ARC INSIGHTS

JULY 26, 2018

Devon Energy Uses Real-time Data and Advanced Analytics to Make Better Decisions

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Keywords

Predictive Analytics, Haul-off, Seeq, Devon Energy, Real Time Data, Situational Awareness, Operations Data, Business Data

Devon Energy has implemented advanced data historian and analytics technologies to transform its data into actionable insights that support data-driven decisions. This required close cooperation between the company's operations technology (OT) and information technology (IT) groups.

Overview

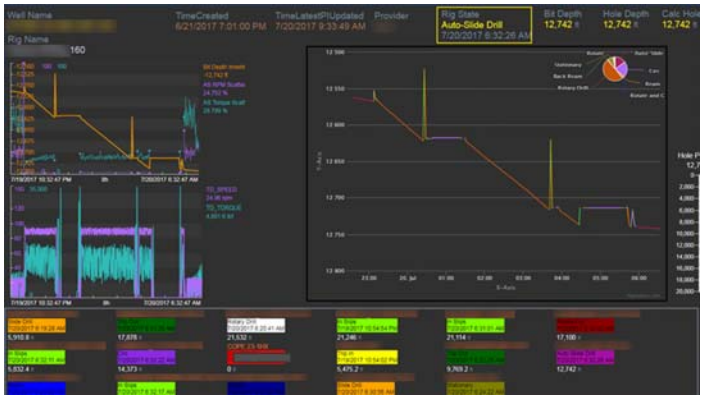
Like many other energy companies, Devon Energy, a leading independent oil and natural gas exploration and production company in North America, generates huge volumes of data. The company's SCADA system monitors 6.5 million data points from multiple sites, with more than 10,000 updates per second. As we learned at a session at the recent ARC Industry Forum in Orlando, Devon Energy has implemented advanced data historian and analytics technologies to transform all this data into actionable insights that support data-driven decisions. This required close cooperation between the company's operations technology (OT) and information technology (IT) groups.

Don Morrison, Real Time Data Engineer at Devon Energy, shared his experience working with newer real-time data and analytics technologies. Devon Energy is based in Oklahoma City with on-shore operations in the US and Canada. The company's 2017 portfolio was evenly distributed with 46 percent oil, 37 percent natural gas, and 17 percent natural gas liquids (NGL). It has a large inventory of future projects planned, mostly in western Oklahoma, southeastern New Mexico, and the Delaware basin.

To continue its successful track record as an industry leader in technology, the company has nurtured a culture of innovation. This includes establishing groups to implement innovative new technologies that provide business value.

Aligning IT and OT

Mr. Morrison is part of the real-time systems OT data and analytics group responsible for managing the data from the company's SCADA and enterprise historian systems. The group works closely with IT to ensure that the products and solutions align with the IT strategy.



Devon Energy Real-time Drilling Operations Dashboard

Devon Energy monitors around 6.5 million data points in the SCADA system, with more than 10,000 updates per second. The update times range from around one second to 15 minutes, depending on the asset. All data is ported from the SCADA system and stored in an enterprise historian system. The data is used by both the company's operations and business groups; including completions, drilling, and production using the Seeq application for a user-driven analytics experience.

Improving Data Quality for Operations and Business Users

Real-time operations and business operations have different data requirements. SCADA data users need real-time data to make decisions. The company's SCADA system was designed to support operations. However, SCADA data often has abnormalities. For example, when a sensor fails or is brought off line for maintenance, data averages become inaccurate. In cases such as these, the data must be cleansed by removing abnormalities. Devon Energy uses its real-time system and Seeq metrics to

Different View of Same Data for Business Planning Purposes

remove some of the abnormalities and improve data quality. Once this is done, the company incorporates the cleansed data into real-time operational dashboards to support drilling and production users as well as business users. For operations users, these dashboards typically provide both basic monitoring information and higher level operational status.

