2nd European Truck Charging Symposium 2025

30th September & 1st October 2025

High Power Charging Network for Trucks: Planning, Financing, Capacity Allocation and Pricing

Recommendations based on an economic analyses and comments on the "Deutschlandnetz"

Preliminary research findings from the **HoLa-project** (High Power Charging for Trucks)

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This presentation is based on joint research with Carolin Grüter and Thorsten Beckers.

Agenda

BACK UP

1) Provision of a high power charging network for trucks at the “BAB” (focusing on capacity allocation and pricing)
   - 1.1) Main tasks for providing a high power charging network for trucks at the „BAB“
   - 1.2) Capacity allocation and pricing
2) Capacity planning, capacity financing, capacity allocation and pricing within the charging network at BAB: centralized responsibility (by the public sector) vs. competition (and disintegrated decisions)
3) Comments on the „Deutschlandnetz“ (focusing on capacity allocation and pricing)

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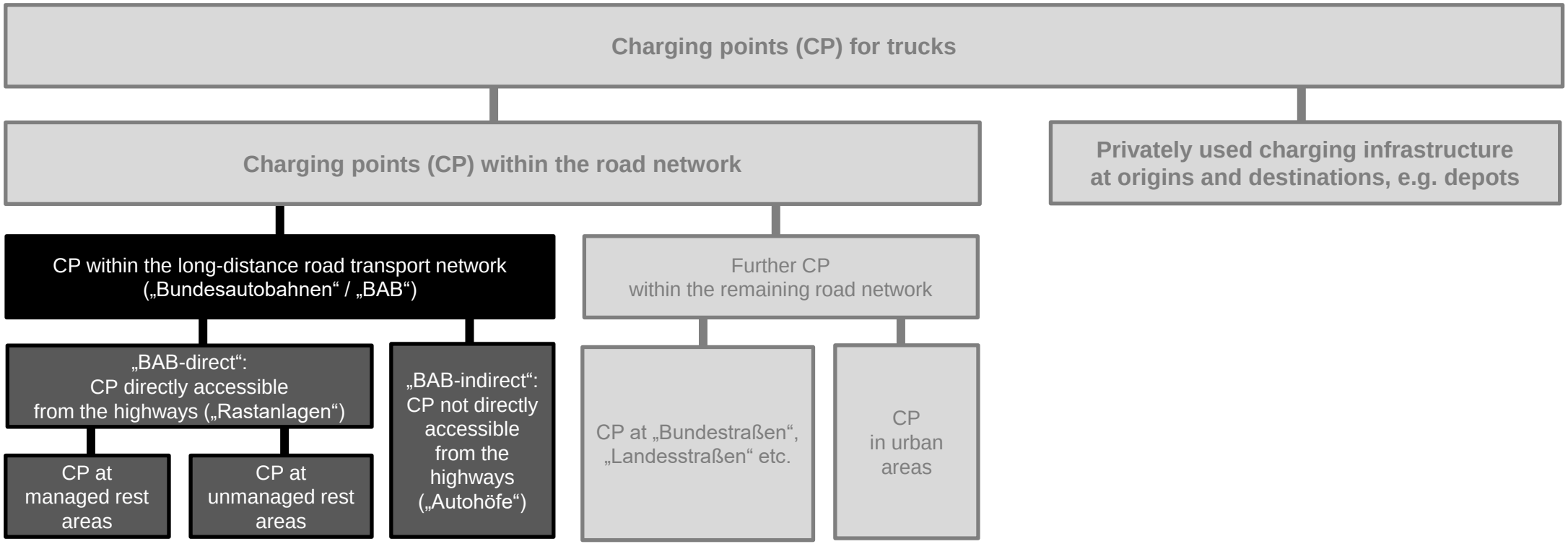
High power charging networks for trucks …
… focusing on the long-distance road transport network („Bundesautobahnen“ / „BAB“)



Provision of a high power charging network for trucks at the „BAB“: Main tasks (1/4)

Capacity planning

Assumption: centralized capacity planning by the public sector

- Based on cost-benefit considerations
- Aimed at network-wide optimization

Capacity financing

Capacity allocation and pricing

Build, maintenance and operation

Electricity procurement

Provision of a high power charging network for trucks at the „BAB“: Main tasks (2/4)

Capacity planning	Assumption: centralized capacity planning by the public sector ▪ Based on cost-benefit considerations ▪ Aimed at network-wide optimization
Capacity financing	
Capacity allocation and pricing	
Build, maintenance and operation	**Not addressed in this presentation**
Electricity procurement	**Not addressed in this presentation**

Provision of a high power charging network for trucks at the „BAB“: Main tasks (3/4)

Capacity planning

Assumption: centralized capacity planning by the public sector

- Based on cost-benefit considerations
- Aimed at network-wide optimization

Capacity financing

- The financing of the capacity (within the whole high power charging network for trucks at the „BAB“) should primary be based on time-related payments
  - … from the users (“vignette”)
  - … and/or from the federal budget
- The need to raise funds through time-related payments may be reduced if revenue is generated from demand-driven pricing for the actual use of charging points

