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Project report

dena-Distribution Grid Study II

Setting the course for climate neutrality among distribution grid operators - a cross-sector perspective

Executive Summary

Legal information

Publisher:
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Last updated:
06/2025

Please cite this publication as follows:
Deutsche Energie-Agentur (Publisher) (dena, 2025): "dena-Distribution Grid Study II - Setting the course for climate neutrality among distribution grid operators - a cross-sector perspective. Executive Summary"

Project management
German Energy Agency (dena).

Expertise
The project was developed in co-operation with

Project steering group
The project was financed and supported by the following partners (in alphabetical order):

The partners were actively involved in the design, implementation and evaluation of the study and contributed significantly to the success of the project.

Executive Summary

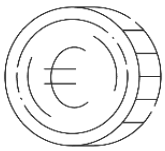
Starting point: Climate neutrality poses enormous challenges for grid operators in all sectors

Distribution grids in all sectors are fundamental to a climate-neutral energy system, as the energy transition is taking place in the distribution grid. Electricity is increasingly being generated and distributed on a decentralised basis, while new consumers such as electric vehicles, heat pumps and battery storage systems are being added at the same time, resulting in a sharp rise in the number of grid users. Gas and heating grids are also facing a massive transformation to enable climate neutrality in buildings and industry. German distribution system operators (DSOs) face enormous new challenges in terms of planning, financing, operational management and the digitisation of grid infrastructures. The necessary resources and specialists must be mobilised under time pressure. Grid operators are faced with the task of balancing various objectives: They must manage investments on an unprecedented scale, deal with the uncertainties of the transformation process and guarantee supply - while at the same time facing public pressure to keep energy prices affordable.

The dena Distribution Grid Study II: Focus on the business perspective of integrated companies

This is why the dena Distribution Grid Study II focuses on the business perspective. It therefore complements the energy system studies, which look at the transformation from a grid and economic perspective. The study was developed under the leadership of dena in close cooperation with the team of experts from BET Consulting GmbH, Bergische Universität Wuppertal and BMU Energy Consulting GmbH as well as the group of 26 DSOs who contributed their practical perspective as project partners.

The study identifies key challenges and possible solutions in the following four fields of action:



Field of action 1: Attractive investment conditions and diverse sources of financing

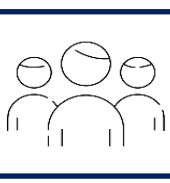
- Reliably adapt the regulatory framework while ensuring sustainable business models and consumer protection
- Expand capital procurement and examine diversification

Field of action 2: Coordination, planning security and data exchange across sectors and levels

- Swiftly implement EU requirements and accelerate authorisation procedures and accelerate permitting processes
- Strengthen horizontal and vertical cooperation
- Improve data quality and facilitate data exchange, avoid parallel structures

Field of action 3: Digitisation for efficiency and flexibility

- Make a political decision regarding grid-orientated dispatch of flexibility
- Drive forward the expansion of metering and control technology and create a data basis
- Creating attractive conditions for digitisation processes



Field of action 4: Transformation as a cooperative joint task

- Strengthen cross-divisional coordination of DSOs
- Intensify cooperation with external players
- Joint efforts when cooperating with service providers

Field of action 1: Attractive investment conditions and diverse sources of financing

Grid operators are faced with the challenge of having to raise considerable sums - in a trade-off between the speed of transformation, attractive financing conditions and the need to maintain the affordability of energy. A successful transformation requires a reliable regulatory framework that enables viable business models, secures investments and simultaneously reduces system costs. Overall, the investments required for the transformation across all sectors significantly exceed previous levels. A significant increase in investment and capital requirements is expected, particularly in the next 10 to 15 years. Compared to 2024, the average annual investments of the modelled sample DSO in the study will increase by 85-123 % across all sectors by 2045.

The traditional internal financing power of the companies is not sufficient to cope with the investment requirements. Grid operators will therefore have to tap into additional sources of capital, which will require additional equity due to restrictions in their ability to obtain external financing. Raising sufficient equity can be a challenge for companies with high investment activity. Various approaches exist to counter this. These include increasing the regulated equity interest rate, founding external companies or examining the provision of strategic state equity. For sufficient equity to be made available, it must be ensured that a risk-adequate and internationally competitive interest rate is provided. From the perspective of the DSOs and experts, an increase in the equity and debt capital interest rates defined in the incentive regulation is the preferred option. To this end, the regulator Bundesnetzagentur is currently conducting a procedure to determine a WACC (weighted Average Cost of Capital) rate on capital. The results of this study should be included in the debate as part of the consultation on the draft of this resolution in summer 2025. As a further possibility, the experts developed an optional participation model (AssetCo) in the study, which could potentially be designed with public participation.

