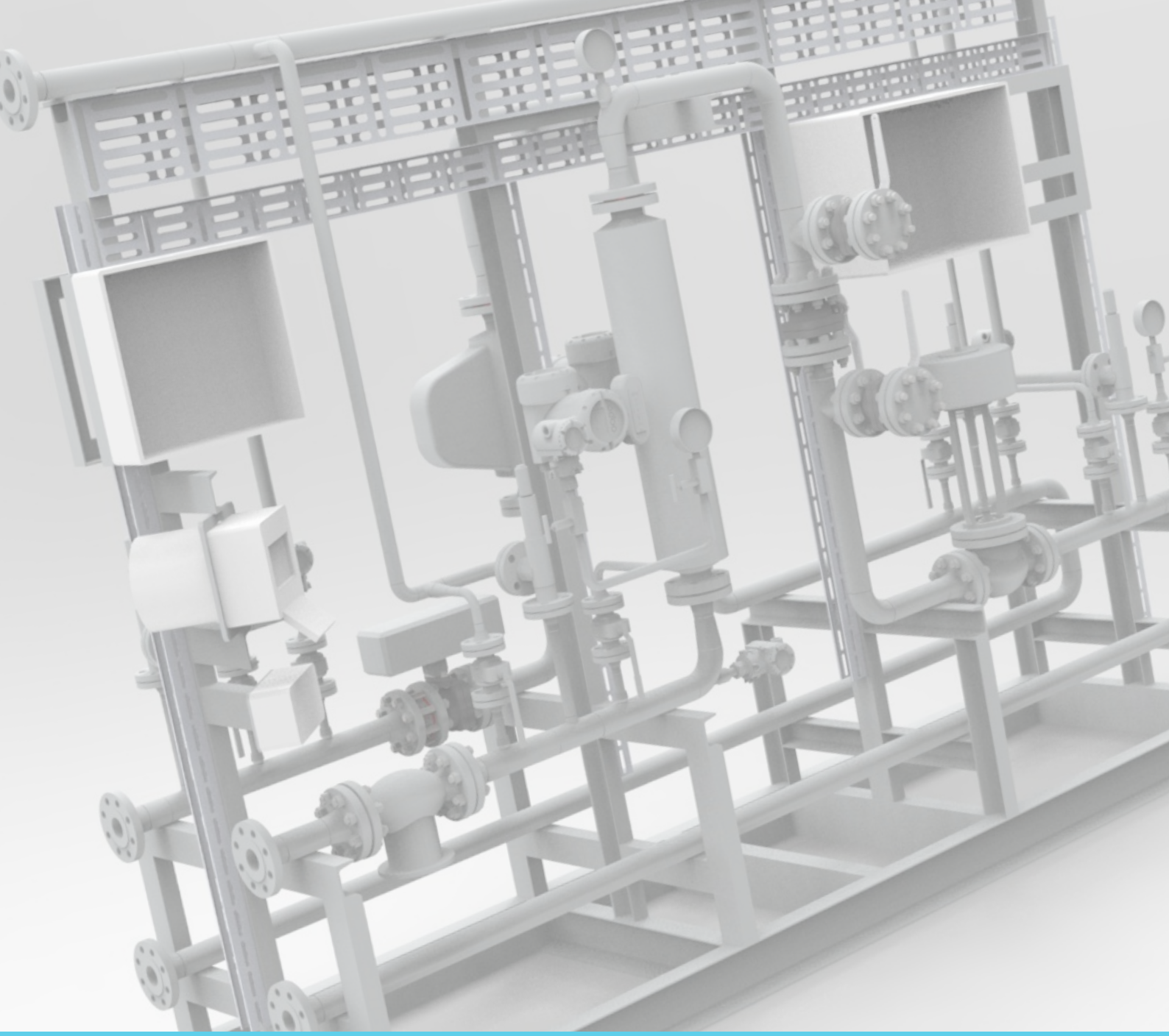


METERING SKIDS

PROJECT OVERVIEW

Custody transfer metering skids, systems and solutions for oil, gas, petrol and chemical products

Design, engineering, configuration, commissioning and start up of complete instrumentation & control solutions in standard fieldbus technologies (Foundation Fieldbus, HART, Profibus)

Design and development of HMI/SCADA applications

Tank Management Systems (TMS) and Tank Inventory Systems (TIS)

WIG SOLUTIONS ARE RUNNING

Metering skids for your applications

Completed complex projects

Design, assembly and delivery of measuring skids, flow computers and control systems, installation on site, calibration and certification, commissioning, training, servising and support after start-up

GASPROM NEFT, Pančevo Oil Refinery (Serbia)

