

Application areas and advantages of DC technologies from the perspective of distribution system operators (DSO)

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VERNEDCT: Ressourceneffizientes Energieverteilernetz durch DC-Technologie

Interdisziplinäres, transdisziplinäres Forschungsprojekt im Call „CZS Durchbrüche: Energiesysteme der Zukunft“

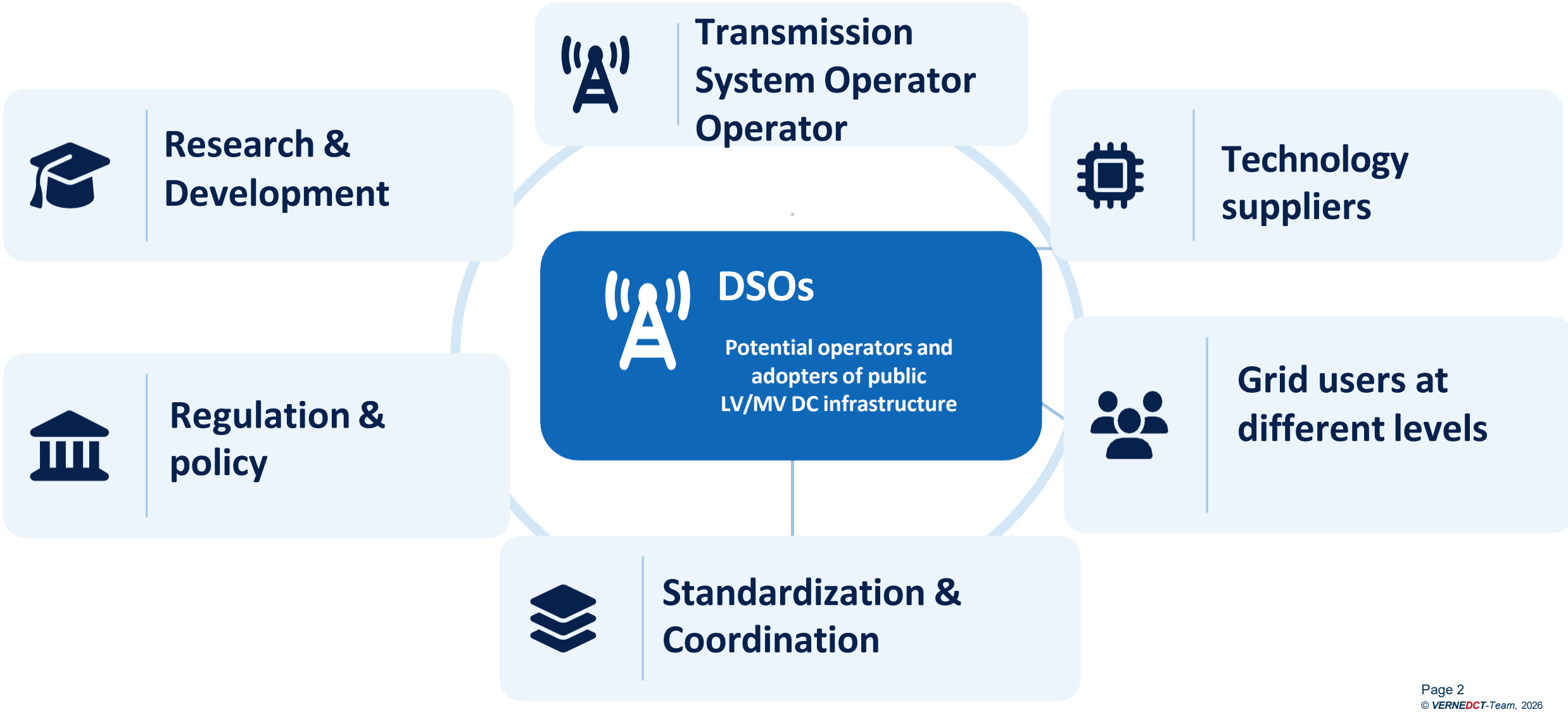
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Core Stakeholders of Public LV/MV DC Distribution Grids

Stakeholder landscape and focus of VERNEDCT



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Survey on Innovation & DC Technologies in German DSOs

Target Population

- Complete Coverage: All electricity DSOs in Germany.
- Database: Marktstammdatenregister (April 2026).
- N = 861 registered operators.

