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Variable Margin Methodology: Light Olefins Asia

ICIS
Independent Commodity Intelligence Services

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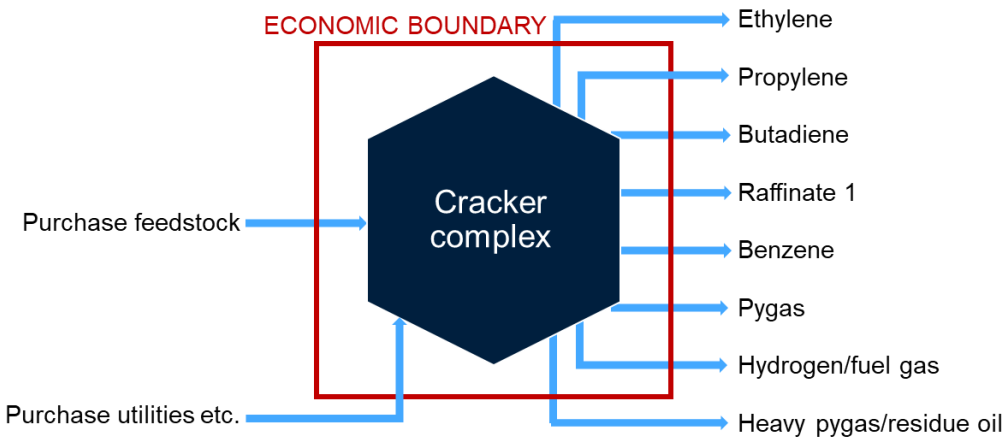
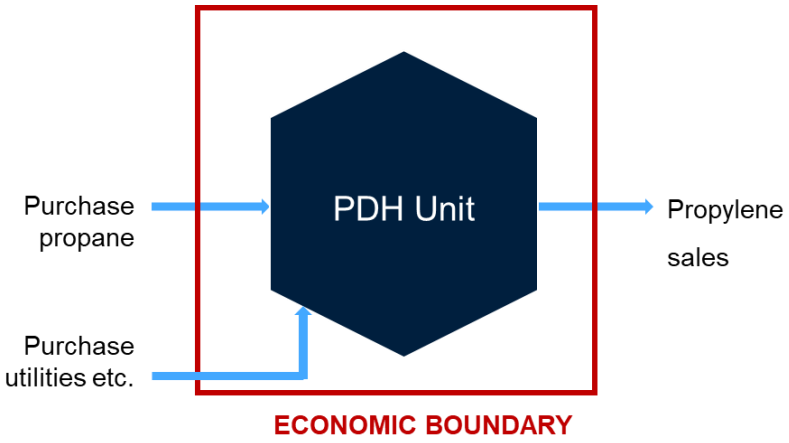
THE BUSINESS MODEL

In Asia, ICIS calculates light olefins margins based on naphtha, liquefied petroleum gas (LPG), methanol and propane feedstocks. Naphtha is a product mainly derived from crude oil, while LPG derives from gas separation processes and as a by-product of refinery processes. Propane is a feedstock gas derived from gas separation and refinery processes, and in North East Asia methanol is primarily produced from coal.

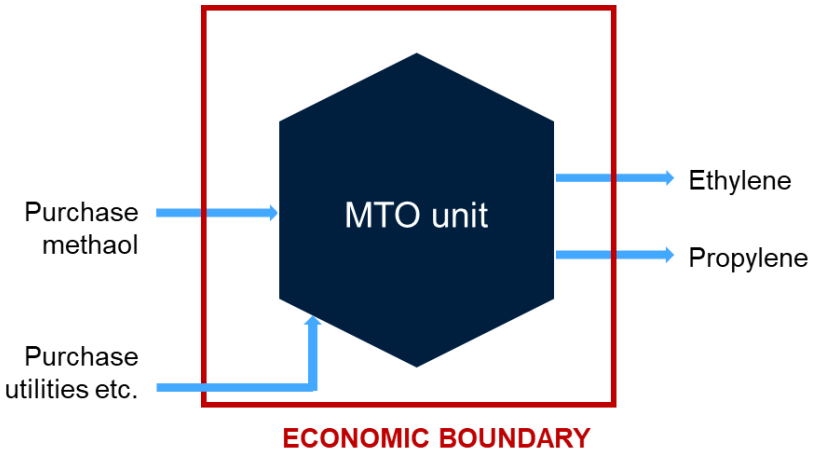
The diagram below shows a light olefins production process using methanol/naphtha/LPG.



In a steam cracking process, the feedstock and steam are fed into a cracker unit where ethylene, propylene, and co-products (such as butadiene and benzene) are made. Light olefins are separated from co-products and typically piped to other chemical plants, where they are further processed into derivative products such as polyethylene or polypropylene. Co-products are also separated, and either sold for use in other chemical plants, or used as fuel.



Propane dehydrogenation (PDH) is a common method for producing propylene. Propane is fed into a PDH unit over a catalyst to produce propylene, which is then sold, or further processed to make polypropylene. There are no co-products for this process.



Methanol has also become an important feedstock in this region, particularly in China. Light olefins are produced using Methanol to Olefins (MTO) technology. There are few co-products from this technology, with ethylene and propylene the major products.