Metering skids, custody transfer measuring & control system for
- loading and uloading ship tankers (jetty)
- product pipelines

Metering skids, custody transfer measuring & control system for
- LPG truck loading/unloading
- LPG rail tank car unloading

Additives dosing of diesel and jet fuel

GASPROM NEFT, Novi Sad Oil Refinery (Serbia)

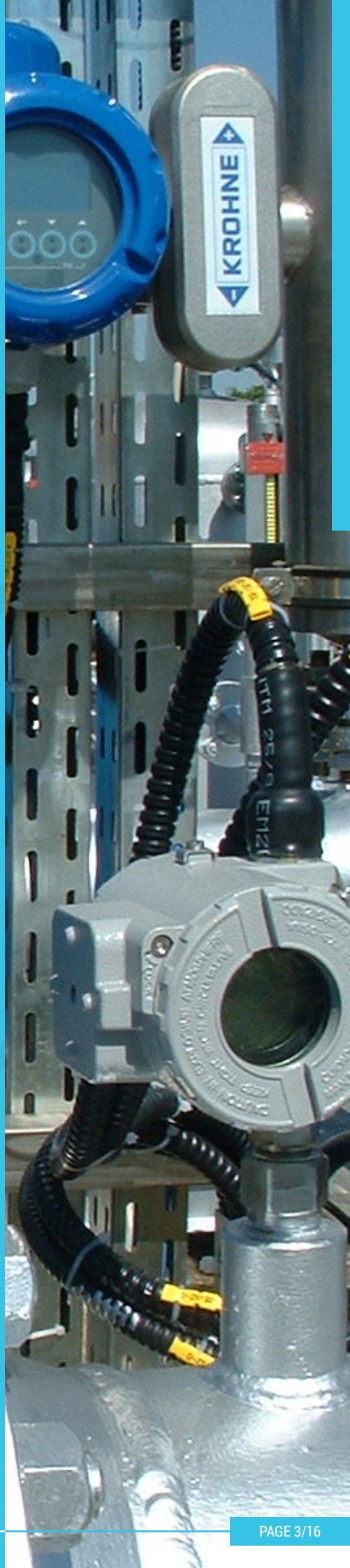
Metering skids, custody transfer measuring & control system for
- crude oil piplines
- liquid fuels and heavy oil pipelines
- loading/unloading ship tankers (jetty)

GASPROM NEFT, 48 oil and gas locations (Serbia)

Measuring & control system for
- own and technical losses

HELLENIC PETROLEUM, Jugopetrol Terminal in Port of Bar (Montenegro)

Additives skids, measuring & control system for
- additives dosing of diesel and gasoline for ECO and Lukoil marketing lines



Jetty in Pančevo Oil Refinery (RNP)

CLIENT: GASPROM NEFT
YEAR: 2008
LOCATION: Pančevo Oil Refinery
26000 Pančevo, Serbia

Introduction

After successful completion of the factory acceptance test (FAT), **ISOIL Impianti SpA Italy** company in cooperation with **WIG doo Belgrade** and **WIG Avtomatika doo Ljubljana** delivered complete equipment for "**Custody Transfer Metering Systems for Reconstruction and Modernization of Loading and Unloading Facilities at NIS-PETROL Pančevo Oil Refinery's Jetty Project"**.

Contract between ISOIL Impianti and NIS PETROL was concluded on 04-Feb-2008, factory acceptance test was carried out in the period between 25-Jul-2008 and 13-Aug-2008, and a complete equipment was delivered to Pančevo on 18-Aug-2008.

Scope

Project includes fabrication, delivery, installation, supervision and start-up of 15 metering instalations for five berths locations with the purpose of metrological (custody) flow measurement of petroleum derivatives, compressed hydrocarbons, benzene and toluene. All measuring lines are realized and delivered on skids.

Transfer measuring and flow control of above mentioned liquids is carried out in flow computers autonomously on five dislocated Local Terminal Stations (LTS) that are, in the same time, integrated via network in the central Loading Control System (LCS).

System integration by using modern technologies

There are three up-to-date technical solutions that integrate this project, all of them independent from each other, but all of them working together as a system. These technical solutions are:

- SKID construction concept,
- ETHERNET as a word wide standard of universal comunicational infrastructure over TCP/IP protocol, and
- DCS or distributed control system with virtual central supervision.

These three solutions constitute a unique but open system that can be further extended in horizontal and vertical direction. For example, it is possible to add new measuring skids, even the ones with different technology. It is also possible to connect to higher hierarchy levels in the sense of transfering data and control from „above".

