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**Citizen concerns and acceptance for novel energy
technologies**

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Abstract:

The introduction of new energy technologies in the context of the transformation of energy systems has repeatedly led to acceptance problems. These can have a decisive impact on the success of individual projects or the introduction of entire technologies. Therefore, three new energy technologies have been selected for an acceptance examination of the population: hydrogen filling stations, stationary battery storage systems, and production facilities for biofuels, which will contribute to the decarbonisation of the energy sector in the future. Based on interviews with experts, a survey was developed to: analyse the acceptance based on the citizen concerns for the selected technologies, the attitude towards financial support, the perceived influence on the implementation process, and the current state of knowledge regarding the respective technology. The first analysis points to a certain acceptance of the selected energy technologies among the population in Germany. The work provides a first cornerstone for a more detailed explanation of the acceptance genesis for new energy technologies.

Keywords: energy technology, acceptance, Germany

JEL codes: Q42, Q47, O21

1 Introduction

1.1 Energy and climate policy at global and European level

Due to global warming and the finite nature of fossil fuels such as oil, gas and coal, there is a global shift from unsustainable use of fossil fuels to a sustainable energy supply. ¹ This process is described as the Energy Transition. At the global level, the Paris Agreement plays the most important role. The agreement was signed in 2015 by 195 member states of the United Nations Climate Convention, the UNFCCC. In it, the aim was to limit global warming to below two degrees Celsius compared to the pre-industrial level. ² The European Union, which cooperates closely with the UNFCCC, last formulated central goals in the context of the "Clean Energy for All Europeans Package" in 2016 and the "Clean Mobility Package" in 2017 in order to commit itself to the Paris Convention. These new legislative packages should lead to more competition, sustainability and stability in the energy and mobility sector. A special focus is the stimulation of investments in sustainable energy technologies.^{3,4}

1.2 The Energy Transition in Germany

In the "Climate Protection Plan 2050" for Germany, the Federal Government describes the planned climate protection measures to implement the Paris Convention. ⁵ In addition to this, the Renewable Energies Act (EEG), which was introduced in 2000 and last revised in 2017, has already caused a revolution in the energy sector.⁶ Former consumers are now increasingly acting themselves as electricity producers on the market, the large energy suppliers have lost their monopoly and sold entire business areas. The resulting structural change in the labour market is putting entire regions that benefited from fossil power generation under pressure.⁷ This change is being accelerated by digitisation, which is opening up new market opportunities for renewable energies.⁸

With the help of Smart-Grids, a better integration of renewables into the electricity market should be made possible and private electricity producers should be able to trade their electricity independently through new developments as e.g. the blockchain technology.⁹ Many young entrepreneurs now see their opportunity in the new market of sustainable power

¹ Cf. Armaroli, Balzani (2006), pp. 52-66.

² Cf. UNFCCC (2015), access: 07 May 2018

³ Cf. European Commission (2016), access: 07 May 2018

⁴ Cf. European Commission (2017), access: 07 May 2018

⁵ Cf. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2015), access: 07 May 2018

⁶ Cf. Bundestag (2000), pp. 305-309

⁷ Cf. Frankfurter Allgemeine Zeitung (2013), access: 07 May 2018

⁸ Cf. Leibniz Institute for Economic Research (2015), access: 07 May 2018

⁹ Cf. Lösch, Schneider (2016), pp.262-284.

generation.¹⁰ Germany's Federal Economics Minister Zypries described the energy transition as one of the largest modernisation and innovation projects in Germany.¹¹

1.3 Challenges and acceptance problems

In Germany, the energy system transformation is facing very special challenges. The decision to phase out nuclear power in 2011 and the subsequent decarbonisation of the energy sector mean that missing capacities must be replaced by renewable energy sources and new storage facilities.¹² The current electricity grid is not designed for decentralised power generation.¹³ The grid is not able to cope with the strong fluctuations in electricity supply due to the feed-in of electricity from renewable energy sources and cannot compensate for the fluctuations in production and demand. This problem is now to be solved using intelligent network management and storage technologies. However, the technologies required for this are still at the beginning of their development.¹⁴ In addition, decarbonisation is to be promoted not only in the electricity generation sector but also in the heating and mobility sectors, the latter in particular being increasingly electrified.¹⁵

In particular, the construction of wind-farms, pumped storage power plants and electricity grids often encounters resistance.¹⁶ For this reason, greater use is also being made of the involvement of local authorities in the area of legislation in order to ensure acceptance by citizens. For the Climate Protection Plan 2050, long before it was drawn up, citizens and municipalities were involved and asked to contribute their ideas and opinions.¹⁷ Also Research projects which focus on the energy transition should include in a prospective manner acceptance issues. The outcome of such an analysis helps on the technology level to include the findings in the further development and implementation of a technology and helps on the energy system level to select in a more holistic manner the most promising energy scenarios.

