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33 ZED (Demonstrating Zwickau's Energy Transition): Innovations and Transformation for the Energy Turnaround -Electrical-Thermal Wide Area Synchronous Grid as the Basis for Energy-Efficient and Socially Fair Quarter Development

Summary: The lighthouse project "ZED (Zwickauer Energiewende Demonstrieren/ Demonstrating Zwickau's Energy Transition)" demonstrates how energy transition in existing buildings can work under everyday conditions in a socially and environmentally compatible, secure and affordable manner with the help of technical and social innovations. Through the intelligent interaction of thermal and electrical components as well as information technology networking in an integrated electric-thermal wide area synchronous grid for year-round sector coupling, the goals of the funding initiative "Solar Construction/Energy Efficient City" are to be achieved, in particular the increase of energy efficiency, reduction of energy consumption (sufficiency) and decarbonisation. In the systemic, transdisciplinary approach of ZED, the networking of participants and their services as well as the participation of residents are crucial to ensure acceptance and awareness for the innovative solutions. Local knowledge and relevance to everyday life can thus be used in the sense of user-oriented technology development so that these solutions are transferable.

33.1 Introduction

Social upheavals and rapid technological developments require new answers to the question of how we can shape our coexistence in Germany and strengthen cohesion in our society. With the Hightech-Strategy (HTS 2025) the Federal Republic of Germany is outlining perspectives on how Germany can successfully shape its future with research and innovation. It is intended to provide orientation for all participants in the innovation process. The Hightech-Strategy (HTS 2025) focuses the promotion of re-

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search and innovation on people's needs – for example in the areas of "Health and Social Care", "Sustainability, Climate Protection and Energy", "Mobility", "Urban and Rural Areas", "Security" and "Economy and Work 4.0". It is intended to help place Germany at the forefront of the next technological revolutions in order to keep jobs in Germany and secure our prosperity. The promotion of new technologies accompanies investments in education and training and the involvement of society to prepare people for upcoming changes. The Hightech-Strategy (HTS 2025) creates scope for innovation and organises cooperation in the innovation process. It aims to encourage a wide range of participants to actively shape progress. For this, the Hightech-Strategy (HTS 2025) shows possibilities and offers support. (BMBF 2022)

The research into technological and societal innovations called for by the High-Tech Strategy must be reconciled with the needs of city residents in the district. The project "ZED (Zwickauer Energiewende Demonstrieren/ Demonstrating Zwickau's Energy Transition)" which was created with reference to the goals of the 6th Energy Research Programme of the Federal Government, combines the forces of science, business, society and politics in Zwickau (West Saxony) and uses the resulting synergies for higher competitiveness, improvement of supply structures and sustainable prosperity. ZED thus actively contributes to the fulfilment of the climate policy goals of the Federal Republic of Germany as well as the German National Action Plan on Energy Efficiency (NAPE) and helps to implement the Energy Efficiency Strategy for Buildings (ESG), or its successor.

The further expansion of renewable energies can only be achieved through intelligent networking in the district and through combination with energy storage systems, as well as through further development and demonstration of systemic concepts at neighbourhood level.

The main objective of ZED is to develop technologies and methods for the local energy transition and in particular for the heat transition on site and to demonstrate them in a suitable district in Zwickau, Marienthal. In this context, the conception and implementation of electrical-thermal wide area synchronous grid forms the basis for an energetic quarter development for the realisation of zero-emission districts. This requires highly efficient storage technologies and the combination of electrical and thermal overall concepts. This enables an increase in the share of renewable energy sources such as photovoltaics and especially solar and geothermal energy in residential quarters. However, ZED is not intended to create "islands" or typical project districts, rather it is essential that the project is oriented towards urban development and helps to shape it.

Concepts previously developed in Zwickau, for example in the areas of climate protection, mobility or urban development, as well as scientific projects of the University of Applied Sciences Zwickau (WHZ), are to be integrated and expanded and contribute

to energy-efficient and socially fair quarter development.[1] In addition to technical developments, social justice plays a key role. In this inter- and transdisciplinary project, it is essential to strive for user-oriented and user-centred technology development. The main objective is therefore to use new technologies and economically viable concepts as well as social science methods to sustainably secure the affordability of housing and actively counteract negative trends such as old-age poverty and energy poverty.[2]

33.2 Project Focus Quarter

The project focuses on demonstrating energy-efficient and socially fair quarter development against the background of current megatrends (Zukunftsinstitut 2018) (climate change, demographic development, etc.) for the particularly vulnerable housing market.

