Potential Energy Group's (PEG) Rail Power – Horizon Europe Cluster 5 IA Concept

European rail and tram networks are under growing pressure to deliver more reliable, higher-capacity services while cutting costs and disruption. Assets are ageing and safety rules are restricting access to the track. Existing condition-based maintenance tools are often siloed and reactive raising generic alarms but struggle to identify what is failing, how fast it is degrading, or how asset condition links to wider network resilience. Rail Power is designed to close that gap.

What Rail Power does

Rail Power is an integrated hardware–software platform for rail infrastructure analytics and predictive maintenance. On the infrastructure side, rugged, low-power sensor nodes mounted on rails and structures capture information rich vibration signals and transmit them securely from live, safety-critical environments. In the cloud, an analytics platform hosts AI models, dashboards and APIs that connect to operator systems, traffic management and digital twins.

The key difference from many existing systems is that Rail Power focuses on predictive and explainable insight. By combining physics-informed models with machine learning, it is proven to identify specific failure mechanisms in infrastructure such as the onset of a squat. Potential Energy Group (PEG) already is deploying Rail Power prototypes on a live light-rail system, proving that the technology can operate on real infrastructure with real operational constraints.

Project aim and pilots

We propose a Horizon Europe Innovation Action that advances Rail Power from TRL 5–6 to TRL 6–7 and embeds it within a broader framework for multimodal passenger transport resilience under Cluster 5 (Transport).

The project will **demonstrate AI-enabled predictive maintenance and resilience services across multiple passenger transport modes, with measurable reductions in disruption, unscheduled maintenance and operating costs.**

From the outset, each pilot will be underpinned by a clear measurement framework. We will define baselines using historical maintenance records, fault logs, delay attribution data and existing diagnostic system performance. This allows the tracking of changes over the project period. For each use case, we will specify quantitative KPIs (for example, number and severity of infrastructure failures per million train-kilometres, delay minutes, false-positive and false-negative rates for anomaly detection, and maintenance interventions avoided or shifted from emergency to planned). This gives a transparent view of activities in each work package to measurable outputs and outcomes.

Measurement will also cover economic l aspects. We will translate operational improvements into indicative lifecycle cost savings and productivity gains for maintenance teams. This will be complemented by user-centred measures such as changes in average passenger delay on pilot corridors and time from disruption detection to communication of a coordinated response. Together, these metrics will support a robust impact narrative and align with a lump-sum funding model based on well-defined deliverables and milestones.

Across the pilots, we would expect indicative gains such as a 10–20% reduction in unscheduled maintenance events on the relevant assets, 15–20% fewer disruption minutes linked to infrastructure issues, and up to a 30% improvement in early anomaly detection compared with baseline tools. The purpose is to provide better sensing and use AI to deliver better insight. This leads to earlier, better-targeted interventions that reduce disruption and cost, improving passenger experience and resilience.

How we deliver

The project follows a typical Innovation Action approach. Industrialise the technology, demonstrate it at scale, and prepare for wider market uptake.

First, Rail Power's sensing and firmware will be refined for industrial-scale deployment across tram, metro and regional rail. This involves maturing the hardware, edge signal processing, power management and secure communications needed for long-term operation on live assets.

Second, an advanced AI and digital twin stack will be developed. Physics-informed neural networks will embed rail dynamics into the models, making them more explainable and transferable between networks. Representation learning will allow models to adapt across modes and asset types so that insight gained on one corridor can inform another. Generative AI will create synthetic data for rare failures and extreme scenarios. These models will feed corridor-level digital twins that combine Rail Power data with traffic management, weather and positioning information, allowing operators to simulate disruptions and test response strategies.

Third, the data architecture will be designed from the outset for interoperability, aligned with European Mobility Data Space principles. Relevant rail standards such as those emerging from Europe's Rail, EULYNX and CENELEC will be embedded. This ensures results are reusable across systems, countries and suppliers.

Finally, we will co-design interfaces, alerting logic and workflows with operators and infrastructure managers. The development of training and protocols so staff can safely and confidently use AI-supported tools. Real-world pilots and structured simulations at the selected sites will provide quantitative evidence against the agreed KPIs and underpin robust business cases and replication plans.

PEG and the consortium

Potential Energy Group combines innovation capability with practical access to live rail environments. Steve Dunn is a materials engineer and former Head of Materials in an SME that secured more than £1.8 million in funding, developed patented technology and took it to market. Gy Harness is a rail infrastructure engineer with direct experience helping SMEs deploy new IoT devices on operational railways and navigate access to organisations such as Network Rail. The ability to get new hardware and analytics safely onto operational rail assets is a major bottleneck for many AI and digital twin partners, our track record directly addresses this.

For the Innovation Action, PEG envisages working with infrastructure managers and train operators as pilot hosts. Key to the project are city and regional authorities, AI and digital-twin specialists in universities, standardisation and regulatory bodies to align with EU norms, and training and skills partners to turn project outputs into durable curricula and certification. Within such a consortium, PEG is well positioned to deliver significant input on pilot deployment, industrial validation and impact.

Fit with Horizon Europe

Rail Power aligns closely with Horizon Europe Cluster 5 and the expected 2026–27 priorities. It advances digitalisation and automation of rail operations, strengthens infrastructure resilience, capacity and ageing-asset pressures, and applies both generative and discriminative AI in a high-value, safety-critical domain. It is built for interoperability.

With clearly scoped pilots, quantified KPIs and a realistic TRL progression to 6–7, the concept is suited to a Cluster 5 Innovation Action under lump-sum funding. Rail Power offers consortia a distinctive combination deployable IoT hardware with ambitions to deliver an ambitious, standards-aligned AI platform. This makes PEG a strong partner for competitive Horizon Europe proposals in this space.