Current challenges and solutions from the perspective of an urban DSO

Stromnetz Berlin, Lisa Hankel
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PERÚ Ministerio de Energía y Minas

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Agenda

- Stromnetz Berlin – The Company
- Current developments and challenges
- Solution approaches
  - Observability of the networks (NS/MS)
  - Preparatory measures and analysis
  - Measurement
- Framework conditions

Stromnetz Berlin in numbers

▪ Household and business customers	approx. 2.35 million
▪ Annual amount of power	13,552 GWh
▪ Number of employees	1,285
▪ Number of energy supplier	514
▪ Length of cables	35,088 km
▪ Investments 2018	EUR 187 million
▪ Revenue 2018	EUR 1,015 million
▪ SAIDI*	13.9 minutes
▪ Changing processes 2018	around 600,000

* *The SAIDI value (System Average Interruption Duration Index) reflects the average supply interruption (unavailability) per connected end consumer in one calendar year.* Provisional value. *Version: May 2019*

Stromnetz Berlin - Investments

High investments in 2020: 211 Mio. €
of this amount, 109 Mio. € goes towards the future of the city

102 Mio. €
Maintenance + Modernisation

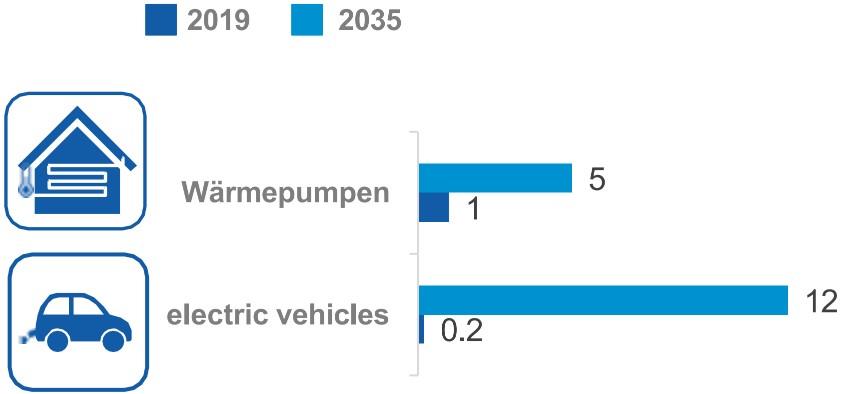
52 Mio. €
Digitalisation

57 Mio. €
Growing City

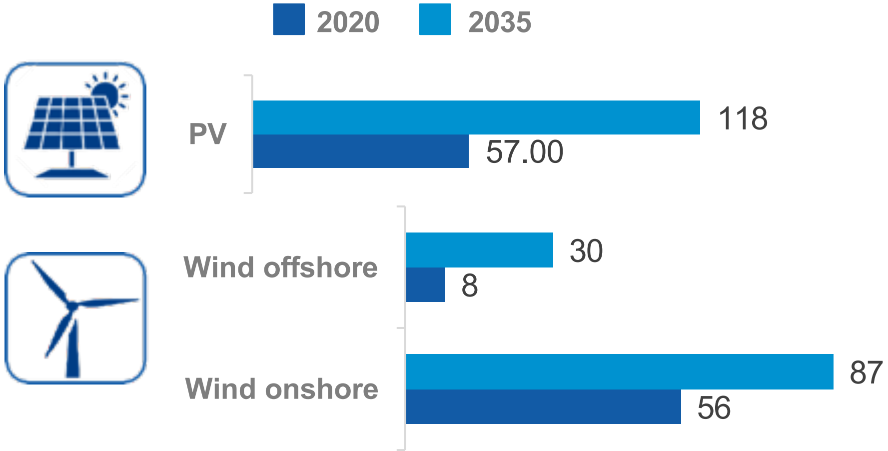
Current developments and challenges

Current developments in Germany

Number of electric vehicles and heat pumps in Mio.*



Development of RES-production in Germany in GW*/**



* Source: *Netzentwicklungsplan Strom (NEP) 2035 der Übertragungsnetzbetreiber (Szenario B)*