Housing is a basic need and the provision of housing is a fundamental right. The affordability of these essential factors is therefore soon a major socio-political challenge. Urban region with its districts, buildings and (energy) infrastructures is also one of the most important drivers of climate change and represents the basis for sustainable living. (Van Bueren/van Bohemen/Itard et al. 2012) The outstanding importance of the housing industry is underlined by the fact that half of Germany's net fixed assets consist of residential buildings. The demographic development and its serious effects are particularly noticeable in focus regions such as Zwickau, where the average age of individual apartment blocks (Figure 33.1) is over 65 years and are a central starting point for sustainable, intergenerational concepts of self-determined and affordable living.

This demographic tension is increasingly exacerbated by the negative development of the ratio of providers (people in employment subject to social security contributions) to benefit recipients (to recipients of social benefits and especially pension payments) in the social economy context. The current ratio of about three to one (Raffelhüschen/Müller 2011) will be about one to one in less than twenty years. (Kochskämper 2018) This imbalance leads to a reduction in pensioners' incomes and illustrates how dramatically the situation of affordable rents as well as health and energy costs will develop. (Geyer/Steiner 2010) Old-age poverty is therefore one of the greatest social risks of the future in Germany and especially in the focus regions.

The global climatic as well as regional demographic and necessary infrastructural changes result in the demand for restructuring of the technical designs in thermal

1 Projects like: "DEF-suE – Demographic energy-balanced Framework for sustainable urban Environments" or "Freiluftlabor "Neue Mobilität" am Sachsenring; ePay "EMV-Robuste Energieabrechnungsszenarien für Gridkomponenten in der E-Mobilität" / Teilprojekt" – further reading: www.aiis.fh-zwickau.de.

2 Details to the development of the energy-coupled grid and the social and affordable aspect of these net are mentioned in the following chapters.

Figure 33.1: Apartment block in the project quarter in Marienthal.
(source: ZED project)

supply systems. Only with the help of novel concepts and systems defined, planned and demonstrated at neighbourhood level, a sustainably affordable way of life can be realised. Therefore, the topics of environmentally friendly and cost-effective conversion of energy supply (local energy turnaround) and the energy efficiency of districts as well as the creation of age-appropriate, affordable housing are priorities for the sustainable development of urban areas.

For this reason, these topics are considered and analysed holistically in the ZED project. In addition, the technical potential of a holistic and also future economic energy supply in the district represents a further motivation for the municipality and its partners. In the past, quarters were usually supplied centrally with heat and electrical energy. In recent years, there has already been a rethinking and approaches to decentralisation have been pursued. Above all, renewable energy generated by photovoltaic systems for the electrical supply or solar thermal systems for the heat supply have been installed in large numbers. The resulting problem, apart from the now required interoperability of the trades, is the necessary on-site energy storage. (Leonhardt/Leonhardt/Teich 2015)

So far there have been no quarter-specific energy storage systems available on the market that combine electrical and thermal energies and take into account all the requirements of a district. A suitable way to store the energy generated on site and consume it at a later point in time is to combine it into electrical and thermal wide area synchronous grid at economic and socially acceptable prices. In the context of ZED, this was developed through the coupling and storage of electrical and thermal energy as well as the different forms of organisation and is being demonstrated in the real laboratory in order to achieve an increase in the individual efficiencies of the still separate systems, convergence towards a zero-emission quarter and reduction of CO2 emissions (decarbonisation).

33.3 The Quarter Zwickau Marienthal

The quarter Zwickau Marienthal (Figure 33.2) was selected as a living lab for the implementation of the project "Demonstrating Zwickau`s Energy Transition" for which different supply models are developed, refined and demonstrated. The urban quarter is located in the west of the city of Zwickau. Around 13,500 of the city's total population of around 91,000 live here. This living lab of a local energy transition covers about 106 hectares, of which about 79 hectares are residential.

