



ENSY
ENERGY

**Introduction to the
WORLD Model**

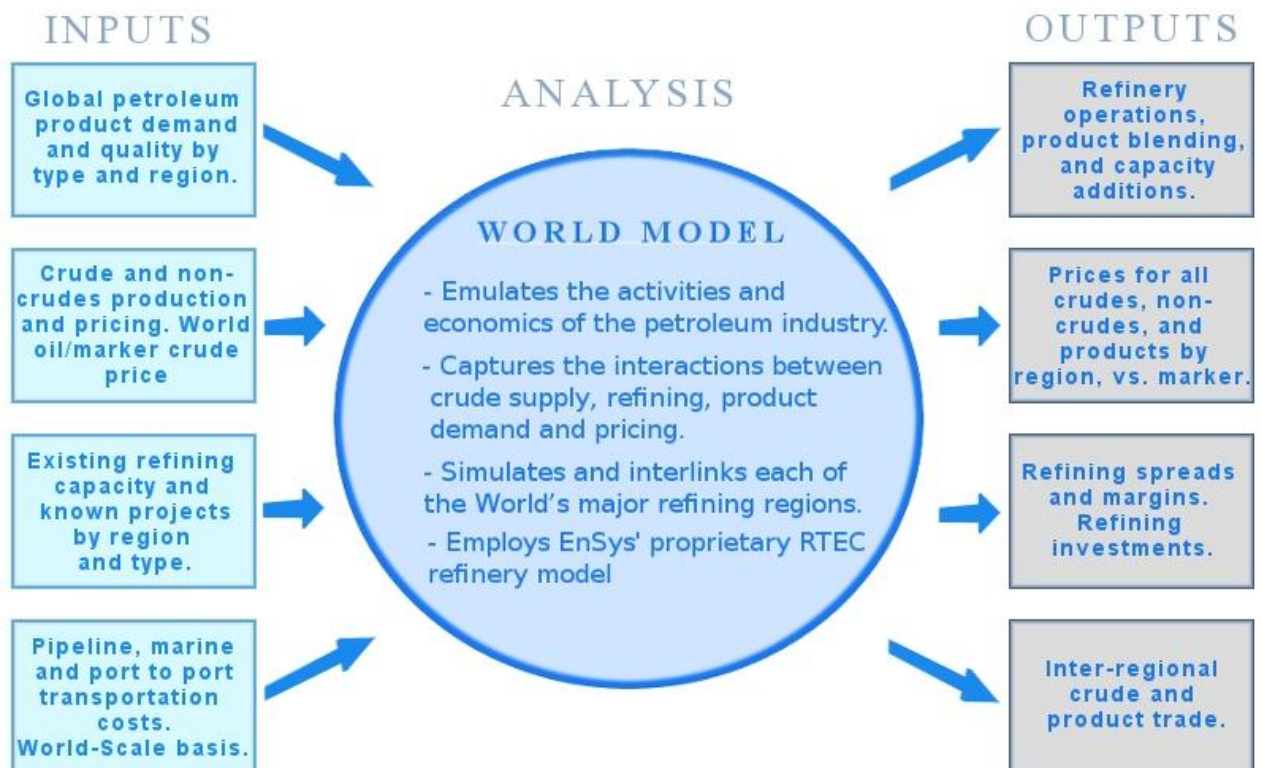
World Oil Refining Logistics and Demand model (WORLD)

The WORLD Model simulates the global refining industry, capturing the interaction of supply, demand, refining and regulation. By marrying together top down scenarios with bottom up detail WORLD produces a wide array of accurate data on refining strategic parameters. It is a highly flexible system, with the ability to model short, medium, and long-term scenarios, to adjust to the level of detail desired per region and to focus on specific aspects of the industry such as marine fuels, condensates or FCC modes.

WORLD is used primarily in one of four ways:

- General and variant global downstream outlooks
- Analysis of specific potential changes and developments such as supply, demand, or regulation
- Outlooks for particular regions and refineries in a global context
- Strained and disrupted markets.

