Managing grid integration of electric vehicles
GEF Global Programme to Support Countries with the Shift
to Electric Mobility
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Vehicle Grid Integration

Smart Charging is crucial, Vehicle-to-Grid powerful

- EVs act as **controllable loads**, to smooth demand peaks
- EVs can act as **distributed storage**, providing energy back to the Grid
- EV drivers earn **rewards** in exchange for grid services
Vehicle Grid Integration – How?

Smart Charging is crucial

Vehicle to Grid is powerful
Smart infrastructure – public or semi-public

**Urban without private parking**
- Public charging and parking
- Semi-public charging (supermarkets, hotels, etc.)
- Multi-unit dwellings (rented)

**Rural areas without private parking**
- Public charging and parking

**Highways**
- Main highways (core TEN-T network)
- Medium-size city connections (comprehensive TEN-T network)
- Logistics/depot charging
Vehicle to Grid

There are 50 V2G projects globally, of which 25 are in Europe, 18 in North America, and 7 in Asia. Asian participation has been more focused on vehicle-to-home and vehicle-to-building (V2H/B) services and contributing as a manufacturing partner than deployment.

Innovate UK

IEA INTERNATIONAL ENERGY AGENCY

IREC

Shaping Energy for a Sustainable Future
Vehicle Grid Integration – Stakeholders and actors

**ENERGY**
- Distribution System Operator (DSO)
- Energy Suppliers
- Transmission System Operator (TSO)
- Aggregators
- Fleet Customers
- Metering providers

**AUTOMOTIVE**
- Charge point operators
- Charge point manufacturers
- Parking operators
- Vehicle manufacturers
- Infrastructure owners and operators

**USERS**
- Domestic Customers
- Domestic Customers
- Domestic Customers
Vehicle Grid Integration

- Hardware and software
- Standards, regulation
- Business models
- Users

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Vehicle Grid Integration

 ✓ Power electronic requirements
 ✓ Protocols and communications requirements
 ✓ Data management

Hardware and software

Business models

Standards, regulation

Users

[Images and logos from IEA and IREC]
Vehicle Grid Integration

- Hardware and software
- Standards, regulation
- Business models
- Users

- Interconnection standards
- Different international electricity market regulations
- Metering regulation
- Lack of definition as DER
- Limited coordination between stakeholders
Vehicle Grid Integration

- Chicken and egg situation
- Regulation not enabling market access
- Lack of coordination between stakeholders
- Unclear roles in the business model
Vehicle Grid Integration

- TCO should be clearly decreased
- Guarantees (EV, battery, full charge, …)
- Stakeholders identification and clarity on costs and revenues

Hardware and software

Standards, regulation

Business models

Users

TCO should be clearly decreased
Guarantees (EV, battery, full charge, …)
Stakeholders identification and clarity on costs and revenues
### Vehicle Grid Integration – policy recommendations

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Policy recommendations</th>
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<tbody>
<tr>
<td>EV as DER</td>
<td>Enable the aggregation of EVs and the participation in energy markets and flexibility services.</td>
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<tr>
<td>Building pre-equipment</td>
<td>New or renovated buildings should be prepared, all parking slots cabled. Local authorities or should support the cabling for residential and office buildings in all parking slots.</td>
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<td>Smart charge pricing</td>
<td>Smart tariff design means pricing both energy and network services to serve EV customers. Adopt and apply dedicated tariff structures for EV charging and require time-varying tariffs.</td>
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<tr>
<td>Smart charging technology</td>
<td>Deployment of smart infrastructure, setting criteria to fund charging infrastructure deployment based on minimum smart management requirements.</td>
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Thank you very much for your attention

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