23 September 2022

Variable Margin Methodology: Polystyrene Asia

Independent Commodity Intelligence Services

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THE BUSINESS MODEL

ICIS calculate margins for General Purpose Polystyrene (GPPS) and High Impact Polystyrene (HIPS). These products are both ultimately made from ethylene and benzene, and, in the case of HIPS, butadiene. All of these materials originate from naphtha, which in turn comes from crude oil.

The diagram below shows the production process for GPPS. Ethylene is produced at a cracker, which, with benzene and other inputs, is used to produce styrene monomer. This is then polymerised to produce GPPS.

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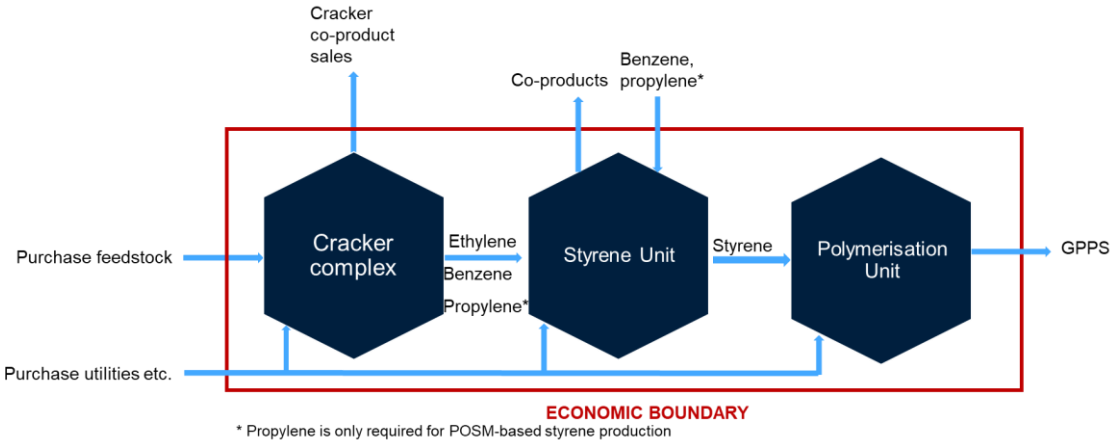
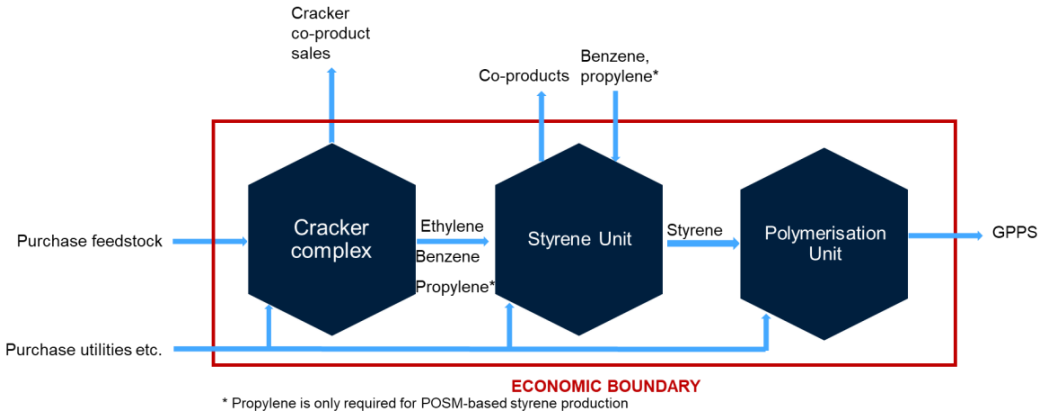


HIPS is produced in a similar way, but styrene is co-polymerised with a small amount of butadiene in the final step.



Both of these diagrams refer to cracker-integrated systems. ICIS has modelled a standalone process for polystyrene, and also polystyrene units only integrated to either POSM or dehydrogenation styrene production units.

THE MARGIN CALCULATION

- The margin measure provides an assessment of the ex-works cash margin obtained or the product over raw material costs, credit for selling co-products, and key variable manufacturing costs, including power and steam, catalysts and chemicals. 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 styrene margin for the North East 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)

GPPS spot price	1,363
Adjustments incl. logistics costs/netbacks	(1)
Styrene product value	**1,362**
Co product sales	254
Total income	**1,616**
Purchase of feedstocks (naphtha, benzene)	1,100
Utilities	85
Variable costs	**1,185**

GPPS margin 1,616 – 1,185 = 431

Standalone margin ($/tonne)

GPPS spot price	1,363
Adjustments incl. logistics costs/netbacks	(1)
Styrene product value	**1,362**
Co product sales	0
Total income	**1,362**
Purchase feedstocks (ethylene, benzene)	1,282
Utilities	15
Variable costs	**1,297**

