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CONTENTS

EXECUTIVE SUMMARY

The report summarizes results and aims of deliverables in work packages 2 and 3, which were devoted to critical review of literature, ongoing projects (EU and national level), politics and mechanisms that contribute to better social acceptance of new technologies based on renewable energy sources and in particular hydrogen technologies. With analysis of surveys, questioners, interviews in WP5 and description of SAMT toolbox in D6.1 “SAMT (Toolbox) data base and basic Structure” this deliverable is providing guidelines with some advisory text for FCH developers that are confronted with public stakeholders on one side and sector stakeholders on other side

The first part of the report presents a review of methods for predicting acceptance of FCH technologies based on social acceptance models and surveys. It focuses mostly on the area of FCH technologies which are relatively new in general domestic use and therefore unknown from social acceptance aspect. Several case studies of various new technologies implementation are presented to get better understanding, what new technology should overcome to get public acceptance, implementation into the existing technical system and penetration of the market.

The agreement regarding new technology implementation between sector stakeholders and public stakeholders can raise four possibilities: positive state from both sides (1), sector stakeholder’s views are more positive (2), sector stakeholders have a less positive view than the general public (3) and both parties agree that the situation is negative (4). In order to assist the FCH developers it is important to identify how the agreement between industry and public stakeholders can be achieved and/or managed. Social acceptance is identified as a main factor for successful new technology deployment. The, basic concept and structure of the SAMT tool is presented that allows developers to interrogate public opinion regarding hydrogen and fuel cell technologies and applications within their field of operation, a specific country or region, and within specific social groups.

After analysis of specific target group and when one of four predicted cases arise, some general prepared advisory text is given, designed to assist the developers to understand the relevance of a given situation. This text is then augmented with additional suggestions and a short extract from a best practice case study, linked to one of the eight themes of the SAMT. When such a situation arises, the user will be alerted to the problem and the text generated as advice on how to tackle each one.

ABBREVIATIONS

CA	Consortium Agreement
CSA	Coordination and Support Action
CMO	Central Management Office
EC	European Commission
EU	European Union
DX.Y	Deliverable X.Y
FCH	Fuel cell and hydrogen
FCH-JU	Fuel Cell and Hydrogen – Joint Undertaking
GA	Grant Agreement
IPR	Intellectual Property Rights
KET	Key Enabling Technologies
MI	Month I
MSI	Milestone I
QFD	Quality Function Deployment
QM	Quality Manager
PC	Project Coordinator
PO	Project Officer
RC	Regional Committee
SAMT	Social Acceptance Management Toolbox
SMC	Steering Management Committee
SMEs	Small and Medium Enterprises
TC	Technical Committee
WP	Work Package
WPL	Work Package Leader

1. INTRODUCTION

The overall **purpose of HYACINTH** is to gain a deeper understanding of the social acceptance of hydrogen technologies across Europe combining the implementation of qualitative and quantitative methods with samples of European citizens and stakeholders. The work programme of the HYACINTH project is structured around the development of two studies: one on public awareness and acceptance of fuel cell and hydrogen technologies (FCH) and another on stakeholder views and expectations;

Social acceptance is the case of different studies more than 20 years (Rogers, 1995). The term ‘social acceptance’ includes the two concepts ‘social’ and ‘acceptance’ with potentially quite different understandings and approaches. ‘Social’ refers to the whole society and its different groups (consumers, producers, etc.). ‘Acceptance’ can range between a rather passive consent and an active approval in form of an active involvement (Williams, R., Mills, 1986).

Based on a **literature review** of previous social acceptance researches, done in WP2 and WP3, it was concluded that a considerable degree of knowledge regarding the social acceptance of FCH technologies has accumulated over the last two decades. For the public in the European countries studies tend to show that low levels of knowledge of - and interest in – FCH technologies coexist with relatively high levels of acceptance. The review of the literature suggests that public attitudes towards FCH technologies might vary depending on the type of application considered or the way hydrogen is produced. The majority of studies reviewed have focused on transport applications and very few studies have focused on the public or stakeholder reactions to FCH stationary residential applications.

In general the **agreement between industry and public stakeholders** can be divided in four basic categories:

(1) positive agreement between sector stakeholders and public stakeholders (plus-plus);
(2) sector stakeholder’s views are more positive than the public stakeholders (plus-minus);
(3) sector stakeholders have a less positive view than the public stakeholders (minus – plus);
(4) both parties agree that the situation is negative (minus-minus);

Case studies (CASE STUDIES ON SOCIAL ACCEPTANCE OF FCH AND OTHER TECHNOLOGIES) can be identified that illustrate bad, good and best practices in managing each of these four options within different technologies implementation in the society. These cases serve as a start point upon which some conclusions can be made. There were many technologies in the past that overcame low initial social acceptance with good governance, inclusion of public stakeholders (wind), economic motivation (PV), environmental approach, etc (Breukers & Wolsink, 2007). But on the other hand there were several poorly accepted technologies that resulted in no social acceptance just because of mistakes in the approach, communications and knowledge distribution (Mallett, 2007).

This document serves **as a guideline for FCH developers** that are confronted with public stakeholders on one side and industry on other side. Some examples from the past are reviewed to get better understanding of consumers´ acceptance, adoption and behavioural intentions regarding environmentally sustainable innovations, mental models, knowledge, and public acceptance, development of a market penetration, etc. Since hydrogen technologies are rather new contrary to renewable energy technologies (RET), the cases and good practices from other RET (wind, solar) are analysed to get deeper understanding.

In addition to that **SAMT model** that was set up on the basis of work in previous WPs is reviewed to understand how the research was structured according to Huijts model of social acceptance (Huijts, Molin, & Steg, 2012).

2. PREDICTING ACCEPTANCE OF FCH TECHNOLOGIES BASED ON SOCIAL ACCEPTANCE MODELS AND SURVEYS

In this chapter some valuable studies focused on social acceptance models and studies based on different surveys are summarised. Based on these studies certain approaches were elaborated how to properly respond in order to improve awareness and/or social acceptance of the FCH technologies.

2.1. Consumers´ acceptance, adoption and behavioural intentions regarding environmentally sustainable innovations (Averdung & Wagenfuehrer, 2011)

Here, the revised Technology Acceptance Model (TAM) was developed, originally devised by (Ajzen, 1991) with its origins in the Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB) (Davis, 1989). The paper focuses on consumer behaviour after the initial trial of environmentally sustainable innovations. By investigating a case, where an eco-friendly product technology is integrated into a pre-existing service it is hypothesised that marketing success of green product and service innovations can be operationalized by a revised technology acceptance model. Thereby, it was explored how the attitude variables affect distinct key behaviour intentions that promote the market success of a sustainable integrated service-product. The effects of consumer’s perceived usefulness to protect the environment as original eco-attributes and its perceived usefulness to convenience of usage were separated. The results showed that the model could uncover the general acceptance structure of sustainable product and service innovations. In the examined case of sustainable product-service integration in the hydrogen transportation market it was concluded that willingness to pay more for sustainable service offerings is dependent on word-of mouth intention as well as comfort of use. These effects are universal and reflect three general findings regarding adoption of sustainable product and service innovations:

- Service-products integration offerings in the field of sustainable technologies need to fulfil special needs of the customers. This is essential as these technologies are naturally interconnected with higher prices.
- Service-products offerings need to address indirectly consumer needs based on their personal characteristics. It was concluded that ecological attitude serves as a key characteristic to address trust, perceived usefulness and loyalty of the product-service bundle. Word-of-mouth intention constitutes the key construct to uncover customers willingness to pay more for these eco-friendly product-service offering. Also, word-of-mouth acts as a key success factor for the dissemination and communication of marketing strategy.
- The comfort of use, interconnected with perceived usefulness, is of major importance for long-lasting marketing success. However, consumer’s choice to uncover utility-requirements regarding the concrete product-service characteristics was not examined. Probably a conjoint analysis may help to identify relevant product and service aspects in generating a target group specific sustainable solution in the future. Possible outcomes regarding cluster analysis based on conjoint data could be

integrated in the technology acceptance model. Results may unveil key determinants of ecological product and service innovation. This is relevant to gain more word-of mouth (net promoter) and higher intention to pay more for sustainable product usage and ecological product-service.

