

A man with a beard and balding head, wearing a dark grey suit, a light blue shirt, and a red and blue striped tie. He has his arms crossed and is wearing a watch on his left wrist. He is standing in front of a blue and orange train car. The background shows a white metal structure, possibly a train door or window.

Europe's ageing diesel shunters:

ticking time-bomb or chance of lifetime?

✉ Nexrail CEO Luuk von Meijefeldt.



The continent's ageing fleet of centre-cab locomotives is heading for retirement. That's not a crisis: it's the opportunity of a generation, argues CEO of Nexrail Luuk von Meijenfeldt.



Walk into almost any rail freight shunting yard across Europe and you will spot them: rusty, noisy centre-cab diesel locomotives, many built in the 1960s and 1970s, still hauling wagons, still shunting trains, still burning diesel by the thousands of litres while disturbing lineside neighbours with their noise and vibration and polluting the air with NOx and particulates.

They are European rail's dirty little secret, because the truth is that every freight train needs them. But their time is running out, and how the industry responds to their obsolescence will define whether European rail freight becomes the clean, efficient, zero-emission transport backbone the continent says it wants.

An ageing fleet meets the inevitable ETCS wall

The numbers are stark. Across Europe, close to 10,000 diesel shunting locomotives are approaching – or have already passed – the end of their economically viable service lives. These machines were designed for a different era: before emissions standards tightened, before digitalisation reshaped operations, and certainly before the European Train Control System (ETCS) began its advance across an expanding share of the network.

That advance is accelerating. Belgium recently completed its nationwide ETCS rollout and will switch off its legacy Class B system at the end of 2027. Even Germany has started converting lines as part of its large-scale infrastructure

catch-up programme. For locomotives in use for 30 years or more, fitting a fully digital ETCS system is either technically impossible or economically absurd. Why pour hundreds of thousands of euros into a platform that is already past its prime?

The conclusion is inescapable: the majority of the shunting fleet must be replaced. The question is: replaced by what?

Underinvestment: a blessing in disguise?

Here is the uncomfortable truth, which may yet prove a blessing in disguise. For years (decades, really), the European rail industry has underinvested in diesel locomotive innovation. The orders that were placed were essentially variations on the same proven platforms. Yes, the sector has moved from diesel-hydraulic to diesel-electric; yes, engines are now Stage V compliant. But none of that has fundamentally changed or improved the underlying performance proposition. The result is an ever-rising average age for the shunting fleet – comfortably above 40 years Europe-wide.

The reasons are partly understandable. The rail freight industry is too small to attract the scale of future-technology investment that the automotive sector commands. The legacy fleet did the job. Low growth rates were never enough to spur large capital commitments. Meanwhile, the liberalisation of the European rail market has, if anything, made things harder.

The changing role of state incumbents

In the past, state incumbent railways such as DB Cargo and Fret SNCF led the way, working alongside leading OEMs to set the standards of the future. Their purchasing power and joint engineering prowess made them natural partners for innovation. Since privatisation, however, the incumbents have lost market share and accumulated financial losses: conditions that make forward thinking difficult. The new private railways often lack the scale, financial strength and

technical depth to take over that role. Manufacturers, in turn, built what their customers ordered – and their customers ordered what they already knew, in very small quantities. The result was a kind of innovation paralysis: very little incentive to change, and a remarkably empty manufacturer landscape.

The battery breakthrough

For European freight locomotives, one of the most exciting frontiers is battery technology. And the good news is that the technology needed to transform European rail already exists.

Battery-electric solutions for passenger trains and locomotives have matured rapidly over the past few years, benefiting from the same revolution in energy storage that has reshaped the automotive and energy sectors. Energy density is up. Costs are coming down. Cycle life is improving.

Battery-pantograph passenger trains, in particular, have begun to compile strong operational track records across Europe. All major OEMs have models on offer and real-world maintenance experience with battery-powered operation. Given the energy-efficiency benefits, it is not unthinkable that every new-build passenger train will carry batteries in the near future. That positive experience is encouraging news for freight locomotives, where the battery breakthrough is yet to happen.

New operational possibilities

The battery tide for locomotives is turning quickly. Consider how a typical freight train operates in Europe. It runs under catenary for the vast majority of its journey: perhaps 80 or 90% of



the route is electrified. But at origin and destination – in ports, terminals, industrial sidings and shunting yards – the wires stop. Today, that means either swapping to a diesel shunter or using a dual-mode locomotive with a diesel engine for the last few kilometres. A battery locomotive changes that equation entirely. There are two distinct options: a full-battery shunting locomotive and a battery-pantograph hybrid mainline locomotive.

