Recently Completed Projects - Automation Projects (Liquid Projects)

Client: **BP Pipelines North America – Liquids Operations**

Project Description: **SCADA System Upgrade; PLC, HMI, Panel Design, P&ID's, PLC and Switchgear Drawing packages**

Project Title: **BP Number 1 System Crude Oil & Products**

Location: **Mid Continent Region USA**
Gulf Coast Region USA
Rocky Mountain Region USA
Pacific Northwest USA

Provided engineering services to BP throughout core and JV pipeline business units for both their crude oil and product divisions. Included development of SCADA and systems for Blending Stations, Tank Stations, Metering Stations, Booster Stations and Junction/Block Valve sites. ENE Partnership with BP led to developing standard PLC and HMI code modules to minimize software development and installations costs. ENE developed standards have been implemented in conjunction with Operator Qualification requirements that were also implemented throughout BP.

Project involved upgrade of minimum of 27 BP facilities across the United States and involved the following:
SCADA System Upgrade; PLC, HMI, Panel Design, P&ID's, PLC and Switchgear Drawing packages; Integrated automatic switching system; Upgrade and tank integration. **APLP-1**

Client: **BP Pipelines North America – Liquids Operations**

Project Description: **SCADA System Upgrade (Active Project) PLC, HMI, Panel Design, P&ID's, PLC and Switchgear Drawing packages**

Project Title: **BP "V" System – Dubuque to Sugar Creek**

Location: **Iowa, USA**

Provided engineering services to BP throughout core and JV pipeline business units for both their crude oil and product terminal locations in Iowa, USA. Included development of SCADA and systems Terminal Facilities.

Project involved upgrade of minimum of 2 BP facilities: Cedar Rapids and Council Bluffs, Iowa. Overall project involved: SCADA System Upgrade (Active Project) PLC, HMI, Panel Design, P&ID's, PLC and Switchgear Drawing packages. **APLP-2**

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Recently Completed Projects - Automation Projects (Liquid Projects)

Client: **BP - Olympic Pipeline Company**
Project Description: **Redundant (satellite/frame relay/fiber optic) Communications System Implementation**
Project Title: **BP Olympic Pipeline Communications Upgrade**
Location: **Oregon & Washington, USA**

Olympic Pipe Line Company, a fuel product transporter delivering products from the mainline to bulk terminals at Seattle, Sea-Tac International Airport, Tacoma, Olympia and Vancouver, Washington and Linnton and Portland, Oregon.
The BP Olympic Pipeline system includes 12 Main Line stations, 2 Booster Stations, 8 Delivery Facilities, and all pipeline Block Valve and Junctions locations.
EN Engineering assisted BP Olympic in implementing a revilutionary redundant (satellite/frame relay/fiber optic) communications system. If primary communications were lost to the Control Center, the system would automatically transfer to the backup communications system automatically. **APLP-3**

Client: **Plains All American Pipeline**
Project Description: **PT SCADA System Upgrade**
Project Title: **Pacific LA Marine Terminal LLC SCADA System**
Location: **Long Beach, California USA**

"Plains Pipeline" provides crude and products storage capabilities for a majority of the refineries in the Los Angeles area. The PT Supervisory Control and Data Acquisition (SCADA) System is designed to allow control, monitoring, and other operations-related functions of 5 automated pumping and heating stations, 8 valve boxes,1 vapor combustion system, and 20 mimic sites.

Hardware/software architecture consisted of Siemens TI PLC-based system and Industrial PC's (Windows 2000 OS) employing Wonderware Intouch designed around a Wide Area Network (WAN) configuration. Wonderware InTouch applications communicate with redundant SQL Server databases located at the Long Beach Control Center logging time and event based data.

Integrated into the Wonderware application is a Sybase PowerBuilder client/server database front-end application developed by EN Engineering. to provide Movement Logging, Leak Detection, Customer Product Transfer Ticketing, Air Quality Emissions Management, and Inventory Management in addition to many other documentation requirements. Installation eliminated need for paper logging of station operating parameters and movement logs which until recently was done manually by the station operators and dispatchers. **APLP-4**

Recently Completed Projects - Automation Projects (Liquid Projects)

Client: **SemStream L.P.**
Project Description: **Design and Install Terminal Truck Rack Automation System for Propane Distribution Truck Terminals**
Project Title: **Terminal Truck Rack Automation Project**
Location: **Arkansas, Missouri, Indiana USA**

SemStream is a midstream company engaged in natural gas liquids (NGLs) supply, marketing, propane terminal operations and risk management services. It is one of the largest private propane terminal operators in the industry.

