JULY 21, 2019

EMERGING STANDARDS FOR LIQUIFIED NATURAL GAS PRACTICES

PITPOINT.LNG

Co-financed by the Connecting Europe Facility of the European Union

Emerging Standards for Liquified Natural Gas Practices

1. Introduction

In order to create a successful large-scale network of LNG fuelling stations within Europa, a high degree of alignment and interoperability is necessary. As the geographical scope of the project covers six different European Member States, standardisation is needed to build sound business cases.
Activity 5 of the LNG motion project aims to contribute to the harmonisation of practices involving LNG refuelling stations. As part of this activity, a desk study has been performed and an overview of the technical, operational, environmental and regulatory practices, including an indication of current best practices is prepared.

In addition to carrying out desk study, PitPoint.LNG has been participating in the pan European member states working groups steered as part of the CEN/TC 326 Natural Gas Vehicles - Fuelling and Operation standards (https://www.cen.eu/news/brief-news/Pages/NEWS-2018-027.aspx). Moreover, PitPoint.LNG is chairing various National and European working groups to coordinate and structure these emerging standards for LNG practices. Results from these stakeholder dialogues are incorporated into this report.

Furthermore, a second study has been prepared to develop the best payment system. At the moment, there is no EU wide payment system for LNG refuelling stations. A harmonised, customer friendly payment system will contribute to the uptake of LNG as alternative fuel for heavy-duty transport.
In this report the results of the study are presented. First an overview of the technical, operational, environmental and regulatory practices, including an indication of current best practices is provided. Secondly, the assessment of a best payment system for an LNG refuelling station is presented.

2. Standards for Natural gas fuelling stations

To address issues regarding interoperability, PitPoint.LNG has been actively involved in the workgroup of the Alternative Fuels Infrastructure Directive (AFID).
The AFID Directive is a European directive on the deployment of the alternative fuels' infrastructure (Directive 2014/94/EU) and was published in 2014 as part of the 'Clean Power for Transport' package. Natural gas - compressed natural gas (CNG) and liquefied natural gas (LNG) - is one of the alternative fuels that is addressed in this directive.
The most important goal of the Alternative Fuels Infrastructure Directive (AFID) is to establish a European network of fuelling stations without issues regarding interoperability. A few issues addressed in this directive will be discussed here.

Firstly, in order to create an integrated network, the filling nozzles need to be compatible all over Europe. For LNG this has already been established and published in the following ISO standard: ISO 12617:2015 Road vehicles -- Liquefied natural gas (LNG) refuelling connector -- 3,1 MPa connector https://www.iso.org/standard/51568.html.

Other operability aspects for LNG fuelling stations are written down in the standard for LNG fuelling stations: ISO 16924:2016 Natural gas fuelling stations -- LNG stations for fuelling vehicles https://www.iso.org/standard/57960.html. This standard specifies the design, construction, operation, maintenance and inspection of stations for LNG to vehicles, including equipment, safety and control devices. In addition, it also specifies the design, construction, operation, maintenance and inspection of fuelling stations for using LNG as an onsite source for fuelling CNG to vehicles (LCNG fuelling stations), including safety and control devices of the station and specific LCNG fuelling station equipment.

Meanwhile, the ISO 16924:2016 standard has been taken over by the European standardization body CEN and has now become an EN-ISO standard: https://www.cen.eu/news/brief-news/Pages/NEWS-2018-027.aspx. A technical report which explains how to convert the normative references into the European equivalents has been added to this EN ISO standard: Natural gas fuelling stations — Guidance for implementation of European standards on CNG and LNG stations for fuelling vehicles.
https://standards.cen.eu/dyn/www/f?p=204:22:0::::FSP_ORG_ID,FSP_LANG_ID:6307,25&cs=1BB4CFE1D72A670C68FCE5C031399995B.

Still there are some gaps in the interoperability. The following major issues are being addressed at the moment and have recently been published as proposal. These Include the following:

1. European harmonized training for LNG truck drivers, how to refuel
2. Standardized LNG unloading coupling
3. Standardized LNG unloading ESD system

3. Refuelling LNG

As the physical properties of LNG are completely different than diesel (e.g. the temperature of the liquefied gas lies around -162 degrees and it evaporates as soon as it comes into contact with outside air, becoming an odourless and colourless gas), extra precautions when refuelling with LNG need to be taken.
Besides the physical properties of the fuel, the refuelling steps are different as compared to diesel. At the moment, countries within the EU still apply different rules regarding training for LNG truck drivers. For example, in the Netherlands it is a legal obligation for drivers to follow an LNG refuelling training. Whereas in neighbouring countries this is not compulsory, posing challenges as most LNG truck drivers drive internationally.
The past year the Natural & Bio-Gas Vehicle Association (NGVA) Europe LNG Working Group has been preparing a standardized European LNG refuelling procedure for LNG vehicle drivers. In this LNG working group, different stakeholders contribute to developing standards for LNG practices. Participants of this working group include among others: almost all European LNG suppliers (including PitPoint.LNG), Original Equipment Manufacturers (OEMs), equipment suppliers and the NGVA.

Recently, the proposal for a standardized procedure has been published, the preliminary report can be found under downloads. The procedure is based on the LNG refuelling instructions prepared by the Dutch LNG platform and has been amended to cover all European LNG stations, in preparation of the CEN TC326 NWIP regarding Operational instructions for vehicles drivers.

FIGURE 1. SOURCE: PITPOINT.LNG

Inquiries with various LNG providers have shown that each party has developed its own pictograms. For LNG drivers operating at different LNG filling stations in different countries, this is confusing.
Therefore, new pictograms conform ISO 7010, the European standard for safety signs, have been developed. Part of the standardized fuelling procedure is the process of standardizing and harmonizing the icons that support the refuelling process. This will make the refuelling instructions more

recognisable and uniform across the different LNG suppliers, which will reduce the probability of (potentially dangerous) errors made by LNG truck drivers.

