



Debunking Myths

About Tier 4 Final Diesel Engines

The Truth

About EPA Tier 4 Final for Diesel Gensets

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**V O L V O
P E N T A**

Volvo Penta teamed with PowerSecure and Miratech last year to present an educational [webinar](#) for facility managers and engineers on the latest developments in environmentally friendly diesel engines for power generation.

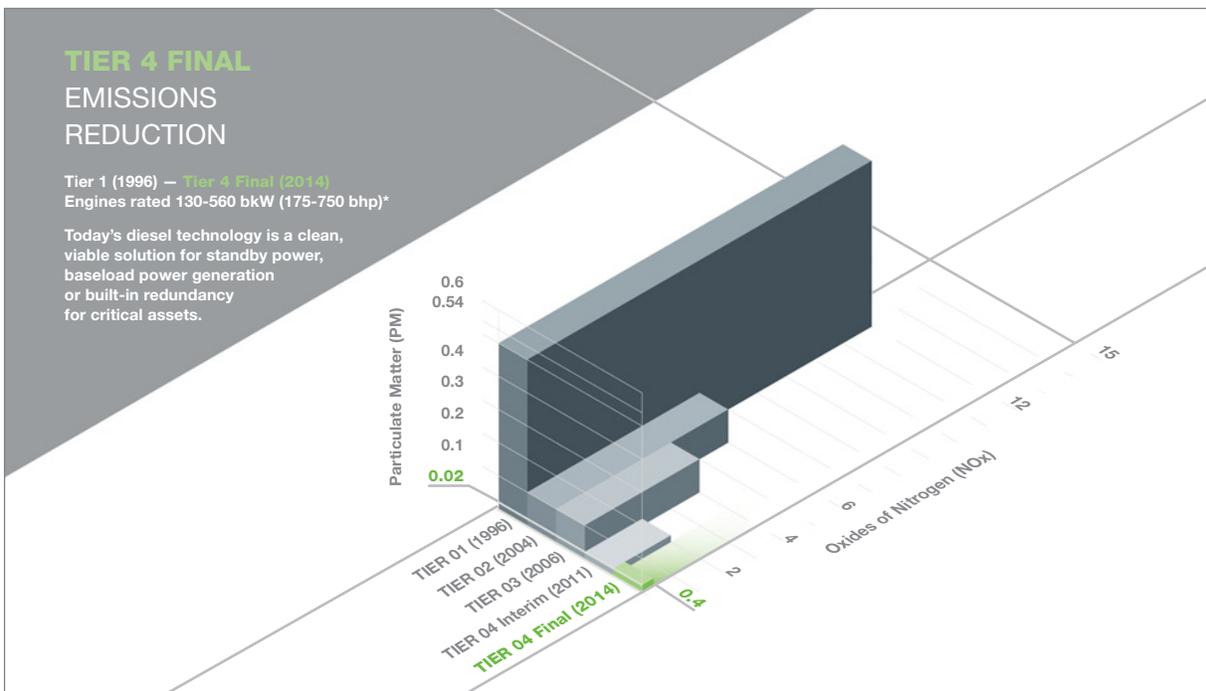
The [webinar](#), entitled “The Clean Secret Behind Diesel”, covered issues and questions concerning diesel engines complying with EPA [Tier 4 Final](#) clean air standards, with a special focus on microgrid applications.

The educational event was hosted by [Microgrid Knowledge](#) magazine, and the moderator was Elisa Wood, energy journalist and editor-in-chief of the magazine. The speakers were Chris Ellis, executive vice president for distributed infrastructure at [PowerSecure](#), Darren Tasker, vice president, industrial, at Volvo Penta of the Americas, and Jim McDonald, director of environmental impact at [Miratech](#).

