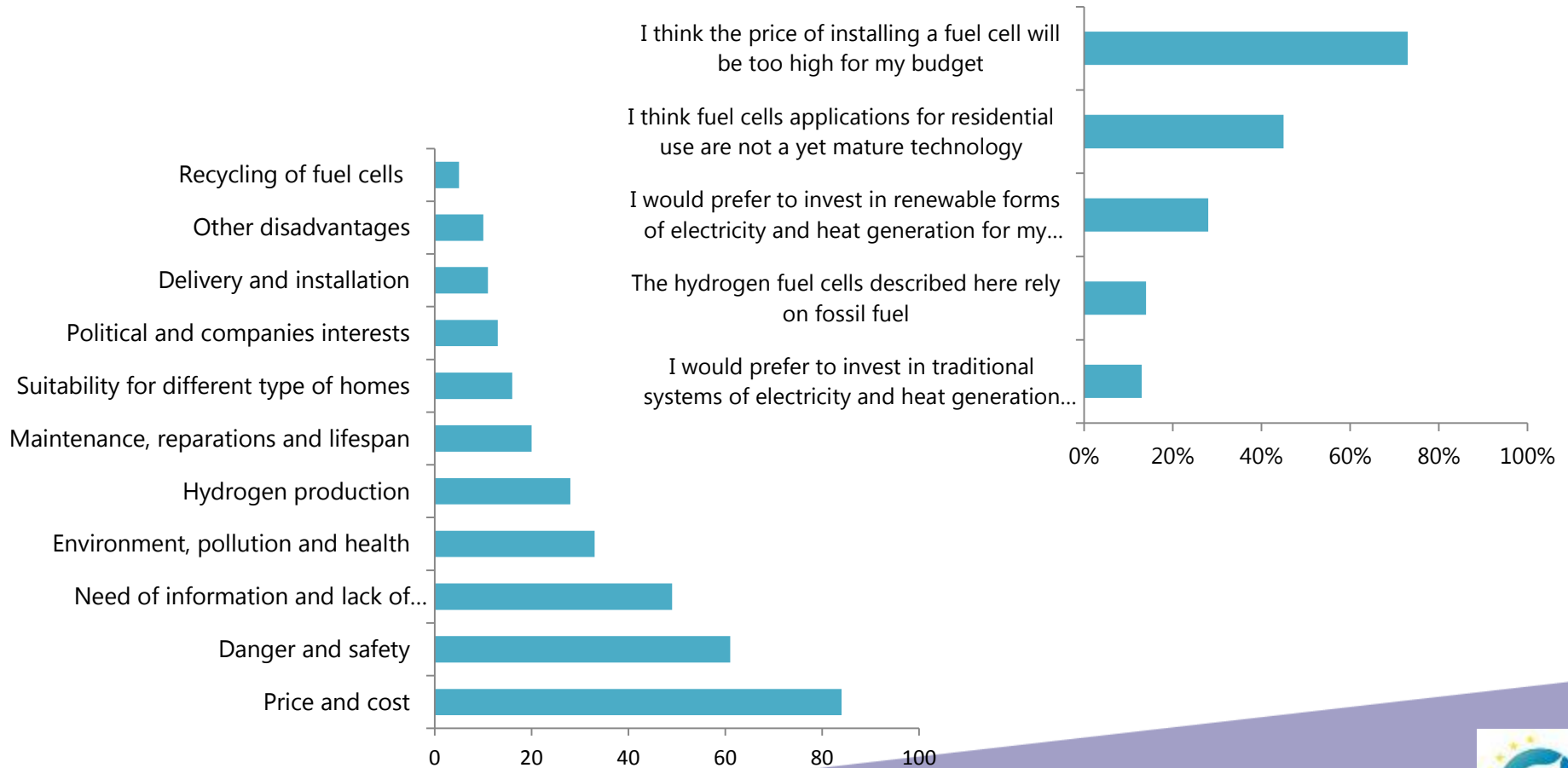
Acceptance of home HFCs

The study shows: “I would be happy to have an hydrogen fuel cell unit in my home in future”. **Around 6 out of 10 would be happy to have a residential HFC unit at home** (2 out of 10 would be very happy), 3 out of 10 are undecided about this and less than 1 out of 10 would not be happy about it at all.

