Factsheet: Creating energy technologies, that are meaningful and usable for all

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How technology developers can contribute to making sustainable energy supply more equal in terms of accessibility to ensure the participation of all.

Technologies are not neutral, but reflect the ideas, values, and perceptions of those who developed them. There is a risk that they are designed without considering the needs and experiences of large parts of the population. This can lead to an exclusionary effect if, for example, the developed technologies require too much technical knowledge or are simply too expensive.

For the development of energy technologies such as "smart home technologies," this implies that developers define "the user" as "a male person who is interested in monitoring energy consumption and prices, understands the language of kWh and energy prices, and responds to incentives and information as if life consisted of 'winning' an energy game. And indeed, the uptake of smart home technologies is much lower than expected by the providers of these technologies, and especially among women," describes Dutch researcher Beukers in her recently published case study as part of the task at hand. (Beukers et al., Gender, expertise and control in Dutch residential smart grid pilots, 2022)

To ensure that future energy strategies take everyone into account, the development process must be designed with a special focus on equal opportunities by means of participatory technology development / design thinking. Diversity plays an important role both on the side of the developing team and on the side of the group of users constantly involved in all four phases of technology development (analysis, concept, development, and introduction phase), so that there is a comprehensive exchange of perspectives. In concrete terms, this means:

1. By continuously involving a group of users as diverse as possible, who differ in terms of gender, age, education, ethnic or cultural background, financial status, impairment, occupation, and technical experience and affinity, diverse perspectives and experiences are introduced with the different life situations.

2. The developing team is multidisciplinary in composition, with creative collaboration on equal footing. The members are sensitized to the unequal distribution of power, influence, and opportunities (social inequality) in society and work to counteract this.

Analysis phase: Identifying needs, empathizing, and observing

The first step is to gather knowledge and information about different users to understand their needs. Different participatory methods such as interviews, surveys, focus groups, observations, and workshops are suitable for this and it can be interesting to ask directly for solutions. It leads to initial ideas for innovative solutions that address a diverse target group. The focus is on questions such as how potential users differ, what they feel, need, or suffer from.

Concept phase: Decisions regarding the development

Based on the previously collected knowledge about different user groups, actual solutions are designed. Various methods can be used to systematically shape the process:

- Card Sorting: In this quick and inexpensive method, test persons sort information into groups that belong together according to them, resulting in a good insight into the mental model of the target group (medium.com/uxness/7-best-card-sorting-tools-6f05780f970a)
- Storyboards: Visualization of a concept (medium.com/@jjman505/how-to-storyboard-an-app-ede5ce249ea5)
- Use Cases: Bundling of possible scenarios in which users interact with the product, resulting in an overall view of the functions of the system to be created (www.pmi.org/learning/library/use-cases-project-manager-know-8262)
- Personas and scenario process: by drawing on key characteristics of possible users, superordinate personas are designed and typical everyday situations (scenarios) are developed in order to assess as closely as possible where and how users will use the new system/product in everyday life (www.interaction-design.org/literature/topics/user-scenarios)

Development phase: Developing, evaluating, and reflecting on the prototype

With the help of experiments involving potential users, a developed prototype is tested and evaluated. Different methods can be used for this, such as:

- Walkthrough: While experts put themselves in the position of hypothetical users, they analyze specified procedures and evaluate user-friendliness. This rapid procedure is inexpensive and can be used at an early stage of development. (economictimes.indiatimes.com/definition/walkthrough)
- Pilot phase: Demonstration phase before the actual launch of the development to observe aspects such as acceptance, economic viability and market potential. (www.west.com/blog/interactive-services/13-benefits-pilot-project/)
- Expert evaluation: Experts analyze the user interface and aim to identify usability problems (www.teced.com/services/usability-testing-and-evaluation/heuristic-evaluation/)
- Usability tests like the Thinking Aloud test: While users interact with a product, they describe their actions in parallel, allowing the usability of a design to be evaluated. Therefore, different aspects of investigation, such as cognitive and unconscious information, can be examined simultaneously. (www.nngroup.com/articles/thinking-aloud-the-1-usability-tool/)

In several loops, the product is adapted, optimized, and tested again based on the experience gained, with it being better adjusted to consumers in each round. With their different insights into diverse realities of life, a diverse test group therefore offers enormous innovation potential for product development.

Introduction phase: Training in utilization and further development of the product

Even if the product is already on the market, further necessary corrections may arise after evaluation of user diaries or accompanying observations. In certain situations, it may also be required to train users. This is the case when

- products must be used appropriately and prudently for the situation, which requires a high degree of sensitivity on the part of users, as is the case in the medical or legal context, for example.
- Inequalities are to be counteracted so that, for example, users with little technical know-how are trained in technical handling so that they can better benefit from the product.

For a process like this, **time and financial resources** have to be calculated in from the beginning. To further illustrate the topic, additional factsheets will be developed as part of the project: **Users TCPs-Annex Empowering all. Gender in policy and implementation for achieving transitions to sustainable energy**.

The basis for this factsheet were the recommendations for action from the study „Digitale Ungleicheit, wie sie entsteht, was sie bewirkt…und was dagegen hilft" (2019), in which ÖGUT was involved.

Further examples of inclusive technology developments are presented by the research programs of the Austrian Research Promotion Agency (FFG): FEMtech research projects and program Laura Bassi 4.0.

The project „IEA UsersTCP: ‚Empowering all' Gender in policy and implementation for achieving transitions to sustainable energy" is being undertaken in the frame of the IEA Research Cooperation on behalf of the Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).

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More information on the project:

- nachhaltigwirtschaften.at/en/iea/technologyprogrammes/users/iea-users-annex-empowering-all.php
- userstcp.org/task/gender-energy-annex/

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