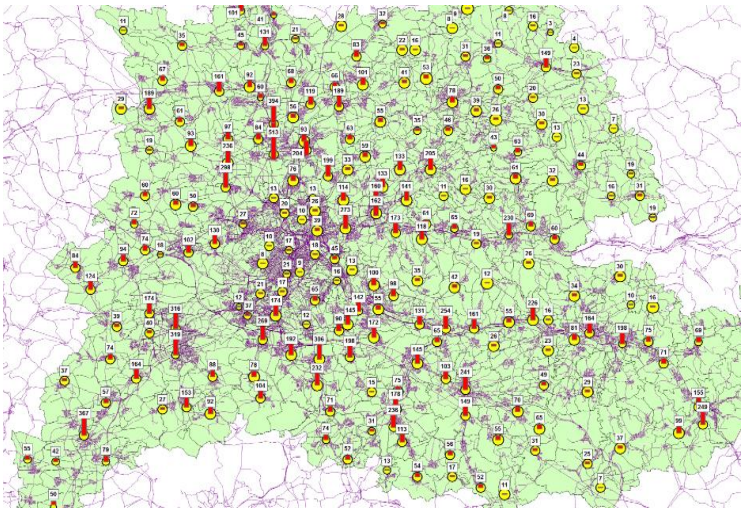
Electromobility: Master Plan for Quick-charging Service Stations

Tool for Expanding the Quick-charging Infrastructure as a Function of Requirements/Planning Tool for Evaluating Locations for Quick-charging Points in the Stuttgart Region



Daily charging of electric vehicles resolved for locations is forecast by the planning tool for expansion of the charging infrastructure in the Stuttgart region. (Map: KIT)

A network of charging points meeting demand is an important key to the acceptance of electromobility. Scientists of the Karlsruhe Institute of Technology (KIT) and the Fraunhofer Institute for Systems and Innovation Research (ISI) developed a geo-information tool for analyses of locations for quick-charging stations in the Stuttgart region. Among other factors, the planning tool takes into account how easily stations can be reached, forecasts charging demand, and can be adapted to different framework conditions.

The “Master Plan of a Quick-charging Infrastructure for the Stuttgart Region” covers a variety of problems and scenarios for the Stuttgart region approximately 3600 square kilometers in size. How many quick-charging stations for public access are required for what number of electric cars? How many locations are needed if they are to be reached from any point in the region within a certain period of time? How many charging processes a day can be expected for what number of electric vehicles, and how much energy is delivered per charging process? Thus, for instance, 58 charging points are needed if they

KIT Mobility Systems Center: Solutions for tomorrow’s mobility

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are to be accessible within ten minutes by car, while the number is 218 for accessibility within five minutes. The evaluation tool was elaborated by the scientists of the KIT Institute for Transport Studies and of Fraunhofer ISI on behalf of the Stuttgart Regional Association.

A sufficient, publicly accessible charging infrastructure for electric vehicles is a major prerequisite for the fitness for everyday operation and the acceptance of electric vehicles. Quick-charging points with a charging power of approx. 50 kW allow the battery of a car to be charged roughly within twenty minutes for a distance of approx. 100 km. Charging takes longer when using one of the 22-kW charging points mostly available now in public spaces. “Outside of motorways, there are hardly any quick-charging points,” says Dr. Martin Kagerbauer of the KIT Institute of Transport Studies. The planning tool developed by the scientists supports municipalities and potential investors in finding appropriate locations for expanding the quick-charging infrastructure in the Stuttgart region. The quick-charging infrastructure master plan among other factors takes into account the number of charging points already existing in the region, highly frequented points, such as museums, supermarkets or restaurants, and the connection to the power grid and the expected economic performance. Dr. Partrick Plotz of Fraunhofer ISI emphasizes: “Economic operation will be possible in a few years at locations whose capacities are fully utilized. However, this requires the very complex step of connecting the charging points to the medium-voltage grid, which depends on very many local factors. This is where specific solutions need to be found.”

The KIT scientists based their master plan on data of mobiTopp, their microscopic multi-agent-supported transport demand model. For a simulation period of one week, the model covers the mobility of all inhabitants of the Stuttgart region, with all distances, destinations, and vehicles, such as the regular use of specific means of transport or the routine contact with specific destinations. The simulation of transport demand, which was performed on behalf of the Stuttgart Regional Association, includes approx. 50 million distances covered per week by all means of transport and reflects the entire mobility profile of the Stuttgart region. Besides bikes, passenger cars and public transit as means of transport, this “LivingLab BWe mobil” showcase project integrates electromobility into modeling. Moreover, other pilot and research projects of the federation and the state of Baden-Württemberg were taken into account in the calculations. “The master plan is tailored specifically to the Stuttgart region as a consequence of the underlying data, while its methodology can be transferred to other regions as well,” emphasizes Kagerbauer. The traffic planner expects a

significant increase in electric vehicles for the next five to ten years. “I can see that the attitude of people is changing in favor of e-mobility,” says Kagerbauer. Environmental aspects played a role in this effect just as much as the fact that technical developments advanced. The establishment of a system of statewide charging points was also one of the objectives of the current “Electromobility III State Initiative” designed to make Baden-Württemberg the lead region of electromobility in Germany.

For more information, see:

https://www.region-stuttgart.org/presse/artikel/aktuell/schnelle-stromtankstellen-fuer-die-region

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https://www.ifv.kit.edu/forschungsprojekte_797.php

More about the KIT Mobility Systems Center http://www.kit.edu/research/6720.php

The Karlsruhe Institute of Technology (KIT) pools its three core tasks of research, higher education, and innovation in a mission. With about 9,300 employees and 25,000 students, KIT is one of the big institutions of research and higher education in natural sciences and engineering in Europe.

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