1.4 The Helmholtz Initiative Energy System 2050

With more than 38,700 employees and an annual budget of more than 4.5 billion euros, the Helmholtz Association, Germany's largest scientific organization, is also addressing the before named challenges of energy system transformation and has launched the "Helmholtz Initiative Energy System 2050" as part of the Energy Research Field.¹⁸ This initiative has set

¹⁰ Cf. Borderstep Institute, Green Economy Start-up Monitor (2013), pp. 7-9.

¹¹ Cf. the Federal Government (2017), access: 07 May 2018

¹² Cf. University of Flensburg, Nuclear Phase-out and Regional Security of Supply (2011), p. 29.

¹³ Cf. German Chamber of Industry and Commerce, Fact Paper (2017), pp. 16-17.

¹⁴ Cf. Federal Ministry of Economics and Energy (2014), access: 07 May 2018

¹⁵ Cf. Wietschel et al. (2018), pp. 36-45

¹⁶ Cf. Südwestrundfunk (2016), access: 07 May 2018

¹⁷ Cf. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2015), access: 07 May 2018

¹⁸ Cf. Helmholtz Association (2018), access: 07 May 2018

itself the goal of developing tangible and usable system technology findings and technological solutions by 2019, which are to be provided by politics and industry. With approximately 130 employees and a budget of 15 million euros, five research topics, which can be regarded as sub-projects, address the fundamental challenges of the energy system transformation. The structure of the Helmholtz Initiative Energy System 2050 is visualized in Figure 1 for a better overview.

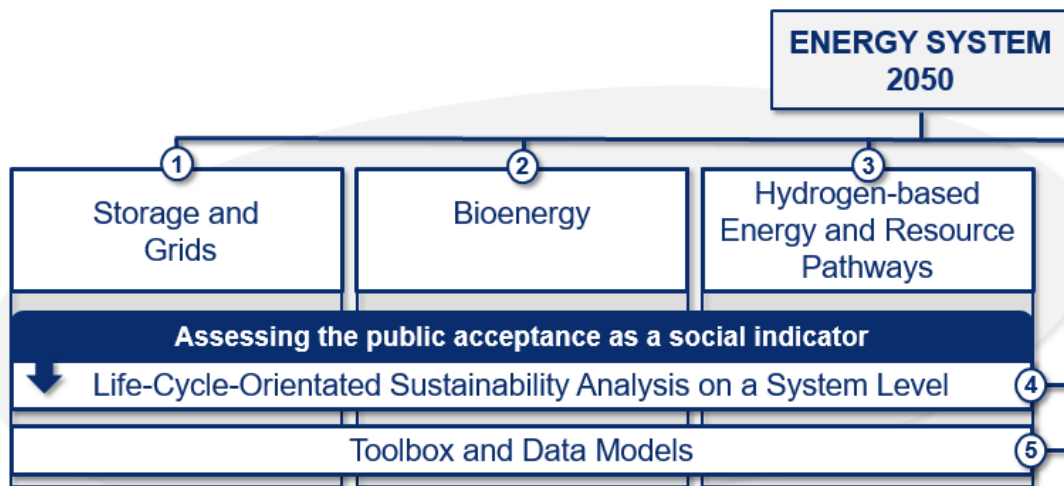


Figure 1: The Helmholtz-Initiative Energy System 2050 and its division into the research topics Storage and Grids (1), Bioenergy (2), Hydrogen-based Energy and Resource Pathways (3) and the two cross-sectional topics Life Cycle- Oriented Sustainability Analysis at System Level (4), as well as Toolboxes with Data Models (5). Source: Own graph based on the project structure

The individual subprojects are Research Theme 1 Storage and Networks (FT1), Research Theme 2 Bioenergy (FT2), Research Theme 3 Hydrogen-based Energy and Resource Pathways (FT3), Research Theme 4 Life Cycle Oriented Sustainability Analysis at System Level (FT4) and Research Theme 5 Toolbox with Data Models (FT5). A total of eight research centers are involved in the overall project: the German Aerospace Centre (DLR), the Jülich Research Centre (FZJ), the Helmholtz Centre Potsdam (GFZ), the Helmholtz Centre Berlin (HZB), the Helmholtz Centre Dresden-Rossendorf (HZDR), the Max Planck Institute for Plasma Physics (IPP), the Karlsruhe Institute of Technology (KIT) and the Helmholtz Center for Environmental Research (UFZ).¹⁹

¹⁹ Cf. Helmholtz Association, Energy System 2050 (2015), access: 07 May 2018

1.5 Objective and research question

Within the framework of the already presented research topic Life Cycle Oriented Sustainability Analysis at System Level, common methods for the sustainability assessment of technologies will be developed and applied. In addition to an ecological and economic evaluation, the social evaluation of the energy system plays a central role here. Acceptance was identified as an important element here. It is seen as a critical factor for the successful implementation of an innovation process such as the energy system transformation.²⁰

The acceptance analysis of new energy technologies within the framework of this work aims to generate new insights and to provide a base for further assessments in the field. The integration of this work in the Helmholtz Initiative Energy System 2050 is shown in Figure 1, and within the framework of the research topic Life Cycle Oriented Sustainability Analysis at System Level (FT4) in Figure 2.

