

Establishment of fast-charging stations: false assumption or right decision?

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Executive summary

Germany published its political will to have 1 million of electric cars on the streets by 2020 [1]. But keeping the current speed with only 90.8 thousand EVs in use (as of January 2017) [2] the fulfilment of the proclaimed objective did not seem possible and the German Government revoked this goal. Nevertheless the availability of a nationwide fast charging infrastructure is one of the most important drivers for the spread of electromobility in Germany [3]. Currently the future of electromobility in Germany depends on private investors who are challenged by still missing viable business models. High initial cost and low willingness of customers to pay more for the fast charging make economic amortization hard to achieve. Apart from the big investment cost there is a high uncertainty of potential customer's number as far as user acceptance of electromobility still remains low. Based on investors' data and expert interviews the present work focusses on identifying and analysing current challenges for establishing and operating fast charging infrastructure. The outcome then will be tested and elaborated in detail. The main goal of this paper is to examine investors business models assumptions for establishing fast charging infrastructure based on status quo.

1 Motivation & prior research

According to experts opinion the breakthrough in electromobility currently depends on three essential factors: 1.) the purchase price of electrical vehicles, 2.) the range of the cars and 3.) nationwide fast charging infrastructure [4]. To develop a basis for a market suitable establishment of the fast charging infrastructure the project SLAM was launched. The project's purpose is to investigate location potential and positioning of charging infrastructure as well as economic viability of business models for a sustainable operation [5]. In the frames of the project up to 200 fast charging points should be built with the help of private investors. To this end there was initialized an application process for potential investors through a standardized profile where participants along with location information should have provided information on their motivation to establish the charging infrastructure as well as first ideas about business models. The number of those who at the end decided to build the fast charging infrastructure slightly outreached 10% of more than 100 applicants. At the beginning of the project there was only a small amount of DC charging points in Germany and the nature of the knowledge on valid business models was rather theoretical [6].

2 Objectives

Using the findings of research network SLAM is aiming to demonstrate how the establishment and operation of fast charging infrastructure in Germany should be scaled up. The investors' visions of business models along with their motivation were examined and the first evaluation regarding long-term viability was provided. The aim of the analysis is to clarify if the assumptions of investors are correct and the decision in favor of establishment of DC charging infrastructure was right.

3 Methodology

During the project, the researcher have been in touch with investors and experts in the field of electromobility. As fast-charging is rather seen as a loss-making venture, this paper focusses on investors assumptions before and experiences after setting up fast-charging infrastructure. Also, experts were involved to get an unbiased view from the outside. Furthermore, data collected from the charging stations is used as objective measurement instrument.

The following parts use a wide range of different methodologies for data generation and result evaluation: written and spoken interviews, an expert workshop and data-driven insights are merged to get hints about the controversial question if one should engage in setting up fast-charging infrastructure or not. Due to the methodology, the results are evaluated rather qualitatively than quantitatively.

3.1 Project requests

From over 100 potential investors that expressed interest in building charging stations, only 16 applied for subsidies from the project SLAM. Based on these requests, an overview of potential location types for DC-fast-charging was developed. Therefore, no guarantee can be given for completeness, but it served as a first object of investigation and was part of the expert workshop.

3.2 Investors applications

In SLAM, subsidies to build-up fast-charging infrastructure has been available to any kind of private investor. A valid application providing information about location, building setup, motivation, business model and cost estimation is the precondition for receiving the subsidy. Also investors' experience, as well as their expectations and suitability for their core business are examined.

3.3 Business Model workshop

Thereafter the obtained results of the analysed applications became a base for an expert workshop; 30 experts from science, and both public and private sector were invited to analyse and evaluate business models for fast charging based on location types. The scenarios were built on the basis of real requests from potential investors. Most of these types (e.g. motorway service areas, mobility hubs, recreation facilities, etc.) have been realised via the project. The experts' evaluation provides additional qualitative insights to what extent assumptions are justified.

3.4 Data from charging stations

As previously described, only fast-charging infrastructure that has been operated for at least 6 months is taken into consideration. This data supports or refutes subjective impressions, expressed by the interviewed investors.

3.5 Final validation

Final validation is provided through interviews of the investors. A comparison between expectations and reality between the time of the interview and the time of the application is drawn.

4 Results

4.1 Location types

Locations, where fast-charging infrastructure is built-up as part of the SLAM project can be categorised into different types as seen in table 1. All locations, except car park and petrol station are represented in the SLAM-network, currently being operated all over Germany and accessible to all users. This does not, however, imply any claim to completeness.