** Source: *Fraunhofer ISE- Energy Charts*

Development of electric mobility in Berlin

Source: p3-Studie für Stromnetz Berlin, 2021

Development of PV in Berlin - Masterplan Solarcity

Target for the master plan:
- 25% of electricity generation in Berlin in 2050 with solar energy
- Target for 2050: 4400 MWp installed PV capacity

- 40-fold increase in solar capacity is required to meet target compared to today
- 19 % of Berlin's roof surfaces must be covered with solar modules to reach the target

Remark:
Instead of solar power, solar heat can also be obtained as an alternative

Berlin		2018	2050
Installed PV-Power	Mwp	106	4,400
Solar Power Generation	GWh/a	86	3,900
Power consumption	GWh/a	13,000	15,576
Share	%	0.7	25

Area in Berlin	Mio. m^2	Share
Total base area	891.1	
Roof surfaces	106.8	100%
Module area for target	20	19%

Source: Masterplan Solarcity Berlin – volle Energie für die klimaneutrale Stadt: Berliner Energietage

New flexible consumers – Challenges and Goals

Challenges

- new loads in the low voltage network
- development path highly uncertain
  - location of charging ➔ low voltage (home, work), medium voltage (super chargers)
  - pace of development
  - customer behavior ➔ potential synchronizing effects

Goals

- save, rapid and efficient integration of new flexible consumers ➔ despite the uncertainties the grid should not become the bottleneck

Solution approaches

Solution approaches for the grid integration of e-mobility

Gaining experience
- Stromnetz Berlin Testcenter
- Pilot projects for grid integration and grid-serving control

Stromnetz Berlin Testcenter
- Own test installations (charging station, measuring systems, control units)
- e.g. local load management, control of unbalance (phase selector) as well as grid-serving control

Projects
- Pilot project for grid-serving control
- Participation in research projects, e.g. WindNODE, Stromnetz Berlin with focus on low-voltage measurement
- Establishment of own charging infrastructure for Stromnetz Berlin vehicle fleet

Solution approaches for the grid integration of e-mobility

Gaining experience

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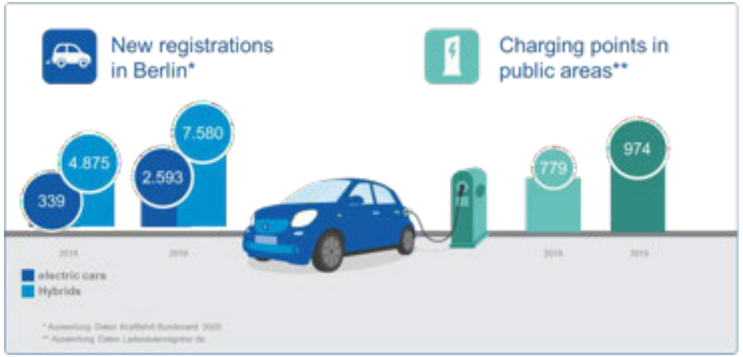
- Pilot projects for grid integration and grid-serving control

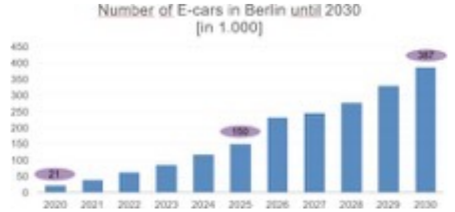
Improve data basis for network planning

- Run-up scenarios and scenario analyses
- Documentation of the registrations for charging infrastructure
- Definition and monitoring of hot spot areas



Start-up scenarios

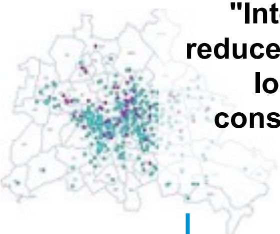
Own analyses as well as contracting of third parties (universities or consulting companies)



