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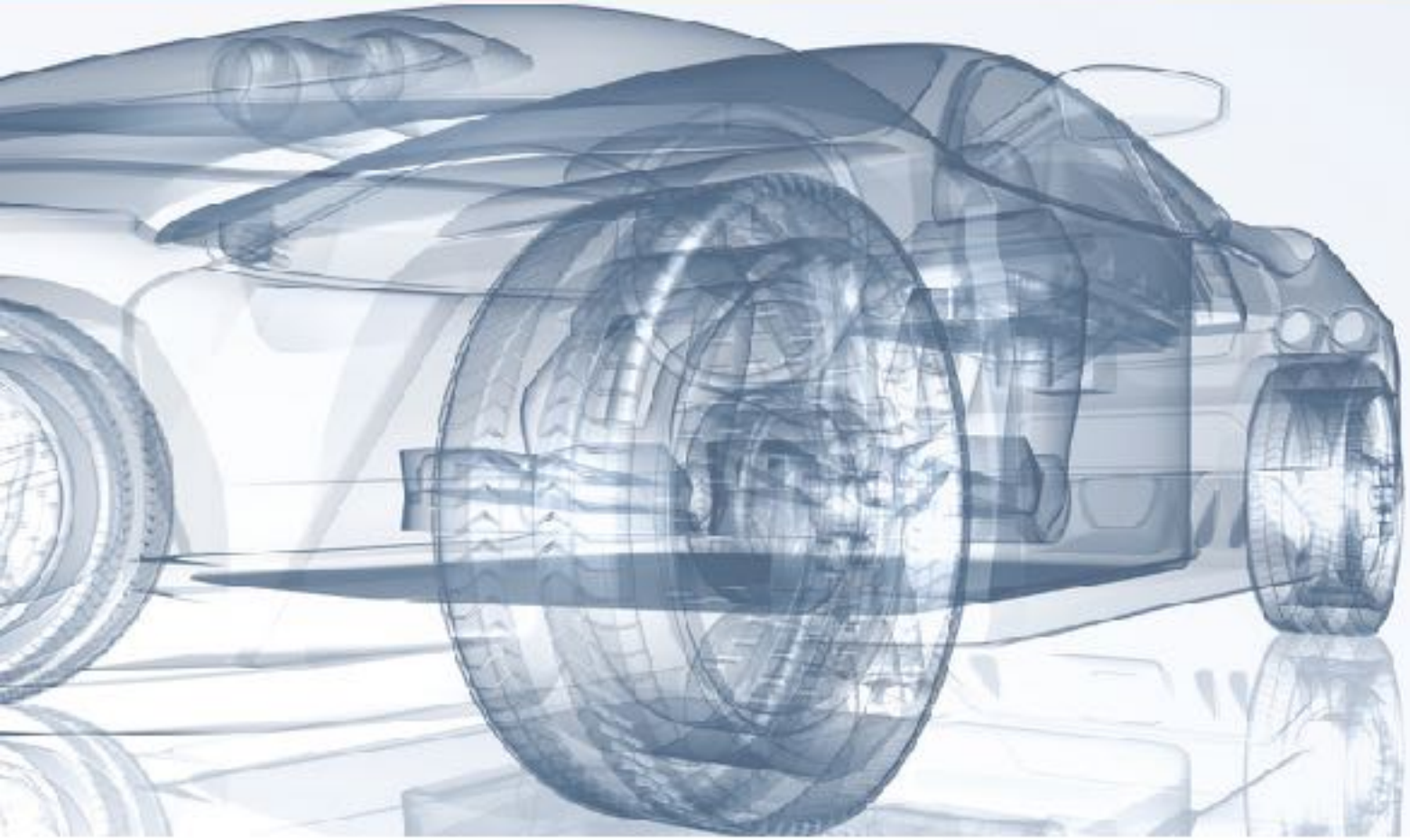

The 30th International
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Messe Stuttgart, Germany