Table 1: location types, appropriate for fast-charging infrastructure

Locations for DC-fast-charging, specified by investors and interested parties	Motorway and off-motorway service area
	Mobility Hub: <i>Airport, harbor, station</i>
	Car park
	Shopping area
	Leisure facility and gastronomy
	Company site
	Petrol station
Car dealer site	

4.2 Investors

Not all investors who are active in the SLAM-network, are represented in this paper. To provide necessary comparability, a restriction had to be set:

- Solely investors that are operating their fast-charging stations for at least 6 months, are taken into consideration

Due to the status of the project, this restriction limits the number to 9 investors.

To get a better overview, the investor are categorised by their territorial field of activity. This allows comparison between investors, but even more between investor-specific business models. Hence the categories are named *local activity*, *regional activity* and *nationwide activity*.

4.2.1 Nationwide activity

Investor A and Investor B are building up a large number of DC-fast-charging stations in Germany.

Table 2: Summarised application of investor A and B

Investors with nationwide activity			
		Investor A	Investor B
Application Items	<i>Core Business</i>	Subsidiary of energy supply company	Energy supply company
	<i>Motivation</i>	Strategic decision: investment in the future as high power charging will take place near motorways ¹	Evolution from providing normal-charging to fast-charging infrastructure
	<i>Business Model</i>	Focus is on operating fast-charging stations throughout Germany	Charge point operator (CPO) and mobility service provider (MSP)
	<i>Assumptions</i>	2-3 charging processes per station each day to cover the costs State subsidies is necessary for that business case assessment	No specific assumptions were named. Existing EVs will not be enough to cover costs
	<i>Location Type</i>	Mostly off-motorway service areas (numerous locations, 4 stations each)	Mostly motorway service areas (numerous locations, 2 stations each)

It must be said that both investors operate the infrastructure on properties with licence agreement with usually up to 10 years duration. Table 2 compares investor A and B in the categories core business, motivation, business model, assumptions and location type. Both investors are experienced in setting up charging infrastructure. Yet, both see their current business model in operating the infrastructure on service areas on or near motorways. B on the other hand, also takes the role of a mobility service provider to keep contact

¹ The project SLAM supports the upgrade on grid-side up to 150 KWh per DC-Outlet

with customers. At first glance, it seems that both investors pursue a classical business model of selling charging current or rather charging time.

4.2.2 Regional activity

This category covers 4 investors, which all operate or plan to operate more than 1 location with fast-charging infrastructure.

Table 3: Summarised applications of investor C and D

Investors with regional activity (urban area)			
Application Items		Investor C	Investor D
	<i>Core Business</i>	Public utility company	Public utility company
	<i>Motivation</i>	Pioneering role / green image / leveraging locational advantages and traffic-favorable position	Electromobility in addition to existing energy concepts for residential areas / leveraging locational advantages and traffic-favorable position
	<i>Business Model Assumptions</i>	Mobility as a product (not specified) 3 customers each day with retention time of about 50 minutes	Advantages for core business Heavy commuter traffic. At least 1 charging sessions daily. Longer retention time due to nearby business park
<i>Location Type</i>	Inner-city location near pedestrian area (1 location, 2 stations)	Inner-city location near business park (1 location, 1 station)	

However, as energy supplier they all act within their supply region; hence, the name *regional activity*. Investor C and D have built up each one location at inner-city spots. Although their core businesses and motivation to operate fast-charging stations is similar, their business models are different. Investor C confidently expressed his business model *mobility as a product*, whereas investor D is seeking advantages for the core business. Also, C assumed that 3 customers each day will stay about 50 minutes each at the charging station or rather at the pedestrian area nearby, which seems at least optimistic. Compared to that, assumptions of D appear to be more realistic, in particular to the similar original position.

Table 4: Summarised applications of investor E and F

Investors with regional activity (extra-urban area)			
Application Items		Investor E	Investor F
	<i>Core Business</i>	Regional energy supplier	Regional energy supplier
	<i>Motivation</i>	Supplement to existing charging infrastructure in supply area (already 100 charging points have been operated) / gaining experience with time-based billing	Increasing the attractiveness of EVs for new customers in the grid territory / Accessing new customer groups
	<i>Business Model Assumptions</i>	Cost coverage by operating the fast-charging stations is pursued	Operating the charging stations / low fixed costs due to long-term license agreement with off-motorway service area
<i>Assumptions</i>	2-3 charging sessions per station each day expected	2 charging sessions per station each day with retention time of about 30 min	
<i>Location Type</i>	Off-Motorway service areas (2 locations, 2 stations each)	Off-Motorway Service areas (3 locations, 7 stations in total)	

Investor E and F are both active in their supply region. They also both chose off-motorway service areas to build-up fast-charging infrastructure on properties with license agreement. Both assume that approximately 2 charging sessions per stations take place each day.

