



A common language for the energy system of the future

New developments are driving forward change in the energy system. The innovations create new processes, interfaces and routines. However, too much diversity would mean that the parts could no longer communicate with each other. That is why the Deutsches Institut für Normung (German Institute for Standardisation, DIN) has created three DIN specifications (DIN SPECs) as part of WindNODE. They are the first step towards a common language for the digitalised, renewable energy industry of the future.

In terms of heating, insulation and CO₂ emissions, the conventional energy certificate still conceives of buildings as they were in the old days of big power plants and oil-fired boilers. All that matters is how much energy a building requires. “But when the house uses this energy and whether the consumption can be postponed to another time aren’t taken into account,” explains Sönke Nissen, Project Manager Innovation at DIN. This is because in the traditional energy landscape there was no need for this information.

As soon as a new technology becomes more widespread, institutions such as DIN, the European Committee for Standardization (CEN) and the International Organization for Standardization (ISO) get to work on defining common terms and standards, otherwise nowadays cars could not be manufactured in German automotive plants with screws made in China, the internet would not work across borders because of the need to switch to a different code, and every country would have its own frequency on the power grid. The standardisation of products and processes is the logical result of industrialisation and globalisation. The first standards date back to before 1800. Today, they are everywhere and so we no longer even notice them.

Nissen’s innovation department at DIN collaborates on national and European research projects with a view to immediately plugging the gaps that are being opened up all the time by technological progress.

In the energy industry, the challenge is to develop a common language as early as possible, whether to ensure the networking of sectors, to deal with the constantly growing number of new market players and generation systems, or to bring about the integration of other applications such as smart meters or storage facilities. In this way, innovations can be marketed as quickly as possible.

The energy certificate that is valid today has its origins in a standard that was developed from around the early 2000s: DIN V 18599. “With the gas and oil heating installations of that time, the energy system didn’t need to know when the units were in operation,” Nissen explains. That is why such issues were not covered by the standard.

But times have changed: most new detached houses in Germany already have heat pumps, while 1.7 million buildings across the country have solar panels on their roofs, and many have large hot-water storage tanks. Moreover, local heat networks are increasingly taking over the role of supplying entire neighbour-

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hoods. At the same time, large wind farms are supplying electricity when the wind is strong enough. Unlike in the past, today’s energy supply fluctuates over time.

Energy consumption: timing matters

In this new energy landscape, it matters not only how much energy a home uses but also when the solar installation generates electricity, or when a hot-water boiler using an electric heating cartridge can consume electricity (at times when there is a surplus on the grid). Such temporal flexibility can now be found in many technical installations, whether in neighbourhoods, in cooling systems or in industry.

“If we are to shape the new era, then we need standards and norms for flexible energy systems,” says Nissen. “There are theoretically hundreds of approaches you can take to networking flexibility solutions with one another. But if every sector speaks a different language, the system as a whole just won’t work.” Standards are supposed to change that.

Therefore, within WindNODE, DIN and partners from the various projects drew up DIN SPECS, standards that are devised by fairly small, informal groups of experts and that can subsequently serve as precursors to binding norms. “A DIN SPEC comes about in a relatively short time. In particular in the case of rapid technical change, the DIN SPEC helps to ensure that various new solutions are subject to similar framework conditions and a common language at an early stage,” Nissen explains.

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Overview of more than 500 existing standards

The process starts with researching the standards that already exist – and there are a lot of those. Nissen’s list of all the relevant standards contains 528 entries. From DIN V 44570-60531 (Household electric thermal storage room heaters) to VDI 2164 (PCM [i.e. phase-change material] energy storage systems in building services) and ISO/IEC 13273, which sets out common international terminology for energy efficiency and renewable energy sources.

Another of these existing standards is DIN V 18599 for assessing the energy efficiency of buildings, and therefore their energy certificate. “That standard is crucial for decisions on whether to provide financial assistance for new buildings and renovations, because support from the State is largely based on energy efficiency,” explains Simon Hinterholzer, who is in charge of the development of DIN SPEC 91410-2, relating to the identification and assessment of flexibility in urban neighbourhoods, at the Borderstep Institute for Innovation and Sustainability in Berlin. In the future, this new DIN SPEC could see the flexibility of buildings join the set of criteria for building funding, or allow operators of virtual power plants to get a quick overview of the flexibility a building can deliver.

