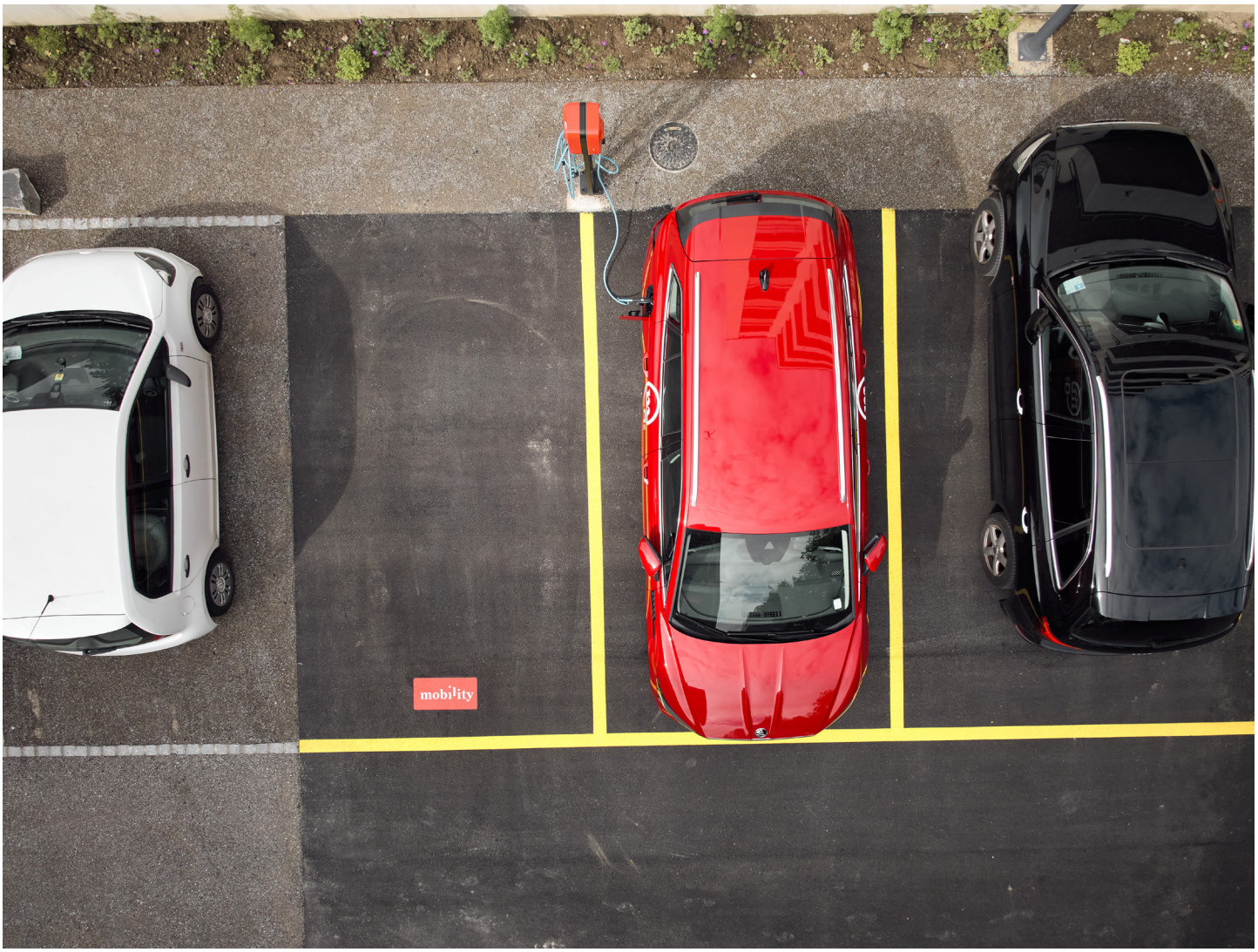
ELECTRIC CAR FLEETS AS PART OF THE POWER GRID

Electric cars are not only used by private customers. Electric cars are often part of a company's or car-sharing provider's vehicle fleet. A research project by the Ticino University of Applied Sciences and Arts SUPSI with partners in Austria and Israel has developed digital tools that will help to achieve economic benefits from the grid-friendly operation of electric car fleets in the future.



Mobility station in the city of Bern. Photo: Mobility Genossenschaft

A technical report about the results of a research project in the field of grids, which is financially supported by the Swiss Federal Office of Energy. The report has been published in the technical magazine Strassenverkehr Schweiz (issue October 2025).