4.2.3 Local activity

In this category, 3 investors are compared. All investors have in common, that they build up and operate charging infrastructure in local areas, primarily at their own properties² or very close to it³. Comparing the investors' core business, fast-charging stations are a suitable supplement for investors G and I, as they have got products and services that can be found in the value chain of electromobility. Investor H, in contrast, offers farmed products in his retail market and wants to promote a green image.

Table 5: Summarised applications of investors G, H and I

		Investors with local activity		
		Investor G	Investor H	Investor I
Application Items	Core Business	Wind generator and photovoltaics manufacturer	Retail market for parquet flooring	Car dealer
	Motivation	Promotion of electromobility / model character / extension of green image	Enhancing the company's reputation / green image	Charging possibility for customers and for local car sharing / Raising awareness beyond local borders
	Business Model	Addition to core business	Advantages for core business / internal use for company vehicles	Operated by local supply company / increase in sales in core business
	Assumptions	1-2 charging sessions each day	1 charging sessions every two days	Purchase incentive increases sales for EVs in Germany
	Location Type	Town hall (1 location, 1 station)	Company site (1 location, 1 station)	Car dealer (1 location, 1 station)

Investor G and H share a similar assumptions of the number of charging sessions, which is quite low compared to other investors. Investor I, instead, did not have an opinion on that, but had high expectations that the purchase incentive is going to boost EV sales in Germany.

4.3 Expert validation

The overall objective of the before mentioned workshop was to work out valid business models for investments in fast-charging locations. Ranked by priority, experts concluded that motorway and off-motorway service areas, as well as fast food restaurants, cafés and supermarkets are economically viable. It should be mentioned that all experts dealt with the question of how to use available retention time at a possible location, no matter if it is for destination charging or for intermediate charging.

Due to the longer periods spent in shopping areas, hotels, restaurants, outlet-centres and specialty stores, they were assessed as mediocre for fast-charging stations. Leisure facilities and mobility hubs were seen at the bottom of the scale, even though there are differences within these two categories.

Car parks and parking garages are considered a perfect fit for AC-normal-charging, but not for fast-charging.

On the other hand, company sites – especially in industrial areas – get a mixed reception. If the position of the company site is not close to motorways and can't be reached easily, there's no reason for external EV drivers to stop by. Nevertheless, fast-charging stations at companies can be useful, in particular when the company fleet is complemented with electric vehicles. However, the experts' task was to evaluate business models for fast-charging infrastructure that is available for public.

² Investor H and I

³ Investor G

4.4 Data evaluation

Data from the SLAM-network shows differing results at the moment. One must say that the investors' locations are quite different. Investor A, on the one hand, started in 2015 installing 4 charging stations at each location. The current number of existing EVs of course does not justify such extended charging locations. The structural analysis calculates charging sessions per station to take the different investment costs into account; that is why the result for investor A is at only 0.1 charging sessions per station and day (see figure 1). Investor B, on the other hand, built up 2 charging stations at each location and therefore achieves slightly better results at each location. Nevertheless, earning money by only selling charging time is a quite unattractive business at the moment. Assuming that about 2-3 charging sessions per station and day are going to take place at the beginning of this venture, was somewhat erroneous. An exception is investor D, who assumed at least 1 charging session each day and effectively has 3-4 charging sessions. This is remarkable, yet has to be placed in the right context: currently, charging at that location with 1 charging station is offered at no costs for customers. Nevertheless, it could be said, that currently fast-charging on axes⁴ is less in demand than fast-charging in urban areas⁵.

Another factor, which strongly influences business models, is the charging time. Fast-charging is seen to last between 20-30 min⁶. Most locations in the SLAM-network are in between that range, except the location from investor C. However, investor C already assumed a charging time of 50 minutes. This was explained with a perfect inner-city location near a pedestrian area, which invites visitors to linger. Of course, these charging sessions also contain normal AC-charging; yet, this is no unique characteristic of that location.

