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Variable Margin Methodology: Ethylene Asia

ICIS
Independent Commodity Intelligence Services

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THE BUSINESS MODEL

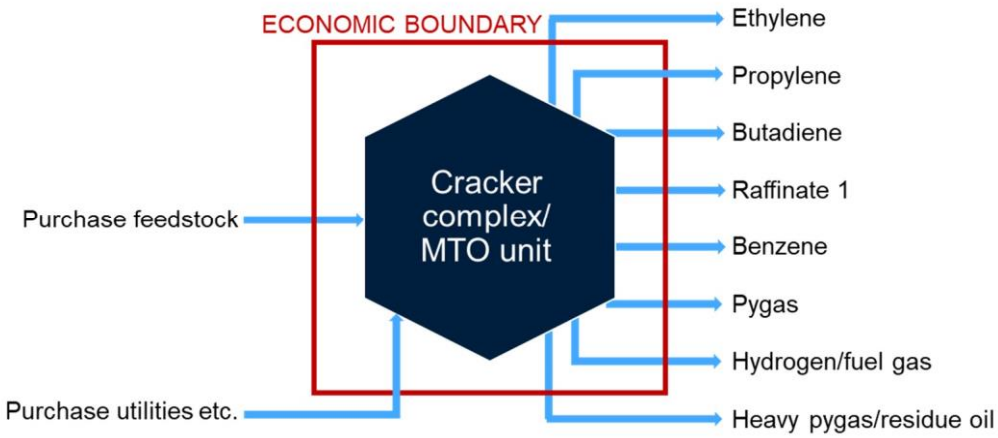
The main ethylene feedstocks in Asia are methanol, naphtha, liquefied petroleum gas (LPG). Ethane-based margins for North East Asia are also modelled in this tool.

Naphtha is a product mainly derived from crude oil. Naphtha and steam are fed into a cracker unit, where ethylene and other co-products (such as propylene, butadiene and benzene) are made. Ethylene is separated from co-products and typically piped to other chemical plants where it is further processed into derivative products such as polyethylene. Its co-products are also separated, and either sold for use in other chemical plants, or used for fuel.

Ethylene is also made from LPG, which can be derived from gas separation processes and as a by-product of refinery processes. LPG is cracked with steam, in a similar way to naphtha, but the co-product slate is different and generally lighter than naphtha.

Methanol is also an important feedstock in this region, particularly in China. In Northeast Asia, methanol is produced mostly from coal. Methanol to Olefins (MTO) technology produces light olefins (ethylene and propylene) with few co-products.

Ethane is produced as a by-product of natural gas extractions and processing.



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. In North East Asia, representative plants are modelled as if they are located in Nanjing, and in South East Asia, they are modelled as being in Singapore.

- 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 margin (feedstock naphtha) for Asia. The example is based on spot sales prices, is denominated in US dollars per tonne, and uses average prices for the year 2017.

Naphtha-based cracker margin ($/tonne)

Ethylene spot price	1,192
Logistics costs/netbacks	(32)
Ethylene product value	**1,160**
Co product sales	**1,025**

Total income	**2,185**
Purchase feedstock (naphtha)	1,535
Utilities	59
Variable costs	**1,594**

Ethylene margin 2,185 - 1,594 = **591**

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 one tonne of ethylene produced, a cracker will use approximately three tonnes of naphtha as feedstock. In addition to the one tonne of ethylene, the cracker will produce co-products (including propylene, butadiene, benzene, raffinate-1, pygas, fuel oil and fuel gas).

- Naphtha is the dominant cracker feedstock in Asia. ICIS also models methanol, LPG (propane and butane) feedstocks and ethane. Some cracker units are flexible, and able to increase LPG or ethane usage when economically favourable.

- Ethylene margins are calculated for the following production processes:

  Northeast Asia:

  - LPG steam cracking with benzene and butadiene extracted
  - Naphtha 80/LPG 20 with benzene and butadiene extracted
  - Naphtha steam cracking with benzene and butadiene extracted
  - Methanol to Olefins
  - Ethane Steam Cracking

  Southeast Asia:

  - LPG steam cracking with benzene and butadiene extracted
  - Naphtha 80/LPG 20 with benzene and butadiene extracted
  - Naphtha steam cracking with benzene and butadiene extracted

- Northeast Asia has been modelled on a CFR China basis.