SKIDS: Dedicated autonomous solutions

Every measuring line installed and attested on a special construcition, called SKID, is equipped with all necessary elements. It is a little measuring plant with gas separator vessel (degasser) with its own automatics, strainer and density measuring skid (for execution with PD meter only), control valve, flowmeter (PD meter or mass flow meter), densitometer, temperature transmitter, pressure transmitter and prover connections. Complete skid is attested and transported to a place where it will be used. It has connections for input and output of the measured fluid, heating steam where needed, power supply and standard comunication connections.

Complete instrumental solution is based on Foundation FIELDBUS protocol, resulting in wiring savings, reliability in work and diversity in application. Instruments, or more precisely their transmitters send signals of various types: FF, 4-20mA current loops, pulse and discrete, terminated in intrinsic safety junction boxes.

Skids of one distribution location (Berth) are connected to a local enclosure containing Flow Computer and other control equipment.

Foundation FIELDBUS Flow Computer – DCS and FCS

SMAR's flow computer comes with necesarry I/O, control and comunication modules and provides modern distributed control system (DCS) solution by combining FF and SCADA standards, with parametrization, monitoring and control in general being forwarded to upper application layers over ETHERNET protocol.

FF field instruments are connected to each other to compose distributed autonomous control system FCS (Field Control System). Flow computers are connected to remote central control system LCS (Loading Control System) by fiber cables.

DCS on PC workstations, universal platform

Apart from skid and flow computer autonomy, WIG has developed special software application based on modern international standards allowing the complete measuring system control of barge loading and unloading as well as supervision of measurement performed over PC operater workstations. System interoperability enables parameterisation of SCADA application, generating trends, data transfer to other LAN networks, reports compiling... System functionality is controlled by two clustered host servers (complete, full real-time redundancy). Of course, all of the access elements are in standard Fast Ethernet LAN network, making the system accessible even from the Internet. This is convenient because end user can freely choose place, time and way of controlling the system.

Participants in the project

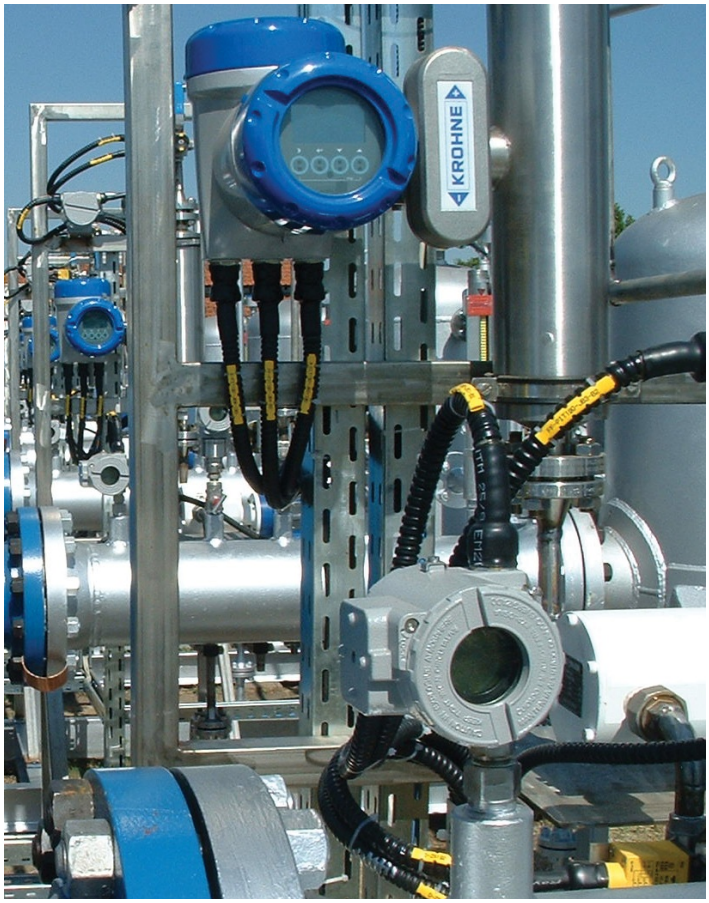
Custody transfer systems are made and delivered on the basis of metering and control technical solutions by WIG Belgrade experts and conform to technical requests of NIS Pančevo Oil Refinery, made according to modified base documentation by Enereco S.C. Italy. Also, WIG Belgrade as ISOIL Impianti partner has overtaken the technical and operative task of assembling and completing the project.

Custody transfer metering skids are created on the basis of PD flowmeters produced by ISOIL Impianti Italy and Coriolis flow and density meters produced by KROHNE England. Also, control valves produced by Flowserve Austria, temperature and pressure transmitters produced by SMAR Brasil and prover connections delivered by ISOIL Impianti are built in. Degassing vessels and strainers were made by Feromont Oprema Pančevo, according to the requests and documentation of ISOIL Impianti Italy. ISOIL Impianti Italy has also delivered marine grounding systems.

