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Global Hydrocarbon Supply Model

The Global Hydrocarbon Supply Model (GHySMo) is a new computer model introduced in the *International Energy Outlook 2019* (IEO2019). As part of EIA's larger World Energy Projection System Plus (WEPS+), GHySMo is critical to EIA's ability to understand liquid fuel and natural gas markets in the mid and long term. GHySMo produces geographically explicit estimates of natural gas, crude oil, and refined product production, processing, and transport.

GHySMo consists of three distinct modules that reflect key parts of the hydrocarbon market. Together, the modules describe the economics of hydrocarbon extraction, transformation, and movement.

- The *upstream module* represents the volume of global resources and production that would be produced as a function of resource extraction costs. This module incorporates global hydrocarbon resource data down to the country-basin level and represents co-production of crude oil and natural gas. It incorporates a measure of geopolitical risk and also represents uncertainties in resource estimates and drilling/completion costs.
- The *conversion module* represents multiple crude oil refinery configurations and operating modes, and it captures refinery operations at a regional level. Each refinery region responds to price signals for different qualities of crude oils and refined products and chooses its input crude slate, output products, and refining operation modes to maximize refinery profit. Over the long term, the conversion module can also build more refining capacity for each configuration to capture the potential of long-term profit. The conversion model is built on key data sources, including estimates of refinery processing capacities by region.
- The *logistics module* includes two network transshipment models: one that calculates optimal transportation and loading/unloading capacities and the other that optimizes flows of commodities given the calculated capacities from the first. The mathematical programs are independent from the markets being simulated, and the data are fully separated from the optimization code, which gives the model the ability to handle different topologies (i.e., regions or routes), commodities, and transportation modes. The model reflects a new database of international logistics data, including capacities and costs for pipelines, ships, and liquefaction-regasification facilities.

IEO2019 reflects the first step in building out the modeling structure and data. IEO2019 is slated to include *Issue in Focus* papers that explore components of GHySMo.

GHySMo can be downloaded as part of the IEO2019 WEPS+ source package (Link). GHySMo is written in AIMMS, python, and SQL, with text input files. EIA does not provide user support; however, many users obtain the model for the data in its input files or for the source code.