2.2. Mental models, knowledge, and public acceptance of hydrogen storage in Germany (Zaunbrecher, Bexten, Wirsum, & Ziefle, 2016)

The study conducted in Germany empirically explores laypersons' mind-sets and knowledge related to storage technologies, focusing on hydrogen. In order to understand the mental models in the context of hydrogen storage in large-scale technologies an exploratory study had been conducted adopting a twofold approach, combining qualitative and quantitative methods: first, interviews were conducted with a range of laypeople to explore mental models about hydrogen storage. Second, a quantitative study was conducted in which knowledge about hydrogen storage, its perception, and its acceptance were evaluated. Both the self-reported knowledge (subjective feeling of being informed) and the factual (objective) knowledge about hydrogen were assessed.

In general, participants in both studies expressed trust towards hydrogen storage. However, fear of risks, especially regarding hydrogen storage in residential areas, should be addressed adequately. In comparison to flywheel and battery storage, perception of hydrogen was more positive. Future studies should also focus on exploring the public knowledge about differentiation between long- and short-term storage, as the laypeople interviewed did not seem to be aware of the differences. Furthermore, research on storage alternatives to hydrogen in tanks in residential areas could be useful, e.g., metal hydride storage, as this could reduce the fear of exploding gas tanks. Overall, a need for adequate communication concepts on hydrogen as a decentralized electricity storage solution was identified.

It was found that subjective knowledge correlated much stronger with attitudes towards hydrogen than objective knowledge. Subjective knowledge especially influenced risk perception. This indicates a call for research on the differentiation between objective and subjective knowledge (in order to understand the sources of knowledge-related acceptance). Furthermore, novel forms of public information strategies need to be developed. This includes, for example, another information policy. Rather than to overload citizens with information that is neither needed nor wanted, it seems to be more useful to first ask the public in which way, about what, and also when they need to be informed (Brunsting, de Best-Waldhober, & Terwel, 2013). This would help to specifically control and organize the information knowledge process.

As hydrogen technology might be too abstract and difficult to assess for laypeople, because it is not part of their everyday reality (Sherry-Brennan, Devine-Wright, & Devine-Wright, 2010), another way could be to give the public some hands-on experience, the chance to get in contact with the novel technology using demonstrators, living labs, or even playful public participation using "serious" games (Poplin, 2012). By this, information would also be delivered, but, at the same time, people with strong concerns are given the chance to gain experience which might also help to increase trust.

2.3. Assessing the social acceptance of hydrogen for transportation in Spain (Iribarren, Martín-Gamboa, Manzano, & Dufour, 2016)

The present work uses a quantitative approach through the design and open distribution of a closed-ended questionnaire in order to subsequently identify key aspects affecting the social acceptance of hydrogen for transportation in Spain. The structure and questions of the survey took into account previous studies on the social acceptance of new technologies within the mobility sector, but it was fully adapted to the specific objectives of the study. The awareness, perception and acceptance of hydrogen for transportation by a random sample of the Spanish society were evaluated based on a survey with 1005 respondents. The following conclusions can be drawn:

- High level of awareness of the existence of research activity on hydrogen as a transportation fuel.
- Favourable public perception of hydrogen in terms of environmental performance and suitability for implementation in the public transport system.
- Strong social support to the establishment of local hydrogen refuelling stations, but preferably away from residential areas.
- Strong social support to the application of an affordable tax for the implementation of hydrogen in the public transport system, but conditioned by the avoidance of a new direct tax.
- Slight preference for on-site hydrogen production over centralized production.
- Economic (operation and maintenance costs) and socioenvironmental (personal environmental commitment) aspects as key motivating factors to purchase a vehicle.
- Economic (current cost) and technical (availability of refuelling stations; vehicle features) issues as key barriers hindering the success of hydrogen vehicles.
- Mass market penetration leading to affordable vehicle prices as a key social requirement for purchasing a hydrogen vehicle.

Overall, the respondents are willing to accept hydrogen as a key actor within the energy and transport sector. However, due to the fact that the survey was electronically distributed via e-mail, institutional website, scientific blogs, and social networks, the results of the survey are unintentionally associated more with young population (18 - 35 years old), with university education level. The results may therefore be slightly distorted because the population sample does not equally cover the general public. However, the findings in terms of high social awareness, perception and support can be considered a promising forecast of the role of hydrogen in the mid- and long-term in Spain. Nevertheless, further policy, industry and research efforts are required in order to overcome current obstacles hampering the success of hydrogen.

2.4. Development of a market penetration forecasting model for Hydrogen Fuel Cell Vehicles considering infrastructure and cost reduction effects (Park, Kim, & Lee, 2011)

In this study, a penetration forecasting model for Hydrogen Fuel Cell Vehicles (HFCVs) was developed. The generalized Bass diffusion model is a more developed version of the Bass diffusion model. In general, the Bass diffusion model can describe the S-shape diffusion curve of a new product using the innovation factor and the imitation factor, based on the assumption that the probability of adoption of a new product or technology at time T is the summation of the probability of adoption by an innovator group and the probability of adoption by an imitator group (Bass, 1969). The innovation factor and the imitation factor refer to the probability of adoption by an innovator group and by an imitator group, respectively. The significance of this study can be classified into four aspects:

- First, a more objective and quantitative demand forecasting model was developed on the basis of historical series data, while most of the previous studies on demand forecasting have been based on survey results, which were based on the subjective opinions of people;
- Second, an analysis technique that could broaden the applicability of demand forecasting models was proposed by constructing a simulation model using system dynamics;
- Third, while the existing system dynamics models implemented a feedback structure based on the intuition of the researchers, this study constructed a system dynamics model based on the proven mathematical form of the generalized Bass model (F. Bass, 1969), (F. M. Bass, Krishnan, & Jain, 1994) to propose the theoretical basis of the model;
- Fourth, the empirical study using simulation model shows that the initial purchase by innovators is a key factor for the successful market penetration of HFCVs, and the initial infrastructure can play a more important role to promote the initial purchase by innovators rather than reducing the price of HFCVs.

The comparison results of the penetration of three countries, ***Korea, the U.S. and Japan***, indicate that market saturation of Korea can be achieved 12 years faster than that of the U.S. It seems that Korea's more active and risk-taking purchasing patterns for innovative products are reflected in the imitation factor. The results of the sensitivity analysis showed that the innovation factor and the imitation factor have direct influences on the time period in reaching the critical mass and market saturation, respectively. Considering that the decision criterion of the success of a new product in the market is the implementation of critical mass, it was judged that various policies would be required to promote the initial purchase probability of the innovators. Also, it was reasoned that the provision of the initial infrastructure would be more important than reducing price for the successful market penetration of HFCVs. It was determined that to prevent delay in reaching the critical mass caused by insufficient infrastructure, 130–260 new fuelling stations should be constructed annually. In addition, to promote the market penetration of HFCVs, it is recommended to implement various incentives including tax reductions and financing for initial investment for the construction of hydrogen fuelling stations.

2.5. Summary

Analysis of these case studies has revealed key issues such as cost, location and infrastructure. Interestingly it also indicates a preference of on-site hydrogen generation rather than transported hydrogen. Whether this is a significant factor is not yet known. However, it can be concluded that there is significant support from the general public for hydrogen given its perceived environmental benefits.

This will be compared with the analysis of other case studies and the responses of the public and stakeholders contained within the Social Acceptance Management Toolbox (SAMT) to provide a deeper insight into the public's willingness to accept particular technologies and also to provide advice on overcoming potential issues.