Charging infrastructure registration

- Since 2019, the registration of charging infrastructure with the grid operator is required by law
- SNB records monthly registrations and monitors the development

Preparatory measures and analysis



"Intelligent control reduces grid expansion - local individual consideration makes sense"

NAVIGANT

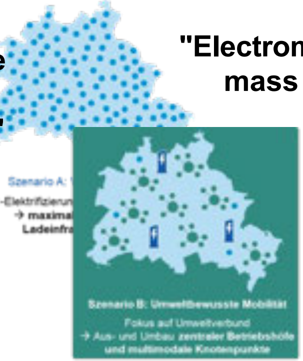
"Analysis of grid-related future scenarios 2030 to 2050"

"Overview market ramp-up to 2030 incl. derivation of regional key areas"

2018 und davor | 2019 | 2020 | **2021**

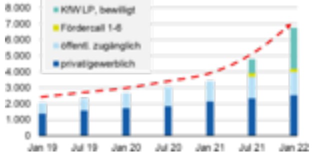
"20% (250,000 cars) electromobility can be well handled by the Berlin grid "

"Solutions built in the test center and electric mobility tour"



"Electromobility is a mass market"

"Tipping point reached: massive expansion of private as well as fleet charging infrastructure due to subsidy."



Example: Analysis of grid-related Scenarios (2050)

Dealing with uncertanties: SNB has examined three scenarios for the development of electromobility and their effects on the grid

Solution approaches for the grid integration of e-mobility

Gaining experience

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Improve data basis for network planning

- Run-up scenarios and scenario analyses
- Document registration of charging infrastructure
- Definition and monitoring of hot spot regions

Increase of the observability of the low voltage level

- Installation of measurements in local network stations + additional in hot-spot areas (in future)
- Central network management and possibility of network-serving control

Erhöhung der Beobachtbarkeit der Niederspannung

- Installation von Messungen in Ortsnetzstationen + zusätzlich in Hot-Spot-Gebieten (zukünftig)
- Zentrale Netzführung und Möglichkeit netzdienlicher Steuerung

status quo

- low voltage network is not observable

In the future

- The low-voltage grid becomes **observable** in a first step and can be **calculated** in a second step (dynamic grid calculation).
- flexibilities in the low voltage network become visible

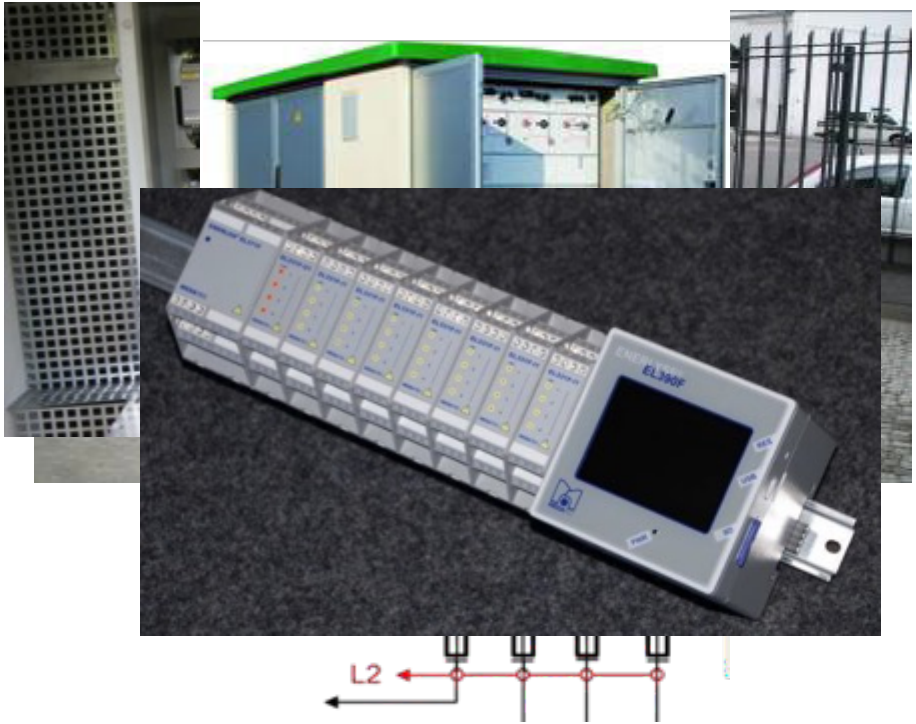
Observability - Measurement of the low-voltage network