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With around 3,000 vehicles at 1,600 locations, Mobility is Switzerland's largest car-sharing provider. Founded in 1997, the company is increasingly focusing on electric cars: at the beginning of 2025, it had around 600 electric vehicles in use, including the Renault ZOE, the VW ID.3 and the Skoda Enyaq. Such fleets have characteristics that go beyond the immediate purpose of the cars: if you combine the batteries of these cars, you get a large storage facility that would be enough to supply ten four-person households with electricity for a whole year.

Electric vehicles for car sharing and companies

Car sharing companies are also active abroad, for example in the Israeli city of Tel Aviv. There, the mobility provider GoTo operates the car sharing company AutoTel on behalf of the city of Tel Aviv with 360 cars, including 100 electric cars. Unlike Mobility cars, AutoTel vehicles do not have fixed locations but can be rented by users throughout the city and parked at any location after use. The advantage of this free-floating system is that the cars have comparatively short downtimes. At the same time, there is the disadvantage that "empty" cars are often parked far away from charging stations and have to be brought to them at considerable expense.

Finally, there are car fleets that are used by company employees. Such fleets are also increasingly consisting entirely or at least partially of electric vehicles. One example can be found in the Austrian municipality of Ernstbrunn. The company "Windkraft Simonsfeld" has been based there since 2009. It operates a number of wind energy and photovoltaic plants. The company also relies on renewable energies for its company cars: the majority of the two dozen or so company cars are electric.

Operating fleets in a grid-friendly manner

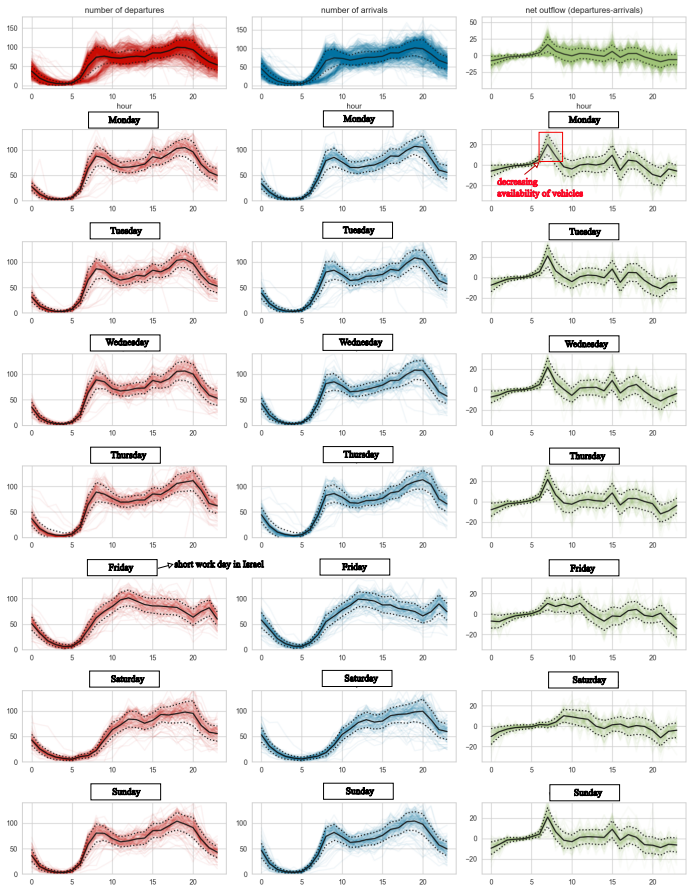
Mobility, AutoTel and Windkraft Simonsfeld – as different as these companies are, they are united by the fact that they operate fleets of electric cars of varying sizes. This has led them to become partners in an international research project coordinated on the Swiss side by the University of Applied Sciences and Arts in Ticino (SUPSI) and financially supported by the Swiss Federal Office of Energy within the ERA-Net Smart Energy Systems international cooperation program. The project is called GAMES. The acronym stands for "Grid Aware Mobility and Energy Sharing", which means that mobility and energy exchange services consider the service of the electricity grid.

«The companies Mobility, AutoTel and Windkraft Simonsfeld were of interest to us because we wanted to investigate how digital tools could be used to generate added value for the electricity grid from electric car fleets,» says Jalomi Maayan Tardif, researcher assistant at SUPSI and project manager of GAMES. «The aim of our project was to provide operators of electric car fleets with innovative forecasting, optimisation and decision-making tools that help them to plan charging processes and vehicle movements efficiently, taking into account demand, electricity prices and grid load,» says the SUPSI scientist.