WORLD MODEL OVERVIEW



History

EnSys Energy has a 22-year track record of successful WORLD model analyses, including for the US Department of Energy, US Environmental Protection Agency, World Bank, International Maritime Organisation, OPEC, major oil companies and specialty suppliers.

Since 1992 WORLD has been the EIA's downstream modeling system of choice. In 2002 EnSys conducted a major update, bringing the EIA model up to date with the then-current EnSys WORLD model.

Similarly, in 2000, the WORLD model was licensed by OPEC for their then internal annual World Oil Outlook. Since that time EnSys has played a key role the development of the WOO. Our Principal, Martin Tallett, was named as the only non-OPEC 'Main Contributor' to the 2009 WOO. WORLD has also been used for numerous private-sector studies by many of the largest participants in the oil industry.

Capabilities

WORLD marries together top-down oil price demand and supply information with bottom up detail on refining, products, and transportation. This top down plus bottom up approach brings both real-world accuracy and flexibility. EnSys can use any of the major global industry projections on supply and demand as the top-down input. These include the extensive EIA, IEA, and OPEC outlooks. It is also possible to apply customized or company-specific outlooks. Bottom-up databases developed by EnSys include information on crude and non-crude streams, refinery capacity and projects, refined products and global transportation. These are regularly updated.

Though the core of the model is a simulation of the global refining industry, the WORLD model captures the supply chain from production to demand, making it capable of running analyses on any single point in the supply chain.

WORLD CAPTURES THE SUPPLY CHAIN

Production



WORLD utilizes top-down supply data, such as EIA, IEA, or OPEC global oil outlooks. This allows for multiple scenarios and variants of standard modeling outlooks.

Crude Transport



EnSys has built and maintains a bottom-up database of crude oil transportation routes, pipelines, and future developments. Shipping rates are based on the World Scale.

Refining



The RTEC module of WORLD simulates the technology and economics of refining. This is WORLD's core functionality, and it is the only model with integrated global capability.

Product Transport



EnSys' bottom-up database of shipping and transportation fully covers product transport. Pipelines, shipping routes, freight costs and future developments are included.

Consumption



For demand, WORLD matches top-down projections with bottom-up detail on regional and national product grades and qualities. Custom outlooks can also be developed.

POSSIBLE WORLD MODEL SCENARIOS

	MARKET OUTLOOK	REGIONAL ASSESMENT	REGULATORY
Objective	Evaluate the effect of differing supply/demand scenarios on refining margins.	Evaluate the most efficient and effective investment in new regional refining capacity.	Evaluate the effects of a proposed regional CO2 limitation on global refining.
Focus	Product prices relative to a marker, refining margins, refining utilizations.	Regional refining economics, global/regional interaction, comprehensive refining evaluation.	Refining throughputs, utilization and margins in regions with and without regulation.
WORLD Provides Answers	The WORLD model can be run with any specified supply/demand outlook. WORLD will then simulate how the global refining market would react. This would provide a projection of refinery utilization, margins and relative product pricing by region.	The regions of the WORLD model can be adjusted to focus in on one geographical area, even down to the refinery level. This allows EnSys to evaluate that region's/its refineries' economics and investment opportunities all in a global context.	WORLD captures the big picture. It lets regulators see the global impact of regulation, notably how utilization, trade flows and regional price spreads will be affected by refinery type. WORLD also enables CO2 costs to directly drive refining economics and trade.

The WORLD model's core functionality is its ability to simulate and capture the interactions between refining, supply, demand, transport and regulation. In this way, the model is capable of analyzing a wide array of issues and scenarios. For example, WORLD can look at the effects of changes in crude supply and/or product demand on the refining industry, the impacts of refining developments and projects on global product flows and margins or the effect of specific regulations such as CO2 cap-and-trade schemes on refining activity and economics.