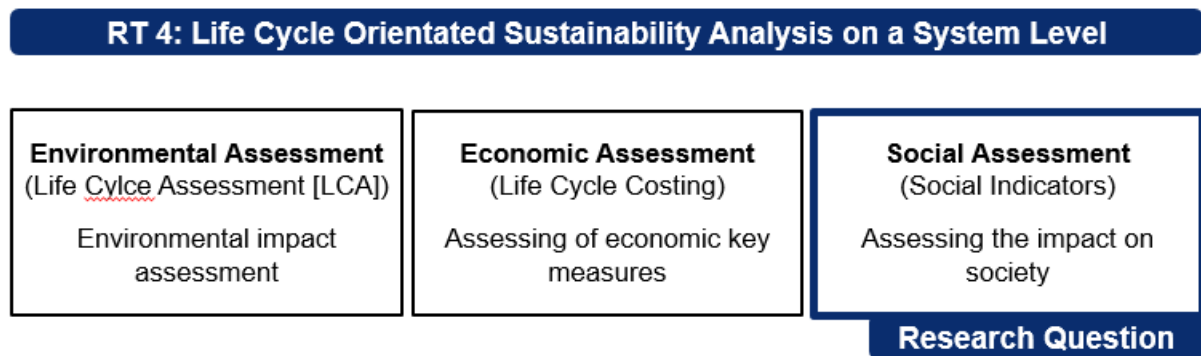


Figure 2: Integration of the thesis into the research topic of life cycle-oriented sustainability analysis at a system level within the framework of the Helmholtz Initiative 2050. Source: Own compilation based on the ES2050 Project Manual

In order to assess the acceptance of new energy technologies in the context of the energy system transformation in Germany, the following central research question arises:

What are the public concerns, which need to be taken into account when introducing and implementing new energy technologies?

²⁰ Cf. Wüstenhagen et al. (2007), pp. 2683-2691

2 Survey development

2.1 Selection and presentation of energy technologies

The analysed technologies were selected in collaboration with scientists from the Helmholtz Initiative Energy System 2050, corresponding to the three research-topics FT1 Storage and Grids, FT2 Biogenic Energy Sources and FT3 Energy and Raw Material Paths with Hydrogen (Figure 3).

2.1.1 Criteria for technology selection

It was decided that all considered technologies should already have taken place in a pilot or industrial scale in order to be able to fall back on experiences from interaction with the public. In addition, the technology should be able to make an important contribution to the decarbonisation of the energy industry in the future energy system. The choice of energy technologies, taking into account the criteria summarised in Table 3, fell on stationary battery storage systems with reference to the research topic Storage and Networks (FT1), Bioenergy (FT2) and on hydrogen filling stations with reference to the research topic Hydrogen-based Energy and Resource Pathways (FT3).

Table 1: Overview of the criteria for selecting energy technologies in cooperation with stakeholders (DLR, FZJ, KIT) from the Helmholtz Initiative Energy System 2050. Source: Own representation.

Selection criterion	Description
Technical Artefact	Energy technology is a physical object.
State of the art	Successful piloting or first industrial application.
External technology	The population is exposed to this technology, clear demarcation from everyday life, and work technology.
Usefulness	Useful for the energy revolution in the sense of a sustainable energy system of the future.

An overview of the selected technologies from the Helmholtz Initiative 2050 can be found in Figure 3.

