Donnerstag, 2. März 2023, 15.00 Uhr
Panorama Saal EDEKA-Arena Kongress 1 - Tiefe Geothermie

Thursday, 2 March 2023, 3.00 pm
Panorama Hall EDEKA-Arena congress 1 - Deep Geothermal Energy

Reducing CO2 emissions at well planning stage, through data modelling and simulation

Verringerung der CO2-Emissionen in der Phase der Bohrlochplanung durch Datenmodellierung und Simulation

Holger Egbers, KCA Deutag Drilling GmbH

With the current focus on energy efficiency, GHG reduction and environmentally sustainably drilling operations, this abstract provides inside on an operator's journey from dip-stick fuel measurements to the prediction of CO2 emissions. A case study describes the development of geo-specific energy figures enabling ecologically responsibly well planning.

For decades fuel consumption on drilling rigs was measured by the dip-stick method. Nowadays, a display tells the mechanic the amount of diesel fuel used, and how much is left to organize the refill in a timely manner. For ESG and sustainability reporting this process may provide sufficient insight in fossil fuel usage as well, however with regard to reduction measures and continuous improvement strategies concerning GHG emissions, in depth knowledge of energy usage is needed. When studying fuel consumption data from two land rigs, drilling similar wells for years in the same field and formation revealed high variances in total GHG figures. This can be caused by different total depths, days on location (i.e. ILT, NPT), more tripping or less hole cleaning, back reaming and higher ROP. Finally, the way the rig is operated by the crew affects efficiency, too. In order to categorize inefficiencies, key performance indicators (KPIs) such as fuel consumption per engine, total rig power demand, various single power consumptions and specific well data were identified as minimum requirement. Because both rigs are equipped with the KCAD FX-Control SCADA system all data was on hand, only the fuel and engine data were missing. The project team developed an interface to the Caterpillar motor controller to read the missing data on a sampling rate of <1sec. The additional information, combined with electrical power and drilling data, engineers reviewed numerous wells of both rigs against each other in various segments on power demand vs litre of fuel burned (fuel to power efficiency) and gained insight on CO2 emissions per meter drilled, per round trip and for specific ILT. Since the FX-CEM feature started to record the CAT data in Q3 2021, 15% of unnecessary engine running hours have been identified, accounting for 272 tons of CO2 emissions per year which equals 59 times the emissions from a typical passenger vehicle.

Since the potential improvements in GHG emissions were confirmed through data simulation, the team moved on to develop solutions that help leveraging power demand and eliminating excessive engine operation. As an immediate remedy, the FX-Control user interface got a simple EcoMeter added, indicating the Driller / Toolpusher / Rig Manager how efficient the rig is operated at any given time aiming to increase awareness and to foster an environmentally responsible behaviour on rig site. Thanks to

highly committed crews, 9% of the 15% inefficiency was removed without the need to implement highly sophisticated technology.

Motivated by the success of the EcoMeter, the engineering team is now looking into utilizing an AI/ML solution that was implemented to the FX-Control earlier already to detect and predict fuel injector failures. Since the architecture for data modelling, training, and validating has proven its effectiveness, the intention is to deploy a second, dedicated ML algorithm that detects anomalies in fuel consumption and inefficient power demand to turn these into rules for generator usage on the edge computer. The interface to the rig power management system will then trigger an engine start / shut down without compromising drilling operations.

The data model supposed to take specific operations, drilling parameter and current / predicted power demand into account to enhance the utilization of the power set from an ecological perspective. Data output from the model shall generate a depth-based data pool (CO2 per meter drilled) that permits the prediction of CO2 emissions from drilling a well before it is drilled, to enable an ecological well planning and regulatory compliance.

The fast application of new technology and emerging digitalization opportunities will help not only to monitor and report on GHG emissions, but as well to reduce the waste of fossil fuels. In future we will be able to take a holistic view on the emissions from drilling a well, and reduce them from well planning phase, throughout the operation of a drilling rig. The next generation of rigs will not only drill wells more efficiently, but as well ecologically sustainable.

GHG	-	Green House Gases
ILT	-	Invisible Lost Time
NPT	-	Non Productive Time
FX-CEM	-	FX-Control, Carbon Emission Monitoring - A KCA Deutag developed SCADA system
CAT	-	Caterpillar