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Ethylene Glycol US Variable Margin Analytics Methodology

Independent Commodity Intelligence Services

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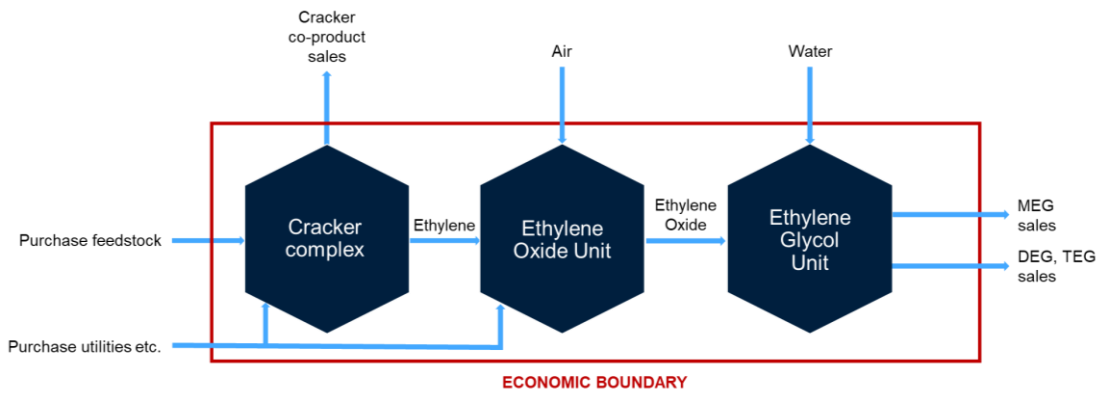
THE BUSINESS MODEL

The simplified diagram below shows the main method of making ethylene glycol (EG) from starting from a steam-cracker.

Naphtha (or LPG, or ethane) with steam is fed into a cracker unit where ethylene and other co-products (such as propylene, butadiene, benzene, etc.) are made. The ethylene from the cracker unit is separated from the co-products and processed with oxygen to make ethylene oxide which is then hydrolysed to produce EG and higher molecular weight glycols including diethylene glycol (DEG) and triethylene glycol (TEG). The cracker co-products are also separated, and either sold for use in other chemical plants or used as fuel.

A simplified illustration of material flows is as follows:



THE MARGIN CALCULATION

- The margin measure provides an assessment of the ex-works cash margin obtained for the product over raw material costs, credit for selling co-products and key variable manufacturing costs, including power and steam, chemicals and catalysts. This measure can also be termed as a variable margin, contribution or benefit.

- This margin measure provides simple signals on the direction of business margins as dictated by the environment, thus informing market positioning by sellers, buyers and traders.

- ICIS does not model beyond raw material costs, credit for selling co-products and key variable manufacturing costs. Further analysis would cease to be generic to the industry and would be highly specific to individual business

operations, their site structure, location, ownership and financial structures. Such detail would not fairly reflect or be applicable in a wider industry context. It may also be more subjective, open to fair challenges and not feasible to reference in commercial discussions.

- ICIS models plant operations for a series of 'representative' plants around the world. These representative plants have no flexibility with respect to feedstock or process configuration and ICIS assumes the plants to be purchasing inputs and selling outputs at constant prices.
- As the process model is generic and not based on any individual operation, the contribution measure is indicative. Instead of absolute value terms, it is most valuable as an index and in step-change terms.
- ICIS plant manufacturing and feedstock yield assumptions incorporate data from Intratec (www.intratec.us), an independent provider of chemical production cost reports.
- Ex-works product price assessments link to ICIS pricing quotations for large-volume commodity products, with netbacks assessed using the ICIS petrochemicals logistics model. To estimate representative transport costs, the ICIS logistics model considers a network with nodes at individual production sites connected by streets and ports linking each continent. The logistics model incorporates shipping data from Xeneta (www.xeneta.com), and duties data from SimplyDuty (www.simplyduty.com).

The calculation below shows how ICIS derives the ethylene glycol margin (feedstock naphtha) for the US. The example is based on contract sales prices, is denominated in US dollars per tonne, and uses average prices for the year 2017.

Naphtha-based cracker margin ($/tonne)

EG contract price		1,049
Logistics costs/netbacks/discounts		(168)
EG product value		**881**
Co-product sales		**711**
Total income		**1,592**
Purchase feedstock (naphtha)		809
Utilities		92
Variable costs		**901**
Ethylene glycol margin	1,592 – 901	**= 691**

MODEL YIELD PATTERN AND CALCULATION

Plant manufacturing data relates to the variable cost components of the cracker operations. Yield pattern data relates to the overall material balance of the cracker unit. For example, for 1 tonne of ethylene glycol produced, a cracker will use approximately 1.5 tonnes of naphtha as feedstock. In addition to the 1 tonne of ethylene glycol, the cracker will produce around 3 tonnes of co-products (including diethylene glycol, triethylene glycol, propylene, butadiene, benzene, raffinate-1, pygas and a fuel export balance).

- US ethylene glycol margins are calculated for four different production processes:
    - Ethane Ethylene Glycol Generic
    - Naphtha Ethylene Glycol Generic
    - LPG Ethylene Glycol Generic
    - Standalone Ethylene Glycol Generic
- Due to the different cracker yield patterns when using different feedstocks, a comparative analysis is not a simple case of comparing feedstock price differences, but must take into account the different co-product credits.
- This analysis demonstrates business volatility and the influence of price floors (as an uneconomic margin generally forces supply reductions).