3. CASE STUDIES ON SOCIAL ACCEPTANCE OF FCH AND OTHER TECHNOLOGIES

In addition to deliverables in WP2 (Report on ongoing hydrogen demonstrative projects, European projects and policies, Report on methodologies and factors) and WP3 (Social acceptance and awareness research concept) here below is a review of different cases of renewable energy technology social acceptance with special focus on hydrogen technologies. It is evident that it is very important from social acceptance point of view if we are dealing with developed western countries in one hand or countries in urban developing world on other hand. Here evaluated are mainly studies from stationary applications social acceptance, since those are much more available in the studies.

A successful case of acceptance of a particular technology is often supported by a well-structured local policy that motivates and stimulates all stakeholders. An overview of the policies was done within WP2. The objective was to search for policies in the selected countries, to identify any mechanisms that support hydrogen initiatives, if they exist, and establish whether they have any influence in the awareness and perception. This information could provide a suitable explanation of the results of the stakeholder and public surveys.

At a European level there are two main mechanisms as published European Directives that would influence two main applications, transport and µCHP, of hydrogen and fuel cell technologies:

- The Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency

- The Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure

Alongside with these Directives, each country has established its own measures and mechanisms, some of them specific for hydrogen and fuel cells, other more specific for zero emission vehicles or renewable energies and energy efficiency.

Seven countries were selected in the project considering them initially as:

- Advanced Hydrogen Support: Germany, United Kingdom and Norway
- Medium Hydrogen Support: Belgium, France and Spain
- Low Hydrogen Support: Slovenia

At a national level, there are differences in the way the support is being managed as commented also previously. To recap the situation, Germany is the only country that has established a specific program for hydrogen and fuel cells and a specific organization as public-private partnership to manage it. For the rest of the countries, besides the mobility initiatives, many actions are financed thanks to demonstration projects, where most of the support is being carried out through national R&D programmes, although many activities are now being considered to be implementation or deployment activities, so they are being backed by national energy or transport agencies. In this scenario, the competence with the implementation of other technologies in some of the countries studied, such as electric vehicles or heat pumps is now harming the direct support for hydrogen and fuel cell applications.

In Belgium, no specific national support for hydrogen vehicles or HRS implementation is now active. As for µCHP, only companies could benefit from a tax reduction. At a regional level, there is more support for both applications.

As for France, there is one national organization, the French Environment and Energy Management Agency, ADEME is active in the implementation of public policy in the areas of the environment, energy and sustainable development with a budget of over 3.3 billion euro dedicated to implementing the Ecological and Environmental Transition. It manages the "Investments for the Future program (PIA)" where most of the demonstration projects carried out at national level have been funded. The "Loi de transition énérgetique" (Energy Transition Law) has been published in 2015 and it will foster the implementation of low emission applications, but concrete actions for implementation low carbon applications have still to be published.

In Germany, the National Hydrogen and Fuel Cells Innovation Program (NIP) was launched and the NOW GmbH was created as public-private partnership to manage the program. It covers all activities related with hydrogen and fuel cells, from basic research to demonstration and market introduction activities with a budget of 1,400 million euro from 2007 to 2016. In addition to NIP, the National Innovation Programme for Hydrogen and Fuel Cell Technology (NIP 2) was launched and in period 2017-2019 250 million euro will be allocated for technologically mature products to be made competitive in the market.

In Norway the deployment activities related with energy are done by a national agency called ENOVA. It supports transport (low emission vehicle fleets) and energy production efficient devices, but has no direct support for hydrogen and fuel cell applications.

As for Slovenia, the Slovenian Environmental Public Fund is the organization that supports low carbon applications including transport and domestic appliances. It supports with loans the purchase of low emission vehicles.

In Spain, the support of efficient energy and transport mechanisms is carried out by the national organization Energy Savings and Diversification Institute (IDEA), which launches the MOVEA Plan for transport applications. Hydrogen applications are not considered among the measures of the 2015 call. IDAE also supports energy efficient home appliances, but µCHP is not covered by any plan now.

United Kingdom has recently announced the direct support for HRS and FCEV through the government's Office for Low Emission Vehicles (OLEV). For heat and power, the support is given through OFGEM, the Office of Gas and Electricity Markets, a non-ministerial government department and an independent National Regulatory Authority.

3.1. Domestic micro generation in UK (Sauter & Watson, 2007)

Domestic micro generation was the case of a social acceptance study in UK where it was shown that more active acceptance by homeowners, where households become part of the electricity supply infrastructure, is required (Sauter & Watson, 2007). Although micro CHP is at the moment mostly gas fuelled, it has the potential to be fuelled by renewable energy sources in the future—e.g. by using a fuel cell that runs on hydrogen that has been produced by renewable electricity, or by using biomass as a fuel. How to establish required social acceptance in the case of domestic micro generation can therefore serve as good example for acceptance approach of FCH technologies.

In the case study they varied **degrees of company and consumer involvement** and argued that it will have significant influence on social acceptance. Methodology was **survey of data from previous studies from UK, Austria and Germany** based on **mail surveys** and **telephone interviews**. They used **three deployment models**: plug and play (owned and financed by owner), company control (more passive consumer, owned by company) and community micro-grid (primary control over unit, help to guarantee supply-demand). These emphasise different potential roles for consumers and energy companies—from passive consumers and co-providers, and from company back up to company driven.

The 'Plug & Play' approach is closest to the current situation in the UK. Survey confirms **that lack of knowledge** is in fact a major barrier for investments and that accreditation schemes have a great influence on households' investment decisions. They have shown that micro-generation technology needs **more active social acceptance** than conventional technologies when compared with large infrastructure facilities. Various technical, regulatory and institutional changes are required to allow increase in domestic micro-generation. Investments on both sides of electricity meter should be treated equally, i.e. homeowners should also ge**t access to tax allowances as big companies** do. **Settlement for grid and industry standards** have to be changed in in order to allow for the fair valuation of micro generated electricity exported to the grid. Furthermore, **easy access to information and skilled installers** is necessary to minimise perceived risks (Watson et al., 2006).

3.2. Wind Power case study in Germany, (Breukers & Wolsink, 2007)

Wind power itself cannot be regarded as new technology since it has been successfully employed for centuries and is in that respect not comparable to hydrogen technologies. It has, however, become far more widespread in the last decades with numerous large scale units installed in various environments. This has inevitably brought up the question of social acceptance at the local level. Wind power can therefore be also regarded as a new technology, facing similar issues with diffusion and acceptance as other new, particularly renewable technologies, including fuel cells and hydrogen. The success or failures of different approaches of implementation of wind power can therefore provide useful guidelines for implementation of hydrogen technologies.

An example of successful practice is the approach of the German state of North Rhine-Westphalia where the installed capacity of onshore wind power units has been rapidly increasing during the last two decades. Several important factors can be identified that were responsible for widespread acceptance of the technology and the consequential rapid implementation.

Although the initial government policy targeted larger industrial stakeholders through favouring large scale units, the policy was soon modified to support smaller scale units. The research and development of these units was carried out by local firms with connection to local academic researchers, so numerous stakeholders were involved in the development and implementation. This resulted in the development of a strong home market for small scale wind turbines with significant economic impact.

Furthermore the government started specific programs to encourage the use of renewable energy that brought benefits to individuals and households as well as municipalities and enterprises. Investment support was also provided as well as simulative energy prices of the feed-in tariff system which reduced risks and encouraged both individuals and industry to invest in wind power.

Except for the initial change from favouring large to favouring small scale units the German policy including renewable energy support programmes remained unchanged providing stable environment for the investors.

