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E-mobility and the residential real estate sector Executive Summary

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Background of the study and the goal definition[1]

Since Germany intends to become the lead market in the field of electric mobility (e-mobility), e-mobility stands high on its agenda. The goal is to achieve 1 million electric vehicles (e-vehicles)[2] by 2020. At the same time, it needs to be realized that these vehicles are likely to spend most of their life-time parked at diverse locations and using a proportion of this time for recharging of their batteries. Provision of parking facilities for the residents in rental apartments belongs to the responsibilities of commercial real estate sector, which administers roughly one quarter of 40 million apartments available in Germany. Therefore, this study had the goal to analyze the challenges which e-mobility introduces to the real estate sector and to suggest technically and economically feasible solutions for these.

Infrastructure development requirements due to electric vehicles

Based on current scenarios, there are 500.000 to 1 million electric vehicles expected to be in use in Germany in 2020 and 6 million e-vehicles in 2030. This represents a market share of 1,1 to 2,3 % in 2020 and 13,3 % in 2030 on the German vehicle inventory. Nevertheless, rental apartment residents are likely to own only a marginal share of these e-vehicles. In 2020, there is less than 1 e-vehicle per 100 rental apartments expected to be present. This number is expected to rise to 7-8 e-vehicles on average till 2030, for which recharging facilities need to be created. Given the low number of e-vehicles for buildings consisting of 6 or 12 rental apartments in 2020, the authors of the study suggest the residential real estate sector to primarily concentrate on recharging solutions at the level of districts instead of individual buildings in the medium term. Only from 2030 onwards, the e-vehicles number is likely to rise to a level where there will be on average one e-vehicle located in every second 6-apartment building and in every 12-apartment building.

Given a daily driven route of 30 km, the power consumption of a single e-vehicle is likely to increase the monthly power consumption of a 6-apartment building by 10 % during the warm months of the year, i.e. from spring to autumn. This share can increase up to 18% during the winter months and unchanged e-vehicle usage. Nevertheless, this new power demand does

[1] Data and literature references are excluded in this summary. These can be found in the final report of the project (long version).

[2] Electric vehicles = Battery-electric vehicles, Plugin-hybrid-vehicles and range extender, pedelecs are treaded separately in this study

not influence the network connection specifications of the building. Normal charging of an e-vehicle lasting over six hours is possible through a regular suitable electric socket with 230 volts/16 amperes. However, the "regular" household cabling and sockets are not designed to carry high constant power load over such a long period of time. Therefore, experts suggest the use of dedicated charging connection which is adjusted to the e-vehicle charging needs and the use of CEE-blue (230 V/16 A) sockets and plugs which are also commonly used for connecting of e.g. motor homes or caravans. The use of so called wall boxes then becomes advisable in situations where several e-vehicles are to be charged simultaneously as this increases the recharging management complexity and makes communication between the power network and the car batteries necessary. In the medium term, the use of even more powerful charging stations within the residential real estate sector is seen as unnecessary by the authors of this study.

Installation of the necessary infrastructure then involves significant expenditures on behalf of the residential real estate sector. Investment costs (including planning, installation and administration) for a relatively simple recharging solution were found to be 1.900 € per e-vehicle. However, if additional 25 m power cable and a wall box were assumed to be installed, then the investment costs increase to 5.400 €. This means that a single e-vehicle in case of a simple solution causes an additional cost of nearly 300 € per year (compared to a regular parking space); in a wall box scenario it is then nearly 700 € per year (in each case excluding the power costs).

Hence, a decision to equip the residential real estate sector with 200.000 e-vehicle compatible parking spaces by 2020 involves investment costs between 380 million and 1.08 billion euros. These expenditures then need to be financed either by the sector's own resources, external subsidies or additional revenues. Here, one could e.g. consider increasing the parking space rent for an e-vehicle compatible space by 25 to 60 € per month.

Within the public discussion it is often called for combining the e-mobility with own power generation. It is seen as technically possible to charge the batteries of tenant's e-vehicles with the power generated directly on the lot of the residential building. Use of small co-generation units (micro-CHP) appears to be well disposed for this task. Use of photovoltaic then seems to be less suitable due to the discrepancies between the seasonal swings (winter low/summer high) in the power production and the power demand of the e-vehicles (winter high/ summer low). Economic feasibility of such solution then appears to be case specific; hence, a universally valid statement cannot be made. In addition, the business case for own power generation depends on the several factors among which charging of e-vehicles plays only a marginal role.