Local Terminal Stations and central Loading Control System are based on flowcomputers and Foundation fieldbus control equipment produced by SMAR Brasil/USA. PC workstations and servers are produced by IBM, and HMI applications are made in Wonderware software.

Production and assembling of all metering skids and LTSs / LCS cabinets as well as FAT were all carried out by M.E.R.A. Zrenjanin.

After installing the delivered equipment in Pančevo Oil Refinery, which is the obligation of customer, accompanied and supervised by WIG Belgrade, ISOIL Impianti and WIG Belgrade have the duty to perform the adjustment and start-up and carry out the final meterological check-ups and approvals for custody transfer utilization of these metering systems.



Flow Metering System for LPG - Loading/Unloading

CLIENT: GASPROM NEFT
YEAR: 2010
LOCATION: Pančevo Oil Refinery
26000 Pančevo, Serbia

Background

Client request referred to a state-of-the-art LPG loading facility, with intention to replace metering systems based on turbine meters and include gaseous component into calculation.

Measurement requirements

Loading and unloading by weight scale is impossible to ensure an accurate batch.

By direct NET flow measurement process is more accurate and less time consuming. The request was to design metering systems with class 0,3 for NET loading.

In addition to this, main request was the usage of Coriolis mass flow meters. Since the LPG loading process means transfer between two vessels under pressure, it is mandatory to measure liquid phase filling the vessel and vapor phase coming out of the vessel to the tank.

Custom-made solution – Revamping the old facility

Project consists of the following installations:

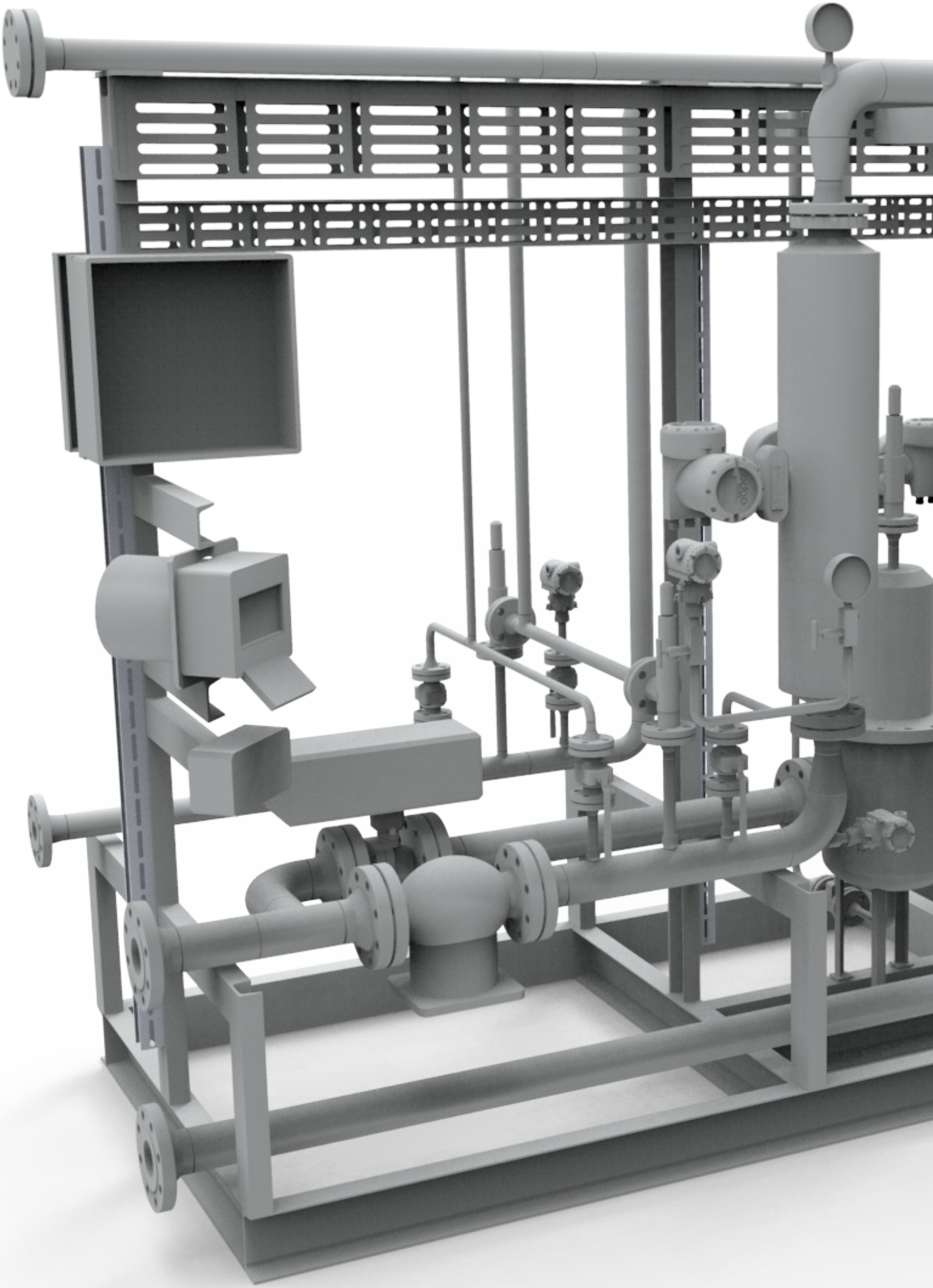
- 6 metering system for truck loading,
- 3 metering systems for rail loading,
- 2 metering systems for truck and rail unloading.