The abovementioned factors can be related to the technology acceptance framework proposed by (Huijts et al., 2012). The government policy provided positive attitudes towards perceived costs, risks and benefits. Local development of the technology also provided knowledge and experience to a wide base of individuals and thus a positive attitude towards wind power. Also the perceived benefits of mostly local individuals and communities as opposed to foreign corporations provided a positive fairness factor.

A less successful example of wind energy implementation can be found in England where the installed capacity of onshore wind turbines is growing considerably more slowly than in Germany. Although the government policy supports renewable energy production including wind power, the policy making was heavily influenced by the existing conventional energy sector. The policy favoured large scale units and consequently only large investors, typically from the existing energy sector, were able to participate in the development. Since this investors focused mainly on the economic aspects of the projects, local development was not stimulated and local public stakeholders were generally not included in the decision making process and in the projects. This might have been the cause of strong local opposition to wind power projects.

3.3. Case study on biomass gasification projects in UK (Upreti & Van Der Horst, 2004)

In this case an example of two identical projects and ***risk communication strategies*** in ***different locations leading to completely different public responses***. Ambient Energy proposed identical biomass gasifying plants in Eye and Cricklade. The case study was conducted through in-depth interviews, content analysis, person to person questionnaire survey, focus group discussion and participatory appraisal methods. Although biomass energy developments in the UK are supported by central government it faces considerable opposition from the public.

Ambient Energy Ltd. proposed the development of a 5 MWe wood gasification plant near the town of Cricklade in North Wiltshire, which is an example of the causes and consequences of public opposition to biomass energy development. Though biomass energy plants in general have fewer environmental impacts than plants which use fossil fuel, there could still be local impacts which give rise to concerns and local opposition to the development. The opposition could be partially explained by the fact that the general public is relatively unfamiliar with biomass energy. Public acceptance or rejection was mainly based on the public trust or mistrust. The case demonstrates two distinctly rigid characteristics among the key stakeholders of biomass energy development. These are the ‘not-in-my-back-yard’ (NIMBY) attitude from the public and the ‘there-is-no-alternative’ (TINA) attitude of the developers. These rigid stances were widely contributing to the failure of the project to gain planning permission. The environmental justification of biomass energy at the national level is not always sufficient to convince the local residents. Winning public support to promote biomass energy requires an alternative approach of planning and action through interactive communication, public participation and collective learning among all the stakeholders.

Ambient Energy Ltd., submitted the planning applications to develop almost identical small biomass plants in Suffolk as in Cricklade. In contrast to plant in Cricklade the Eye plant in the Suffolk got the planning permission. The main reason was the site/location of the proposed power plant. The Eye plant was proposed in an industrial zone, right next to a much larger existing chicken litter combustion plant. There living people were accustomed with such development. The proposed wood burning plant was better (in terms of its smell) than the existing chicken litters power plant. Therefore public did not vehemently oppose it.

Eye public opposition was negligible and planning permission was gained very smoothly (all councillors voted in favour). In contrary the proposed Cricklade site was in the rural buffer zone and public were not ready to accept the development in that site.

3.4. RET social acceptance – solar water heaters case (Mallett, 2007)

The research done in the case of **Mexico** (Mallett, 2007) is focused in renewable energy technologies (**RET**) social acceptance in particular in **solar water heaters** (SWH) from all involved parties point of view (technicians, industry, government, community and end users).

It emphasis the evaluation of **Rogers model** (Mallett, 2007) of social acceptance which claims that adaptation comes from decision making process in stages and argues with the model that is very useful tool to explain social acceptance, but has to be revised to reflect of **technology cooperation**. The study summarizes SWH use, including physical object and brother processes linked to adaptation. The main source of data came **from interviews**.

The main conclusion is that Rogers model is limited when trying to explain social acceptance in **urban developing world**. **Communication** was deemed as important factor affecting social acceptance. Three technology cooperation models were accessed. Those versions of technology cooperation that involved **public-private partnerships with academic sector included** proved to be the most effective in eliciting social acceptance. Ultimately it was determined that those actors involved at various stages in the technology cooperation process that operate in isolation often have poor communication networks with those they work with (distributors, users), thus hindering social acceptance. In contrast, social acceptance of RETs is inclined to be greater with those companies that are actively involved in networks involving academic, private and public-sector actors and where there are high levels of consistent communication.

3.5. Initial infrastructure development strategies for the transition to sustainable mobility in Netherland (Huétink, Vooren, & Alkemade, 2009)

In this paper the research was done within the Dutch (Netherland) transition policy framework for hydrogen-based transport and is seen as a promising option towards a sustainable transport system. The focus is in transition to sustainable transport, **policy recommendations** for build-up of a **hydrogen infrastructure** for a **hydrogen vehicle** because this is crucial before (even the most innovative or environmentally friendly) consumers will substitute their conventional car for hydrogen vehicle (Dunn, 2002). This situation is often referred to as the chicken-and-egg problem of infrastructure development.

However, the build-up of infrastructure is costly and irreversible and it is therefore important for policymakers to gain insight in the minimally required levels of initial infrastructure that will still set off the transition. In the research they follow the **model of Rogers** (Rogers, 2003), to model the adoption decision of consumers. Rogers states that the diffusion of innovations is mainly determined by the attributes of the innovation and by how these attributes are valued by potential adopters and innovations that are highly visible are more likely to have a high adoption rate (Rogers, 2003).

Within the simulation model in this paper, diffusion patterns for hydrogen vehicles were created through **the interactions of consumers, refueling stations and technological learning.** Some inputs for the simulation model are based on Dutch car statistics (Bovag/Rai., 2007). They compare results to the benchmark patterns derived from the hydrogen roadmap (European Hydrogen Energy Roadmap, 2008). The strategies for initial infrastructure development differ with respect to the placement (urban or rural) and the number of initial refueling stations. Simulation results indicate that when taking social learning between **consumers** into account, diffusion is generally lower than in the benchmark patterns. Furthermore, simulation results indicate that a rural deployment strategy generally leads to faster diffusion of hydrogen vehicles than a strategy focused on urban areas. These demand side aspects of the transition to sustainable mobility are considered especially important in the Netherlands since besides the high cost associated with infrastructure investment the Netherlands do not have a domestic car industry so that policy measures will most likely focus on **infrastructure** and **consumers**.

Increased insights in the relation between infrastructure development strategies and hydrogen vehicle diffusion are thus necessary to further manage the transition to sustainable mobility. This paper illustrates the necessity to take the **social processes** that play an important role in the adoption and diffusion of new technologies into account when designing such policy measures (Huétink et al., 2009).

3.6. Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review (Devine-Wright, 2007)

Public acceptance is recognized as an important issue shaping the widespread implementation of renewable energy technologies and the achievement of energy policy targets. Furthermore, it is commonly assumed that public attitudes need to change to make more radical scenarios about the implementation of renewable energy technologies feasible. This paper critically summarizes existing social research on public understanding and attitudes towards renewable energy technologies, and provides a novel classification of personal, psychological and contextual factors explaining public acceptance. Despite a range of studies being carried out on public attitudes towards renewable energy technologies, genuine understanding of the dynamics of public acceptance remains elusive. One reason for this is the fact that the determinants of public acceptance are rarely considered as a whole, taking account of the multiple personal, psychological and contextual factors described in the paper. The paper concludes and identifies several implications of reviewed studies (Devine-Wright, 2007):

- That a deficit of technical understanding does not equate with an absence of personal meanings or beliefs associated with energy technologies.
- That there are important symbolic, affective and discursive aspects of how individuals relate to renewable energy technologies that have been insufficiently captured in the literature thus far, but may play an important role in motivating public responses.