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.

- Asian light olefins pricing is calculated from the proportional average of ethylene and propylene prices for each of the processes mentioned above.

- 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.

- 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).

- ICIS calculates light olefins margins instead of pure propylene margins because most market participants produce both ethylene and propylene. This margin model gives measure of the profitability of the propane dehydrogenation process. From this, comparisons can be drawn between margins for ethylene and propylene, and their derivative products, polyethylene and polypropylene.

The calculation below shows how ICIS derives the light olefins 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 cracker margin ($/tonne)

Light olefins* spot price	809
Logistics costs/netbacks	(65)
Light olefins product value	**744**
Co-product sales	**405**
Total income	**1,149**
Purchase feedstock (naphtha)	887
Utilities	30
Variable costs	**917**

Light olefins margin 1,149 – 917 = **232**

*2:1 ethylene-to-propylene ratio

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, a cracker will use approximately two tonnes of naphtha as feedstock to produce one tonne of light olefins. In addition to the one tonnes of light olefins, the cracker will produce approximately one tonne of co-products (including butadiene, benzene, raffinate-1, pygas, fuel export balance).

- Asia light olefins margins are calculated for the following production processes:
    - Propane dehydrogenation
    - 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 processes

- 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

ICIS uses the following inputs to generate the full content of the ICIS Light Olefins Asia margins:

NORTH EAST ASIA

- Naphtha in Asia Pacific Spot CFR Japan (ICIS pricing, Friday assessment) ($/tonne)
- Propane spot CFR Japan/Korea (refrigerated cargo) C1 Energy (Thursday assessment) [from 13 June 2014, previously weekly average from 1 November 2010, previously Propane C+F Tokyo Term Spot (Reuters, weekly average)] ($/tonne)
- Butane spot CFR Japan/Korea (refrigerated cargo) C1 Energy (Thursday assessment) [from 13 June 2014, previously weekly average from 1 November 2010; previously Butane Tokyo C+F Tokyo Term Spot (Reuters, weekly average)] ($/tonne).
- Butane spot CFR China (refrigerated cargo) (ICIS pricing, weekly average) ($/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 NE Asia (ICIS pricing, weekly average) ($/tonne)
- Propylene in Asia Pacific Spot CFR China Main Port (ICIS pricing, weekly average) ($/tonne)
- Light Olefins Asia is calculated as an average of ethylene and propylene prices, weighted according to the production factors ($/tonne).

- Butadiene in Asia Pacific Spot CFR NE Asia (ICIS pricing, weekly average) ($/tonne)
- Benzene in Asia Pacific Spot CFR NE Asia (ICIS pricing, Friday assessment) ($/tonne)
- Benzene in Asia Pacific Spot FOB Korea (ICIS pricing, Friday assessment) ($/tonne)
- Benzene in Asia Pacific Spot CFR Main China Ports (ICIS pricing, Friday assessment) ($/tonne)
- Toluene in Asia Pacific Spot CFR NE Asia (ICIS pricing, Friday assessment) ($/tonne)
- Xylene (Solvent Grade) in Asia Pacific Spot FOB Korea (ICIS pricing, Friday assessment) ($/tonne)
- Xylene (Solvent Grade) in Asia Pacific Spot CFR China ($/tonne)
- Fuel Oil 3.5% in Europe Spot CIF Cargoes NWE (weekly average) [from 5 January 2018, previously High Sulphur Fuel Oil mixed/cracked 180 cst FOB Singapore spot (C1 Energy, weekly average) [from 29 August 2011 to 29 December 2017], previously Fuel Oil 180 cst Singapore spot (Reuters, weekly average)] ($/tonne)

SOUTH EAST 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) [from 13 June 2014, previously weekly average from 1 November 2010, previously Propane C+F Tokyo Term Spot (Reuters, weekly average)] ($/tonne)
- Butane CFR Japan/Korea (refrigerated cargo) C1 Energy (Thursday assessment) [from 13 June 2014, previously weekly average from 1 November 2010; previously Butane Tokyo C+F Tokyo Term Spot (Reuters, weekly average)] ($/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) [from 29 August 2011 to 29 December 2017; previously Gasoline 95 unleaded FOB Singapore cargo spot (Reuters, weekly average)] ($/bbl)
- Fuel Oil 3.5% in Europe Spot CIF Cargoes NWE (weekly average) [from 5 January 2018, previously High Sulphur Fuel Oil mixed/cracked 180 cst FOB Singapore spot (C1 Energy, weekly average) [from 29 August 2011 to 29 December 2017], previously Fuel Oil 180 cst Singapore spot (Reuters, weekly average)] ($/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 – Light Olefins Asia model are denominated in USD unless specifically stated otherwise.

LIGHT OLEFINS ASIA WEBPAGE

Filter date on the website using the following criteria.

- **Process**: Process type can be selected: propane dehydrogenation, LPG steam cracking, naphtha 80/LPG 20 steam cracking, MTO based production and naphtha steam cracking
- **Price terms**: ICIS generates variable margins for spot price terms.

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 light olefins.

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

PUBLICATION FREQUENCY

The ICIS Weekly Margin – Light Olefins 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.