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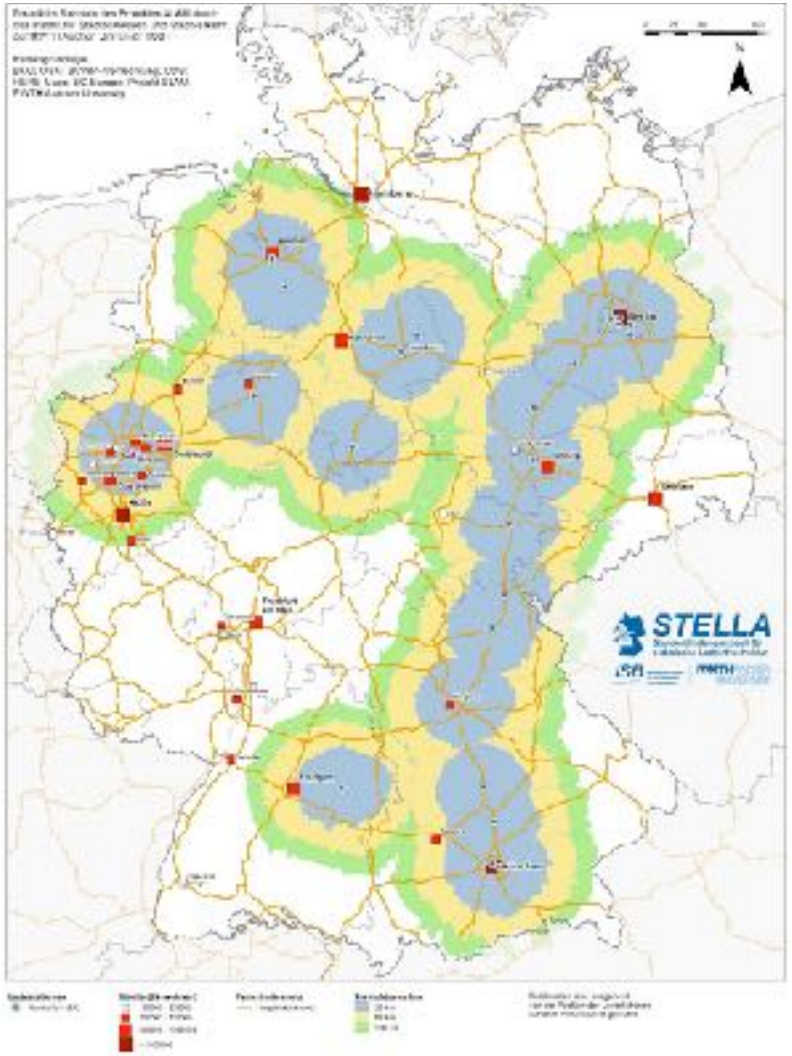
Agenda

- Fast-Charging in Germany
- Approach
  - Project SLAM
  - Fast-Charging Research Network
  - Database
- Analysis
- Results & Discussion