- Southeast Asia has been modelled on a CFR Singapore basis.

- Due to the different yield patterns when using naphtha, LPG, ethane and methanol feedstocks, a comparative analysis is not a simple case of comparing feedstock price differences; it takes 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

ICIS uses the following pricing inputs o generate the full content of the ICIS Ethylene Asia margins:

NORTHEAST ASIA

- Naphtha in Asia Pacific Spot CFR Japan (ICIS pricing, Friday assessment) ($/tonne)
- Propane spot CFR Japan/Korea (refrigerated cargo) ICIS Pricing, (weekly average) ($/tonne)
- Propane spot CFR China (refrigerated cargo) (ICIS pricing, weekly average) ($/tonne)
- Butane spot CFR Japan/Korea (refrigerated cargo) (ICIS pricing, weekly average) ($/tonne).
- Butane spot CFR China (refrigerated cargo) (ICIS pricing, weekly average) ($/tonne)
- Ethane Mt Belvieu FOB USG Spot (weekly average) (cts/US gal converted to $/tonne)
- Methanol in China spot CFR, Assessment, Specific Origins, 2-9 Weeks, Full Market Range, Weekly, CFR China ($/tonne)
- Ethylene in Asia Pacific Spot CFR NE Asia (ICIS pricing, weekly average) ($/tonne)
- Propylene in Asia Pacific Spot CFR China Main Port (ICIS pricing, weekly average) ($/tonne)
- Butadiene in Asia Pacific Spot CFR NE Asia (ICIS pricing, weekly average) ($/tonne)
- Benzene in Asia Pacific Spot CFR Main China Ports (ICIS pricing, Friday assessment) ($/tonne)
- Gasoline 92 Spot CFR China (ICIS pricing, weekly average) ($/bbl)
- 180 CST FOB Singapore Spot (weekly assessment) ($/tonne)

SOUTHEAST ASIA

- Naphtha in Asia Pacific Spot FOB Singapore (ICIS pricing, Friday assessment) ($/bbl)
- Naphtha in Asia Pacific Spot FOB Singapore (ICIS pricing, weekly average) ($/bbl)
- Propane CFR Japan/Korea (refrigerated cargo) C1 Energy (Thursday assessment) ($/tonne)
- Butane CFR Japan/Korea (refrigerated cargo) C1 Energy (Thursday assessment) ($/tonne)
- Ethylene in Asia Pacific Spot CFR SE Asia (ICIS pricing, weekly average) ($/tonne)
- Propylene in Asia Pacific Spot CFR SE Asia (ICIS pricing, weekly average) ($/tonne)
- Butadiene in Asia Pacific Spot CFR SE Asia (ICIS pricing, weekly average) ($/tonne)

- Benzene in Asia Pacific Spot FOB SE Asia (ICIS pricing, Friday assessment) ($/tonne)
- Toluene in Asia Pacific Spot CFR SE Asia (ICIS pricing, Friday assessment) ($/tonne)
- Xylene (Solvent Grade) in Asia Pacific spot CFR SE Asia (ICIS pricing, Friday assessment) ($/tonne) [from 5 January 2018]
- Gasoline 95 Unleaded FOB Singapore spot (C1 Energy, weekly average) ($/bbl)
- 180 CST FOB Singapore Spot (weekly assessment) ($/tonne)

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 Asia model are denominated in USD unless specifically stated otherwise.

ETHYLENE ASIA WEBPAGE

Filter data on the website using the following criteria.

- **Area**: Select from Northeast Asia and Southeast Asia.
- **Process type**: Select from LPG steam cracking, naphtha 80/LPG 20 steam cracking, MTO based production, naphtha steam cracking and ethane steam cracking
- **Price terms**: Variable margins are generated only for spot price terms.
- **Frequency**: Viewable at weekly, monthly, quarterly, or yearly granularity.
- **Currency**: Allows conversion from displayed currency to currency of choice.
- **Unit**: Allows conversion from displayed unit to unit of choice in data download only.

Variable margins data are available online from January 2014 onwards. Six months trailing data shows as default.

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

- **Main product value, ex-works**: the estimated ethylene 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 variable margin.

PUBLICATION FREQUENCY

The ICIS Weekly Margin – Ethylene Asia model is based on the latest data at the close of business in Asia 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 an update on some public holidays. Holiday dates and days of publication may be subject to revision.