Case Study
October 2022
D352398X012

Enagas S.A. Builds Multi-platform Simulation System Based on PipelineManager™

Challenge

Enagas S.A is the leading natural gas transportation company in Spain.

The company's main mission is to ensure competition and security of the Spanish Gas System. It has around 10,000 km of gas pipelines throughout the Spanish territory, three underground storage facilities, and four regasification plants. Enagas terminals in Spain total2.6465 million cubic meters of LNG storage capacity and the system has an output capacity of 6,250,000 Nm^3/h (Figure 1).

Enagas required a multi-platform simulation system for training purposes that could provide their operations personnel with the ability to simulate realistic scenarios for routine training and provide regular performance evaluation metrics for the pipeline controllers and new apprentices. The simulation system needed to allow Enagas to simulate normal and abnormal operation of the pipeline based on a detailed model of the actual pipeline network. The scenarios had to be submitted to the pipeline operators as a mirror image of the actual SCADA system and its environment via the same graphical user interface. All SCADA system functionality needed to be available for the trainees as it would be in real-world operations.

EMERSON

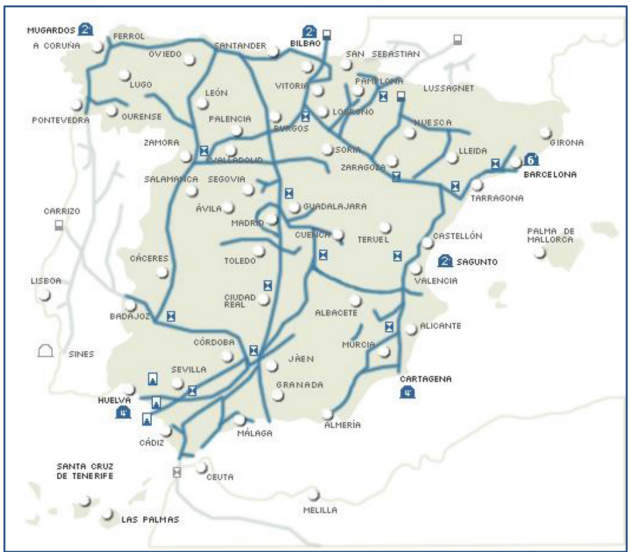

Figure 1. Enagas Gas Network

On a complex gas network with high consequences in the event of an accident, the controllers and operators of the pipelines and storage facilities need to be well trained for all scenarios, understanding the implication of each scenario and actions to take, similar to a flight simulator for airline pilots. The simulator would also enable Enagas to certify and re-certify controllers and operators on a regular basis.

Solution

Emerson (formerly Energy Solutions International) worked closely with Enagas to implement the simulator using Emerson's PipelineManager training module, called PLM PipelineTrainer™.

The concept of The PLM PipelineTrainer is based on four main elements: a fully thermo-hydraulic detailed transient model of the actual Enagas network; an instructor interface; an operator interface; an automatic evaluation module and a trainer session.

The PLM PipelineTrainer application comprises a set of software modules providing the following main functions:

- Offline dynamic real time (or faster than real time) pipeline modeling
- Detailed compressor modeling
- Detailed valves modeling
- Detailed regulator modeling
- Simulation of relevant SCADA data and alarms
- Separate Instructor environment that allows for sudden changes i.e., compressor failure
- Trainee evaluation environment that keeps track of individual Trainees' training results

The Trainee Interface (Operator) uses an off-line copy of the SCADA environment, allowing the operator to interactively enter the same type of commands as in the real SCADA system, e.g. change of set-points, start/stop of pumps/compressors, close/open valves. Such entries from the Trainee will have a direct impact on the Model in a similar manner as control output from the real SCADA system. Thus, the trainee can observe the reactions of the pipeline as if he/she was operating the real pipeline. This gives the operator the possibility to perform operations within a safe offline environment. The solution is described in Figure 2.

