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Electric Supercar Concept Uses Small Turbine Engine To Boost Range

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We're gearing up for the Los Angeles Auto Show here at GreenCarReports, and the press releases are flying across the desk. Most of them don't apply to green car buyers and fans, but here's one worth watching.

At the show, Capstone Turbine Corp. will unveil its CMT-380 concept, an extended-range electric supercar. Here's the kicker: The CMT-380 extends the 80-mile range of its lithium-ion battery pack by up to 500 miles with an onboard generator turned by...a turbine engine.

The powertrain uses the same extended-range electric car concept as the 2011 Chevrolet Volt. Technically, neither car is a hybrid, since the range extender (a 1.4-liter gasoline engine in the Volt, the turbine in the CMT-380) never powers the wheels mechanically.

Many companies are developing dedicated engine designs for range extenders, including Lotus. But you can turn a generator with any power source that produces torque, and that's hardly limited to gasoline combustion engines. Now, an efficient microturbine steps up.

Tesla performance, 500 miles

Capstone claims a 0-to-60-mph time of just 3.9 seconds (the same as the Tesla Roadster), along with a top speed of 150 mph. Physics being what it is, those two are not likely to be achieved together if the electric range is to remain at 80 miles.

The 30-kilowatt (40-horsepower) C30 microturbine runs on diesel fuel (or biodiesel). The generator it powers is mounted on the same shaft, supported by air bearings, meaning no lubrication is required. There's also no radiator needed for cooling.

Capstone claims the turbine runs so clean that its exhaust needs no aftertreatment to meet U.S. Environmental Protection Agency regulations, or the even tougher limits of the California Air Resources Board.

Capstone Turbine CMT-380 concept car

High speeds, many fuels

The Capstone turbine uses a so-called recuperator (or air-to-air heat exchanger), that extracts heat energy from the exhaust stream and recycles it to preheat the air entering the combustion chamber, increasing efficiency.

Turbines can run on a huge variety of fuels, including diesel, biodiesel, kerosene, propane, natural gas, and even waste methane from landfills.

But the main advantage to a turbine is that it runs cleanly and efficiently at steady ouput, at extremely high speeds (up to 96,000 rpm for the C30). Just think of jetliners, which accelerate from idle to high power, take off, throttle back, then run their engines at steady speeds for hours.

Achilles Heel: power cycling

But the standard driving "duty cycle" of a combustion engine, on the other hand, requires a much wider power range. Accelerating a 2- or 3-ton vehicle away from a stoplight in less than 10 seconds can take up to 20 times the power needed to keep it cruising at 60 mph on a level highway. Gasoline engines have evolved over a century to handle these competing needs most efficiently.

As Chrysler learned in the Sixties, when it released 56 prototypes of its elegant Chrysler Turbine coupe for real-world tests by roughly 200 drivers, turbines are not necessarily suited to rapid acceleration cycles of varied driving.

Chrysler's test cars suffered from throttle lag, very high exhaust temperatures, and mediocre fuel economy (17 mpg) from their 97-kilowatt (130-horsepower) turbine engines, which powered the car through a standard automatic transmission.

Using a turbine as a steady-speed source to generate electric power, on the other hand, lets it operate most efficiently and at close to its maximum output.