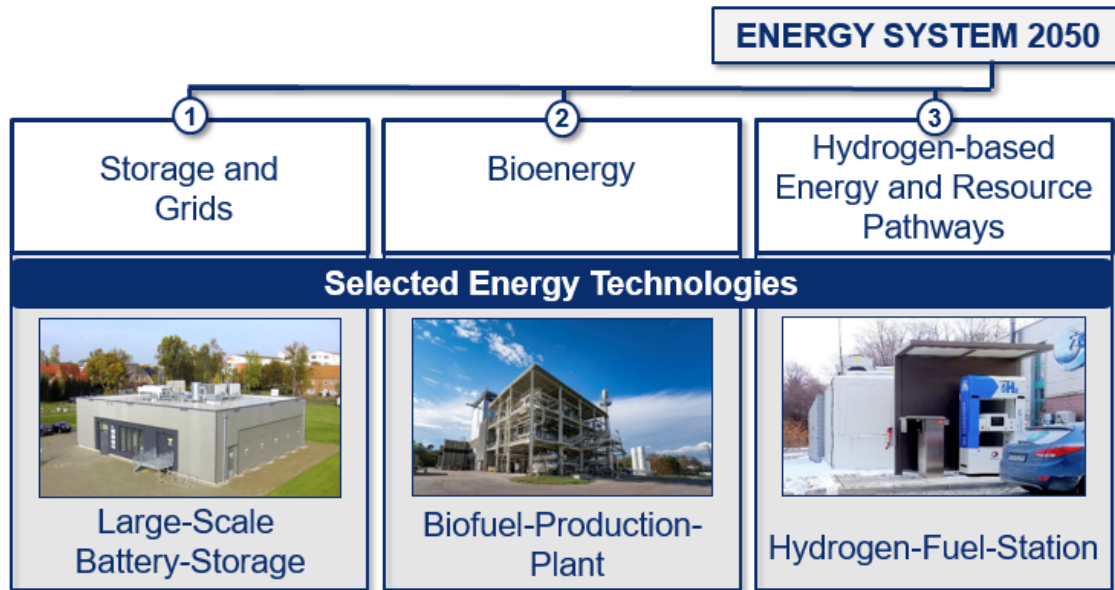


Figure 3: The three energy technologies selected from the research topics of the Helmholtz Initiative. Source: Own graph, pictures with friendly support from left to right by WEMAG AG, Laila Tkotz (KIT), and Jens Peters (KIT).

2.1.2 Stationary battery storage systems

A stationary battery storage system allows storing energy electrochemically in rechargeable cells. The reversal of the storage reaction releases the energy again. The use of battery storage makes it possible to decouple the varying electricity production of wind and solar power plants from energy consumption. This enables an increased share of renewable energies in the electrical grid and at the same time increases security of supply at the local level. This reduces or prevents, for example, a cost-intensive and locally undesirable expansion of the electricity grid and replaces electricity production with gas and coal-fired power plants.^{21,22} The construction of battery storage systems is also subject to e.g. safety requirements in order to minimize potential hazards in the event of a fault (e.g. fire or explosion hazard).

2.1.3 Biofuel production plants

In decentralised production plants, regionally produced biomass is to be processed into an intermediate product with a higher energy density that can be transported over longer distances. Any type of dry biomass can be the raw material for the process of such plants, whereby the process aims in particular at the use of residues from agriculture, forestry and landscape conservation. The liquid intermediate product is then converted into fuel, electricity

²¹ Cf. Wietschel et al. (2015) pp. 147-214, p. 193

²² Cf. Sterner et al. (2014) pp. 629-745

and heat in a central plant. The biomass is transported to the decentralised plant by local means of transport such as tractors and trucks. The liquid intermediate product is transported to the central production plant by tank trucks. The biomass can be used for the production of electricity, heat and fuel. Biomass can also be stored. It can therefore contribute to the security of energy supply and compensate for fluctuations in other renewable energy sources, such as wind turbines during calm periods and solar plants at night.

The use of bioenergy can lead to a reduction in fossil carbon dioxide emissions, since the combustion of fuels based on biomass usually only releases as much carbon dioxide as was previously absorbed from the air during the growth phase of the biomass (plants). In addition, the use of biogenic residues from agriculture and forestry can increase regional added value. Since biogenic waste and residual materials are only regionally available to a limited extent, there is a risk of land use conflicts when biomass is cultivated or of dependencies on the import of biomass.^{23,24}

2.1.4 Hydrogen fuel stations

Hydrogen is a possible alternative fuel for vehicles. Like previous fuels, this can be supplied to vehicles at filling stations within a short period of time. Plans have been announced throughout Germany to set up a hydrogen infrastructure with such filling stations. The individual stations are supplied with liquid or gaseous hydrogen by tanker- trucks. Hydrogen filling stations require equipment for the storage, compression and release of hydrogen.

The use of hydrogen as an energy carrier can reduce urban air pollution and dependence on fossil fuels (provided that electrical energy from renewable energy sources such as wind or biomass is used for production via electrolysis). In contrast to mineral oil, hydrogen as a fuel is therefore only limited by the supply of regenerative energy sources. The main advantage of hydrogen is that its use produces harmless water vapours instead of harmful carbon dioxide and nitrogen oxide emissions. The production of hydrogen, however, requires high energy consumption and large investments in the necessary infrastructure.^{25,26}

2.2 Survey design based on expert interviews

In order to capture and validate the various concerns and acceptance problems arising from the experience gained, semi-structured interviews were conducted with two experts from each technology field. When selecting the experts, care was taken to ensure that they had not only

²³ Cf. Bioliq Biomass to Liquid Karlsruhe (2018) Call: May 14, 2018

²⁴ Cf. Energy Agency (2009) pp. 21-22.

²⁵ Cf. Robinius et al. (2018) pp. 1-108

²⁶ Cf. Wulff (2017) pp. 1-165

specialist knowledge of the technology, but also experience with reactions from the population to the energy technologies concerned.

2.2.1 Selected Experts

For the hydrogen filling station a business analyst of a hydrogen mobility spin-off of a leading global automotive company and a project manager of a provider for local hydrogen infrastructure were interviewed. Both have experience from projects to set up hydrogen filling stations in Germany at various locations.