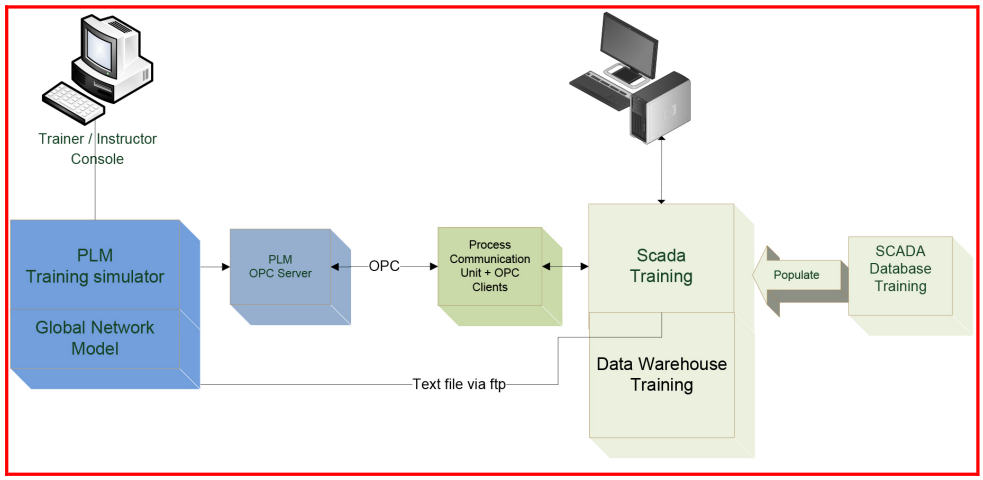

Figure 2. PipelineTrainer Solution

Key Capabilities

The PLM Trainer solution is based on a fully transient pipeline model built in PipelineManager capable of providing a mirror image of the actual pipeline network and related SCADA operations, including:

- Accurate transient simulation of the pipeline network
- Realistic simulation of actual pipeline events
- Adjustable execution speed
- Pause and fast forward functions
- Supports OQ regulation requirements
- Training session with or without instructor interaction
- Session initiation from archives or Real Time (if it is available)
- Enhanced displays, profiling & trending
- Alarm handling
- Chronological Event Log

The system also supports the following operational scenarios to test the response and performance of the trainees, whether advanced personnel undergoing routine, periodic training and testing or new personnel learning about the pipeline network for the first time:

- Start-up and shutdown procedures
- Valve opening and closing sequences
- Set-point controls
- Batch operations
- Pump/compressor operations
- Normal and abnormal operating conditions
- Emergency simulation operations

The Trainer can be also used to simulate many incidents, including both leak detection and theft detection. The Trainer is capable of handling typical scenarios:

- Leak simulation
- High/low pressure alarms
- Regulator operations
- Pump/compressor unit shutdown/startup
- Control valve operation
- Unexpected valve operations
- Valve failure
- Pump/Compressor failure
- Instrument Failure

Expected Results

Enagas became operational on the new PLM PipelineTrainer solution and quickly began utilizing the solution for a range of training and testing needs within their organization. The solution exceeded their expectations in terms of both capabilities and precision in accurately modeling the real-world network.

Expected Benefits

The PLM Trainer solution will deliver the following benefits for years to come:

- Training for future operators in a controlled and isolated system, without compromising the safety of the real world transportation network
- A highly accurate, fully responsive model to interactively train operators under critical conditions that could not be generated under real world simulations
- The feel of operating the real network, given the high definition responses the transient application can emulate, without the risk
- An objective criterion to measure the performance and development of the operator's skills
- Replication of SCADA screens in the operator GUI without the need for special purpose displays

North America and Latin America
Global Headquarters
Emerson Automation Solutions
Energy and Transportation Solutions
6005 Rogerdale Road
Houston, TX, USA 77072
T: +1 281 879 2699

Europe
Emerson Automation Solutions
Energy and Transportation Solutions
Unit 1, Waterfront Business Park
Dudley Road, Drierley Hill
Dudley, UK DY5 1LX
T: +44 1384 487200

Middle East and Africa
Emerson Automation Solutions
Energy and Transportation Solutions
Emerson FZE
PO Box 17033
Jebel Ali Free Zone - South 2
Dubai, UAE
T: +971 4 8118100

Asia Pacific
Emerson Automation Solutions
Energy and Transportation Solutions
1 Panda Crescent
Singapore 128461
T: +65 6777 8211

Visit us online at **Emerson.com/EnergyandTransportation**

Emerson Energy Solutions
Energy and Transportation Solutions
@Emerson_ETS