Therefore Stromnetz Berlin is developing a **new network operating concept for the low-voltage level**

- we equip our substations with online metering technology
- The measuring devices record current and voltage of all outgoing feeders

➔ **We already installed over 2000 of these online metering devices (total number of substations rd. 8000)**

➔ **Next step:** Testing online transfer



Towards an observable and calculable low-voltage grid

What is the data used for?

- The data will be transferred into our new central low-voltage control center and IT-systems.
- enables determination of the low voltage network status for the detection of network bottlenecks by using a network security calculation

Goal: The low voltage network is observable and calculable

➔ flexibilities in the low voltage network become visible and could be used in case of potential grid overload („netzdienlich“)

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Optimize processes
- Simplify registration processes for the customer
- Create internal processes and standards

Simplify the registration process for customers
- Simple explanations of the process on the website
- Checklists for customers
- Online portal for registration of PV systems available since July 2021; expansion for electromobility planned
- Flyer with information

Optimize processes
- Cross-functional working group (customer consultants, network planners, etc.) for new issues in day-to-day business
- Create language rules and guidelines for client advisors

Recommendations from a DSO-Paper (bdew)

Recommendation	Details
Ensure registration of charging infrastructure	• In Germany, mandatory registration for charging infrastructure facility since spring 2019 • Informing grid customers and the electrical craft • Setting up a customer-friendly grid connection process (e.g., registration portal) • Documentation of reported charging points (internal)
Monitor network utilization	• Demand-oriented recording and evaluation of the max. utilization of the operating resources • Prevent unexpected load increases through: − Comparison of reported e-vehicles with registration data − Consider charging station register (if available) • Establishment of own monitoring systems in low voltage: − Analog meters: detect load growth through regular evaluation − Electronic meters: digital measurement of load flows
Setting up sustainable grid planning	• Evaluating the impact of charging infrastructure through performance assumptions and simultaneity factors • predictive network planning for new network connection and for expansion/adaptation

Source: bdew Anwendungshilfe Stromnetz für Elektromobilität; Netzintegration von Ladeinfrastruktur

Current regulatory framework and further development

Regulatory framework (extract)

Operation of charging points

- Distribution system operators are not allowed to operate charging points for electromobility in Germany (Section 7c EnWG)

Grid-serving control of flexible loads

- The german energy law (§14a EnWG) allows flexible low-voltage customers and DSOs to conclude contracts for load shifting

  ➔ in return the customers receive a reduced network tariff
- **Idea: Network expansion can be optimized by the possibility of reducing the charging capacity at peak load times**