Figure 33.2: The quarter Zwickau Marienthal (detail).
(source: ZED project)

Zwickau's largest housing provider, the municipal subsidiary GGZ, which is represented as a partner in the project, manages 34 residential buildings with about 1024 residential units and a total living space of about 56,320 m^2. The buildings are mainly renovated three- or four-storey GDR-type buildings built between 1957 and 1964 with gas central heating (insulation standard 8/0400 cm/WLG). The hot water supply is provided by electric instantaneous water heaters in most of the residential units. The heat supply is usually provided by natural gas-fired heat generators that supply several buildings with heat via small local heating networks. The heat is transferred to the buildings via a transfer station with hydraulic decoupling. This equalises the pressure level in the main distribution circuits. Heat is transferred to the flats exclusively via panel radiators. The consumption value (heating energy) of the residential buildings in the quarter is an average heat demand of refurbished buildings of about 70 kWh per m^2 and about 3,942,400 kWh per year. In addition to the residential buildings of the major landlord, public buildings (schools, kindergartens, sports facilities, etc.) are also located in the quarter, which are also to be analysed and connected to the developed networks. In addition, all urban functions such as housing, services, commerce, infrastructure and transport are located in the quarter. The age structure in the quarter Marienthal re-

flects that of the entire city. Approximately 58% of the working-age population is between 16 and 65 years old. About 35% of the people in Marienthal are older than 65. The household structure is equally representative of the overall structure in Zwickau, with about 48.5% single-person households and about 35.5% two-person households.

33.4 Objective and Structure of the ZED Project

The funding initiative "Solar Construction/Energy Efficient City" (PtJ 2017) aims to promote an environmentally friendly, safe and cost-effective transformation of the energy supply in Germany. Therefore, comprehensive lighthouse projects at neighbourhood level are being funded in Module II "Energy-efficient city" – with the aim of addressing the various energy-related aspects from a systemic perspective, from basic research to technology development to demonstration, including socio-ecological aspects. Moreover, it is important to reduce energy consumption, advance sector coupling and gradually decarbonise the entire system through the integration of renewable energies.

The project " ZED (Zwickauer Energiewende Demonstrieren/ Demonstrating Zwickau's Energy Transition)" is a joint project initiated by the city of Zwickau with twelve other partners. In addition to the city of Zwickau, which as the coordinator of the network focuses primarily on municipal issues, three research institutions with different focal points are involved in the project. The University of Applied Sciences Zwickau (WHZ) is represented in the project by the Chair of Networked Systems in Business Administration, in particular Energy Management, the Chair of Electrical Power Engineering/Renewable Energies and the Chair of Thermal Engineering/Computer-aided Planning Methods, thus setting the focus on these project fields. The Chair of Technical Thermodynamics at University of Technology Chemnitz (TUC) and the Institute of Sociology at Ludwig-Maximilians-University Munich (LMU) complete the scientific partners. The claim of integrated demonstration of the topics of ZED also requires the participation of relevant private-sector actors. The principal actors are the local energy supplier (Zwickauer Energieversorgung GmbH) and the largest housing provider in Zwickau (GGZ), as well as other partners from the fields of infrastructure, health, architecture and mobility. (Leonhardt/Höhne/Neumann et al. 2018)

Since the beginning of the funding in 2017, the ZED Lighthouse has been making a corresponding contribution with its 13 collaborative partners from science and practice and its three pillars "energy infrastructures", "data bases and planning tools" and "social science issues": development of technologies and methods for the local energy transition, in particular the on-site heat transition and its demonstration at neighbourhood level in Zwickau, Marienthal (Figure 33.3).

In the original specific project approach, the quarter Marienthal is divided into three sub-areas. For that reason, different approaches to energy supply were analysed, designed and compared with each other.

