Openbare Samenvatting / Public Summary
TELN116057 - Ontwikkelen van een meet- en regelsysteem voor LNG overslag
Project partners: TNO, Henry Systems Holland, Hobre Instruments, Krohne, Flexim

Development of a measure and control system for LNG transfer

For large scale applications the amount and quality of LNG is typically determined using the GIGGNL Custody Transfer Handbook. The measurements are typically based on level gauging in combination with a tank-table, pressure and temperature readings and measurement of the gas composition. These measurements include level gauging and composition measurement and are time consuming and rather expensive, yet acceptable for large scale LNG. For small scale LNG, however, there is a need for faster and more cost-effective measurements. Furthermore, for small batches, the volume determination with level gauging, is relatively inaccurate. The levelling error itself does not depend on the batch size, hence the smaller the volume transferred, the larger the relative error. Consequently, for small scale LNG transfer, other measurement principles to determine the volume are required. This project, therefore, has the aim to design and develop a prototype measurement system and develop principles to determine the amount and composition of the LNG transferred for small scale LNG applications.

A measurement and calibration skid has been designed, developed and subjected to the first cryogenic tests. This skid contains a circa 1 m3 collecting tank for LNG, or any other fluid. This collecting tank is supported by load cells, which means the mass of the collected liquid can be accurately determined. Furthermore, this skid houses a float and radar level gauge as well as various temperature and pressure sensors. As a result the skid can be used to calibrate flow meters through a comparison of the indicated (total) mass (or volume) by the flow meters versus the mass (or volume) of the collected fluid, as measured by the load cells (reference). Furthermore, this skid can be used to test and calibrate level gauges by comparison against the float and/ or the collected volume. Once validated and accredited, this skid can, for example, be used to verify LNG dispensing systems for truck or (small) ship refueling/ bunkering. A first series of tests have been conducted where the reading from two different flow meters has been compared with the load cells. A good match was found between the flow meters and load cells which indicate this skid is a feasible approach to calibrate flow meters.

To investigate whether flow meters can be readily used to measure the amount of transferred LNG, various type of flow meters have been calibrated on the VSL flow loop facility. An important aspect was to investigate the impact of the subcooling margin (margin towards (local) boiling) on the flow meter performance. Furthermore, in-line flow meters as well as clamp-on flow meters have been investigated. Clamp-on flow meters have the advantage that they are non-intrusive, hence can be easily installed on existing pipe-work, however potentially at the expense of reduced accuracy. The calibrations have shown that Coriolis mass flow meters are excellent instruments to measure Liquefied Nitrogen flow. For the tested range of temperature, pressure and flow rate, the deviation compared to the reference was hardly significant taking into account the calibration uncertainty of 0.3%.

A new prototype for a Raman based gas analyzer has been realized and tested for various pure gases and several certified gas mixtures. An accuracy equal to, or better than, 0.5% by volume for all components measured has been shown. Hobré has made a license agreement with TNO such that Hobré can use the novel IP in their product development and bring novel measurement principles to the market