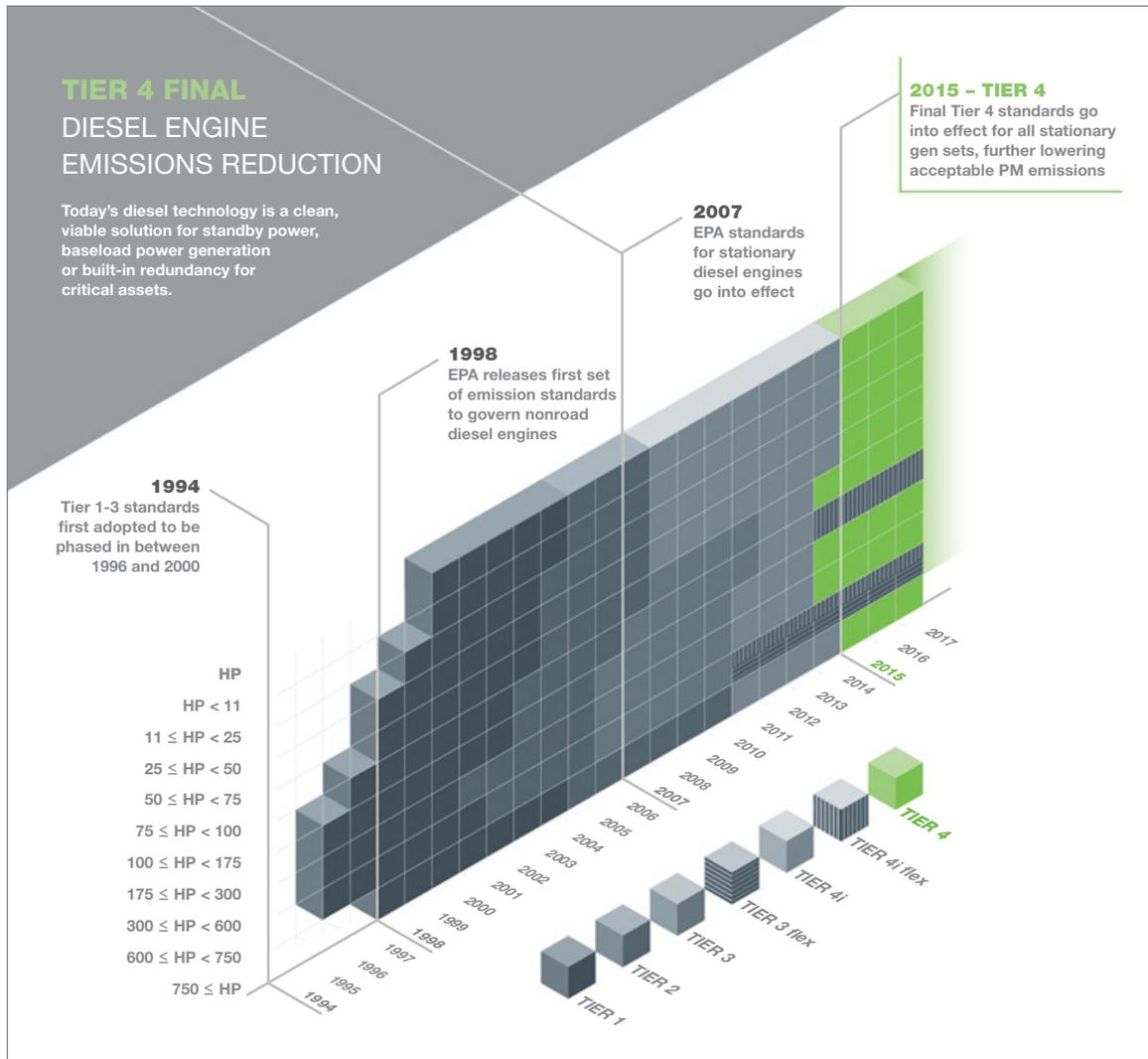


Volvo Penta Stage II & III/Tier 2 & 3

Tasker commented: “Despite the proven results of Tier 4 Final diesels for power generation, particularly from an overall cost of ownership, reliability and emissions standpoint, there are still a lot of questions in the marketplace. Our goal with this [webinar](#) was to educate operators on the overall benefits of a simple, cost-effective and environmentally friendly package such as the one Volvo Penta and PowerSecure deliver.”