SemStream owns and operates 10 private propane terminals in six states with combined throughput capacity of more than 300 million gallons per year. All 10 of the terminals operate 24 hours a day, seven days a week, and serve customers throughout the Mid-South and Midwestern United States.

EN Engineering designed and developed a TACS (Terminal Automation Control System) Server/Client based system for Delivery, Inventory, Facility Access, Bill of Lading, and Billing of propane transactions for four (4) propane terminals across Midwest United States. **APLP-5**

Client: **Explorer Pipeline**
Project Description: **Design and Install PLC, HMI and SCADA System For 12 New and 12 Existing Pumping Stations**
Project Title: **Explorer 2003 Mainline Expansion Project**
Location: **Various States, USA**

Explorer operates a 1,400 mile pipeline system that transports gasoline, diesel fuel and jet fuel from the Gulf Coast to the Midwest. The expansion project included the addition of 12 green field pumping stations, modification to 12 existing pump stations, addition of 500,000 bbls or additional storage capacity, and implementation of a new SCADA system at the company's corporate headquarters in Tulsa.

- Develop code for 12 Allen-Bradley ControlLogix Process Control PLCs and ControlLogix Safety Shutdown System (SSS) at each of the new pumping stations.
- Develop code for 3 Allen-Bradley ControlLogix Process Control PLCs at tank farm facilities
- Modify code for Allen-Bradley SLC Process Control PLCs at the existing pipeline booster stations
- Develop code for an Allen-Bradley ControlLogix central data communications processor in Tulsa.
- Develop a MODBUS TCP interface to the new SCADA system. A wide area SCADA network was implemented, via 56k frame relay network, with satellite backup, which would provide a bumpless communications transfer within 15 seconds of failure on the primary network.
- Develop HMI color graphic application for all facilities, using Rockwell Automation RSView32, and later RSViewSE platforms.
- Provide start-up and field commissioning support and training
- Develop system documentation and operations manuals **APLP-6**

Recently Completed Projects - Automation Projects (Liquid Projects)

Client: OneOK Partners
Project Description: Automation of existing natural gas liquids salt dome storage caverns and truck loading facilities
Project Title: OneOk – Conway Terminal
Location: Near McPherson, Kansas USA

Conway Terminal specializes in the underground storage and truck loading of NGL products. It is comprised of 44 Salt Dome Storage Caverns, 4 Truck Loading Spots, Brine Water System, and a Dehy System. One GE 90-70 and two 90-30 PLC's were used in the Automation of the Terminal

Terminal operations were addressed with 3 X GE PLC's, 1 90-70 and 2 X 90-30's. The GE90-70 PLC handles the bulk of the Terminal Automation. This includes the metering, Dehy Control, Vaporizer Control, Pump Control, and Meter Proving. A Diamond Loading System handles truck Loading/Unloading.

Communications at the Conway Terminal was mostly via Ethernet either over copper or Ethernet Radio. Communications between Conway Station and Haverhill Station/Eldorado Terminal was via Leased Phone line using two Black Box 3600 Leased Line Modems and two Freewave Radios. Modbus was the protocol that is used for the communications.

The HMI system was derived with 2 X Wonderware Viewer nodes, and one data server. The server is a Dell 2550 Server with redundant hard drives, power supplies, and network cards. Server is responsible for gathering all the data from the field using the GEHCS, and EFMMGR. GEHCS driver is used to retrieve the data from the GE PLC's via Ethernet. EFMMGR retrieves the Modbus data from Haverhill Station and Eldorado Terminal. Wonderware's SCADA alarm package is also installed on the server to annunciate any Haverhill or Eldorado alarms to the Haverhill/Eldorado personnel via their pagers. Data Trending at the Terminal is done using the Canary Labs Trending Package. All trend data is written to the Dell Server and is kept for a year. However DOT trend data is stored off to a CD and saved for 5 years. **APLP-7**

Recently Completed Projects - Automation Projects (Liquid Projects)

Client: **Wespac Energy Group**
Project Description: **Jet Fuel Delivery Automation and SCADA System**
Project Title: **10th Avenue Jet Fuel Delivery Pipeline Automation**
Location: **San Diego Airport, California USA**

SCADA system was implemented to allow easy interaction to receive jet-fuel from Kinder Morgan into Wespac's Quality Control facility. Wespac delivers jet-fuel, on-demand, to the San Diego International Airport.

