



Clean Diesel Technologies

Clean Diesel Technologies, Inc.: Recipient of the
2009 North American Remote Class 6-8 Emission Reduction
Excellence in Technology of the Year Award



“We accelerate growth.”

2009 North American Class 6-8 Emission Reduction Excellence in Technology of the Year Award Award Recipient: Clean Diesel Technologies, Inc.

Award Description

Frost & Sullivan's Excellence in Technology Award is bestowed upon a company that has pioneered the development and introduction of an innovative technology into the market; a technology that has either impacted or has the potential to impact several market sectors. This award recognizes a company's successful technology development that is expected to bring significant contributions to the industry in terms of adoption, change, and competitive posture. It also recognizes the company's overall technical excellence and its commitment toward technology innovation.

Research Methodology

To choose the award recipient, Frost & Sullivan's analyst team tracks technology innovation in key hi-tech markets. The selection process includes primary participant interviews and extensive primary and secondary research via the bottom-up approach. The analyst team shortlists candidates on the basis of a set of qualitative and quantitative measurements. The analysts also consider the pace of technology innovation, and the potential relevance or significance of the technology to the overall industry. The ultimate award recipient is chosen after a thorough evaluation of this research.

Measurement Criteria

In addition to the methodology described above, there are specific criteria used to determine the final rankings. The recipient of this award has excelled based on one or more of the following criteria:

- Number of new technologies developed or introduced
- Significance of a technology/ technologies in the industry
- Competitive advantage of technology/technologies vis-à-vis competing technologies
- Ease of adoption of new technology/technologies
- Potential of technology/technologies to become an industry standard
- General impact of technology in terms of shifting R&D focus



Frost & Sullivan recognizes Clean Diesel Technologies Inc. (Clean Diesel) with the 2009 Excellence in Technology of the Year Award in Class 6-8 truck emission-reduction technologies. This Award recognizes the company's excellence in developing and offering a comprehensive portfolio of solutions that help diesel commercial trucks deliver peak efficiency and meet EPA 2010 emissions regulations. It has emerged as a prime mover in this market by leveraging its intellectual property in diesel emission reduction technologies, its strategic partnerships and its proximity to stakeholders and distributors in diesel engine and powertrain technologies. Clean Diesel systems effectively reduce nitrogen oxide (NOx), particulate matter and hydrocarbon emissions enabling truckmakers and powertrain system manufacturers to produce more advanced and efficient vehicles.

By Combining SCR and EGR Technologies, Clean Diesel Develops a Complete Emissions-reduction Solution

The company understands the challenges facing heavy-duty truck fleets and owner-operators in complying with stringent emission reduction regulations across the globe. International emissions regulations are in increasing alignment with each other, augmenting demand for technology platforms that reduce NOx-induced atmospheric pollution. Clean Diesel offers its customers solutions to meet regulatory compliance, maximum fuel efficiency and lower lifecycle costs, while also reducing greenhouse gas emissions.

The combination of the exhaust-gas recirculation (EGR) and selective catalytic reduction (SCR) technologies clearly illustrates the dual benefits of improved fuel-efficiency and reduced emissions. This innovation includes the fuel-efficiency benefits of SCR technology and the NOx reduction benefits of EGR technology in cold operating conditions. Patented in 1999, Clean Diesel was the first to develop and introduce this technology as a viable aftertreatment alternative for the North American Class 6-8 truck market. This technology is rapidly becoming the defacto industry standard worldwide.

In the area of NOx reduction, the company has also developed expertise in urea injection technologies and hydrocarbon injection, which reduce NOx emissions cost-effectively. Clean Diesel's patented return-flow designs improve reliability and eliminate the need for compressed air, expanding the use of SCR technologies in mobile applications. Its hydrocarbon injection system supported the development of an alternative urea-free SCR technology, offering the potential for simplicity and savings in urea-related lifecycle costs.

Clean Diesel has obtained numerous patents while developing and commercializing its technologies. Several leading powertrain system and component suppliers are adopting the company's systems. Its success in advanced diesel combustion and aftertreatment technologies has generated several strategic non-exclusive licensing partnerships.

Industry Participants are Following Clean Diesel's Lead

The Environmental Protection Agency's (EPA) emissions reduction regulation that takes effect in 2010 demands a 90 percent reduction in NOx emissions over the EPA 2004 emission regulation limits. While cooled-EGR technology offers an in-cylinder emissions reduction approach, the fuel efficiency penalty is emerging as a key hurdle for this technology. The fuel penalty for high EGR rates is well documented by many engine manufacturers including Cummins, Volvo and Detroit Diesel who all claim a 3-5% penalty. In contrast, SCR is fuel efficient but its operation requires exhaust temperatures typically not achieved during startup or idling. Clean Diesel's EGR-SCR technology mitigates these deficiencies by using EGR technology to reduce NOx emissions in low-starting temperatures and switching to SCR when the temperature increases and the catalyst is fully active. Clean Diesel's patented combination is capturing a lot of attention and shifting the focus away from purely-SCR or purely-EGR approaches in favor of one that leverages the positive attributes of both of these emissions-reduction alternatives.