Fast-Charging Infrastructure in Germany



Source: ISB, RWTH Aachen

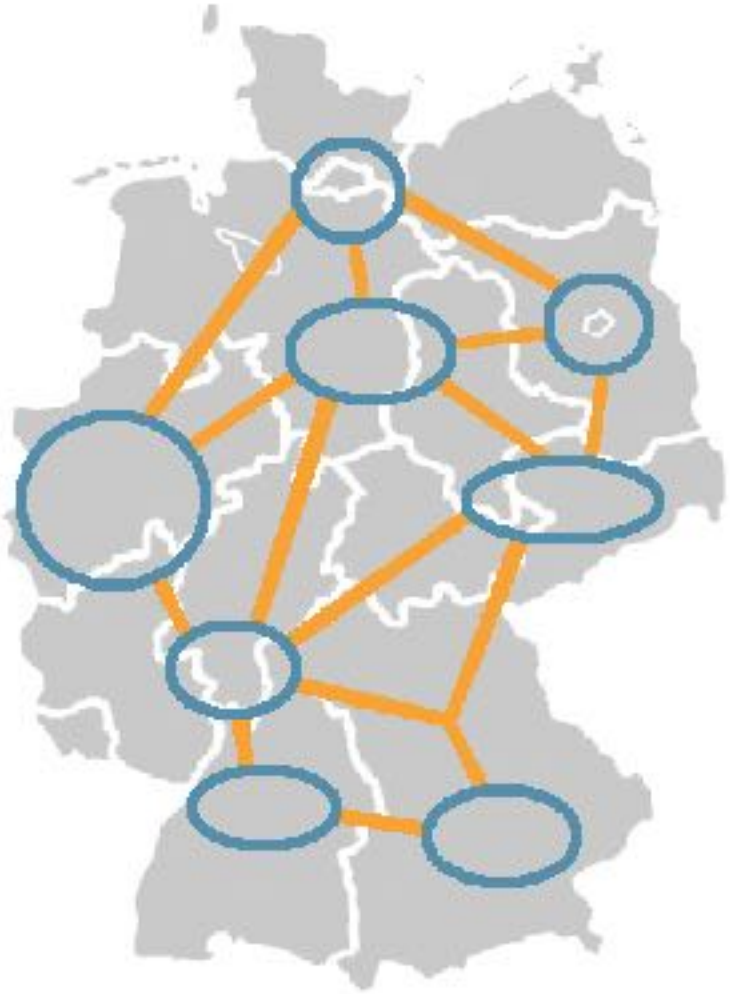
Back in 2014…

- ❑ Single epicentres of fast-charging infrastructure
- ❑ Large-scale white spots without charging infrastructure
- ❑ Hardly any connection between metropolises (except Autobahn A9)
- ❑ …

At that point, EVs were not convenient for long-distance trips!

Project SLAM: Objectives

- Development of the biggest fast-charging research network in Germany
- Establishment of up to 200 fast-charging points with the help of private investors
- Research issues:
  - Analysing attractiveness and potential of locations
  - Understanding, development and evaluation of business models
  - Identifying the challenges of setting-up fast-charging infrastructures
  - …