All actions with the SCADA system are reported on the HMIs located at the terminal the airport control building. Historical logs of all alarms, actions and pipeline properties are kept in the Intellution and Canary Labs trending software.

Field data is collected into the GE 90-30 PLCs utilizing GE rack mountable I/O, Genius distributed I/O, Modbus communication to Accuload flow-computer and to Kinder Morgan 90-70 PLC. Field data is presented to operations using Intellution iFix32 HMI software. Intellution iFix32 communicates to the GE 90-30 PLCs through a GE OPC server. **APLP-8**

Client: **Enterprise Products Partners LP**
Project Description: **Design and Install Automation for Cavern Inventor Management**
Project Title: **Cavern Inventory Management Project (CIMP)**
Location: **USA**

The Cavern Inventory Management Project (CIMP) software allows the operators to obtain current accurate information about the product to brine ratio in each of twelve underground caverns. Real-time calculations are performed on each cavern's data to find compensation factors for temperature and pressure plus rate-dependent meter factors to extend the meters flow rate ranges.

The CIMP system allows Enterprise to eliminate the potential for cavern overfill, eliminate force balanced cavern measurement, and provide more accurate and reliable information for scheduling and deliveries and to obtain compliance with the Texas Railroad Commission Rule 95(1) (3).

Real-time field data is collected by two TI-555 PLCs and communicated to CIMP through a central CTI-2572 DDE server. The two PLCs act as primary and backup units, allowing for temporary failure of either without loss of data or compromise of system integrity. Refer to the figure 2 below showing the communication layout.

All events and reports are kept in an MS-SQL database for retrieval and review utilizing Powerbuilder for report generation and Wonderware for HMI. All reports are also published for remote retrieval using Modbus slave communication to Arcom Director communication equipment. The data is published to support Williams' Customer Interface Support standard report retrieval format. **APLP-9**

Recently Completed Projects - Automation Projects (Liquid Projects)

Client:	**Enterprise Product Partners / Williams**
Project Description:	**Automation of existing natural gas liquids salt dome**
Project Title:	**Enterprise/Williams Conway Station**
Location:	**Near McPherson, Kansas USA**

Conway Station specializes in the underground storage and transportation of NGL products for much of the Midwest USA. It is comprised of 84 Salt Dome Storage Caverns, 9 Electric Mainline Units, Brine Water Systems, Flare Systems, and Dehy Systems. Automation of all these systems requires many different communications protocols and PLC platforms.

The Storage Cavern network must safely store different NGL products that Conway Station handles. Each one of the caverns is controlled via a GE VersaMax or TI-RTU PLC and a MDS radio. The PLC is responsible for monitoring the product and brine psi's, hazgas levels, and operate the ESD valves. The MDS radio is used to relay the cavern data back to control room using the Modbus protocol.

Outside the Caverns, Station Operations are handled by 8 X TI 555/545 PLC's. The TI PLC's are located at 6 different locations around the station complex. Each PLC handles a specific task dependent on it's location in the station. These tasks range from operating Flare Systems, Degasifier/Brine Systems, Mainline Units, Limitorque Valve Communications, Control Valves, or the NH3 Loading Rack. Helping the TI PLC's are GE VersaMax PLC's. These PLC's handle the smaller processes like running the 2 Dehy Regin Heaters, Fresh/Fire Water Pumps, and the Rain Water Recovery Pumps. **APLP-10**

Client:	**Gavilon Oil Tanks & Terminals LLC**
Project Description:	**Automation of Crude Oil Terminal**
Project Title:	**Cushing Terminal Automation**
Location:	**Oklahoma USA**

Provided complete design and automation integration for 16 x 300,00 BBL above ground tank terminal facility to store and distribute crude oil. Project involved metering, valve automation, product accounting, and all facets of automation for facility. EN Engineering also designed and supplied the control panels for the project. Integrated automation system provide complete control of flow, storage and metering. Database application developed to provide detailed reporting of over/under variance as compared to metered product results.