The company partners with industry associations and academia to remain at the fore of research, development and innovation in diesel aftertreatment technologies. Its management looks beyond current

emissions regulations scenarios to examine the challenges of emerging regulations on diesels. As a result, Clean Diesel's systems are considered crucial to regulation compliance by leading powertrain and aftertreatment system developers. The company's technologies cover not only the North American market, but also enable compliance in global markets. Chart 1.1 illustrates Clean Diesel's best practices in NOx reduction technologies for commercial vehicles.

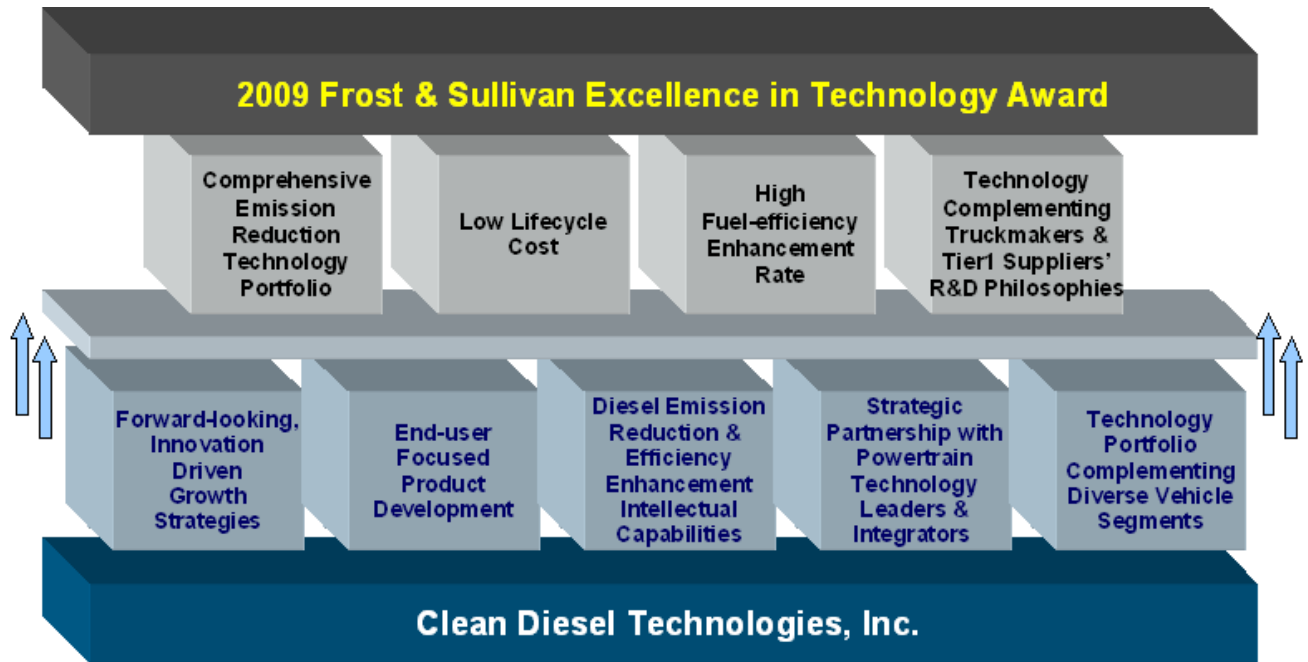


Chart 1.1: Class 6-8 Emission Reduction Technologies Market: Best Practices of Clean Diesel Technologies Inc. (North America), 2009 Source: Frost & Sullivan

Conclusion

Frost & Sullivan's research covering heavy trucks in North America shows significant demand among fleet managers for technologies that meet EPA 2010 emissions regulations, improve fuel efficiency and offer comparatively low lifecycle costs. Clean Diesel can market its EGR-SCR emissions reduction technology at an attractive price, offering OEMs and consumers a tremendous value and leading to rapid market penetration across North America and the world. Clean Diesel Technologies Inc.'s EGR-SCR and airless injection technologies are a clear demonstration of technology excellence. Frost & Sullivan expects the company's NOx reduction technologies to generate significant revenue growth over the 2009-2012 period.

About Frost & Sullivan

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