



Vibration energy harvesting system for rail

Background

Barrow Hill Ltd, Unipart Rail Ltd, and the University of Derby worked together to design and test a **vibration energy harvesting (VEH) system** – a device that **turns vibrations from moving trains into usable electricity**. The aim was to create a prototype capable of generating more than 120 mW of power at over 50% efficiency, providing a **new source of clean energy for rail applications**.



The challenge

Rail is one of the most **sustainable forms of transport**, but the industry needs to reduce its emissions to meet the UK's net zero goals. Trains produce large amounts of **vibration energy that is currently wasted**. Capturing this energy could:

- Power low-voltage devices such as lights, charging ports, and onboard electronics
- Reduce reliance on batteries or external power sources
- Suppress unwanted vibrations, improving passenger comfort and protecting train infrastructure

What's innovative about this project?

The project developed a **hybrid VEH system** to capture a wide range of vibration frequencies.

Unique feature: Uses a method called vibrational resonance to boost energy capture from low-frequency vibrations.

Dual benefit: Generates usable power and reduces vibrations.

Progress: Analytical and simulation studies produced promising results, followed by lab and field testing to measure efficiency and output.

Next steps

The partners are now refining the design based on test results, with Unipart Rail providing specifications to **optimise the system for commercial deployment**. Once complete, Unipart will lead the route to market.

Why this matters for the East Midlands

The project supports the East Midlands' position as a **hub for rail innovation and clean energy technology**. By turning wasted vibration into power, the system could **improve passenger comfort, extend train life**, and help the UK rail sector meet its **net zero targets** — creating **opportunities for local manufacturing and the supply chain**.

Key achievements

- Designed and built a **prototype VEH device**
- Conducted **lab-based and field tests** to validate performance
- Identified **design improvements** for higher efficiency
- Developed a **roadmap for commercialisation** with industry partner Unipart Rail

"It was reassuring to see how the **combined strengths of an industry and university partnership** can demonstrate the ambitious harvesting vibration energy innovation as a working pilot solution for rail applications."
Barrow Hill Ltd

"The partnership has **fostered a dynamic environment** where ideas are exchanged, challenges are addressed collaboratively, and innovative solutions are generated."
Unipart Rail Ltd