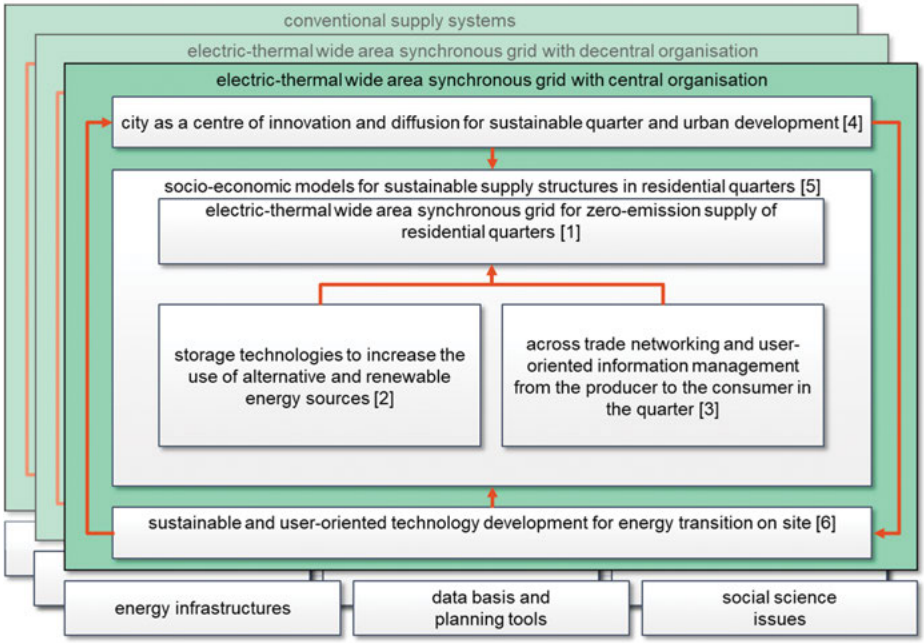

Figure 33.3: Overview of ZED's structure.
(source: ZED)

The starting point for all scientific-technical developments and sociological investigations is a conventional supply system. In a subarea of the living lab, the energy supply system remains unchanged. The existing infrastructure was expanded with additional measurement technology. Thus, a (temporary) digitalisation in the supply network could be achieved, which is also the basis for further analyses and development of methods, e.g. for models of service charge statements. In addition, the area is the starting point for the implementation of socio-scientific quarter analyses and other studies with a socio-scientific background. Last but not least, with the conventional comparison areas, the basis for quarter-internal, energy benchmarking could be created.

In comparison to the conventional system, both a centrally organised and a decentrally organised electric-thermal wide area synchronous grid was designed for supply.

The technical approach of the centralised electric-thermal wide area synchronous grid was designed with the construction of a walk-in power house in the quarter, which serves for monitoring and as a showroom (especially against the background of the transfer concerns of ZED). The integration of different renewable energy sources, such as solar heat, photovoltaics and waste heat, was conceptually investigated for the central integrated system. In addition to the power house, the centrepiece of the system is the highly efficient hot water tank, which guarantees long storage times

with low losses and very good stratification behaviour, with simultaneous integration of several heat sources. In order to be able to use different temperature ranges, several high capacity (industrial) heat pumps are to be integrated into the system.

This is contrasted with the approach of a decentrally organised electric-thermal wide area synchronous grid, which applies an innovative working principle of energy flow to individual residential blocks in the quarter. These are connected to each other via an intelligent heating network. In contrast to the conventional heating network, heat is transported bidirectionally in a pair of pipes. It enables to see each client in the network as a source and a sink in a higher-level operating regime of the energy network. The operating principle allows the heat transport medium in a heat network to be conveyed only when heat is required and to run different medium temperatures on partial routes at the same time. In this way the transportation of waste heat or residual heat from the network and storage systems to the place of a sensible use (e.g. home) is possible.

On a more abstract level, ZED addresses structural transformation and innovation processes. (Leonhardt/Höhne/Schneider et al. 2022) The lighthouse project is geared equally towards innovation and transformation theory approaches:

Transformation theories emphasise the simultaneity of change processes because they always proceed co-evolving or even temporally staggered in different levels or sectors, whether (energy) infrastructures, (storage) technologies, services or value orientations and consumption patterns. (Geels 2002, Rotmans/Fischer-Kowalski 2009)

Research on current transformations in the context of energy system transformation and climate protection shows the complexity of control, governance and strategy approaches. In addition to infrastructural-technical path dependencies, actor-specific barriers such as fear of change, protection of vested rights interests or short-term thinking are of great importance in the development, implementation and establishment of innovations. Therefore, the involvement of the most important stakeholders in the “transformation of landscape” is a decisive factor for successful transformation. The active involvement of the different stakeholder levels and analysis of the specific motives, interests, but also knowledge bases, are from this point of view central drivers and success factors for the development of sustainable energy infrastructures and realisation of zero-emission residential quarters such as Zwickau, Marienthal. This is a suitable way to develop specific strategies that, in addition to the challenges posed by the energy transition and climate change, also address the expectations and needs of politics, business and civil society and provide instruments that appear particularly suitable for use in practice and are communicated accordingly. (Leonhardt/Neumann/Gottschalk et al. 2022)