Source: SLAM – Schnellladenetz für Achsen und Metropolen

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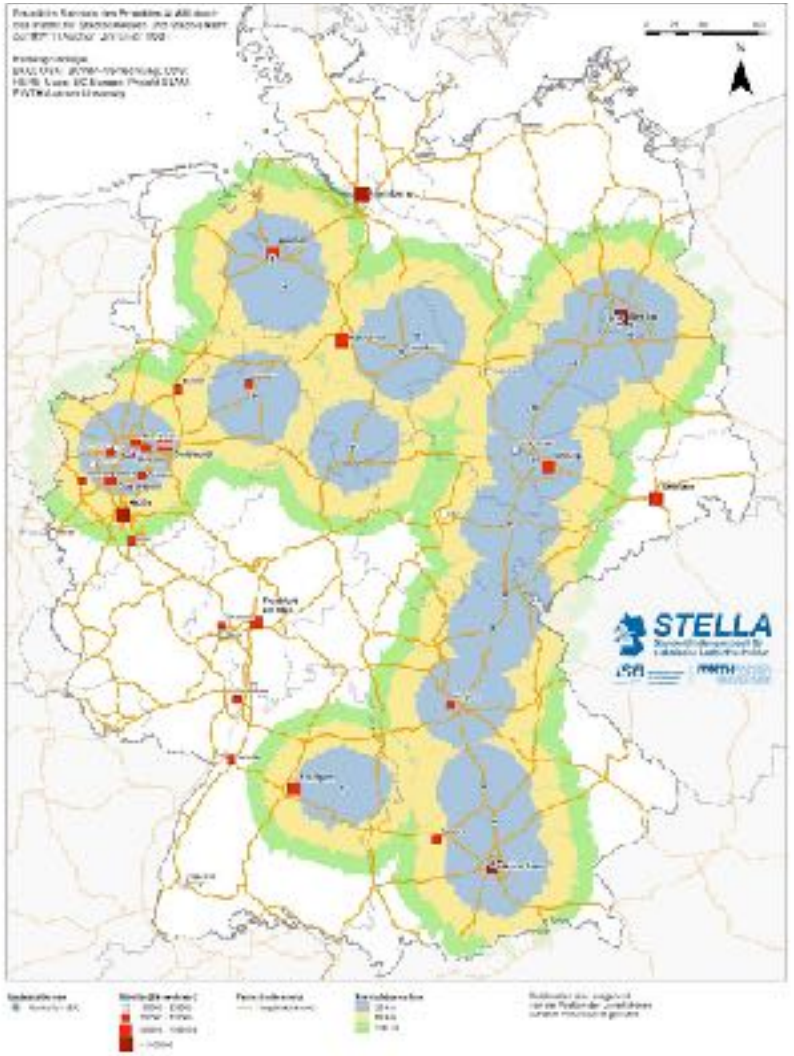
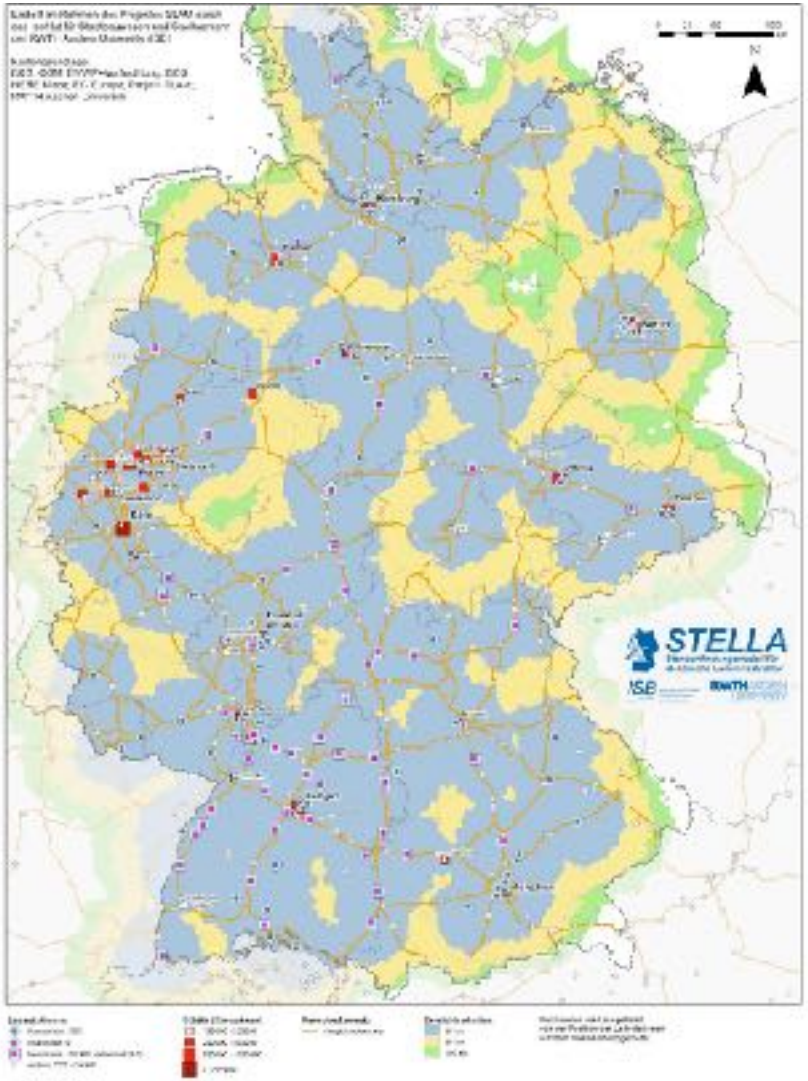
Fast-Charging Research Network