Infrastructure development requirements due to the electric bicycles

Already at present, the residential real estate sector is confronted with the demand stemming from the increasing use of electric bicycles (pedelecs). With 700.000 electric bicycles currently

in use, the authors of the study expect pedelecs to reach a 10% share of German bicycle inventory by 2020 and potentially 35% by 2030. This implies 14 to 21 pedelecs per 100 rental apartments in 2020. In other words, there is likely to be at least one pedelec present in every building with 6 or more apartments in 2020. Pedelecs are noticeably heavier as compared to normal bicycles (25 kg instead of 15 kg) and characterized by a significantly higher purchase price. Therefore, provision of appropriate transport aids (ramps, staircase rails) and storage facilities such as bicycle racks or preferably easily reachable and lockable bicycle rooms in the basement gain importance. Provision of lockable bicycle boxes might be considered if there is no cellar in the building available. At the same time, charging of the batteries does not need to be specifically addressed by the residential real estate sector. The batteries can be usually easily removed from the pedelecs and recharged at the regular power socket within the apartment.

Even though the installation costs for bicycle racks, boxes and transportation aids are per bicycle significantly lower as compared to the infrastructure cost for e-vehicles, the total investment cost involving upgrade of roughly 1.4 million residential buildings in the hands of the German residential real estate sector could possibly range between 440 and 835 million €.

The relevance of e-mobility for the residential real estate sector

There are at least two good reasons which justify the investment of the real estate sector into the development of e-mobility:

- Given the higher purchase price of pedelecs and e-vehicles, tenants characterized by higher income levels are the most likely group to be interested in e-mobility. The Residential real estate sector will need to meet the new requirements of these tenants, if it wishes to keep this customer group.
- Widespread use of e-mobility is likely to prevent noise and air pollution in the long run, which in turn would increase the value of many residential districts. In the long run, this development might make it easier for the real estate sector to find occupants for rental apartments on congested streets within the inner city.

Nevertheless, there is going to be a significant time gap between the necessary investment of the residential real estate sector and the above described positive effects. This is especially the case for the latter effect.

The interests of the residential real estate sector

It is unlikely that the residential real estate sector is financially capable to manage the upgrade of one quarter of German housing inventory to e-mobility needs on its own. This is then especially valid for the early implementation stages where economies of scale are not yet fully utilized. The above identified necessary investment, which involves 380 million to 1.08 billion

€ to be invested by 2020 only within the e-vehicle sector, will not be possible without significant governmental support. Here, subsidies are seen as the most preferable option. The same seems to be also valid with respect to storage facilities for pedelecs – here, the investment need was calculated to range between 440 and 835 million €.

At the same time, construction of charging facilities with no additional operating costs is of interest for the residential real estate sector (i.e. facilities which are well protected against vandalism, have low maintenance requirements, etc.).

In addition, the residential real estate sector will need an appropriate regulatory framework which will allow the sector to produce power on its properties and deliver it to its own tenants as well as – in order to improve the capacity utilization of the recharging infrastructure – to third parties. This then also involves an income tax system which is not obstructive to operation of renewable energy facilities, especially in case of tenancy associations.

The role of residential real estate sector within the e-mobility development

Up to now, the e-vehicle discussions concentrate on the vehicles, batteries and the charging infrastructure located at the public spaces. At the same time, the fact that roughly ten million parking spaces are owned by the residential real estate sector is being completely ignored. These parking spaces provide an unique opportunity to promote the development of e-mobility in the field of e-cars with rather simple technical and organizational means. The effort involved in upgrading the rental garage spaces, park house spaces and most of the outdoor parking spaces involves at maximum one quarter of costs associated with the construction of charging stations in public spaces. Given favorable conditions, simple solutions are available from 100 € upwards; mid-range solutions (wall boxes) are then available in the range from 1.000 to 2.500 €. Therefore, with respect to construction of charging infrastructure, the authors of this study see the cooperation of the residential real estate sector with other companies, especially from the energy industry, and with government at local and higher levels as desirable.

The bicycle market then seems to provide one interesting occasion for this kind of a cooperation, as pedelecs might represent the first contact for significant parts of the population with the e-mobility sector. Already at present, pedelecs can take over a significant part of the people's local transportation needs. Accelerated efforts in the construction of secure storage facilities in the residential buildings as well as at the destination locations (shopping centers, schools and universities, industrial locations, recreational centers) would further support even more widespread use of pedelecs. This in turn would reduce the street congestion, environmental pollution and demand for parking. Such an exemplary cooperation between the residential real estate sector, communes and government could later serve as a model for the joint construction of e-vehicle recharging infrastructure, which will in the mid-term become necessary.