In this way, the ZED project goes beyond the funding initiative right from the start, especially since energy research and policy have also predominantly discussed technical strategies and efficiency measures for decarbonisation for the building stock (Harputlugil/de Wilde 2020). Even in the new German National Action Plan on Energy Efficiency (NAPE 2.0), the demand side of the energy system is now more strongly considered and

the previous efficiency policy is expanded to include stakeholder processes, but the policy mix still focuses on reducing energy consumption and CO2 primarily with technical measures. In contrast, user behaviour, socio-technical interactions, cross-sectoral cooperation, social participation or financial participation have so far been given little consideration when addressing a comprehensive transformation of the energy system and in particular the heat supply. Although these and other questions are addressed by various social science disciplines, they rarely reach the interdisciplinary dialogue and the design of political measures and instruments. (Arrobio/Sonetti 2021)

In the ZED Lighthouse, coherent concepts with highly innovative solutions have currently been developed, which address the challenges of the funding initiative and thus the goals of the Federal Republic of Germany and, with their implementation in the quarter, fulfil the lighthouse character for demonstrating the urban energy transition. This involves technical, social and economic elements whose intelligent interaction in a systemic-transdisciplinary approach leads to holistic innovations. To achieve the tightened climate targets, cities must maximise their contribution to the energy transition. The project "ZED (Zwickauer Energiewende Demonstrieren/ Demonstrating Zwickau's Energy Transition)" shows with its developed visionary future concept in the smallest urban unit – the quarter – that the goals of the energy transition (sufficiency, sector coupling, decarbonisation) can be implemented, especially in existing buildings, and thus proves the extremely high leverage effect of this approach. In addition, the development process of ZED is a prime example of how regional innovations can develop target-oriented approaches to solving social problems through the interaction of research and local knowledge from practice and society.

33.5 Specific Approaches of ZED with Reference to the Goals of the Energy Transition

In addition to the implementation of the energy transition in the quarter, the approach chosen in ZED manages to make the path towards it acceptable and sustainable for the environment and society. Especially for the implementation in existing buildings, resource efficiency is an important factor. On the one hand, the approach of the electric-thermal wide area synchronous grid in ZED creates a space-saving implementation, as no additional land consumption (sealing, etc.) occurs and thus there is no competition for space with other uses. Existing, previously unused roof surfaces (pitched roofs) are efficiently used for photovoltaics and solar heat, and decentralised storage facilities are accommodated in existing basement rooms of buildings. For new grid structures, routes of existing grids are used as a matter of priority, and the grids themselves are partially reused.

The security of supply, previously fossil-fuelled systems, is also guaranteed in the implementation of the new ZED overall system, through the expansion and inclusion

of green district heating. This link between city-wide supply and local innovation means that district heating also becomes more efficient and its primary energy use decreases. The use, intelligent integration and linking of technologies already established on the market from photovoltaics, solar heat, district heating and storage, as well as the possibility of replacing the established system with the new one in sections, also lead to the preservation of supply security.

Despite the high degree of technical innovation of the ZED system, the self-imposed goal of maintaining neutrality of rent including heating as well as innovative operator models lead to a socially acceptable and thus affordable implementation. The use of renewable energies and the reduction of the residents' energy consumption also lead to the sustainable securing of affordable housing and the prevention of energy poverty.

In the project ZED, different building blocks, which are thought of in an integrative way, make a corresponding contribution to achieving the goals of the energy transition:

In ZED, several technical and social components, which are described in more detail in the following chapters, lead to the reduction of energy consumption (sufficiency). The plan is to reduce primary energy use by (at least) 84% compared to the current state in the sub-quarter:

As a central element of the developed electric-thermal wide area synchronous grid (see Chapter 33.6.1 of this article), a so-called smart thermal grid in interaction with an in-house development of a ubiquitous (information) infrastructure offers a new way of demand-driven heat supply. For the first time, supply and demand for heat/cooling from the flats are combined. In addition, the smart thermal grid offers the advantage of lower temperatures in the network due to its shorter supply sections. Thereby losses of distribution are minimised as well as by the demand-oriented "heat dispatch in package form". The information platform also manages as a "digital aid" to prevent major user misbehaviour and reduce user energy consumption through intelligent mechanisms. In the technology development (user-oriented) as well as in the later operation (user information/behaviour reflection), there is direct interaction between the system and the residents. Pre- and rebound effects are prevented. The year-round use of the electric-thermal wide area synchronous grid also ensures the establishment of a simple cooling function in the supply area in summer without additionally required infrastructures (energy-intensive air conditioning, etc.). The interface offered by the information platform for other value-added services created in the project and which is also available in the quarter, such as the ZED mobile station Marienthal (see Chapter 33.6.2 of this article), is as well the focus of the project and contributes to sufficiency (sharing instead of ownership) at neighbourhood level.