EPA Emissions chart showing Tier 4 Final compared to other emissions tiers



EPA Emissions chart showing Tier 4 Final compared to other emissions tiers

The opening presentation, delivered by Tasker, explained the EPA regulations on emission reduction, the most recent of which, Tier 4 Final, requires a reduction in NOx and particulate matter of up to 99 percent compared to previous emission requirements. He explained that Volvo Penta's engines, which are used by PowerSecure, use a process called Selective Catalytic Reduction (SCR), which reduces the NOx emissions by injecting a diesel exhaust fluid (DEF) into the exhaust. The DEF breaks down the NOx into harmless nitrogen and water vapor. At the same time, the Volvo Penta diesels are designed to reduce particulate matter in the engine's cylinder with a very efficient combustion process.

Tasker also noted that the Volvo Penta Tier 4 Final solution is extremely cost effective with very low operating and maintenance costs.

Ellis presented a discussion of the benefits of Tier 4 Final diesel for emergency standby or backup power for different applications, as compared to natural gas. He observed that Tier 4 Final diesel has almost twice the power density of a natural gas generator.

"Tier 4 Final diesel generators are currently being used for peak shaving, load management and resolving capacity constraint with utilities," Ellis said. "It's also being used for frequency response programs largely in the Southwest, where there's plenty of solar capacity on the grid."

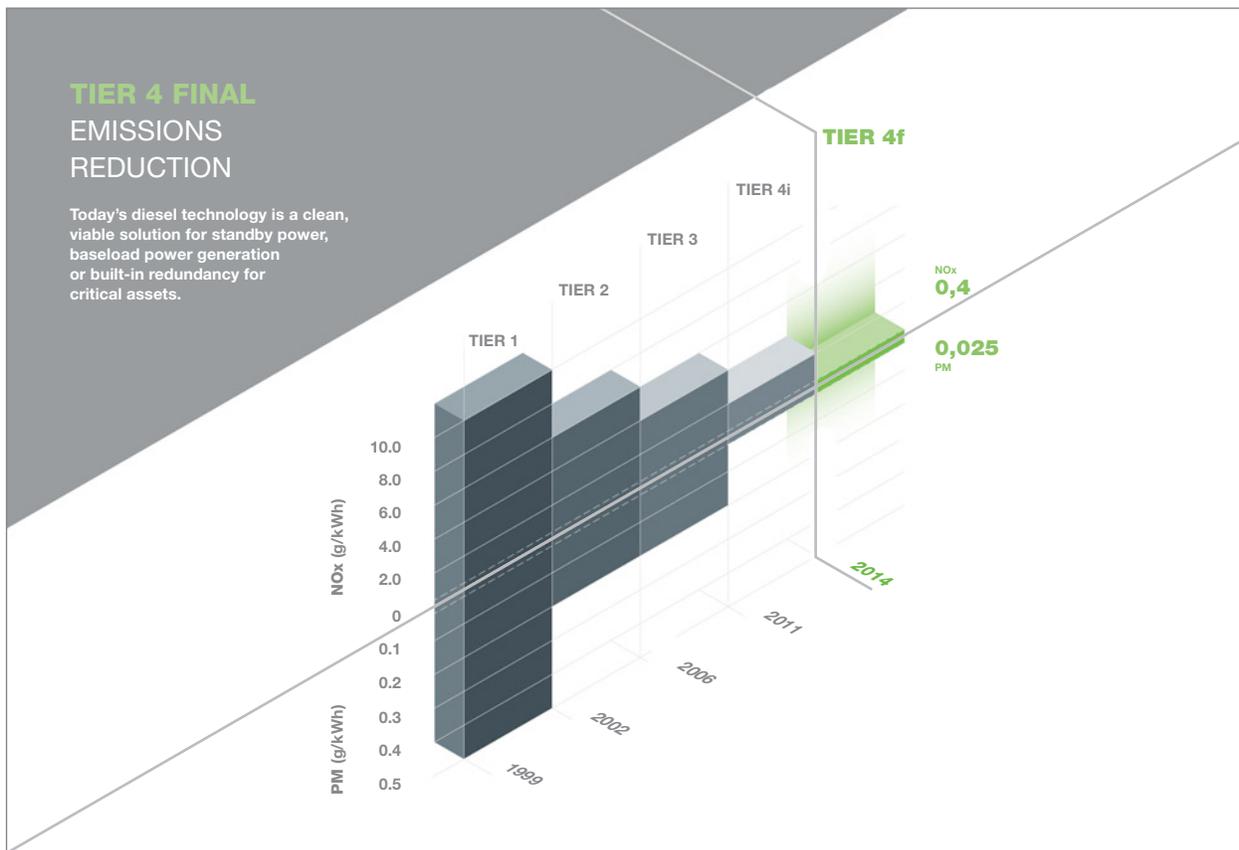
McDonald followed with a deeper discussion of the pollutants involved and how they are dealt with in the Tier 4 Final diesel design. He noted that the pollutants including NOx, CO, hydrocarbons from aldehyde, air toxics and the greenhouse gases N2O and methane, are all reduced dramatically with Tier 4 Final. He also pointed out that particulate matter (PM) emissions are reduced by 90 percent compared to the previous EPA tier and that natural gas engines are actually much higher in ultra-fine particulate matter, which is much more dangerous to humans.

