

# Diesel Emissions Conference India 2011

Highlights from the latest Diesel Emissions Conference, held in Delhi

<http://dx.doi.org/10.1595/147106711X612760>

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## Introduction

The 2nd Diesel Emissions Conference India 2011, held in Delhi on 5th–7th September 2011 (1), brought together over 200 leading stakeholders from India and beyond to discuss the industry's progress in meeting the Bharat Stage III and IV legislation which also applies to commercial vehicle diesel applications over 3.5 tonnes (2). The conference also showcased the latest emissions reduction technologies being used in India and across the world, and acted as a platform for networking among Indian diesel emission industry delegates. There were 27 presentations given over three days which included topics such as:

- Government strategy for supplying Bharat Stage IV (BS IV) diesel fuel;
- The crucial development of AUS 32 (aqueous urea solution, 32.5%, also known as AdBlue<sup>®</sup>) supply infrastructure and AUS 32 price analysis in India;
- New fuel economy standards in India and their impact on the automotive industry;
- Emissions control for on- and off-road vehicles in India to further improve air quality;
- Case study on the implementation of Euro IV in China and lessons for the Indian market.

This review focuses on the use of selective catalytic reduction (SCR) technology for controlling diesel nitrogen oxides (NO<sub>x</sub>) emissions and the development of the AUS 32 market in India. Papers can be purchased from the Diesel Emissions Conference website (1).

## Selective Catalytic Reduction Technology

Original equipment manufacturers (OEMs) in India are choosing between an SCR or an exhaust gas recirculation (EGR) route for controlling NO<sub>x</sub> emissions. EGR works by recirculating some of the exhaust gas back into the engine. This lowers the temperature of combustion and reduces the amount of NO<sub>x</sub> formed.

SCR is a very effective alternative NO<sub>x</sub> emission control technology. It provides a means of converting NO<sub>x</sub> to nitrogen gas (N<sub>2</sub>) and water (H<sub>2</sub>O) (3). Ammonia in the form of AUS 32 is typically added to the exhaust stream to act as reductant. An accurate ammonia con-

trol system is required to inject the ammonia at an appropriate rate. The operation of an SCR system is shown in **Figure 1**. Ammonia SCR does not deal with hydrocarbon (HC), carbon monoxide (CO) or particulate matter (PM) emissions. These may be removed by a diesel oxidation catalyst (DOC) and/or a diesel particulate filter (DPF). While SCR typically uses base metal/zeolite-based catalysts, the DOC uses a platinum group metal (pgm) catalyst and DPFs may also be catalysed by pgms to aid regeneration. Platinum can also be used to control ammonia slip – preventing emissions of unreacted NH<sub>3</sub>.

Cummins Emission Solutions, India, showcased why the market trend, in their experience, is towards the use of SCR systems (4). Following are the salient points given on why SCR is preferred over EGR for the Euro IV and V markets:

- Improvement in overall system efficiency;
- Robustness to variation in fuels quality;
- Fuel economy improvement;
- Increased power density and lower heat rejection;
- Service interval improvement (oil drain – low soot);
- Low maintenance cost;
- Technology path to Euro V.

The presentation described Cummins' global experience of SCR, with approximately 9 billion km on-road experience in Europe and 24 million km in the USA. Some pros and cons of both EGR and SCR were also presented, of which the most important was fuel economy. This is 5%–8% better with SCR compared to

EGR. Challenges for the adoption of SCR technology include the packaging, dosing strategy and cost of AUS 32 (3).

### AUS 32 Demands and Forecast in India

After the launch of BS IV in India, around 17% of total diesel and 27% of total motor gasoline consumption was of BS IV quality in 2010–2011. The percentage of vehicles using BS IV fuel is expected to increase in the next few years as BS IV fuel becomes available in 50 cities. This will allow more vehicles to be fitted with an exhaust aftertreatment system which meets the BS IV standards. To achieve the BS IV standards for the commercial vehicle segment in India, OEMs are developing systems based on SCR and DOC plus DPF options. **Figure 2** shows diesel emissions control technologies which can be found in the Indian market to achieve the BS IV and V standards.

The current scenario in the Indian commercial vehicle market is summarised in **Table I**. Current penetration of SCR in the Indian commercial vehicle market is negligible but is expected to reach 60% by 2015–2016. Currently the Indian commercial vehicle market is dominated by the DOC plus DPF option, but this may come down to 37% of market share once SCR and the availability of automotive quality AUS 32 are established.

Gulf Oil Corporation Ltd, India, shared a presentation on different modes of distribution of AUS 32 in India and the impact of its price on the SCR market in India. Presently the mode of distribution is mainly in drums (200 litres). In the next 3 years as demand

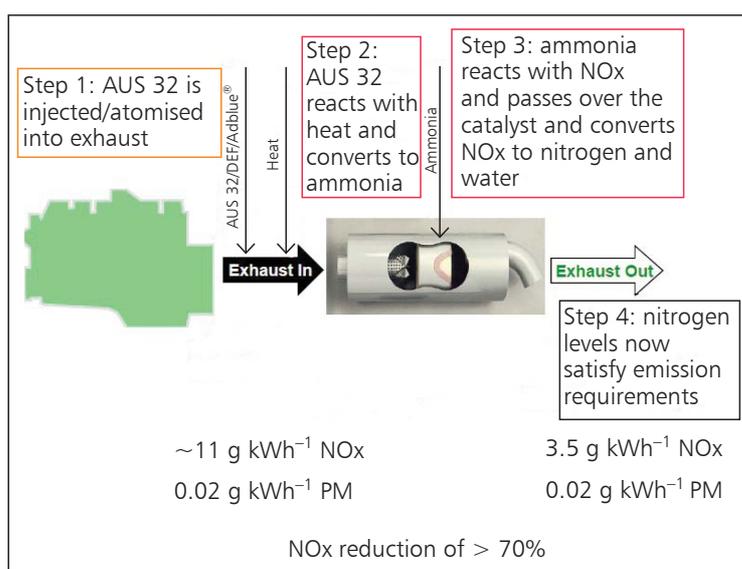


Fig. 1. Selective catalytic reduction system operation. (DEF = diesel exhaust fluid)