Metrological consistency was achieved with control valves, permanently controlling differential pressure between liquid phase and LPG vapor pressure.

For flow meters, WIG applied OPTIMASS 7300 T40 CT and T50 CT for liquid, and OPTIMASS 8300k S25 for vapor. Single tube OPTIMASS 7300 CT version is approved for CT applications worldwide and in Serbia too, therefore we have quite a lot of experience with measuring light hydrocarbons. Vapor meter is OPTIMASS 8300k as a twin U shape tube designed for measuring low density and even low flow vapors.

Advantages

- Highly accurate net batching,
- Measuring of LPG liquid phase and LPG return vapor phase,
- Compact system on single skid,
- Remote operation, certified according to OIML R-117-1 and MID directive.



Additives Dosing System in Oil Refinery Pančevo (RNP)

CLIENT: GASPROM NEFT
YEAR: 2012
LOCATION: Oil Refinery Pančevo
26000 Pančevo, Serbia

Introduction

The project of construction of the newly constructed plant in oil refinery in Pancevo, MHC/DHT, which was planned to produce jet fuel and euro diesel didn't include the installation of systems for the dosing of antioxidants in jet fuel and diesel fuel additives for the euro diesel. Dosage of antioxidants is regulated in the "Official Gazette of RS", no. 64/2011, Annex II, and dosing the additives for required lubricity and electrical conductivity in euro diesel is regulated in accordance with the Standard EN-590. For this reason, it was necessary to set up a project for the construction of installations for the dosage of antioxidants in jet fuel and dosing the additives for euro diesel fuel. Therefore, NIS Serbian oil industry owned by GaspromNEFT released the tender which was after the bidding phase awarded to WIG.

Implementation

System for additives dosing is supplied from a single cylindrical horizontal tank divided in two parts with the volume of 60 m^3 and 40 m^3 for each part of the tank. Tank consists of two different types of additives. The first part of the tank, with the volume of 60 m^3, consists of the additive for dosing the diesel metering line. The second part of the tank, with the volume of 40 m^3, consists of the additive for dosing the jet fuel metering line. Below the lowest level of the tank, 4 self-priming gear pumps for pumping the additives are placed. The capacity of the pumps is 19 l/min.

Bypass valve is installed before the entrance of the injection block, which will set the inlet pressure in the injection block. Pressure should be about 5 bars higher than the pressure in the main line. For optimal performances, additive is injected down the course of the fluid. A static mixer is installed in the main pipeline.

As per the technical requirements, the system adds additives in two lines, diesel and jet fuel, as well as two independent entities. Each dosage unit is made out of two completely separate metering lines. This provides continuous additives dosing at all operating conditions and at the high redundancy of the system. The solution is based on a specially designed module connected to a control unit that can be controlled by adding additives for each line.

The modular system consists of an injection unit which containing PD flow meters, solenoid valves and filters, injection controller connected to the main line standards and depending on the fluid flow in the main line and prediction formulas. Pulse signal opens and closes the valves in the injection block.

System for additives dosing can be controlled via local display remotely from the control room. This type of system control is considered redundant. In case of a communication breakdown between the control room and the system for additives dosing, locally configured HMI takes the main role in controlling the system.

The system operates in a redundancy. There are installed two SMAR controllers, type DF73, which are working in a full redundancy. There is a high degree of security of the system in the event of a potential failure of one of the controllers. Namely, if one controller fails, its role as the primary takes another one , redundant controller.