A current head of energy storage projects of a German energy provider and a managing director of another energy provider were interviewed for the stationary battery storage. Both have experience as project managers for the implementation of stationary storage facilities near housing estates. For the biofuel production plant a spokesperson for such a project and long-standing expert in the field of renewable raw materials, were interviewed.

2.2.2 Interview

The experts were asked to report freely on their experiences with reactions and concerns of the public and residents of the construction projects. The interviews were recorded on tape, transcribed and anonymised at the request of the experts. For evaluation using coding method based on Miles and Huberman (1994) was used.²⁷ They describe a deductive approach based on an organized basic structure with initial codes with which the data is coded line by line. The approach helps researchers to integrate already existing concepts from the literature.²⁸

²⁷ Cf. Miles, Huberman (1994) pp. 58-62

²⁸ Cf. Bradley et al. (2007) p. 1763

3 Survey approach

First the selected energy technologies were presented to the survey participants (test persons), that means only one technology consideration for each test person. After that presentation section the effects identified during the interviews were listed in the questionnaire and the test persons were asked to mark the effects they are concerned with regard to the energy technology presented. In addition, the option was given to name further effects. An overview of the effects surveyed in the questionnaire can be found in Table 2.

Table 2: Overview of the external effects surveyed in the questionnaire. Source: Own representation.

Choices of feared effects:

(1) Electrosmog, (2) Odour pollution, (3) Noise pollution, (4) Air pollution, (5) Fire hazard, (6) Explosion hazard, (7) Negative effects on landscape or cityscape, (8) Others (9) "Supplementary option by free text field".

For a further analysis, it was determined how the test persons position themselves towards a state promotion of energy technologies and whether the test persons see themselves in a position to influence the process of introducing the new energy technologies.²⁹ A free text field for optional feedback has also been integrated on the last page of the questionnaire. In order to obtain information on the composition of the sample, a number of socio-demographic data were collected. These included the gender, population of the place of residence, income situation, activity, age and education of the test person. In order to simplify the answering, the highest precision was omitted with the indication of the age and a selection of provided intervals was made possible. The sociodemographic data were compiled on the basis of the HYACNINTH project and the literature on the general population survey of the social sciences, the ALLBUS.^{30, 31}

3.1 Survey preparation

The complete questionnaire was created using the online platform Sosci-Survey, which is freely available for non-commercial use. For each technology, a version with identical content was designed for the desktop and for mobile devices. To evaluate the questionnaire, 5

²⁹ Cf. Huijts et al. (2014), p. 157

³⁰ Cf. HYACINTH access: 14 May 2018

³¹ Cf. General Population Survey of the Social Sciences ALLBUS (2017), p. 57f

cognitive pre-tests were conducted using the loud thinking method.³² During these tests, the test person was asked to say anything he or she noticed during the processing of the questionnaire, as well as to give his or her thoughts on the individual questions. For this purpose, five test persons with a diverse age and educational background as possible were selected. Subsequently, 10 standard pre-tests were carried out to determine the processing time and to check the technical function on various terminal devices.

³² Cf. Charters, E. (2003). *Brock Education*, 12(2), 68– 82.

4 Results

The sociodemographic data of the sample, the external effects and some attitude questions on energy technology were initially collected for a purely descriptive analysis.

4.1 Sample

A total of 211 data sets were generated, of which 71 can be assigned to the stationary battery storage, 70 to the biofuel production plant and 70 to the hydrogen filling station. The evaluation of the sociodemographic data of all technologies showed that the test persons were predominantly male, the age between 25-29 years, the highest educational attainment a university degree, the job employed, the size of the place of residence can be considered as rather rural and the income situation as rather good. However, there were slight variations with regard to the sample composition for the individual technologies. Thus, the questionnaire on the hydrogen filling station was answered predominantly by students, and with regard to the size of the place of residence, the questionnaire on stationary battery storage was answered predominantly by test persons living in urban areas with 200,000-1,000,000 inhabitants. The hydrogen filling station was mainly operated by test persons from a small town with 20,000-200,000 inhabitants.

4.2 Citizen concerns

Based on the reports of the expert interviews, it was determined which external effects (externalities) were feared with regard to all considered individual energy technologies. The effect options electric smog, odour pollution, noise pollution, fire hazard, explosion hazard, negative effects on the landscape or cityscape and "Others" could be selected and further effects could be added or specified in a free text field. An overview of the feared effects with regard to the individual energy technologies can be found in Figure 4. Because it was a non-comparative survey chosen, to identify the potential hurdles of a technology, it has to be mentioned that the values of the different technologies cannot be compared with each other.