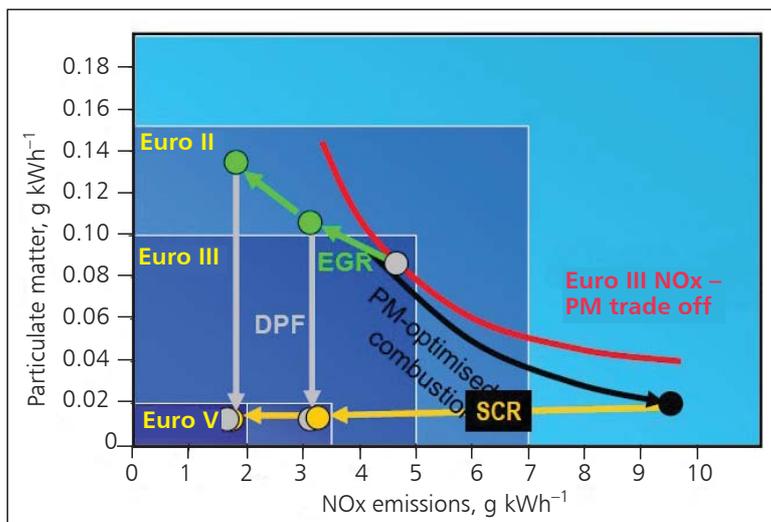


Fig. 2. Diesel emissions control regulation limits in India, and the technologies currently found in the Indian market to achieve them. Note: the Bharat II, III, IV and V emissions limits are equivalent to the Euro II, III, IV and V limits, respectively

**Table I**  
**Classes of Diesel Commercial Vehicles in the Indian Market, with the Dominant Types of Emissions Control in 2011**

Class	Size, tonnes	Different emissions control technologies
Light commercial vehicles (LCV)	3.5 to 7.5	EGR or EGR + DOC or EGR + DOC + DPF
Medium commercial vehicles (MCV)	7.5 to 12	Mostly EGR or EGR + DOC, EGR + DOC + DPF, some SCR
Heavy commercial vehicles (HCV)	> 12	Mostly SCR

grows; a bulk dispenser option will also come in along with small packs (10 litres and 20 litres). **Figure 3** shows the expected demand projection of Adblue® (AUS 32) in BS IV cities for the buses which are more than 12 tonnes.

The price of AUS 32 will also play a key role in making SCR popular among Indian OEMs (5). Presently the price in India is approximately US\$1 per litre (plus taxes). The speaker indicated that it will be essential to bring down the price to be equivalent to that of diesel, which is US\$0.82 per litre in Delhi at the time of writing. It will then be necessary to further reduce the price to two thirds of the diesel price to make it commercially viable for customers. AUS 32 is a subsidised commodity in India and its pricing and availability will remain a critical point of discussion in Government corridors.

**Conclusion**

India is moving ahead with stringent emissions standards for commercial vehicle applications. It has

already implemented Bharat IV, equivalent to Euro IV, in thirteen cities and the number of cities will increase in future. OEMs have opted for either an SCR or an EGR route to achieve these standards. During the three day course of the conference and panel discussions, there was much discussion of the advantages and disadvantages of the SCR route for NOx control. To what extent SCR will be used by OEMs in India will also depend upon the availability of AUS 32 in India. Good infrastructure and easy availability of AUS 32 at a reasonable price are a few points which the Indian government needs to look into in the future.

Presently in the heavy duty diesel segment the majority of OEMs are ready with either DOC only or DOC + partial filter (uncoated) or SCR as exhaust aftertreatment systems on different platforms to meet the stricter emission standards. The major volume share is currently DOC or DOC + partial filter systems. However, we envisage that the use of SCR technology will increase as the BS IV standards are implemented across India.

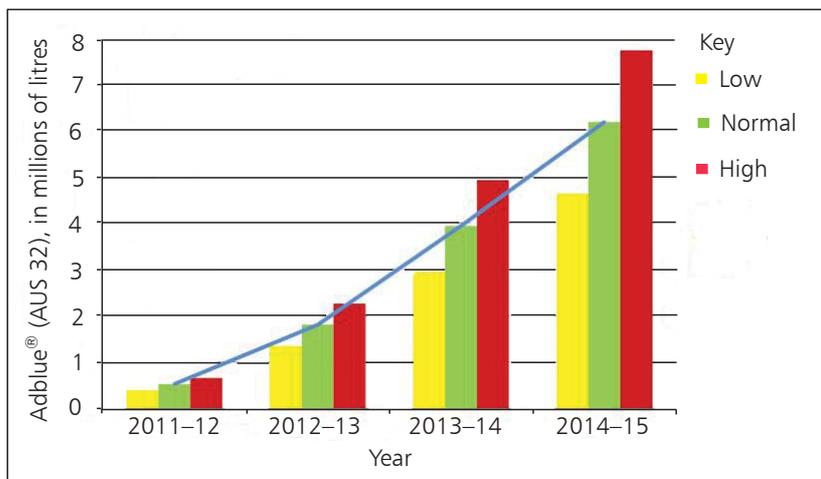


Fig. 3. Projected demand of Adblue® (AUS 32) in Bharat Stage IV cities for buses (> 12 tonnes)

### References

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### The Reviewer



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