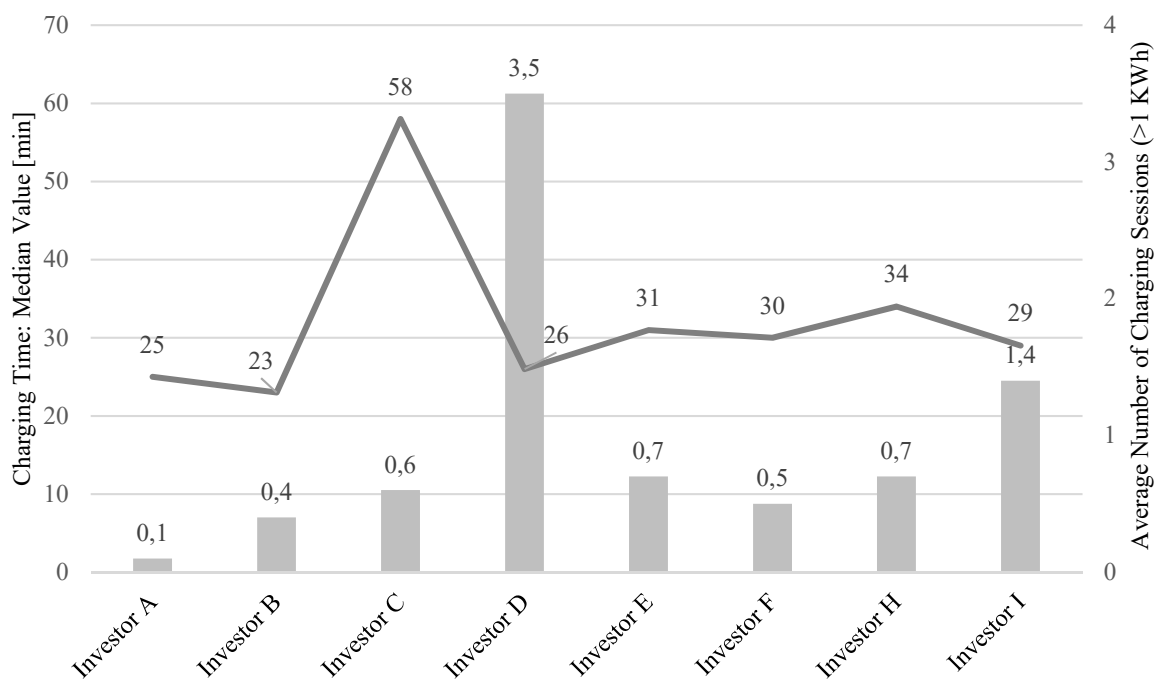


Figure 1: Evaluation of charging time (median value) and average number of charging sessions per station and day⁷ [illustration of University Stuttgart based on data of the project SLAM]

Another insight gained, is the impact of management decisions, in particular the introduction or adjustment of tariffs. Investor E, who pursues cost coverage by operating the fast-charging stations (see table 4), decided to introduce tariffs after free-of-charge was offered for a few months (see figure 2, section I). It must be said

⁴ Locations from investor A, B, E and F

⁵ Locations from investor C, D, G, H and I

⁶ As a guideline, 0-80% SOC is achieved in 20-30 minutes, while 80-100% takes a lot longer, due to physical limitation

⁷ Data from investor G was not available until the date of this document

that the pricing was handled wrong. It shows a decline in charging sessions, starting in April 2016 (see figure 2, section II). In June 2016, the decision was corrected and the tariffs were adjusted.

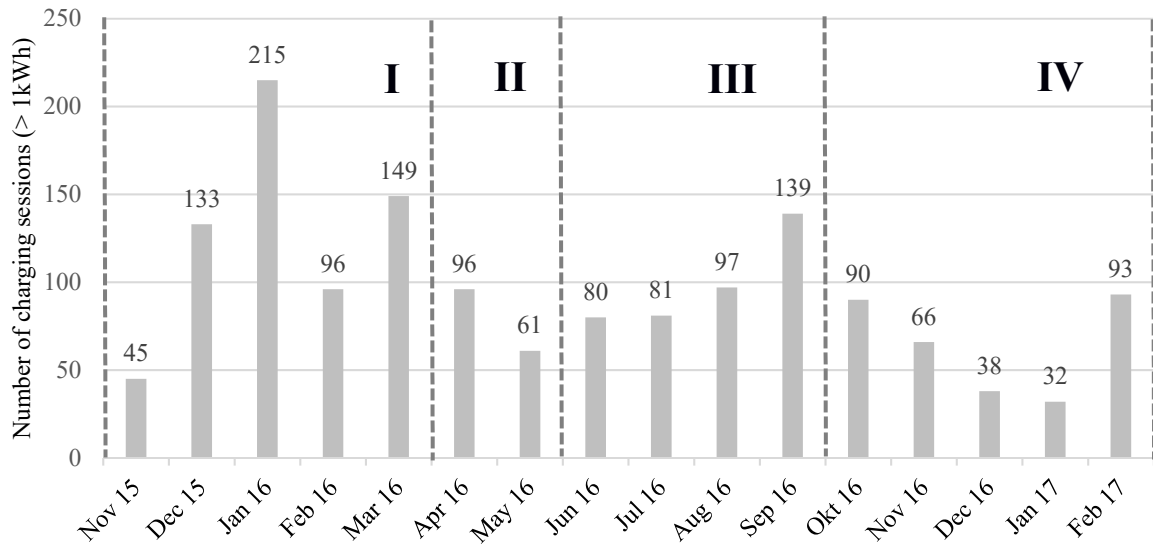


Figure 2: Decline of number of charging sessions after introducing tariffs at location from investor E [illustration of University Stuttgart based on data of the project SLAM]

A marked improvement was achieved, even if it is not the same numbers as with charging being completely free (see figure 2, section III). This shows that even with investors being experienced in operating normal-charging, pricing breaks new ground in case of fast-charging. The decline in section IV can be explained with seasonal effects and normally occurs in cold season. This effect can be perceived at other locations as well.