- That such beliefs are 'social' as much as 'personal', dynamic rather than static, in that they may be shared across a community or social network, and generated through interpersonal communication, hence the incompleteness of an approach to public understanding based upon a more individualistic and static 'public attitudes' perspective.
- That qualitative, visual and discursive research methodologies have a useful role to play, complementing more quantitative, empirical studies based upon questionnaire surveys
- That more deliberative method of public engagement are widely cited as being necessary to address problems with public acceptance; however, there is relatively little empirical research critically examining the nature of deliberative engagement, and its impacts upon levels of public acceptance in the context of specific projects.
- That there is a need for interdisciplinary research to integrate and consolidate existing research, leading to a multi-level conceptual framework integrating the many factors identified.

3.7. Place attachment and public acceptance of renewable energy: A tidal energy case study (Devine-Wright, 2011)

This research comprises a case study of a **tidal energy convertor** installed in Strangford Lough, Northern Ireland, said to be the first grid-connected device of its kind in the world. Since the development was sited proximate to two local villages, a comparative design was employed involving data collection in both contexts. The study had two aims. First, it aimed to address a gap in the literature on a novel form of low-carbon electricity generation (tidal energy) about which little is currently known regarding its public acceptability. Second, it aimed to provide further evidence of a potentially useful and valid alternative to the 'NIMBY' (Not In My Backyard) explanation by investigating the relative importance of location of installation, place related meanings and personal variables in explaining acceptance of renewable energy, and the degree to which this may vary by context.

This study applies an alternative approach, empirically investigating the role of place attachment and place-related symbolic meanings in explaining public responses to a tidal energy converter. 271 residents in two nearby villages completed **questionnaire surveys**, three months post-installation, following up preliminary qualitative research using focus groups.

Although results indicated predominantly positive and supportive responses to the project manifest by emotional responses and levels of acceptance, significant differences between residents in each village were also observed. Contrasting patterns of association between place attachment and emotional responses suggest that the project enhanced rather than disrupted place attachments only in one of the two villages. In regression analyses, place attachment emerged as a significant, positive predictor of project acceptance in both places, affirming its value in explaining public response. Place-related symbolic meanings also emerged as significant, with contrasting sets of meanings proving significant in each context. Implications of the findings for research on place attachment and responses to land-use changes, as well as for developers seeking to engage with residents affected by energy projects are discussed.

In conclusion, this study aimed to further refine and develop an alternative conceptual approach to 'NIMBY' responses to renewable energy technologies, drawing on the concept of place attachment.

Connecting the literatures of place attachment and technology acceptance benefits both areas of research in going beyond typically negative framings of public objection and 'disruption' to place attachments. The findings affirm the relevance of place attachment and place-related meanings to understand public responses to local development proposals, demonstrate how energy projects may enhance emotional attachments to place, suggest that a narrow focus upon public objections overlooks potentially ambivalent as well as supportive responses by local residents, and reveal how local responses vary by context (Devine-Wright, 2011).

3.8. Rural public acceptance of renewable energy deployment: The case of Shandong in China (Liu, Wang, & Mol, 2013)

This paper examines rural social acceptance of renewable energy **(biogas and solar energy)** deployment taking **Shandong as a case study** via a field questionnaire survey. China has set ambitious goals to increase the use of renewable energy. Developing renewables in rural areas is also one of the most important energy strategies. A **questionnaire survey was conducted** in April, 2011 in Zhangqiu County of Shandong province. Shandong province has almost 90 mn inhabitants and it is the third largest according to Gross domestic product (GDP) in China.

Theory of planned behavior is adopted to establish an analytical framework, and a logit model is used to examine possible determinants of local social acceptance. Institutional, technical and financial shortcomings were examined, in particular, a lack of public support was found to be an important cause of the project failure. For instance, villagers were unwilling to change cooking routines and refused to pay for the installation of pipes and stove for biogas use, and even some villagers refused to pay for biogas. Obviously, there are various obstacles to renewable energy deployment especially in rural areas in light of poor economic condition, low educational level and others.

The results show that rural residents were generally positive regarding renewable energy but they were less willing to change their practices to accommodate these technologies. A stated willingness to pay more for renewable electricity is taken as a variable representing an individual's behavioral intention. The probability of occurrence of positive intention is found to increase with household income, individual knowledge level and belief about costs of renewable energy use but decrease with individual age. Residents with higher level of income are more likely to be willing to pay more for green electricity, so are the younger people. **Enhancing knowledge** and **understanding** about renewable energy (for instance, the cost) would be conducive to win public acceptance of renewable energy deployment (Liu et al., 2013).

Summary

The Social Acceptance Management Toolbox (SAMT) will collect responses from 7000 public surveys regarding FCH technologies and correlate them to 333 stakeholder survey responses and 145 stakeholder interviews to help stakeholders avoid making similar mistakes and build upon the body of best practice demonstrated within these case studies. The case studies chosen demonstrate the problems and issues faced by developers of similar applications and technologies. Clear messages may be inferred from them particularly with regard to inclusivity and communications. These have been incorporated into the SAMT and appear as advisory text.

4. HYACINTH'S PSYCHOLOGICAL FACTORS INFLUENCING SUSTAINABLE ENERGY TECHNOLOGY ACCEPTANCE

The overall purpose of HYACINTH is to gain a deeper understanding of the social acceptance of fuel cell and hydrogen (FCH) technologies in Europe as well as to develop a tool to assist hydrogen project developers in thinking about the social acceptance factors of their projects and products, with the objective of supporting a more widespread use of these technologies in the future. The study, based on a survey design and interviews is structured around two hydrogen fuel cell applications:

(1) *Hydrogen fuel cell stationary applications for heating and electricity;*
(2) *Hydrogen fuel cell transport applications and related infrastructures;*

These two applications are at the focus of the project given that, from a consumer perspective, it is most likely that citizens will be confronted with them sooner or later, i.e. these technologies are likely to become part of the portfolio of heating technologies or transport options about which consumers have to decide. Furthermore, the technology development for these two fields have reached an advanced stage, thus, they are about to be marketable. Additionally, the diffusion of these technologies depends on consumers' involvement in decisions, i.e. to buy or lease them. Therefore, understanding consumer attitudes is more important than for other applications that do not require active consumer engagement, but only passive acceptance. Perhaps one example in latter category are FCH technologies that use H_2 as a storage medium for excess electricity from renewable energy sources, although they would probably also need a minimal general public acceptance. Earlier work stresses out that attitudes towards FCH technologies are rather positive on a general level.

The study in Hyacinth aims to construct a predictive model for the (social) acceptance of FCH technologies based on segmented responses to FCH technologies, including factors known to be relevant in this context. Thus we take a socio-psychological perspective, drawing partly on a technology acceptance model (Huijts et al., 2012), a model describing the causal links among the attitudinal elements that directly and indirectly affect technology acceptance (Figure 1). Given the assumed unfamiliarity of the technologies and a modest questionnaire completion period of 20 minutes, in order to secure similar multi-country study response rates, the survey mainly refers to the attitudinal path of the model, attitude formation being considered the most important process for influencing intention to act and finally acceptance. Accordingly, normative concepts, behavioural control and fairness aspects were not added to the questionnaire. The fairness issues from the model are mainly relevant for acceptance of siting decisions (passive acceptance) and less for the appliances under study. Normative issues were neglected as we assumed that no (accessible) norms on FCH technologies have been formed so far, thus, hence measuring these would not be a priority. Perceived behavioural control was replaced by perceived consequences, following the rationale of an informed questionnaire approach, i.e. that the first priority was to support respondents in their understanding of the broad nature of the technology.

