Challenges with the Largest Commercial Hydrogen Station in the World

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Challenges with the Largest Commercial Hydrogen Station in the World

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Abstract

This abstract's objective is to share with the participants the story of the largest hydrogen fuelling station made to this date and to kick-start the story, we will cover the challenges; first the technical ones; the operational ones; the distribution ones and; the financial ones. We will then move on to review the logistic (geographic) issues raised by the project and conclude our presentation by sharing the output values of the largest fuelling station built so far in the world.

1 The Challenges

First and foremost the challenges were linked to the transit operator technical specifications, the station needed to be installed and permitted in a city that did not have any experience with hydrogen before, it also needed to fill one transit bus (46 kgs) in less than 10 minutes, an equivalent of the time taken by current operators to fuel a diesel bus. Product quality was also important, the quality of the product at the nozzle needed to meet the SAE J2719 specifications despite the fact that the SAE specification was not going to be finalized and approved as a standard for another 4 to 5 years. The station needed to be available 99.9% of the time and provide transfers at 350 bars in a safe manner, training for operators and drivers was not to take more than 2 hours to familiarize them with the safe fuelling of a bus. Intelligent redundancy became more and more important during the design stage of the station.

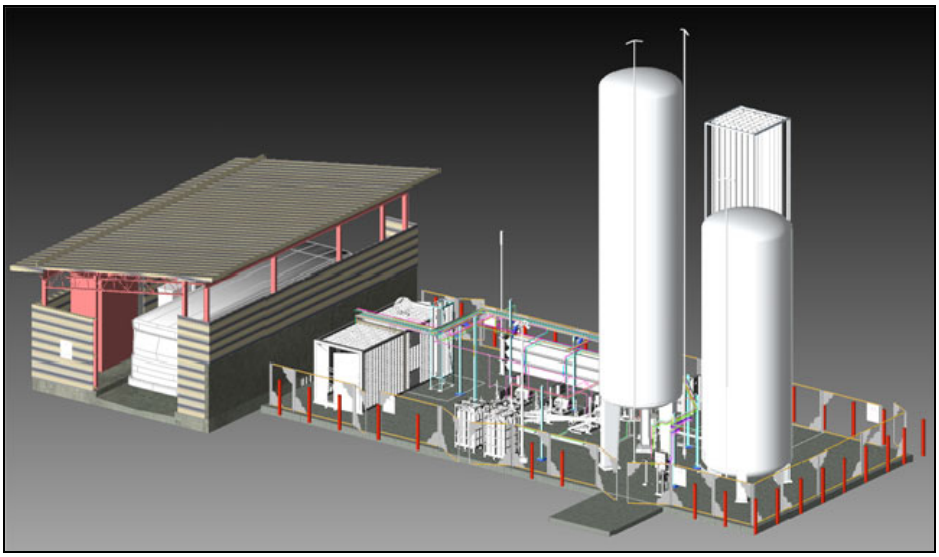

Figure 1: Whistler refuelling station design.

On the operational challenges, hydrogen as a fuel was to be as user friendly as diesel, therefore fuelling of the fleet needed to take place in any three-hour window, i.e. 18 consecutive fills in 3 hours or less. Use of the dispenser was to be as easy as any other refuelling experiences and ID verification, pre-fuelling steps and ID recognition needed to be as easy as swiping an RFID tag in front of the reader. One could appreciate the fact that moving 20 buses in a yard early in the morning or late at night could be a logistic nightmare, it is more important to ensure the flow of hydrogen vehicles going to the fuelling station is constant in order to reduce any potential product losses at the station.

Canada being a large country, we also had to solve distribution challenges as the liquid hydrogen trailer was to travel 4500 kilometres between the liquid plant and the fuelling station site. Ensuring timely deliveries, back-up plans in case of road restrictions, road accidents and weather conditions became a very important element of the fuelling station uptime. A back-up plan was carved, intelligent redundancy developed, remote monitoring and operating of the station implemented, a larger than required storage was also implemented ensuring complete autonomy for the 2010 Olympics. The Olympics and the security surrounding them added one more level of difficulty to the overall distribution issues identified, restricted access during the Olympics, additional security checks, additional volumes of passengers, unknown bus usage data, etc. all these helped produce more sleepless nights.

Figure 2: Liquid hydrogen delivery to Whistler refuelling station.

The financial challenges of the project were to ensure alignment of pre-project estimates versus the hard spent construction costs, commissioning costs, babysitting costs during the Olympics and distribution costs. The fuelling station needed to be a win-win project, allowing the transit operator to reap the benefit of the new technology and its fuel cell efficiencies while the industrial gas supplier who took a lot of risks would see the project materialize on target as to construction costs. We are all aware that operating cost is the most important element of any transit operator, in the case of hydrogen fuel cell buses, we know that the efficiency of the fuel cell bus will be double the one of the diesel bus, it is therefore important to maintain the rest of the operating costs as low as possible or as close as possible to the current ones. Fuelling time and fuelling station downtime should be better or equal to what the transit operator experienced in the past. This is what we have managed to reproduce on the west coast of Canada.

2 The Outcome

After civil work preparation has been completed, the refuelling station construction was initiated in September 2009 and lasted for 2 months. After completion of commissioning, the first liquid hydrogen delivery took place on November 13th 2009 and the first filling event with a BCT bus occurred on November 16th 2009.

Since busses were delivered to the site progressively, December and January were used to ramp up the normal operations.

The official opening ceremony took place on January 22nd 2010 with the support of Whistler's Mayor and the presence of the government of British Columbia, more than 100 people attended the event.

Figure 3: Fuel cell busses line-up at Whistler refuelling station.

Since the beginning of the project, the number of busses ramped up steadily up until a few weeks before the Olympics. During the Olympic Games, the busses were used in standard

transit operations and the users as well as the drivers enjoyed a quite ride producing zero emissions.

Mid of April, the buses had travelled more than 275,000 kilometres and more than 1350 fuelling events performed since the beginning of the project mid-November 2009.

Vehicle ID	Vehicle Odometer (Km)
1000	22404
1001	12334
1002	17717
1003	13916
1004	16066
1005	17916
1006	14482
1007	15522
1008	14770
1009	15561
1010	11636
1011	7739
1012	7665
1013	9676
1014	15271
1015	14999
1016	6454
1017	14111
1018	14668
1019	13745
TOTAL	**276652**

Month	Number Of Fills	Quantity (kg)
Apr 2010	275	7590
Mar 2010	485	13208
Feb 2010	332	7766
Jan 2010	166	2829
Dec 2009	102	1402
Nov 2009	25	482
TOTAL	**1385**	**33207**

Figure 4: Whistler refuelling station data - Updated on April, 19th 2010.

The drivers are all happy with the transition, the wash-bay operators, those who fill the buses every night do not see a huge difference between the diesel isle and the hydrogen isle in terms of speed or in terms of complexity, the buses are on the road and the passengers do not see any disadvantages, the noise level is way down in the bus, and the fleet of 20 buses will account for a reduction of green house gases in the neighbourhood of 1800 tons per year.

Buses can be filled in less than 10 minutes, the whole fleet can be filled in less than 5 hours, a normal transit operation in Whistler is now running on hydrogen, another step forward for our industry.

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