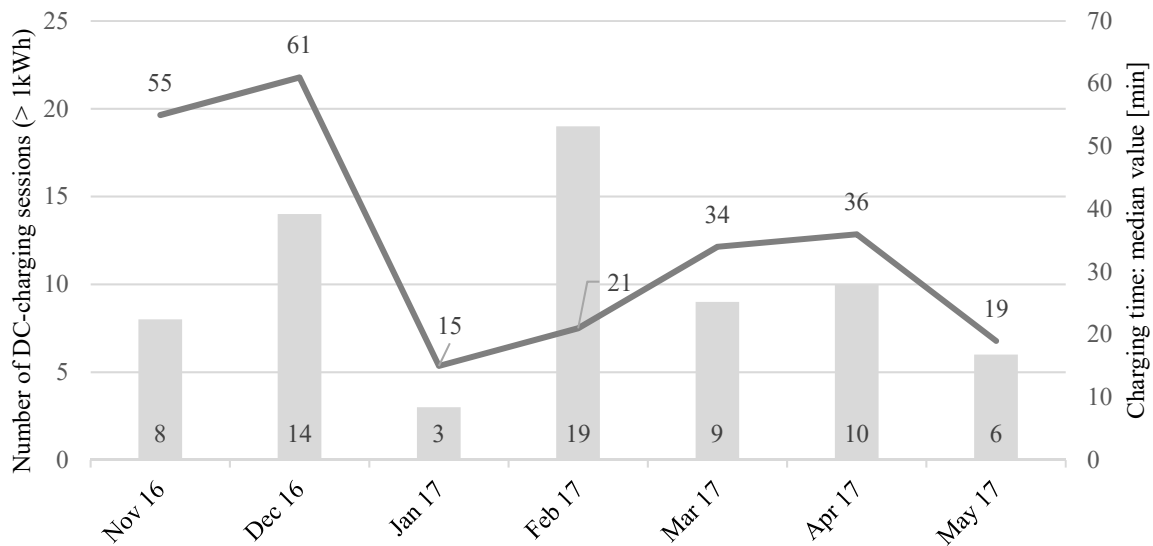


Figure 3: Decline of charging time⁸ (DC-charging sessions) after introducing time-based-tariffs at location from investor C [illustration of University Stuttgart based on data of the project SLAM]

Investor C introduced time-based tariffs and achieved a decline in charging time. Especially the time for DC-charging sessions was at least cut in half (see figure 3). Business models that are designed to make profit by

⁸ Only DC-charging sessions were strongly affected

selling charging time should follow that example, whereby correct pricing still matters a lot as seen in the previous example.

4.5 Investors self-evaluation

As described in chapter 3.5, all investors were interviewed after at least 6 months of operating their respective fast-charging stations. The statements made during the application phase were checked against the essential points of the interviews. The differences are converted into measurable scores and are illustrated in diagrams for the sub-chapters *motivation* and *business models*.

In the following, *motivation*, *business model*, *assumptions* and *barriers* will be presented.

4.5.1 Motivation

The subjective results were quantified by the following pattern, described in table 6. The more the investors dedicate themselves to electromobility and charging infrastructure, the higher is the score.

Table 6: Overview of strategic involvement parameter score

Criterion	Parameter score
Added value for own customers	1
Image boost / brand awareness	2
Geographical coverage in supply region	3
Strategic decision to secure attractive locations	4

Figure 4 shows the results for the category *motivation*. Motivation can be understood as preliminary stage to or part of a business model. The authors' intention was to find out, if assumptions have been met or if even higher motives arise after experiences with operating fast-charging infrastructure were gained. The investors' ambitions have in no case decreased. Feedback from customers was consistently positive, as well as each investor was able to notice a better brand awareness. Investor C and D even raised ambitions after operating charging stations for a while. It cannot be ruled out that they already had those plans before but they clearly expressed it after receiving good press. In summary, the investors regard their expectations as fulfilled while some are even more motivated now and are about to intensify their efforts. It can be said that committed pioneers and stakeholders receive rather positive feedback from the outside which eventually leads to that result.