Platforms Utilized:
HMI: Wonderware Archestra
PLC: Rockwell ControlLogix
Other: Microsoft C#
Microsoft SQL Server

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Recently Completed Projects - Automation Projects (Natural Gas)

Client: **Kinder Morgan**
Project Description: **Conversion of Compressor Station PLC Platforms**
Project Title: **Compressor Station Control System Upgrade**
Location: **Hersher, Illinois USA**

Complete rewrite of station PLC control software and conversion from a Siemens 555 PLC platform to a Rockwell ControlLogix platform for the company's largest and most critical gas storage facility comprised of 11 reciprocating compressor units, 3 gas turbine compressor units and a gas dehydration plant. Also included in the project scope were development of a new ControlLogix ESD PLC program and complete rewrite of the station Wonderware HMI application and integration of a new compressor control system into the existing plant-wide control network. Services provided included sequence of operation development, PLC and HMI programming, commissioning and preparation of a complete operators manual for the station control system. **APNG-1**

CONFIDENTIAL CLIENT

Client: **CONFIDENTIAL CLIENT**
Project Description: **Turbine Compressor Station Control Software Rewrite**
Project Title: **CONFIDENTIAL**
Location: **Confidential USA**

Complete rewrite and optimization of ControlLogix station and ESD PLC programs and RSView SE station HMI. Control system functionality included automatic sequencing for single stage and series operation of two Solar Taurus gas turbines, recycle valve control, surge control, gas cooling control and control and monitoring of station auxiliary systems. The scope of services included, completion of the functional specification, development sequence of operations and cause and effect charts, PLC and HMI programming, integration of the control system with the pipeline SCADA system and commissioning. **APNG-2**

Client: **Kinder Morgan**
Project Description: **Compressor Station Automation Upgrade**
Project Title: **Station 204 Automation**
Location: **Columbus Junction, Iowa USA**

Design, programming and commissioning of a PLC based compressor station control system and emergency shutdown system for an expansion of an existing compressor station / gas storage facility. The system is designed to provide monitoring and control of 7 engine driven reciprocating compressors, 75 yard valves and 5 gas storage fields. The control system functionality includes flow and pressure control and monitoring, remote control of satellite compressor station and 99 operator configurable flow modes. The station control system is based on the Allen Bradley ControlLogix platform with Wonderware HMI software. The ESD system is based on the Siemens 545 PLC platform. The project scope included conversion from a Siemens 545 based PLC control system to a ControlLogix based control system, integration of the new control system with existing flow computers, an upgrade of the existing PLC-based ESD system, control panel design and fabrication, PLC and HMI programming and on-site commissioning services. **APNG-3**

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Recently Completed Projects - Automation Projects (Natural Gas)

Client: **CenterPoint Energy**
Project Description: **New Compressor Station PLC, HMI and ESD Implementation**
Project Title: **North Louisiana Expansion**
Location: **Panola, Texas & Vernon, Louisiana USA**

Design, programming and commissioning of PLC based compressor station control systems and emergency shutdown systems for two new compressor stations with gas turbine driven centrifugal compressor units. The control systems are based on the Allen Bradley ControlLogix platform with Allen Bradley RSView HMI software. The systems are designed for remote, unattended operation and provide automatic station start capability and pressure setpoint control. Project scope included control panel design and fabrication, PLC and HMI programming and on-site commissioning services. **APNG-4**

Client: **Kinder Morgan**
Project Description: **Control System Network and Wellhead Control System Upgrade**
Project Title: **Station 388 Control System Upgrade**
Location: **Longview, Texas USA**

Provided programming and commissioning of a PLC system designed to serve as a control system network master to coordinate communication between multiple PLC based control systems and HMIs from different vendors, for control of a compressor station, dehydration plant, two CO2 removal process plants and seven compressor units. Project scope also included development of algorithms and PLC software for remote pressure / flow control of over 40 I/W wells and communication with RTUs for a gas storage field. The control system is based on the Allen Bradley ControlLogix platform with Wonderware HMI software. **APNG-5**

Client: **Rockies Express Pipeline (REX)**
Project Description: **Control System Software and Commissioning**
Project Title: **Rockies Express**
Location: **Western United States (Multi-State)**