ASSESSMENT INPUTS

The following ICIS inputs are used to generate the full content of the ICIS Ethylene Glycol US margins:

- Ethylene Glycol in US Gulf Contract FOB (monthly assessment) (cts/lb converted to $/tonne)
- Diethylene Glycol in US Gulf Contract FOB (monthly assessment) (cts/lb converted to $/tonne)
- Ethane Mt Belvieu FOB USG Spot (weekly average) (cts/US gal converted to $/tonne)
- Naphtha in US Gulf Spot Del USG Paraffinic (weekly average) ($/tonne)
- Ethylene – Net US Gulf Contract Delivered (cts/lb converted to $/tonne)
- Propane Mt Belvieu FOB USG Spot (cts/US gal converted to $/tonne)
- N-Butane, Assessment, In Store, 10-30 Days, Closing Value, Weekly, Mt Belvieu FOB USG Spot (cts/US gal converted to $/tonne)
- Propylene in US Gulf Contract P Grade (cts/lb converted to $/tonne)

- Butadiene in US Gulf Contract FOB USG (cts/lb converted to $/tonne)
- Crude C4s in US Gulf Spot CIF (weekly average) ($/tonne)
- Benzene in US Gulf Contract FOB ($/US gal converted to $/tonne)
- Gasoline Premium Unleaded (Pipeline) in US Gulf Spot US Gulf (weekly average) (cts/US gal converted to $/tonne)
- Residual Fuel Oil: FOB US Gulf (barges) Spot No 6 1.0% (weekly average) (cts/bbl converted to $/tonne)
- NYMEX Henry Hub Natural Gas forward month (ICIS energy, weekly average) ($/MMBtu converted to $/tonne)

CONVERSIONS

The following conversion factors are used:

- Ethane: 742.2 US gal per tonne
- Benzene: 299 US gal per tonne
- Gasoline: 358.8 US gal per tonne
- Residual Fuel Oil: 264 US gal per tonne (42 US gal/bbl)
- Natural Gas: 0.0173 tonnes of fuel oil equivalents per MMBtu

The methodology associated with each individual ICIS pricing quotation referenced above is available on the ICIS Compliance and Methodology website.

In addition to the listed ICIS pricing inputs, the model also takes into account logistics costs (calculated through the ICIS logistics model), and utility costs.

A key objective of the calculation process is to provide a weekly summary that strongly aligns to the reported market price positions on the date of release.

Where inputs are unavailable for individual weeks, e.g. due to public holidays, prior-week data is carried forward to the current week. This is for the specific purpose of populating the model and preventing model inconsistency. This form of data interpolation infers some limited data points that may not be market derived, and customers should be aware of this assumption.

As the majority of petrochemical trades are in US dollars, all data used in the ICIS Margin – Ethylene Glycol US model are denominated in USD unless specifically stated otherwise.

US ethylene glycol margins are only calculated for contract price terms.

ETHYLENE GLYCOL US WEBPAGE

Filter data on the website using the following criteria.

- **Process**: Select from Ethane Ethylene Glycol Generic, Naphtha Ethylene Glycol Generic, LPG Ethylene Glycol Generic, and Standalone Ethylene Glycol Generic.
- **Price terms**: ICIS generates variable margins only for contract price terms.

Variable margins data are available online from January 2014 onwards. One year of trailing data shows as default.

The website deploys the following data, all per tonne of ethylene glycol.

- **Main product value, ex-works**: the estimated ethylene glycol netback value for the producer, taking into account the ICIS assessed price, shipping costs, handling costs and applicable duties.
- **Co-product credits**: the revenues from the other products generated in a process, also ex-works. This data is also available broken down into co-product types.
- **Feedstock and utility costs**: or total variable input costs for a process. This data is also available broken down into the component feedstock costs and utility costs.

Calculated outputs are:

- **Variable cost** = [Feedstock and utility costs] – [Co-product credits]
- **Variable margin** = [Main product value] + [Co-product credits] – [Feedstock and utility costs]

A selected variable margin (i.e. a margin for a specific location, process and price term) is comparable with margins of different process technologies in the same region, and with margins using the same technology in different regions. Subscribers can review margin performance by week, month, quarterly and per annum. Subscribers can view the flows of different products, in terms of their volume and value, into and out of the representative production unit used to calculate the ethylene glycol variable margin.

PUBLICATION FREQUENCY

The ICIS Weekly Margin – Ethylene Glycol US model is based on the latest data at the close of business in Europe on Friday and released to customers on the following Monday, along with written commentaries, subject to schedule planning. When the Monday is a public holiday in the UK, commentaries will be made available the following day. ICIS does not publish the report on some public holidays. Holiday dates and days of publication may be subject to revision.

The margins feature allows users to select data for the period they are most interested in from January 2014 onwards. Key margins data includes the calculated margins, feedstock and utility costs and the assessed ex-works values for co-product credits and ethylene glycol on a weekly basis. Combined with relevant price history series, also available via ICIS dashboard, this allows subscribers to manipulate ICIS data more easily than was previously possible.