Smart Grids-Roadmap Baden-Württemberg 2.0

SHORT VERSION

SmartGridsBW
Energien intelligent vernetzen.

GEFÖRDERT DURCH

Baden-Württemberg
MINISTERIUM FÜR UMWELT, KLIMA UND ENERGIEWIRTSCHAFT

About this short version of the Smart Grids Roadmap Baden-Württemberg 2.0

This paper summarises the main contents of the Smart Grids Roadmap Baden-Württemberg 2.0 in a short version. The focus is on a brief summary of all fields of action. To this end, the challenges and the requirements for political decision-makers that can be derived from them are presented in brief. A complete overview of the measures aimed at implementing the relevant goals can be found in the the German full version of the roadmap.

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1 The Smart Grids Roadmap Baden-Württemberg 2.0

The Smart Grids Roadmap Baden-Württemberg 2.0 shows how the intelligent design of the energy grids must be advanced in order to efficiently shape the energy transition and thus achieve the ambitious climate protection goal of decarbonising Baden-Württemberg.

Intelligent energy networks – so-called “smart grids” – support the necessary massive expansion of renewable energy generation. They represent the essential link between energy generation plants, storage and consumption facilities. As the requirement to couple the electricity, heat and transport sectors takes on an ever greater dimension, so too does the need to orchestrate energy flows more efficiently. The vital “intelligence” of the grids arises from their digitalisation, the collection and processing of data on the energy flows.

As the developments since the first Smart Grids Roadmap Baden-Württemberg (2012/13)[1] and the experience gained in projects over the past ten years reveal: it is now a matter of rolling out smart grids on a large scale and continuously optimising them.

The current roadmap is the result of a 13-month stakeholder dialogue process in which more than 140 participating individuals and institutions engaged in detailed discussions on a total of four fields of action.

All recommendations in this roadmap must be understood in the context of the energy transition and climate protection activities of the state of Baden-Württemberg, Germany and the EU. In cases where topics overlap with other activities of the state of Baden-Württemberg, only those aspects relevant to the smart design of energy grids will be addressed.

The stakeholders involved in the roadmap process agree that rapid action is necessary to digitalise the energy grids. The state government of Baden-Württemberg is called upon by the participants in the roadmap process to support the achievement of the identified goals to the greatest possible extent. Furthermore, the roadmap serves the state of Baden-Württemberg as a guide for articulating its demands at the federal policy level. The challenges identified in the roadmap consequently affect the design of smart energy grids throughout Germany. Since a considerable part of the regulatory competence is to be found at the federal level, the demands equally address federal policy.

This short version of the Smart Grids Roadmap Baden-Württemberg 2.0 presents the contents of the full version in a condensed form. For each of the four fields of action, the respective challenges, objectives and the requirements derived from them are formulated for the decision-makers. A more detailed presentation and additional explanation of concrete implementation measures can be found in the full version of the roadmap in the respective chapter with the same number.

2 Overarching Challenges

Time

Time constraints are a critical factor: Necessary planning periods, lengthy approval processes, possible supply bottlenecks and the high number of necessary installations (e.g. smart meters, heat pumps, etc.) represent a major hurdle in connection with the equally scarce resource of personnel. This makes immediate action necessary for all measures.

Shortage of Staff/Specialists

The large number of systems to be installed increases the need for installation, operation and maintenance staff as well as IT specialists. Suitable training and incentive programmes with early involvement of the skilled trades, training companies, (dual) colleges and universities are indispensable. Targeted education policies, training and recruitment campaigns by the state and the federal government must address this staff shortage.

Hardware

Adequate availability of hardware components is jeopardised by the high number of necessary installations. Even if there is hardly any competition for end products (such as measurement hardware), extreme competition prevails with other industries regarding individual components (e.g. ICs). Due to global supply chains, these are also vulnerable to shock events such as war, etc. Political measures such as the targeted location of supplier companies in safe regions (e.g. the EU) should be examined as well as the more robust positioning of supply chains.

Financial Resources

There is a major need for investment in network optimisation, network reinforcement and implementation measures. Not only is sufficient funding required, but also the possibility to utilise this in a targeted fashion. The increasing complexity of the system calls for more personnel, which significantly increases the OPEX share of the costs. Moreover, only components that are "smart grid ready" should be installed in order to avoid stranded investments.