2014



Source: ISB, RWTH Aachen

2017



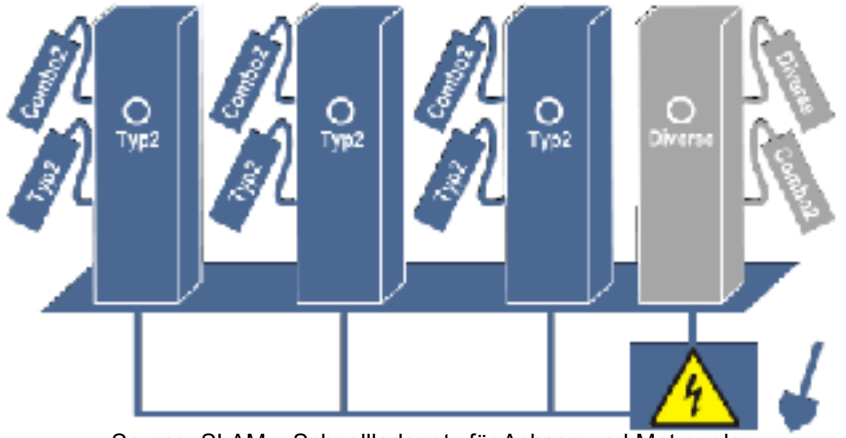
Source: ISB, RWTH Aachen

Project SLAM: Framework for investors

- Setup:
  Up to 4 charging stations at hot spot locations*

Source: SLAM – Schnellladenetz für Achsen und Metropolen

...



Source: SLAM – Schnellladenetz für Achsen und Metropolen

- Option:
  Enabling of high performance charging on grid side
  (150 kW for each DC-outlet)

* Hot spots are locations with a prospectively high number of EV-drivers

Existing Database from NPE

- National Platform Electromobility (NPE) delivered in 2015 the following estimation about CapEx for establishing fast-charging stations with 50 kW DC in Germany*

Hardware	Grid Connection	Location Search, Planning, Permission	Civil Engineering, Assembly
25.000,00 EUR	5.000,00 EUR	1.500,00 EUR	3.500,00 EUR
∑: 35.000,00 EUR			

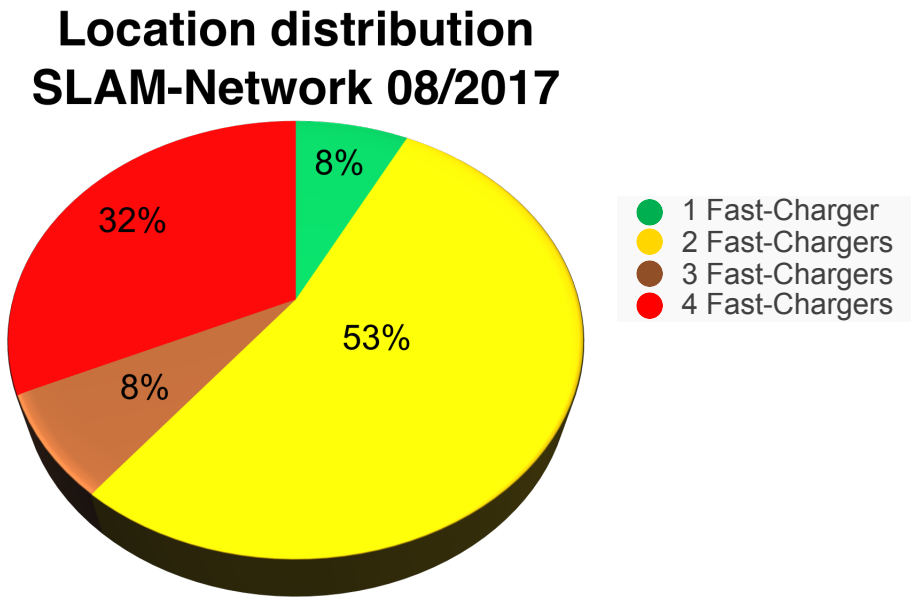
- When enabling high performance charging on grid side (150 kW each DC-Outlet), costs for grid connection shoot up…

