

Green Power For The Planet's Biggest Polluters

University of British Columbia



Westport Innovations, a small company in Vancouver, British Columbia, is driving a change in the way the world powers its buses and trucks, which are a major source of urban air pollution and greenhouse gases in industrialized areas around the globe.

Air pollution casts an ugly cloud over the world's largest cities, hanging over crowded highways in places like Sao Paulo and Mexico City. Trucks and buses alone contribute more than 20 percent of total particulate air pollution around the globe. These heavy-duty vehicles are usually powered by diesel engines, long a favorite of manufacturers and suppliers of commercial vehicles because of their characteristics, which combine robust performance with energy-efficiency. Unfortunately, the engines also are a major source of urban air pollution.

For the air quality regulation authority in Los Angeles, the "last remaining beachhead" to cleaning up air pollution in the area were the ports of Los Angeles and Long Beach. Together, the two ports contribute 9 percent of the smog; 12 percent of the particulate matter pollution, or soot; and 45 percent of the sulfur oxides, or acid rain air in Greater Los Angeles, according to the ports' Clean Air Action Plan.

Westport Innovations is working with the South Coast Air Quality Management District in Los Angeles to reduce particulate air pollution from diesel engines in the trucks that transport container cargo from the ports. The Vancouver, British Columbia-based company is helping government agencies and suppliers of vehicles around the world switch to a cleaner natural gas power while retaining the positive traits of diesel.

Westport's engines are developed around a technology called high-pressure direct injection (HPDI), invented by Philip Hill, an emeritus professor of mechanical engineering at the University of British Columbia in Vancouver. Hill wanted to preserve the characteristics of the diesel engine that made it popular, while reducing its harmful by-products.

"Diesel has amazing fuel flexibility and energy efficiency, but, unfortunately, these engines also produce disproportionate amounts of air pollution," says David Demers, founder and chief executive of Westport. "If we could start with a cleaner fuel, inevitably we would get few problems coming out of the tailpipe."

Hill explains: "There was a serious defect in the diesel engine, and that was the emission of particulates and nitrous oxide, and that demanded a solution."

Hill dedicated his career to working out a solution, starting in the early 1980s, with funding from the Canadian Science and Engineering Research Council and the Science Council of British Columbia. Most common engines are spark-ignited, and most gasoline-powered cars today use a three-way catalyst that reduces dangerous emissions, but these catalysts are not useful for diesel engines.

HPDI was the answer. It allows diesel engines to use a cleaner fuel without sacrificing performance. Injecting a small amount of diesel pilot fuel into the combustion chamber before a main injection of natural gas starts combustion, preserving performance, but with much lower emissions.

Hill knew his discovery could greatly improve the quality of the very air that we breathe. Originally, his goal was to repower the bus fleets in North America. Eventually, this was expanded to potentially include all heavy-duty transport engines around the world.

In 1995, the University of British Columbia introduced Hill to David Demers, a successful entrepreneur, and Westport Innovations was born, built around the core technology of HPDI. It now owns more than 200 patents. Demers says the original plan was to further develop and demonstrate the benefits of the technology, and license it to diesel engine companies around the world. But it turned out to be more complicated than that.

"It's the classic story of a new technology company that discovers there is no market for their fantastic new idea," he says. "Most people didn't understand how this innovation could be important to their future."

Facing the market realities, the company targeted a few of the leading engine companies active in the California transit bus market. Demers says the management team knew it would need a complete solution for vehicle fleets, including new fueling infrastructure and gas suppliers, in order to create a market that could use its technology.

"We could've set up as a new engine company and compete with the existing industry, but we would need a new plant, new vehicles, new support channels — a tremendous investment and a lot of risk involved," Demers says. "It made more sense for us to try to partner with companies that already had that expertise and those support channels in place."

The industry at the time was experiencing excess capacity around the world and competition was fierce, according to Demers. So it made sense for major diesel companies to work with Westport on a niche market like natural gas,

enabling them to focus on their core business. Companies that used the Westport technology had a competitive advantage. The Westport engines burned cleaner but they still had the workhorse properties of old-fashioned diesel.

To solve the infrastructure problem, Westport partnered with the natural gas company BCGas (now Terasen) in British Columbia to build the infrastructure necessary to meet the needs of commercial fleets around the world. This included new natural gas fueling stations in Southern California and elsewhere. This venture, now called Clean Energy Fuels, is the largest supplier of natural gas vehicle fuel in North America.

Today, Westport is developing technology with Cummins, Ford, BMW, Isuzu and many others. Uncertainty about access to secure oil supplies, combined with more stringent air quality standards, has created a demand for Westport technologies.

“*Stricter regulations pose tough challenges for city governments, making natural gas attractive because it costs less and produces fewer emissions.*”

Demers notes that most pollution comes from transportation, and most fuel consumption, in general, is by heavy vehicles. China and India, the world's two fastest growing economies, must build transportation infrastructure to meet their economic goals, and yet are challenged by environmental regulations. Westport helps suppliers of heavy vehicles meet the regulations and at the same time keep a check on soaring oil prices.

Westport has partnered with Cummins to become Cummins-Westport, in order to leverage Cummins' global manufacturing, distribution and support network. Cummins does the manufacturing at plants around the world; Cummins-Westport does the engineering and marketing. Demers says Westport will try to replicate that model with other companies in other parts of the world.

Demers has seen a change in attitudes from global vehicle manufacturers and energy suppliers, and their customers, regarding global climate change. He says they are convinced that something needs to be done about greenhouse gas emissions. And he feels a certain pride in the contributions of Westport.

“I think we are already changing the world,” he says. “We've seen material improvements in air quality in every place we've shipped — and we've shipped more than 14,000 engines to heavily populated areas around the world.”

This story was originally published in 2007.

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