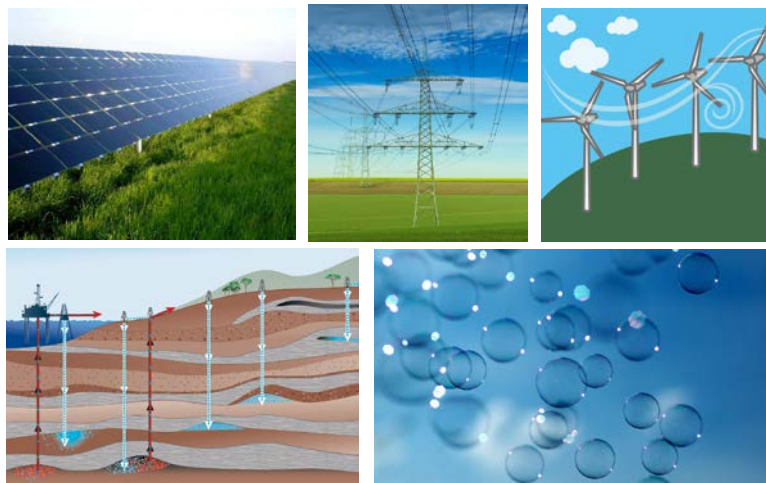


Energy Infrastructure: Public Acceptance

EXECUTIVE SUMMARY REPORT



Webinar on 24 November 2020, organized under the auspices of the
IEA Experts' Group on R&D Priority-setting and Evaluation (EGRD).
Hosted by the Swiss Federal Office of Energy

On 24 November 2020, EGRD organized a webinar on public acceptance of energy infrastructure in cooperation with the Swiss Federal Office of Energy. Transition to a sustainable, clean energy system requires a restructuring of the existing energy system with radical changes in how we produce, transmit, and consume energy. This will only succeed with public engagement. But public engagement goes both ways. Nuclear power has met widespread public opposition and led to the closure of plants in some countries. The large-scale wind power and its transmission face local opposition. The new smart grid is also subject to concerns about security, privacy, and potential health impact. Understanding public perception of and response to new energy technologies can help policy-makers to facilitate better communication with stakeholders and anticipate potential public reactions to new technologies and associated events/accidents.

The webinars, therefore, addressed four factors shaping public perceptions:

1. **Technology** comes with both risks and benefits which are perceived differently by engineers/professionals and the general public. For large-scale energy infrastructure concerns are related to safety, aesthetics, environment, and habitat but also potential benefits such as job creation, tax revenue, and services. For residential technologies such as solar panels, electric vehicles, or smart appliances the perceived advantages and disadvantages compared to standard technologies shape consumer readiness and adoption.
2. **People** or sociodemographic factors such as age, gender, ethnicity, income, and education influence attitudes towards energy technologies. Early adopters of high-cost innovations often have higher levels of income and education while this seems not persistently to be the case regarding large-scale energy infrastructure.
3. **Location** offers different resources (e.g., hydropower, solar, wind), technical potential, and different regulatory and political contexts that influence behavior.
4. **Process** is the key to shape public perception where the decision-making is characterized by

transparency, consultation, and collaboration. Public engagement can be characterized in political terms such as consultation but also in economic terms such as ownership, compensation, etc. Participation may also build trust in institutions and educate the public.

The presentations and discussion focused on the following overall questions:

- What influences public perception of and response to new energy technologies?
- How does information provision influence people's attitudes towards different technologies?
- What are the knowledge gaps in our understanding of public perceptions of energy infrastructures in general and in new energy technologies and systems in particular?
- What can public RD&D programmes do to better facilitate knowledge creation and diffusion related to public perception?

All presentations are available [here](#).

Dr. Rolf Schmitz, of the Swiss Federal Office of Energy, presented welcome remarks and stressed the importance of integration of technical research and social research.