Hardware	Grid Connection	Location Search, Planning, Permission	Civil Engineering, Assembly
25.000,00 EUR	50.000,00 EUR	1.500,00 EUR	3.500,00 EUR
∑: 80.000,00 EUR			

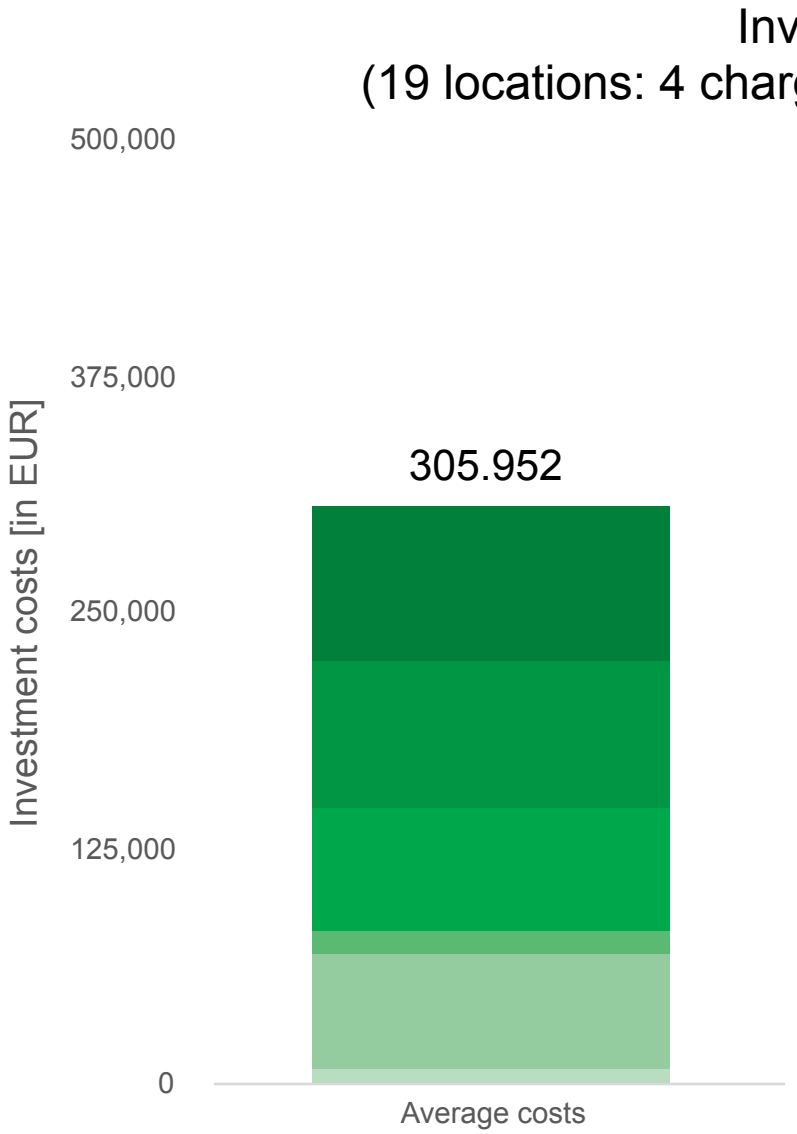
* Nationale Plattform Elektromobilität, Ladeinfrastruktur für Elektrofahrzeuge in Deutschland, Berlin, November 2015, chapter 3