At the heart of the model is our proprietary Refining Technology (RTEC) module. Developed over many years, the RTEC module simulates refinery activity and incorporates all major refining processes, operations and economics. A combination of linear programming and highly refined algorithms make the RTEC module accurate and effective. It embodies multiple process units and operating modes, the ability to incorporate new refinery processes, a high-level of detail on product qualities and blending and a recently developed ability to report CO2 emissions and

to use CO2 costs as drivers of refining investment and activity. The RTEC module forms the basis of Bloomberg's Refining Netbacks (NTBK) service developed and supported by EnSys.

The combination of the advanced RTEC simulation of the global refining industry with both top-down and bottom-up inputs give the WORLD model a level of analytical scope that is unmatched. Outputs from the WORLD model include refining utilizations, margins, and investments. We refer to these as refining's "strategic parameters."

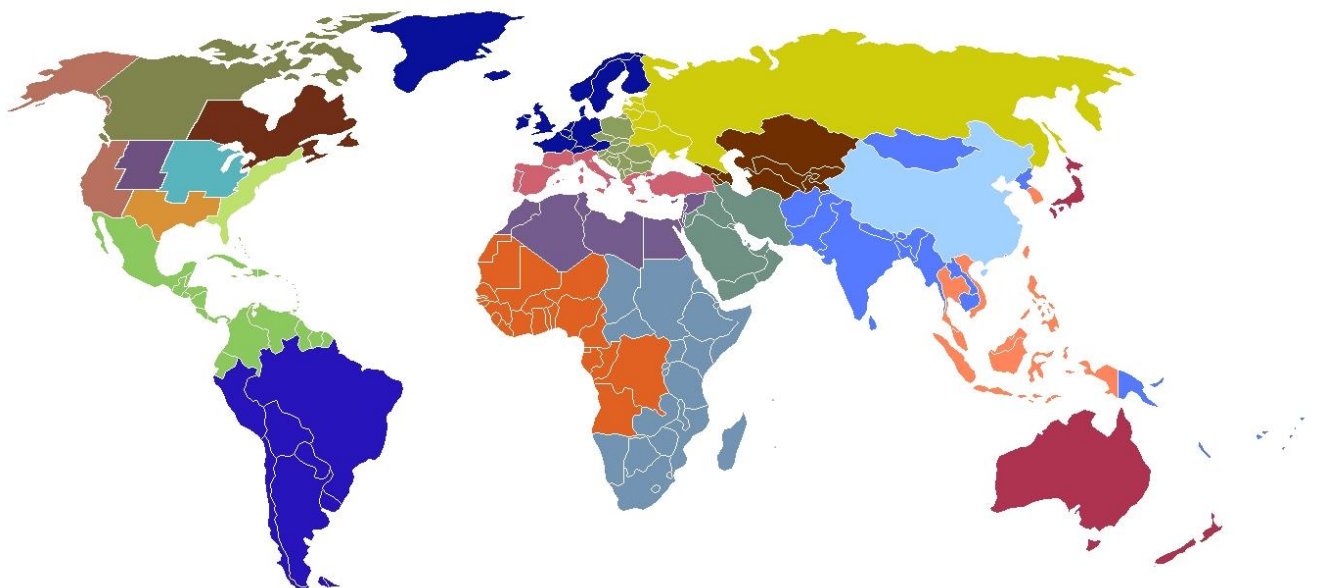
The model also projects product blending and pricing, prices for crudes and non-crudes relative to

the input world oil price, and inter-regional trade.

The model is able to assess impacts to changes in any and all parameters, a flexibility which allows the WORLD model to be applied in highly varied contexts. Critically, all outputs of a WORLD model case are internally consistent.

Along with broad global assessments, WORLD has often been applied to detailed national and regional refining/supply system analyses. WORLD's standard 22-region representation offers an effective global view.

