



UK V2X Energy progress



EV Workshop - V2X: Electric Vehicle Charging,
Communication and Infrastructure

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Innovate UK

We are the UK's innovation agency

A key delivery body of the UK Government's Innovation Strategy

We support business-led innovation in all sectors, technologies and UK regions

Our Mission

To help UK businesses grow through the development and commercialisation of new products, processes, and services, supported by an outstanding innovation ecosystem that is agile, inclusive, and easy to navigate

EVs and Energy Flexibility

- UK Government ambition for GB electricity grid to be zero carbon by 2035
- EVs provide significant energy flexibility potential to support
 - ✓ shift energy consumption to balance supply & demand
 - ✓ store renewable energy locally
 - ✓ export energy back to a system - grid, home, building, vehicle
- **Smart charging** – demand-side response (DSR), shifting EV charging to off-peak periods or periods of abundant renewables
- **Electric Vehicles (Smart Charge Points) Regulations 2021**
 - ✓ all EVCPs sold in GB for private domestic or workplace use from June 2022 must have smart functionality (respond to signals)
- **Vehicle-to-X technology (V2X)** – bidirectional smart charging, providing flexibility through enabling export of energy from an EV battery

Smart charging benefits overview



Reduce network and generation costs, lowering prices for all consumers



Maximise use of variable renewables



Reduce cost of charging for EV drivers (ca. £500 saving for average driver by smart charging)

Smart charging rollout will develop into realising V2X ambitions for UK Government

- Smart charging becoming commonplace across domestic settings. Public chargepoint operators increasingly offering dynamic tariffs with peak/off-peak cost structures
- V2X supplements unidirectional smart charging. Barriers to V2X need to be reduced / removed

Current state of play: V2X in the UK

Vehicle-to-X bidirectional smart charging is still a nascent technology. It requires more vehicles compatible with the technology, and a clearer economic case for businesses wanting to serve the market and for consumers who will use the products. The connection process for V2X charge points is more difficult than for unidirectional smart charge points.

The ambition

Mid 2020s: Barriers to participation in V2X are reduced through greater access to compatible vehicles and chargepoints (both choice and cost) and market reform. Viable business models proliferate. V2X services used by commercial entities.

Late 2020s/2030s: Smart charging is the norm. Business model offerings promote behind-the-meter and V2G services for domestic users.



UK Government action seeking to reduce barriers to V2X roll-out

[icons from FlatIcon.com]



Grid	Aggregator	Chargepoint	Vehicle	Consumer
Overcoming network and market barriers		Bringing down cost difference V1G → V2G	Research on V2X battery health impact	Ensuring consumer protection and interoperability
Electricity system design and level playing field for flexibility technologies			Limited choice V2X-capable EVs	Provision of trusted information
		Bi-directional charging standards		Establishing behaviours
		Innovations in V2X technologies, use cases, and business models reducing barriers and leading to mass rollout		

Initiatives include:

