

PRESS CUTTING  
Originally published in Cleantech magazine.  
September 2008.  
[www.cleantechinvestor.co.uk](http://www.cleantechinvestor.co.uk)



## CLEAN DIESEL TECHNOLOGIES INC.

### Retrofitting diesel vehicles for the London LEZ

by Anne McIvor

**C**lean Diesel Technologies Inc. (Clean Diesel), founded in 1994, specialises in technology for the reduction of emissions from automotive engines. Its portfolio of technologies is focused around intellectual property for two applications: the reduction of diesel particulates (including the 'fine' particulates PM10 or less), and the reduction of NOx.

The technology suite includes fuel-borne catalysts (FBCs) – which are added to diesel (and other fuels) and operate at the point of combustion. In addition to reducing emissions, the use of a FBC, in conjunction with filters, reduces fuel consumption by improving the performance of the engine. Clean Diesel's Platinum Plus® FBC contains minute amounts of platinum and cerium. One advantage is that less platinum is required in the diesel particulate filter. The fact that the catalytic action takes place 'in-cylinder' improves the completeness of combustion. By reducing soot, Platinum Plus® keeps the filter clean and helps avoid the need for expensive self cleaning filters.

Leading filter manufacturers such as Johnson Matthey are reportedly now looking at solutions which combine a FBC with a filter. Johnson Matthey is one of the companies which blends the platinum containing concentrate for Clean Diesel.

A second product line is the catalyzed wire mesh diesel particulate filter. These filters are retrofitted into older, higher emissions diesel vehicles to help ensure that they meet increasingly strict emissions regulations. Clean Diesel has developed a wire mesh technology which offers a low cost solution to emissions, avoiding the need for coating or ceramics. Used in conjunction with Clean Diesel's FBC, an 80% reduction in emissions can be achieved on older diesel engines, which is sufficient in most instances to meet Euro4 standards. Although the technology does not meet with Euro5 standards, the application is more than adequate to meet the criteria of Asian markets (including China) and

markets in Latin America, which are broadly equivalent to the Euro3 level.

A solution which combines the catalyzed wire mesh filters with Clean Diesel's Platinum Plus® FBC has received verification from the US EPA and certification from Transport for London for use within London's Low Emissions Zone (LEZ). The certificate from Transport for London for Clean Diesel's Purifier™ particulate matter (PM) emission control technology permits it to be marketed as a retrofit solution for older commercial vehicles, enabling the vehicles to enter London without having to pay the £200 daily charge for non-compliance.

The third major product is the ARIS® selective catalytic reduction (SCR) system, a patented technique for applications such as SCR, lean NOx traps, NOx absorber catalyst and active diesel particulate filter regeneration systems. ARIS® is especially effective in reducing NOx in all types of combustion engines – ranging from small cars to large turbine engines – and in all types of fuels, including LPG and CNG. In technology terms it has an advantage over other SCRs in that it doesn't need compressed air.

NOx will first be addressed in Europe by Euro5 in 2010, which is likely to open up a significant market opportunity for Clean Diesel. US and European legislation look set to make it virtually impossible to tune an engine to avoid NOx reduction technology.

Given the restrictions on weight and space in passenger cars, Clean Diesel believes that its ARIS® system is the most efficient solution. The company has been successful in licensing this technology to Robert Bosch GmbH, an OEM, and to Tenneco, a major Tier 1 automotive supplier.

In 2007, Clean Diesel saw its revenues surge to \$4.9 million, from just \$1.1 million in 2006. The jump was the result of one-off up-front payments related to these two major licensing agreements with Robert Bosch and Tenneco. Bosch, a major player in the diesel market, has licensed the rights to ARIS® for reducing NOx emissions with SCR, the patented combination of EGR (exhaust gas recirculation) with

SCR – and other related technologies. The agreement with Bosch also provides for using the technologies in non-vehicular applications such as stationary power generation, rail and marine. Tenneco, a major Tier 1 automotive supplier, has licensed the ARIS® emissions control technology and related patents for SCR, diesel particulate filter regeneration, lean NOx traps and absorbers, and the combination of EGR-SCR for minimising engine emissions while improving fuel efficiency.

Licensing revenue for 2007 amounted to \$3.5 million, or 70% of total income. Revenues of this magnitude are unlikely to be replicated this year: in fact Clean Diesel, which made a net loss of \$4.5 million in 2007, is unlikely to generate a profit in the next year or two. However, the longer term potential is underpinned by the licensing deals. Clean Diesel's management is very optimistic on the potential for the Bosch agreement to drive growth long term. Non-exclusive licensing deals such as these, with Tier 1 suppliers and OEMs, are central to Clean Diesel's business model. The company's core competencies are its IP and management does not, generally speaking, aim to be active in the areas where its partners' core competencies lie: i.e. manufacturing, systems integration and distribution. However, Clean Diesel has overlapped into these non-core areas in order to develop the brand. The company's most high profile foray outside its central business has been the London LEZ. The company has now gained a strong reputation for its expertise in addressing LEZ-type business, and it has been commissioned by a host of customers who are considering solutions similar to the LEZ in some 20 cities around the world.

Clean Diesel's shares are listed on NASDAQ and on AIM. The share price spiked last year on news of the licensing agreements with Bosch and Tenneco, but has fallen back from the peaks as the market has taken on board a more realistic view of the potential for these deals to translate into longer term profit.

CLEANTECH ON NASDAQ