Innovative Regenerative Energy Suspension System Poised to Eliminate Reefer-Truck Emissions

Propitious Technologies Unveils System that Uses Road Energy to Power Refrigerated Truck Trailers; Designed to Displace Millions of Tons of CO2 Annually

Propitious Technologies LLC

PHOENIX, ARIZONA, UNITED STATES, April 11, 2023 /EINPresswire.com/ -- Using a vehicle's suspension travel on rough roads to recapture energy is not a new theory. But a patent-pending application from cleantech startup Propitious Technologies aims to revolutionize how refrigerated cargo is transported on big-rig trucks – and would slash diesel fuel use and its resulting CO2 and particulate emissions in the process.

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>
> *Dr. James Kirtley*

More than 90 percent of food consumed in America is transported in refrigerated shipping trailers. These "reefers" are one of the largest vehicle polluters in America. They often require a secondary diesel generator, which are lightly regulated and produce tons of particulate emissions – 22.5 pounds of CO2 per gallon of diesel fuel burned.

Propitious has developed an innovative, patent-pending power generating suspension system ("PGSS") mated to an electric generator to cool the refrigeration unit. This technology is designed to replace the diesel-fueled refrigeration units in the hundreds of thousands of "reefer" trailers currently on the road in the United States and Europe.

The Propitious technology leverages the first inch of suspension travel on the trailer to harvest the power produced by the compression and rebound strokes of the suspension. It physically

links to the suspension and translates its vertical travel into a horizontally mounted linear generator. A power electronics box then collects and boosts that output to the battery pack, while burning off residual energy. In heavy-truck application, the Propitious system is about six feet long and six inches in diameter. The system in total weighs about 1,800 pounds – a more compact and lightweight alternative to massive battery packs.

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Designed to operate at variable vehicle speeds, the Propitious design could be custom-tuned for Class 6-8 trucks hauling goods at 65 mph for hours at a stretch, or for last-mile delivery vans doing stop-start residential runs at an average of 35 mph.

“Because of the design of the generator, this system can attach to any suspension type as long as there is room for it to fit,” said Johan de Nysschen, Propitious chief executive officer.

Why attach the PGSS to the trailer and not the tractor rig? Simplicity, and regulations. “There is less vehicle integration involved, so it will be quicker to market. Retrofitting suspensions in trailers is not as complex of an integration,” said Elsbeth Hurry, Propitious chief operating officer. Plus, equipping this system to a rig’s dynamic air suspension could alter its ride characteristics, whereas a trailer is a static setup.

The system elegantly harnesses the kinetic energy naturally produced when a vehicle drives over a road irregularity at speed. “The PGSS specifically harvests power that would otherwise be dissipated in the shock absorbers that are part of a trailer’s suspension,” said James Kirtley, an electrical engineering professor at Massachusetts Institute of Technology and a member of Propitious’ advisory board.

The symbiotic paradox: The worse the road condition, the better the system works. “In other words, poor-condition roads actually make the PGSS more efficient,” said Jon Hurry, Propitious chief technical officer. The technology is also being developed for use in electric buses, garbage trucks, railroad cars, and mining equipment.

But the seeming simplicity of the theory belies the complexity of its creation. Direct linear generators designed to recuperate energy from suspension systems must deal with low differential velocities and high force levels – both of which are contrary to electric machine capability. That’s where the Propitious electrical engineering brilliance comes into play.

As for the expected cost of the system, the numbers speak for themselves:

 A typical reefer trailer runs about 4,000 hours a year which equates to roughly $12,000 - $18,000 worth of diesel fuel for a year's refrigerated transport;
 With a projected cost of $20,000, the Propitious system will pay for itself during its second year of use.

Even more dramatic than the fuel savings is the impact it will have on climate change. How much emissions could be cut if every reefer truck converted to the Propitious system, combined with a compact battery power storage for when the trailer is parked?
 There currently are about 500,000 reefer trailers in the United States, according to PLS Logistics Services.
 Reefers need to be kept cold throughout transport, whether driven or parked.
 A lack of cold storage at many destinations means the trailers are running diesel generators for days after delivery.
 This always-on duty cycle means that reefers within the state of California alone were responsible for nearly 900,000 tons of greenhouse gas (GHG) emissions, 7,000 tons of NOx, and 277 tons of toxic diesel particulate matter in 2019, according to the most-recent California Air Resources Board (CARB) calculations.

This has not escaped the notice of CARB and some like-minded policy states. Mandates of escalating emissions restrictions begin this year through 2029, when reefer trailers transporting through these states must be zero-emission or result in heavy fines. The oft-proposed solution: A massive battery in the trailer that will add literally tons of weight and consume precious cargo space. Instead, Propitious' PGSS can eliminate 75% of this battery and is positioned to launch before the CARB regulations take effect.

Such advancements do not happen in a vacuum. The Propitious team exclusively licensed a Tufts University patent on a power generating strut that was filed in 2001. Dr. John Miller is the mastermind behind the design of the linear generator; Engineering assistance for power electronics and mechanical integration is provided by Abtery Electric Drive Systems in Gothenburg, Sweden. Long-time MIT electrical engineering professor Dr. James Kirtley is a technical advisor.

ABOUT PROPITIOUS TECHNOLOGIES:
Based in Phoenix, Arizona, Propitious is the brainchild of Jon and Elsbeth Hurry – two engineers with deep connections in the automotive, biomedical, and academic world. In March 2023, Propitious named automotive industry veteran Johan de Nysschen as Chief Executive Officer.

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