McDonald proceeded to dispel, one by one, some of the myths regarding Tier 4 Final diesels in terms of effectiveness, costs, maintenance requirements

and proven reliability. He pointed out that Tier 4 Final engines have been used for over a decade in Europe and America in trucks, buses and off-highway equipment, with many thousands of applications.

The formal presentations were followed by a lively question-and-answer period.

“The wide range of questions from attendees reflected the high level of interest within the facilities engineering and management community in the subject,” Tasker said.



EPA Emissions chart showing Tier 4 Final compared to other emissions tiers

See [The Truth about EPA Tier 4 Final Diesel Gensets](#) to learn more about the Ten Myths.

The Truth About EPA Tier 4 Final for Diesel Gensets

**V O L V O
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The Environmental Protection Agency (EPA) has established scaled standards to restrict emissions of nitrogen oxides (NOx), carbon monoxide (CO), particulate matter (PM) and non-methane hydrocarbons (NMHC). These standards have been implemented in stages over the last 24 years. The latest and most restrictive EPA standard for stationary diesel engines today is Tier 4 Final, which reduces emissions up to 99 percent compared to previous tiers.

Unfortunately, there are many misconceptions in the power generation marketplace as to the impact and performance of Tier 4 Final compliant engines. To get the true story, we talked with Darren Tasker, Vice President, Industrial, for Volvo Penta of the Americas.

Q. How proven are Tier 4 Final engines in the field?

A. Our Tier 4 Final engine technology is field proven. Our sister company, Volvo Trucks, pioneered implementation of Selective Catalytic Reduction (SCR) as a key part of the Tier 4 Final solution for over-the-road trucks in North America in 2010. As a result, we are able to leverage this proven technology that has been deployed in over 270,000 Trucks in the Americas.

Q: Are natural gas engines better than diesels?

A: Diesel fuel provides more efficiency and power by volume compared to natural gas. With the Volvo Penta Tier 4 Final application, the design has built-in efficiencies that meet stringent emission requirements reducing particulate matter and NOx levels. Natural gas engines emit carbon dioxide as a result of combustion. While natural gas is a cleaner burning fuel and typically has lower operating costs than diesel, the initial cost of a natural gas system is higher than a Tier 4 Final system. Other considerations are:

- (1) diesel fuel is less flammable than natural gas;
- (2) natural gas lines may be disrupted, shutting down the genset, while diesel fuel can be stored on the premises;
- (3) diesel engines require less maintenance than natural gas engines; and
- (4) while natural gas engines are often quieter than diesels, new mufflers and SCR catalyst significantly reduce the noise levels of a modern Tier 4 Final diesel.



