The digitization of heating technology

IoT @HOME

BDH
Federation of
German Heating Industry

Networked heating technology –

The idea behind the >Digital Star<

The digitization of heating technology

In recent years digitization has become one of the big topics in the heating industry. Today, the equipment of heat generators with a digital interface is already standard. Digitization offers a number of advantages. It enables the heating to be controlled from mobile interfaces, such as smart-phones, which also enhance the user‘s access to subjects such as energy efficiency and potential savings.

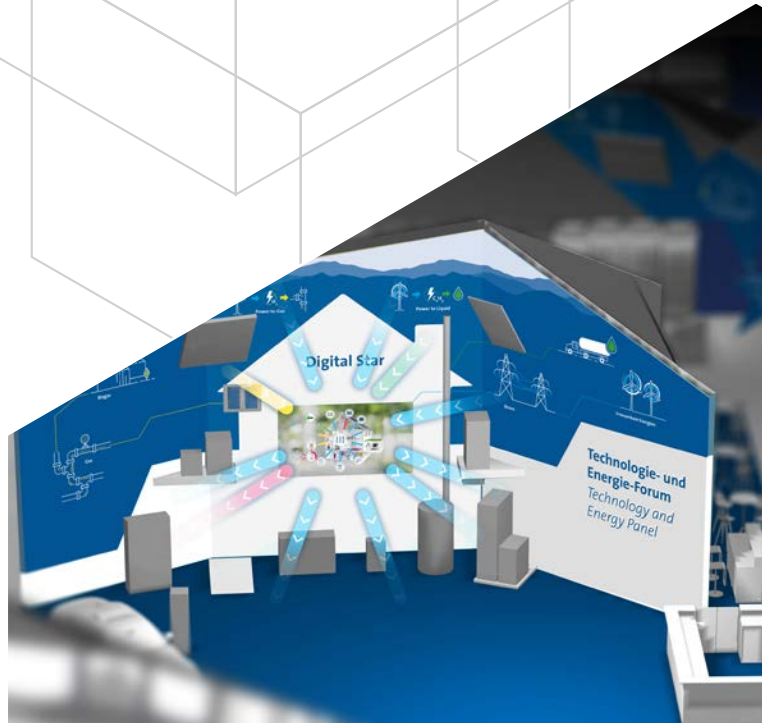
Furthermore, linking the heat generator in the user’s own home (micro area) to the electricity and gas networks or the logistics for liquid e-fuels (macro area) opens up significant additional potential, for both the user and the success of the energy transition.

Networked heating technology – The idea behind the >Digital Star<

To demonstrate the above-mentioned interre-lationships, BDH will be exhibiting the >Digital Star< at the Technology and Energy Forum during ISH 2019 in cooperation with Messe Frankfurt and 14 other associations.

Based on typical scenarios, the setup de-mon-strates the interactions between the networked devices in the IoT@Home and the resulting benefits.

This brochure first describes the structure of the >Digital Star< and then the scenarios displayed.



Electricity and heat grow together –

The structure of the >Digital Star<

Energy networking in one's own home (micro area)

The heart of the exhibit is the networking of energy-related systems in one's own home by means of a central Home Energy Management System (HEMS). This controls local generators, such as photovoltaic and solar thermal systems, electrical and thermal storage, and energy consumers.
The HEMS increases the level of self-sufficiency of a building by optimally coordinating local energy pro-duction, storage and consumption. For example, the locally generated PV power can be stored for use at a later time, instead of being fed into the power grid at a low price, and then later being drawn from the grid at a higher price.

An electric vehicle with a charging station and other household consumers, represented by a domestic appliance, are also integrated in the system. Photo-voltaic and solar thermal systems are installed as the decentralized energy generators. All these products are networked with the smart center of the energy network, the **HEMS (Home Energy Management System)**.

The processes in the energy network of the >Digital Star< are coordinated by the HEMS and visualized on a monitor in the exhibit. The components involved in each particular scenario are also displayed, together with the energy flows.

In the >Digital Star<, the energy network consists of products exemplifying the various energy-related technologies. As the heating sector accounts for a large part of final energy consumption in Germany, products for heat generation and storage play an important role.

Energy networking with the energy grid (macro area)

In addition to the advantages gained by networking the heating technology in one's own four walls, it is particularly important with regard to the ener-gy grid (macro area). After automatic optimization to meet the user's require-ments (minimized costs and greater comfort), a building that uses an HEMS can draw and feed energy flexibly. This flexibility can help the grid to offset peak loads. This can also benefit the end customer if the energy system encourages this network-relieving behavior by offering variable electricity prices.

This mechanism can help stabilize the grid and reduce the cost of expanding the grid to meet the climate protection targets. Depending on the expansion of electromobility and the resulting demands on the capacity of the distribution network, such load management procedures may even become necessary in order to avoid excessive network expansion costs. The >Digital Star< describes the energy grid (macro area) on the back wall of the exhibit, which displays the smart grid with the fluctuating generation of electricity from renewable sources, and the interface between micro area and power grid (the Smart Meter Gateway). These also form part of the scenarios described.