Sector coupling is implemented in the ZED project through the electric-thermal wide area synchronous grid. This directly couples heat and electricity and integrates other sectors such as mobility and information. In addition, the possibility of year-round sector coupling and the cooling function it enables he climate resilience of the

quarter. The approach of the electric-thermal wide area synchronous grid also represents an open, flexible system that can also incorporate other (renewable) energy sources (wind power, hydrogen) in the future.

In the area of informational connection, via the developed information platform, to products and services in the quarter structures, participants are networked (energy, housing, health industry, mobility, etc.) and new joint operator models shall be enabled. (Leonhardt/Neumann/Kretz et al. 2019, Werner/Leonhardt/Höhne 2020, Franke/Kretz/Mager et al. 2020)

The gradual decarbonisation of the existing status quo (gas boiler) in the supply area is achieved in ZED by integrating various renewable energy producers. New primary energy sources in the local heating network of the supply area will be developed with photovoltaics and solar heat; in addition, the green district heating of the local supplier will be connected to the quarter. The mobility sector, integrated by sector coupling, also experiences a shift away from fossil energy sources in the form of charging infrastructure for electric vehicles and electric cars connected to the system. Decentralised thermal and electrical storage systems in the ZED project also manage to cushion the fluctuation of renewable energies, but also to store energy from the other sector (electricity in heat). In particular, energy in the form of heat can remain available for a longer period of time in the electric-thermal wide area synchronous grid.

33.6 Overall System and Implemented Parts

Based on the evaluation of the individual system approaches – conventional, centralised and decentralised – of the "individual sections of the quarter", the following overall system (33.6.1) was designed for the entire quarter Marienthal, taking into account the cross-cutting issues and overarching developments, which will be implemented for approx. 800 households and a school building in the quarter from mid-2022. Other individual overall system components and project approaches, such as the mobile station Marienthal (33.6.2) and the demonstration in the competence centre ubineum, have already been successfully implemented from 2020 and 2018 respectively.

33.6.1 Overall Technical System

Based on the work carried out in the project process and the parallel evaluation process of the individual concepts (centralised, decentralised) within the consortium, an electric-thermal wide area synchronous grid as shown in Figure 33.4 is to be implemented. This approach has enormous potential to achieve Germany's climate goals in urban areas and can act as a lighthouse for demonstrating the energy transition in

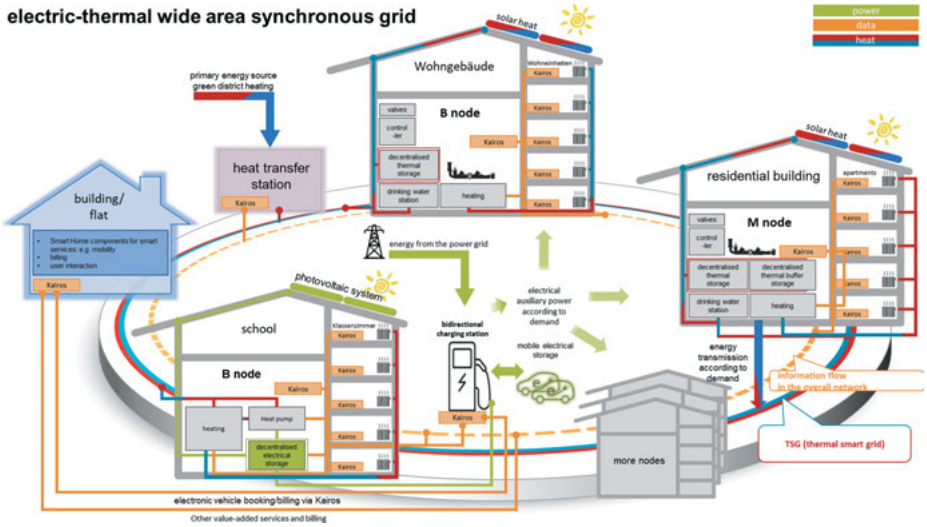

Figure 33.4: ZED energy system.

the quarter Zwickau Marienthal and beyond in the sense of the "Solar Construction/ Energy Efficient City" funding initiative.