Configuration of control system software and commissioning of station control and ESD systems for ten new compressor stations for a 1,600 mile, 1.8 BCF/D, cross country pipeline. The horsepower at these facilities consists of gas turbine/centrifugal, engine driven/reiprocating and motor driven/cetrifugal compressors. The control systems are based on the Allen Bradley ControlLogix platform with Wonderware HMI software. The systems are designed for remote, unattended operation and provide automatic station start capability and setpoint control. Project scope included configuration, modification and testing of PLC and HMI software, integration of unit control systems with station controls, control system loop checks and on-site commissioning services. **APNG-6**

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Recently Completed Projects - Automation Projects (Natural Gas)

Client: **Kinder Morgan**
Project Description: **New Compressor Station PLC, HMI and ESD Implementation**
Project Title: **Station 214 Automation**
Location: **Columbus Junction, Iowa USA**

Design, programming and commissioning of a PLC based compressor station control system and emergency shutdown system for a grass roots compressor station. The control system is based on the Allen Bradley ControlLogix platform with Wonderware HMI software. The system was designed for remote, unattended operation and provides automatic station start capability and pressure setpoint control. Project scope included control panel design and fabrication, PLC and HMI programming and on-site commissioning services. **APNG-7**

Client: **Kinder Morgan**
Project Description: **Control System Hardware and Software Upgrade**
Project Title: **388 Gas Cooler Control System**
Location: **Longview, Texas USA**

Design, programming and commissioning of a PLC based control system for gas cooling and separation equipment which was installed at this existing facility as part of a storage capacity expansion project. The control system is based on the Allen Bradley ControlLogix platform with Wonderware HMI software. Project scope included control panel design and fabrication, PLC and HMI programming, integration of the new control system into the existing station control system and on-site commissioning services. **APNG-8**

Client: **Central New York Oil & Gas**
Subsidiary of Inergy
Project Description: **Optimization of Compressor Station Control Systems**
Project Title: **Stagecoach Storage Facility Control System Upgrade**
Location: **Owego, New York USA**

Assessment and optimization of control systems for a compressor station and gas storage field. Control systems for station yard valves, the station ESD system, three electric motor driven centrifugal compressor units, a dehydration plant, and the gas measurement/control system are being reviewed and upgraded as part of this project. All of these systems are based on the Allen Bradley PLC5 platform. The project also includes programming and start-up of Omni flow computers for injection and storage wells. ENE is also serving as the control system consultant to facilitate integration of a new compressor unit control system with existing station and ESD control systems for the horsepower expansion project. The scope of services includes assessment and analysis, control system troubleshooting, modification of existing PLC programs, flow computer programming and on-site commissioning services. **APNG-9**

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Recently Completed Projects - Automation Projects (Natural Gas)

Client: **Nicor Gas**
Project Description: **Control System Hardware and Software Upgrade**
Project Title: **Station 50 Turbine Control System Upgrade**
Location: **Troy Grove, Illinois USA**

Project scope included design, programming, control panel fabrication and commissioning of PLC a based control system for an Allison 501KC5 / Dresser Rand CDP-416 gas turbine/cetrifugal compressor package. The control system is based on the Allen Bradley ControlLogix PLC platform with a Panelview touchscreen PC running RSView ME as the HMI. Control system functionality includes all start/stop sequencing, shutdown and alarm functions, fuel control control, surge control, temperature limiting and automatic load control. Fuel, surge and temperature limiting algorithms and software for this application were developed by ENE. **APNG-10**

Client: **Kinder Morgan**
Project Description: **Compressor Station PLC and HMI Upgrade**
Project Title: **Station 201 Unit Control System Upgrade**
Location: **Hersher, Illinois USA**

Design, programming and commissioning of a PLC based control system for an engine driven reciprocating compressor unit (Cooper Bessemer 10W330). The control system is based on the Siemens 545 PLC with a touch screen PC running Wonderware Intouch as the HMI. Control system functionality includes all start/stop sequencing, shutdown and alarm functions, speed control, air/fuel ratio control, ignition timing control and automatic load control. Calculations included fuel torque, compressor torque, horsepower, capacity, flow, loadstep and compressor efficiency. **APNG-11**