WORLD Model 22 Region Breakdown



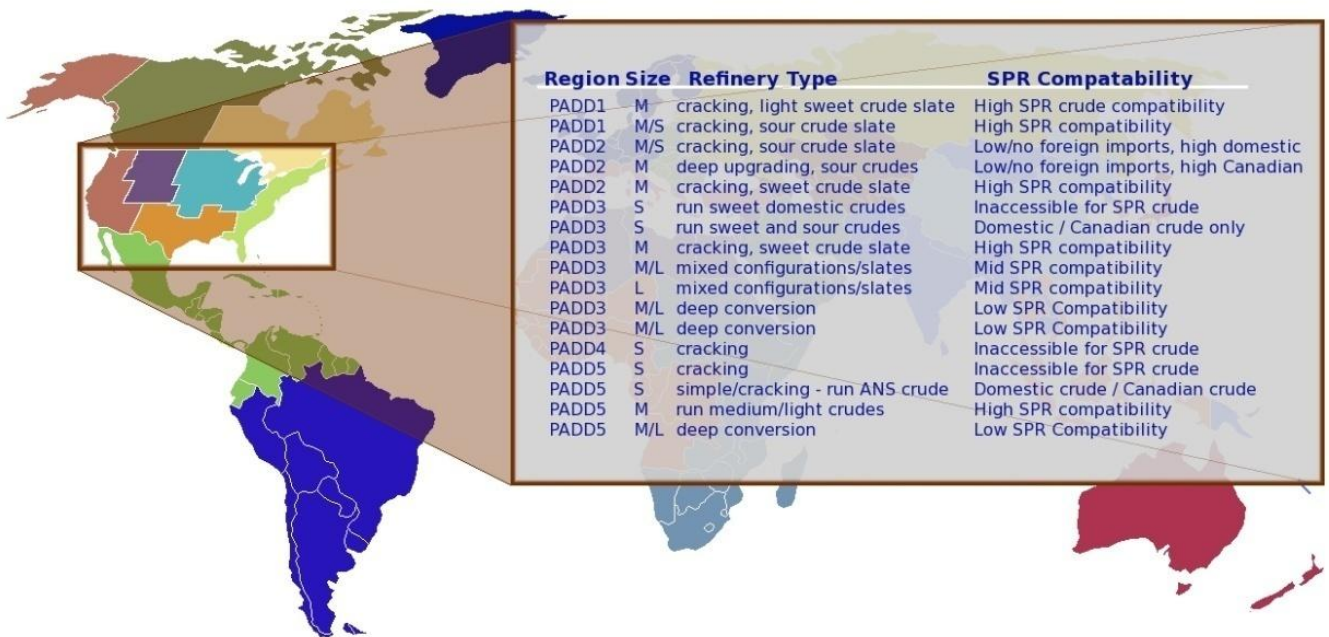
Highly specific models, such as for a recent study on Sub-Saharan Africa for the World Bank, can also be developed, allowing the client to “zoom-in” on a specific area of interest. The model currently allows for detailed regional refining representations with up to 35 refining groups worldwide. Geographically focused versions include a US-centric model with PADD refinery sub-groups which was developed for the US Dept. of Energy.

With the WORLD model EnSys offers a unique service: we provide data on the global refining industry or the price differential of a single crude stream all at the same time.

Though there are no directly competitive offerings, EnSys has evaluated offerings which fall into roughly the same field and found that they are generally narrowly focused and inaccurate.

Fundamentally, the refining industry does not conform well to traditional economic modeling with its gradual curves up and down: refining has many step-changes, points where the economics shift rapidly and drastically. The linear programming of the WORLD model captures this.

US Refinery Groupings for Dept of Energy Strategic Petroleum Reserve Study



For more information about the WORLD Model or EnSys Energy's consulting services please contact us at:

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Our Principal, Martin Tallett, President of EnSys Energy is a chemical engineer (M. Eng. University of Nottingham UK 1969) with extensive oil refining experience with Exxon and Amoco before entering energy consulting. He is widely acknowledged as a leading international expert on refining. Expert witness work has included high-profile cases across the US, and he is frequently called upon by governments and corporations for insight.