Blueprint for Germany’s energy transition

Prof. Dr Werner Beba, head of the Competence Centre for Renewable Energies and Energy Efficiency (CC4E) at the HAW Hamburg, explains the ways in which the world can learn from the Hamburg/Schleswig-Holstein model region when it comes to mastering the energy transition.

Professor Beba, with the NEW 4.0 project initiative you are focussing on the Hamburg/ Schleswig-Holstein region. Why are these two federal states in the north of Germany particularly suited as a showcase for Germany’s energy transition?

Werner Beba: With 4.5 million inhabitants and 36,000 renewable energy generating plants, Schleswig-Holstein constitutes a major production region, and with large industrial enterprises, Hamburg constitutes a large heavy duty area with very pronounced disparities. Merging these two regions into one model region enables us to actually represent all of the challenges associated with the energy transition. In purely arithmetical terms, the model region generates about 40% of its electricity demands from renewable sources, which means that we have met the targets set for Germany for the year 2025 even at this stage. Basically, this means that the model region is approximately ten years ahead of the overall transition process. Therefore it is an ideal prototype for demonstrating ways of mastering the energy transition in the coming years.

You have mentioned imbalances in the generation and load situation. Energy-intensive companies repeatedly point to the need for reliable and cost-effective energy supplies. How are you planning to meet this basic need of industry?

Beba: With Trimet, Aurubis and ArcelorMittal we have Hamburg’s three largest energy-consuming enterprises on board of the project. Together, they consume about 25 percent of Hamburg's electricity demands, which amounts to 12 billion kilowatt hours annually. As “load management flexibility partners”, industrial companies will play an important role in the project. By analysing the relevant production processes, we may be able to use surplus electricity whenever it is accrued in the grid. Optimised load management holds considerable potential for the successful implementation of the energy transition. Such synchronisation of production and consumption is one of the core tasks on the way to innovating the energy system.

What are the project objectives you are aiming for, and what is the main issue in implementing the energy transition?

Beba: The NEW 4.0 project is aimed at providing the model region with a 70 percent share of renewable energies via a safe and stable supply system by 2025. This means that we will be able to save about 50 percent of CO2 emissions by 2025. What is more, we are aiming to achieve a 100 percent coverage by 2035. To achieve this, we need a flexible, intelligent energy system that is highly innovative. However, system stability means e.g. that we keep the power network frequency at 50 Hertz. If the frequency varies by more than 0.2 Hertz, the grid operator needs to intervene and reduce the output at the generating plants or balance out the frequency with

additional reserve capacities, respectively. With the expansion of weather-dependent renewable energy sources, fluctuations, and thus interventions, are increasing – which means that we need solutions for balancing out the stability of the system.

This sounds rather technical, and yet the political debate on the challenges of the energy transition is often reduced to issues such as network expansion and new storage options. What is your strategy in this regard?

Beba: We have developed a dual strategy: on the one hand, we need to increase electricity exports to the European grid and improve the technological use of the existing infrastructure through sensible storage solutions and intelligent data communications. Network expansion is a part of this. However, it will not be possible to level out the extreme disparities between production and consumption by means of network expansion alone. Therefore, we are also aiming to align the energy mix with regional supply and demand patterns. On the other hand, industrial processes are often operated on gas. To the extent possible, we want to replace this with renewable electricity. We refer to this as sector coupling, i.e. linking up the electricity and heat sectors. Storage technologies are another important component here. We need flexible short-term memories that are able to compensate frequency fluctuations within seconds or minutes and restore system stability. What is more, we are going to increase the intelligence of wind farms in order to better respond to fluctuating network demands. Alongside these technological measures we are going to create local market incentives for network operators, plant operators and industrial enterprises for this flexible system to work. This means that we need to achieve system security by means of various components while combining a range of different technologies.

Will you be able to build on existing structures in the context of this project, and if so, which of the pilot projects will be integrated into the NEW 4.0 project initiative?

Beba: We will indeed build on existing structures and various preceding projects. As part of the overall venture we will be coordinating a total of 101 individual projects. The partners of our Innovation Alliance will be developing projects aimed at improving flexibility, load transfer and storage. For example, with power-to-heat plants we are able to convert electricity into heat and feed it into Hamburg's district heating grid. Battery storage facilities are already existent on a smaller scale on the wind farms. Now we are planning to connect larger areas to electrical energy storage systems. The novelty of our venture lies in merging all these components via communication and network technologies and operating it under the roof of one overall system, which is yet unprecedented.

While electromobility has long been regarded as a promising storage option, registration figures are far short of expectations. So what is the role of the transport sector within the project?

Beba: To be quite honest, electromobility will only play a minor role in the project, since it is a large-scale reality test. That said, when it comes to the traffic sector, Hamburger Hochbahn is highly innovative in testing alternative drives and fuels, and they are planning to expand their

hydrogen vehicle fleet considerably. Excess renewable electricity for industrial applications and the conversion of mobility into hydrogen are among our core topics. Thus, the energy transition will also have positive effects on local public transport. We will take this into account in the course of the project.

The project involves around 60 partners with quite different fields of expertise. You are expecting innovative ideas from industry. Could you tell us which other areas are likely to swiftly develop possible solutions?

Beba: Well, the most exciting task in the context of our project is indeed the question of how to connect the various stakeholders involved in the energy system and how to facilitate the exchange of information regarding network conditions and energy consumption in real time. During the project development phase we therefore established the ICT Working Group, which is to develop the relevant communication technology and the exchange of data between the different stakeholders. Even at this stage we have achieved some initial successes by getting network operators, industrial enterprises and IT service providers round a table to disclose their individual problems and challenges and to collaborate in order to develop conceptual solutions. Beyond the ICT sector, I am also expecting swift solutions in the area of load management.

In what ways can these solutions be put into practice?

Beba: We have a strong utilisation cascade, and for each of the working groups we have defined potential outcomes in the form of targets. We will continuously monitor which of the technological solutions have proven successful. In the area of markets and market regulation we will experiment with different market mechanisms and share the results with the Federal Ministry for Economic Affairs, the Federal Network Agency or the state governments as a means of introducing viable solutions in the regulatory framework and legislation. The companies involved will ultimately develop concrete tools and products and launch these on the market. What we need is a blueprint for the energy transition that presents businesses and the broader public in Germany and Europe with transferable solutions.

In the international community, Germany's energy transition is monitored with quite a critical eye. In your opinion, what can the world learn from the model region?

Beba: At this point in time it is most crucial and important to demonstrate the feasibility of the energy transition. Quite frankly, I don't know how the target of 1.5° C agreed in Paris can be achieved in the absence of a global energy revolution. On a global scale, the North German Energy Transition 4.0 might be a very small project, but it can certainly provide solutions for a European and global context. Just consider those large energy-intensive industrial companies. If we manage to increase efficiency through new energy-saving solutions emerging from our project, this could trigger a tremendous leveraging effect for global enterprises.

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Further information available at www.new4-0.de

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