Client: **Kinder Morgan**
Project Description: **Compressor Station Control System Hardware and Software Upgrade**
Project Title: **Exterran Compressor Package Control System**
Location: **Mills County, Iowa USA**

Designed, fabricated, commissioned and programmed a control panel for a compressor unit package consisting of a Caterpillar 3612 engine and an Ariel JGD6 compressor. The control system is based on the Allen-Bradley ControlLogix platform with a Wonderware InTouch 9.0 operator interface. A ProSoft MVI56-MCM Modbus module provides communications between the unit ControlLogix PLC and the Caterpillar engine control system PL1000 interface. The PLC control system funtionality includes all compressor control, safety and monitoring funtions, valve sequencing and modulated recycle valve control. The HMI provides monitoring, control, historical and real-time alarming, logging and trending for both the engine and comperssor control systems. The HMI program provides on-linehelp files, Cause & Effect Charts, and operational manuals. **APNG-12**

Recently Completed Projects - Automation Projects (Natural Gas)

Client: Nicor Gas
Project Description: Compressor Station Control System Hardware and Software Upgrade
Project Title: Station 70 Unit Control System Upgrade
Location: Pontiac, Illinois USA

Design, programming, control panel fabrication and commissioning of PLC based control systems for two engine driven reciprocating compressor units. The control systems are based on the Allen Bradley ControlLogix PLC with a Panelview touchscreen PC running RSView ME as the HMI. Control system functionality includes all start/stop sequencing, shutdown and alarm functions, speed control, air/fuel ratio control, ignition timing control and automatic load control. Calculations include fuel torque, compressor torque, horsepower, capacity, flow, loadstep and compressor efficiency. Units automated included two Clark HRA-8Ts. **APNG-13**

Client: Louisville Gas and Electric
Project Description: Compressor Station Control System Hardware and Software Upgrade
Project Title: Unit Control System Upgrade
Location: Magnolia, Kentucky USA

Design, programming, control panel fabrication and commissioning of PLC based control systems for three engine driven reciprocating compressor units. The control systems were based on the Allen Bradley ControlLogix PLC with FlexIO and a Panelview touchscreen PC running RSView ME as the HMI. Control system functionality included all start/stop sequencing, shutdown and alarm functions, speed control, air/fuel ratio control, ignition timing control and automatic load control. Calculations include fuel torque, compressor torque, horsepower, capacity, flow, loadstep and compressor efficiency. Units automated included five Cooper Bessemer GMV8s. **APNG-14**

Client: Louisville Gas and Electric
Project Description: Compressor Station Control System Hardware and Software Upgrade
Project Title: Unit Control System Upgrade
Location: Muldraugh, Kentucky USA

Design, programming, control panel fabrication and commissioning of PLC based control systems for three engine driven reciprocating compressor units. The control systems were based on the Allen Bradley ControlLogix PLC with FlexIO and a Panelview touchscreen PC running RSView ME as the HMI. Control system functionality included all start/stop sequencing, shutdown and alarm functions, speed control, air/fuel ratio control, ignition timing control and automatic load control. Calculations include fuel torque, compressor torque, horsepower, capacity, flow, loadstep and compressor efficiency. Units automated included two Cooper Bessemer GMV10s. **APNG-15**

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Recently Completed Projects - Automation Projects (Natural Gas)

Client: Kinder Morgan
Project Description: New Compressor Station PLC, HMI and ESD
Project Title: Station 803 Automation
Location: Mt. Pleasant, Texas USA

Programming and commissioning of a natural gas compression station control system and emergency shutdown system. Project scope also included design, fabrication, commissioning and programming of control panels for the 2 compressor units with Caterpillar 3616 engines utilizing the PL1000 communication interface module. The Allen-Bradley ControlLogix platform with a Wonderware InTouch 9.0 operator interface was implemented on all four control schemes. All HMI programs have integrated help files, Cause & Effect Charts, and operational manuals. The operator interfaces also provide historical and real-time alarming, logging and trending. A ProSoft MVI56-MCM Modbus module was employed for the communications between the unit ControlLogix PLCs and the Caterpillar PL1000s. This provides detailed and critical engine data to be displayed on the each operator interface. **APNG-16**

Client: Kinder Morgan
Project Description: Retrofit Compressor Station PLC, HMI Implementation
Project Title: Station 184 Unit Control System Upgrade
Location: Sayre, Oklahoma USA