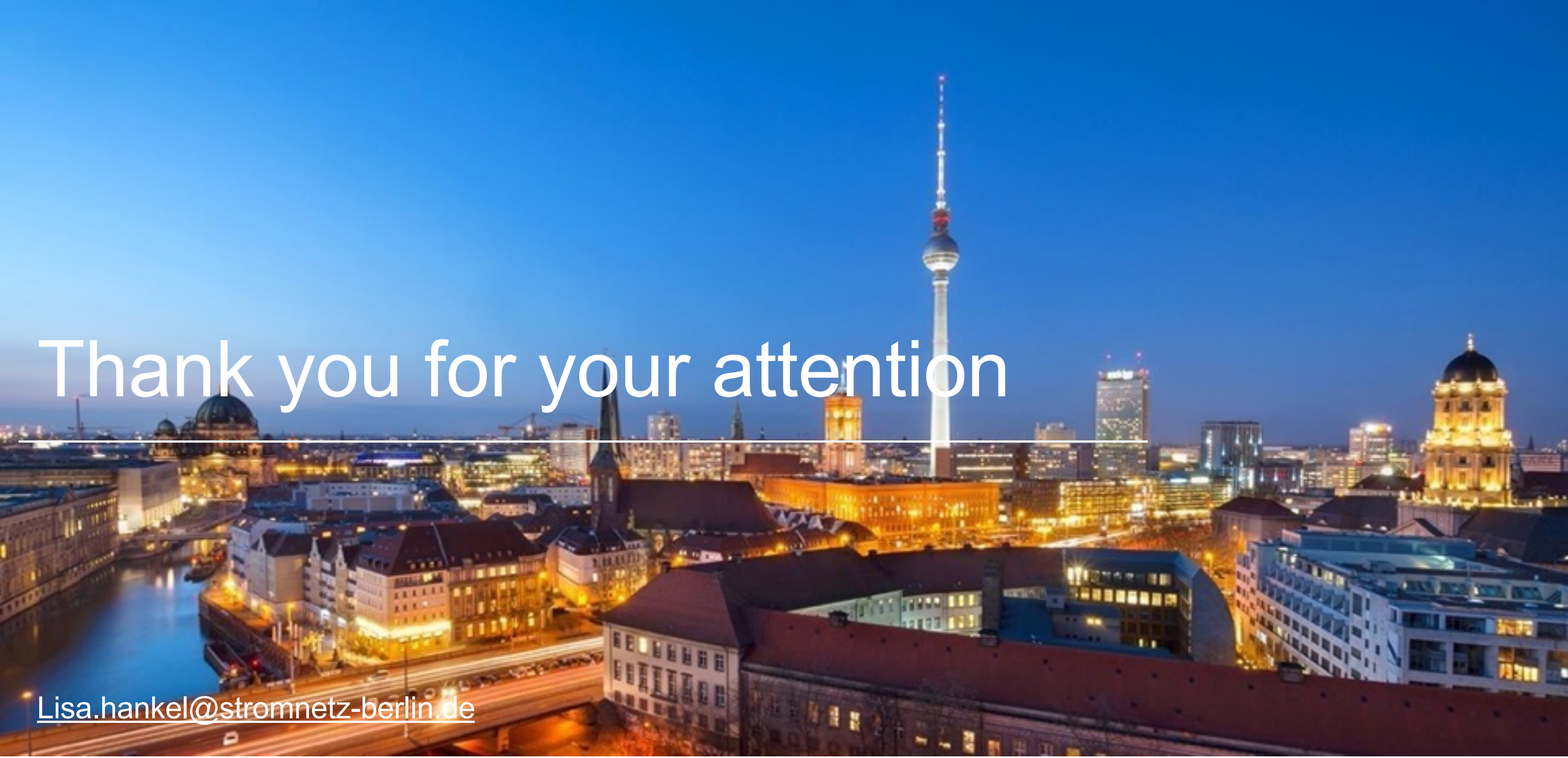
Further development of the regulatory framework

Necessity

- However, the current regulatory framework does not lead to many e-cars being integrated into the grid in a grid-serving manner.
- Due to the expected market ramp-up of electromobility and the deficits of the current legal framework different stakeholders (consumer protection, automotive and energy sectors etc.) have been discussing a new useful legal framework for flexible loads since 2019.

Discussion

- Topics: Incentives for load shifting (e.g., time-variable grid tariffs), technology for control, technical capability for controllability as standard or voluntary?, prioritization of different control commands, etc.
- Grid operator position: Flexible customers should be technically capable of receiving and applying grid-serving control signals. To avoid grid overloads, grid operators should be allowed to send grid-serving signals, which then have priority over other control signals.