Three use cases modelled

Electric car fleets can generate added value for the electricity grid in various ways:

• Electric cars can be charged at specific times when little electricity is otherwise consumed in the distribution grid. GAMES researchers investigated this use case using data from the car-sharing provider AutoTel. This issue is particularly re-



The graphs show the number of rentals (red), returns (blue) and trips (green) for the AutoTel fleet in Tel Aviv for each day of the week and each time of day. Graph: GAMES final report

levant in Tel Aviv, where there is a lot of solar power available during the day, but also high electricity demand for air conditioning.

• Electric car fleets can be used to temporarily store solar power with the aim of increasing the self-sufficiency of decentralised prosumers, who produce and consume their own solar power. This use case was investigated using data from the company fleet of ‹Windkraft Simonsfeld›: model calculations were used to attempt to use as much of the ‹green› electricity from the company's own power plants as possible to charge the company fleet.

• Electric car fleets can be used for peak shaving. During periods of high photovoltaic production, electricity is temporarily stored in car batteries so that it can be fed back into the grid later when there is no longer any PV surplus. To make this technically possible, bidirectional charging stations (vehicle-to-grid technology/V2G) are required. This use case was ‹run through› by the scientists using data from Mobility.

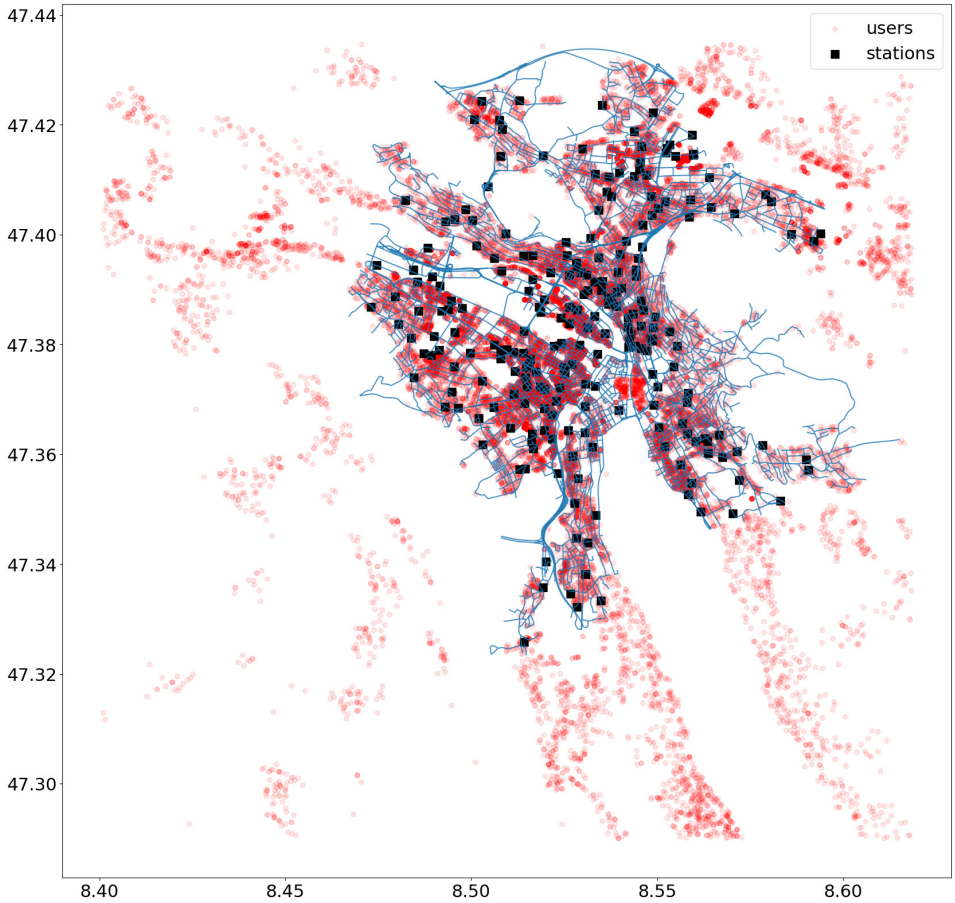
Models predict user behaviour

GAMES was not about empirically testing the use cases in Tel Aviv, Ernstbrunn and Zurich. Instead, data (processed in accordance with data protection regulations) from AutoTel, Windkraft Simonsfeld and Mobility was used to develop digital tools that make such applications possible in the first place, i.e. tools that are capable of ‹intelligently› controlling the charging processes of electric car fleets. To this end, the scientists developed prediction models that are capable of realistically predicting the mobility behaviour of electric car users and the associated electricity demand over hours and days.