Key Research Dimensions

- Technical Innovations: Current State of Development and Future Relevance
- Drivers and Barriers to Innovation
- Investments, Organization and Cooperation
- Perspectives on DC Technologies

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PHASE 1 • APRIL 2026

Initial Rollout

Paper & online survey dispatched to central company addresses.

71 Responses (18 Paper, 53 Online/Mail)

PHASE 2 • JULY - AUG 2026

Targeted Reminder Wave

Direct contact to Technical Leads & Asset Managers.

+ 86 Additional Online Responses

FINAL SAMPLE
Evaluated Net Sample

154 Net Interviews analyzed

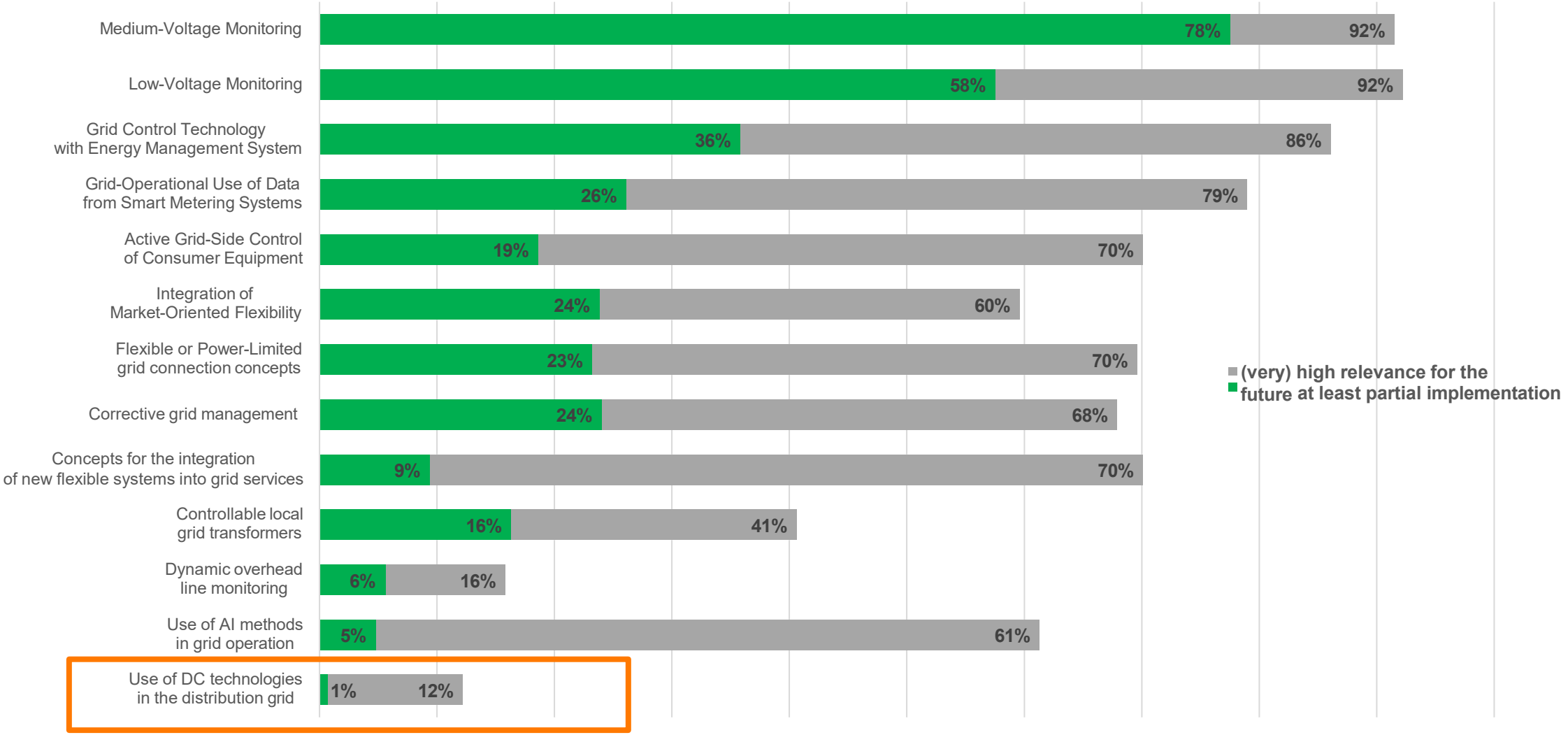
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Research Questions