The measuring system has the following functions:

» local control by using the local HMI, or remote control through the existing LCS system (Redundancy),
» scaling of pulse input signal from a flow meter used for measuring the main flow of the fluid and flow of the additive,
» control of digital input signals for permission, choice of additive, and signal flow,
» control solenoid valves additives,
» pump control for additives (start / stop),
» control of digital output signals: block valves, alarms, interlock,
» display: total of the main flow and additives, total batch, the current percentage of additive, the status of the solenoid valves and pumps, alarms,
» diagnostic alarm and error: no flow of additives; additive above or below tolerance; uncontrolled swelling additives;
» auto calibration,
» wash and pipeline rinsing,
» calibration set included in delivery.

Custody Transfer Skids in Refinery Novi Sad (RNS)

CLIENT: GASPROM NEFT
YEAR: 2009
LOCATION: Rafinery Novi Sad, 21000 Novi Sad, Serbia

Introduction

In 2006 Serbian Oil Industry released the tender for design, delivery, assembly and start-up of flow meters and related equipment, intended for "custody transfer" of petroleum and petroleum products. This tender represented only the first step of Serbian Oil Industry (NIS) general master plan for reconstruction of all custody transfer measuring points in refinery Pancevo and Novi Sad. Several well-known flow meter product suppliers submitted their solutions for this project. After detailed technical and commercial evaluation of bids, contract has been awarded to WIG.

Implementation & Scope of work

A total of fourteen measuring lines were planned and implemented for this project. These include four product pipelines (euro-diesel, euro-premium, fuel oil), two oil pipelines (one of those bidirectional, for both loading and unloading, with equipment for automatic sampling), seven measuring skids for loading and unloading of barges, and one skid for loading only (euro-diesel, euro-premium, distillates and LPS, and fuel oil).

This project uses the same technical solutions as Jetty in Pančevo Oil Refinery.

Standard measuring skid consists of:

- volume or mass flowmeter,
- degasser,
- pressure switches,
- lesser skid for measurement of density, manual sampling and calibration,
- temperature and pressure transmitters,
- DBB valves for setting of flow direction (loading/unloading), equipped with position switches,
- valve and connections intended for prover.

Signals from all measuring lines are collected in five system cabinets. Inside each of those cabinets, user can find seven Smar FC302 flow computers, single Krohne Alto V flow computer and Smar DF62 controllers, together with all necessary I/O modules. FC302 is used to read pulse signals from flowmeter (Krohne Altosonic III and Optimass 7000), analog current (4-20mA) signals, and Foundation Fieldbus signals from pressure and temperature transmitters. DF62 controllers are used to collect discrete signals from set-stop valves needed for pressure control. Communication cabinets are located next to system cabinets. Communication cabinets house all the necessary communication equipment, like Ethernet switches and media converters (optical to Ethernet). All flow computers and controllers are integrated into two separate networks, control and supervision network, using optical links from communication cabinets to Control Room. Server and work stations (operator and engineering) are located in Control Room. All of the stations are equipped with necessary software (SCADA applications, OPC Server, SQL Server, etc.). While server and work stations are used for control and supervision, flow computers are regarded as "brains" of this system. Each flow computer is tasked with calculating actual volume, standard gross volume (15 °C), standard net volume (15 °C), mass, average density, temperature and pressure, among other calculations. Flow computer also accepts inputs and controls such as batch size value, and start and stop commands. Up to four different measurements can be handled by single flow computer. The rest of the process is controlled by DF62. This includes valve opening/closing, pump start/stop, generation of necessary conditions for start of the batch, and many others. All transaction results are stored in historical database, and on finish of each transaction, batch report with all relevant data is automatically generated and printed.

Directorate of Measures and Precious Metals made sure that all measurements are regarded as fiscal measurements. This was achieved by systematical inspection of each measuring line, and this is process is repeated on regular basis.

Most of monitoring and control is done from inside of Control Room. However, additional local displays and local printers have been included to offer local supervision and control on each of the five system nodes. Local displays showed all the necessary data regarding that particular node, and offered all controls needed to operate process from that local station. Additionally, all 5 nodes were supplied with their local own printers.

Control Room was designed to be the center of the whole system, and also headquarters of the operations. Server and workstations were installed to replace old wall-size monitoring panel.

The greatest improvements delivered by new system are:

- almost complete automation, which minimizes human error,
- superior diagnostic and supervision which offer much shorter response time of errors and in emergency situations,
- greater precision of measuring equipment,
- reliability in both standard work operations, and under special conditions,
- ease of control and operation,
- historical database, with extensive tools for data and trend analysis.

Several similar systems were designed and implemented by WIG for same customer (Serbian Oil Industry – Gazprom Neft). All of these systems proved to be of exceptional quality and reliability. They still prove their worth nowadays, with some more than six years in operation.