Recommendations for action		Actor
Ensure the basis for economically viable business models in the legal and regulatory framework and safeguard consumer interests	**Ensure that DSOs have sufficient equity and debt capital**. In addition, ensure that the costs required for the transformation can be covered and that the return on capital can also be generated as a result - subject to efficiency. Make unavoidable cost burdens for consumers socially acceptable.	Regulator, federal government
Expand capital procurement through a variety of financing sources	**Ensure higher equity and debt capital inflows**, considering a sustainable level of debt, distribution obligations and retention options vis-à-vis shareholders on a case-by-case basis.	DSOs
Examine alternatives to traditional financing models such as hybrid capital or off-balance sheet solutions	**Examine** case-specific **options for raising mezzanine capital and founding external companies**, such as the proposed AssetCo model.	DSOs
	Examine specific options for fleshing out the optional **AssetCo model**.	Regulator, federal government
Also examine state support measures, to secure transformation financing	**Targeted subsidy measures** can support financing in difficult situations. The following options should be examined: state mezzanine capital, low-interest (municipal) loans or state equity investments.	Federal government, federal states
Solve additional challenges in the heating and gas sector regarding the regulatory framework	Examine design for financing hydrogen distribution grid ramp-up, implementation of biomethane cluster and **controlled gas grid transformation** that reduces costs.	Regulator, Federal government
	Reliably develop **funding framework for economically viable heating networks** in the long term and harmonise various mechanisms. Adapt pricing and price structures to increase refinancing power and transparency and ensure affordability.	Federal government

Field of action 2: Coordination, planning security and data exchange across sectors and levels

Coordinated planning encompassing the electricity, gas, hydrogen and heating sectors at an early stage is one of the most important foundations for efficient design and implementation of grid measures. Like this, parallel energy infrastructures can be avoided, and changes can be responded to quickly. The further development of electricity grid and heat planning towards an energy system planning is an important prerequisite for this. In addition, a stable legal and regulatory framework is required in all sectors in the long term. These offer legal certainty and predictability for operators and grid users and help to meet challenges in a way that makes sense for the economy. Forward-looking planning processes and grid models can also reduce costs, especially for replacement investments.

To ensure a climate-neutral and resilient energy supply in all sectors, hydrogen distribution grids or local biomethane clusters can be useful in individual cases. Where they make sense, the regulatory framework must enable their implementation and financing. The expected extensive decommissioning of the gas distribution network is also a challenging task that requires further clarification. The legislator must therefore urgently implement the EU requirements from Art. 56 and 57 of EU Directive 2024/1788 for H2 development planning and decommissioning planning, coordinate the relevant planning processes in terms of timing and build on the existing regulatory framework. The aim is to ensure long-term and reliable planning for DSOs and customers. EU, federal and state authorities must continue to reduce bureaucratic hurdles and digitise permitting procedures for grid expansion to speed up processes and reduce costs. This also includes equipping the implementing authorities with qualified personnel and the tools required for the transition.

Horizontal and vertical cooperation are important levers for reducing investment volumes by leveraging synergies between the divisions. A key success factor is coordination between the plans - including across companies. This applies to coordination across divisions (horizontal) and between planning processes at different levels (vertical), which should also include planning assumptions for the expansion of renewable energy plants, load development and grid expansion. Vertical coordination must harmonise overarching goals such as the system development strategy with local planning, e.g. in municipal heating plans, electricity distribution grid planning, hydrogen development planning and decommissioning planning for gas distribution grids in the long term. In addition to top-down and bottom-up harmonisation, this requires the ability to evaluate comparable data from different plans and coordinate them in a streamlined process without creating new parallel structures. The quality of heating plans must be improved, and economic efficiency must be considered when designating areas for heating network development.

Recommendations for action		Actor
Further develop a reliable legal framework	**Implement EU requirements** for hydrogen distribution network planning (conversion and new construction) and decommissioning plans - taking biomethane into account.	Federal government, states, regulator
	Provide implementing **authorities with qualified personnel** and other **resources** required for digitisation.	Federal government, states, municipalities
	Reduce bureaucratic hurdles, enable **digitisation in approval procedures** for grid expansion and cross-company coordination.	Federal government, federal states, municipalities, regulator
Strengthen horizontal and vertical coordination	**Horizontal coordination:** further strengthen coordination across sectors with a view to the upcoming challenges of the transformation.	Companies
	Vertical coordination: Efficiently coordinate and harmonise planning processes at different levels.	Federal government, states, municipalities, companies
Improve data quality and facilitate data exchange	Establish **uniform data standards**, make them binding and implement them in corresponding planning processes at public authorities and companies.	Federal government, states, companies

Field of action 3: Digitisation for efficiency and flexibility

Digitisation is a key instrument for efficiently organising the operation of a climate-neutral electricity system. It represents an opportunity for grid operators to increase supply reliability through real-time information on the grid state, accelerate processes and optimise grid expansion and grid management through the transparency gained. It improves observability, controllability and predictability and thus allows flexibility potential to be utilised.

Grid expansion can also potentially be reduced by taking greater account of flexibility in grid planning, provided that legal requirements permit the permanent, grid-neutral or grid-orientated utilisation of flexibility. The participating DSOs favour extending Section 14a of the German Energy Industry Act to include the permanent permission of strategic and time-limited dimming without a direct grid expansion obligation - analogous to curtailment of renewable energy plants. The target image should be a "smart grid" with strategic integration of controllable consumers into operational management and not a "copper plate" in which the grid is operated statically and expanded for every theoretically possible power peak. This requires an adapted legal framework that enables the economically prudent utilisation of flexibility. The DSOs should be allowed to decide which solution is the more efficient in the respective context by weighing the economic benefits and costs.