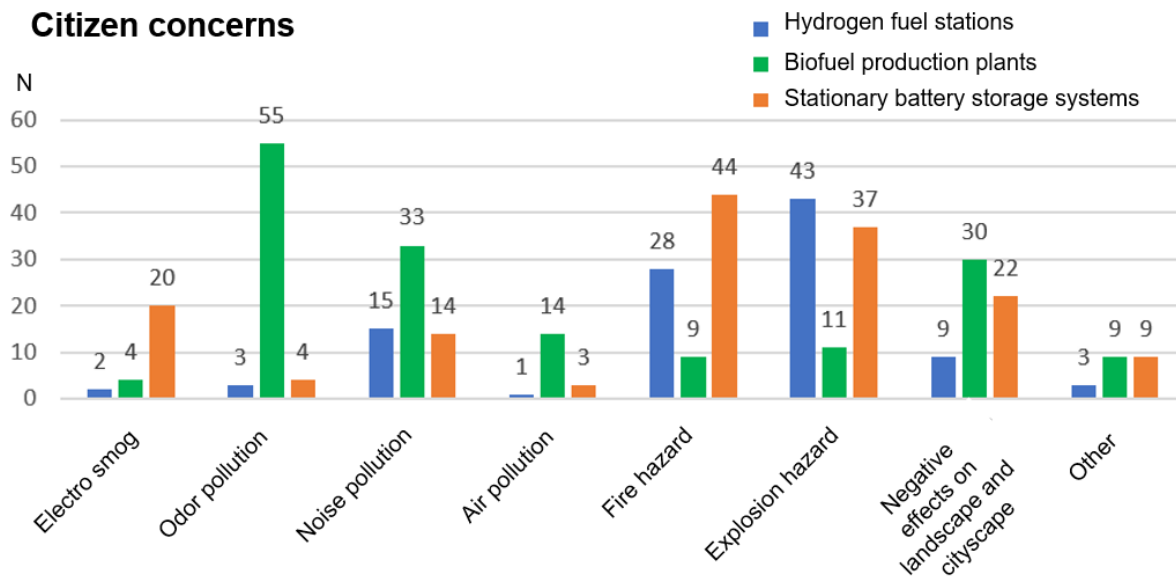


Figure 4: Feared effects of the test subjects that were previously extracted as external effects from the expert reports. From left to right: electro smog, odour pollution, noise pollution, air pollution, fire hazard, explosion hazard, negative effects on the landscape or cityscape and others. The values of the different technologies cannot be compared with each other. Source: Own representation.

With regard to stationary battery storage and hydrogen filling stations, fire and explosion hazards are the most frequently expressed concerns, while odour and noise pollution are the most common concerns for biofuel production facilities; also, if such feared effects like explosion, fire and odour would not occur in a controlled operation. The comments of the test persons on the individual energy technologies listed in Table 3 mostly reflect the previously selected effects and supplement these with further concerns to be considered in order to discuss the results.

Table 3: Overview of the additional concerns expressed by the test persons with regard to the individual energy technologies. Source: Own representation.

Effects reported by subjects:

Stationary battery storages

- Pollution of the soil / groundwater
- rays
- Increased risk of cancer
- disposal problems
- Ruthless exploitation of the environment, increased lithium degradation, what happens to the waste generated after the plant has reached the end of its service life?
- Catastrophic life cycle assessment
- I give here the consequences of the steps too necessary (especially the extraction of lithium) to consider the environment (not directly adjacent to my residential area). The focus should be on novel, more environmentally conscious electrolyte materials!
- Possible serious interference with ecosystems by wind farms. This is for example very controversial in Münstertal in the southern Black Forest.
- Impairment of real estate

Production plants for biofuels

- traffic load
- Increased traffic volume and thus higher air and noise pollution
- With biogas plants it comes to my mind that these plants were heavily subsidized by the EEG (at least in the beginning). These high subsidies have led to large areas of rapeseed being cultivated today in order to produce energy with this...
- That instead of vegetables, cereals or fruit the land is used for biomass. The way corn is grown to produce fuel. This leads to ever smaller usable areas
- Groundwater/river water pollution;
- Cultivation of plants for use as biofuel instead of growing food. Even stronger training of monocultures.
- That not only biogenic waste is used, but also agricultural land is misused to grow biomass.
- additional traffic load
- car traffic
- increased traffic load due to transport vehicles
- Increase in monocultures in agriculture

Hydrogen refuelling stations

- It's like a regular gas station.
 - But I've also seen it at conventional gas stations.
 - The arrivals and departures lead to car noise, independent of the fuel, which I don't want at my apartment.
 - That the necessary energy is provided by renewable raw materials, raw materials that are withdrawn from the food industry. The only permissible energy source of this kind (renewable) I see on the Ukrainian fields...; Only ecological...
 - less funding for electric filling stations which, in my opinion, make more sense
-

4.3 Perceived possibilities of influence, attitudes towards financial support and knowledge

In order to be able to assess how the attitude towards a technology could manifest itself in an active commitment for or against the technology, the test subjects were measured according to

the acceptance model of Huijts et al. (2014) to see their possibilities of influencing the implementation process.³³ As shown in Figure 5, the perception of the influence possibilities is different, with a tendency towards perception not to be able to influence the introduction of energy technologies.