Figure. % of respondents in the total sample that would like to have a hydrogen fuel cell system in their home

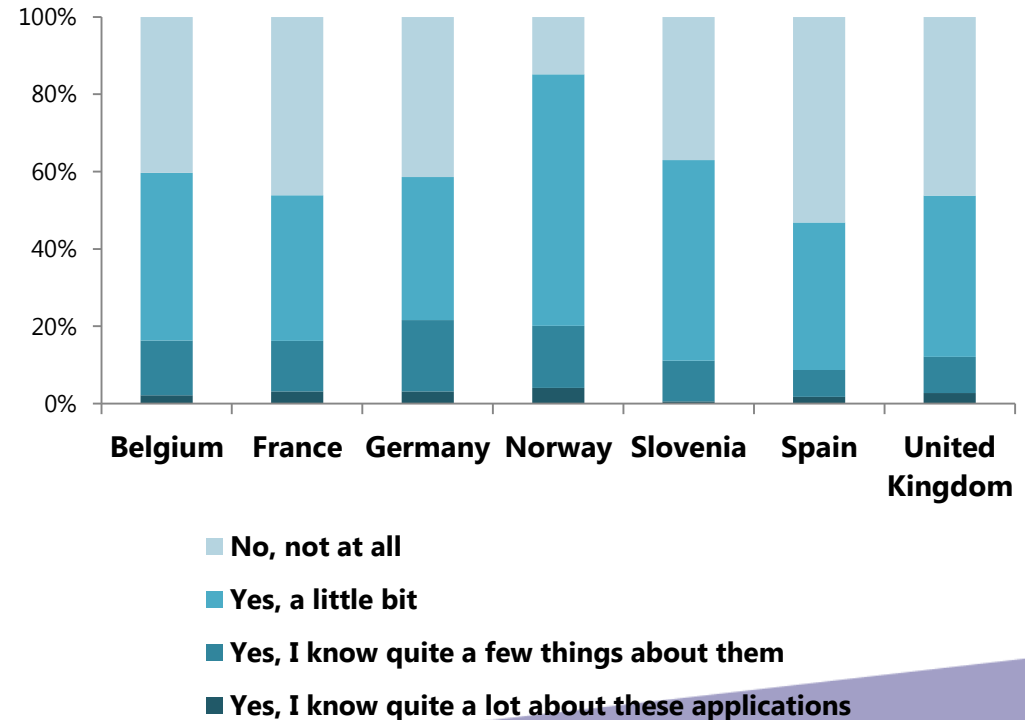
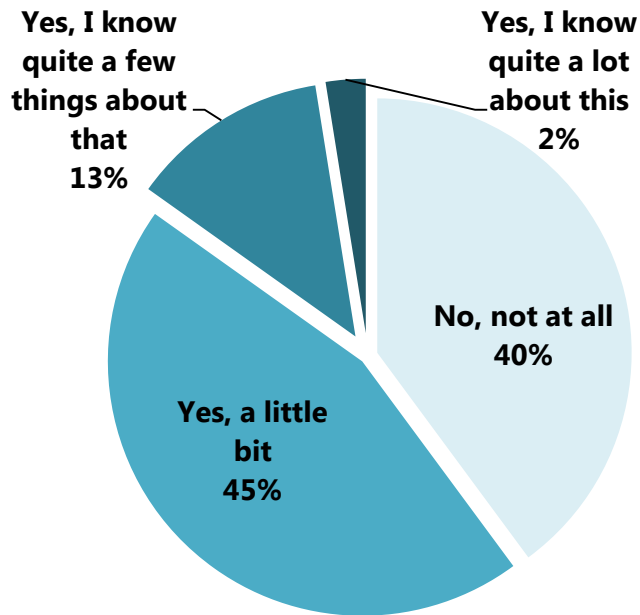


Respondents' reasons for not willing to buy a home HFC

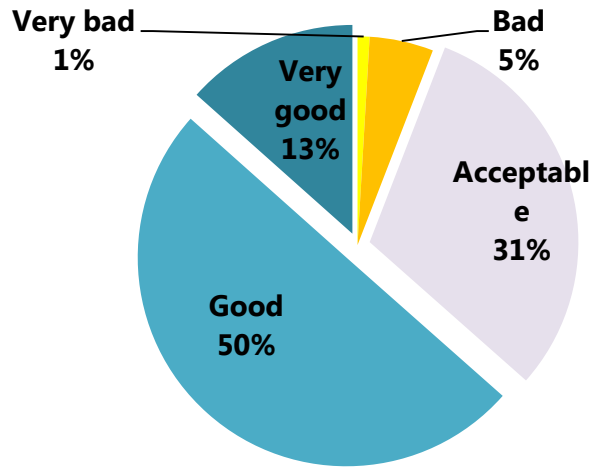


Awareness of FCEVs

Awareness is significantly higher for FCEV relative to residential fuel cell micro-CHP. **Around 45% of respondents have heard a little bit about FCEV** and even a 15% reports knowing a few things about fuel cell cars.



