System Analysis of the Energy Transition in One Region of North Rhine-Westphalia

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Motivation

- The **share of renewable energies in gross electricity generation** in **Germany,** North Rhine-Westphalia (**NRW**), in **2024** was **19.73%** or **24,40 GWh** (State Agency for Nature, Environment and Climate NRW).
- According to Statista **2020**, energy-related carbon dioxide emissions in **NRW** amounted to **10.50 t CO_2 per capita**. According to the German Federal Climate Protection Act, greenhouse gas emissions must be gradually reduced, with **carbon emissions neutrality** set to be achieved **by 2045**.
- With the German Bundestag's resolution of 3 July 2020 **to end coal-fired power generation by 2038**, the Structural Reinforcement Act for Mining Regions was adopted.
- The Coal Regions Investment Act stipulates that the federal government will provide **structural aid for locations that must end** their use of **coal-fired electricity generation**.
- The German **districts Warendorf**, **Unna**, **Soest**, and the district-free **city Hamm** belong to these selected locations.
- According to the Energy Atlas NRW **2025**, the **potential electricity yields from wind and solar energies** at these four locations are shown in Figure 1.

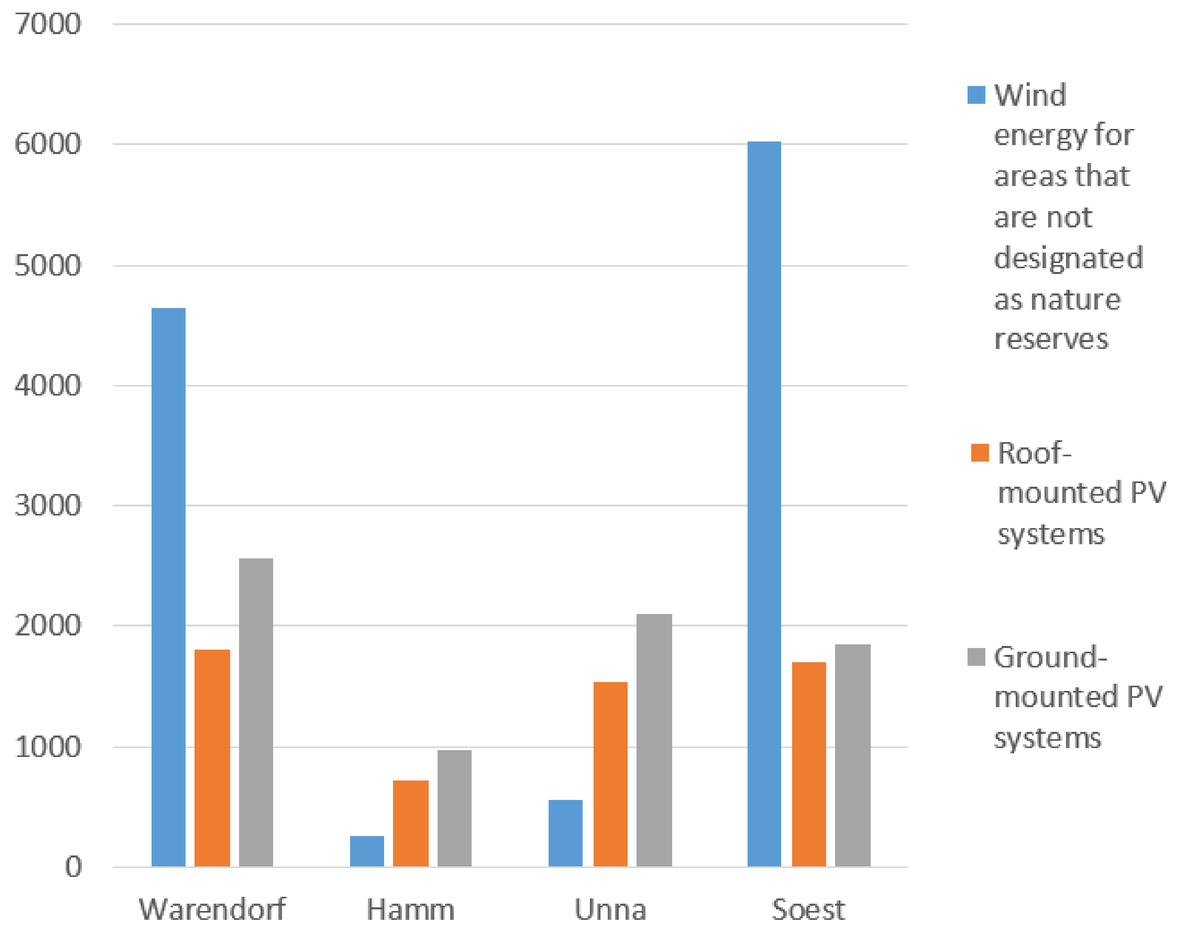

Figure 1. Potential electricity yields in GWh/a

Project

- **'Sector Coupling Workbench'** ("Werkbank Sektorenkopplung") **project** is funded **since 2024** by the German Federal Ministry for Economic Affairs and Energy by resolution of the German Bundestag and through the "5-StandorteProgramm" of the Ministry of Economic Affairs, Industry, Climate Action, and Energy of NRW.
- The project aims to **transfer knowledge on sector coupling** by linking the energy sectors of electricity generation, (process) heat or cooling, mobility, and hydrogen in an intelligent way (see Figure 2).
- **User groups**: Citizens, small & medium-sized enterprises, craft businesses, energy suppliers, pupils, inter alia.
- The **project team** consists of 14 specialists, including engineers, scientists, media computer scientists, educators, social scientists, business economists, and two project managers.
