Date: August 17th, 2021

To: Mike Morden, Gibson Energy
Bill Frerking, USD Group

From: Damien Hocking, Corelium Software

Re: Operational Value Chain Carbon Emissions Model Review **-** Summary

I was contracted by Gibson Energy (Gibson) and USD Group (USD) to conduct a third-party review of their operational value chain carbon emissions model. I have twelve years' experience developing and analyzing carbon emissions models in the hydrocarbon industry and I am the original author of the Petroleum Refinery Lifecycle Inventory Model (PRELIM) now supported by the University of Calgary.

Gibson and USD have collaborated to develop an Excel-based model to quantify the operational $CO2_e$ emissions associated with transporting bitumen by pipeline and rail from near Hardisty, Alberta to near Port Arthur, Texas, utilizing current pipeline and railroad routes. The model analyzes four scenarios:

1) Shipping diluted bitumen (Dilbit) from Hardisty, Alberta to the U.S. Gulf Coast market through the Enbridge Mainline pipeline and returning diluent to Hardisty, Alberta through the Southern Lights pipeline from the Gulf Coast.
2) Shipping Dilbit from Hardisty, Alberta to the U.S. Gulf Coast market through the Keystone pipeline and returning diluent to Hardisty, Alberta through the Southern Lights pipeline from the Gulf Coast.
3) Shipping Dilbit from the Hardisty Rail Terminal (HRT) near Hardisty, Alberta to the Port Arthur Terminal (PAT) in the U.S. Gulf Coast market via rail, returning empty railcars, and returning diluent to Hardisty, Alberta through the Southern Lights pipeline from the Gulf Coast.
4) Shipping minimally-diluted bitumen (DRUbit™) from HRT to PAT via rail and returning empty railcars. Diluent is recovered at the diluent recovery unit at the Hardisty Energy Terminal (HET) in Alberta near Hardisty.

The operational $CO2_e$ emissions model is based on the contracted processing rate of 50,000 bbl/d of Dilbit at HET. The model includes diluent recovery at HET in Alberta; rail transport including car counts and locomotive performance from HRT to PAT; pipeline transport including electrical grid intensity; railcar unloading, blending, and product delivery at PAT; and diluent recovery at the end-user refinery. The model is based on factored emissions from fuel or energy consumption; this is standard industry practice. Upstream bitumen production $CO2_e$ emissions and downstream refinery processing emissions beyond diluent recovery are not included as they are outside the Gibson/USD value chain.

Modeled $CO2_e$ emissions from HET and PAT are based on the engineering design calculations for the respective facility at the 50,000 barrel per day rate. Emissions for rail transport are based on the railcar loading capacities for Dilbit and DRUbit™, locomotive fuel efficiency for the rail route and the return of empty railcars to Alberta. Emissions for pipeline transport are based on calculated pumping power requirements for Dilbit and diluent with average electrical grid intensity for each pipeline section. Emissions for diluent recovery/recycle at the refinery in Texas are assumed to be the same as HET.

The assessment methodology followed standard review practice, each section or process of the model was examined independently for calculation errors, data integrity, and quality of references. Over the course of the review with Gibson and USD, data sources were updated to the latest publicly available information and the pipeline transport analysis was improved and updated with 2020 capacities.

Overall, the model is well-organized and comprehensive with appropriate assumptions and supporting data, providing a robust basis for the results. Specific and credible information in the model includes HET and PAT design information from Gibson and USD; rail route, locomotive, and rail car information from Canadian Pacific and publicly reported information by CP and KCS, the rail carriers for DRUbit™; pipeline information from Gibson and publicly reported information from the included pipelines; and information from publications by the University of Calgary's Energy Technology Assessment Research Group on their COPTEM pipeline emissions model.

The model indicates that the DRUbit™ scenario above saves between 20% – 36% of operational $CO2_e$ emissions compared to the Dilbit rail and pipeline scenarios. Against the Dilbit by rail scenario, the model predicts that the DRUbit™ scenario saves approximately 63,000 metric tonnes $CO2_e$/year (20%, 69,000 U.S. tons/year). Against the Keystone scenario, the model predicts that the DRUbit™ scenario saves approximately 92,000 metric tonnes $CO2_e$/year (27%, 101,000 U.S. tons/year). Against the Mainline scenario, the model predicts that the DRUbit™ scenario saves approximately 137,000 metric tonnes $CO2_e$/year (36%, 151,000 U.S. tons/year).

These savings are achieved by removing the diluent required to enable pipeline transport and replacing those pipeline transport emissions with rail transport emissions. Diluent is recovered at the upstream HET location instead of the downstream end-user refinery, removing the diluent transport loop and associated emissions. A comparison of the predicted total emissions for each scenario is shown in Figure 1 below.

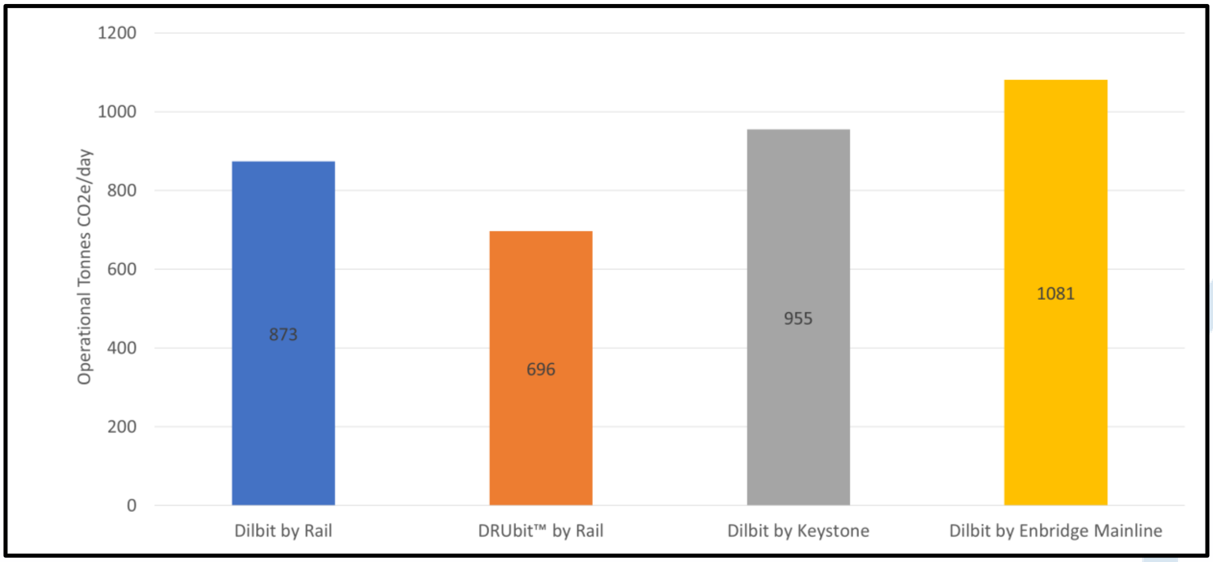

Figure 1

I appreciate the opportunity to provide the model review. For any questions or clarifications please contact me at dhocking@coreliuminc.com or 403 510 6619.

Kind Regards,

Dr. Damien Hocking

CEO, Corelium Software