Retrofit of new PLC-based unit control panels on three TCV Clark engine/compressor units. The project scope included the reverse engineering of the existing OEM pneumatic control panels, and defining functional requirements, design, fabrication, installation, and commissioning of the new control panels. ENE also designed, installed and commissioned a new fiber optic Ethernet control network for the compressor station. The engine governor, the air manifold pressure & temperature, the ignition timing, gas cooler discharge temperature and all water and oil cooling PID control loops are integrated into the PLC's. Each unit control panel is equipped with a dedicated touchscreen HMI operator interface running Wonderware for local control, operating data, statuses and alarm histories. **APNG-16**

Client: Kinder Morgan
Project Description: Retrofit Compressor Station PLC, HMI Implementation
Project Title: Station 206 Unit Control System Upgrade
Location: St. Elmo, Illinois USA

Detailed design, programming and commissioning of the software for a new retrofit unit control panel for a Cooper-Bessemer engine/compressor unit with gas cooling at a natural gas storage facility. The engine governor, the air manifold pressure & temperature, the ignition timing, gas cooler discharge temperature and all water and oil cooling control loops are integrated into the PLC. The unit control panel is equipped with a dedicated touchscreen HMI operator interface running Wonderware for local control, operating data, statuses and alarm histories. **APNG-17**

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Recently Completed Projects - Automation Projects (Natural Gas)

Client: Nicor Gas
Project Description: Compressor Station Control System Hardware and Software Upgrade
Project Title: Station 70 Unit Control System Upgrade
Location: Pontiac, Illinois USA

Design, programming, control panel fabrication and commissioning of PLC based control systems for two engine driven reciprocating compressor units. The control systems are based on the Allen Bradley ControlLogix PLC with a Panelview touchscreen PC running RSView ME as the HMI. Control system functionality includes all start/stop sequencing, shutdown and alarm functions, speed control, air/fuel ratio control, ignition timing control and automatic load control. Calculations include fuel torque, compressor torque, horsepower, capacity, flow, loadstep and compressor efficiency. Units automated included two Clark HRA-8Ts. **APNG-18**

Client: Louisville Gas and Electric
Project Description: Compressor Station Control System Hardware and Software Upgrade
Project Title: Unit Control System Upgrade
Location: Magnolia, Kentucky USA

Design, programming, control panel fabrication and commissioning of PLC based control systems for three engine driven reciprocating compressor units. The control systems were based on the Allen Bradley ControlLogix PLC with FlexIO and a Panelview touchscreen PC running RSView ME as the HMI. Control system functionality included all start/stop sequencing, shutdown and alarm functions, speed control, air/fuel ratio control, ignition timing control and automatic load control. Calculations include fuel torque, compressor torque, horsepower, capacity, flow, loadstep and compressor efficiency. Units automated included five Cooper Bessemer GMV8s. **APNG-19**

Client: Louisville Gas and Electric
Project Description: Compressor Station Control System Hardware and Software Upgrade
Project Title: Unit Control System Upgrade
Location: Muldraugh, Kentucky USA

Design, programming, control panel fabrication and commissioning of PLC based control systems for three engine driven reciprocating compressor units. The control systems were based on the Allen Bradley ControlLogix PLC with FlexIO and a Panelview touchscreen PC running RSView ME as the HMI. Control system functionality included all start/stop sequencing, shutdown and alarm functions, speed control, air/fuel ratio control, ignition timing control and automatic load control. Calculations include fuel torque, compressor torque, horsepower, capacity, flow, loadstep and compressor efficiency. Units automated included two Cooper Bessemer GMV10s. **APNG-20**

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Recently Completed Projects - Automation Projects (Natural Gas)

Client: Northern Natural Gas
Project Description: Control Panels and Compressor Automation Upgrade
Project Title: Oakland Automation Project Phase I & II
Location: Oakland, Iowa USA