Informed evaluation/ global attitude of FCEV

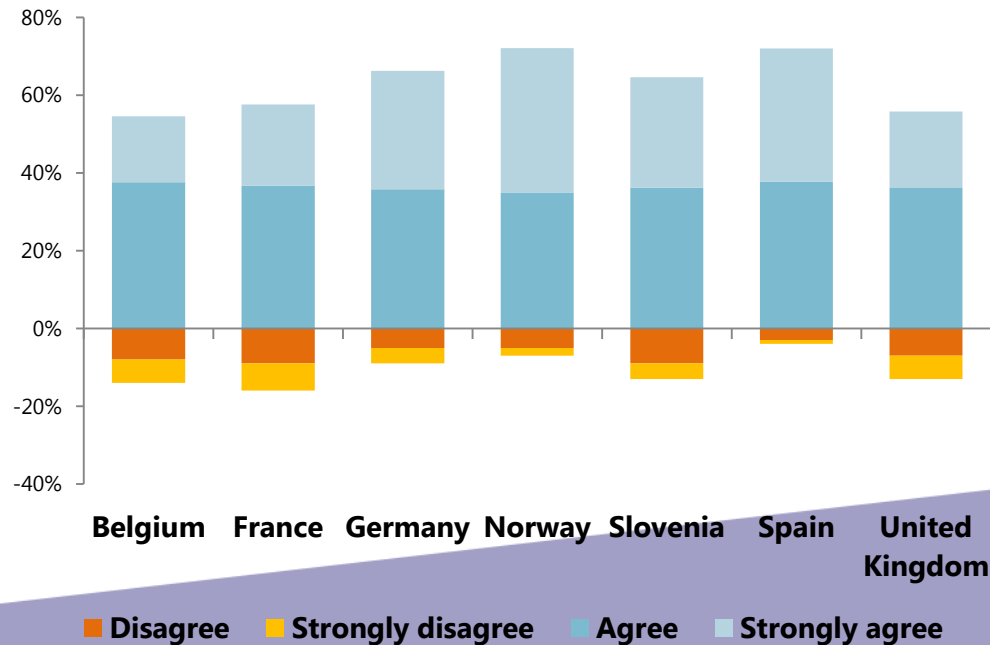


In all the countries surveyed we find that **the majority of the population rates the technology as a good option** (percentages vary between 44% and 56%), followed by those who rate it as acceptable (between 23% and 37%).