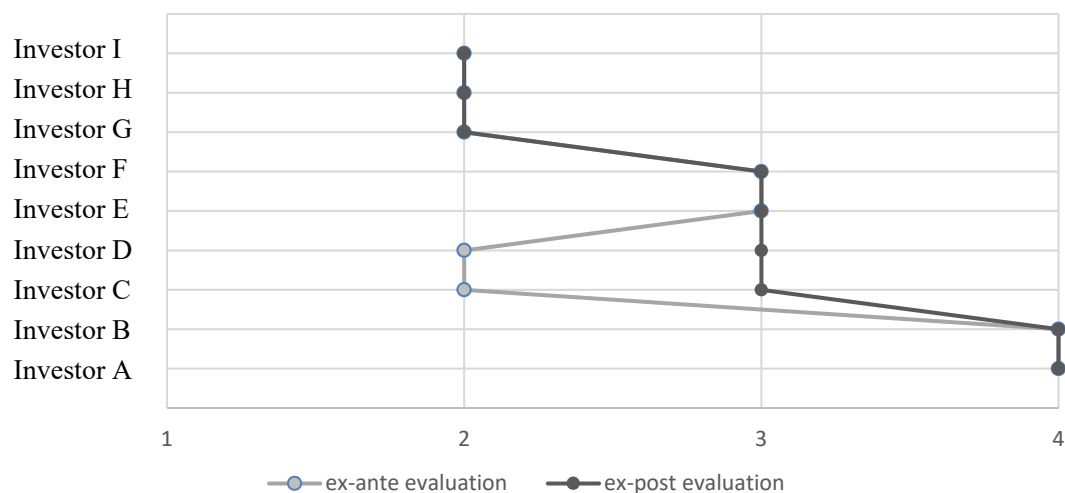


Figure 4: change in motivation after operating fast-charging infrastructure [illustration of University Stuttgart based on data of the project SLAM]

4.5.2 Business model

This following section discusses the changed approach of the investors towards the business model. The subjective results were quantified by the pattern described in table 7. The more unique features and complexity the business model contains, the higher is the score. The lowest score (=1) describes the charging station as support of the core business which can be put on a level with marketing activity. At that point, the offer around the charging station is not very complex, because authentication and billing are not necessary. The next higher score (=2) is about the immanent benefit of a charging station: selling electricity or rather charging time, combined with benefits for the investors core business. Thereafter (=3), operating fast-charging stations is a means for the purpose to offer new value-added services in which the product is wrapped. The highest score (=4) is the supreme discipline with covering all components along the customer journey.

Table 7: Overview of business model complexity score

Criterion	Parameter score
Marketing	1
Sale of charging time / advantages for core business	2
Contracting model / value-added services	3
New smart products / mobility-as-a-service / customer journey	4

Figure 5 displays the results for the category *business model*. A business model describes the context how companies or ventures generate revenue and profit. Because electromobility in general and fast-charging in particular are emerging markets, it is currently difficult to find valid business models. The authors' intention was to find out how the opinion about the own business model evolves in the long term. While all investors mentioned marketing effects as positive, none of them does it for this purpose exclusively. At the beginning, all investors, except investor C and D, stated that the sale of charging time and / or advantages for the core business is a cornerstone of their business model. Furthermore, C and D cited that either new business fields, mobility-as-a-service or a combination with existing energy services are intended extensions to the operation fast-charging stations. The greatest leap in advancing the business model is achieved by investor B, who pointed out the steps from being operator of charging stations to becoming provider of smart products and being able to cover all tasks of a customer journey. The investors A, F, G, H and I stayed with their originally intended business model. This is quite remarkable, given that they are very different in their core business activity. However, staying with the original business model does not imply a valuation by the author of this paper. There might be reasons not to evolve the business model significantly, e.g. when being part of a partner network with defined roles and activities. It could just as well mean that a charging station is just a very small part of the whole and its only task is to leverage the core business. This effect may pay off for the investor as part of a business model.

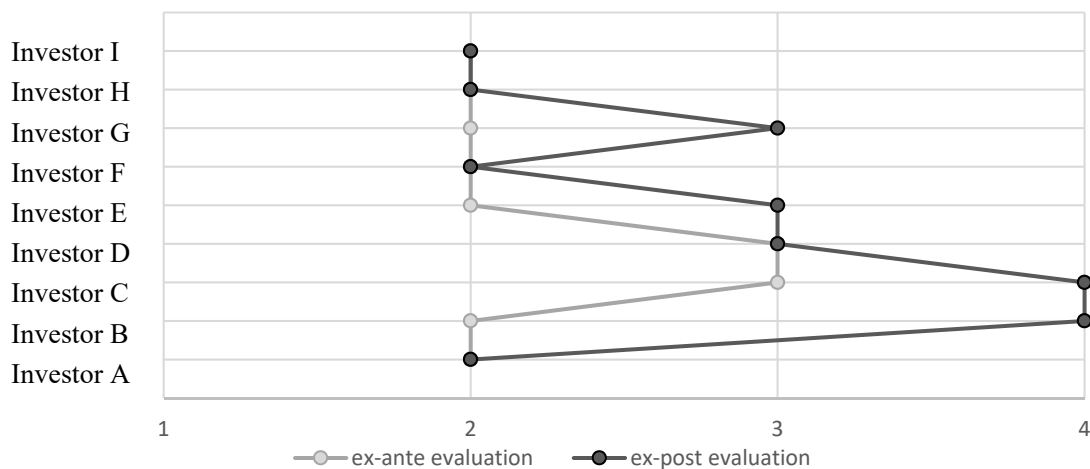


Figure 5: change in business model scores [illustration of University Stuttgart based on data of the project SLAM]