Project SLAM: Current Status

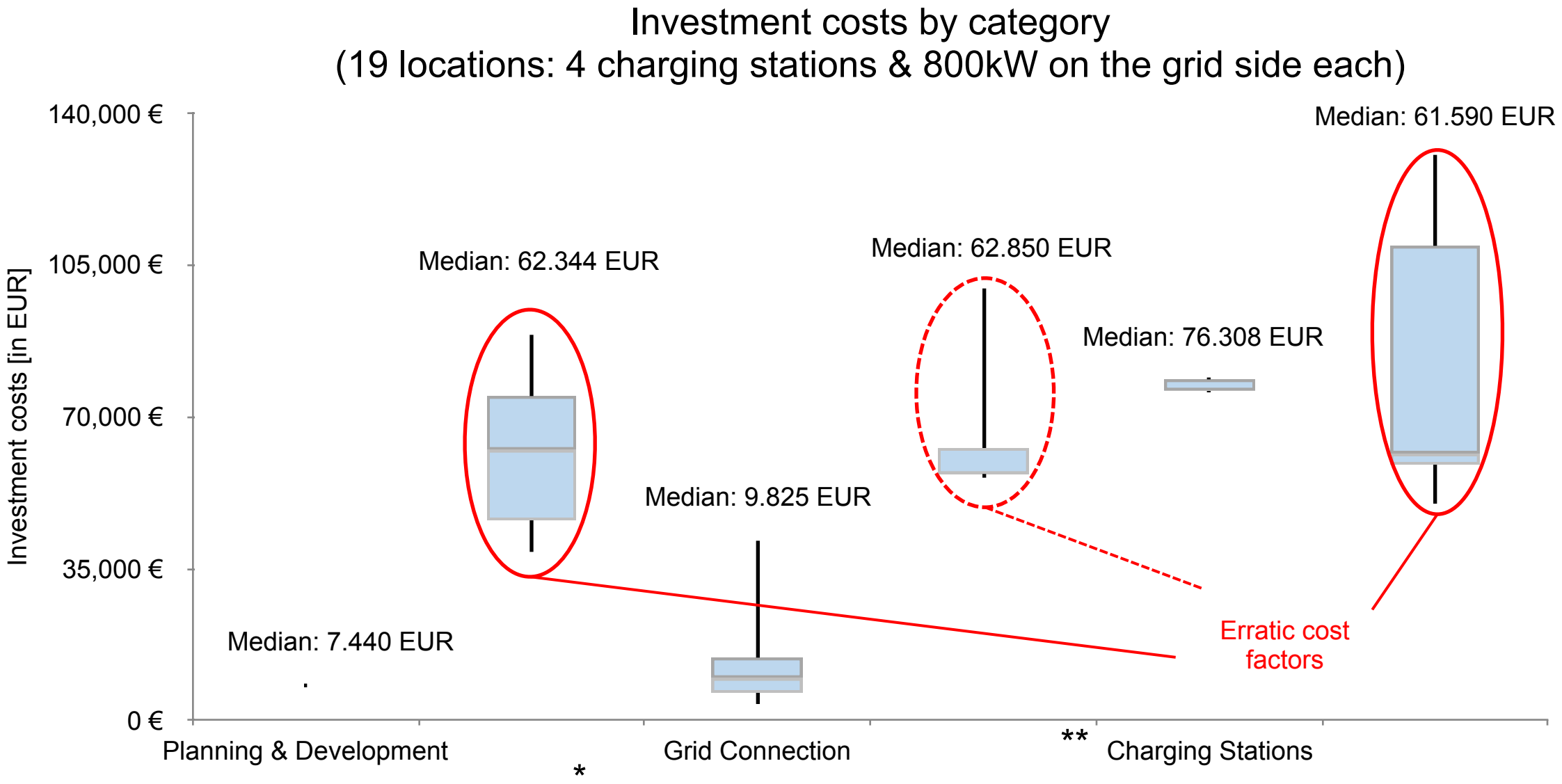
- To date, the SLAM research network comprises 66 locations with 174 fast-charging points (established by 10 investors)
- 21 of 66 locations are equipped with
  - 4 fast-charging stations each (50 kW DC each)
  - High performance enabled on grid side (150 kW DC each DC-Outlet)
  - Making it round about 800 kW for the whole location
- 19 locations were taken into consideration for the following analysis