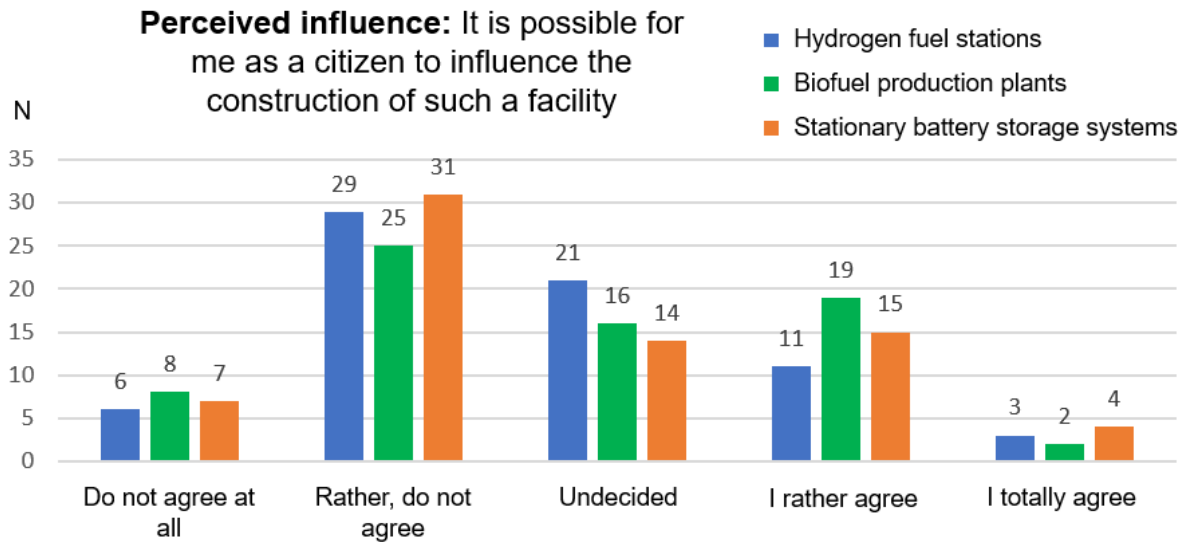


Figure 5: Evaluation by the test persons of the possibilities of influencing the introduction process of the individual energy technologies. Source: Own representation.

In addition, the attitude towards financial support for individual energy technologies was measured. As can be seen in Figure 6, financial support for individual energy technologies is generally advocated. The political attitude of the test persons was also recorded in order to further shed light on the attitude towards financial support. However, due to the limited sample size and frequent use of the fall-back option, this analysis was not performed.

³³ Cf. Huijts et al. (2014), p. 157

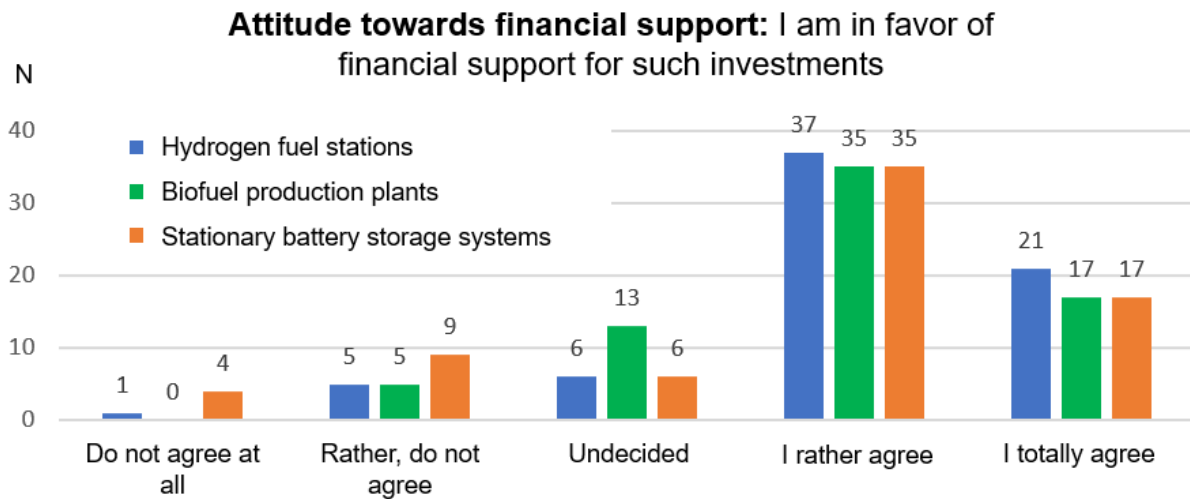


Figure 6: Attitude of the test persons towards financial support for the individual energy technologies. Source: Own representation.

A self-assessment of the test persons' existing knowledge with regard to the allocated energy technology showed that the selected energy technologies are little known for the majority of the participants. An overview of the self-assessments of all test persons can be found in Figure 7.