4.5.3 Assumptions

The following section covers how the initial assumptions made by the investor as part of the investment decision have proven to be true in the operation phase. The subjective results are described in table 8. In addition, a conclusion is drawn to illustrate how assumptions are met or may still be fulfilled.

Mostly all investors made assumptions about the number of charging sessions; regarding the data evaluation (see chapter 4.4), these expectations cannot be necessarily seen as fulfilled. However, the investors are more or less satisfied with that number, at least at the moment. While operating the stations, they all experienced benefits, while at the same time a boost in the market of electromobility is eagerly awaited. The assumptions are changing to some extent, insofar as concessions, made by the state and the automotive industry, are fully met as soon as possible

Table 8: review of assumptions before and after establishing fast-charging stations

Analysis of investors motivation				
	Ex-ante evaluation	Ex-post evaluation	Conclusion	
Investor	<i>A</i>	2-3 charging sessions each station and day is a prerequisite to cover the costs. A necessary condition is state subsidy, otherwise no business case pays off	Market as a whole only develops when existing properties and property building are supported by subsidy programmes. This is the only way that electromobility can become attractive for users.	Increased state support is still expected
	<i>B</i>	No assumptions were made	The number of charging sessions failed to live up to the expectations. However, a ketchup bottle effect is expected.	Tipping point is expected soon
	<i>C</i>	After a longer start-up phase, operating the charging station should be cost-effective. 3 customers each day with a 50 min stay is expected.	There should be more charging sessions, but obviously the registration figures of EVs are too small.	Market still needs time to develop
	<i>D</i>	1 charging session a day with increased stay time is expected	It is way better than expected. The stay time is fine and clearly better than nearby normal-charger (AC).	Expectations are fully met
	<i>E</i>	2-3 charging sessions per charging station and day is expected. A nearby DC-Charger serves as comparison.	The fast-chargers are best-utilized in the supply region. However, it doesn't fully meet the expectations.	Market still needs time to develop
	<i>F</i>	2 Charging sessions per charging station with a 30 min stay each is expected	4-5 charging sessions are needed to economically operate the charging stations. The introduction of tariffs came along with a medium-decline of user numbers.	Market still needs time to develop
	<i>G</i>	1-2 charging sessions are expected.	By means of state support, the investor expected the market up and running	Increased state support is expected
	<i>H</i>	1 charging session every other day during the first year	Expectations are fully met	Expectations are fully met
	<i>I</i>	Assumes that development of electric city cars puts electromobility in fast lane	Expected a stronger demand for purchase incentives for EVs. Criticises the automotive industry for EV model policy	Expectations in automotive industry were dashed

4.5.4 Barriers

The fact that only 16 out of over 100 potential investors applied for funding and therefore to receive up to 75% subsidy as part of being part of a test network, already proves the existence of entry barriers.

Barriers for the implementation of fast charging infrastructure can be categorized in the following milestones: until the investment decision is made, until implementation is finished and the time during operation.

As shown by the data already more than 80% of intuitions doubtlessly thinking about investing into charging infrastructure did not even apply for funding. Asking these investors about the problems they encountered and what made them discard the opportunities, some of the most mentioned reasons are: unexpected costs for implementation, administrative challenges to receive the relevant permit, challenges in the communication with the local grid providers and for the large-scale investors: commitment of the land owners. These challenges are diverse but in many occasions related to administrative challenges that could be overcome by a more widespread positive attitude towards the implementation of charging stations. Successful implementations are characterized by a high commitment of most stakeholders.

So, as a final point, the investors were asked which barriers occurred while establishing fast-charging infrastructure in Germany. None of them has cited concerns in advance of this new and unknown venture. All investors, except investor H and I, are already experienced in building up charging infrastructure, especially AC-charger with lower power.

Barriers occurring during implementation however after the investment decisions delayed the opening of the charger to the public in almost all of the SLAM cases. In very few cases this was due to unexpectedly high delivery times of the charger itself, most often delays were caused while asking for the building permit or issues with the grid connection.

