LPG Vehicle Initiatives

Introduction

In the mid-to-late 90's, air pollution in Hong Kong has become an issue attracting wide public concern. To alleviate the air pollution problem, one of the measures identified was to replace diesel vehicles with vehicles using cleaner fuel. An inter-departmental working group was established in September 1996 to study the feasibility in this regard. The working group considered liquefied petroleum gas (LPG) to be a readily available replacement for diesel and decided that a one-year trial on the use of LPG taxis should be undertaken to assess its feasibility and effectiveness in improving air quality.

The trial of LPG taxis was launched in November 1997 and LPG taxis were found to be suitable for operation in Hong Kong. There was also general support from taxi passengers for the introduction of LPG taxis. The Chief Executive has then announced in his 1999 Policy Address to require all new taxis to use LPG as its fuel from 2001 onwards and to replace all diesel taxis with LPG ones by end 2005 (Photo 1 & Figure 1).

Photo 1 - LPG Taxi

Figure 1 - LPG Vehicle Logo

LPG Vehicle Scheme

Under the LPG Vehicle Scheme, Electrical and Mechanical Services Department (EMSD) is closely involved in regulating all safety aspects and implementation of the Scheme. These include safety control and approval of fuel system on LPG taxis, LPG filling stations and LPG vehicle workshops as well as establishing and maintaining a system of enlisted competent LPG vehicle mechanics. EMSD is also deeply involved in the development of LPG filling network through administrating the construction of new dedicated LPG filling stations and retrofitting suitable petrol filling stations with LPG filling facilities. Below are some of the details relating to the current development of the Scheme:

- At present, there are over 17,000 LPG taxis running on road, representing over 90% of the entire 18,000 strong taxis fleet;
- 44 LPG filling stations including 12 dedicated station, 31 combined (retrofitted) Petrol/LPG stations and 1 temporary station are in operation to serve the LPG vehicles;
- The lowest auto-LPG pump price at dedicated LPG filling stations is $1.94 per litre in May 2003;
- 24 commercial LPG vehicle repair workshops are in operation and 3 more workshops are under construction;
- Over 800 LPG vehicle mechanics have been enlisted as competent persons for repair and maintenance of the fuel system of LPG vehicles under the Gas Safety Ordinance.

Success Factors

The conversion programme of diesel taxis to LPG ones has progressed well in recent years. The major contribution factors are summarized as follows:

(a) ***Successful Trial Run*** – Government launched a trial run of 30 LPG taxis in 1997 for a period of one year to collect necessary operational data including fuel consumption, repair and maintenance requirement and driver's & passenger's feed back. The trial run suggested that it was technically feasible to replace diesel taxis by LPG ones in Hong Kong on a large-scale basis.

(b) ***Safety*** - EMSD commissioned a consultancy study on "Quantitative Risk Assessment Study on Gas Vehicles and Associated Infrastructures in Hong Kong" in 1998 to assess the risk levels of LPG vehicles in tunnels, car parks and workshops, and the associated risks from LPG filling stations, import terminals and bulk transport of LPG. It was confirmed that the engineering safeguards for LPG taxis were adequate and the replacement of diesel taxis fleet by LPG ones would be acceptable on risk and safety ground.

(c) ***Public and Government Support*** – A public consultation on "A Proposal to Introduce LPG Taxis" has received support from the public at large after the trial run. The Government has decided to stop importing diesel taxis after year 2000 and announced the provision of $40,000 grant to encourage diesel taxi owners for early replacement. Owners of diesel taxis that were seven years old or above by 31 December 2001 had to apply before the same day to be eligible for the grant.

(d) ***Availability of LPG Taxi Models*** – Up to now, EMSD has given type approval to 4 LPG taxi models of which two are imported from Japan and are now commonly found in Hong Kong. The selling price of LPG taxi is comparable to that of diesel, or even lower.

(e) ***Provision of LPG Filling Network*** – The Government has provided adequate LPG filling capacity for the entire fleet of LPG taxis. At present, 44 LPG filling stations are in operation providing sufficient filling capacity for all the 18,000 taxis (Photo 2).