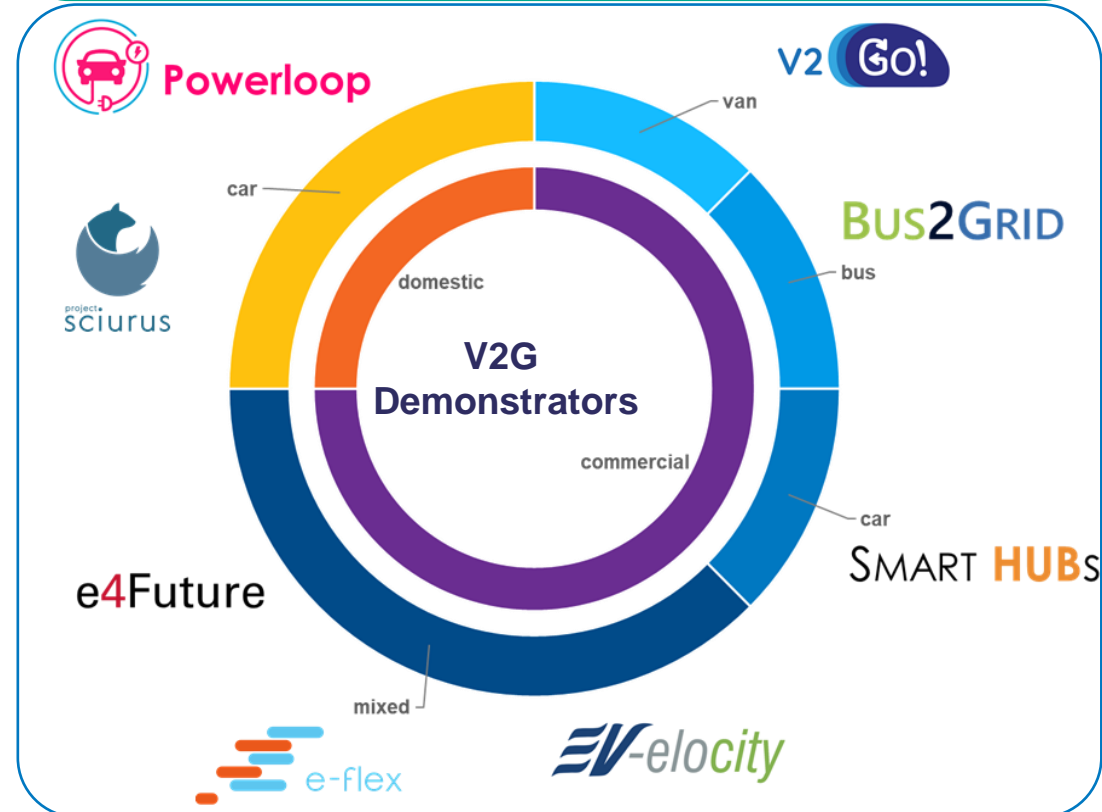
- V2G Programme (2018-2022)
- EV Smart Charging Regulations (2021)
- EV Smart Charging Action Plan (Jan 23)
- Call for Evidence: Gov't response (Jan 23)
- V2X programme (Sep 22-March 25)
- Secure Smart Electricity Systems programme

The UK V2G Programme 2018 - 2022

- A **£46M** programme with £30M funding from government
- **100** partners: EV OEMs, energy suppliers & aggregators, DNOs, charging providers, Local Authorities, fleets & academia
- **650** bi-directional chargers in UK homes & workplaces
- Cars, vans & buses now supplying energy back to the grid
 - ✓ Proven technical feasibility
 - ✓ Developed commercial V2G propositions
 - ✓ Launched new V2G products & services
 - ✓ Achieved consumer energy savings
 - ✓ Advanced education & engagement

■ **8 Feasibility Studies:** innovative business models and applications for V2G

■ **4 R&D Projects:** onboard charger development, V2G on-streets, gamification for V2G



V2G Programme Results*

- Data analysed from 508 CHAdeMO DC V2G chargers, 500 domestic & commercial fleet EVs
- EVs can act as a substantial energy store – 62% of energy supplied was returned to grid through V2G
- Spare capacity still available – domestic charging & discharging only 37% of time plugged-in, much wider range with fleet users
- Commercial propositions do change behaviour – both plug-in availability & charging/discharging behaviour
- Limited battery SoH data – small loss over 1 year (not significant)
- No negative impact on range - EVs driven away with average 74% SoC
- Costs are still a constraint, making the business case uncertain
- Majority of trialists want V2G on their next EV - need more V2G enabled EVs



* Caveat – Covid-19 period



Sciurus – domestic customers



EV-elocity – council & commercial fleets



Powerloop – domestic customers

Using V2G in homes



Powerloop

The first EV programme to enter National Grid's Balancing Mechanism

"... 1 million EVs could realise a profit of around £62million per annum"

" Individually, EV drivers could save up to £840 per year"

"... reduced balancing costs would help lower bills for everyone"

octopus energy



energy saving trust



open energi



Department for Energy Security & Net Zero



Office for Zero Emission Vehicles

Project Sciurus: Achievements from the world's largest V2G trial



KALUZA
AN IFC COMPANY



project
sciurus

£420

Average customer saving per year

50%

Proportion of fleet exporting during Supply Margin Notice event, 6th Jan 2021

900 MWh

Total energy exported to the grid

3 million

Free miles driven by V2G customers

V2G findings

User findings

- Most trialists satisfied & want V2X functionality
- Need further reassurance re battery degradation
- Clear financial rewards are necessary
- Ease of use, trust & data security are key
- Need control override facility
- Smart charging experience is an enabler

Electricity system

- Long, complex & costly grid connection process
- Multiple renewable assets & supply constraints add complexity & cost
- Minimum grid participation levels are prohibitive
- Dynamic tariffs could optimize for cost & carbon
- Rewards & competition required within flex market

Vehicle findings

- Significant EV data capture challenges
- Need standardised data access & reporting – functionality & consumer reassurance
- Need more V2X enabled EVs – choice
- Need all charging protocols to facilitate V2X

