

A Comprehensive Roadmap for V2X Integration in Europe

May 2024

Electric Vehicles (EVs) both pose particular challenges and present promising opportunities for the energy system; they mark a pivotal moment in the evolution of transportation and energy sectors. With the increased adoption of EVs lies the imperative for strategic planning and collaborative action on Vehicle-to-X (V2X), a crucial technology for smartening the road transport sector.¹

Recently adopted legislation - as part of the European Green Deal - has already paved the way for the roll-out of smart-charging technologies in the electromobility ecosystem.² We welcome these initiatives and will monitor their implementation closely. Smart charging is a fundamental prerequisite for V2X, which will deliver further advantages for people, the climate and European businesses alike.

Recognising this, this document from the Platform for Electromobility seeks to present a comprehensive roadmap on V2X, setting out a series of actionable steps that by Member States (MS) should undertake, along with measures required at the EU level. Stressing the importance of a cross-sectoral approach, our strategy seeks to navigate the complexities of V2X integration in our energy system without delving too deeply into intricate technicalities. The paper outlines enablers and barriers to adopting bidirectional charging systems, clarifies crucial barriers - and highlights ongoing efforts to mitigate them - and underscores the imperative for concerted and regulatory action to realise the transformative potential of V2X integration.



[More about the Platform for Electromobility](#)

The Platform for Electromobility is a unique alliance of Europe-based producers, infrastructure managers, operators, transport users, cities and environmental civil society organisations from across industries and transport modes. Our overarching goal is to reach a sustainable, multimodal transport system in which people and goods are moved across land, inland waterways, sea and air in Europe using exclusively fossil-free electricity. To reach its vision, the Platform unites all sectors constituting the electromobility ecosystem to pragmatically ensure the conditions for the full electrification of new light-duty vehicles by 2035, and build a sustainable European zero-emission transport system by collectively sharing their expertise, challenges and solutions.

For more information about the platform and its members, please visit:

<https://www.platformelectromobility.eu/>

1/ Benefits of bidirectional charging

a/ Benefits for public finances & grid investments

V2X integration offers a multifaceted solution, one with the potential to unlock a wide range of benefits across various domains. Foremost among these, V2X - as with other flexibility resources - complements conventional grid reinforcement measures, helping alleviate the strain on existing infrastructure while enhancing its resilience. We are already starting to see increasing tensions in the grid and the overwhelming need to reinforce it; therefore, the deployment of V2X and the use of EVs as batteries represents a 'no-brainer'³ and would effectively smooth the rollout of grid reinforcement, something that usually takes between 5-15 years. V2X integration thus offers access to a realm of 'low-hanging fruit' opportunities, allowing the cost-efficient adaptation of the grids to growing electrification.

b/ Benefits for Europe energy autonomy

The integration of V2X will help deploy renewable energy sources (RES), by providing efficient storage solutions. It has the potential to help balance the grid and increase the penetration of renewable electricity (RES-E) into it, thus accelerating the drive to climate neutrality. Indeed, in order to ensure generation adequacy – key for the energy transition – V2X will be pivotal. As intermittent renewable energy becomes increasingly prevalent, maintaining grid stability and meeting demand poses significant challenges. Here, V2X solutions can play a crucial role in balancing supply and demand, enabling dynamic resource adequacy analyses that realise the enormous potential of V2G capabilities.

c/ Benefits for grid operators

From the perspective of the grid operators, there are manifold advantages. For Transmission System Operators (TSOs), V2X is particularly beneficial for Frequency Regulation (FCR) Services, which are pivotal functions for TSOs. In addition to mere savings in battery costs, V2X optimises both standalone and grid-connected storage battery systems. FCR plays a critical role, not only in reducing the necessity for investment in battery storage services but also in minimising the need for grid upgrades. These efficiencies translate into systemic savings, ultimately benefiting electricity consumers. For DSOs, V2X can play a major role in local flexibility markets and congestion solutions providing services to DSOs and representing a valuable flexible resource that can be procured to ease tensions on distribution grids. This requires flexibility mechanisms in which V2X value can be stacked based on related remuneration. To enable even more value of V2X for every DSO, market based procurement of flexibility based on V2X shall be stimulated.