- The project lasts **until the end of 2027**.

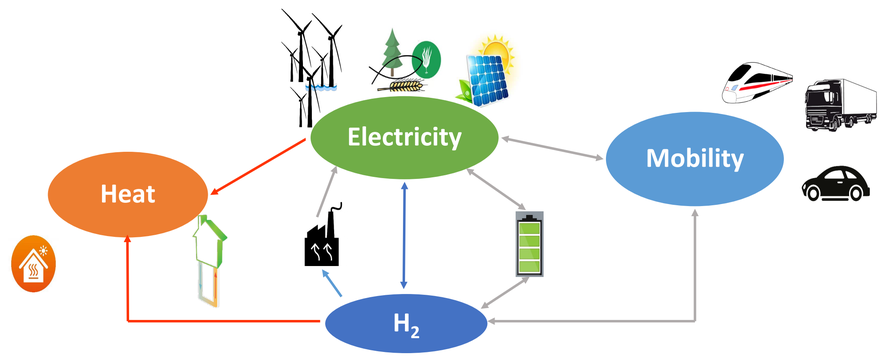

Figure 2. Sector coupling concept

Activities

- **'Heat Pump Check'** is an initiative to assess the **suitability** of houses **for the use of heat pumps**. In 2024 / 2025, the campaign took place for existing **single-family houses**. Currently, there is an ongoing campaign for **multi-family residential buildings**.
- Projects **for rural inns and manufacturing companies** to help them to apply sector coupling for energy transition were carried out.
- A social study on the **acceptance of electric mobility** among **taxi companies** was conducted.
- **'Experience Lab'** is a combination of projects and activities (see Figure 3). It focuses primarily on disseminating information regarding energy transition, using innovative approaches like **gamification** and **extended reality (VR and AR)**. Schoolchildren are the main user group.
- 'Fair E-Charging Infrastructure' is a project to develop a **concept for equitable electric charging infrastructure** in **multi-party rental buildings**, taking into account the interests of all user groups.
- There are **ongoing activities to develop digital twins** for a sorption heat storage demonstrator and for a water-water heat pump.
- In the village of Drensteinfurt-Walstedde (population 3200), a **survey** was conducted among **800 households** to determine their **interest and willingness** to participate **in a local heating network** to be built and operated by a local citizen energy cooperative.
- **Podcasts on the potential of sector coupling** for a successful energy transition.
- **Open lecture** "Germany After the Election – What Course Does the Energy Industry Need to Set Now?" ("Deutschland nach der Wahl - Welche Weicheenstellungen die Energiewirtschaft jetzt braucht").
- **Book publication**, "Digitalization and Climate Change – Business Models and Services", in: Böttcher, Jörg (ed.), pp. 641–671.
- **Project newsletter**: https://werkbanksektorenkopplung.de/newsletter/

Figure 3. 'Experience Lab' activities

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WERKBANK Sektorenkopplung
IfSK Institut für Sektorenkopplung in der Energiewende
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