Hardware and Software upgrade of Automation for Five (5) Clark TLA-10 Vertical Engines. Designed and manufactured Station Panel, Unit Panels, and Remote Valve Panels. Packaged servers, power supplies, media converters, Ethernet switches and ancillary equipment into a 19" EIA cabinet. Implemented Allen-Bradley ControlLogix PLC for the Station PLC, Unit PLCs, Remote Valve Panels. Implemented code for an Allen-Bradley RSView SE HMI with Client/Server architecture with 2 rich client HMI terminals for the control room; rich client terminals (touchscreens) at identified hazardous and non-hazardous locations. Deployed Ethernet switches, media converters, power supplies, & communications equipment at the HMI end of the network. Exchange data with existing PLCs, RTUs, HMIs, UPS & fire controller. Provided the Functional Requirement Documents (FRD), Drawings, Job Books & Documentation. Coordinated the Startup & commissioning of this system. Phase II involved modification of Station PLC code and Station HMI integration with new Solar Turbine installation. **APNG-21**

Client: Northern Natural Gas
Project Description: Control Panels and Compressor Automation Upgrade
Project Title: Paulina Automation Project
Location: Paulina, Iowa USA

Hardware and Software upgrade of Automation for Five (5) Clark TLA-10 Vertical Engines. Designed and manufactured Station Panel and Remote Valve Panels.

Develop code for Allen-Bradley ControlLogix PLC for the Station PLC; Unit PLCs. Develop code for Allen-Bradley FlexLogix PLC for the Remote Valve Panel PLCs. Develop code for an Allen-Bradley RSView SE HMI with Client/Server architecture and 2 Rich Client HMI Terminals in Control Room and Hazardous Locations (touchscreen). Exchange data with existing PLCs, RTUs, HMIs, UPS & fire controller. Provide the Functional Requirement Documents (FRD), Drawings, Job Books & Documentation. Coordinate the Startup & commissioning of this system. **APNG-22**

Client: Northern Natural Gas
Project Description: Compressor Functional Documentation (FRD)
Project Title: Macksville Compressor Station FRD
Location: Macksville, Kansas USA

Document existing station PLC & HMI logic. Document interaction of HMI with outside devices. Examine MOE block diagrams to determine interaction with the HMI. Produce complete Compressor Functional Documentation (FRD) for compressor station. **APNG-23**

Recently Completed Projects - Automation Projects (Natural Gas)

Client: **Northern Natural Gas**
Project Description: **PLC/HMI Upgrade & Commission Compressor Station**
Project Title: **Mullinville Station Automation Project**
Location: **Mullinville, Kansas USA**

Develop code for an Allen-Bradley ControlLogix PLC for Station PLCand Hot/ Cold Well PLC. Develop code for an Allen-Bradley FlexLogix PLC for the Remote RTU Panel PLC. Modify existing Wonderware InTouch HMI for interface to new ControlLogix and FlexLogix processors.

Design and develop Station manifold flow path and MAOP matrix. Provide automatic flow path color code based on external pipeline path. Exchange data with existing PLCs, RTUs, HMIs, UPS & fire controller. Provide the Functional Requirement Documents (FRD), Drawings, Job Books & Documentation. Coordinate the Startup & commissioning of this system. **APNG-24**

Client: **Northern Natural Gas**
Project Description: **Compressor Functional Documentation (FRD)**
Project Title: **Macksville Compressor Fire & Gas Upgrade**
Location: **Macksville, Kansas USA**

Develop logic in the TI PLC program to handle configuration of a new 2573 serial interface card; map data from the Detronics fire and gas controller; and map fire and gas data to SCADA. Develop HMI screens for interaction to the fire and gas data. Develop auto-dialer alarms based on the data from the fire and gas controller. Clean up and optiomize the existing fire and gas logic that currently resides in the TI PLC program. **APNG-25**

Client: **Northern Natural Gas**
Project Description: **Optimize PLC Logic & Commission Compressor**
Project Title: **Redfield Compressor Station Integration**
Location: **Redfield, Iowa USA**

Develop logic in the TI PLC to handle the configuration of 1 new turnaround sequence; 2 PID loops with anti-windup to replace the existing ramp open/ramp closed PLC logic for valves 40 and 99. Optimize existing TI PLC logic that will improve operation and retain existing functionality. Provide complete TI PLC documentation inside of the PLC program and in the form of Excel spreadsheets. Startup and commissioning of the TI PLC to include testing and verification of an estimated 83 discreet and 5 analog I/O points. Review and training in regards to the functionality of the Macksville turnaround TI PLC. **APNG-26**

Note: *Inclusion in this list does not imply any endorsement of EN Engineering.*
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