The company's business users, on the other hand, typically want a higher level of aggregated data for daily, weekly, or monthly reports and need to see the data in even time intervals.

Inconsistent data uptake rates can also represent a challenge for some SCADA systems. Some assets may update data every second, others once an hour, and still others once per day. Business users often require additional data analysis and manipulation to align these data for business intelligence. Aligning different operational data types by consistent time intervals for business users typically requires additional data analysis and manipulation. Devon Energy does this by putting the SCADA data into a SQL-like table database accessible to many of its business users. Mr. Morrison observed that most business users have strong SQL skills, but are not as skilled at using time-series databases.

He presented several examples of how the company uses data and analytics to improve situational awareness and performance in its various operations. These included an interesting solution developed for the company's liquid haul-off operations and associated business process.

Improving Liquid Tank Haul-off Operations

At Devon Energy's unmanned, remote production sites, the liquid haul-off process for the tank battery used to separate the oil, water, and gas components, previously involved a significant amount of manual data entry. This surprisingly complex operation involves custody transfer of oil and water from the production facility to a tanker truck to move the product to a point of sale for marketing purposes. Ideally, trucks are dispatched to site when the tanks approach capacity, but not any sooner. That's because Devon pays to transport a full load, whether or not the truck is actually filled. On the other hand, if the tanks are not emptied in time, the company would have to halt production, which would be even more costly.

In the past, the truck drivers would simply write the amount of oil or water taken and put it in a mailbox hidden somewhere on the site. Various employees around the company then manually entered this information into spreadsheets. As a result, the company could never be sure that what the trucker wrote down was accurate or if there was spillage, which was a problem for marketing. The central operations group had no idea what the contracted truck drivers were doing, or even when they were on site, which posed an operational and safety risk. The entire process was slow, time-consuming, and error prone.

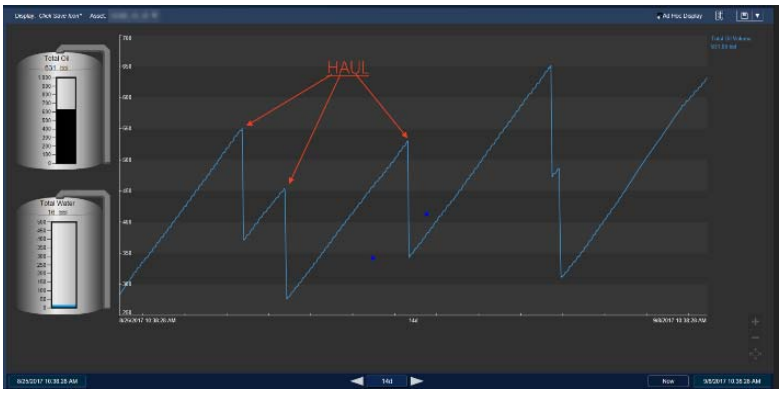
Intelligence Required

Specifically, when a truck was on site, the oil marketing and water management business groups wanted to know:

- Did the driver pick up oil or water?
- How much oil or water was taken?
- Was there more than one truck on site?
- Did they receive a full or partial load?
- At what rate are the tanks filling up?
- Can we predict when the next load will need to occur to be able to schedule pickups more efficiently?
- Can we get enough data to rate our service providers?
- What is the current level of the tank battery?

Situational Awareness and Predictive Analytics

To improve real-time visualization into these tank haul-off events, Mr. Morrison's team developed digital dashboards using tank level information from the SCADA system to enable operators to see when haul-off events occurred, determine how much oil or water was taken, and detect any spills or other issues in real time. The dashboards also showed when the tanks were filling up so the remotely located operators could dispatch trucks in time to avoid having to shut down production. But this just scratched the surface of the potential functionality.



Digital Dashboard Proves Real-time Visibility into Remote Tank Haul-off Operations

Using Analytics to Predict Haul-off Events

Now that they could visualize the haul-off events, the company wanted to be able to predict when future haul-off events would be required, with enough lead time to optimize the process from both the operational and marketing perspectives. To reduce the time and effort needed to develop this solution, the company implemented the Seeq predictive analytics tool.