33.6.2 Mobile Station Marienthal

The findings of the participatory interactions with stakeholders and residents were regularly incorporated into the conceptual work of the project team. Based on this procedure, target-oriented impulses for the project resulted for the conception of a mobility station and, beyond that, for the integration of the overall system. The aim was to ensure mobility for all residents of the quarter and thus to offer target group-specific environmentally friendly vehicles (electric scooters, electric bikes). In addition, the internal project communication and the participation workshops with stakeholders in the quarter led to the intention of not limiting the mobility station to offering mobility alone. The design of the station demonstrates to the citizens that projects of this kind should not be viewed one-dimensionally, but can set an example that other, integrative possibilities also exist. The mobility station serves not only as a provider of mobility, but also as a social meeting point in the quarter. By employing a "quarter pilot", a contact person for residents is on site who helps people and informs about the project.

On 17 July 2020, the mobility station (Figure 33.5) opened for all residents of Zwickau-Marienthal. As a new building block for Zwickau's mobility and transport transition at neighbourhood level, the station aroused curiosity about the services on offer, but also about the ZED project. (Ziegert/Höhne/Teich et al. 2021)

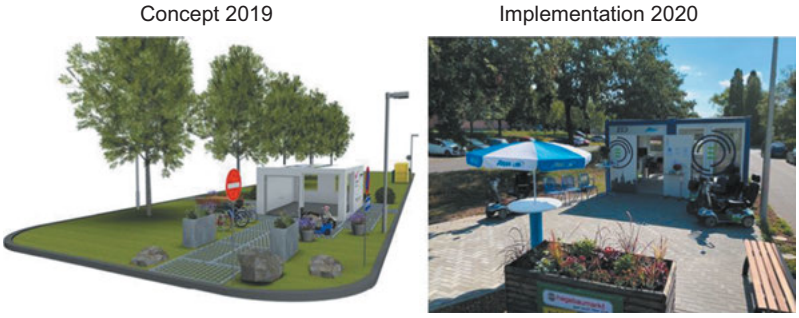

Figure 33.5: Concept and implementation of the mobile station "Marienthal mobil". (own illustration, own source).

33.6.3 Demonstration in the Context of the Project

ZED has aimed to demonstrate on the smallest scale level how the local, urban energy transition can be implemented. In a transdisciplinary approach, various ideas from different expert communities compete with each other (centralised, decentralised) to compare them with the conventional status quo in order to find out which innovative solutions can lead to sustainable implementation in practice. In the project, so far, the lighthouse character in technological development can be found especially in the exchange between research and relevant stakeholders from the housing industry, energy suppliers, service providers and residents, as well as in their interlocking (sector coupling). In this process, the project's charisma primarily reaches expert representatives in the individual sectors and, in the area of citizen participation, primarily interested parties. However, to ensure a successful implementation of the solutions in the area, a broad involvement of stakeholders and residents is indispensable, even if they are not among the experts of the energy transition. For this purpose, ZED is breaking new ground to take a holistic approach and look at cross-cutting issues such as mobility and the development of sustainable quarter structures in addition to the key issue of energy in conjunction with digitalisation. In this way, practical and sustainable concepts can be developed that address the everyday challenges of the quarter Zwickau Marienthal. By their very nature, participation processes are also innovation processes. They do not have a rigid sequence of phases, but many branches.

Experiences show that routine behaviour patterns have to be broken or complex contexts affected (e.g. energy supply, sustainable mobility), especially in the realisation of goals that go hand in hand with partly "hard" engineering changes. Communication with the right framing and an appropriate tone is necessary here. The ZED project has already shown in many ways that it can convey its message, the topics of the project and the energy transition in general, in suitable settings, including the tangible demonstration (Figure 33.6) (Leonhardt/Neumann/Schneider et al. 2018) of the

planned energy system, albeit on a small laboratory scale at the competence centre ubineum.

