Rural Energy Resilience

V2X Innovation programme: bi-directional charging demonstrations

Cybermoor Services Ltd 2026

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Summary

The Rural Energy Resilience project was funded as part of the V2X Innovation programme: bi-directional charging demonstrations, which was part of the Net Zero Innovation Portfolio. The programme was run by Innovate UK on behalf of the Department for Energy Security and Net Zero. The funded project demonstrations concluded in September 2025.

Project Overview

The Rural Energy Resilience (RER) programme set out to show how vehicle-to-everything (V2X) can strengthen energy security and mobility in rural places by linking car clubs, community buildings, local renewables and smart chargepoints. Running from 1 April 2024 to 30 September 2025, the programme combined technical development with field trials and community engagement across the North of England. RER's central question—whether community-scale V2X can increase energy flexibility for distribution network operators (DNOs) and hosts in real-world conditions—guided its monitoring and evaluation approach. Our evidence base is anchored in real-world trials with local drivers and their vehicles, supported by interviews with DNOs, analysis of historic charging data and a power-cut questionnaire.

The RER programme aimed to answer these Research Questions.

- Value: What financial and non-financial value can 16 rural V2X chargepoints create for buildings, car clubs, DNOs, chargepoint operators, Local Authorities and citizens across multiple use cases?
- Dependencies & requirements: What are the key dependencies (e.g., availability of EV battery storage) and how do these maximise value?
- DNO flexibility: To what extent did the project increase energy flexibility for DNOs—can it meet real-world demand?
- Costs: What additional costs (capex/installation timeline) arise compared with standard electric vehicle chargepoints (EVCP)?
- Cyber resilience: What are the unique cyber-resilience and mitigation challenges for EV charging in remote energy systems (limited connectivity/oversight)?

Sites and Methods

Fifteen AC and DC chargepoints were installed or operated through the programme, creating a meaningful testbed for varied use cases. Sites ranged from village halls and a gym to a faith venue and a community transport depot, with local volunteers and EV drivers participating in charge and discharge sessions. The breadth of settings proved important: each location brought distinct electrical constraints, connectivity conditions and user needs, allowing the team to interrogate both technology performance and human factors.



Filming with IUK at Keswick ECO Car Club, Cumbria.

Technology Achievements

On the technology side, Hangar19 developed and refined the UK's first AC V2X charger intended for non-domestic, community applications, with a multi-socket design enabling vehicle-to-grid (V2G), vehicle-to-building (V2B) and vehicle-to-vehicle (V2V) transfers. The unit was engineered for reliable operation and straightforward use, with direct OCPP (Open Charge Point Protocol) control for stability and an OCPI (Open Charge Point Interface) link into Fuuse for user-facing operations. During delivery it became clear that, while ISO 15118-20 exists, vehicle support remains uneven; the team implemented workarounds to infer key metrics for AC bidirectional operation until standard maturity improves. To align use cases with the car club's existing Nissan Leaf fleet, we deployed CHAdeMO-based Nichicon DC units and integrated them via an Echonet-Lite bridge so they could be managed and reported alongside the AC platform. The OCPI integration highlighted inconsistencies in how EVSEs (Electric Vehicle Supply Equipment) and sockets are modelled across systems; resolving these improved the user app and data consistency and will streamline future roll-outs.

Findings — Success in Practice

The trials showed that, when the dependencies are in place, V2X works for rural resilience. Participants reported high satisfaction where systems were stable and guidance clear, and hosts saw credible potential for lower energy costs, community benefits and backup power during outages. Training was a particularly strong lever: once briefed, 26 local volunteers could operate charge and discharge sequences confidently and interpret basic performance data, building local ownership. Alongside these positives, the programme surfaced practical design improvements for rural contexts, including the need for tethered cables, clearer visual feedback and accessible interfaces, and attention to modest but meaningful issues such as display readability and colour coding.