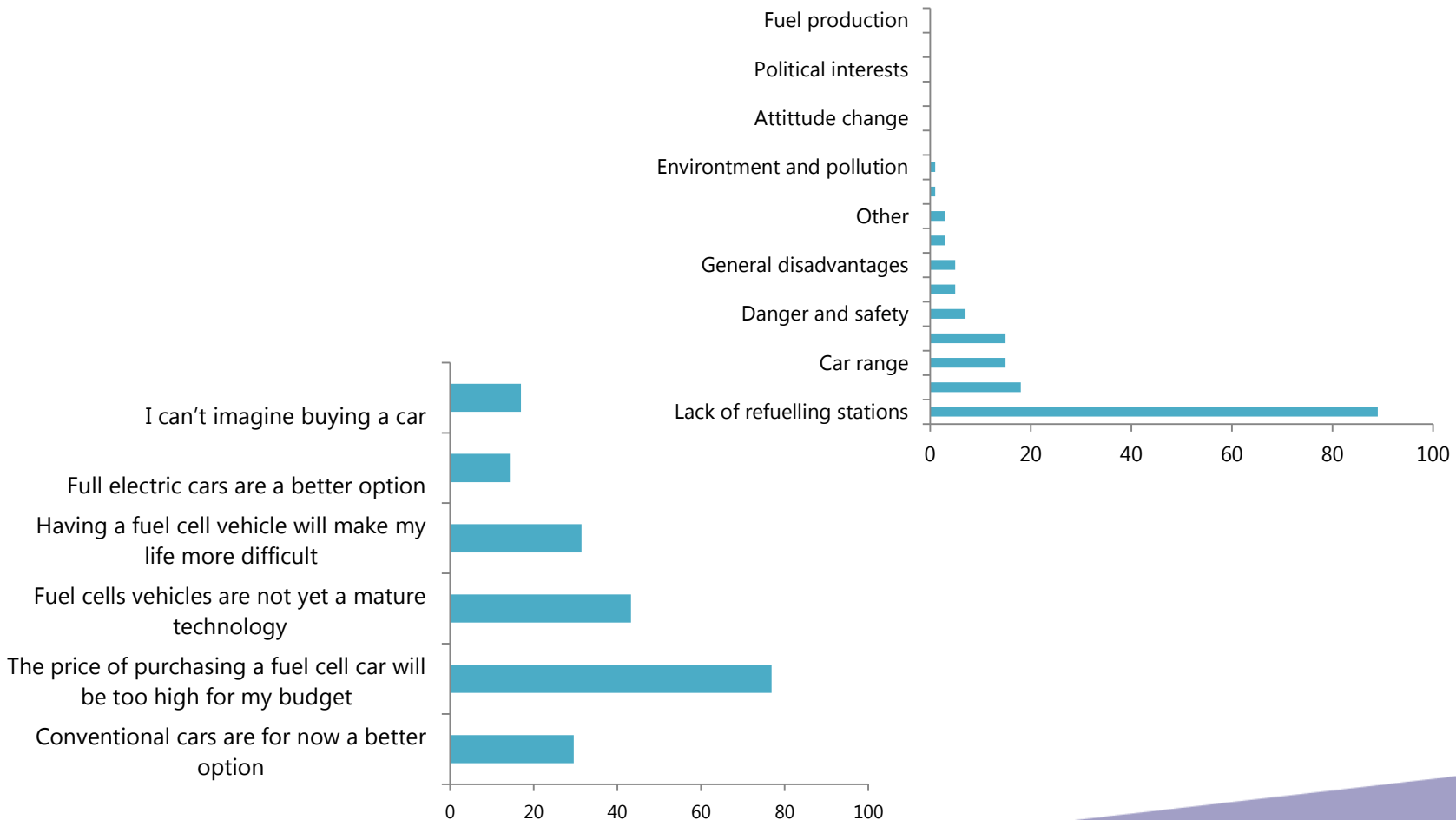
Acceptance of FCEVs

The majority of participants in the seven studied populations would be happy to have a hydrogen fuel cell car in the future (keeping all else equal). **More than 60% in the full sample would like to buy a HFC electric car in the future.** Around 30% of respondents are undecided about it; and around 10% are not willing to have a hydrogen fuel cell car in the future.

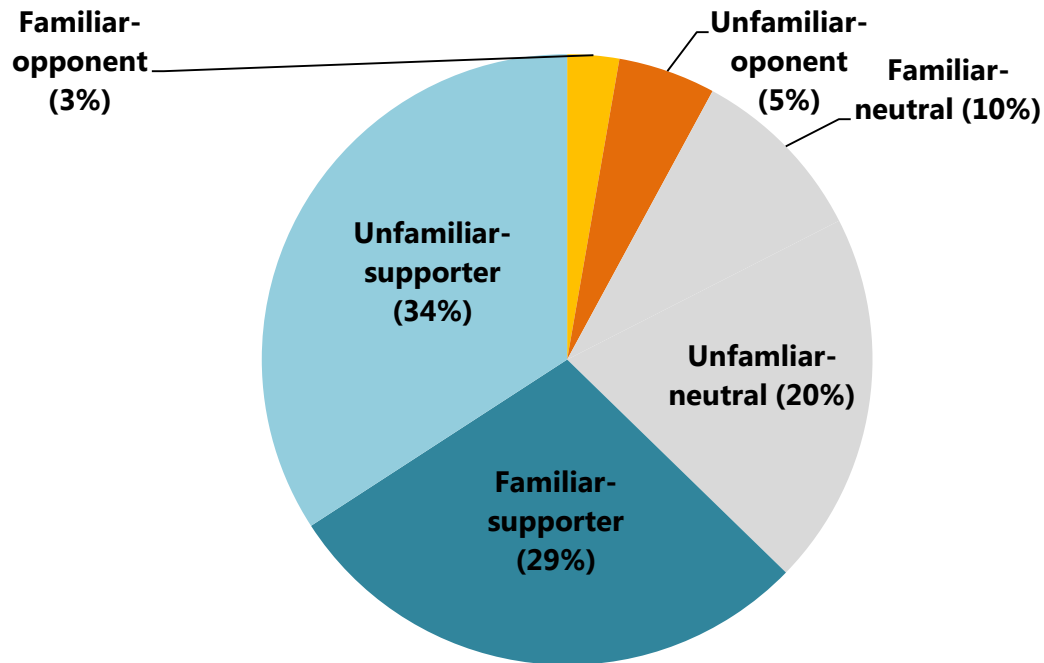
Figure . Global evaluation of HFCEVs (as % of respondents that consider them a very bad-very good solution)