Economic viability

- V2G feasible for some domestic & fleet uses
- Cost constraints make current business model uncertain
- Cost reduction required = smart charging

UK's V2X Innovation Programme (2022 – 2025)

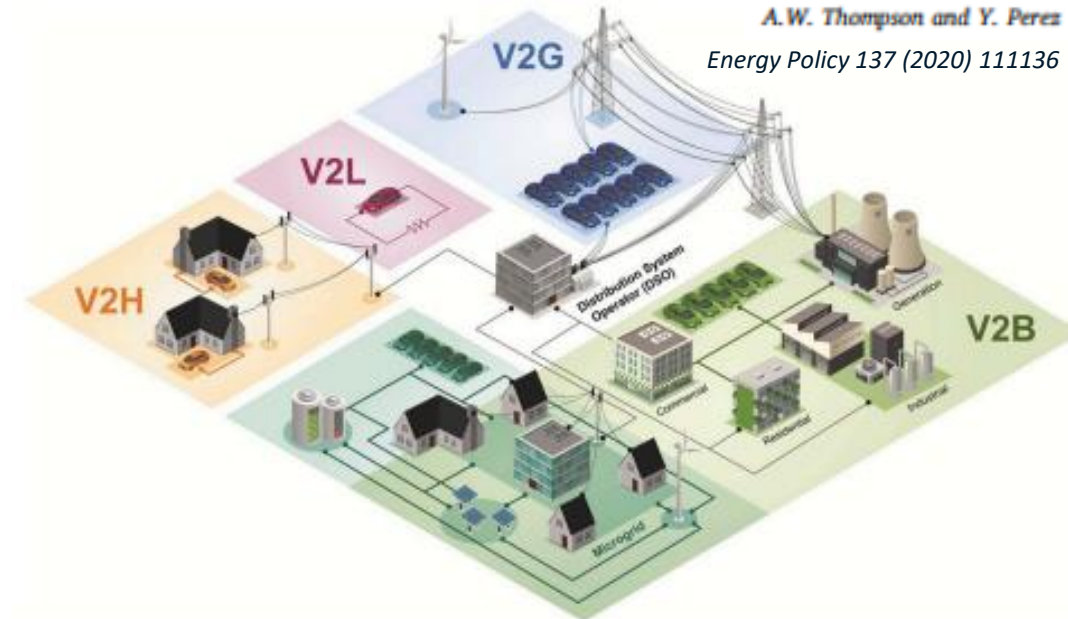
<https://www.gov.uk/government/publications/v2x-innovation-programme>

Programme Funding: Up to £ 12.6 million

Programme Timing: September 2022 – March 2025

Phase 1: 17 research & development projects
Awarded £3.2 million funding
September 2022 - August 2023

Phase 2: Up to £ 9.4 million funding
Minimum 6-month demonstrations with real-world drivers in a real-world setting
Of innovative V2X customer propositions for domestic & commercial use-cases
Using DC CCS, DC CHAdeMO and AC V2X protocols
Beginning October 2023



17 V2X Innovation Phase 1 R&D projects

- Designing and developing to prototype stage new V2X components, sub-systems, hardware and software products & services, including business models
- which can reduce entry barriers for domestic or non-domestic use of V2X bi-directional chargers to provide energy flexibility services

Range of charging protocols:

- AC
- DC CCS
- DC CHAdeMO
- Megawatt

Range of challenges:

- Cost reduction
- New technologies
- New use cases
- Improving the customer experience
- Energy barrier solutions

Range of use cases:

- V2H
- V2V
- V2B
- V2G
- Heavy freight
- Public spaces (on-street and destination car parks)

Communication requirements for V2X energy

V2X Call for Evidence (2021)

[Role of Vehicle-to-X energy technologies in a net zero energy system: summary of responses to call for evidence \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/95444/role-of-vehicle-to-x-energy-technologies-in-a-net-zero-energy-system-summary-of-responses-to-call-for-evidence.pdf)

Alongside electricity system and consumer barriers, communications were identified as playing a pivotal role in enabling V2X energy

What is needed to facilitate the rollout of V2X energy flexibility?

- Standards for communications between EVSE & flexibility service providers
- Certification of V2X charging standards
- Interoperability across smart ecosystem – between all Energy Smart Appliances
- Cyber security standards protecting infrastructure and consumers
- Consistent data access between EV & EVSE models to encourage and facilitate smart charging and V2X



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Department for
Energy Security
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Thank you

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