The man who set forth to capture the wind

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By Dorothee Bürkle

Holger Hennings was one of the first people to show an interest in wind power. He followed the failure of the large Growian science project and saw how wind power turbines went on to become a surprising success. Today, Hennings works at the DLR site in Göttingen, making wind power turbines safer and more efficient to operate.

Holger Hennings - a man with a feel for wind and science

"I have had a feel for wind and water since I was a child. I grew up in Dithmarschen on the coast of the North Sea, 11 kilometres from the dyke." At first glance, Holger Hennings is a quiet, contemplative man, who likes the open, unbroken landscape of north Germany. From the age of nine he had the North Sea wind in his sails and has loved the interplay between wind and water. Generating electricity from power in the air caught his interest at 14. During a holiday on Sylt in 1976, he discovered aircraft construction engineer Hans-Dietrich Goslich's pioneering equipment. "That was the spark - a unit with a counter-rotating rotor - still a technical challenge today," recalls the qualified mechanical engineer with accuracy. Hennings sought out literature on wind power turbines and devoured the few books available at the time on the subject of renewable energies.

Pioneer spirit and shattered dreams

At the same time - at the end of the seventies - scientists at the research centre in Jülich were planning the construction of Growian ("GROss-WIndANlage"), the large wind turbine, under the leadership of the German Federal Ministry of Research - a response to the oil price shock in the early 1970s. In 1983, at the Kaiser-Wilhelm-Koog in Dithmarschen, with its 100.4-metre-diameter rotor and three megawatt nominal output, Growian was the largest wind energy facility in operation in the world. However, it was very soon apparent that a facility of this size could not be controlled using the technology of the day. Growian did not once achieve sustained test operation and was ultimately more of an argument against the use of wind energy.

But not all the pioneers or those involved were discouraged, recalls Hennings. At that time a couple of mechanical engineering companies were manufacturing wind energy turbines in manageable dimensions, including MAN (Maschinenfabrik Augsburg-Nürnberg). In parallel with Growian, the company was developing AeroMAN, a significantly smaller machine with a rotor diameter of 12 metres, of which several hundred examples had been built worldwide and were being operated successfully.

By the time he left school at 18 and was training to be a machine fitter, Hennings was part of a small group of wind power enthusiasts. "They were pioneers, and numerous experiments were conducted." This circle was very straightforward at the time; you could become personally acquainted with the 10 facilities that were then in operation in Germany. "Wind energy projects were being operated in a niche, and many of their supporters came from the ecology scene." Hennings describes the feeling among the wind pioneers as a cautious spirit of optimism: "All those involved were sure that significant amounts of power could be generated with wind. On the grid operator side, however, there were concerns that instabilities could occur if as much as three percent wind energy was fed into the network."

Hennings followed developments closely. In 1983, a farmer in Cecilienkoog in North Frisia purchased a facility belonging to Danish wind power turbine manufacturer Vesta and became the first private producer of wind energy to feed into the Schleswig-Holstein network. It was a

milestone. "Of course, in the 1980s, it wasn't at all obvious to those involved that there would be the kind of explosive development that we have seen since then."

Holger Hennings studied mechanical engineering at the TU Braunschweig and attended a lecture on aeroelasticity by professor Försching from DLR Göttingen. By 1990, he had completed his thesis on the subject of vibration in wind power facilities at the Institute of Aeroelasticity. In doing so, he spent four months in the university city at DLR. As rooms there are hard to come by, DLR offers its graduates accommodation on the DLR campus itself, with the ‘tower room’ on the first floor, the shower in the cellar, and the toilet in the hallway. Hennings enjoyed the freedom that the research and the proximity to his place of work offered. "It was the most efficient period of my life. It was really interesting to get so much motivation and help from experienced scientists. I applied new computer processes in fluctuation science involving data from wind facilities that I had previously only approximately understood in theory."

At the same time, DLR terminated its involvement in wind energy research. Nevertheless, Hennings decided to stay at DLR Göttingen and continue working on aeroelasticity, where he was part of the group investigating the aeroelasticity of turbo machines. After gaining a doctorate in the field, he later held the position of Head of Department of aeroelastic experiments at the Institute and, since 2012, Head of Department of Aeroelastic Simulation.

"I have learnt a great deal about structural dynamics, unsteady aerodynamics and aeroelasticity, and how to model them, and I have continually received new input from experienced colleagues," he says, looking back on his two decades at DLR. He wants to pass on this experience of intensive exchange to his younger colleagues and enjoys the culture of debate that has been established in front of the blackboard and around the tables in the coffee kitchen. His family - his wife and three daughters - also make him happy. Like him, they find the environment in Göttingen ideal to live in.