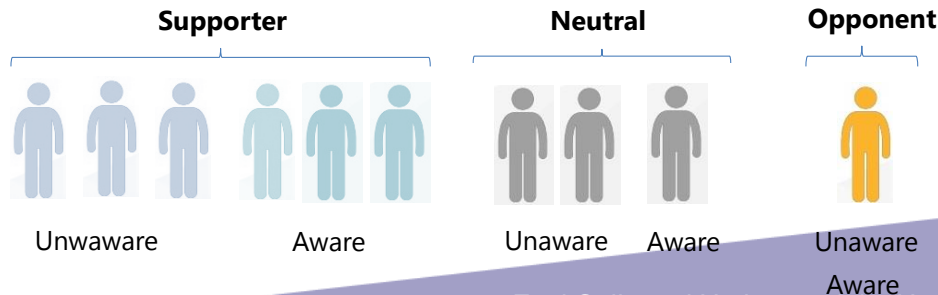
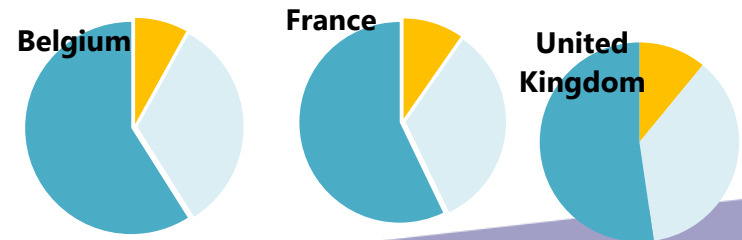
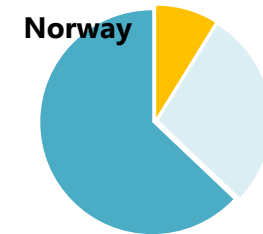
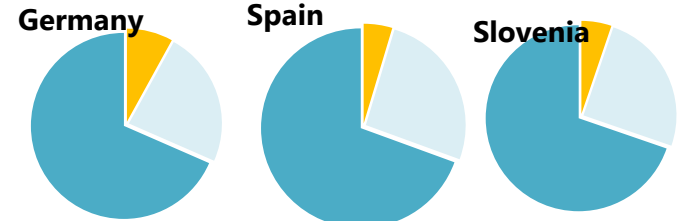
Respondents' reasons for not willing to buy a FCEV



Supporters and opponents (all countries, both applications)



■ Opponent ■ Neutral ■ Supporter



STAKEHOLDER SURVEY-METHODS

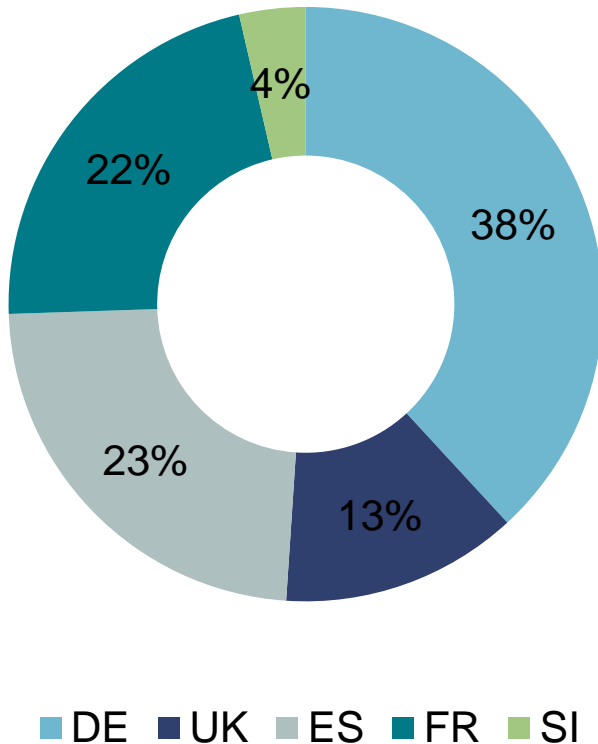
- **Survey content:**
 - Innovation systems rationale: successful technologies require stakeholder alignment
 - Stakeholder perceptions of hydrogen technologies
 - In-depth evaluation of either
 - Small static hydrogen fuel cell applications
 - Hydrogen fuel cell electric vehicles (FCEVs)
 - Perception of other actors in the innovation system
 - Factors influencing future market development



- **Questionnaire survey during spring 2016**
- Population: **selected stakeholders in 5 countries**
- Implementation: **Online questionnaire** (by Norstat)