Photo 2 - LPG Filling Station

(f) ***Lower Price of Auto-LPG*** – The auto-LPG price, which is duty free, at dedicated LPG filling stations is subject to a price cap. The adjustment of the ceiling price is based on a pricing formula specified in each contract. The formula comprises two elements, namely LPG international price and LPG operating cost (the Composite Consumer Price Index). Although the auto-LPG price at retrofitted stations is not subject to the same calculation method, oil companies would also adjust their price accordingly in order to maintain their competitiveness in the market.

(g) ***Provision of LPG Vehicle Workshops*** – Besides refueling of LPG vehicles, the repair and maintenance services for the fuel system of LPG vehicles are equally important. It is necessary to set up proper LPG vehicle workshops to support the LPG vehicles. EMSD has issued a set of safety requirements for LPG vehicle workshops servicing the fuel system of LPG vehicles. At present, 24 commercial workshops are in operation (Photo 3) and some more are under construction. It is expected that the number of approved LPG vehicle repair workshop will increase in commensurate with the age and growth of LPG vehicles.

Photo 3 - LPG Vehicle Workshop

(h) ***Qualified LPG Vehicle Mechanics*** – For proper repair and maintenance of the fuel system of LPG vehicles, it is necessary to ensure that the vehicle mechanics are competent to carry out the works. EMSD, together with the Vocational Training Council (VTC), have organized a number of appropriate training courses on LPG vehicle servicing in the VTC Kwai Chung and Lee Wai Lee Training Centres. Up to now, more than 800 mechanics have been enlisted as competent persons under the Gas Safety Ordinance for the repair and maintenance works on the LPG fuel system of vehicles.

Safety Features of LPG Filling Station

A LPG filling station is classified as a Notifiable Gas Installation under the Gas Safety Ordinance Cap. 51. Approvals by the Gas Authority of its construction and use are required. As part of the construction approval process, a Quantitative Risk Assessment is required to demonstrate that the risk levels associated with the station are in compliance with the Government Risk Guidelines.

To ensure the safe operation of LPG filling stations, all operators of the stations and LPG road tankers must receive proper training provided by registered gas supply companies for LPG filling operation as well as emergency response. All LPG filling stations are also required to be equipped with the following safety features (Figure 2):

