Siemens AG

TransCanada Corporation, Canada

Key to Keystone XL

It has been almost seven years since TransCanada filed for its presidential permit to build the Keystone pipeline expansion from Alberta to Nebraska, and while the project has yet to receive approval, the Canadian oil and gas giant is already at work – partnering with Siemens to implement equipment and systems that will make Keystone XL one of the safest, most advanced pipelines ever built.

Plans for the Keystone XL pipeline include not only the pipes but also an automated system that will send more than 20,000 data points from pump stations along the pipeline to an oil control center in Calgary every five seconds. Siemens provided a large majority of the equipment for the project, including pumps, motors, variable-speed drive systems, switchgear, contactors, and control systems. "TransCanada has spent $2.4 billion on the system already – buying motors, pipes, and other components that are scattered throughout warehouses in North America," says Corey Goulet, president of Keystone Pipeline Projects. "Right now, they're all just waiting to be used."

Pump stations are typically located about every 50 miles along the pipeline. "Today it takes 56 pumping stations to get oil from Hardisty, Alberta, to the Gulf Coast. With Keystone XL, there will be 36 pump stations," adds Goulet. "We can get oil from the western Canadian sedimentary basin to the Gulf Coast in less than a month. No other pipeline can do that, and it's important because there's a value associated with getting it there quickly."

Connecting the parts

The Keystone pipeline thus far has been a collection of sections. The base Keystone section went into operation in 2010 and stretches 275 miles. Another section of the pipeline, which was completed in early 2012, connects Steele City, Nebraska, to Cushing, Oklahoma. Beyond that is Nederland, Texas, on the Gulf Coast.

Siemens was contracted to equip 35 stations with medium-voltage motors, switchgear, contactors, variable-speed drives (VSDs), pumps, and automation control systems. TransCanada and Siemens are emphasizing scalability by implementing systems that are easy to program, maintain, and expand if needed. On the automation side, Simatic S7-300 programmable logic controllers (PLCs) and Simatic ET 200 remote units provide a scalable yet standardized foundation for process and system control. "We designed and built the system modularly, so if it needs to be expanded, that can be achieved by simply adding modules," says Brad Wojcik, senior lead engineer at Siemens.

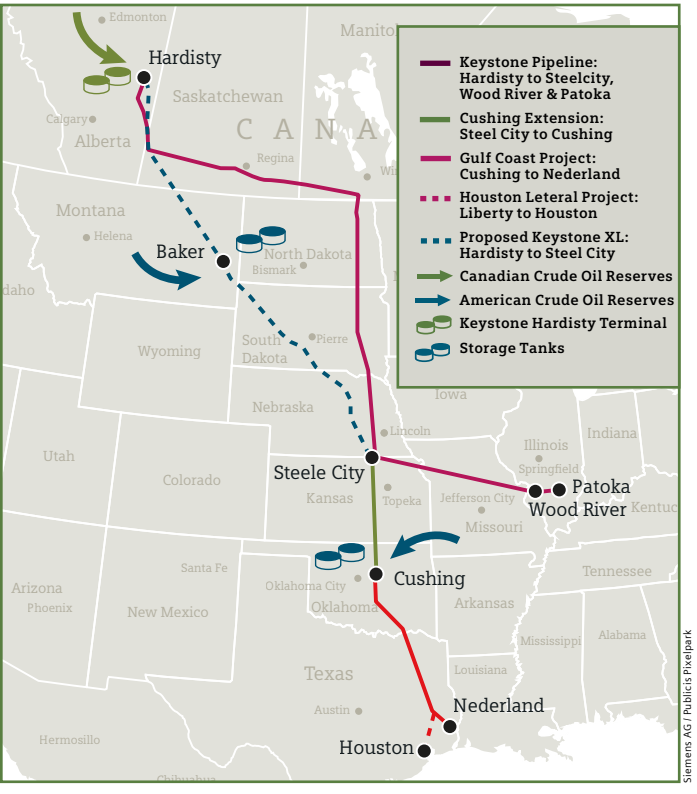
A soft start for a tough job

With such a large project, the project team had a special focus on the drive solution for the pump stations, which are key to getting the oil through the pipeline. One such station is located in Stanton, Nebraska, and was implemented as part of

Keystone Phase I. It moves roughly 550,000 barrels of oil a day and is equipped with four motors that drive the pumps sending oil through the system. Each motor is started with the VSD for smooth acceleration to operating speed and to minimize fluid pressure pulsations. The pump motor is then bypass-powered directly from the utility. One motor is always left on the VSD to provide adjustable pump speeds for regulating pump station pressure and flow in the pipeline, and to accommodate different types of crude oil products and grades.

In addition to transporting oil from Canadian oil sands, the Keystone XL pipeline will carry product from other producers in Texas, Oklahoma, Montana, and North Dakota. "Keystone has 47 different approved commodities," says Virgil Pfennig, Stanton's station manager. "There can be 100 different batches in the line at any given time." The pumps regulate the flow with varying pressures. Oil comes into the first pump at approximately 290 psi. Each pump that follows will increase that pressure. The number of pumps used will depend on the grade and density of the crude coming through the line, both of which can be monitored by personnel operating the stations.

The Keystone XL pipeline extension project will link Canada with the US Gulf Coast



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Keystone XL: the project

Keystone Phase III – Gulf Coast
- **40 pumps (6,500 HP)**
- **40 medium-voltage motors (6,500 HP)**
- **10 medium-voltage variable-speed drives**
- **10 variable-frequency drives (VFDs) electrical shelters**
- **10 medium- and low-voltage distribution electrical shelters**
- **10 unit control (automation) systems**

Keystone Phase IV – US Steele City
- **95 pumps (6,500 HP)**
- **95 medium-voltage motors**
- **20 medium-voltage variable-speed drives**
- **20 VFD electrical shelters**
- **20 medium- and low-voltage distribution electrical shelters**
- **20 unit control (automation) systems**
- **3 electrical substations**

Keystone Phase IV – CA Steele City
- **40 pumps (6,500 HP)**
- **40 medium-voltage motors**
- **20 medium-voltage variable-speed drives**
- **8 VFD electrical shelters**
- **8 medium- and low-voltage distribution electrical shelters**
- **8 unit control (automation) systems**
- **1 electrical substation**

Pressure-control valves (PCVs) are also used to regulate the flow of oil. The control system is designed as failsafe, meaning that if there were ever an over-pressure, everything would shut down.

Remote yet real-time control

Pump stations are monitored primarily through the oil control center in Calgary, which has three consoles: one for monitoring the pipeline and pump stations, one for the terminals, and one to monitor the leak detection system. While stations are largely unmanned, personnel are always on call. Data are communicated through satellite connections, though there is a landline backup if needed. "All data are received from each pump station, terminal, and delivery station every 5 seconds, and from each valve site every 30 seconds. It's pretty much in real time," Pfennig says. Once approved, the nearly 1,200-mile expansion would become part of the existing Keystone XL system, creating a faster route for getting product from the oil sands of Alberta to refineries on the Gulf Coast. ■

INFO AND CONTACT
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