STAKEHOLDER SURVEY - SAMPLE

Participants by country

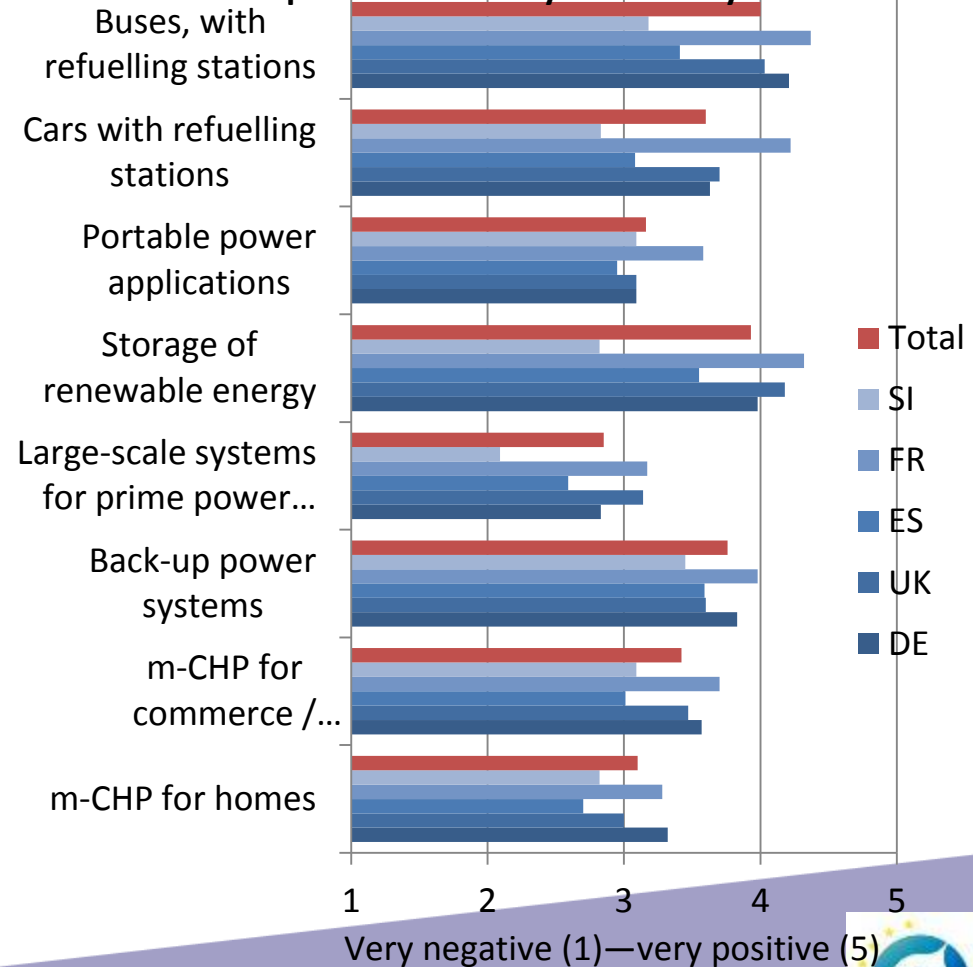


- Heterogeneous affiliations:
 - Around **33% from private companies**
 - Around 15% from public and government organisations, education and other non-profit
- Plenty of experience:
 - **>25% have 11+ years of work experience**
 - >21% 5-10 years of experience
- Different fields of expertise:
 - **>50% work in research**
 - 30% on H2 production
 - 25% in systems integration

4. STAKEHOLDER SURVEY- METHOD AND RESULTS

- 88 % think that HFC are a good or a very good solution for energy and environmental challenges (no country differences)
- Most positive future expectations about H2-buses and H2 as a means of storage for renewable energy
- Respondents are in favour to further governmental support for FCH technologies

What are your expectations regarding the medium-term (5-10 years) market implementation in your country?



■ Mobile applications



- **Most challenging:** providing refuelling points followed by costs
- **Less challenging:** safety
- They favour FCEVs over other drivetrains / fuels. The highest competition → battery electric vehicles
- Public funding: Support for research and development and providing infrastructure is most important; demonstration project and subsidies for vehicles less relevant.
- Professionals from the same sector and researchers are perceived as most familiar, the public's familiarity lowest. Attitudes are perceived similarly.

■ Static applications



- **Most challenging:** cost disadvantages
- **Less challenging:** safety issues and technological maturity
- Support for research and development is favoured over funding for demonstration project and subsidies on purchase prices.
- Professionals from the same sector and researchers are perceived as most familiar, the public's familiarity lowest. Attitudes are perceived similarly.

■ Factors influencing ratings of future market deployment

- For **stationary applications**:
 - Competition of renewable electricity and heat technologies
 - Implementation of air quality regulations
 - Development of business models for H2 distribution infrastructure
- For **FCEVs**:
 - Competition from alternative technologies
 - Competition from full electric cars as well as CNG / LNG cars
 - Perceived attitudes of professionals from the same sector and from actors from the automotive sector

STAKEHOLDER ACCEPTANCE STUDY

■ Interviews template

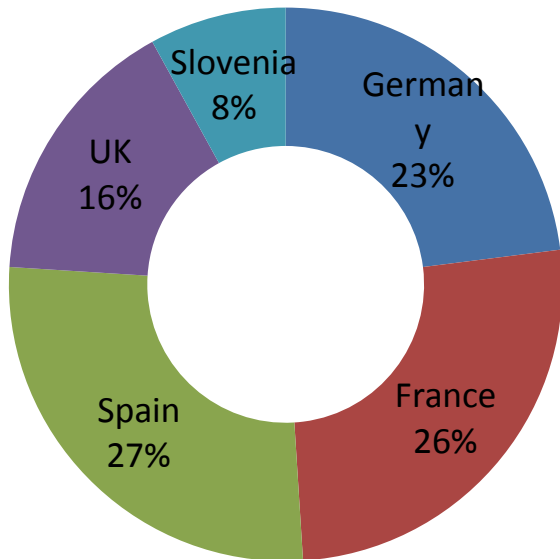
- Project initiation and overview.
- Evaluation of the hydrogen application, acceptance and support.
- Expectations regarding the future adoption of the specific technology/application.
- Recommendations for advancing use of the technology.