GPPS margin 1,362 – 1,297 = 65

INTEGRATED AND STANDALONE

- Non-integrated or standalone market participants produce styrene only. Our margin model assumes plants that are co-located and that the ethylene and benzene are transferred as part of the process.
- Integrated market participants produce both ethylene and styrene. The business model is to buy ethane or naphtha feedstock, process it into ethylene, benzene and cracker co-products. The balance of benzene is procured from the market. Ethylene and benzene are converted into styrene, which is sold alongside cracker co-products. This business model is applicable to the majority of manufacturing facilities in Asia.
- Integrated production units may be co-located and/or connected by pipeline and with common equity ownership across both assets in the supply chain. Therefore, the economic boundary for the majority of industry producers is more extensive than a standalone polymer unit.

MODEL YIELD PATTERN AND CALCULATION

Plant manufacturing data relates to the variable cost components of chemical unit operations. Yield pattern data relates to the overall material balance of the cracker unit. For example, for one tonne of GPPS produced, 0.8 - 0.9 tonnes of naphtha feedstock and 0.7 - 0.8 tonnes of benzene are required, which will additionally produce co-products (including,

but not limited to, propylene and butadiene) of 0.3 - 0.5 tonnes (depending on the process). Approximately one tonne of styrene is required to produce a single tonne of polystyrene.

As the dominant cracker feedstock in Asia for ethylene, ICIS has selected naphtha as a representative feedstock for cracker-integrated production and therefore best demonstrates the overall margin differences given by integration. Ethylene feedstocks like LPG and methanol are also used in this region, but the effect these different feedstocks have on polystyrene margins are minimal. ICIS has also modelled standalone production for styrene, where ethylene is purchased on the open market.

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 to generate the full content of the ICIS Polystyrene Asia margins:

NORTHEAST ASIA

- Naphtha in Asia Pacific Spot CFR Japan (ICIS pricing, Friday assessment) ($/tonne)
- Ethylene in Asia Pacific Spot CFR NE Asia (ICIS pricing, weekly average) ($/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)
- ($/tonne)
- Gasoline 92 in Asia Pacific Spot CFR China (ICIS pricing, weekly average) ($/bbl)
- 180 CST FOB Singapore Spot (weekly assessment) ($/tonne)
- Styrene in Asia Pacific Spot CFR North East Asia (ICIS pricing, weekly average)
- ($/tonne)
- Mineral Oil (as Group II SN 150) in Asia Pacific Spot CFR China (ICIS pricing, weekly average) ($/tonne)
- Propylene Oxide in Asia Pacific Spot CFR China (ICIS pricing, weekly average) ($/tonne)
- Toluene in Asia Pacific Spot CFR North East Asia (ICIS pricing, weekly average)
- ($/tonne)
- GPPS in Asia Pacific Spot CFR China (ICIS pricing, weekly average) ($/tonne)
- HIPS in Asia Pacific Spot CFR China (ICIS pricing, weekly average) ($/tonne)

SOUTHEAST ASIA

- Naphtha in Asia Pacific Spot FOB Singapore (ICIS pricing, weekly average) ($/bbl)
- Ethylene in Asia Pacific Spot CFR South East Asia (ICIS pricing, weekly average)($/tonne)
- Propylene in Asia Pacific Spot CFR South East Asia (ICIS pricing, weekly average)($/tonne)
- Butadiene in Asia Pacific Spot CFR South East Asia (ICIS pricing, weekly average)($/tonne)
- Benzene in Asia Pacific Spot FOB South East Asia (ICIS pricing, Friday assessment)($/tonne)
- Toluene in Asia Pacific Spot CFR South East Asia (ICIS pricing, Friday assessment)($/tonne)
- Gasoline 95 Unleaded FOB Singapore spot (C1 Energy, weekly average) ($/bbl)
- 180 CST FOB Singapore Spot (weekly assessment) ($/tonne)
- Styrene in Asia Pacific Spot CFR South East Asia (weekly assessment) ($/tonne)
- Mineral Oil (as Group II paraffinic SN 150) Spot in Asia Pacific Ex-tank Singapore (weekly assessment) ($/tonne)
- GPPS in Asia Pacific Spot CFR South East Asia (weekly assessment) ($/tonne)
- HIPS in Asia Pacific Spot CFR South East Asia (weekly assessment) ($/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 – Polystyrene Asia model are denominated in USD unless specifically stated otherwise.

All margins presented are for Asia are spot.

POLYSTYRENE ASIA WEBPAGE

Filter data on the website using the following criteria.

- **Process:** Select feedstock source, and from the dehydrogenation and POSM styrene processes.
- **Price terms**: ICIS generates variable margins for spot price terms.

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

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

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

PUBLICATION FREQUENCY

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