Capacity allocation and pricing

Build, maintenance and operation

Not addressed in this presentation

Electricity procurement

Not addressed in this presentation

Provision of a high power charging network for trucks at the „BAB“: Main tasks (4/4)

Capacity planning

Assumption: centralized capacity planning by the public sector

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Capacity financing

- The financing of the capacity (within the whole high power charging network for trucks at the „BAB“) should pr

Capacity allocation and pricing

- Th ue is generated from

Discussed below …

Build, maintenance and operation

Not addressed in this presentation

Electricity procurement

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     - 1.2.1) **Demand constellations and how to address them with specific products that differentiate in pricing**
     - 1.2.2) **Further instruments for capacity allocation: Prioritization rules and a reservation system**
2) **Capacity planning, capacity financing, capacity allocation and pricing wit**
   centralized responsibility (by the public sector) vs. competition (and disir
3) **Comments on the „Deutschlandnetz“ (focusing on capacity allocation and pricing)**

Assuming that the public sector is responsible for designing capacity allocation rules and a pricing scheme
- Based on cost-benefit considerations
- Aimed at network-wide optimization

Assumption:
No prioritization rules and no reservation system

Demand constellations for charging points
within a high power charging network for trucks at the „BAB“

Demand constellations	
Charging due to regulations on driving time and rest periods	**45 min**
	540 min
Need for **immediate charging** (as fast as possible)	
(Diverse) further charging constellations	

Adressing the demand constellations with targeted products (1/3)

(Non-)time-block-products Demand constellations		Non-time-block-products	Time-block-products
Charging due to regulations on driving time and rest periods	**45 min**		product „time-block-45-charging“
	540 min		product „time-block-540-charging“
Need for **immediate charging** (as fast as possible)		product „immediate charging“	
(Diverse) further charging constellations		…	…

Adressing the demand constellations with targeted products (2/3)

BACK UP

(Non-)time-block-products Demand constellations		Non-time-block-products	Time-block-products
Charging due to regulations on driving time and rest periods	**45 min**	Offers charging of a predefined amount of energy in 45 min	product „time-block-45-charging“
	540 min		product „time-block-540-charging“
Need for **immediate charging** (as fast as possible)		product „immediate charging“	offers charging of a predefined amount of energy in 540 min
(Diverse) further charg constellations		offers charging with the maximum power available	…

Adressing the demand constellations with targeted products (3/3)

BACK UP

(Non-)time-block-products	Non-time-block-products	Time-block-products
Demand constellations		
Charging due to regulations on driving time and rest periods — 45 min		rging“
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Need for **immediate charging** (as fast as possible)		
(Diverse) further charging constellations	…	…

Not addressed in this presentation

Rationality for (dynamic) prices and price components ... (1/3)
… as well as rationality for product-specific pricing

Rationality in pricing (as a tool for demand management and thus capacity allocation)

- Shifting demand through pricing to avoid (or minimize) queues during supply shortages
- Approaches to managing demand through pricing
  - Managing demand over time through pricing
  - Spatial demand management through pricing
  - Managing demand with respect to charging products
- Note: No unnecessary displacement of demand due to (unnecessarily high) prices

Example:
The charging should take place earlier and before the area with capacity shortages

Example:
Scarce capacity at „Rastanlagen“ (“BAB-direct”) should preferably be used for “45-minute charging,” while “540-minute charging” should take place at „Autohöfe“ (“BAB-indirect”).

Rationality for dynamic pricing

- Dynamic pricing is necessary to take into account current shortages (at various locations in the charging network at certain times)
- One challenge with dynamic pricing is announcing future prices to users in order to achieve the intended shifts of demand
- Note: Dynamic pricing leads to transaction costs for users, which is why the complexity and thus the dynamics of pricing should be limited

Rationality for multiple price components

- Rationality: Addressing various origins of shortages on the supply-side
- Bottlenecks addressed with price components
  - Parking spaces → price with respect to charging/parking time
  - Capacity of charging stations and grid connection → pricing with respect to the desired (or required) capacity for charging
  - Electricity → (electricity) price with respect to the amount of electricity

Rationality for (dynamic) prices and price components ... (2/3)
… as well as rationality for product-specific pricing

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Reservations, which will be discussed below, are important for overcoming this challenge

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Rationality for (dynamic) prices and price components ...
… as well as rationality for product-specific pricing

Rationality for product-specific pricing

- To establish incentives for users to provide accurate information about the desired charging product before starting the charging process (so that the operator can optimize the charging of all users at his station over time)
- In order to manage demand specifically

Examples related to time-block products and the dwell time at the charging points

- For the “time-block-45-charging”-product, the price for using the space should rise sharply from (but only from) minute 46
- For the “time-block-540-charging”-product product, on the other hand, the price for using the space should rise sharply from (but only from) minute 541