Data preparation and cleansing can absorb as much as 80 percent of the development time and costs for this type of project. But with Seeq, the engineer applies a smoothing algorithm that quickly cleans up the data and removes jagged data edges. Mr. Morrison pointed out that the tool is easy to use and does not require any programming, enabling the engineer to analyze data or find events quickly. "Using the Seeq tool, we can now determine exactly how much oil was taken during each event by matching up the time series data to when the haul-off event started and ended. This enables us to accurately and quickly estimate events using an interactive inventory and haul-off analytics approach built into the tool."

"Using Seeq to take the time series data directly from the historian enables us to match the data to our assets and analyze the data quickly and accurately." As Mr. Morrison explained, Devon's process tests the data in real time, takes the data and runs it through the tool to get an output to their assets, and applies the technology to the company's approximate 1,200 battery storage units. Using the Seeq API technology, they process the data, write the data back into the historian system, then make the intelligence available for the operational dashboards.

Tank Event Reporting in Power BI

New Tools for Haul-off Reporting and Scheduling

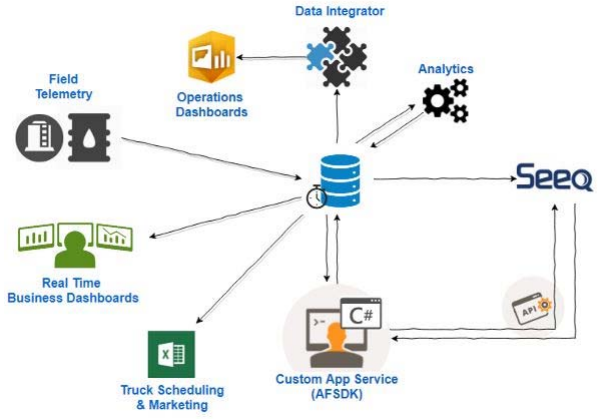
Prior to implementing this data and analytics tool, the company would send out an Excel file for everyone involved in the tank haul-off process to fill in. The data would then be compiled manually into one file to determine the haul-off schedule.

Now, in addition to automating this data entry, the company can also sync the data to Microsoft Power BI, enabling business users to further "slice and dice" the data in a business reporting format to simplify and improve the accuracy of its haul-off scheduling.

Results and Recommendations

Using the available data platform and analytics tools, Devon Energy was able to gain actionable insight and thus increase value from the data it was already collecting.

In the implementation discussed in this report alone (one of several already implemented), the company eliminated manual data entry; improved situational awareness, reduced partial hauls; and enabled IT, OT, and the marketing teams to collaborate more effectively.



Devon Energy's Integrated Tank Inventory and Haul-off Process

Using Seeq applications in conjunction with the company's real-time system and other tools, Devon Energy can normalize its data, predict events, improve scheduling, and accommodate update requests quickly. Devon improved ability to predict haul-off events. The technology also enabled the ability to improve intelligence and react to the data faster, and improve truck haul-off scheduling. Engineers and operators can obtain faster data analysis and audit information using the situational awareness dashboards.

ARC Advisory Group believes that companies should focus on making data actionable and transforming the data into value. Companies should use analytical tools to make better decisions. Data quality is important. Ac-

cording to Mr. Morrison, "Users need to trust the data. They don't like seeing data abnormalities." A unified view of clean data is important.

Devon Energy will continue to work with these types of new and innovative technologies. Future projects include further integration of the company's scheduling and process systems and matching the haul tickets submitted by its service providers to automated detection events with automated haul-off audit traceability. The company would like to be able to use this data to create a mechanism to grade the performance of its various service providers. It also plans to implement digital load tickets (in addition to using the SCADA system to detect what is occurring). The goal is to be able to independently verify that what the hauler says was done on-site actually happened.

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