Volvo Penta Tier 4 Final Generator engine

Q. Do Tier 4 Final engines have similar levels of fuel-efficiency than earlier tier levels?

A. Actually, Volvo Penta's Tier 4 Final engines are more fuel efficient due to the precise control of the fuel-air mixture controlled by the Engine Control Module. By reducing the particulate matter and NOx in the engine with the SCR system, we have eliminated the need for additional Exhaust Gas Recirculation (EGR). The result is reduced fuel consumption and better reliability.

Q: Will the increased complexity of the Tier 4 Final engine result in more maintenance costs?

A. The Volvo Penta Tier 4 Final engine requires the same amount of maintenance as previous iterations. We designed our SCR system to be simple and reliable. There are only two major components: SCR and non-cooled EGR. The benefits are obvious. Fewer parts mean lower risk of failures or malfunction. Additionally, our SCR catalyst is maintenance free.

Q. Is there a higher price tag for Tier 4 Final solutions?

A. It's important to look at the total cost of ownership and benefits that can be achieved. The peak shaving, load management or other electric market benefits that can be received typically offset costs and contribute significantly to paying for the Tier 4 Final solution. It is our experience that a Tier 4 Final certified system is actually less costly in initial acquisition and total cost of ownership in comparison to a Tier 2 system with aftertreatment. Our Tier 4 Final package promises better fuel efficiency, lower maintenance costs and reduced downtime. Additionally, the SCR catalytic converter is designed to last the life of the engine.

Q: It is sometimes claimed that new engines with emission mitigation have shorter lifetimes than older engines. Is that true?

A. The combination of SCR, non-cooled EGR and an air throttle system help to reduce the amount of NOx emitted by our engines. The air throttle controls the amount of air entering the engine, which in turn affects the exhaust temperature that determines how much particulate matter is burned off by SCR. The throttle closes partially during light loading to maintain the necessary engine temperature for meeting those requirements. Together, these elements provide a simple solution for Tier 4 final while reducing wear in the engine over time and improving reliability.

Q. How about performance in cold weather climates?

A. The Volvo Penta Tier 4 Final engines perform exactly the same in cold temperatures as previous emission-step engines.

Q: Do the Tier 4 Final pollution controls hamper the reliability of the engines for data center applications?

A. Data centers have traditionally employed pollution avoidance measures like increased stack height, which is very costly, or limiting operating hours. A Tier 4 Final engine reduces installation costs and allows unlimited operation. In reality, the

flexibility to test and run engines more often during system checks and maintenance actually increases system reliability. The latitude to run an emergency backup system without restriction also leads to increased facility uptime.

Q. What about shutdowns when the SCR system is not functioning properly, for instance if Diesel Exhaust Fluid (DEF) runs out?

A. There is a concern that the engine will automatically shut down if the SCR system is not working properly to reduce emissions. We have worked with our power generation partners to design a system that mitigates inducement. This is done predominately through sizing of the DEF tank to match the fuel tank on site. This is because diesel fuel and DEF are typically delivered from the same provider. In addition, there is an emergency inducement override in compliance with Federal regulations, which allow the Tier 4 Final system to continue operating during an emergency event even if the SCR is not functioning properly.

Q: Is it true that all Tier 4 Final solutions require diesel particulate filters (DPFs)?

A. Some Tier 4 Final engines from other manufacturers use a DPF to meet the requirement for particulate matter reduction. A downside for DPFs is their need for intermittent downtime for regeneration. In addition, DPFs have higher maintenance costs and require frequent replacement. Volvo Penta's Tier 4 Final uses a more efficient and improved SCR solution that reduces particulate matter emissions without a DPF.