Interoperability

Up to now, many components – both on the hardware and software side – have utilised a large number of different communication and control channels, protocols or network models. If interoperability of the systems is to be ensured, standardisation of the interfaces must be promoted politically and at the user level. This includes the standardisation work of the responsible bodies, e.g. the VDE and the BMWK/BSI. Likewise, the use of open source or consensually created standards (e.g. EEBUS) increases system interoperability.

Digitalisation

The energy grids must be equipped with active sensors, data processing and actuators. This will make the physical grids easier to map and control on the basis of data. Such a strategy enables greater transparency of the network conditions as well as more differentiated and thus "intelligent" network management. Besides the implementation of the technical components, this calls for a major redesign of operating processes with integrated data use and processing.

Regulatory Hurdles

Owing to the long lead times of regulatory changes, there is a need for action now to enable the deployment of smart grid technologies, products and services in the following years. A reduction in the time required and administrative complexity are vital in order to better cope with the high dynamics of the developments. Certainty in regulatory planning is also important – as uncertainty inhibits investment.

3 Field of Action I: Grid and Market Alliance

The design of smart energy grids includes not only technical developments but also their implementation and integration into business processes. Areas that have so far often been considered separately – such as hardware and software development, system processes as well as remuneration and market models – must be thought of in context and developed together. In the following, the technical, organisational and economic links are discussed in four subfields.

3.1 Establishing Sufficient Grid Transparency

Challenges

In order to manage energy grids efficiently, it is crucial to know as much as possible about the grid status. Load flows in distribution grids are often still a black box. In order to orchestrate the strongly increasing power demands (e.g. from wall boxes and heat pumps), the growing power of decentralised feed-in in distribution grids (e.g. from PV) and the changing, larger grid loads, sufficient grid transparency is necessary. This makes it possible to align grid management even more precisely to different load conditions and to avoid grid bottlenecks. Likewise, sufficient grid transparency is a prerequisite for further measures in the areas of grid and market (chapters 3.2, 3.3, 3.4) as well as sector coupling (chapter 4).

Objectives

The aim is to establish **sufficient grid transparency.** Effective grid transparency means that a sufficient number of metering devices are installed and the remaining "blind spots" are simulated using statistical models. The question of when "sufficient" metering devices (smart meters and at substations) are present must be determined by the grid operators depending on the circumstances of their grid areas.

Demands on Politics

- On the part of politics and the supervisory authorities, the establishment of legal certainty through stable framework conditions is of vital importance. Legal uncertainties lead to investment barriers – and thus to delays in the already tight time frame (cf. situation of the smart meter rollout).
- Consistent incentive regulation should enable necessary investments (e.g. the possibility to increase OPEX shares in network investments) in order to push the expansion of metering facilities.

3.2 (Partially) Automating Grid Management

Challenges

With the increasing complexity of energy grids, partial automation allows for more efficient grid management compared to purely manual action. Furthermore, this simplifies the leverage and use of flexibilities in a way that is beneficial to the system and the grid. Wherever possible and efficient, the latter can also be raised as so-called market-based flexibility offers. (Partial) automation can also improve reaction times for avoiding or eliminating critical grid conditions – thereby making grid congestion management more efficient thanks to improved coordination.

Objectives

A necessary **(partial) automation of grid management** not only refers to the **management within individual grids** – it should also be understood **across grids.** This also simplifies the **integration of flexibilities.**

DEMANDS ON POLITICS

- Policy-makers must create an environment that supports cooperation between actors. This concerns technical, procedural and legal aspects of cooperation.
- The policy should promote and support standardisation processes both in the state and at the federal level.
- Platforms and formats that simplify coordination between network operators are to be explicitly supported.

3.3 Making Variable Energy/Capacity Tariffs Available

Challenges

Variable energy and capacity tariffs enable an economic optimisation of consumption, as end customers adapt their usage behaviour to the price structure. The increase of implicit flexibilities is made possible by using economic incentives as a control element. So far, variable tariffs are not available across the board. The large number of price components poses a challenge. A distinction must be made between legally fixed (such as grid charges and concession fees) and dynamic components.

The dimension in which the variability of the tariffs lies (e.g. fixed time periods, dynamic versatility in real time, based on the power demand, etc.) also needs to be clarified. Economic incentives must be designed in such a way that they do not lead to dysfunctional behaviour for the networks.

Objectives

The goal is the **nationwide availability of variable energy pricing** and variable tariffs with an **economic incentivisation** of flexibility provision.