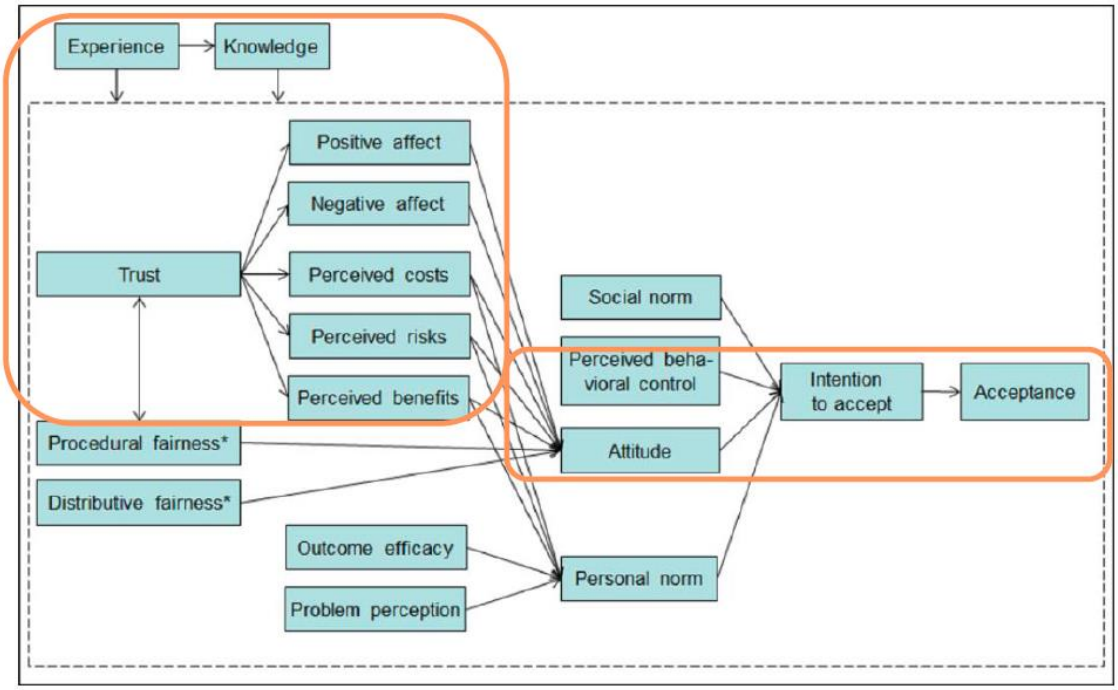

Figure 1: A schematic representation of the technology acceptance framework, (Huijts et al., 2012)

The research model based upon an adapted model from Huijts et al (Huijts et al., 2012), seeks to understand the psychological factors influencing acceptance. The structure of this model was used to provide the framework of the SAMT.

The toolbox is designed to contain the information gathered during WP4 according to the research plan developed in WP3 and analysed in WP5:"*Data analysis and interpretation*". The SAMT allows developers to interrogate public opinion regarding hydrogen and fuel cell technologies and applications within their field of operation, a specific country or region, and within specific social groups. Using modified QFD (Quality Function Deployment) techniques this information is both correlated using a matrix based system and compared where strong correlations are found, to the findings from the stakeholder qualitative interviews and quantitative survey in order to highlight any points of disagreement between the different respondents, any areas where the overall opinion is one that might indicate a negative outcome with regard to social acceptance and those where things are going well and thus whatever actions are being taken should be maintained (Figure 2).

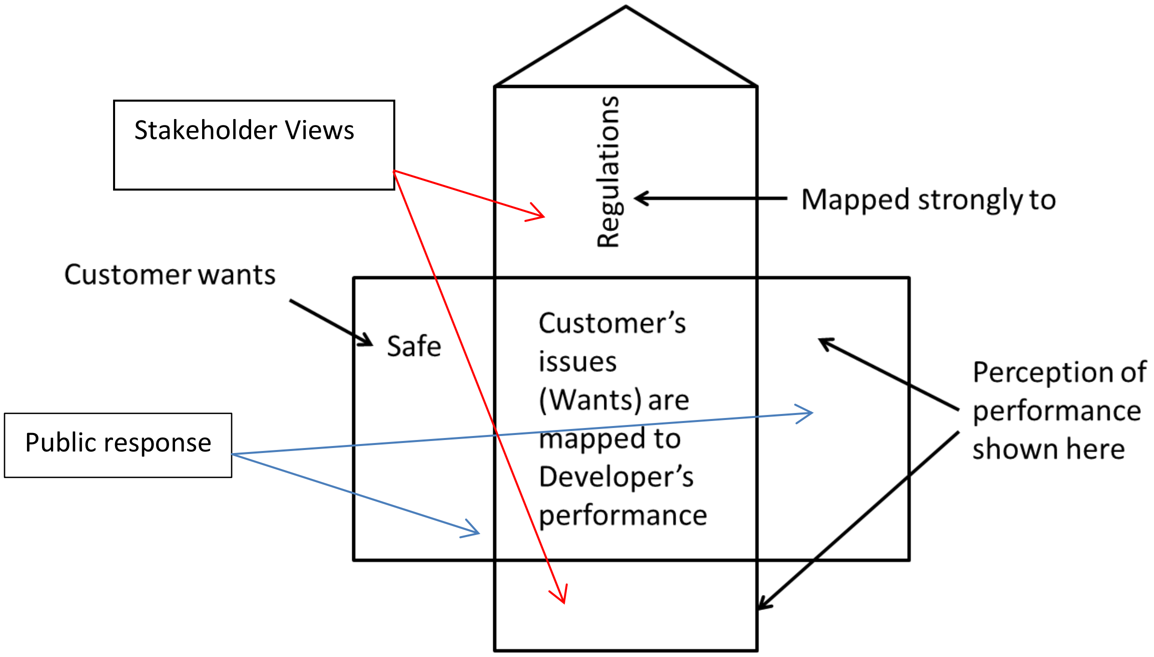

Figure 2: The QFD model

Thus the toolbox offers a set of information aimed at facilitating decisions regarding promotion activities, market preparation, and effective policy support mechanisms, all of it particularized for a given European region and a certain technology.

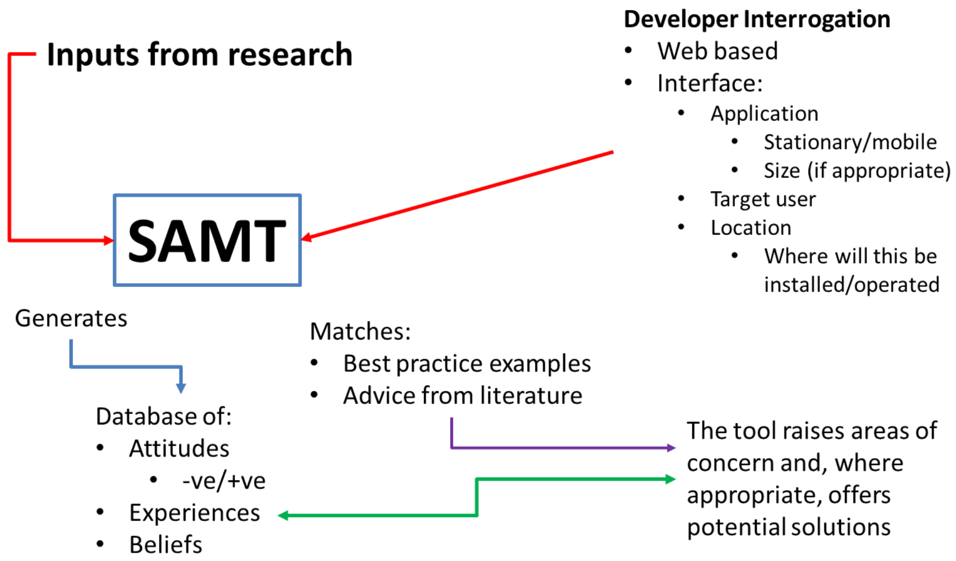

Figure 3: SAMT General operation

The toolbox takes the form of a database containing the above data. Potential FCH technology developers will interrogate this database via a user interface that will ask them to filter the responses from 7148 public respondents and 333 stakeholder respondents in order to assist them in narrowing down their search. The tool then matches their requests to the responses recorded in the quantitative and qualitative research (WP3 and WP4) and presents this to the developer as a set of criteria statuses. These may be used, along with explanatory text and examples of best practice also contained in the toolbox to guide the FCH developer in improving the potential of their technology gaining widespread acceptance.

