Federal Ministry
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An Initiative of the Federal Ministry of Education and Research
GRoW
WATER AS A GLOBAL RESOURCE

WANDEL – How Do Available Water Resources Impact the Energy Transition?

Water as a Global Resource (GRoW)

The energy and water sectors are inextricably linked. Water is needed for cooling purposes in power generation and the water supply system requires energy for pumping, for instance. The United Nations' Sustainable Development Goals (SDGs) include goals for both water and energy: SDG 6 focuses on "Clean Water and Sanitation", while SDG 7 aims to achieve "Affordable and Clean Energy". Due to the interdependency of the sectors, the energy transition can trigger conflict between these two SDGs, if renewable energy systems consume more water than conventional systems, for example. But the reverse is also true, with there being a potential for synergies between these two goals. The joint research project WANDEL seeks to explore whether and how water availability advances the development and use of renewable energy systems regionally and globally as well as how these energy systems impact the water resources.

The Water Footprint of Energy Systems

Energy generation from renewable sources often requires less water than energy from fossil fuels. Nevertheless, certain renewable energy systems, such as solar thermal power plants in regions with scarce water resources, for example, can result in conflict with other water utilization requirements and hamper the continued development of renewable energy.

A key component of the analyses conducted within the WANDEL project is the water footprint concept. It includes every process along the energy supply chain that requires water, whether direct water consumption at the power station site or indirect consumption, for example if copper is imported for the construction of a plant and water is required to extract this raw material in the export country. Further, it is not only the individual instances of water consumption that are important but also their impact on the respective water resources: it is just as important to factor pollution into the evaluation as it is to take the removal of water into account. A key consideration here is also whether water resources in a respective region are abundant or rather scarce. This analysis is underpinned by an evaluation scheme which is based on case-specific environmental sustainability studies.

Gundelfingen power plant on the Danube. Here, river barrages are used to produce electricity.

For the first time, this enables project researchers not only to analyze the effects of energy generation at the local and regional level but also to assess far-distance impacts on other regions around the world, taking water availability into consideration. The current situation is critical: recent studies on global water availability indicate that water in certain regions could become increasingly scarce in the future. Climate change might exacerbate this situation.

Detailed Analyses for Four Case Studies

The project presents detailed analyses for four case studies, involving regional stakeholders in the process: In the Upper and Middle Weser catchment in Germany, power is generated using conventional coal-fired plants, while the Upper Danube case study focuses on hydroelectric power generation. In the Drâa Valley in Morocco, a solar thermal power station already exists and two more are under construction. In the case study for the Dos Patos River area in Brazil, biomass from sugar cane is converted into power.

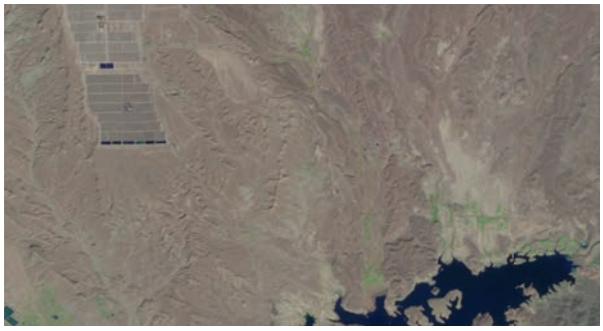
In the Weser case study, the WANDEL project is looking at the impact the decision to replace thermal power

plants with other energy sources has on Germany's energy transition. In the case of the hydroelectric power plants on the Danube, the aim is to optimize energy generation by factoring in other utilization interests such as environmental protection. In the Morocco case study, the focus is on reducing water consumption in light of rapidly advancing social and economic development. And, lastly, at the Dos Patos River in Brazil, the primary interest of the project partners is how to use the available water resources more efficiently.

Using a Global Approach to Identify Regional Hotspots

Not only are project partners seeking to identify particularly water-intensive process steps along energy supply chains. They also aim to identify areas around the world where there is potential for conflict between the goals of water resource protection and energy generation systems. In the WANDEL project, global spatial analyses are supported by remote sensing technologies and computerbased geo information systems and the findings are presented visually. The spectrum of energy systems covered by the case studies as well as the range of climatic and economic conditions in the regions investigated also enable the transfer of project findings to other catchment areas with similar conditions.

In cooperation with regional partners, the researchers are developing innovative and dedicated technical and governance solutions tailored to each region, designed to help reduce or even prevent conflict between the two sustainability goals for water and energy. Here, legal and regulatory requirements play a role, as do the water consumption of different technologies, and energy and land use scenarios.



Satellite image of the Noor solar thermal power plant in the Drâa Valley in Morocco. The solar panels can be seen in the top left of the picture.

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