In doing so, it was necessary to ensure that the cars were sufficiently charged at all times so that their use was not restric-

FOUR RESEARCH PARTNERS

The research project was carried out under the umbrella of the European research network ERA-Net Smart Energy Systems. Participants included the University of Applied Sciences and Arts of Southern Switzerland (SUPSI), the Austrian consulting firms E7 and Salzburg Research, and Reichman University in Israel.



Locations of the car-sharing provider Mobility in the city of Zurich (black dots), supplemented by the places of residence of people who use Mobility (red dots). Graphic: GAMES final report

ted, meaning that the electric car fleet could be used as desired for car sharing or internal company purposes. Ideally, the ‹intelligent› control algorithms should be integrated into the existing booking and management platforms. In the course of the project, the GAMES researchers succeeded in developing a proof-of-concept for a digital interface that takes into account the mobility behaviour of car users as well as the economic needs of fleet operators and the desire of electricity grid operators for the most balanced grid load possible.

Financial incentives

The researchers drew various conclusions from their investigations that are important for the grid-friendly operation of electric car fleets. One of these is economic in nature: for peak shaving using V2G to be economically viable, a new system of tariffs is needed: The high investments in V2G infrastructure will only pay off if peak shaving (or other applications) generate sufficiently high revenues later on.

Another finding, done by the Israeli research team, is of a socio-scientific nature and concerns the acceptance of electric car sharing. According to this, people are still sceptical about car sharing with electric vehicles because they doubt their performance and find that the reduced costs do not necessarily outweigh the benefits of owning a private car. «However, when electric car-sharing vehicles are used in a residential area to utilise the residents own solar power, people are more positive about them. We conclude from this that high self-consumption can help to overcome some of the resistance to shifting to electric drives,» says Maayan Tardif.

The Austrian company Windkraft Simonsfeld operates a number of wind power and solar power plants – and produces solar power itself at its headquarters in Ernstbrunn with a powerful PV system (70 kW). The GAMES project investigated how this can be used to power the company's own fleet of electric cars. Photo: Windkraft Simonsfeld

As part of the project, Austrian consulting firm E7 developed a linear optimisation model that uses data from SUPSI to simulate fleet charging scenarios and compare smart charging with vehicle-to-grid. The model can be used in future to quantify the economic benefits of different strategies, taking into account dynamic and static prices. Among other things, the tool can be used in the planning of urban charging infrastructures.

It was shown in the project that users of car-sharing vehicles can be motivated by financial incentives to park the cars at a charging station after use rather than simply leaving them in the nearest available parking space. This is valuable because it frees car-sharing fleet operators from the task of having their own employees bring the cars to the charging stations. The question of how high the incentive must be to be attractive to users and economically viable for fleet managers remains to be tested.

Overcoming obstacles

«Electric car fleets and car sharing have great potential for decarbonising mobility,» says SUPSI professor Vasco Medici, whose research group carried out the Swiss part of the GAMES project. However, it is not yet clear what new business models operators of electric car fleets can use to generate additional revenue. «There are still various hurdles to overcome, such as the need for updated regulatory requirements, limited communication and compatibility between cars and charging stations, data protection regulations and unresolved issues regarding the proof of origin of electricity from car batteries. These issues need to be clarified before new business models can be implemented,» says Medici.

The results of GAMES provide an indication of where the journey could lead. As part of the project, two platforms with high application potential were developed: one platform allows company fleets to participate in the balancing energy market; a corresponding platform is already operational in Switzerland (FLEXO, a cooperation between Axpo and Clyde Mobility). The other platform supports operators of free-floating electric car fleets in distributing cars to charging stations in such a way that the local distribution network is burdened as little as possible. This platform is not yet in use, but was meant as a proof-of-concept.

- The **final report** of the research project 'Grid Aware Mobility and Energy Sharing' (GAMES) is available (in English) at https://www.aramis.admin.ch/Texte/?ProjectID=49972.

- For further **information** on the project, please contact Michael Moser (michael.moser@bfe.admin.ch), Head of the SFOE's Electricity Research Programme, and SUPSI project leader Jalomi Maayan Tardif (jalomi.maayantardif@supsi.ch).

- Further **technical articles** on research, pilot, demonstration and flagship projects in the field of electricity can be found at www.bfe.admin.ch/ec-strom.

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