Across all sites, more than 7,100 kWh of energy has been successfully delivered—an impressive milestone that reflects the growing utilisation and reliability of the EV infrastructure. This cumulative figure highlights not only the scale of charging activity but also the tangible impact of coordinated deployment across locations like Bampton Village Hall, Keswick House, and Eaglesfield. It’s a testament to the effectiveness of multi-site rollout and the increasing confidence of EV users in these systems.

Looking at discharge events—those moments when vehicles transition from active charging to “Return to charge mode”—we see 56 distinct instances, suggesting a healthy rhythm of energy exchange and vehicle readiness. The data also shows 66 Hyundai/Kia interactions and 8 MG events, indicating brand-specific usage patterns that could inform future charger compatibility and outreach. With Keswick House and Bampton Village Hall leading in activity volume, these hubs are clearly central to regional EV behaviour. This blend of high energy throughput and consistent discharge cycles points to a well-functioning, user-responsive network.

Constraints and risks

Not every dependency sits within the control of site hosts or technology providers. Connectivity drop-outs in some rural locations affected user experience, reinforcing the case for resilient communications and clear fall-backs. Installation pathways were more complex than for standard AC charging, with additional hardware, commissioning and assurance effort—though teams reported learning curves that reduced friction over time. Vehicle capability also varied: public, reliable information on V2L/V2X support is still thin, and compatibility guidance will help avoid failed or frustrating sessions as adoption widens.

DNO engagement and commercial traction

Engagement with DNOs was promising but uneven. Electricity North West and UK Power Networks engaged proactively around small-scale flexibility, while Northern Powergrid’s participation was more limited. Feedback has been provided and has resulted in development

of flexibility products better suited to community-scale assets. Importantly, the programme achieved commercial traction, winning two ENWL flexibility tenders (Alston and Yealand), which provides a route to revenue and live-dispatch evidence for rural V2X.

Outcomes and exploitation (what we delivered and what's next)

From an outcomes perspective, the programme delivered practical demonstrations, new integration capabilities and a bank of social and technical learning. AC V2X hardware and firmware matured through iterative testing; OCPP control and OCPI integration provided a workable operating model with Fuuse; and the testbed validated discharge routines and reporting that can underpin future services. The stakeholder workstream expanded visibility and demand—car clubs grew in interest beyond pilot areas, and partners built relationships with local authorities, funders and national bodies to explore replication pathways. The monitoring and evaluation work concludes that RER increased energy flexibility potential and laid groundwork for scaling, whilst acknowledging that a compressed trial window limited the number and duration of real-world events captured. In parallel, exploitation planning identified near-term market opportunities, including collaboration with funders such as the Northern Powergrid Foundation and exploration of a national expansion proposal to GB Energy, potentially taking V2X-enabled community infrastructure to dozens more locations.

Key lessons (recipe for scale)

The lessons are clear and mutually reinforcing: integration is paramount—retain stable, direct OCPP control with a robust OCPI layer and a shared EVSE/socket data model to avoid reporting and UX inconsistencies—and design for rural realities as standard, with tethered leads, unambiguous on-device cues, resilient communications and plain, inclusive instructions to improve first-time success and reduce support. People matter as much as equipment: concise briefings and hands-on demonstrations turn curiosity into confident use, while ongoing host support sustains performance. From WP2–WP5, we also learned that early, well-resourced engagement; stronger supplier relationships; more flexible approvals; realistic expectations for flexibility-provider integrations; and fewer manual workarounds are essential. Planning risks and site individuality require early checks on charger/feeder-pillar positions and honest conversations about feasibility—full island mode is often impractical without extensive rewiring.

Next steps (building on success)

A practical path to scale combines a hardened end-to-end OCPP/OCPI stack with a shared data model; rural-ready hardware and communications; structured training and ongoing support; early engagement with planners and DNOs; and a site-specific cost–benefit

assessment of islanding before committing design and spend the programme has shown that community-centred V2X is technically and socially viable today, delivering tangible resilience and social value when implemented as an integrated package of hardware, software and community practice. It leaves improved devices and integrations, trained local operators and a clearer route to scale with DNO and local-authority partners—ready for further deployment, informed by the insights gathered during the trial.

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