



# HTEC

## Zero-Emission Medium and Heavy Duty Vehicle Adoption Case Study

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 CLEAN ENERGY CANADA

## Tell us a little bit about the company.

HTEC works across the hydrogen value chain. The company produces, distributes, and owns/operates hydrogen refuelling stations as well as procures and leases heavy-duty trucks that run on hydrogen.

Currently, HTEC has five light-duty hydrogen refuelling stations across BC and is developing several low carbon hydrogen production facilities, as well as hydrogen refuelling stations for heavy-duty vehicles.

## Tell us a little bit about the company's current hydrogen pilot projects.

**HTEC is currently executing two heavy-duty fuel cell electric truck (FCET) demonstration projects.** The first is the BC H2 Ports Project, and the second is the BC H2 Pilot Project—both of which involve leasing out fuel cell electric trucks to fleet operators. Each project will deploy six heavy-duty fuel cell trucks. Out of those, 11 are class 8 trucks and one is a class 7 vehicle. All of the 12 trucks have been ordered and will be delivered in the coming months. HTEC will incorporate one of these Fuel Cell Enabling Technologies (FCET) to distribute hydrogen fuel to our various station locations, supporting our efforts to further decarbonize our operations. All of the trucks will operate in the Greater Vancouver area and will be fuelled at a hydrogen refuelling station in Tsawwassen.

For the BC H2 Ports project, HTEC has partnered with Aquatrans (on the drayage side of the operation) and HarbourLink. HTEC will operate one truck, Aquatrans will operate two, and Harbourlink will operate three. HTEC will own all of the vehicles and will be leasing/loaning them to the operators. The six pilot trucks will each be leased to six different fleet operators.

HTEC's Vehicle Leasing Corporation (VLC), a wholly owned subsidiary of HTEC, will lease the heavy-duty fuel cell electric trucks (FCETs) to fleet operators. The VLC aims to provide fleet operators with a fully supported, comprehensive service designed to facilitate the integration of FCETs into their fleets. As part of the BC H2 Pilot project, HTEC has signed several lease agreements, each spanning one to three years with the possibility for extension. Some of the fleet operators include: Nortrans, TripleEight Transport, Arrow Transportation Systems, and Speedoline Transport.

**HTEC is working with various Original Equipment Manufacturers (OEMs) who will provide class 7 and 8 fuel cell electric vehicles.** This includes well-established vehicle manufacturers that are building up manufacturing to produce purpose-built hydrogen vehicles, as well as "vehicle integrators" that are incorporating zero-emission technology into existing vehicle platforms.

Currently, no OEMs are providing ready-made fuel cell vehicles for large 63.5 tonne tractors, but we see this as an important platform for B.C. We are working with a Canadian integrator to deliver this type of vehicle.

**HTEC's aim is to bring down the leased cost of the vehicle to near what a fleet operator would pay for a conventional diesel vehicle, with a modest "green premium" to the fleet operator.**

HTEC plans to build on these two projects by procuring an additional 100 fuel cell trucks and has collected letters of intent to deploy over 170 vehicles, demonstrating interest from fleet owners/operators in using fuel cell trucks. These additional vehicles will further catalyze the zero-emission heavy-duty vehicle market in B.C. HTEC sees this as the next step in scaling up the hydrogen mobility sector and showcasing the benefits of fuel cell electric trucks. The trucks will be operated by multiple fleets, enabling learning and experience for many organizations pursuing decarbonization. These trucks will be deployed in concert with HTEC's growing network of hydrogen refuelling stations and production facilities, which will expand beyond Metro Vancouver to include Vancouver Island, the Southern Interior, and Prince George. These steps will make it easier to deploy fuel cell electric trucks in B.C. and remove key barriers to entry for fleet operators. HTEC's network will serve as a launching pad for the heavy-duty hydrogen vehicle market and enable decarbonization of one of the hardest to abate sectors.

## Why hydrogen as a powertrain choice?

Hydrogen vehicles can be operated in essentially the same way as conventional internal combustion engine vehicles. They are refuelled at stations much like gasoline or diesel filling stations and it takes a comparable amount of time to refill the tank.