4. Payment system for LNG fuelling stations

A more customer friendly and standardized way of filling up trucks will contribute to the acceptance and uptake of LNG. The payment system for the use of LNG fuelling stations plays part in the successful uptake. The system needs to be easy to use by both truck drivers as well as the staff and operators of the LNG fuelling stations. As part of activity 5 of the LNG-motion project, a selected payment system was tested from a user and administrative perspective. Here the outcomes of the evaluation are discussed.

The payment system that has been tested during the project is a Tokheim payment system, specifically the Tokheim Crypto VGA™. The Crypto VGA™ is Tokheim's most advanced payment system today. It is an outdoor payment system with a touchscreen that guides the customer through the purchasing process. It currently can communicate in 17 different languages; the user can select the language at the start of the payment process. The payment method that was tested were Fuel Cards as this is generally the standard payment method for freight traffic. All transactions are fully reconciled with the indoor Electronic Point-Of-Sale System (EPOS) or site controller, real time, allowing the station operators to manage all aspects of their fuel business. The Crypto VGA provides a direct customer interface tool and the system passed the PCI UPT (v3) certification, which is a dedicated approval scheme for un-manned payment devices (anti-fraud protection).

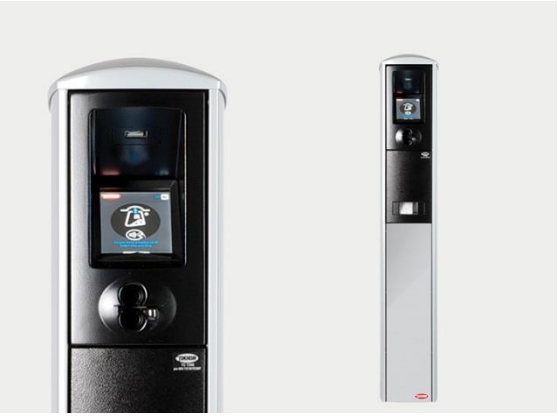

FIGURE 2 TOKHEIM CRYPTO VGA™. SOURCE: HTTP://TOKHEIM.COM/SYSTEM/CRYPTO-VGA/.

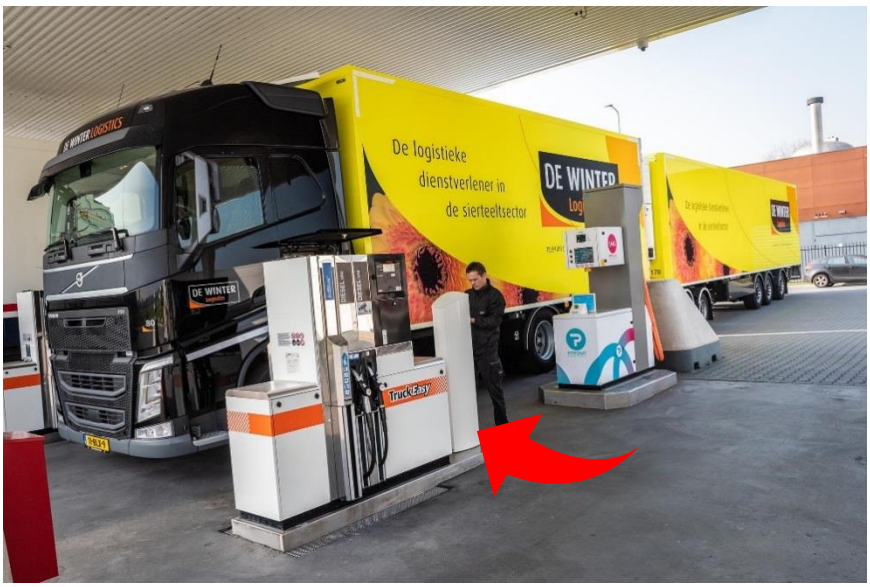

FIGURE 3 THE TOKHEIM CRYPTO VGA™ IN USE AT ONE OF THE PROJECT LOCATIONS (LNG SERVICE STATION IN VENLO)

When selecting a payment system for an LNG fuelling system, there are several important aspects to consider. Firstly, the system needs to be reliable. The number of LNG fuelling systems in Europe is still limited, consequently truck drivers are oftentimes highly dependent on specific station locations. For that reason, the payment system needs to have a high level of uninterrupted system availability.
Tokheim has a service network throughout Europe, contributing to system continuity as a technician can be on site quickly in case of any malfunction. In addition, Tokheim ensures high level of transaction security. Moreover, the system allows for broad card acceptance and more cards can be added to the accepted cards relatively quickly. In fact, the main reason for choosing the Tokheim payment system has been that, to the best of our knowledge, it is the only payment system on which practically all cards can be accepted. Accepting many different fuel cards is an important aspect when talking about customer friendliness of the station.
During the project a survey was send out to drivers who refuel at one of the project locations. The survey results showed that the main challenges users face include card acceptance, poor station network coverage and station availability.
Currently, transport companies need multiple fuel cards to refuel LNG as cross card acceptance is still limited. Especially international carriers encounter this issue often because the different European Member States have in part different LNG suppliers. These findings underline the importance of cross acceptance and system continuity.

In conclusion, a suitable payment system for LNG fuelling stations should have the capacity to accept a broad range of fuel cards and payment options. In addition, high uptime must be guaranteed. The real-life trials with Tokeheim's Crypto VGA™ proved positive and indicate that the system meets these conditions.