# Satellite and AI innovation aims to accelerate and cut costs in UK rail electrification



A promising new innovation combining satellite imagery and artificial intelligence (AI) promises to transform the planning and cost efficiency of rail electrification projects in the UK. Developed by rail electrification specialist Furrer+Frey, the Electrification Benefits Optimisation Tool (Ebot) uses AI to analyse railway line data and generate thousands of possible electrification design options, each evaluated for cost and carbon emissions. Backed by funding from the UK Space Agency (UKSA) and in partnership with Airbus Defence and Space, the tool is set to integrate earth observation satellite data to further enhance its capabilities.

Noel Dolphin, Furrer+Frey’s head of UK projects, explained to New Civil Engineer that the goal is to dramatically accelerate project planning while reducing costs, making rail electrification a more attractive investment. The UK currently lags behind other European nations in rail electrification, a sector historically marked by boom-and-bust cycles influenced by political will. Recent halts in key projects such as the Midland Main Line electrification underscore a decline in political prioritisation, largely due to perceived high upfront costs and slow returns, a view echoed by former Network Rail CEO Andrew Haines and rail minister Lord Hendy.

Ebot has been under development for several years. It can devise electrification schemes by modelling every combination of variables including systems type, structural spacing, electrical tension, and around 50 other factors, using real construction cost data from Network Rail. The tool can run thousands of design permutations rapidly, ranking these options by cost and embodied carbon to help decision-makers identify the most efficient solution. In one case, Network Rail tasked Furrer+Frey with benchmarking an existing electrified line using Ebot. Findings indicated the line was not optimally designed, revealing opportunities for significant cost savings by tweaking design rules—such as reducing foundation numbers, which yields savings in materials and allows projects to finish sooner.

Traditionally, Ebot has required extensive manual input of data sourced from record drawings, surveys, or Lidar, a time-consuming process taking weeks. Integrating satellite imagery from Airbus will automate data collection, rapidly identifying key route features like level crossings, underbridges, and weak embankments. Satellite technology also offers dynamic insights; multispectral imaging can highlight vegetation growth—critical as trees must not encroach on live wires—and repeated overflights enable monitoring of embankment stability, identifying potential problem areas requiring special foundation designs. This geospatial intelligence allows designs to be visualised directly over actual railway landscapes, improving accuracy and planning responsiveness.

The project, supported by UKSA funding as part of their Unlocking Space for Business programme, aims to complete the satellite-AI integration by March 2026, with trials on selected unelectrified routes underway. Ebot’s developers are confident of success, investing substantially alongside grant funding. While there are natural concerns about AI replacing traditional engineering roles, Dolphin emphasises the technology is designed to free engineers from repetitive tasks, enabling them to concentrate on complex, high-value design challenges like intricate junctions or heritage site adaptations. The project is also creating new roles around AI-supported design and decision-making.

This innovation forms part of a broader push to modernise and decarbonise rail infrastructure. In parallel, Furrer+Frey has introduced a lightweight composite electrification cantilever, weighing just 40% of traditional steel versions, potentially reducing manufacturing and installation costs, and improving sustainability. This development, demonstrated at the Global Centre of Rail Excellence in South Wales, complements AI-driven design efforts to make electrification projects more financially viable. The company has also benefited from UK government support, including a £1 million funding allocation aimed at cutting electrification costs and emissions.

More widely, satellite technology is gaining traction across transport infrastructure sectors. UK Power Networks and Boston Consulting Group’s Project Satelline uses satellite imagery and AI to optimise vegetation management around overhead power lines, enhancing clearance accuracy and potentially reducing outages by over 25%. Airbus Defence and Space has also provided land use and change data to Network Rail through Project LUCI, enabling better risk management including flood prevention strategies near rail corridors. These initiatives are part of a £1.5 million UK Space Agency investment in six projects using satellite and AI technologies to combat climate change and revolutionise transport networks under their Unlocking Space for Business programme.

Ultimately, Furrer+Frey’s Ebot tool, augmented by satellite data, aims to fundamentally reduce both the time and cost of rail electrification scheme development, particularly in the design phase. According to Dolphin, accelerating the optioneering and outline design process by even a year could yield substantial savings by limiting prolonged project team efforts. Faster, more cost-effective electrification is seen as central to expanding the UK’s electrified rail network, reducing carbon emissions, and supporting the nation’s net-zero goals, while stimulating greater industry investment and job creation.