Analysis: Scenarios



Analysis: Classification in Categories



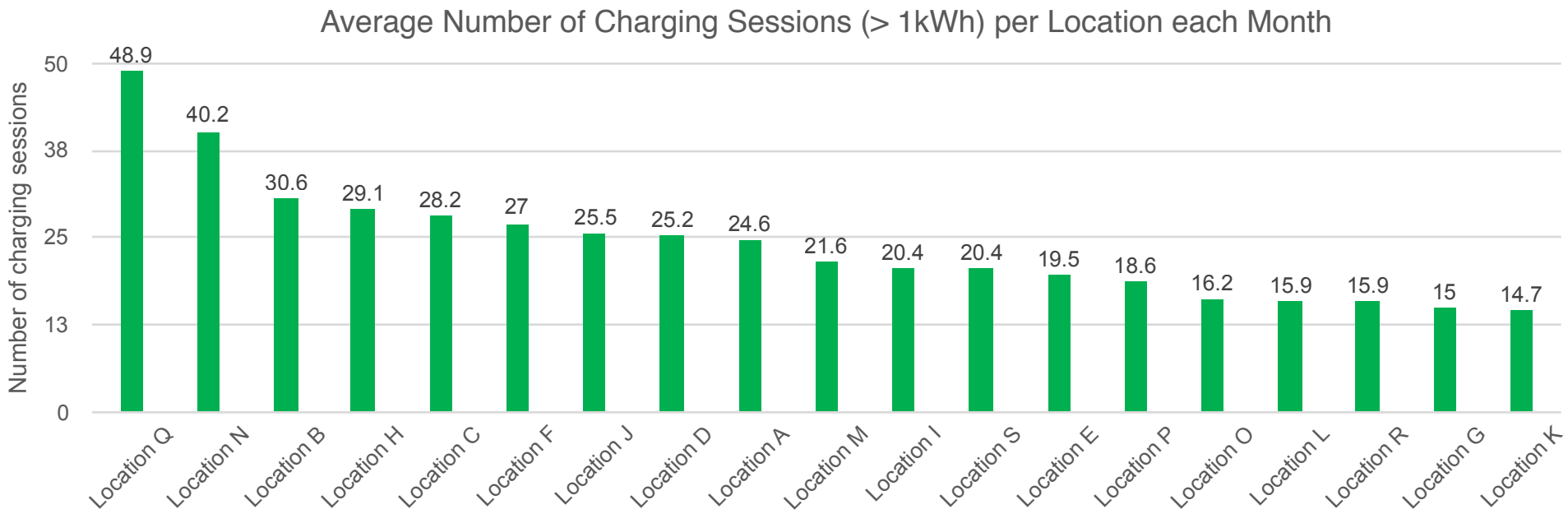
*Contribution for grid development

**Medium Voltage Transformer (1,2 MVA)

Preliminary Results

- Major differences between single locations in investment costs
- Comparing best and worst case scenarios, investment costs can be doubled up
- Essential investment volume depends on
  - Site conditions (Civil engineering)
  - Grid operator (Grid development)
  - Grid operator (Medium voltage transformer)

Business Perspective



Snapshot of current market situation!

Amortisation rate of investment (per month)		
Average costs	Best case scenario	Worst case scenario
4.730 EUR	3.590 EUR	6.935 EUR
97 - 315 EUR each charging session	73 - 239 EUR each charging session	142 - 462 EUR each charging session

Subsidies not included!

Implications

Impact of investment costs on business model

- Attractiveness of certain (expensive) locations is poor
- Competitive position against nearby and less expensive locations is weak
- In the short / medium term, business models exclusively based on the sale of charging time are critical

Impact on nation-wide establishment of fast-charging infrastructure

- Risk of white spots at important traffic points
- Increasing the density on the fast-charging map isn't too attractive so far
- Without public funding, a nationwide fast-charging network would be out of reach

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