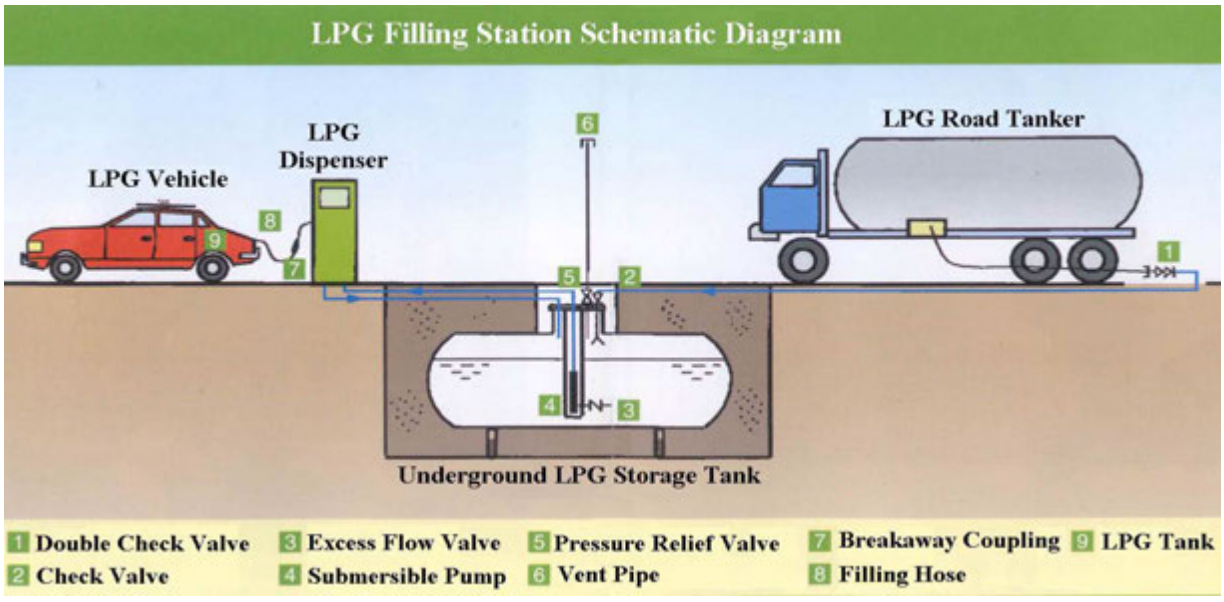

Figure 2 - LPG Filling Station Schematic

(i) ***LPG Storage Tank*** – The tank is designed and constructed in accordance with international pressure vessel standards such as PD 5500 or AS 1210. It is designed to a minimum pressure of 1.725 MPa and a minimum design temperature of –10°C. It is installed underground in an individual concrete chamber filled with washed sand to minimise any possible external damage. The LPG storage tank is protected by corrosion resistant coating and equipped with a cathodic protection system to prevent corrosion of the tank.

(ii) ***Submersible Pump*** – LPG pump is installed inside the LPG storage tank so as to reduce the amount of space required, the chance of tampering and impact by vehicles.

(iii) ***Pressure Relief Valve*** – It is connected to the vapour space of the LPG tank for relieving excessive pressure during abnormal condition when the LPG tank is subject to fire or other heat source. LPG will be safely discharged to the atmosphere by means of individual elevated vent pipe at least 3m above ground level and 2m above the LPG storage tank.

(iv) ***Excess Flow Valve*** – It is installed at the outlet of the LPG tank to shut off the flow of LPG under abnormal conditions. e.g. pipeline rupture.

(v) ***Check Valve*** – Check valve is installed at inlet port of the LPG storage tank whilst double check valve is installed at the inlet LPG filling pipeline to prevent gas leakage even if the pipeline is broken.

(vi) ***Dispensing Nozzle*** – The dispensing nozzle is provided with coupling threads of 1 3/4" x 6 T.P.I ACME form such that it cannot be disengaged inadvertently during the dispensing operation. A double-check arrangement is also provided at the dispensing nozzle to prevent gas leakage.

(vii) ***Breakaway Coupling*** – The coupling is installed at the LPG filling hose for preventing damage to the LPG dispenser in case the driver accidentally drives away the vehicle when the dispensing nozzle is still engaged to the vehicle.

(viii) ***Remote Emergency Shut-down Button*** – Emergency shut-down buttons are provided at various locations of the LPG filling station including the extended fill connection, LPG storage tank, dispensing area and sales office, for shutting down the whole LPG dispensing system in the event of emergency.

(ix) ***Water Sprinkler System*** – Water sprinklers are installed to cover the fill connection at road tanker unloading point and the floor/surface area of LPG dispensers to provide automatic fire fighting in case of gas leakage or fire;

(x) ***Gas Detection System*** – Gas detectors are provided at different locations of the LPG filling station. The system would give audible alarm and activate the water sprinkler system when LPG leakage is detected. It would also give signal to Fire Services Communication Centre.

Conclusion

In promoting the use of auto-LPG, the Government has taken into account of the critical success factors behind a commercial market. The most important factor is the financial incentive provided to potential auto-LPG vehicle owners, i.e. payback period on the initial investment and the availability of refueling network. As noted from the information above, the Government has provided adequate incentives for the taxi owners to switch to the LPG option and also provided adequate LPG filling capacity for the entire fleet of 18,000 LPG taxis.

Apart from LPG taxis, the Government has also provided an incentive scheme to encourage existing diesel public

and private light bus owners to replace their vehicles with ones that run on cleaner fuels including LPG in order to further improve the air quality in Hong Kong. At present, there are already over 500 LPG light buses running on the road and the number is gradually increasing (Photo 4).

Photo 4 - Clean Fueled Light Bus

EMSD will continue to provide support on setting up the necessary infrastructures and supporting facilities for LPG light buses by working closely with the vehicle trades, the oil companies and other relevant parties. Most importantly, EMSD will continue to ensure that the safety standards of these supporting infrastructure and support facilities are properly maintained so that public safety is always ensured.

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