Example:

Between users in different demand constellations who (accordingly) opt for different products

Once again: Scarce capacity at „Rastanlagen“ (“BAB-direct”) should preferably be used for “45-minute charging,” while “540-minute charging” should take place at „Autohöfe“ (“BAB-indirect”)

- …
- And last but not least:
  Product-specific pricing makes it possible to achieve the desired demand management with the lowest possible prices

Particular features of pricing for “time-block products” and “non-time-block products”

BACK UP

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BACK UP

Rationality for product-specific pricing

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- In order to manage demand specifically
- …
- And last but not least:
  Product-specific pricing makes it possible to achieve the desired demand management with the lowest possible prices

Particular features of pricing for “time-block products” and “non-time-block products”

BACK UP

- “Non-time-block products” (“immediate charging”)

  Direct pricing of the capacity of charging stations and grid connection
- Time-block products (time-block-45-charging, time-block-540-charging)
  - Indirect pricing of the capacity of charging stations and grid connection → pricing refers to the amount of energy
  - This is because the operator has the option of varying the charging power during the time block (taking into account the charging power of the trucks)

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       - 1.2.2.1) **Prioritization rules**
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2) **Capacity planning, capacity financing, capacity allocation and pricing within the charging network at BAB: centralized responsibility (by the public sector) vs. competition (and disintegrated decisions)**

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Assuming that the public sector is responsible for designing capacity allocation rules and a pricing scheme
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Prioritization rules as an instrument for capacity allocation

Rationality for prioritization rules

- Queues cannot be completely prevented even with dynamic pricing, especially if the aim is (as recommended) to avoid excessively high prices that would unnecessarily suppress demand.
- Holders of higher priority rights are moved to the front of queues

Look at other sectors

- Non-priced priority rights

  E.g. police with blue lights can make preferential use of road capacity
- Priced priority rights
  - Priced priority lanes at airport security checks
  - Preferential allocation of mobile phone capacity in the event of congestion to customers with premium tariffs
  - Special reserved seats on DB ICE trains for premium customers (with BahnBonus status level Gold or Platinum)

Approaches to the pricing of priority rights

- Time-based pricing of priority rights (example: time-based premium mobile phone tariff)
- Pricing of priority rights based on individual cases of use (example: purchase of access to the priority lane at airport security for a specific flight)

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Reservation system as an instrument for capacity allocation

Rationality for a reservation system

- Information gathering regarding future demand in the network by the (public) operator
  - Specifically: Information gathering through realized demand for reservations
  - This provides a better understanding of expected demand and shortages than when using forecasting tools alone
- Providing a certain degree of security for users (regarding future access to capacity at specific prices)

Various design issues with respect to a reservation system

- (Dynamic) pricing of reservations
- Return and adjustment of reservations in the context of an uncertain environment (traffic jams, changed routes, etc.)
- …

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Capacity planning, capacity financing, capacity allocation and pricing within the charging network at BAB:

Centralized responsibility (by the public sector) vs. Competition (and disintegrated decisions)

Highly condensed presentation of results of our analyses

Capacity planning and capacity financing

- Significant advantages of integrated central responsibility
  - Based on cost-benefit considerations
  - Aimed at network-wide optimization
- Once again: Not the focus of this presentation

Capacity allocation and pricing

- Assumption so far: The public sector is responsible for designing capacity allocation rules and a pricing scheme
  - Based on cost-benefit considerations
  - Aimed at network-wide optimization
- (One) alternative: competition (both between CPOs and between EMPs) and multiple (disintegrated) pricing regimes
  - Significant disadvantages to be expected
  - Various (potential) problems and disadvantages
    - No optimization of usage across the entire network
    - Exploitation of (possibly only local) market power by individual players or by all providers in the context of scarcity
    - ...
  - Note: Access rules and central distribution platforms are by no means sufficient to eliminate the problems and disadvantages listed (not only to an unsatisfactory extent)

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Comments on the „Lkw-Deutschlandnetz“ (focusing on capacity allocation and pricing)

Capacity planning	▪ Positive: Public planning with respect to the entire network ▪ Negative: Among other things, only unmanaged rest areas are included in the "LKW-Deutschlandnetz" at BAB
Capacity financing	▪ Positive: At least most of the capacity financing is provided by a public financing regime (federal budget) ▪ Negative: ...
Capacity allocation and pricing	▪ Positive: The public sector has at least greater influence on capacity allocation and pricing in the “German truck network” than in the “German car network” and could in consequence, among other things, probably still push through relevant improvements in renegotiations if desired. ▪ Negative: • No network-related regime for pricing and capacity allocation. • No regime for pricing and capacity allocation geared towards efficient capacity allocation with limited usage prices is to be expected. • ... ▪ Overall assessment: significant potential for improvement
Build, maintenance and operation	**Not addressed in this presentation**
Electricity procurement	**Not addressed in this presentation**

Thank you for your attention!

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