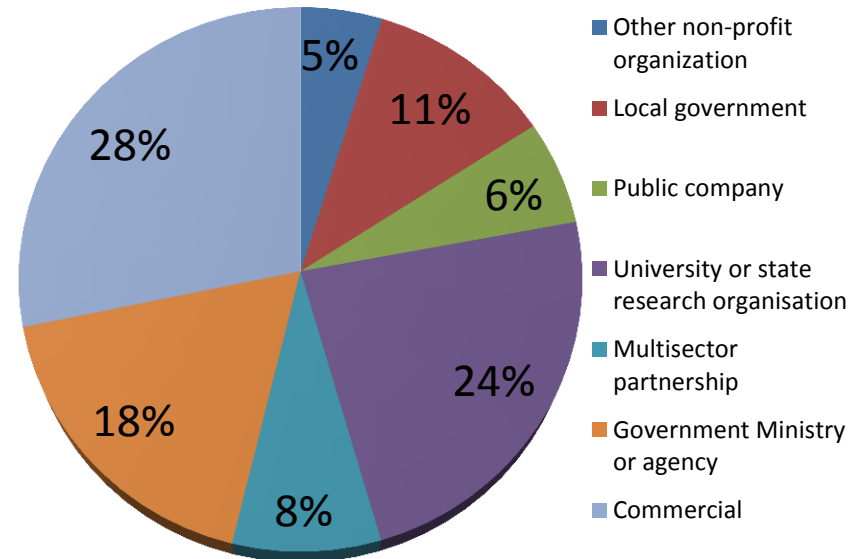
- **Semi-structured interviews** between November 2015 and June 2016
- Population: **selected stakeholders in 5 countries**
- Implementation: **telephone or face-to-face interviews**, recorded and summary transcripts

4. STAKEHOLDER INTERVIEW- METHOD AND RESULTS

Interviewee percentage
by country



Interviewee percentage by
affiliation

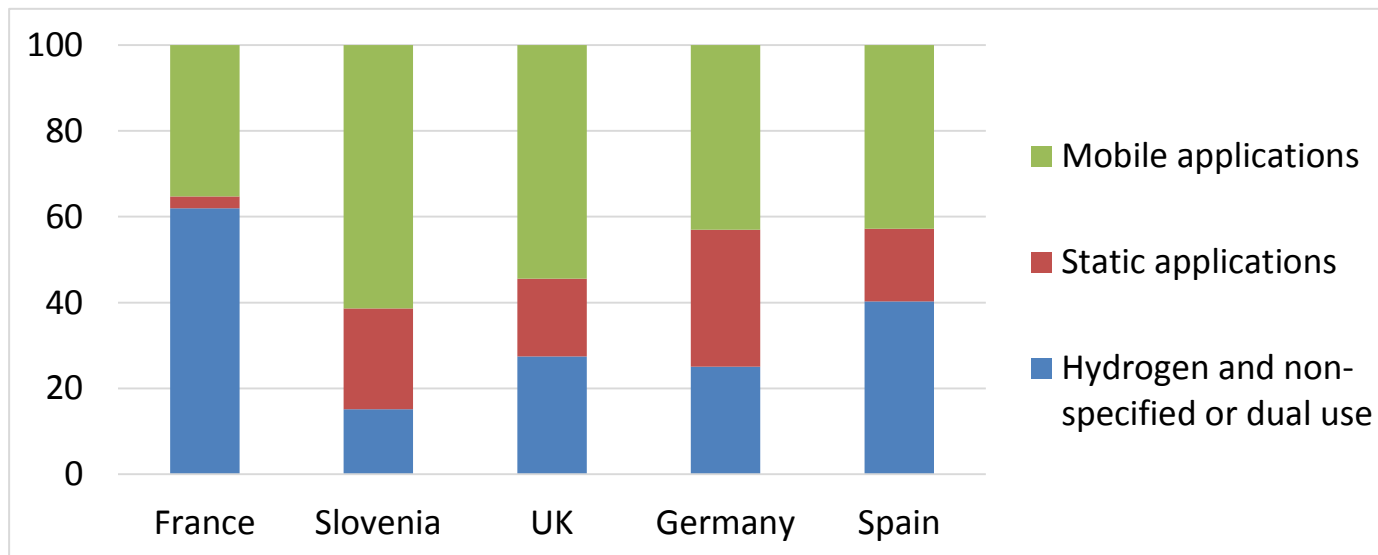


STAKEHOLDER INTERVIEWS - SAMPLE

- Applications of HFCs discussed in the interviews

Technology application	Percentage of comments, all interviewees
Static applications	16
Mobile applications	44
Hydrogen and non-specified or dual use	40

- Percentage of comments, by application, by country



■ Perceptions of hydrogen supply and use

Strengths:

- **Environmental performance of hydrogen** (despite the scepticism of the inefficiency of combining multiple conversion processes)
- **Versatility: energy storage vector for renewable energy supply** (per se and in relation to electrical grid balancing)

Weaknesses:

- Cost
- Limited awareness among regulators and government
- Inadequate or excessive regulation
- Competition from alternative technologies
- Lack of commercial support and lack of markets
- Immaturity and durability
- General lack of infrastructure
- Perceived safety issues

Key expectations (mixed):

- Positive view: market development expected by many in the relatively near term (albeit with national differences and specificities).
- Uncertain future for hydrogen and a high degree of conditionality on government policy support.