Thank you for your attention

Lisa.hankel@stromnetz-berlin.de

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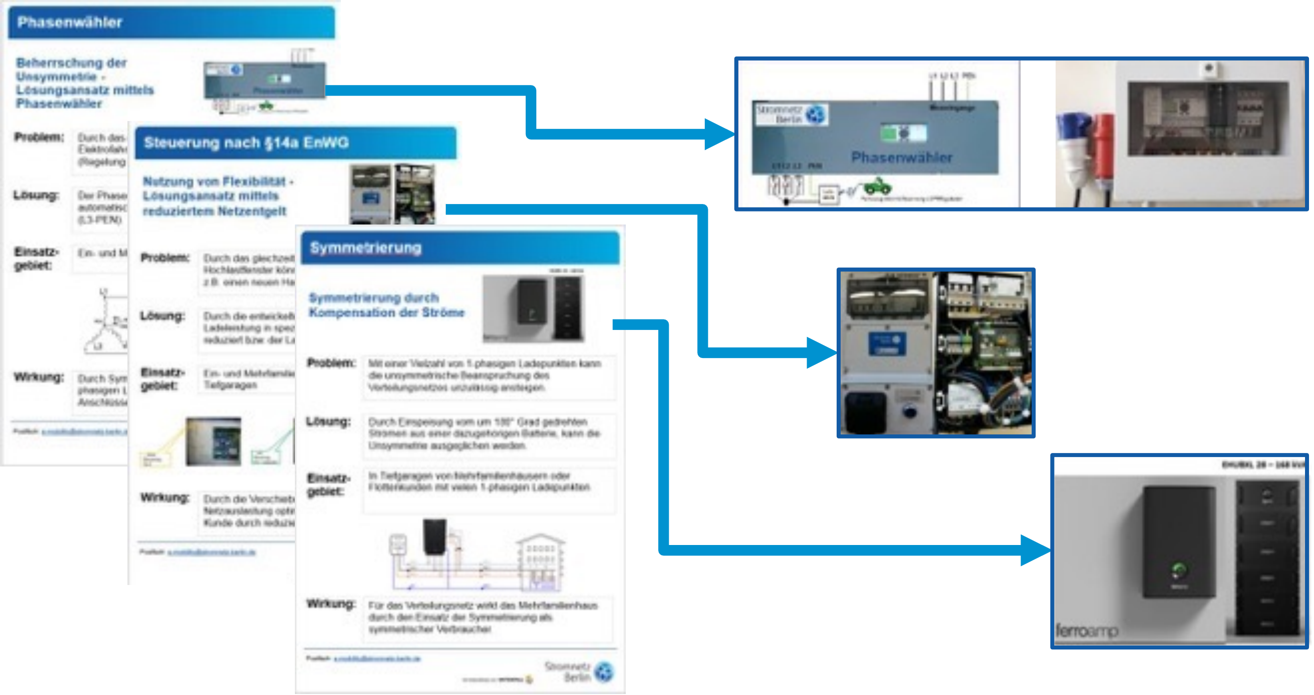
Annex

Stromnetz Berlin

Im Testcenter entwickeln wir technische Innovationen



Charge column in test operation

In the test center, Stromnetz Berlin examines various installations and control systems that could be put into practice when electric mobility runs up.

Electromobility at SNB

Electrifying our fleet

- Berlin has set itself the aim of **driving forward the electrification of transport**.
- Stromnetz Berlin is making our contribution: **Our cars will be 70% electric by 2020.**
- **Partner** for E-Mobility
  - We advise our customers on connecting to charging infrastructure and accompany infrastructure expansion with grid and management concepts, amongst other things.

Charge column in test operation

By 2030, the BVG aims to replace all 1,400 diesel buses with electric buses. Stromnetz Berlin is a partner for charging infrastructure.

Muchas gracias

por su atención

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