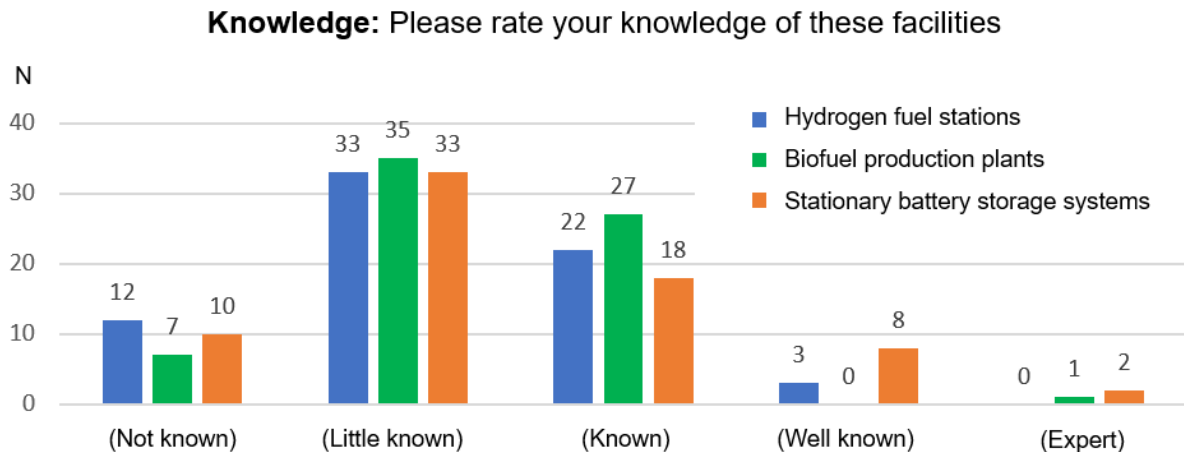


Figure 7: Self-assessment of knowledge. (1) Not known: I've never heard of that. (2) Little known: I have already heard about this technology (for example, newspaper articles, television, conversations with others). (3) Known: I have already dealt with these facilities once, for example in the context of personal interest, school time, studies, or work. (4) Very well known: I am regularly confronted with this technology and deal with its development. (5) Expert: I refer to myself as an expert in this field. Source: Own representation.

The evaluation of the sociodemographic data shows that predominantly younger test persons with a university degree were reached. This can be attributed to the modus of the survey

spreading and the sophisticated questionnaire design with complex connections in the information bases. It is possible that the scenarios described above will predominantly address people who are already dealing with the complex problems of the energy system transformation. The distribution of the questionnaire via an online platform also favours younger test persons who have grown up with mobile devices and use them more frequently in everyday life.

5 Discussion

Overall, it was possible to obtain an overview of the attitudes and public concerns for the selected energy technologies.

5.1 Stationary battery storage systems

The technology was little known to most of the test persons. The major concerns are explosion and fire hazards. A large proportion of the test persons are in favour of financial support for the systems. Most test persons see no possibility to influence the introduction process of the technology. Overall, the introduction of stationary battery storage seems to be positively received by the test persons. However, attention should probably be paid to the origin and life cycle of the raw materials, as this is already mentioned by the test persons in the supplementary comments (Table 3).

5.2 Biofuel production plants

Most test persons see financial support for such a technology as rather positive. Major concerns are noise and odour pollution. Here, too, the test persons see rather few possibilities to influence the implementation- process. Nevertheless, the comments of the test persons suggest that a number of additional effects such as land use conflicts and an additional traffic load are additional concerns in the context of raw material extraction for the operation of the plant.

5.3 Hydrogen fuel stations

The major concerns by most test persons are, similar to stationary battery storage systems, the danger of fire and explosion. The test persons see little possibilities to influence the introduction process for hydrogen filling stations. Overall, the support of hydrogen filling stations seems to be positively received by the test persons. It should be added that in an expert interview it was pointed out that customer and user acceptance of hydrogen filling stations also plays an important role for a successful introduction of the technology.

6 Conclusion

In a survey, citizen concerns, attitudes towards financial support, perceived possibilities of influencing the introduction process and a self-assessment of knowledge for stationary battery storage systems, biofuel production plants and hydrogen filling stations were assessed. All selected energy technologies were largely unknown to the test persons. Financial support for the selected energy technologies is seen positively by most test persons. The most frequently concerns for hydrogen filling stations and stationary battery storage systems are explosion and fire hazards, in the case of biofuel production plants, these are odour and noise pollution; also, if such feared effects like explosion, fire and odour would not occur in a controlled operation. These concerns can be reconsidered by the technology developer in order to improve the technology in this regard, or, if the concerns can be shown to be rather untenable, to find ways for a good and transparent information of society.

In order to better understand the acceptance genesis, key factors should be identified and their influence on the acceptance genesis analysed. Furthermore, the survey cannot be considered as representative and the test sample is rather small. Thus, to gain more robust conclusions, the survey needs a revision in this respect, which is the task of ongoing work.

Acknowledgement:

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