A battery-pantograph hybrid charges from the overhead line during the electrified portion of the journey and draws on stored energy to cover the non-electrified segments. It offers the flexibility to take non-electrified detours with no diesel, no CO₂ emissions, no engine

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✘ An old V100 diesel-hydraulic locomotive in use with Deutsche Bahn.

maintenance, no local pollutants and no noise complaints from neighbours. The upcoming introductions of the Vossloh Modula (ordered by Northrail and Railpool), the Stadler EURO9000 Battery (ordered by Nexrail) and the Siemens Dual Mode Battery (ordered by Akiem) will kick-start this trend.

The other option, full-battery shunting locomotives, charge much like an electric car at home. With today's technology, a single charge is enough for virtually any user profile. Topping up can be done at remarkable speed – a coffee-break charge adds enough energy for an entire shift. This type will, in time, completely replace dedicated diesel shunters.

Much like electric cars, battery locomotives deliver superior power-to-wheel conversion and tractive effort. On top of that, short preventive-maintenance windows (a one-day annual inspection and a three-week heavy overhaul) and higher reliability combine with savings on diesel to deliver a compelling total cost of ownership. The first homologated locomotive of this kind is yet to be ordered, but several parties are watching the space closely.

Diesel is not dead – yet

Batteries are no panacea. Use cases that combine high speed and long distance still demand more energy than today's batteries can store. For regional feeder traffic and railway construction trains, the diesel-battery hybrid remains the most practical stepping stone toward zero emission operations as exemplified by the Vossloh DE18 Smart Hybrid (purchased by Nexrail). This segment of heavy shunters will be the last to see diesel replaced by batteries, but even if it is decades off, that day, too, will come. The locomotive examples above reveal a clear trend: locomotive leasing companies are increasingly leading the innovation charge. There are sound reasons for that. As the market has liberalised and state railways have retreated, leasing companies now account for more than half of all new-build orders. They are eager to grow; ordering new-build locomotives is their primary growth lever. And they have the capital to act, backed by large private-equity funds and institutional investors such as insurance companies.

But they cannot change the industry alone. The future of locomotive innovati-

on will be driven by consortia of lessors, manufacturers and operators. In the past, state railways were both end-user and capital provider. Today, lessors are the linchpin between end-users (operators) and designers (manufacturers). This is a critical role. Not only do they provide highly competitive access to equity and debt financing; they are also uniquely positioned to select widely applicable and adoptable standards.

A call to the industry

Fleet renewal is a continental challenge. Thousands of locomotives need to be replaced over the coming decades, across every single European country. For the consortia of change to be effective, every participant in the rail market must adjust.

- Operators are arguably the most crucial players. They must move beyond the daily imperative of keeping their trains running and adopt a long-term partnership approach to future locomotive leasing. Their willingness to adopt is what unlocks projects.
- Lessors hold a pivotal position as providers of capital and the bridge

between users and builders. Traditionally, they have taken a conservative approach to locomotive innovation. The successful launches of ELP and Nexrail demonstrate that such hesitation was overcautious.

- Manufacturers must recognise that the commitments lessors make require long-term partnership, support and loyalty. Only then can lessors reap the rewards of their risk-taking.
- Financiers must recognise that diesel remains a necessary part of railway operations for years to come. Blanket "no diesel" policies amount to greenwashing and are short-sighted. At the same time, they should critically review investments in ageing diesels where modern, greener alternatives are already available.

- Infrastructure managers need to ensure that their grids and grid rules fully embrace the opportunities presented by on-board battery storage. Operators should be able to save on their electricity bills when providing grid stabilisation. Give low-emission locomotives a lower track-access fee than old diesels, like in the Port of Hamburg.
- Policymakers need to create frameworks – financial incentives, emissions standards, access rules – that reward early-moving leasing companies. Change tendering restriction to allow for early lease commitments. Revise old-thinking subsidy structures with leasing company orders in mind.

If all parties do their part, the pace of

locomotive innovation in Europe will become the envy of the world.

The window is now

The advanced age of the European shunting locomotive fleet is, paradoxically, a gift. Pushed by the introduction of ETCS across the networks, an era of innovation is upon us: the era of zero-emission operations, enabled by batteries.

European rail freight has all the right ingredients to become a leading sector of sustainable innovation. The fundamental technology has already been developed in adjacent industries. The necessary engineering prowess exists within manufacturers and suppliers. And investors have capital eager to drive sustainable change.

But the world has changed. To bring innovations to market, manufacturers, operators and lessors must cooperate closely. Infrastructure managers, governments and financiers must play their part. That requires a shift in mentality, yet several successful introductions of innovative locomotives have already shown it is possible.

The replacement window is now. Let's make it count. •

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✘ The EURO9000 panto-battery hybrid locomotive.