Measuring Skids for Technical Losses and Own Gas Consumption

CLIENT: GAZPROM NEFT
YEAR: 2013-2014
LOCATION: 48 oil and gas stations in North Serbia region, Serbia

Introduction

The Serbian Oil Industry (Gazprom Neft) oil and gas field stations have only recently been refurbished to meet the most complex production processes. All facilities include a wide range of energy consuming devices such as heavy fuel and gas boilers, steam heaters, glycol dehydrators and compressors. Most of the systems are fueled by natural gas from the gas fields. In order to control the energy efficiency of each of their gas field stations, the company decided to monitor the natural gas consumption of their systems, as well as to detect technical losses due to soot formation in burners.

Implementation

This project consisted of design and delivery of the project documentation, equipment supply, installation and start-up of the System for Measurement of Technical Losses and Own Gas Consumption in all oil and gas field plants. Given the volatile parameters of the medium, it was required that temperature and pressure measurement were included as a part of the solution. ATEX zones 2 Ex d ia approvals were also mandatory.

The solution included Krohne Vortex flowmeter OPTISWIRL 4070C installed on over 70 measuring skids, with integrated pressure and temperature compensation, thereby prevailing over solutions with turbine meters, rotary gas meters or multivariable transmitters as offered by competition. The instruments were mounted on bypass lines to allow easy dismantling without process interruption. The majority of these lines were meant to be part of a permament system of piping with different nominal sizes from DN 15 to DN 100 (classes 150 lb, 300 lb and 600 lb). Flowmeters with sandwich process connection were used at these measuring sites. Five other flowmeters were fitted at mobile metering systems that allow for a temporary flow measurement at 14 varying measuring sites. These flowmeters were installed with flanges.

Standard measuring skid consists of:
- vortex flowmeter,
- pressure gauge,
- temperature gauge,
- bypass ball valves.

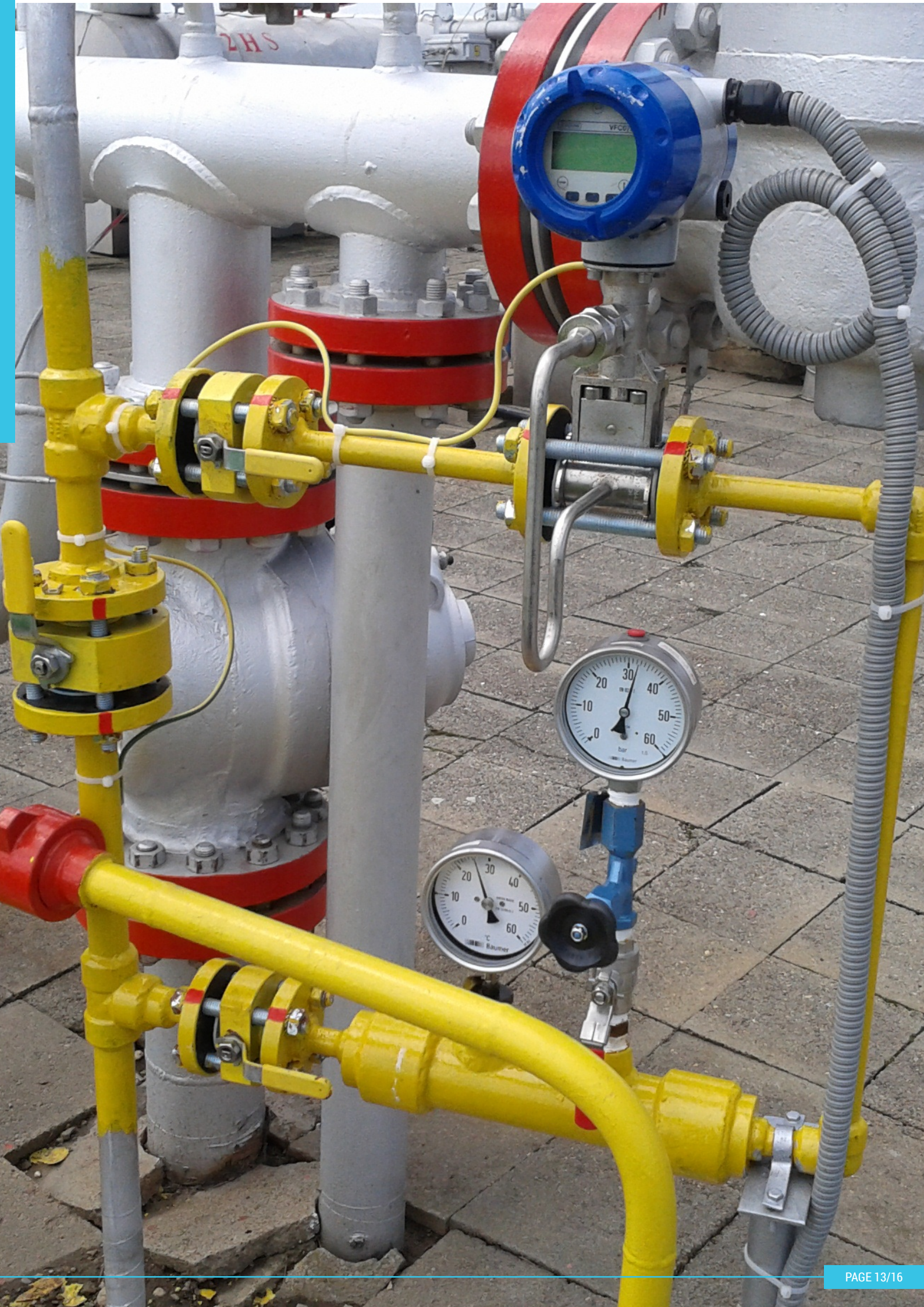
The vortex flowmeter measures the operating volume flow of natural gas and calculates accumulated standard volume flow. Since all devices also feature integrated temperature and pressure sensors, they can compensate for the unsteady medium parameters. Their readings are provided via digital HART signal transferred to data acquisition enslosures with PLCs located in the control rooms. A PLC with integrated HMI touch screen is reading four HART variables from the flowmeter (operating volume flow, accumulated volume flow, pressure and temperature) through the HART to MODBUS converter. The PLC is also providing 12-hours and 24-hours average, minimum, maximum and total values, and enables 60-days storage of all 12/24 values. All the PLCs are integrated within the unique supervision network and all data are telemetrically transferred to SCADA systems in dispatcher centres.