DEMANDS ON POLITICS

- Policy-makers are required to design price components in such a way that variable tariffs are economically feasible.

3.4 Economically Leveraging System and Grid-Serving Flexibilities

Challenges

Load and feed-in flexibilities are essential elements – in terms of compensating the increasing volatility in the grids, balancing increasing power demands and maintaining the grid frequency and voltage when used in a way that serves the system. The use of flexibilities in grid congestion management is rendered more efficient through improved grid transparency (chapter 3.1) and (partially) automated grid management (chapter 3.2). It is important to connect the different sectors of energy use to the electricity grids in order to leverage flexibility potentials (chapter 4).

Objectives

The aim is to **economically boost flexibilities at all levels** – ensuring they retain adequate availability for use **serving both systems and grids.** How much generation and load flexibility is “sufficient” must be defined by the respective grid operators and regulatory bodies.

DEMANDS ON POLITICS

- State and federal policy must create a legal framework that enables grid operators to exploit flexibilities and use them economically.
- Where possible, the provision of flexibilities should be encouraged, e.g. with economic incentives. One example is the promotion of charging stations/wall boxes: Since more and more vehicles are capable of bidirectional charging, subsidies should also encourage the corresponding design of charging points. For example, a feedback capability of wall boxes and charging stations could be defined as a funding condition to enable bidirectional charging and thus encourage the availability of electric vehicles as flexibility options.

4 Field of Action II: Consistent Sector Coupling

The targeted interlinking of sectors and intelligent energy use are crucial for rapid decarbonisation. Smart grids represent the central linking element. They make energy flows transparent and enable efficient control of the integrated plants. The amount of energy required and the demand for selectively available power in the electricity grids will increase sharply. In the area of e-mobility, an effective ramp-up is emerging – calling for an expansion of the infrastructure. While the total energy volume of an electrified car traffic of 90-100 TWh[2] does not represent a hurdle, the simultaneity of charging processes in grid areas can pose a challenge for grid congestion management. In the area of heat generation, electrification is emerging in industry as well as in domestic heating, as well as the switch from natural gas to hydrogen. Smart meters, metering at substations, private and public charging points and heat (e.g. heat pumps) have an expected number of installations in the millions. In addition to electricity, the use of climate-neutral H_2 will play a decisive role. This means that energy can be stored in large quantities in the gas grid and used especially in the industrial, heating and transport sectors. It is important to intelligently couple the energy source networks with each other and always use the most advantageous energy transmission for the overall CO_2 balance.

4.1 Including Sector Coupling in Planning Processes

Challenges

Until now, energy has often been considered separately by sector in planning and implementation. This is based on grown patterns of thinking, acting and organising, which consider a separation of the sectors (especially electricity, heat and transport) as a given. However, the energy transition makes it necessary to intelligently link heat supply and transport with the electricity and gas/hydrogen grids. Such sector coupling must be taken into account as early as the planning phases for properties and infrastructure. This includes closer, prior agreements and data sharing: For example, the heat planning of the municipalities as well as the gas grid area transformation and electricity grid planning of the distribution grid operators should be linked more closely. It should also typically be made available to other actors in order to make optimal use of the existing data stock. Furthermore, it is important to link the sectors on a supra-regional level in order to prevent dysfunctional trade-offs between decarbonisation on site and in the overall system.

Objectives

In order to anchor sector coupling consistently in planning processes, **information work** is necessary that breaks up the established patterns of thinking and acting. The **responsible actors must be aware** of the relevant steps for taking energy aspects into account. A **legal anchoring of "energy" in planning processes** should flank this. The **overarching and long-term goal** is that **sector coupling is taken into account in all real estate and infrastructure planning** – both in existing buildings and in new construction – and that climate protection is consistently implemented.

Demands on politics

- Municipalities should already define energy use as a criterion in approval procedures.
- Legislators are called upon to shape municipal planning law in such a way that climate protection concerns and consequently energy are incorporated at an early stage.
- The awareness of involved actors for energy issues must be raised. This includes information work using existing information and advisory services (e.g. from the KEA-BW and the regional energy agencies) along with other networking services.

4.2 Integrating Electric Heat, Transport and H_2 Grids

Challenges

In order to integrate the different sectors on a functional level, it is necessary to take a number of technical and organisational measures that ensure the compatibility and interoperability of the components. This follows on directly from the requirements for the (partial) automation of networks and installations (Chapter 3.2).