Recommendations:

- More government and political support is required
- Need to inform and engage stakeholders
- Additional R&D to reduce costs

■ Perceptions of static applications

Strengths:

- H2FCs for portable power (could also be bracketed with the potential for uninterruptible power)
- **Integration with existing infrastructure** (UK respondents only)
- Efficiency of fuel cells (reducing the pressure on the electrical network)
- **The capacity to offer domestic and non-domestic CHP, power and heat, including high power.**

Weaknesses

- Cost & Investment costs
- Complexity of the system and its components
- Perceived and 'actual' safety
- Competition from alternative technologies
- The challenge of finding commercial partners

Key expectations (mixed):

- Expectations expressing a positive inevitability for the technology
- Uninterruptible supply systems as one such niche (German respondents only)
- Stationary uses being more likely than mobile uses (UK respondents only)
- Hydrogen being used as a storage medium as key to the take-up of static applications (UK respondents only)

Recommendations:

- Government support
- Regulatory support particularly relating to issues of safety

■ Perceptions of mobile applications

Strengths:

- Operational performance: long range, **short refill times**, high torque, strong performance generally and relative to alternatives
- **Ease integration with existing infrastructure**
- **Suitability for specific fleets**

Expectations:

- **Specific vehicle fleets being the first to use H2FC technology**
- Niche uses first or only
- **Tighter emissions standards driving H2FC use**
- Battery electric vehicle (BEV) with H2FC being the most likely option
- **Transport corridors being first to support H2FCs**

Weaknesses:

- **Financial cost**
- Perceived competition with other technologies
- Lack of infrastructure
- Limited awareness and support by regulators and government
- Inadequate or excessive regulations, codes or standards
- **Safety**

Recommendations:

- Governmental, political and regulatory support
- R&D to support cost reductions
- Commercial partner support
- More communication and engagement generally, including of publics
- Investment in refuelling infrastructure

- **Less than half of the population in the seven countries is aware of the existence of hydrogen and fuel cell technologies** in the context of energy production.
 - Public awareness is significantly lower for residential applications and higher for hydrogen fuel cell vehicles.
 - The majority of **the population in the seven studied countries have a positive initial attitude towards HFC technologies**. The label associated to hydrogen and fuel cells seems to invoke positive feelings and thoughts among respondents.
-
- Variation across countries: **associated with differing levels of government investment in R&D programmes**.
 - **R&D stakeholders have a strong positive appraisal of HFC technologies**, but with limitations:
 - **cost and limited regulatory**, political and commercial support;
 - **competition from other technologies** and inter-related obstacles.
 - Stakeholders view: medium to long term rather than near term.
 - HFC technologies view: realistic niche potential in the shorter term
 - **uninterruptible power, auxiliary power and high power demand such as forklifts and heavy goods vehicles**.

It is increasingly understood that the success of innovative energy technologies is dependent not only upon the technical characteristics of those technologies, but equally on supportive social, political and economic contexts (EC, 2014 and 2015; OECD, 2014).



Thank you for your attention!

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ARE YOU INTERESTED IN THE RESULTS?

If you wish to know more about the project:

- the website: <http://hyacinthproject.eu>
- Project Coordinator maria.jaen@cnh2.es
- Social Networks    
- Webinars & Workshops
- Digital mailing



HYACINTH PROJECT

The social acceptance by the general public, the stakeholders and the potential customers of hydrogen and fuel cell (FC) applications across Europe is recognized as a key dimension in the implementation of these technologies. If FC technologies are to play a significant role in Europe's new energy and transport systems, social acceptance issues are needed.

OBJECTIVES

The main objective of HYACINTH project is to gain a deeper understanding of the social acceptance of hydrogen technologies across Europe. HYACINTH aims to:

- Identify and understand awareness and acceptance of hydrogen energy and FC technologies and perceived potential benefits.
- Identify the main drivers of social awareness and acceptance of FC technologies.
- Support stakeholders through the development of a Social Acceptance Management Toolbox.

PARTNERS

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HYACINTH PROJECT
First results from the opinion poll: general public and stakeholders

This project has received funding from the Fuel Cells and Hydrogen Joint Undertaking (FCH-JU) under grant agreement N° 621228. hyacinthproject.eu



<https://www.youtube.com/watch?v=OJHyXGWxCzg>

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