Prof. Gundula Hübner, of MSH Medical School of Hamburg and Martin-Luther-University Halle-Wittenberg, reported research on the social acceptance of wind energy on behalf of the IEA Wind TCP Task 28 Social Acceptance.

A recent survey of neighbors living in the vicinity of wind turbines in the US and Europe found that a large number of neighbors was neutral or positive prior to construction, and positive attitudes increased after construction. A German example indicated that residents who are against the project prior to construction became much more active compared to the ones who were in favor of the project. Important social acceptance and local acceptance factors are the fairness of the planning process, annoyance in terms of noise and landscape. Economic impact on the local level and a positive evaluation of the energy transition on the national and international level are also influential factors. A newly developed annoyance assessment scale (ASScale) allows to reliably characterize stress-impacted individuals living within populations near turbines, combining perceived annoyance and stress symptoms. Objective indicators, such as the distance from the nearest turbine and sound pressure level modeled for each respondent, were not found to be correlated to noise annoyance – as long as the emission regulations were full filled.

The conclusions drawn are (1) To improve the acceptance of projects, reliable energy and climate politics at a larger level are crucial, and to show the indirect benefits for nature protection – besides local benefits. (2) The planning process is important, and the “silent” positive majority should be activated more strongly, allowing positive feelings towards the projects. (3) Strong annoyance assessment standards are strongly recommended to allow for reliable information and comparisons; mitigation measures and the impact on humans should be evaluated. People's stresses should not be neglected, even if it is a small number of strongly annoyed residents.

Recommendations for landscape development through renewable energy infrastructures in Switzerland (ENERGYSCAPE) were presented by **Dr. Ulrike Wissen Hayek**, of ETH Zurich.

How people perceive landscape changes through renewable energy infrastructures influences the social acceptance of these infrastructures. The ENERGYSCAPE project systematically examined in a preference study how the population judges different scenarios in seven character landscapes of Switzerland for a number of different combinations of renewable energy infrastructures (wind energy, photovoltaic (PV), power lines). A laboratory experiment and an online survey were part of this study. The online survey provides representative statements which developments the Swiss population prefers when comparing the character landscapes. The more natural a landscape is, the more negative the judgment of the developments generally is. In a comparison of the landscapes studied, the developments were judged

most positively in the urbanized landscape of the Plateau. Landscape developments with a low to medium level of PV are rated most positively. The least desirable scenarios are those with a high number of energy infrastructures. The laboratory experiment measured emotional reactions, which revealed that the landscape scenarios with a combination of many infrastructures triggered a stronger emotional arousal in the participants than scenarios with few.

In conclusion, (1) the results can foster incorporating the views of the population in spatial planning activities and thus strengthen the basis for strategies for landscape development with renewable energy systems. (2) Current people's perceptions can be captured. Long-term studies are required as the connotations of the landscape and the energy infrastructure can change through time.

Dr. Maik Bohne, researcher in the nationally funded project *Dialogbrücken* in Germany, described the role of municipalities as dialogue bridges between national planning and the local level, referring to transmission system expansion. It is key to implementing Germany's Energiewende.

7,700 km of new power transmission lines are planned or have to be planned, but only 1,800 km are approved or constructed so far. Municipalities are the first addressee for protesting resistance on the local level. There is a dilemma between the national importance of the transmission system expansion, and the municipal level because of little alignment between planning decisions and benefits for the local communities. The goals of the research project are the scientific analysis of the role of municipalities, the identification of factors which drive the behavior of municipalities and the public, and advice for municipalities under the complex process of building trust for planning. Working packages of the project are theoretical foundations, qualitative case studies, a consulting dialogue board, and a representative survey of municipalities in Germany. The case studies will compare different designs. One example is a shared agreement to cooperate with the national, Länder and local levels, and the transmission system providers in the northern part of Germany. In contrast, there is a conflict case in the middle of Germany where municipalities lead the protest and proceeded against transmission system operator in court. For case studies, socio-demographic data, cultural aspects, and narratives will be surveyed through interviews and situational analysis.