Laying down the requirements for the technology

In the case of heat pumps, the standard currently involves questions about, for example, what their output is, how quickly they can be activated, what a hot-water boiler’s storage volume is and the temperature limits within which the heat pump may heat the water boiler. As well as such technical criteria, there are queries about organisational arrangements. When is the heat pump available? Is it used for space heating or hot water? And last but not least, how can you access the installation from outside (via internet protocol)? Or does a smart meter already exist for reading out consumption values? The DIN SPEC also reels off similar questions for battery storage facilities and charging stations for electric cars.

“If such flexibility is needed on the electricity market in a few years’ time, then the electricity supplier or anybody combining decentralised storage facilities into a virtual power plant will be able to see at a glance whether this building can be meaningfully integrated,” explains Hinterholzer. Furthermore, the State could set the flexibility criteria the building services must meet to be eligible.

Reality check on existing projects

For the DIN SPEC to pass its reality check, the ‘flexibility properties’ specified there were checked in the field, specifically by looking at 13 houses in

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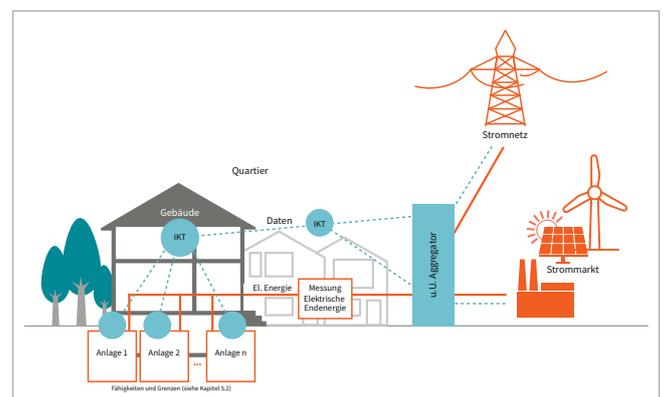
Schleswig-Holstein, two houses in Hesse and a neighbourhood with over 220 apartments in Berlin.

In particular in the Schleswig-Holstein municipality of Friedrich-Wilhelm-Lübke-Koog by the North Sea, this showed what the interplay of houses’ heat supply with wind power can do for the energy system.

The ‘Wind and Heat’ model region was officially launched there in April 2019. In this North Frisian municipality, intensive use has been made of wind power for decades, with, **according to the mayor**, Europe’s first wind farm being constructed behind the North Sea dike back in 1991, and today most members of the community having a financial stake in the surrounding wind turbines. Unlike in the past, however, nowadays the wind turbines are regularly ‘shut down’ because the lines carrying the power southwards are congested when there are strong winds. With a view to harnessing this electricity, 13 houses’ heating systems were expanded as part of the Wind and Heat project. The heating systems were fitted with larger hot-water tanks comprising electric heating cartridges, similar to an immersion heater. These heating elements are switched on by means of a



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signal from the grid operator, at times when wind energy generation at the nearby community wind farm would otherwise be curbed via feed-in management. “During 2020, surplus wind power was used in a targeted way to help with heating the homes. This reduced their fossil-fuel consumption and led to fewer turbine shutdowns,” explains Hinterholzer.

Here and in the other projects, the data collection sheets trialled for the DIN SPEC relating to flexibility in urban neighbourhoods proved their worth. The extent of the projects’ CO₂ savings and the effectiveness of the flexible control for the energy system will only become apparent when the results are evaluated in 2021. But Hinterholzer is optimistic about their potential. “In the second phase of the energy transition, flexibility in the energy system will be vital. Although this cannot be easily quantified, it is only possible to develop it in a meaningful way using evaluation criteria. The new DIN SPEC provides a good approach to enable this to be used in buildings and neighbourhoods as well.”

Uniform requirements for flexibility trading platforms

As part of WindNODE, experts developed DIN SPEC 91410-1 on energy flexibility for the congestion management of electrical power grids. This could form the basis for nationwide flexibility trading platforms.

The Intelligent Energy Showcase (SINTEG) funding programme run by the German Federal Ministry for Economic Affairs and Energy (BMWi) launched five joint projects, four of which developed their own flexibility platforms. On these, operators of facilities such as battery storage facilities, cooling systems and electrolyzers make offers to power-grid operators to postpone their electricity consumption to a favourable period. That usually means times at which a lot of electricity is being generated by wind and solar energy, when there is a risk of power grids being overloaded and renewable energy systems being switched off.