Surprisingly, those investors that are mostly experienced with charging infrastructure, announced time delay due to administrative barriers and permission processes. One of the reasons for is explained in the fact that many different locations, each with differing prerequisites, have been developed simultaneously. The basic procedure may be the same, but each problem has to be addressed in a different way and individually. With regards to permits, local administrations often have not set up standard processes to deal with the implementation of charging infrastructure yet, e.g. which reports and assessments are necessary. Unclear responsibilities slow the process drastically and in many occasions for several months.

Equally surprising is the fact, that the investors C, D, E and F, who are public utility companies and regional energy suppliers, did not have any trouble in building up the charging stations. Investor D reported small challenges with the billing model which lies in the history of public utility companies; billing in a time-based tariff is new to them, while billing per kWh would have been easily managed, because it is their everyday business.

Investor G, H and I all mentioned challenges during the realisation. In contrast to investor A and B who were not experiencing any administrative barriers. This is easily explained with the property owners: G, H and I all have built the charging stations on their own companies properties or pretty close to it, while A and B built it on properties with license agreement involving several public and private stakeholders.

Nevertheless, investor G, H and I were challenged during their cooperation with the grid operator. Connecting charging stations to the grid requires in almost all cases the involvement of the grid operator which in Germany is a highly regulated market limiting the flexibility of the grid operators through long-term investment targets not suitable for open market investments.

During operation, investors face fewer however very visible barriers. Investments decisions are often made with the assumption of being the only provider in the specific area, at least for some years. With the lack of a central planning, it is possible, and has happened in several occasions, that charging stations are opened at very similar times in locations that are sharing the same customer market.

5 Discussion

A lot of good and bad conclusions for the development of the market for fast charging provision can be drawn from the insights and data gathered. Most importantly after a long time of discussing the chicken and egg problem, implementation of charging infrastructure is happening through a wide range of different stakeholders. All stakeholders involved in SLAM stated that they are ready to make the first step, although this venture is subject to uncertainty. While they are all among the first pioneers, who opted for the establishment of fast-charging infrastructure, a final evaluation draws a differentiated picture.

These different stakeholders have different business models, assumptions and motivations to supply a fast-charging service for the general public. In general one can say that, despite the over-optimistic estimations of the number of charging sessions, all investors are glad to have taken the step. Besides the positive feedback for their engagement, and the ensuing impact on the investors' image and brand awareness, all business models could be adjusted or refined to suit the needs of the intuitions. Several investors, intend to utilise their gained experience to offer new services, e.g. contracting models for building and operating fast-charging infrastructure. This again is a bet into the future market as all investors are awaiting an extensive positive development in the near future. None of the initiatives can be assessed as good in the long-term, if the current status-quo will endure. The long-time hesitant position by the state and the automotive industry is a complaint by nearly all stakeholders. It is not only about subsidies and financial advantages but also about regulation and standardisation; a standardised procedure for offices and authorities, as well as a higher priority when dealing with a grid provider, would help to improve the situation significantly. Also a strong commitment by the automotive industry along with a quick and direct exchange is desperately awaited.

In the following, a conclusion is drawn, comparing the 3 investor groups (see chapter 4.2)

National/international large scale investors

Currently large scale investors are focussing on efficiently reserving locations with the potentially highest value, the often called hot spots, and in creating and formalizing alliances with relevant market participants. One of their main challenges today is to find the right partners for locations. They often integrate all building and operating tasks in-themselves, bundles almost as often with direct end-customer products. These investors, in particular, expect a soon-to-be boost in the market of electromobility. This is mainly due to the fact that they carry out their work on properties with license agreement; therefore only a short period of time (mostly 5-10 years) exists to recover the investment. Due to the range of EVs, those expensively established fast-charging locations on hot spots are less frequented than locations with single fast-charging stations in urban areas. With increasing battery capacity and new car models in the pipeline, a turning point along with an advantage for hot spots on axes could occur any time soon.

Regional investors

Regional investors are currently often local energy providers, grid operators or public utility companies that are building a sustainable branding close to a new customer market allowing them closer and more frequent interactions. Due to their regional focus, they act in accustomed environments, along with long-term partners to provide locations. Their experience with AC-chargers helps to get along fast with the challenging tasks of building and operating fast-charging infrastructure. Depending on the location, regional investors can have customers from their own supply region, as well as customers who are passing through. Currently, there are slight advantages, regarding the number of charging processes.

Local investors

Local investors often operate fast charging infrastructure jointly with own fleets and the decision is made jointly or after a vehicle has been purchased. Locations are not necessarily close to the main streets and often operated on local low voltage grids. Besides, these investors own the land or have a long-term lease, which is good foundation to implement and operate infrastructure. However, they have no experience with electromobility and in particular with charging stations. The simple idea of opening the charging station to the public is to refinance some of the investments costs and as a side effect, the image and brand awareness are boosted. Thereby, the companies get in touch with existing, as well with new customers. Local investors all work with existing service providers to operate their charger and offer services to a wider market.

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