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Design and Implementation of a Comprehensive Carbon Intensity Estimation and Forecasting Platform

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Summary

With growing worldwide consensus about the impacts of climate change, the oil and gas industry faces unprecedented pressure to redefine itself, minimize its carbon footprint, and ultimately move towards an energy transition. It is therefore imperative that the industry can easily and accurately measure its carbon footprint, monitor key sources of emissions and ultimately minimize it via operational and other optimizations. This need is further accelerated by regulatory, investor, consumer, and market forces, in many cases making it mandatory for corporations to report their carbon footprints. The objectives of this work are design and implementation of a carbon estimation and forecasting platform to be the one-stop-shop for all the carbon needs of the oil and gas industry.

Theory / Method / Workflow

We leverage the industry standard OPGEE which is a life-cycle assessment (LCA) tool that estimates the GHG emissions of petroleum production operations from reservoir to transport to the refinery. It is developed by Stanford University and California Air Resources Board (CARB) and has been used and validated to report carbon intensity for over 9000 fields worldwide. This not only provides a robust, tested, and reliable approach to estimate carbon intensity, but also provides transparency to all calculations, thereby making it thoroughly auditable. Given the field-specific data, OPGEE uses fundamental engineering equations and empirical correlations to estimate the energy and mass flow through each stage (component) of the process, and therefore estimate GHG intensities per 1MJ petroleum delivered. The emissions from different stages are combined to obtain the total GHG emissions estimate.

Results, Observations, Conclusions

The platform provides a user-friendly, cloud based, scalable interface to OPGEE, and allows users to seamlessly integrate various sources of data (public, private, third party) to estimate current GHG emissions at component level. It further leverages production forecasting tools to provide an estimate for future forecasts. Additionally, the platform provides tools for collaboration, as estimating carbon intensity requires expertise and data from many domains. Sensitivity analysis is also implemented to understand key factors impacting carbon intensity for a field and helps the managers to make sustainable decisions and reduce their carbon footprint. Results from multiple fields will be discussed.

Novel/Additive Information

Design and implementation of a tool that integrates different sources of data to estimate current and forecast future carbon intensity from oil and gas production operations and provides benchmarking, sensitivity analysis, and collaboration tools to make sustainable decisions is the novelty of this work.