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An EU-funded project has demonstrated that it is economically and technically challenging for rail operators to replace or retrofit older diesel locomotives to meet tighter emission limits on pollutants. Market incentives should be provided to speed-up the switch to new, cleaner technologies, the project recommends.

New EU rules have set stricter limits on the exhaust emissions that can be emitted by diesel locomotives. The change tightened limits for two types of pollutants – particulate matter and nitrogen oxides (NOx).

The rules address a health risk, and an environmental one. Particulates can enter into the lungs and NOx can turn into smog in reaction to sunlight. For some, such as those suffering from severe asthma, the risk from both can be life threatening.

On average, about 20% of Europe's current rail traffic is hauled by diesel locomotives. Some EU countries – such as the UK, Greece, Estonia, Latvia and Lithuania – are highly dependent on diesel traction.

To help rail companies comply with the new rules, the EU-funded CleanER-D [2] project field-tested new filtering technologies and engines in Germany, France and Italy. The tests and research fed into guidance for rail companies and policymakers on the best way forward.

"The trials showed it was feasible to retrofit existing locomotives with configured and compliant engines," says project spokesperson Jan Steinkohl of Belgium-based Union of the European Railway Industry (UNIFE). "However, the most efficient way for industry to meet the target is to renew the fleet – speed up the replacement of non-compliant diesel locomotives with newer ones."

Locomotive tests

The project, which ended in January 2014, conducted field trials of three existing locomotives retrofitted with cleaner technologies. The aim was to develop and improve on emissions reduction technologies and determine their impact.

One test involved retrofitting a 40-year-old freight locomotive with a prototype diesel engine developed by project partner MTU Friedrichshafen in Germany. The engine was equipped with emission-reduction technologies and connected to a particulate filter.

The locomotive had to be adapted to fit the new engine and emission-reduction technologies. Germany's Deutsche Bahn, a project partner, tested the locomotive on its regular freight service from January 2012 to May 2013.

In parallel, project partner SNCF, France's national railway company, carried out another field trial of a shunting locomotive installed with a particulate filter system.

"Retrofitting old locomotives is not always possible," says Steinkohl. "However, the tests showed that when done on these particular locomotives, retrofitting can contribute to reaching the EU's emission targets."

In the third field trial, a prototype engine developed by project partner Caterpillar was successfully integrated in a new diesel-electric locomotive, along with an exhaust gas recirculation system and a particulate filter.

Project partner Trenitalia tested the locomotive in Italy, hauling heavy freight from September 2013 to January 2014. The trial allowed the project to evaluate the performance of the new emission reduction technologies.

The project found that installing the new compliant engines resulted in a significant weight and space increase. For example, the test locomotive required a 20% larger cooling plant and a new roof hatch. The locomotive design had to be modified to reduce weight in other areas to comply with rules on axle load limits.

"These field tests confirmed that cutting emissions levels with current technologies meets EU requirements," says Steinkohl. "However, the technical and economic feasibility of retrofitting has to be carefully evaluated.

Even if solutions were available from the engine manufacturers to comply with new emission regulations, the trial in Italy showed that several years might be required before the new compliant vehicles can enter into service, he adds.

"Cutting emissions levels with current technology tends to lead to heavier and bigger propulsion units – increasing weight and potentially fuel consumption," says Steinkohl. "Even if solutions were available from the engine manufacturers to comply with new emission regulations, the trial in Italy showed that several years are required – due the process of getting approval from regulatory authorities – before the vehicles can enter into service."

Industry guidance

The project's trials and scientific research fed into recommendations on the most feasible way the rail industry could achieve EU emission targets for diesel engines.

However, policymakers should also provide incentives for rail operators to replace older diesel engines with the new, cleaner freight locomotives, adds Steinkohl. One such incentive would be a subsidy to encourage industry to scrap and replace older, more polluting locomotives. Without incentives, many diesel locomotives might be taken out of service without being replaced.

Such decisions could result in a lack of capacity, and some customers might shift from rail to road.

This would have a larger environmental impact than maintaining capacity, the project found.

“Emerging technologies and hybrid engines could help to reduce diesel emissions even more, but industry needs time to evolve these to commercial applications,” concludes Steinkohl.

See also:
CORDIS [3]
Project:
Clean European Rail - Diesel
Project Acronym:
CLEANER-D
Project website:
http://www.cleaner-d.eu [2]

Links
[1] https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/newsroom/fotolia_72282469_subscription_s_8841.jpg
[2] http://www.cleaner-d.eu
[3] http://cordis.europa.eu/project/rcn/91307_en.html