Solution for mobile metering systems includes mobile data acquisition enslosure and cable reel with 150m long cables.

Customer benefits

Main customer benefits on this project include:
- better and more accurate overall balance for their own consumption and technical losses,
- integrated pressure and temperature compensation,
- same technical solution for all 48 oil and gas stations,
- unique staff training for maintenance,
- unique spare part list,
- easier maintenance.

SOLUTIONS ARE RUNNING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Additives Dosing System, Truck Loading Terminal in Port of Bar

CLIENT: HELLENIC PETROLEUM / LUKOIL
YEAR: 2013
LOCATION: JP Kotor truck loading terminal
Port of Bar, Montenegro

Introduction

After a successful installation of the Additives Dosing System in Petrol Terminal in Stip, Macedonia, LUKOIL and Jugopetrol Kotor intended to, for their own purposes, install the identical system.

Implementation

Two skids for additive dosing have been installed, each with the separate additive tank. Each skid contains a set of two dosing blocks (Fleximix) and two pumps, as per Customer request. Simultaneous additivation on more loading points is possible, both for LUKOIL and Jugopetrol, separately, with the restriction that the additivation of the same fuel type with the different additives at the same time is not possible (LUKOIL and Jugopetrol additives).

Systems for additivation are supplied with additive from replaceable IBC containers that are placed in the vicinity of the parapet above the existing pipeline. IBC containers were placed on standard pallet racks.

Below the lowest level of containers there are placed 4 self-priming gear pumps. The pumps have a capacity of 19 l/min. Pumps also provide continuous circulation of additives during the process of filling the trucks. This achieves the regular process of mixing the additives in the system and ensures the uniform quality of additives. Systems for dosing the additives are mounted on the panel with a canopy at a standing height. Prior to the inlet of injection blocks, there are installed bypass valves on which the input pressure is set for the inlet of injection blocks. The pressures should be about 5 bars higher than the pressure in the main line.

Looking at the flexibility of the system in terms of integration with other systems, we can say that the system is very flexible. In addition to other extensions and modifications of already existing system, it is possible to expand the range of control to other systems that are in conjunction with it. In addition, it is possible to forward and receive data from the other systems and thereby perform the control furthermore. This flexibility comes from a variety of options that HMI has, both in terms of software and in terms of hardware integration.

Complete process, as previously agreed with the Customer, was performed with minimum disruption of regular activities of the Truck Loading Terminal. Advantages of the system are its mobility, simple and quick installation, user friendly usage and accessibility. By installing this system, the investor is able to offer high quality and high performance fuels.

The proposed measuring system has the following functions:

» locally mode to control the system via HMI, or remote control through the LCS which can be connected to L3 VPN and after that with other systems in network,

» scaling of pulse input signal from a flow meter main fluid flow and flow additive,

» acquisition and control of digital input signals for permission, choice of additives, prescription signal to flush the pipeline,

» control solenoid valves,

» pump control (start / stop),

» control of digital output signals: block valves, alarms, interlock.

SOLUTIONS ARE RUNNING

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