Objectives

Heating systems, charging infrastructure, generation systems and gas/H_2 grids should be **technically integrated into the smart grid infrastructure** and be controllable. Existing systems are to be integrated **via appropriate retrofits** – while new systems are to be integrated **as soon as they are installed.**

Demands on politics

- Plant operators in the mobility and heating sectors should ensure that their plants are interoperable. If a smart grid connection is not yet possible in new buildings, systems should be designed to be "smart grid ready". Existing installations must be retrofitted.
- Property operators should seek contact with grid operators, energy supply companies and such like so as to facilitate system integration.
- The standardisation processes should be supported by state and federal policy.
- Measures for integrative energy use in the transport, heat and electricity sectors are to be driven forward by the state institutions. In the mobility sector, this includes the Ministry of Transport BW and the "Strategy Dialogue Automotive Industry BW". In the area of heat, this typically concerns the Ministry of State Development and Housing BW and the "Affordable Housing and Innovative Building" strategy dialogue.

4.3 Market Integration and Consistent Enhancement of Flexibilities

Challenges

In addition to the technical linking of the sectors, it is also important to use the integration as efficiently as possible in economic terms, e.g. within the framework of the use of flexibilities in the management of the electricity grids. Since heat generation and e-mobility will require large amounts of electrical power in the future, there is also great potential for flexibilisation. While measures for the aggregation of small flexibilities (such as pooling) are easily scalable for stationary plants (such as heat pumps and home storage), the question is how this unfolds with electric vehicles and at which grid levels these flexibilities are deployed. Bidirectional charging opens up further feed-in flexibilities (V2G) for use serving systems or grids – so as to potentially also reduce the number of required storage facilities in the grid (chapter 3.3).

Objectives

Flexibilities should be able to be traded via common market platforms where possible and economically viable. A **use of coupled plants serving systems or grids** should be guaranteed. Furthermore, consumption behaviour should be modelled and forecast and the necessary **incentives should be set via an adapted market design.**

Demands on Politics

- The legislator must provide the legal framework for a consistent optimisation in terms of grid and system efficiency and, building on this, economic optimisation of the use of flexibilities. Existing approaches such as the reform of §14a EnWG (German Energy Industry Act) are expressly welcomed.
- When making regulatory adjustments, it is important that no dysfunctional economic incentives are set that counteract the optimisation of CO_2 emissions in the overall system (such as optimising self-consumption versus the systemic benefit of electricity fed into the grid).
- Economic incentives (e.g. subsidy programmes) should aim to stimulate investments with the greatest possible range of functions (e.g. bidirectional charging wall boxes and charging stations instead of unidirectional models).

4.4 Integrating Hydrogen (H_2) into the Energy Grids

Challenges

The integration of climate-neutral hydrogen as an energy carrier is a central component of decarbonisation. With the need to reduce the dependence on fossil fuels of autocratic regimes, hydrogen (in addition to the available quantities of biogas) has a decisive role to play in the field of natural gas, coal and various petroleum derivatives. Since hydrogen – produced on the basis of green electricity – is set to account for the largest amount of molecule-based energy, it is already high time to refine and convert existing infrastructures. H_2 generation itself is addressed in the Hydrogen Roadmap BW.[3]

Objectives

The goal within the framework of the intelligent equipment and coupling of the energy grids is **conversion of the infrastructure – this so far having been oriented towards fossil gas – to H_2-capable grids.** In all activities, this includes the complete coupling of the H_2 grids with the electricity and heating grids. The upgrading of the gas grid infrastructure must be driven forward without delay at both the transport and distribution grid level.

Demands on Politics

- Criteria for the use of energy carriers are in particular their CO_2 balance and their economic efficiency. A consistent coupling of the sectors allows a combined exploitation of the advantages of the energy carriers (e.g. flexibility and simple transport for electricity, high energy density for H_2).
- Introduction of a mandatory and integrated network planning process for gas (hydrogen and biomethane).
- Introduction of a consistent, uniform and mandatory regulatory framework for all operators of public supply gas/H_2 networks.
- For energy supply companies, grid and plant operators, it is important to make new plants and existing plants "H_2-ready". This safeguards investments – even if the plants are still geared towards the use of fossil fuels.