d/ Benefits for users, people and businesses alike

From an end user's perspective, the benefits of V2X integration will be substantial. Through leveraging V2X capabilities, users will have the opportunity to earn money from feeding energy into the grid, thus enhancing the overall value proposition of electric mobility.⁴ Remuneration mechanisms (such as those based on availability, capacity or time) will trigger further consumers to participate; once they do so, they will naturally generate demand for V2X. V2X integration will not only enhance grid resilience and promote renewable energy uptake but also pave the way for a more sustainable, efficient and adaptive energy ecosystem, one where EVs can equally participate in flex mechanisms.

2/ Legislative and Regulatory Principles for V2X Integration

As we call on legislators to begin shaping the regulatory framework for V2X integration, there must be a number of core founding principles that underpin their efforts to foster innovation, interoperability, fairness and trust within the emerging ecosystem.

a/ Consumer trust

Foremost among these principles must be building and maintaining consumer trust. Legislators must prioritise creating a robust system that instils trust among users, system operators and businesses alike. This will entail ensuring transparency and accountability in V2X transactions while also safeguarding consumer rights and interests.

b/ Business models based on use cases

The deployment of V2X infrastructure must be accompanied by corresponding business models, particularly where financed/cofinanced by public entities. As the value of V2X depends on the use case of fleet and chargepoints, there need to be proper business models created that provide an incentive for consumers. Regulators should therefore facilitate mechanisms to support user compensation and fair pricing; these should recognise the pivotal role granular pricing structures play in enabling diverse business models and in incentivising dynamic energy management. The increased volatility in our energy system arising from renewables and negative grid tariffs can further stimulate consumers to engage and participate in V2X initiatives.

c/ Commonly accepted and harmonised standards

The promotion of common standards is paramount for ensuring interoperability and reliability across V2X systems. These should allow the CCS standard to provide smart and bidirectional charging. This should be implemented as early as possible in both charging stations and cars. Any further delay will lead to infrastructure that is not future-proof and will fail to deliver the smart-charging services we will need for the energy transition to succeed. Standardisation bodies should prioritise development and enforcement of standardised protocols for battery efficiency and warranty and for EV charging protocols between both the grid and vehicle. This will bolster consumer confidence and trust in V2X technologies.

d/ Affordability through democratisation

The accessibility and affordability of V2G-capable vehicles must be a priority if access to this transformative technology is to be democratised. By incentivising competition and innovation in the production of V2X-capable chargers and EVs as well as through lowering the barriers detailed below, legislators can drive down costs and promote widespread adoption. This in turn will create economies of scale and lower barriers to entry. With the right regulatory framework in place, recharging costs can theoretically be brought down to zero with bidirectional charging.⁵

e/ Equal treatment for all grid usages

Ensuring equal access, participation, and treatment for all energy usages, including all type of V2X, is fundamental. All grid users should receive equal treatment without discrimination, be they electric vehicles, wind turbines or home appliances. Any exceptions - such as tariff exemptions - should be restricted to emerging user groups, should remain temporary and should be appropriately justified.

f/ Upgradability path

In envisioning the regulatory framework for V2X integration, it is imperative to prioritise establishing future-proof systems capable of evolving alongside advancing technologies and changing needs. Although V2X technology is not as yet fully harmonised across Europe and still faces barriers, its early rollout is needed in order to facilitate improvements. Central to this endeavour is the need for an 'upgradability path', embedded within the regulatory framework. Such a path will not only instil trust among consumers and markets but also ensure compliance with future technological advancements and emerging requirements.

g/ Public charging hidden potential

In Europe, a significant proportion of the car fleet lacks access to home charging. As a result, publicly available charging will continue to be necessary in the future. This presents an opportunity to leverage V2X technology at these points also. We therefore encourage public charging points to be V2X-capable; this is provided that the cost-benefit analysis is positive, they are priced similarly, only implemented on slow chargers and do not impede the rollout of charging stations across Europe.