Thinking electricity and power-to-X

In the course of the energy revolution and sector coupling, electricity consumption for heat generation and electromobility is expected to increase in the future. On the other hand, there is the problem of the fluctuations in the amount of electricity generated by renewable energy sources. One solution is provided by power-to-X technologies based on renewable sources of carbon and hydrogen. Such processes enable energy to be stored and transported by existing and proven supply structures, so that the renewables can maintain the supply of energy for heating (hybrid heating) and mobility (hybrid car) even on cold, dark, windless days.

In the >Digital Star<, the use of power-to-X technologies is made possible by the interface between the gaseous and liquid fuels from renewable sources and the micro area with the hybrid heating in one's own home.

In the course of the energy revolution, there will be a fundamental movement away from power generation optimized for consumption towards controlling consumption according to the availability of energy from fluctuating, renewable sources. The technology this requires is available and exemplified in the >Digital Star<.

The manufacturers organized under the BDH umbrella produce efficient heating technology and components, which can be networked with other energy producers and consumers, as shown in the exhibit, the >Digital Star<.

www.bdh-koeln.de/en/association/members

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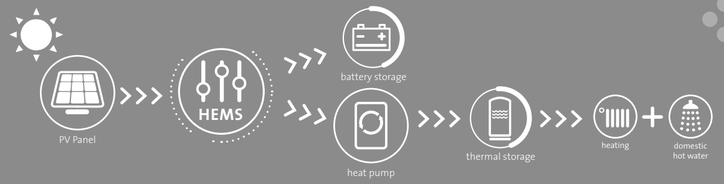
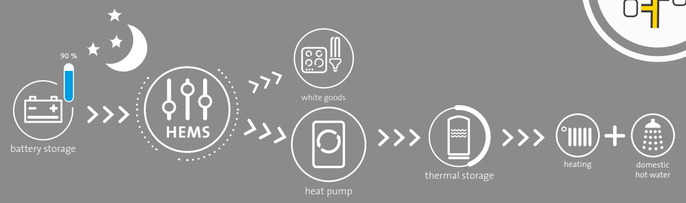
Smart energy management in the IoT@Home **Scenario 1**

This scenario explains how cost savings and ease of use can be achieved by networking with a smart energy management system.



The sun is shining, the PV system is generating free electricity. The smart energy manager detects that there are no immediate energy requirements, and sends the power to the heat pump, which charges the thermal storage unit.

Then, the electric car returns home. The energy manager recognizes the urgent power needs of the electric car. Accordingly, it directs the PV power to the charging station to recharge the vehicle.



After the electric vehicle has been sufficiently charged, the PV power is directed back to the thermal and battery storage. After sunset, the free energy generated during the day can be used to supply heat and power the electrical consumers during the night.

These processes are automatically controlled by a smart energy manager without the user having to intervene. This saves money and increases ease of use.

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Scenario 1

- ✓ Cost reduction
- ✓ Ease of use

Scenario 2

- ✓ Grid stabilization
- ✓ Cost reduction for network expansion

Scenario 3

- ✓ Security of supply
- ✓ Climate and resource protection

Scenario 2 IoT@Home for the energy system of the future

The second scenario describes how the micro system contributes to grid stabilization and cost savings in the macro system. In the course of the energy revolution and the increased use of energy from fluctuating, renewable sources, a paradigm shift will take place from consumption-optimized power generation to generation-optimized electricity consumption.

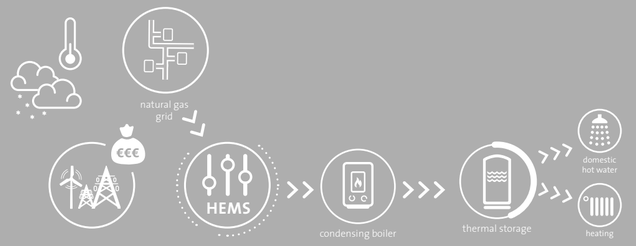
This scenario shows how energy can be drawn from the electricity grid and stored locally in thermal or electrical form at times when the grid has plenty of energy. For example, this could be during the day, when there is a lot of solar power available in the grid.

Later, when less electricity is available from renewable sources, this locally stored energy can be used to supply heat or operate electrical consumers.

This network-assisting behavior can be rewarded by the energy system, for example by variable elec-tricity tariffs. This gives further cost benefits to the user. At the same time, network-related behavior contributes toward stabilizing the grid and reducing the extent of grid expansion required for the energy revolution.

IoT@Home: Security of supply during cold, dark windless days **Scenario 3**

The third scenario shows how the reliability of the supply can be maintained, even on cold, dark windless days by combining power generated from fluctuating renewable sources with power-to-X technologies. As long as enough energy is available from renewable sources, it is used by the heat supply.



However, if no electricity is available from renewable sources on cold, dark windless days, power-to-X technologies can draw energy from renewable sources previously stored in gaseous or liquid energy storage systems to maintain the heat supply