5 Field of Action III: Research Promotion and Living Laboratories

The contents of this roadmap are largely based on experience gained in many research projects by the stakeholders involved.[4] Since the first Smart Grids Roadmap BW (2012/2013), the research focus has now shifted to testing under real conditions. It is important to continue research at all stages of development in order to solve problems that only become apparent during implementation, to further develop the technologies and to continuously increase efficiency.

5.1 Research Funding for Innovations in the Field of Smart Grids

Challenges

From basic research to the further development of concepts and technology to testing under real conditions, adequate research funding is needed at all stages of development – both on a monetary and administrative basis. Research programmes should be made even more accessible; especially for start-ups and SMEs, the effort required can otherwise be a major obstacle to participation in projects. It is also important that those responsible for projects are not swamped by a multitude of regulatory changes of course (e.g. in the interpretation of experimentation clauses), but are given maximum planning security.

Objectives

Research programmes in the field of smart energy grids are to be further promoted and expanded. Research projects are relevant at every stage of development – from fundamentals to living laboratories.

5.2 Bringing Living Laboratories into Continuous Economic Operation

Challenges

Living laboratories serve as a "bridge" for the transition from laboratory to continuous operation. Testing new technologies and concepts under real conditions is an important step, as they are then confronted with boundary conditions that cannot be reproduced under laboratory conditions.

Objectives

Living laboratories with a climate protection effect should, where possible, **be transferred to continuous economic operation.** In particular, if project facilities have been realised with funding and own resources, continued operation should be considered – also to avoid stranded investments.

5.3 Clarifying Prerequisites for Continued Operation

Challenges

In order to offer future living laboratories a perspective for continued operation right at the start of the project, the necessary technical, economic, organisational and legal framework conditions must be considered in advance. Yet if the entire spectrum of research projects is to be covered, it must also be possible to plan living labs without economic continuation. Tender conditions that define the criteria for continued operation can be included in the project evaluation as an optional component.

Objectives

The aim in designing new living lab laws is that the transfer of projects (if environmentally and economically viable) to permanent operation after the end of the project can **already be taken into account in the application phase as an optional component.**

DEMANDS ON POLITICS

- The complexity of the "funding jungle" must be reduced. For economic actors with little application experience (e.g. SMEs), this can otherwise be a major hurdle.
- Living lab laws should provide incentives to keep investments usable and avoid stranded investments. For instance, an optional application supplement for the continued operation of living lab projects would be possible.
- The growing complexity of the energy system increases personnel costs (e.g. in the IT sector). Subsidised shares are to be increased here.
- When implementing living lab projects, it should be clarified in advance whether continued operation after the end of the project is possible. In this way, participants can be involved who can take over the operation.
- The costs for communication and public relations work are to be funded in the context of living lab projects – as communicating the results contributes to raising the population's awareness of the energy transition.

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6 Field of Action IV: Enabling Participation at all Levels

Participation (in the sense of: involvement) of citizens as well as intermediary societal actors and municipalities in the energy transition is relevant in several respects.[5] They should themselves actively participate in the implementation of the energy transition, support it politically and at least accept it. However, since (smart) energy grids (in contrast to renewable energy plants for instance) are not visible except for a few components (such as smart meters[6]), participation in their design is more difficult to convey. Another challenge is the provision of sufficient personnel capable of implementing the energy transition.

6.1 Municipalities as a Hub for the Implementation of Smart Grids

Challenges

With their properties (e.g. citizens' offices, sports halls, municipal halls, car parks) and municipal enterprises (e.g. public utilities, housing associations), municipalities have many opportunities to implement energy transition measures and therefore play a central role. With municipal steering options such as urban land use planning or building law, they also determine the scope for other actors with regard to energy measures. Last but not least, they are a source of information and a role model for citizens and thus important multipliers on the ground.

Objectives

Municipalities themselves should implement the most effective and far-reaching energy transition measures possible and act as **multipliers** for local citizens, businesses, industry and civil society.

6.2 Intermediary Actors as Implementers, Users and Multipliers of Smart Grids

Challenges

Associations, clubs, companies, civil society institutions and – to a large extent – the trades are important players in the design of smart energy grids. Associations have a large reach due to the representation of many companies and can communicate smart grid services (e.g. demand side management, variable energy pricing, etc.) to their members. Awareness of their multiplier role as well as the implementation possibilities in their own properties still needs to be enhanced. The trades sector is perceived by end customers as the first point of contact.