3/ Barriers to V2X Deployment

Despite the potential offered by V2X integration, several barriers continue to hinder its widespread deployment. Overcoming regulatory, technical and market hurdles will require concerted efforts.

a/ Implementation of the Electricity Market Design

At the forefront of these challenges are regulatory barriers, most notably the lack of implementation by MS of the 2019 Electricity Market Design, which discriminates and disincentivises the participation of V2X in the electricity markets. To address this, there is an urgent need for MS to accelerate their implementation.

b/ Double Taxation

One of the asks of battery stakeholders (EVs and stationary) is to eliminate double taxation; that is, the taxing again of electricity injected into the grid from a battery. Double taxation⁶ remains a persistent concern, particularly in scenarios where energy storage is integrated with other loads. While progress has been made in mitigating double taxation for large-scale storage, challenges persist for small-scale storage assets such as V2X. For example, in Germany, double taxation for stationary storage has been removed, yet remains in place for mobile storage.

c/ Uncoordinated grid requirements

The absence of the anticipated regulations, coupled with limited access to organised markets and revenue streams, poses significant challenges to V2X deployment. Uncoordinated grid requirements and standards between countries are exacerbating these challenges, hindering interoperability and complicating cross-border deployment efforts. Divergent communication standards and disparate smart meter adoption rates – something that is particularly evident in countries such as Germany, which has low penetration rates – underscore the urgent need for harmonisation and standardisation initiatives to realise the full potential of V2X integration.

4/ Call for coherence, actions and political ownership at EU level

a/ Coherence across Member States

As the EU navigates the complexities of V2X integration, it is vital to address the prevailing divergences among MS and to foster a cohesive regulatory framework that promotes innovation and harmonisation. Despite incremental progress, no MS has successfully removed all barriers to V2X deployment, underscoring the imperative for EU-level intervention. For V2X for slow public charging, we therefore call for national capacity targets - rather an EU-wide one - because the share of cars without access to off-street parking at home differs significantly between MS.

b/ Coherence across EU legislations and regulations

To advance implementation of V2X and harness its manifold advantages within Europe, it is crucial that the newly installed European institutions adopt a holistic approach to this challenge. All V2X-relevant measures should be in the form a comprehensive regulatory framework, rather than addressing them in isolated discussions, or rather than discussion technologies (AC vs DC). One way of ensuring this seamless integration across diverse legislative frameworks - and avoiding a fragmented approach - is to establish political ownership.

c/ Multilevel coherence on V2X

Cities will, in general, be the key enablers and accelerators of V2X due to the alignment between clean air and decarbonisation strategies (such as growing adoption of zero-emission zones, electrification of heating as an alternative to petrol/gas/wood). V2X should therefore be part of an integrated mobility and energy strategy at all territorial levels. We therefore call upon the EU to adapt the proposed SUMP/SULPs into SUMEP/SULEPs (Sustainable Urban Logistics/Mobility and Energy Plan). This will ensure coordinated and integrated planning, helping couple mobility/logistics with energy aspects

d/ Double mandate to jumpstart the market.

Mandating V2X interoperability for all bidirectional-capable vehicles, while at the same time requiring V2X capability for public fleets and buildings would be decisive in kickstarting the market and boosting widespread adoption. It would also ensure flexibility for independent aggregators and promote the use of submeters. Requiring interoperability and encouraging public fleets to lead by example will help jumpstart the market.

Conclusions

Additional measures, including addressing communication standards and issuing non-binding guidelines for MS, will be essential for fostering coherence and facilitating the transition towards a sustainable, interoperable V2X ecosystem. With upcoming revisions to key pieces of legislation now on the horizon, it is an opportune moment for the European Commission to demonstrate leadership and to spearhead concerted action to achieving V2X integration goals. By embracing coherence at an EU level, policymakers can unlock the full potential of V2X technologies and accelerate the shift to a smarter, greener future.

