> Shaping Technology Together

Early public involvement based on the example of artificial fotosynthesis

acatech IMPULS – Summary

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DEUTSCHE AKADEMIE DER TECHNIKWISSENSCHAFTEN

How will energy be supplied in the future? Can we manage without scarce fossil fuels? And is there an efficient way of storing renewable energies? The questions relating to the future energy system demand innovative answers. Artificial fotosynthesis is a visionary technology that could make an important contribution to the energy mix. Artificial fotosynthesis follows the example of plants in using sunlight to produce energy-rich hydrocarbons from the raw materials water and CO_2. The energy in these hydrocarbons can be put to direct use as fuel or they can be regarded as chemical raw materials and converted into usable chemicals. Artificial fotosynthesis does not pass via the biomass stage that subsequently requires further conversion or is simply burnt. Another artificial fotosynthesis approach is generating electricity, for example using photovoltaics, and using it for the electrolysis of water to produce energy-rich hydrogen. Both approaches offer numerous opportunities for a sustainable energy revolution. Sunlight is an inexhaustible resource and is available for free the world over. Solar energy can be stored efficiently in chemical compounds. And since the fuels are produced from existing CO_2, no new emissions are generated when they are burnt.

The technology is still at a very early stage of development and the technical possibilities are only just beginning to emerge. It is impossible at present to indicate either its opportunities or its limits with any degree of accuracy. The potential use of genetic engineering or heavy metal catalysts could prove controversial. It would be both scientifically and economically beneficial to know the points of criticism as soon as possible and also the conditions of acceptance. Consequently, the public should be involved in the development of artificial fotosynthesis early on. At the same time, members of the public can help shape the technology and its utilisation at an early stage rather than simply using or being affected by it later on.

Acceptance of technology depends on trust, but people are not given sufficient opportunities to express their wishes, concerns and visions for the future. Scientists, economists and politicians must consider the hopes, fears and opinions of the various social stakeholders and take these seriously. The expert knowledge must be augmented by a layperson's perspective, social values and visions. This is the only way to make sufficiently objective and morally justified decisions about the future. Participation and citizen science are key words in the technical dialogue with members of the public. There is, however, no perfect solution for the required public involvement.

The project "Artificial Fotosynthesis – Developing Technology Futures" provided acatech with some initial experience. Scientists and communication experts entered into dialogue with sections of the public to establish their ideas, ideals and concerns regarding the innovative field of artificial fotosynthesis.

In order to enable interested members of the public to understand artificial fotosynthesis at an early stage in the research, the project group created various "technology futures" as a basis for discussion at dialogue events. This method of communicating technology turns research results into stories describing where the journey might lead and what a possible future may look like, for example with artificial fotosynthesis. They include both society and technology and can take various forms such as scientific predictions, literary or film-based science fiction scenarios or reports in the mass media. The technology futures for artificial fotosynthesis that the project group created for dialogue with

At a glance

- Artificial fotosynthesis is a visionary technology that follows the example of plants in using sunlight to produce energy-rich hydrocarbons or other forms of energy.
- acatech discussed the opportunities and risks of artificial fotosynthesis with sections of the public at an early research stage.
- Interested members of the public were able to help shape utilisation of the technology and incorporate their ideals, ideas and concerns in its further development.
- Dialogue based on technology futures proved successful, but there is no perfect solution for public involvement.

the public focus on micro-algae and duckweed that act as green cell factories producing energy-rich substances, on nanospheres that produce energy-rich methane gas from water and industrial waste gases containing CO_2 in an electrocatalytic process, and on transparent organic solar cells which, when used as construction materials, turn building façades into a power plant generating electricity. At various dialogue events, acatech presented these technology futures to, and discussed them with interested laypersons, students and schoolchildren in the form of stories about the future. The formats ranged from science cafés to a seminar and a comic workshop at which participants used drawings to depict their visions.

In addition to ascertaining participants' ideas and points of criticism, the project group also discovered which aspects of artificial fotosynthesis are seen as opportunities and which as risks. Many participants feared that genetically modified organisms could be released, for example in the event of accidents. As well as questioning aspects such as efficiency and cost-effectiveness, they were also sceptical about the consumption of water and energy and the use of fertilisers but saw the utilisation of industrial waste gases as an opportunity. Organic photovoltaics inspired many to produce original ideas for possible applications.

The technology futures approach proved a success in the dialogue formats. The stories made artificial fotosynthesis accessible to participants, enabled laypersons to understand the technology and served as a starting point for discussions. The organisers faced a dilemma, though. On the one hand, involving members of the public – especially at an early stage in the development of artificial fotosynthesis technology – makes sense if there is still room for manoeuvre. On the other, artificial fotosynthesis is still a relative unknown at this stage of development, the media has not presented it as being controversial to any great extent and it is only of limited relevance to the lives of participants. In the case of complex visionary subject matter such as artificial fotosynthesis, participants' interest first needs to be aroused, for example by using technology futures. The way the subject matter is presented – whether as a comic, in an exhibition, in mass media or packaged in a story – guides the discussion and influences the perception and evaluation.

Conclusion

- Early public involvement in shaping technology is essential in today's society.
- The approach of basing discussion on technology futures has proved successful.
- The general challenges associated with scientific communication need to be taken into consideration.
- New formats should be identified and tested and the media's role should be explored.
- It is recommended that the public also be involved in other areas of technology at an early stage.

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