Up to now there have been no standards for integrating systems into grid congestion management on a voluntary basis. In SINTEG, the individual joint projects initially developed their own flexibility platforms based on their regio-

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nal circumstances. The lessons learned in the subprojects come together in DIN SPEC 91410-1. This standard thus forms a basis for laying down uniform requirements for providers on flexibility platforms on the German grid.

Specifically, the DIN SPEC sets out in this connection the access requirements for suppliers, the process for the submission and acceptance of bids, the time periods, the information and the interface and data structures needed and data protection requirements. In this way this DIN SPEC can be used as a potential blueprint for prospective flexibility trading platforms.



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Simon Hinterholzer, Borderstep Institut

Overall assessment for the energy system of the future

DIN SPEC 91432 lays the foundations for a multi-criteria assessment of energy systems, taking into account environmental and climate factors as well as the costs of various scenarios for Germany.

Regardless of whether you are looking at the energy system of a single home, a big city or a country like Germany, such a system's performance depends on its environmental impact, the costs and the reliability it offers. For example, an energy supply based purely on coal and oil could be regarded as very reliable in one model but a very poor option in terms of costs, import dependency, climate protection and the environment. On the other hand, a system solely using renewables that is introduced very quickly would be a strong performer in terms of the environment and the climate, but could find itself at a disadvantage in terms of security of supply and land use.

In a bid to establish a level playing field for evaluating different energy systems, DIN SPEC 91432 was developed as part of WindNODE. This provides the framework for a multi-criteria assessment – i.e. one that includes an adequate set of ecological, social, economic and security/safety-related aspects.

Assessing the profitability of a system involves examining, for example, the investment and running costs, income and employment. Ecological aspects include CO₂ emissions, air pollutants, critical emissions, resource consumption and recyclability. Overall, this DIN SPEC is based on the specifications for life cycle assessments (DIN EN ISO 14040: 2009) and expands them to include economic and social aspects.

The result can be seen for the German energy system, for example: in WindNODE, Siemens and the Department of Energy Systems at the TU Berlin took a look at three different scenarios for the German energy system between now and 2050. In Siemens AG's ZUKUNFTSRAUMENERGIE (Energy Future Room) showroom in Berlin, visitors can also set up their own energy transition scenarios and work out various ecological and economic consequences for the chosen energy system of the future using an energy flow diagram.

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3 QUESTIONS FOR...

**Sönke Nissen, Project Manager
Innovation at the Deutsches
Institut für Normung (German
Institute for Standardisation, DIN)**



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Sönke Nissen, Project Manager Innovation at the Deutsches Institut für Normung (German Institute for Standardisation, DIN)

What contribution did the standardisation activities make to WindNODE?

Nissen: For the first time, we managed to address the question of what the energy system of the future would look like. Norms and standardisation are absolutely pivotal to this. The millions of installations that will be involved in the future must be able to communicate with one another. For this we need uniform rules. Otherwise every company will end up doing things differently and there can be no cooperation and no markets. In this context, the exchanges that were part of WindNODE will at the very heart of enabling mutual understanding and close cooperation.

How did the cooperation between the partners work?

The nature of standardisation means that a lot of people and companies work together on this. About 30 parties were involved in devising the three DIN SPECs. In this context, at DIN we create the framework for the experts and guide these processes. The cooperation in WindNODE was really good. Despite the coronavirus crisis, we managed to compile the standards in more or less the envisaged time frame or are currently finalising them.

Where can readers see the results?

The DIN SPECs and the associated documents are available to the public for downloading from the Beuth Verlag website free of charge, and so they can be accessed by any interested parties at the end of the project.

DIN SPEC 91410-2 will be published at www.beuth.de during Q1 2021.

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This publication is the print version of the WindNODE spotlight edition 'A common language for the energy system of the future' from 1 0. February 2021 on www.windnode.de/en/windnode-spotlight/din/

Contact: WindNODE head office • c/o 50Hertz Transmission GmbH
project management Markus Graebig (V.i.S.d.P.)
Heidestr. 2 • 10557 Berlin
info@windnode.de • www.windnode.de



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Sönke Nissen, Project Manager Innovation at DIN