Objectives

Intermediary actors should use their **multiplier effect** for energy transition measures and implement them **in their own properties.**

6.3 Involving Citizens in the Design of Smart Energy Grids

Challenges

The participation of citizens includes, in particular, their action on the basis of sustainable consumption and investment decisions in the energy sector. In addition to opportunities for use, this calls for acceptance of the technologies and a good information base. The population should participate with installations in the home, in transport and in energy use and generation. Both technical (e.g. radio network reception) and organisational (e.g. rented flat versus owner-occupied home) and legal circumstances determine the individual possibilities for participation. Nevertheless, not all options are available to every citizen due to the boundary conditions (e.g. in rented flats).

Objectives

Citizens should act as **energy consumers, producers and investors as well as multipliers.** They must be aware of their options for action and also be empowered to exercise them if they are interested.

DEMANDS ON POLITICS

- Local politics and administration must be role models. This includes a commitment to the energy transition, its consistent implementation and low-threshold communication work on the topic. Installations in public spaces are good examples of the possibilities of renewable energy generation and should provide low-threshold information.
- Policy-makers must create more opportunities for citizens with low incomes and without home ownership to participate in the energy transition. Even if not everyone has the same participation opportunities, they must be maximised.

7 Conclusion and Outlook

Rapid and joint action is needed to digitalise the energy grids – thereby flanking the massive expansion of renewable energy generation. Only in this way can the energy transition be implemented with the greatest possible efficiency and the development of new economic potential. At the same time, the high level of grid stability is maintained and the resilience of the energy grids is increased. Smart grids represent the crucial link between generation and consumption plants as well as storage facilities. Due to the very long planning periods and the large number of measures to be implemented and plants to be installed, any hesitation would make it much more difficult to achieve the state's decarbonisation goals.

The consideration of overarching challenges (Chapter 2) clearly shows that lack of resources (time, personnel, finances), standardisation and the creation of planning security through the regulatory environment are issues that can only be tackled in cooperation between policy-makers and implementers. State and federal policy-makers are called upon to meet these challenges decisively – especially by creating conducive framework conditions.

Integrative thinking and the early involvement of all stakeholders such as the public sector, the energy industry, planners, tradespeople and others are necessary to use energy across sectors – and thus more efficiently. It is evident throughout that cooperation needs to be intensified. Politics should take on the role of an "enabler" in order to promote dialogue between the participants from the energy sector, research and industry (e.g. in standardisation processes, see Chapters 3 and 4).

Functional regulation, e.g. for the grid-serving use of flexibilities (see chapter 3), must be initiated quickly. It is also important to set legal guard rails – typically be anchoring far-reaching links in the area of sector coupling in early planning phases (Chapter 4). Involving citizens and other social actors is of direct relevance for increasing acceptance and decentralising energy use (Chapter 6).

The participants in the roadmap process call on the state government of Baden-Württemberg to continue to support smart grid activities in the state in order to continue and intensify established cooperation. Since the political scope of the state primarily includes the regulatory framework as well as training/education and economic policy, it is important to start here in order to create the appropriate conditions.

Together, the federal government of Germany should also be approached to pave the way for smart energy grids based on fruitful regulations – especially in terms of planning security for those implementing them in the energy sector.

Baden-Württemberg has a pioneering role due to the political, economic and civil society cooperation already unfolding in the field of smart grids. This Smart Grids Roadmap Baden-Württemberg 2.0 serves as a tool to channel the potential of the stakeholders, to intensify cooperation and to further make Baden-Württemberg a model state for the nationwide implementation of smart grids in Germany.

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Abbreviations

BMWK	German Federal Ministry for Economics and Climate Action
BSI	German Federal Office for Security in Information Technology
CO_2	Carbondioxide
EEBUS	Interface Specification for the Interconnection between Energy Management Systems
EnWG	German Energy Industry Act (EnWG)
H_2	Hydrogen
IC	Integrated Circuit
IT	Information Technology
KEA-BW	Klimaschutz- und Energieagentur Baden-Württemberg GmbH
ONS	Local Network Station
OPEX	Operational Expenditures
PV	Photovoltaics
SG	Smart Grids
SME	Small and Medium-Sized Enterprises
TSO	Transmission System Operator
V2G	Vehicle-2-Grid
VDE	Association for Electrical, Electronic & Information Technologies (VDE)
DSO	Distribution Grid Operator

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