The SAMT provides outputs based around 51 questions grouped over eight themes described in WP3, deliverable 3.1 Hyacinth Social H2 Acceptance and Awareness research concept and deliverable 3.2 Questionnaires to the General Public and Selected Stakeholders. The themes are:

- **Theme One: Knowledge & Experience**
- **Theme Two : Trust**
- **Theme Three ; Positive and Negative Affects**
- **Theme Four ; Perceived Effects – Costs, Risks and Benefits**
- **Theme Five : Perceived Consequences**
- **Theme Six : Attitude**
- **Theme Seven : Initial Acceptance**
- **Theme Eight : Acceptance**

These responses were augmented with the key issues highlighted within the "*Thematic Analysis of the Stakeholder Interviews*" in task 5.5.

5. IMPROVING SOCIAL ACCEPTANCE

New and developing technologies are always faced by the question of acceptance by all involved stakeholders from industry and governments to certain interest groups and individual customers. Their responses to a novel technology depend on numerous parameters that need to be taken into consideration during introduction of the technology. Even the most successful cases had to overcome initial resistance and only appropriate strategy can result in full acceptance and widespread distribution of the technology. To achieve economic success the most important is the acceptance by public and industry stakeholders. In general the **agreement between industry and public stakeholders** can be divided in four basic categories:

(1) positive agreement between sector stakeholders and public stakeholders (plus-plus);
(2) Sector Stakeholder's views are more positive than the public stakeholders (plus-minus);
(3) Sector stakeholders have a less positive view than the public stakeholders (minus – plus);
(4) both parties agree that the situation is negative (minus-minus);

When the agreement is reached and the technology is accepted by both parties, it is nevertheless important to critically evaluate the situation that enabled the positive outcome. Even though the technology was initially accepted the supportive attitude should be maintained in order to provide successful further development. Commercial success of a new technology might eventually attract larger multinational corporations and oust the local stakeholders. If the focus turns away from benefits of local residents and industry this might result in certain resistance to further development and penetration of the new technology.

If one of the parties is not willing to accept a particular technology all the factors that influence the acceptance should be examined separately to identify the critical ones. After that an appropriate strategy should be set up that specifically targets the critical factors and improve the possibility of the acceptance. Different strategies are most likely to be needed for each of the stakeholders. While industry is primarily focused commercial achievement, the public stakeholders will also be motivated by long term benefits such as environmental and social.

If neither industry nor public stakeholders show interest in a new technology, the technology might not be viable under particular circumstances, including economic, social, environmental and political circumstances. It could also be a result of a 'chicken and egg' problem, where neither party is willing to take the first step. Implementation of the technology might nevertheless be desirable due to other reasons. In this case both industry and public needs to be motivated into accepting the technology. Various subsidies and incentives proved to be successful means of attracting industrial actors, while motivation of public should also be based on education, demonstration of benefits and building a positive attitude towards the new technology.

If and when each case arises the tool will produce a piece of general prepared advisory text, designed to assist the developers to understand the relevance of a given situation. This text is then augmented in the pdf report with additional suggestions and a short extract from a best practice case study, linked to one of the eight themes of the SAMT. Thus in the pdf report, when such a situation arises, the user will be alerted to the problem and the text generated as advice on how to tackle each one. It is not anticipated that this will happen for every occasion. It is expected that this will happen only when one of the above situations is present.

General Advisory Text to be used in all themes

Positive/Positive

There is a strong agreement between sector stakeholders and the public respondents that the situation is positive. Whilst this a beneficial position to be in you should take care to establish the reasons for this. This should reduce the risk of inadvertently damaging product strength and help to build on this.

Positive/Negative

There is a disagreement between stakeholders and the public. Members of the public believe that the situation is more positive than stakeholders. Attention should be paid to discovering the reasons why the public believe the situation is good or acceptable while stakeholders are more pessimistic. This may reduce significant amounts of needless work or highlight major gaps in the knowledge and understanding within the general public.

Negative/Positive

There is a disagreement between stakeholders and the public. This situation arises when the public holds a less optimistic view of the technology than stakeholders. This may be due to the public measuring their experience in a different way to the stakeholders. For instance what seems simple to developers may seem overly complex and daunting to the general public. Alternatively it may be due to a failure to transfer key messages to the public or overcome certain myths or misconceptions. Take care to understand the likely cause in your case and take the appropriate steps to alleviate the issue.

Negative/Negative

There is a strong agreement between stakeholders and the public respondents that the situation is negative. It should however be recognised that these views may not be held for the same reasons and care should be taken when proposing ways to address this. In general however, it is possible that this sort of situation will arise due to external influences such as government policy. Alternatively it may be due to reliability or convenience issues that are recognised as product deficiencies. Whilst this may mean that managing the situation will be tricky, it is also an opportunity to differentiate your product from your competition and gain an advantage over your rivals by entering the market earlier with a better product.

Theme specific text

The following sections contain the theme specific text to be used in the event of one of the four cases occurring. The SAMT is divided into eight themes. Each theme has specific advisory text that augments the general text shown above.

Theme 1: Knowledge and Experience

The following is some advice on ways to tackle this issue. This advice is not intended to be used in its entirety. Rather it is intended as a set of prompts to suggest different ways in which a situation may be managed. Thus they may be viewed individually or used in sets depending upon the situation.

- Recruit and train early adopters as peer educators
- Increase the use of social media to raise profile and promote positive messages
- Increase faith in products with “try outs” or “test drives”
- Use mainstream media, advertising and stories to boost credibility
- Focus on promoting social norms rather than just product benefits, e.g. who else is using your product.
- Avoid categorising the public as NIMBYs and seeing your product as the only way (TINA: There Is No Alternative)
- Do not overload your customers with information. Rather review what is needed, when and determine the most effective channels to use.

“*As hydrogen technology might be too abstract and difficult to assess for laypeople, because it is not part of their everyday reality* (Sherry-Brennan et al., 2010)*, another way could be to give the public some hands-on experience, the chance to get in contact with the novel technology using demonstrators, living labs, or even playful public participation using “serious” games (Poplin, 2012). By this, information would also be delivered, but, at the same time, people with strong concerns are given the chance to gain experience which might also help to increase trust.*”

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Theme 2: Perceived affects

The following is some advice on ways to tackle this issue. This advice is not intended to be used in its entirety. Rather it is intended as a set of prompts to suggest different ways in which a situation may be managed. Thus they may be viewed individually or used in sets depending upon the situation.

- If costs appear higher than those of the current technology you may need to enhance consumers' understanding of the real costs of the technology they're using.
- Publicise any environmental improvements and economic benefits
- Consider how your technology improves the consumers' immediate environment for instance with respect to fumes, noise, cost, etc.
- Consumers may need to change their habits and behaviours in order to get the best from your technology. Consider creating structured demonstrations, workshops and online support.
- What is the "end of life" strategy for your technology? How might this influence the consumer?
- Consider ways in which your technology might boost the local economy in terms of jobs, technological development, infrastructure, etc.

"The policy provided positive attitudes towards perceived costs, risks and benefits. Local development of the technology also provided knowledge and experience to a wide base of individuals and thus a positive attitude towards wind power. Also the perceived benefits of mostly local individuals and communities as opposed to foreign corporations provided a positive fairness factor."

Further information may be found in these references:

Breukers, S., & Wolsink, M. (2007). Wind power implementation in changing institutional landscapes: An international comparison. *Energy Policy*, *35*(5), 2737–2750. https://doi.org/10.1016/j.enpol.2006.12.004

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Theme 3: Positive and Negative Affects

The following is some advice on ways to tackle this issue. This advice is not intended to be used in its entirety. Rather it is intended as a set of prompts to suggest different ways in which a situation may be managed. Thus they may be viewed individually or used in sets depending upon the situation.

