Quantification Of Emissions During Well Construction For Process Optimization


Abstract

Objectives/Scope: Emissions associated with well construction process need to be quantified at the major operations granularity in order to come up with effective abatement strategies. This paper outlines methodologies to quantify emissions and discusses abatement strategies.

Methods, Procedures, Process: Authors took a bottom up approach to develop a model linking major operations on the rig with the corresponding energy consuming equipment. A hybrid model that contained both the data analytics as well as the physics based approach was developed. Equipment on a few rigs was studied for its energy consumption while a particular activity was being carried out at the rig. This energy consumption was then converted into emissions based on the source of energy generation.

Results, Observations, Conclusions: The link between the emissions and any particular activity is not a straight forward one. It was challenging due to the nature of the tasks undertaken. Each task involved the use of multiple pieces of equipment utilizing power from multiple sources and converting this power into multiple forms of energy (Electrical, mechanical, etc.) and corresponding emissions. Results showed that most of the energy, in fact, gets wasted. Most energy consuming operations are drilling where both the top drive and the running of mud pump accounted for over 80% of the energy consumption and emissions. Energy efficiency drops with the depth of the well as the energy loss due to the friction etc. increases with depth resulting in higher emissions.

Novel/Additive Information: Combined use of data analytics and the physics to build a hybrid model that can predict the energy required to perform a well construction operation is a new approach. The new hybrid approach used here increase the confidence level in the predictions when compared with a pure data analytics based approach.