The analyses show that the potential savings clearly outweigh the additional consumer burden resulting from investments in metering and control technology, although the savings effects can vary depending on the grid section. It is therefore necessary for digitisation costs to be rewarded and fully and promptly recognised in grid regulation. The development of a digital data basis at the grid operators is crucial to enable data-driven applications and leverage optimisation potential. Good conditions for digitisation processes, including a clear target model, are essential here.

Recommendations for action		Actor
Make a political decision regarding grid-friendly use of flexibility	Bring about a strategic decision on the **permanent grid-neutral or even grid-supporting use of flexibility**, with a view to controllable loads in households, large battery storage systems, large loads and generators.	Regulator, Federal government
Drive forward the expansion of measurement and control technology and create a database	Consistently drive forward the expansion of metering and control technology and the creation of **transparency regarding the grid state** at all grid levels.	DSOs
	Implement **the rollout of smart metering** systems across the board in accordance with legal requirements to **enable** flexible control concepts and dynamic grid management.	Meter operator
	Establish a **digital data basis** in the form of master and transaction data, including standardised interfaces and formats.	DSOs
	Drive forward innovative **data-driven applications** to leverage optimisation potential, particularly in **grid planning**.	DSOs
	Further develop and implement **planning and operating principles**, including curtailment of renewable energy systems, grid-friendly integration of controllable consumers and battery storage and flexible grid connection agreements.	DSOs
Create good conditions for digitization processes	Enable full **cost recognition** for digitisation costs as part of the NEST process and reward grid operator's energy transition competence.	Regulator
	Establish **a cross-organisational target model** for government actors and authorities involved in digitisation and manage implementation in an agile manner.	Federal Ministry for Economic Affairs and Energy, regulator, Federal Office for Information Security
	Establish a clear vision for digitisation and an **agile approach to** the implementation of complex measures within the DSOs.	DSOs

Field of action 4: Transformation as a cooperative joint task

The transformation of the energy system is a joint societal effort that can be implemented faster, more effectively and more cheaply through close cooperation between the stakeholders involved at all levels. DSOs should promote strong internal networking and, in some cases, already existing joint, overarching coordination even more intensively to take a holistic view of digitisation, planning and operation. Increased regional alliances and cooperation in the procurement of resources as well as the exchange of skilled labour are recommended to effectively address the existing shortages. Collaboration with external players such as universities and start-ups should be intensified to promote innovation and the recruitment of skilled labour. In addition, the cross-divisional and cross-sector utilisation of service providers makes sense to implement measures quickly and cost-effectively, also in the interests of network customers.

The creation of a common target model for cross-organisational transparency regarding targets and objectives and structured exchange platforms is necessary. To this end, DSOs should involve the relevant institutions and authorities (such as BMWE, BNetzA, BSI, BDEW and FNN in Germany) even more closely to ensure coordinated and efficient implementation.

At the local level, strong municipalities form the basis for success. Instead of master solutions, a variety of flexible but binding and legally compliant cooperation and organisational models must be possible that are tailored to the heterogeneity of DSOs (size, ownership structures, etc.) and specific regional conditions and local requirements. To strengthen this diversity, local authorities should be able to react more flexibly to the requirements of federal and state authorities.

The narrow limits of unbundling, concession and competition regulations must always be observed in all collaborations - restrictions regarding coordinated planning, joint procurement and closer cooperation must be analysed and reduced. The proposed coordination and cooperation approaches must avoid creating additional structures and thus additional burdens for the DSOs. With the necessary legal, organisational and financial framework conditions, an environment must be created so that cooperation does not become a risk but a success factor for transformation.

Recommendations for action		Actor
Strengthening cross-sector coordination of DSOs	Promote even stronger **cross-sector networking and coordination** for a holistic approach and implementation.	DSOs
	Regional alliances and cooperation in binding and legally secure organisational models for procurement. Expand bilateral exchange of skilled labour and joint training.	DSOs
	Use services offered by larger DSOs to smaller ones, promote **the formation of functional units** (e.g. planning groups) between neighbouring DSOs.	DSOs
Intensify cooperation with external players	In the future, develop **joint target models** with the DSOs.	DSOs, municipalities
	Facilitate cooperation with universities and start-ups as well as the formation of competence clusters and joint ventures to **utilise external innovation strength.**	Federal government, federal states, municipalities, DSOs
	Intensify cooperation and communication **with grid customers**, especially in the context of the heating transition.	DSOs, municipalities
Coordinated cooperation with service providers	**Make** targeted **use of joint service providers**, e.g. the same civil engineering company, especially for cooperative and coordinated construction projects.	DSOs
	Set up interfaces at the DSOs or in the municipalities for coordination purposes.	DSOs, municipalities

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