### 📌 Reference Map:

* Paragraph 1 – [[1]](https://www.newcivilengineer.com/latest/satellite-imagery-and-ai-to-be-used-to-optimise-and-lower-cost-of-rail-electrification-03-10-2025/), [[4]](https://www.gov.uk/government/news/space-projects-unlock-climate-and-transport-innovations), [[5]](https://business.esa.int/news/airbus-project-helps-uks-network-rail-build-maintain-safer-smarter-railways)
* Paragraph 2 – [[1]](https://www.newcivilengineer.com/latest/satellite-imagery-and-ai-to-be-used-to-optimise-and-lower-cost-of-rail-electrification-03-10-2025/), [[6]](https://www.railtech.com/innovation/2024/02/21/1-million-euro-funding-boosts-for-rail-electrification-innovation-efforts/)
* Paragraph 3 – [[1]](https://www.newcivilengineer.com/latest/satellite-imagery-and-ai-to-be-used-to-optimise-and-lower-cost-of-rail-electrification-03-10-2025/)
* Paragraph 4 – [[1]](https://www.newcivilengineer.com/latest/satellite-imagery-and-ai-to-be-used-to-optimise-and-lower-cost-of-rail-electrification-03-10-2025/), [[5]](https://business.esa.int/news/airbus-project-helps-uks-network-rail-build-maintain-safer-smarter-railways)
* Paragraph 5 – [[1]](https://www.newcivilengineer.com/latest/satellite-imagery-and-ai-to-be-used-to-optimise-and-lower-cost-of-rail-electrification-03-10-2025/), [[4]](https://www.gov.uk/government/news/space-projects-unlock-climate-and-transport-innovations)
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* Paragraph 7 – [[1]](https://www.newcivilengineer.com/latest/satellite-imagery-and-ai-to-be-used-to-optimise-and-lower-cost-of-rail-electrification-03-10-2025/), [[2]](https://www.railbusinessdaily.com/furrerfrey-demonstrates-cost-cutting-composite-electrification-equipment/), [[6]](https://www.railtech.com/innovation/2024/02/21/1-million-euro-funding-boosts-for-rail-electrification-innovation-efforts/)
* Paragraph 8 – [[3]](https://innovation.ukpowernetworks.co.uk/projects/satelline), [[5]](https://business.esa.int/news/airbus-project-helps-uks-network-rail-build-maintain-safer-smarter-railways), [[7]](https://www.openaccessgovernment.org/satellite-technology-and-ai-driven-uk-innovation-in-climate-and-transport/198512/)
* Paragraph 9 – [[1]](https://www.newcivilengineer.com/latest/satellite-imagery-and-ai-to-be-used-to-optimise-and-lower-cost-of-rail-electrification-03-10-2025/), [[6]](https://www.railtech.com/innovation/2024/02/21/1-million-euro-funding-boosts-for-rail-electrification-innovation-efforts/)

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## Bibliography

1. <https://www.newcivilengineer.com/latest/satellite-imagery-and-ai-to-be-used-to-optimise-and-lower-cost-of-rail-electrification-03-10-2025/> - Please view link - unable to able to access data
2. <https://www.railbusinessdaily.com/furrerfrey-demonstrates-cost-cutting-composite-electrification-equipment/> - Furrer+Frey has unveiled a composite electrification cantilever designed to significantly reduce railway electrification costs. Weighing just 40% of a traditional steel counterpart, this innovation aims to make manufacturing, installation, and renewal processes more cost-effective and efficient. The 'Innovative Cantilever for Greener Electrification (ICAGE)' was demonstrated at the Global Centre of Rail Excellence in South Wales, showcasing its potential to enhance rail electrification investments. The project received support from Innovate UK and is seeking partners for further development and mainline testing.
3. <https://innovation.ukpowernetworks.co.uk/projects/satelline> - UK Power Networks, in partnership with Boston Consulting Group, has initiated Project Satelline to revolutionise vegetation management using satellite imagery and AI. This approach aims to optimise trimming plans by measuring clearances between conductors and vegetation, enhancing accuracy and efficiency. The pilot, covering 400km of overhead lines in Rotherfield and Polegate, demonstrated a 95% accuracy rate in clearance measurements, potentially reducing vegetation-related outages by over 25% and optimising trimming expenditures.
4. <https://www.gov.uk/government/news/space-projects-unlock-climate-and-transport-innovations> - The UK Space Agency has allocated £1.5 million to six innovative projects leveraging satellite technology and AI to address climate change and transform transport networks. These initiatives aim to deliver practical, scalable solutions to real-world challenges, supporting the Government’s Industrial Strategy by driving innovation in priority sectors, accelerating growth, and developing technological leadership. The funding is part of the Unlocking Space for Business programme, which seeks to integrate space-enabled solutions into various industries.
5. <https://business.esa.int/news/airbus-project-helps-uks-network-rail-build-maintain-safer-smarter-railways> - Airbus Defence and Space has conducted a pilot project for Network Rail, delivering land use and land use change data across the UK rail network. Project LUCI (Land Use Change Identification) provides baseline land use reports tailored to Network Rail’s specifications, updated every six months. This data enables Network Rail to monitor and manage land adjacent to railway infrastructure more effectively, identifying potential risks such as flooding due to land development, thereby enhancing safety and sustainability.
6. <https://www.railtech.com/innovation/2024/02/21/1-million-euro-funding-boosts-for-rail-electrification-innovation-efforts/> - The UK government has allocated £1 million (approximately €1.68 million) to Furrer+Frey GB to spearhead innovation projects aimed at reducing rail electrification costs and curbing carbon emissions. This funding is part of initiatives under the Global Centre of Rail Excellence in South Wales, supporting the development of cost-effective and sustainable electrification solutions in the rail industry.
7. <https://www.openaccessgovernment.org/satellite-technology-and-ai-driven-uk-innovation-in-climate-and-transport/198512/> - Six new projects have received £1.5 million in funding from the UK Space Agency to use satellite technology and artificial intelligence (AI) for tackling climate change, transforming transport, and improving accessibility across the UK. The funding is part of the Unlocking Space for Business programme, which aims to bring space-enabled solutions to sectors that have traditionally not used space technology. These projects are expected to drive sustainable development and accelerate the path to net zero, while also creating new economic opportunities in the UK’s growing space sector.