- How important do DSOs consider DC technology to be as an area of innovation?
- Is DC technology primarily an issue for large DSOs?
- What benefits and areas of application do DSOs see for DC?

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Degree of Implementation and Assessment of the Future Relevance of Technological Innovations



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Current Awareness of the Use of DC in Distribution Grids

Are you aware of any potential applications of direct current (DC) technologies in the public power distribution grid, based on technical discussions, literature, research, or your own experience?

	Company Size		
	Small distribution network company (fewer than 50 employees) **n=50**	Medium-sized distribution network company (50 to 250 employees) **n=73**	Large distribution network company (more than 250 employees) **n=31**
No, never heard of it before.	40%	32%	32%
Yes, I've heard of it before.	52%	63%	58%
Yes, I have more in-depth prior knowledge of it.	8%	5%	10%

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Evaluation of potential benefits of using DC

Regardless of your level of knowledge, where do you think the potential benefits of using direct current (DC) technologies in public power distribution networks might lie?

	No awareness (n=53)			At least some awareness (n=101)		
	Cannot be assessed	No to slight benefit.	Significant benefit.	Cannot be assessed	No to slight benefit.	Significant benefit.
Better utilization of existing grid capacity	59%	17%	25%	27%	33%	41%
Improved integration of distributed power generation	59%	19%	23%	22%	32%	47%
Improved controllability of power flows	64%	23%	13%	26%	41%	34%
Greater resilience (e.g., through island operation)	65%	31%	4%	27%	46%	28%
Long-term economic benefits	72%	26%	2%	29%	51%	21%
Reduced space requirements for infrastructure	70%	26%	4%	33%	53%	15%

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Evaluation of future potentials of using DC

Imagine how electricity generation and consumption will evolve in your distribution network through the year 2050. In which of the following application examples do you see potential for the use of DC technology?

	No awareness (n=53)			At least some awareness (n=101)		
	Cannot be assessed	No to slight potential.	Significant potential.	Cannot be assessed	No to slight potential.	Significant potential.
Powering charging infrastructure (fast-charging hubs)	30%	34%	36%	14%	21%	65%
Integration of renewable generation (collector networks)	47%	36%	17%	19%	41%	41%
Connection of **energy-intensive consumers** (e.g., data center)	42%	45%	13%	18%	48%	35%
Interconnection of grid segments— DC interconnection of two adjacent AC distribution grids or grid segments	57%	42%	2%	22%	54%	25%
Power supply in neighbourhoods or new development areas	47%	47%	6%	16%	61%	23%
Supplementing existing AC grids (e.g., interconnecting low-voltage feeder lines via a DC line)	51%	42%	8%	21%	65%	14%

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Summary

- DC technology, as an innovative application, has not been very relevant to DSOs so far.
- Knowledge of DC is independent of the size of the DSO.
- Assessment of potential applications and advantages depends on prior knowledge.
  - High level of uncertainty with limited knowledge
  - Positive assessment of potential with extensive knowledge

  - **Communication to increase the level of knowledge is a top priority**

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