System integration

Coupling the electricity sector with other large consumer sectors, such as heat and mobility, using modern algorithms creates the stability of the grid. The success of the world’s energy grid in the future will depend on:
- a system integration of the various energy technologies and sectors, including
  - more dynamic control and regulation in the decentralized networked communication structure.

In order to technologically control the renewable energies, it is necessary to have suitable coordination of flora and fauna and also the reduction of the wind turbines’ light and noise emissions.

Energy storage systems

The higher flexibility of electricity generation and generation must be supported in order to secure the renewable energies by efficient energy storage systems, especially:
- short-term load and generation fluctuations can be exactly absorbed.
- the economic efficiency of wind energy can be maximally utilized.

The necessary synchronisation of consumption and generation must be supported in the electricity grids with an increasing share of renewable energies by way of efficient energy storage systems, so that:
- increased wind turbine efficiency and generation capacity can be achieved.
- grid stability can be achieved for innovative capacities that are beneficial to the grid.

The X-Energy project supports this change through three areas of research: wind energy, system integration, and energy storage systems. These topics are of particular importance for the expansion of renewable energy. In the X-Energy project, three research areas are directed at the three areas of action: “environment and acceptance”, “innovative renewable energy generation”, and “sector coupling”.

In doing so, HAW Hamburg would like to
- strategically design sub-control circuits.
- systematically evaluate the system components, as well as learning and predictive regulations.
- increase wind turbine efficiency and generation capacity, and also
- adjust wind turbines for innovative capacities that are beneficial to the grid.

In order to promote societal acceptance of wind energy, it becomes more and more necessary to find innovations that improve the environment. Furthermore, by example the protection of flora and fauna and also the reduction of the wind turbines’ light and noise emissions.

By way of the interdisciplinary X-Energy project initiated, the University of Applied Sciences Hamburg (HAW Hamburg) wants to become a leading innovation centre in the development of solutions to future-proof the energy system and therefore also wants to become an important innovator drive in the meeting place Hamburg. In the context of the X-Energy, a network of regional and national business partnerships with numerous individual projects is established.

In doing so, HAW Hamburg wants to
- become an impulse generator for excellent research.
- promote a successful transfer of knowledge and
- be a driving force in innovative products and services.

In this regard, Hamburg’s projects within the collaboration in X-Energy are specifically designed so that the projects are materially connected. The goal is to create holistic, interrelated results, products, procedures and services that combine scientific teaching and transfer knowledge within the partner circle.
The Competence Center for Renewable Energy and Energy Efficiency (CC4E) is dedicated to the research and development of innovative solutions for energy efficiency and renewable energy systems. The center’s focus is on wind, solar, and geothermal energy generation, as well as energy storage and conversion technologies. The CC4E is a platform for interdisciplinary collaboration between academia and industry, aiming to foster technology transfer and commercialization of innovative energy solutions.

**About the Competence Center for Renewable Energy and Energy Efficiency (CC4E)**

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**X-Rotor**

Electricity generation costs must be further reduced in order to increase the number of wind turbines. For this purpose, innovative concepts regarding wind power generation onshore and offshore are being developed. The target is to improve the efficiency of wind turbines and reduce their impact on the environment.

**VIBROAUSTIC**

The goal is to develop a cost-effective, sustainable, and efficient method to produce hydrogen from water using renewable energy sources. The technology is based on the direct conversion of solar energy to hydrogen, thereby minimizing the environmental impact of energy production.

**Innovation in Wind Turbines**

The goal is to research the electromethanogenesis, the direct biogenic synthesis of hydrocarbons from carbon dioxide and water using renewable energy sources. The technology is based on the direct conversion of solar energy to hydrogen, thereby minimizing the environmental impact of energy production.

**READi-PtL (Power to Liquid)**

Using the two-stage READi-PtL process, the industrial conversion of renewable electricity into sustainable liquid fuels is achieved. The technology is based on the direct conversion of solar energy to hydrogen, thereby minimizing the environmental impact of energy production.

**Projects**

- **Project management**
  - Prof. Dr.-Ing. Thomas Willner
  - Prof. Dr. Hiroshi Takenaka
  - Prof. Dr.-Ing. Birgit Wendholt
- **Team**
  - Prof. Dr. rer. nat. Rasmus Rettig
  - Prof. Dr. Dipl.-Ing. Peter Dalhoff
- **Outlook**
  - Prof. Dr. Dr.-Ing. Thomas Netzel
  - Prof. Dr.-Ing. Friedrich Ueberle

**Contact**

Mike Blicker
CC4E Energy und Energy Efficiency (CC4E)

**Location**

Energy Campus of the CC4E

**Website**

www.cc4e.de

**Energy Storage Systems**

- **Electric grid**
- **Heating grid**
- **Battery storage systems**
- **Energy bunker**