The operators that are leasing these vehicles are going to test how these vehicles fare in their daily operations. But generally speaking, the daily range that is being travelled is long (e.g. 700 km on diesel vehicles and operators are looking for something equivalent), and there is a requirement for fast refuelling with a high payload.

Some of the fuel cell trucks are a bit heavier than their diesel counterparts, but lighter than their battery-electric equivalent. For those operators focused on maximizing their payload in a large truck, this can be important. Since B.C. transportation regulations limit the total weight of tractor-trailers, increasing the weight of tractors leads to a reduction in the payload a single tractor-trailer can transport. Since hydrogen vehicles are lighter than battery electric vehicles, this creates an advantage for hydrogen tractors in some applications.

There are lower maintenance requirements with a fuel cell vehicle. Similar to battery-electric vehicles there are fewer moving parts so there should be reductions in maintenance costs as well. While there is more complexity than the battery-electric vehicle, it is still less than a diesel vehicle.

It is clear that both battery-electric and hydrogen vehicles will have a huge role to play in decarbonizing the transportation sector. HTEC sees battery and hydrogen technologies as complementary and that they will each play an important role in the market.

### What have been the best benefits of offering zero-emission technology for fleets?

For all the institutions involved in the projects, decarbonization is a key measure for them. The fleet operators that signed the letters of intent either have a decarbonization target or are motivated by decarbonizing their operations. In addition, it's not just reducing carbon emissions, but also reducing other air pollution contributors such as nitrogen and sulfur oxides.

A primary motivator has been to gain experience and learn from using hydrogen fuel cell vehicles. A lot of the fleet owners/operators know that the B.C. government is looking at implementing a zero-emission MHDV sales regulation. The fleets see this as an opportunity to get ahead of the curve.

### What have been the challenges?

**1) Vehicle specifications.** Each jurisdiction has specific requirements for on-road vehicles to ensure safety and the integrity of our roads. The OEMs producing zero-emission vehicles are tailoring their designs to leading markets in the space. Motivated by our demonstration projects, the OEMs are working with HTEC to make sure their vehicles comply with BC. restrictions. HTEC's hydrogen infrastructure creates an attractive market for fuel cell electric trucks and the OEMs are responding quickly to ensure they can supply the region. The B.C. government has also worked to make zero emission vehicle adoption easier by making certain regulatory accommodations—for example, by increasing the allowable gross vehicle weight by 1,500 kg for electric and hydrogen vehicles to help mitigate the impact of increased tractor weight (Ministry of Transportation and Infrastructure Compliance Circular No. 03-21).

**2) Costs for the hydrogen vehicles and supply chain.**

Currently the vehicles are expensive and the supply chain is also expensive for the hydrogen sector. Support from the government to incentivize and subsidize the projects has been critical. These

investments now enable a lower cost in the future by building through economies of scale. Getting started is the difficult part.

**3) Building hydrogen infrastructure is tricky at a small scale.** Unlike battery-electric where there is one charger at the facility or at a public charging station, doing this for one fuel cell vehicle can be difficult. Therefore, HTEC is trying to do this with its own distribution and station assets all at once. HTEC is simultaneously developing hydrogen production facilities, fueling stations, and hydrogen demand (trucks) to make sure the entire ecosystem is built up together, and so one component of the supply chain doesn't significantly outpace the others. By building up the sector as a whole we can ensure continuity and match supply with demand. HTEC is learning from California's experience, where a more siloed approach left gaps that have stunted expansion such as supply availability. Still, it can be challenging to align all the projects and timelines together.

### How did you implement the right infrastructure for the project?

One of the key pieces of work with hydrogen infrastructure has been ensuring the refuelling stations are in accessible and practical locations. For refuelling stations, one solution has been to leverage existing gasoline and diesel infrastructure with an experience that is similar to conventional fuelling. Currently, the light-duty hydrogen refuelling stations are co-located at Esso and Shell stations, and HTEC pays a site license to operate at those stations.

On the heavy-duty side, HTEC is looking to do similar things. The first heavy-duty hydrogen refuelling station will be located in Tsawwassen at a Chevron commercial cardlock site where trucks already go to refuel. This will enable the operations of fleets today. None of these sites are purpose-built for hydrogen refuelling. This might be more common in spaces like transit which has dedicated refuelling for its buses, but not as much in the trucking space.

