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REGULATORY ASSISTANCE PROJECT

Out of the sandbox

How to scale vehicle-to-grid in Europe.

Electric vehicles (EVs) are capable of much more than simply transporting people or goods from one place to another. Through smart and bidirectional (often called V2G, short for vehicle-to-grid) charging, their batteries can become an important societal resource. **Smart charging** — loading electricity into a battery when renewable energy production is high but demand is low — supports a more efficient energy system. **Bidirectional or V2G charging** allows electricity to flow both into and out from a battery, enabling EVs to act as power sources to the grid. This is useful when renewable energy production is not sufficient to cover demand. But energy regulations are not always ready for these mobile batteries feeding in. The European Commission now promotes the use of **regulatory sandboxes**, temporary deviations from energy regulation, to trial solutions to regulatory barriers for V2G.[1]

Batteries require precious resources to be built, and it is important to make the best use of them. With almost 10 million battery-electric cars, vans, and buses on Europe's roads by the end of 2024[2] — and a multiple of that expected by 2030 — the useable capacity of these batteries on wheels is enormous. **For V2G to thrive, however, more than just technology is required:** access to electricity markets to unlock value, network tariffs and metering fit for purpose, as well as free user choice are needed, so that a variety of services catering to different user needs can emerge. Regulatory sandboxes can ease the introduction of V2G, but alongside this, it is important to remove barriers to all demand-side flexibility. In this document RAP offers recommendations for Member States to create a healthy ecosystem for V2G to scale.



Unidirectional smart charging is here already

The prospect of V2G should not prevent us from taking advantage of the wide-scale opportunities available today.

All EVs on the road today can already be charged in an optimal way, **reducing costs for the user, increasing the utilisation of renewables and alleviating grid pressure.**

Users should be able to benefit from lower charging prices through smart charging at all private and public charging locations.



Being able to use any charger with any car requires more than technical standards and rules

Users should be able to use any car with any charger and service. In addition to technical standards and grid codes, we need user choice in legislation.

Technical and commercial lock-ins should be avoided that limit user choice and shorten the useful lifespan of EVs and chargers.

Harmonised European grid codes, data access and control rules allow products and services to scale.



What is measured gets rewarded

Through efficient metering concepts, such as device-level measurements, EV (dis)charging can participate in all relevant energy markets and system services.

Simpler, standardised measurement concepts **ensure the flexibility of EVs can be rewarded.**

Data from meters in charging points must be included in market operations in the same way as grid meters.



Pricing fit for the flexibility era

Granular price signals from energy markets and the local grid should be the guiding principle for charging and discharging.

Time-varying prices signal grid and system needs and provide consumers with lower-cost charging options.

Price-based smart and bidirectional charging reduces costs for all electricity system users.

[1] European Commission (2025) Automotive Action Plan https://transport.ec.europa.eu/document/download/89b3143e-09b6-4ae6-a826-932b90ed0816_en
[2] IEA (2025) Global EV Outlook https://www.iea.org/data-and-statistics/data-tools/global-ev-data-explorer

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Smart charging is here already

Unidirectional smart charging can already make a significant contribution to system flexibility whether charging at home, at the workplace, public charging stations at long-duration parking locations and with high-power charging. Removing barriers to small-scale device participation in all energy and flexibility markets could enable an ever-increasing number of small and large consumer energy devices, like EVs, to contribute to a resilient and clean energy system. **Time-varying network tariffs and energy prices would reward grid-beneficial behaviour for all EV charging sessions.** RAP recommends:

1. Ensure that EV drivers can benefit from variations in network and energy prices. Communicate prices clearly and consistently, for example at the same frequency and in advance as day-ahead dynamic electricity prices, to help users, and services that act on behalf of the user, to plan accordingly.
2. Extend the benefits of smart charging to public charging points. Allow mobility service providers to aggregate flexibility and optimise charging on behalf of users. For users paying ad hoc for their charging session, the choice to have the charging point operator (CPO) shift the session to more favourable times should be straightforward.
3. Prioritise the swift implementation of European energy market provisions, such as on the digitalisation of grids, since insights in grid conditions and capacity are key inputs for smarter energy use. All energy system users benefit from lower costs when network tariffs are cost-reflective and incentivise flexibility. Removing barriers to distributed energy resources, such as minimum bid size and duration requirements, benefits all forms of demand-side flexibility.