Holger Hennings has continued to follow events in wind energy and travels to meetings and conferences in his spare time. In 1990, three years after the demolition of Growian, there was a lively debate in the wind energy community about a law on the sale of electricity to the grid. This was passed in the same year by the federal government of the day, and came into force on 1 January 1991. "This law, which was a forerunner of the Renewable Energies Act, meant guaranteed current pick-up for a set price for operators of wind power turbines for the first time. This was the critical breakthrough," recalls Hennings. The energy suppliers had to pay 16.61 pfennigs for each kilowatt hour of wind power fed in. Investors and entrepreneurs in the wind energy sector finally achieved a degree of planning certainty with this law. Among these was Aloys Wobben, who had started to construct wind facilities in 1984, working part-time in his garage. Today the company he founded, Enercon, is among the top five in the world with a turnover in the range of billions.

Expertise from aviation for wind energy projects

Nowadays, wind energy provides over 10 percent of the net energy consumed in Germany, and Holger Hennings is now attending meetings and conferences in a professional capacity. In 2012, DLR started researching wind energy once again. The Institute and Holger Hennings' department are involved in these research projects, because scientists can transfer a great deal of knowledge from aviation research to wind energy research in the field of aeroelasticity. At the age of 50, Hennings still wants to be a wind energy researcher. "What is different for us about this research area, and what also makes it attractive to collaborative partners, is our expertise and the useful tools from aviation?"

In a video from 1987 that focused on lightweight turbines and left an impression on him, Holger Hennings remembers how important a profound understanding of aeroelasticity is. At first, the facility runs smoothly and you can see how the rotor is turning. But then one rotor blade in the unit fails between one frame and the next. "At the time, this meant that the turbine had a stability problem. When I look at the video today, it's obvious: it was flutter. But clearly, that was still not properly understood at the time."

Understanding and improving are what motivates the engineer in wind energy research and in aviation. As head of the department of aeroelastic simulation, Hennings mainly investigates flutter in helicopter rotors. Flutter is a mechanism whereby blade vibration is increased by movement-induced aerodynamic forces; in extreme cases, so much so that the rotor blade breaks. With his experience of helicopter rotors, the engineer can now simulate the vibration behaviour of large rotor blades. "In today's wind turbines, a rotor blade breakage through flutter is impossible. But the trend is towards larger, leaner turbines. With these, the manufacturers must take into account that such phenomena will start occurring again." In his field of

aeroelasticity, Hennings is investigating how a rotor blade vibrates both experimentally and digitally. As an aerodynamicist, he also observes which aerodynamic movements are induced through the rotor blade. "In order to understand flutter correctly, you need precise knowledge of the complex processes of structural dynamics and aerodynamics. If we want to prevent the occurrence of flutter, we need to change at least one of the two complex processes on the rotor blade."

In Hennings' opinion, the turbine manufacturers are still apart from the ideal rotor blade. Like most experts, he believes that rotor blades will be lighter and be able to use active elements to adapt to the wind in future. "However, active elements in the rotor blade also mean more maintenance work, and they do not reduce the risk of flutter," he warns. He still sees a need for a great deal more research here.

"Perhaps I've missed a trick, especially when you see how companies of pioneering individuals always become bigger and better," says Hennings retrospectively. As an engineer, he is an analytical person and has already considered this: "But it's not a major problem for me. In my field I've worked with many inspiring scientists and have been able to introduce new approaches and implement ideas of my own." And now he can pass on his experience and knowledge to an inquisitive and receptive new environment.

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Holger Hennings

Holger Hennings has had a feel for wind and water since he was a child in Dithmarschen in northern Germany. Understanding wind energy turbines better and improving them is what still motivates the engineer.

Wind turbines in the USA

Keeping wind turbines in mind; in 1989, Holger Hennings recorded the construction of a wind farm with his camera.

Credit: DLR (CC-BY 3.0).

Advanced training in wind energy in 1984

Seminar participants in Vlotho test a converted light flux machine.

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DEBRA 25

Wind power turbine DEBRA 25 in the Ulrich Hütter test field in Stötten/Schnittlingen. It was assembled and erected on 13 July 1984. Image: Jan Oelker.

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Debate culture at the Institute of Aeroelasticity

Holger Hennings places great store on intensive exchanges with younger colleagues.

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