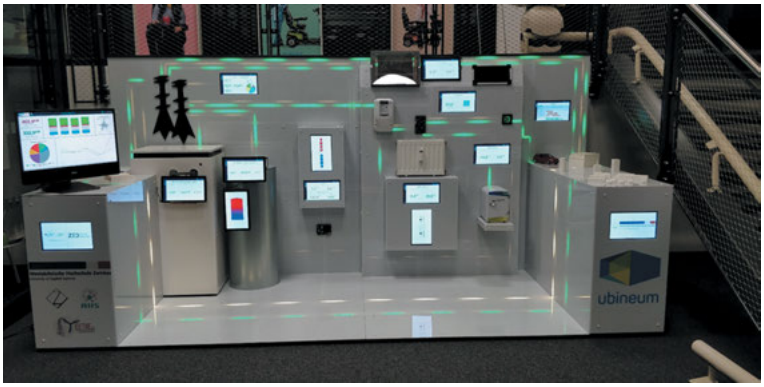

Figure 33.6: Developed demonstrator of the energy network in the ZED approach for transfer in the competence centre ubineum (own source).

33.7 Final Consideration

With its holistic transformation approach, the project ZED shows that the existing building sector can already become climate-neutral today, even without comprehensive renovation. With the help of technical solutions such as the developed wide area synchronous grid and digitalisation as a promoter of these and social innovations (value-added services, participation, etc.), other challenges facing society (demographic change, old-age poverty, etc.) can also be successfully overcome. The open interfaces (open data) in the system (energy, information, etc.) also promote the scalability and transferability of the approach. ZED can therefore be seen as a blueprint for a successful energy transition at neighbourhood level in an urban context. In order to achieve a sustainable effect as a lighthouse of the energy transition in the quarter itself, to tackle the transformation of the energy system, but also to take away the fear of it and to show that it can be implemented in an affordable, safe and environmentally friendly way. An actual implementation in the quarter is also necessary.

Network Partners ZED

ZED is embedded in the “Solar Construction/Energy Efficient City” funding initiative as one of six funded projects in Germany (Table 33.1).

Table 33.1: Network partners ZED.

1	SVZ	Stadtverwaltung Zwickau	Hauptmarkt 1	08056 Zwickau
2	WHZ/ WIW	Westsächsische Hochschule Zwickau – Fakultät Wirtschaftswissenschaften Professur für Vernetzte Systeme in der Betriebswirtschaft: Prof. Dr. rer. pol. habil. Dr.-Ing. Tobias Teich	Kornmarkt 1	08056 Zwickau
	WHZ/ VUT	Westsächsische Hochschule Zwickau – Institut für Energiemanagement: Professur für Gebäudeklimatechnik / Integrale Planung Prof. Dr.-Ing, Mario Reichel Professur für: Wärmetechnik/Computergestützte Planungsmethoden: Prof. Dr. rer. nat. Matthias Hoffmann	Kornmarkt 1	08056 Zwickau
	WHZ/ ET	Westsächsische Hochschule Zwickau – Fakultät Elektrotechnik: Professur für Energietechnik und Regenerative Energien: Prof. Dr.-Ing. Mirko Bodach	Kornmarkt 1	08056 Zwickau
3	TUC	Technische Universität Chemnitz- Fakultät für Maschinenbau: Institut für Mechanik und Thermodynamik Professur Technische Thermodynamik Prof. Dr.-Ing. habil. Thorsten Urbaneck	Reichenhainer Straße 70	09107 Chemnitz
4	LMU	Ludwig-Maximilians-Universität München - Sozialwissenschaftliche Fakultät Institut für Soziologie Prof. Dr. Bernhard Gill	Konradstr. 6	80801 München
5	ZEV	Zwickauer Energieversorgung GmbH	Bahnhofstr. 4	08056 Zwickau
6	GGZ	Gebäude und Grundstücksgesellschaft Zwickau mbH	Gewandhausstraße 7	08056 Zwickau
7	GIIZ	Gesellschaft für Intelligente Infrastruktur Zwickau mbH	Uhdestraße 25	08056 Zwickau
8	JUH	Johanniter-Unfall-Hilfe e.V. Regionalverband Zwickau/Vogtland	Uferstraße 31	08412 Werdau
9	ALI	Alippi GmbH	Leipziger Straße 160	08058 Zwickau

Table 33.1 (continued)

10	BC	Bauconzept Planungsgesellschaft mbH	Bachgasse 2	09350 Lichtenstein/Sa.
11	SAM	Samson AG	Weißmüllerstraße 3	60314 Frankfurt am Main
12	ASD	Autoservice Demmler	Kirchberger Str. 55	08112 Wilkau Haßlau
13	SEN	Senertec Sachsen	Karlsbader Str. 65	08359 Breitenbrunn

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