One benefit with hydrogen fuel is that one does not need to have facility-specific production, like battery-electric vehicles with electricity. Hydrogen trucks can continue to operate in essentially the same way as diesel vehicles—they are stored in a depot and fuel at stations. Battery electric trucks typically require chargers at their depots and many don't have sufficient electrical infrastructure to support their fleet. Significant upstream electrical upgrades may be required from the utility to support battery electric truck deployments at scale.

Additionally, the fuelling experience at a hydrogen refuelling station is comparable to diesel. It takes a similar amount of time to refill the on-board hydrogen tanks at a station as it does to refuel a diesel vehicle.

The site for hydrogen production is also important. For hydrogen produced via electrolysis, there needs to be a lot of electricity, clean water, and the site needs to be zoned for that type of facility. HTEC is technology agnostic when it comes to hydrogen production, but one of the key caveats is that the hydrogen produced needs to be low carbon intensity hydrogen—this could include natural gas with CCUS produced hydrogen or electrolysis.

Currently, HTEC is only working in the “green” hydrogen space (or electrolysis). There are three electrolyzers planned for B.C. to provide local load. In addition to the three electrolyzers, HTEC is co-locating a clean hydrogen liquefaction facility at an existing ERCO Worldwide sodium chlorate plant in North Vancouver. Low-carbon byproduct hydrogen vented from the existing industrial plant will be liquified for use as a clean transportation fuel. The facility will produce 15 tonnes per day of clean liquid hydrogen to supply HTEC’s network of hydrogen fueling stations across B.C.

### What programs and incentives did you use?

Both the BC H2 Port Project and BC H2 Pilot Truck Project have been funded in part by the province of B.C. from a variety of sources. HTEC has signed contribution agreements for the BC H2 Port Project project with the province of B.C.’s Commercial Vehicle Pilot Program, and B.C.’s Advanced Research and Commercialization Program.

The B.C. Low Carbon Fuel Standard (LCFS) has been very impactful, and it is one of the reasons why B.C. is ahead of many other parts of the world when it comes to hydrogen and other low carbon fuel development. The program has supported the installation of key infrastructure through initiative agreements and helps bring down the cost of hydrogen through ongoing credit generation. **The federal Clean Fuel Regulation (CFR) is similarly helping to bring down the cost to the end user. Today, the price of hydrogen at HTEC’s light-duty hydrogen refuelling stations is \$14.70/kg, which enables fuel cost savings to drivers on a per-km basis compared to gasoline vehicles.**

For the BC H2 Pilot project, HTEC received funding from the B.C. Innovative Clean Energy Fund. It is important to note that some programs are not stackable with others. For example, NRCan’s ZEVIP and Transport Canada’s iMHZEV program might not be stackable with all of the province’s programming, so it is important to keep note of this.

Regulated sales targets for MHDVs such as B.C.’s proposed targets would be instrumental in driving zero-emission technology adoption in the MHDV sector. There is only so much B.C. can do on its own, but aligning with other states in the U.S. that have implemented regulated sales targets is helpful.

Some programs like the Innovative Clean Transit Program in California required public transit fleets to put together a plan for how they were going to fully transition to zero-emission technology. That encouraged long-term thinking by transit agencies to improve the likelihood of success. Fleets can come to different conclusions when they think about how to convert the whole fleet versus how to convert the first five vehicles. That might mean a mix of both battery-electric and hydrogen fuel cell vehicles for the more difficult to decarbonize vehicles or routes. This kind of programming requirement has led to more hydrogen deployment in California. It could be a model to look at things more holistically and have a longer term view with its own advantages.

### Did you hire any new staff or did current staff change their day-to-day operations for this transition?

HTEC is working with the Velocity Truck Centre at their hydrogen bay where there will be training available onsite. Each OEM has reps that they will be sending to train the fleets’ engineers. HTEC will also be doing driver training at that site to understand refuelling practices and will be taking the drivers out to do test runs. This is built into a program that HTEC has developed. Currently, there is no university or industry association that offers this type of training so HTEC is building it into a key part of their business.