PLATFORM
FOR
electromobility

Renault
Group

EVBOX

UFe
Union
Française
de l'Électricité

VOLVO

EUROBAT
ASSOCIATION OF EUROPEAN AUTOMOTIVE
AND INDUSTRIAL BATTERY MANUFACTURERS

HAROPA
PORT
Le Havre
Rouen
Paris

SolarPower
Europe

Uber

Cu International Copper
Association Europe

TESLA

Danfoss

FREENOW

Hitachi Energy

3M Science.
Applied to Life.

EGEC
GEO THERMAL

ALSTOM

enel x

POLIS
CITIES AND REGIONS FOR TRANSPORT INNOVATION

Ford

BELLONA
EUROPA

Wind
EUROPE

CER

eurelectric

AVERE
The European Association
for Electromobility

smartEn
Smart Energy Europe

EuropeOn
ELECTRICAL CONTRACTORS ASSOCIATION

MOTUS

ECF
EUROPEAN CYCLISTS' FEDERATION

E.D.S.O.
SHAPING SUSTAINABLE MOBILITY FOR YOUR FUTURE

FPPE

CONEBI
Confederation of the
European Bicycle Industry
1918-2018
100 ANS D'UNION EUROPEENNE DE LA BIEN-ÊTRE

ecos

ELECTRA

TRANSPORT &
ENVIRONMENT

Iberdrola

unife
THE EUROPEAN RAIL INDUSTRY

CHAdEMO

Allego

greenway

RECHARGE

VATTENFALL

EIM
European Rail
Infrastructure Managers

-chargepoint-

CLIMATE GROUP
EV100

milence

EURO
CITIES

UITP
EUROPE

END NOTES

¹ V2X is an EV bidirectional charging technology encompassing several sub-technologies: When the vehicle is plugged in, and electricity automatically flows from the car back to the grid, this is known as Vehicle-to-Grid (V2G). Where the charging and discharging of electricity stored in electric vehicles takes place in buildings, this technology is known as Vehicle-to-Building or Vehicle-to-Home (V2B or V2H).

² Notably in the Energy Performance of Buildings Directive, the Renewable Energy Directive and the Alternative Fuels Infrastructures Regulation

³ It has been calculated that V2G can offer 21TWh of upward flexibility and 24TWh of downward flexibility by 2030, considering 30% of the EVs are charged bidirectionally. Together with other flexibility resources, €11 to €29 billion could be saved in annual savings in distribution grid investments.

Source : https://smarten.eu/wp-content/uploads/2022/09/SmartEN-DSF-benefits-2030-Report_DIGITAL.pdf

⁴ In a fleet demo in Denmark, a 10-EV fleet engaging in frequency regulation (FCR) services recorded an average revenue of € 1,860 per car per year.⁴ In a residential V2G project connecting 320 homes in the UK, the V2G units were able to create 'between £230 and £300 of value per year through the spot electricity market' and the project team expects that 'when combined with flexibility services this could grow to £500 per year⁴'. In the UK, a solution already commercialised proposes the first V2G tariff in the UK where EV drivers would get free charging thanks to their V2G charger and vehicle⁴, providing clear incentives and enhancing the social acceptance of the consumer to opt for bidirectional charging.

Source: <https://www.ofgem.gov.uk/publications/case-study-uk-electric-vehicle-grid-v2g-charging>

⁵Source: <https://smarten.eu/position-paper-why-flexible-consumers-matter-a-contribution-to-eu-elections-2024/>, p 9

⁶ In fact, battery stakeholders face a triple taxation. Once when the energy is taken from the grid, twice when part of the energy is injected into the grid and a third time when that electricity is used somewhere else. The electricity injected to the grid should not be taxed when taken by the battery nor when injected back into the grid.