See **Imagine all the people**



Being able to use any charger with any car requires more than technical standards and rules

Users should be able to charge their car smartly and bidirectionally with any charger or service, often called interoperability. Although technical standards are important for interoperability, they are not enough. Interoperability and freedom of choice for users cannot be achieved through technical standards alone. Legislation and regulations must guarantee the freedom to use any device and vehicle with any service/operator of one's choice. **Accompany technical standards with fit for purpose interoperability and user choice principles in legislation.** RAP recommends:

1. Enable users, via legislation, to switch the operator for their smart energy devices and make free choices. This should include support for existing EVs, which may use older standards, and access to essential vehicle data and charging functionality for services acting on behalf of users. Limitations on access to or recognition of digital certificates (part of the ISO 15118-20 standard) could restrict users' choices, which must be avoided.
2. **Harmonise EU rules to create the scale for growth.** In order to expand across Europe, carmakers, charging point manufacturers, and energy service providers should have harmonised EU rules regarding vehicle and energy data access, security, device control, grid codes and market access. National deviations should be avoided by Member States, and non-discriminatory access to flexibility programs of national and regional system operators, including for independent aggregators, should be assured.

See **Enabling two-way communication**



What is measured gets rewarded

Simple yet effective measurement arrangements, in combination with a grid meter, are needed for many use cases of bidirectional charging. By using measurements directly from EV charging points, whether combined with those from the grid meter or not, the challenge of double energy taxation can be resolved, and new use cases made possible. **Device-level measurement helps with the accurate measurement of flexibility provision,** separate from other consumption and enables new operating models. This data can improve transparency regarding the use and origin of renewable electricity, whether generated on-site or supplied via the grid. RAP recommends:

1. Allow sub-metering using device-level measurements (the updated Measuring Instruments Directive will cover EV charging points) in all energy market operations.
2. Simplify company car home charging, participation in energy communities, and the creation of virtual balancing networks through device-level metering and energy contracts, allowing for easier aggregation in energy markets and the provision of flexibility.

See **Credit where credit is due**

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Flex pricing for consumer benefits

High taxes, levies and static network tariffs act as barriers to energy flexibility. Reducing taxes and levies on electricity would be a good first step. Network tariffs should be cost-reflective and evolve into a granular, time- and location-based two-way tariff that can provide a **non-discriminatory signal for all types of demand flexibility, including when to discharge a vehicle's battery.** RAP recommends:

1. Reward charging and discharging, if that helps reduce peak grid load at certain times, by including negative prices in a network tariff. This measure enhances grid-supportive behaviour from batteries, rather than simply exempting this group of users from grid tariffs. Various options could be trialled in regulatory sandboxes before a full rollout.

2. Enable devices, such as EV charging points or electric vehicles, and services that manage EV charging on behalf of the user to access granular energy and network prices. These devices and services combine multiple inputs, allowing for more gradual transitions and targeted adjustments. High granularity in energy and network prices is no longer an obstacle with the automation of energy services and devices.

3. Expand tariff and service models to appeal to different user groups: For example, current V2G subscriptions offer users risk-free 'free driving'. Dynamic tariffs shift risk and gains to consumers, where a trusted service may operate on their behalf, and also serves flexibility mechanisms and other markets beyond the spot market. Policymakers and regulators should consult stakeholders on ways to increase the range of tariffs on offer and encourage user participation.

See **Making Electricity Cheaper: RAP's eight priority actions**



Conclusion: Use sandboxes for innovation, but don't delay needed action

Although technical standardisation and regulations are progressing at the European and global levels, Member States can still do more to speed up the rollout of V2G. Regulatory sandboxes allow for temporary deviations from existing energy regulations. They can facilitate the transition from legacy regulations and policies and enable testing of new approaches, such as novel network tariffs (e.g., dynamic, granular network tariffs that include negative prices). Sandboxes, however, should not hold up the wider introduction of V2G to the market. Sandboxes should also not delay implementing the EU Electricity Market Directive provisions that would benefit all system users and technologies. The prospect of V2G should, likewise, not stand in the way of deploying unidirectional smart charging for all EVs today.

In addition to working on regulatory sandboxes, policymakers and regulators should aim to adjust administrative rules, for example those surrounding feed-in tariffs or renewable support schemes, to remove barriers to the efficient use of all flexibility in the energy system. Regulators should remove barriers to the participation of small-scale devices, such as minimum bid size and duration requirements, in all energy and flexibility markets. This will enable an ever-increasing number of small and large consumer energy devices, like EVs, to contribute to a resilient and clean energy system. Wider availability of granular energy and network prices, in a diverse range of tariff types and services, enables as many EVs and other new electricity users as possible to operate in a manner that is beneficial to both users and the grid.