

Europe’s first hybrid-powered heavy truck



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Sisu manufactures a few hundred diesel-powered trucks every year. The company set a target for 20% of all new trucks to be made with a hybrid drivetrain by 2019. Providing new functionalities, lower fuel consumption and higher performance to customers. This could further speed up the breakthrough of the hybrid system.

Tackling fuel consumption with minimal changes

The main challenge for Danfoss was to develop a solution that reduced fuel consumption (and therefore lowered emissions). At the same time, making minimal changes to the truck itself. The solution also needed to be compatible with the existing drivetrain and easily integrated into the truck’s electrical system.

Bringing together diesel and electrical power

Danfoss developed the electric power system including parallel hybrid drive for a proof of concept vehicle. Power is provided by an electric motor and a diesel engine connected via the same axle.

The electric motor assists the diesel engine during peak load demand from the drivetrain. In addition, it charges the supercapacitor energy storage unit during off-peak periods. The electric motor is located between the engine and gearbox. This ensures simple assembly with no need to alter the existing chassis or suspension structure.

Danfoss developed the electric drive system to work in parallel with the Mercedes-Benz OM471 and OM473 diesel engines. The technology from the proof-of-concept unit has since been adopted for use in the Sisu Polar Hybrid truck range.

Improved fuel efficiency, fewer carbon emissions

Danfoss developed a solution that lowers fuel consumption and emissions. In addition, the powerful hybrid system boosts available low speed torque. This means the driver experiences the sensation of power when the vehicle is accelerating.

With the electric drive system, the driver feels the impact of the torque immediately, even at very low speeds. This makes the electric machine a useful addition to any powertrain. It improves on the performance capability of a combustion engine.

The solution also enables the use of the vehicle with or without a source of electric power. For instance, the system can be fully automatic or manual. Since the drive line is mechanically continuous from the diesel engine to the axle. The system supplies additional power and charging automatically, which means the driver can better focus on the road. The driver can also keep track of the system’s data. If required, bypass the automated system and take control.

In manual mode, the driver can use the electric motor to rock the truck back and forth if conditions are muddy. In addition, he can make a three-point turn without having to shift gears from forward to reverse. The same movements can be done quickly and easily using a separate joystick-type controller. This is enabled by the location of the clutch between the combustion and electric machines in the drivetrain.

Since the successful delivery of the first proof of concept vehicle Sisu has received orders for several hybrid trucks. The first is scheduled for delivery in Autumn 2018.

Specifications

Project	Sisu Polar Hybrid truck
Customer	Oy Sisu Auto Ab
Location	Karjaa, Finland
Scope	Electric power system for a proof of concept vehicle (and eventually for a hybrid version of a standard product model). Integrating parallel hybrid drive which draws power from both an electric motor and a diesel engine connected via the same axle.
Solution	A proof of concept vehicle that integrates the parallel hybrid drive. Which draws power from both an electric motor and a diesel engine connected via the same axle.
Power	<p>900hp and 3800Nm for the Sisu Polar Hybrid truck (electronically limited due to it being the maximum torque the gearbox can handle). This is the most powerful production truck in the world.</p> <p>Power is delivered via the Danfoss EM-PMI permanent magnet motor. While the mechanical powertrain is controlled by a Danfoss EC-C1200 inverter and EC-C1200 DC-DC converter. Energy is stored with the company’s supercapacitor unit.</p> <p>Danfoss’ component flexibility enables customer and system-specific customization; simplifying integration with customer systems.</p>
Benefits	<p>The proof of concept vehicle, with its smaller motor and smaller energy storage reduced diesel consumption by 5-10%.</p> <p>It is anticipated that the production models with their improved electric performance will be more than 10% fuel efficient. This is depending on the road profile and load cycles in the real-world application of the truck.</p>