Major implication expected is the clarification of tipping points in the course of planning phases which give hints to when public opinion and constellations of trust in key infrastructure projects change locally - and why.

Prof. Kenshi Itaoka, of Kyushu University, explained social acceptance of new technology in Japan, referring to the public survey of CCUS and hydrogen energy.

The public survey on climate mitigation technologies awareness including hydrogen and CCS was introduced. As for Tomakomai, the CCS demonstration site, regional mining history, and intensive public and stakeholder engagement led to successful regional acceptance and implementation. Potentially public are supportive or neutral to CCS as a mitigation portfolio across the nation, however, the negative portion increases when an actual implementation plan is introduced. Potential acceptance of hydrogen infrastructure is relatively good, except hydrogen pipelines, because people feel the benefit to the community. Dominant factors in CCS opinion formation are information trustworthiness and risk perception. Market acceptance is another key for new consumer goods. Consumer preferences on new vehicles purchase would be influenced by the performance and proximity to hydrogen refueling stations.

In summary, (1) Most public is still not aware of CCUS while hydrogen technologies are gaining recognition, and the public does not have negative images of hydrogen and CCUS. A portion of the public is very indifferent to energy and environmental issues. (2) Three aspects of social acceptance of new technologies are related to socio-political, community, and market acceptance. Also, safe operation records of both CCS and hydrogen infrastructure would help sustain good perceptions. (3) Clear policy signals are necessary for large scale CCS deployment and strong incentives for FCVs and refueling infrastructure density.

Key messages issued were:

- **Society** can be defined in many levels such as individual, group, community, municipality, region, and nation. The perceptions of acceptance are interlinked to each other. As a result, the social acceptance level is formed for the specific technology. However, the level itself fluctuates based on the social context of stakeholders. As illustrated in the transmission acceptability study, such linkages across technologies, context, and national/local divide require in-depth analysis.
- **Risk perception** changes acceptance behavior. All presentations discussed acceptance behaviors from different views. Especially, issues on physical risks on wind, cognitive risks on landscape, and economic risks on hydrogen were raised during the presentations.
- **Transparent decision-making processes** are the key to enhance social acceptance of energy technologies. Clear policy goals, early involvement of the public along with open information and outreach activities are crucial. Otherwise, projects or policies will fail, as we observed in past examples.

RD&D recommendations including those from discussions are:

- **Integration of technological and social RD&D**
Sometimes activities of the technological research community and social research community are independent. Dialogues and collaborations are needed during phases of concept, design, research, demonstration, and deployment.
- **Public outreach to increase awareness and dialogues**
Most people are neutral or indifferent to new technologies, but understanding the technologies is not enough. Benefits to the society such as global benefits of climate change mitigation, local community benefit of jobs and investments do impact the perception of the general public. Dialogues among stakeholders, engagement processes, and local identity recreation should be on the political agenda. This is also the case for the national/local divide where benefits are different and coordination is required based on the respective background contexts.
- **Impact assessment of new infrastructures**
Traditional environmental impact assessment is designed for the industrial district, assuming most of the large-scale energy infrastructure location is remote or located in industrial areas. Distributed renewable energy system is subject to an environmental impact assessment which has to take into account the distributed spread within a larger territory, such as nature or an urban environment. Community engagement in the early phase would enhance acceptance. R&D in social acceptance can assist the implementation of new infrastructure.
- **Social media impacts**
Social media is an emerging research topic and research literature is found also in the renewable infrastructure social acceptance issues. It is a new channel of participatory dialogue, in addition to traditional local, regional, and national channels. Communication speed and international diffusion are fast and efficient. This is a large challenging topic for R&D.
- **International RD&D cooperation**
It is especially useful to compare social responses among countries and regions because they have different political, social, cultural, and energy infrastructure backgrounds. We encourage that IEA Technology Collaboration Programmes (TCPs) would include social acceptance issues in their Annex frameworks depending on the resources that can be allocated.