Technologies for energy efficiency and trustworthy autonomy

FORGING

INTRO

Modern societies are dependent on consuming vast amounts of energy. At the same time, there are many huge problems related to our current energy infrastructures, all the way from ecological crisis to a pressing inequality of access. Developing better energy infrastructures and technologies is thus crucial.

Potentials:

- New, sustainable energy forms can revolutionise industry, leading to a zero-carbon path.
- Individuals can take a more active role in their energy use, e.g. by setting up energy communities.
- Technological solutions such as:
  - energy waste can be reduced e.g. by using excess heat that is currently mostly wasted
  - Smart energy grid and energy storages.
- Through financial incentives and taxes, energy use could be steered towards clean energy and lesser energy use in both industrial and individual levels. Carbon market or similar solutions can make clean energy even more profitable alternative

Risks:

- Increasing population most likely equals incresing energy demand.
- Energy scarcity leads to conflicts. Energy can also be weaponised.
- Uneuqal access to electrisity and energy is a persisting form in inequality.
- Some industrial sectors can be very hard to turn into sustainable in their energy use.

1: Research

- With energy technoloies, esearch phase consists of exploration of new potential energy sources and properties of different materials, for example. Ecological and societal considerations should be present already in this stage.

Ecological considerations

- Less harmfull end products and more efficiency: When deciding what to research, the ecological concerns should always be used as a guide. Looking for more ecological alternatives to current energy technologies can take many paths, and at the research state this multitude should be embrased.

Societal considerations

- Aiming for fair energy systems: even thought at this stage the research can seem detached from surrounding society, the seeds of fair and just energy systems are often already laid up.

2: Development of concepts and products

- After new potential energy solutions are recognised, they need to be turned into products that can be used by the public.
- At the moment, for example small scale nuclear power plants are beind conceptualised as potential power sources in many different areas.

Ecological considerations

- Use of rare minerals and materials: Many novel energy solutions demand the use of rare metals, minerals or other materials that can be environmentally harmful to produce. The use of such materials in new solutions should be considered carefully and minimised where possible.

Societal considerations

- Autonomy of users: When developing new energy solutions, it is often possible to give the users more power to choose and impact their own energy use. Empowering end users can be a good choice from both sustainability and marketing points of view.
- Openness of licensing: New, sustainable solutions have far more potential impact, of they can be picked up in different places without expensive licenses. As new solutions are developed, the possibility of open licensing and sharing of solutions should be pondered.

3: Introduction and early implementation

- New energy solutions introduced to the system usually have some sort of friction at first, as they are entering the energy grids. Many new solutions start off-grid in small scale.

Ecological considerations

- Often, as energy is used more efficiently the total energy use will not decrease but there will simply be more usage. When picking up new, more efficient technology, in order to achieve sustainability gains it is important to make sure the savings do not add to energy use elsewhere.

Societal considerations

- Equal access to electricity: as new electricity grids and solutions are built, it should be ensured that electrisity access has the potential of distributing equally, i.e. no areas are left behind.

4: Scaling-up and fine-tuning established technologies

- As new energy solutions turn from niches to important infrastructures, new types of possibilities and potential problems are faced. At the moment for example windmills and solar energy are fastly taking up a bigger role in the energy infrastructure.

Ecological considerations

- Multi-criteria decision making: as new energy technologies are scaled, their impact on multiple different environmental issues should be considered. Solutions that are good for carbon balance, such as the use of biomass, can be harmful for other matters, such as biodiversity, if they are scaled up too much.
- Problems possibly arising with volume: in small scale, many solutions can have no negative effects, but with scale their waste, burning product or some other part of the process might become problematic. For example, burning oil was not harmful before it was scaled accross the globe in bigger scale. These issues should be looked for and there should be an option not to scale a certain solution too much, if it is necessary.

Societal considerations

- Fairness for local communities: As new distributed energy solutions are build, it should be ensured the processes are fair for the local communities near the production sites. They should also be engaged in the planning phase.
- Security concers: As modern societies are very dependent on electricity, energy production is a potential target when seeking to disturb societies. Therefore, when speaking of nationally important energy forms, security threads need to be taken seriously and production secured accordingly.

The FORGING Consortium

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