- Consider the location of any proposed facility
  - Is it too close to population centres?
  - Is it located to maximise traffic?
  - Have local residents been consulted?
- Have local and regional stakeholders been included in decisions?
- What benefit, if any, will they receive?
- Publicise any environmental improvements and economic benefits
- Consider how much consumers' behaviours may need to change in order to adopt the technology.
- Consider redesigning to maximise ease of use and simplicity
  - Study previous trials and pilot projects to understand ways to make the technology more convenient and lower cost.

"In a study carried out in rural China, institutional, technical and financial shortcomings were examined, in particular, a lack of public support was found to be an important cause of the project failure. For instance, villagers were unwilling to change cooking routines and refused to pay for the installation of pipes and stoves for biogas use. Some villagers even refused to pay for biogas."

Further information may be found in this reference:

Liu, W., Wang, C., & Mol, A. P. J. (2013). Rural public acceptance of renewable energy deployment: The case of Shandong in China. *Applied Energy*, *102*, 1187–1196. https://doi.org/10.1016/j.apenergy.2012.06.057

Theme 4: Trust

The following is some advice on ways to tackle this issue. This advice is not intended to be used in its entirety. Rather it is intended as a set of prompts to suggest different ways in which a situation may be managed. Thus they may be viewed individually or used in sets depending upon the situation.

- Lobby for a stable and well structured national and regional policy
- Consider alternative points of view to yours as these may prove of benefit to your proposed technology
- Opposition may be due to relative unfamiliarity with the technology. Ensure your positive message outweighs any myths, folklore or misconceptions surrounding your propsed technology.
- Share any risks and benefits in an equitable fashion, e.g. feed in tarriffs for micro generation, through life costs, etc.

*"In a survey carried out in the UK it was discovered that **lack of knowledge** is in fact a major barrier for investments and that accreditation schemes have a great influence on households' investment decisions. It was shown that micro-generation technology needs **more active social acceptance** than conventional technologies. Investments on both sides of electricity meter should be treated equally, i.e. homeowners should also ge**t access to tax allowances as big companies** do. **Settlement for grid and industry standards** have to be changed in in order to allow for the fair valuation of micro generated electricity exported to the grid. Furthermore, **easy access to information and skilled installers** is necessary to minimise perceived risks (Watson et al., 2006)."*

Further information may be found in these references:

Sauter, R., & Watson, J. (2007). Strategies for the deployment of micro-generation: Implications for social acceptance. *Energy Policy*, *35*(5), 2770–2779. https://doi.org/10.1016/j.enpol.2006.12.006

Watson, J., Sauter, R., Bahaj, B., James, P. A., Myers, L., & Wing, R. (2006). *Unlocking the Power House: Policy and system change for domestic micro-generation in the UK*. SPRU, Brighton.

Theme 5: Attitude

The following is some advice on ways to tackle this issue. This advice is not intended to be used in its entirety. Rather it is intended as a set of prompts to suggest different ways in which a situation may be managed. Thus they may be viewed individually or used in sets depending upon the situation.

- Lack of technical knowledge does not necessarily equate to a lack of belief. To win public support consider:
  - An alternative approach through interactive communications and public participation (seeing is believing).
  - Using networks with high levels of consistent communications
- Beliefs are as much ***social*** as they are ***personal***. So:
  - Be ready to modify your communications strategy to take advantage of or react to events.

    - Publicise who is using the technolgy and where
- Consider encouraging local actors to become involved in the development of the particular technological solution. This will help share the risks and benefits.

"A study of Wind Power implementation in Germany found that although the initial government policy targeted larger industrial stakeholders through favouring large scale units, the policy was soon modified to support smaller scale units. The research and development of these units was carried out by local firms with connection to local academic researchers, so numerous stakeholders were involved in the development and implementation. This resulted in the development of a strong home market for small scale wind turbines with significant economic impact."

Further information may be found in these references:

Breukers, S., & Wolsink, M. (2007). Wind power implementation in changing institutional landscapes: An international comparison. *Energy Policy*, *35*(5), 2737–2750. https://doi.org/10.1016/j.enpol.2006.12.004

Huijts, N. M. A., Molin, E. J. E., & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. *Renewable and Sustainable Energy Reviews*, *16*(1), 525–531.

Theme 6: Perceived consequences

The following is some advice on ways to tackle this issue. This advice is not intended to be used in its entirety. Rather it is intended as a set of prompts to suggest different ways in which a situation may be managed. Thus they may be viewed individually or used in sets depending upon the situation.

- Raise the profile of the technology by having as many as practical in operation
- Provide a "hands on" experience for potential users as technical information is often too inaccessible for the general public.
- Emphasise the risks of being left behind
- Avoid aligning your policy too closely with that of the existing conventional energy sector. Look for the disruptive elements of your prosed technology and point out their advantages.

"A less successful example of alternative energy implementation can be found in England where the installed capacity of onshore wind turbines is growing considerably more slowly than in Germany. Although the government policy supports renewable energy production including wind power, the policy making was heavily influenced by the existing conventional energy sector. The policy favoured large scale units and consequently only large investors, typically from the existing energy sector, were able to participate in the development. Since this

investors focused mainly on the economic aspects of the projects, local development was not stimulated and local public stakeholders were generally not included in the decision making process and in the projects. This might have been the cause of strong local opposition to wind power projects."

Further information may be found in these references:

Breukers, S., & Wolsink, M. (2007). Wind power implementation in changing institutional landscapes: An international comparison. *Energy Policy*, *35*(5), 2737–2750. https://doi.org/10.1016/j.enpol.2006.12.004

Huijts, N. M. A., Molin, E. J. E., & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. *Renewable and Sustainable Energy Reviews*, *16*(1), 525–531.

Theme 7: Intention to Accept

The following is some advice on ways to tackle this issue. This advice is not intended to be used in its entirety. Rather it is intended as a set of prompts to suggest different ways in which a situation may be managed. Thus they may be viewed individually or used in sets depending upon the situation.

- Control and organise knowledge. Don't over burden people with unnecessary information.
- Provide easy access to information. Consider online support.
- Offer strong face to face support
- Provide a strong network of skilled installers.
- Reward users by promoting them via social networks.
- Consumers are generally supportive of renewable technologies given their positive impacts upon the environment but costs can be a significant variable. Compare true costs with alternatives, especially incumbent technologies.
- Keep dispelling myths and misconceptions regarding your technology.

Theme 8: Acceptance

The following is some advice on ways to tackle this issue. This advice is not intended to be used in its entirety. Rather it is intended as a set of prompts to suggest different ways in which a situation may be managed. Thus they may be viewed individually or used in sets depending upon the situation.

- Control and organise knowledge. Don't over burden people with unnecessary information.
- Provide easy access to information. Consider online support.
- Offer strong face to face support

- Provide a strong network of skilled installers.
- Reward users by promoting them via social networks.
- Reinforce social norms by highlighting how many people are using your technology and who they are.
- Provide positive anecdotal evidence from end users, e.g. from demonstration projects or pilots.

6. Summary

By understanding the level of awareness and utilising best practice as well as learning from the mistakes of others, the SAMT will be improved. The advice offered to stakeholders in their efforts to make the leap from demonstration to mass market acceptance should provide them with a solid foundation to move forwards. The analysis carried out within this deliverable and previous social acceptance research carried out by the consortium and others will provide the basis for the advisory text to be offered to stakeholders as a result of the analysis of the responses of both public and other stakeholders. Whilst the advisory text cannot provide answers to every possible scenario, it is intended to provide clues and greater insight to stakeholders. In addition to the text, stakeholders will be directed to further reading in order to enhance their understanding of any given situation.

Thus the SAMT has received significant input from previous projects and the knowledge gained from them regarding social acceptance.

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