

Polypropylene China Margin Report Methodology

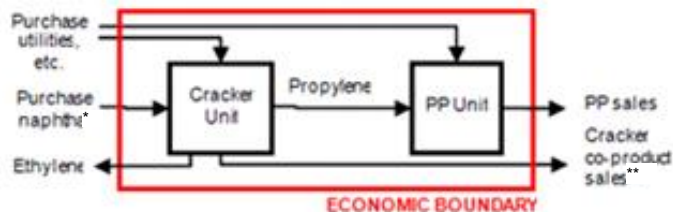
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THE BUSINESS MODEL

The diagram below shows the major method of making polypropylene (PP) in China: from naphtha, a product mainly derived from crude oil.

Naphtha with steam is fed into the cracker unit where ethylene, propylene and other co-products (butadiene, benzene, etc.) are made. The propylene from the cracker is then further processed (polymerised) in the PP plant to make the PP pellets for sale.



*Naphtha is the dominant cracker feedstock in China

**includes butadiene, raffinate-1, fuel gas, benzene, gasoline blending components

THE MARGIN CALCULATION

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

- It represents a cash margin measure available for supporting the direct and allocated fixed manufacturing costs, working capital, taxes, royalties, corporate costs, debt service costs, capital costs and owner's returns from the business.

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

- ICIS chooses not to model beyond raw material costs and key variable manufacturing costs as this ceases to be generic to the integrated industry and 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.

- Plant manufacturing and feedstock yield model data have been provided by Linde Engineering, a division of Linde AG. Linde Engineering (www.linde-engineering.com) is a leading international chemical plant designer, process engineering, procurement and construction contractor. It has extensive experience in steam cracker and PP plant design.

- The process model is generic and not referenced to any individual operation, so that the contribution measure is only indicative. It can be most valuably referenced in index and step change terms as opposed to absolute value terms.

- Naphtha feedstock has been chosen as this represents the most commonly used feedstock for ethylene and propylene manufacture in China. As such, the cost model is broadly applicable to the majority of the Chinese commodity PP business.

- Margin measure from the cracker is calculated on a 'per tonne of olefin' basis i.e. the margin achieved when producing one tonne of ethylene and propylene. A combined olefin analysis is used because ethylene is the primary product from the cracker.
- Ex-works product price assessments are linked to ICIS domestic quotations for large volume commodity products with netbacks assessed using typical logistic cost assessments.
- The PP grade referenced in the ICIS PP - China Margin report is the PP flat yarn grade. This generally represents large-volume commodity grades in the PP market. The domestic market spot price of Eastern China is referenced as it is broadly representative of the China market.

Below is a detailed calculation of how the integrated and standalone margins are calculated. The figures refer to averages for China in 2012. Figures indicated in red are those found in the tables of the margin report; others relate to underlying assumptions of the model.

Integrated margin – 2012

	\$/tonne PP
PP flatyarn price	1,495
Logistics costs/netbacks	<u>(20)</u>
Net selling price	1,475
Purchase feedstock (naphtha) ¹	(2,062)
Co-product sales/tonne of PP produced ^{2,3}	898
Variable cost of PP unit ⁴	<u>(156)</u>
	(1,320)
Integrated margin	154

Standalone margin – 2012

	\$/tonne PP
PP flatyarn price	1,495
Logistics costs/netbacks	<u>(20)</u>
Net selling price	1,475
Propylene price	(1,414)
Net propylene price paid /tonne PP produced ³ , ie Purchase feedstock (propylene) (1,428)	
Co-product sales/tonne of PP produced	-
Variable cost of PP unit ⁴	<u>(156)</u>
	<u>(1,584)</u>
Standalone margin	(109)

¹The model assumes 2.115 tonnes of naphtha are required to produce 1 tonne of olefin (ethylene and propylene) and 1.01 tonnes of propylene are required to produce 1 tonne of PP. The average net naphtha price (including handling costs) for 2012 was \$965/tonne.

²Co-product sales include credits for butadiene, benzene, raffinate-1, pygas and a fuel export balance. Since the cracker margin is based on 1 tonne of olefin (ethylene and propylene) produced, the figure also allows for the difference in net price between ethylene and propylene on transfer to the PP unit.

³The model assumes 1.01 tonnes of propylene are required to produce 1 tonne of PP.

⁴Includes power and catalysts/chemicals for the PP.

DIFFERENCE BETWEEN NON-INTEGRATED AND INTEGRATED

- Non-integrated or standalone: market participant involved with PP production only. The business model is to buy propylene, convert it into PP resin and sell the PP. Our margin model assumption is that the plants are co-located and that the propylene is transferred at an ex-works value. This business model is applicable to around 2% of manufacturing facilities in China.

- Integrated: market participant involved with both propylene and PP production. The business model is to buy naphtha feedstock, process it into ethylene, propylene and cracker co-products, convert the propylene into PP, and sell both the PP, ethylene and cracker co-products. This integrated business model is applicable to nearly 98% of the manufacturing facilities in China.

WHY INTEGRATED ANALYSIS

- Most Chinese PP plants (approximately 98% by capacity) are integrated back to cracker sources of propylene. This may be co-located and/or connected by pipeline and with common equity ownership across both assets in the supply chain, that is, the economic boundaries for the majority of the industry producers are bigger than a standalone polymer unit.

- The margin is therefore measured across the supply chain from cracker feedstock (naphtha) through to PP and cracker co-products.

- This analysis demonstrates the volatility of the business and the influence of price floors that can lead to an uneconomic integrated margin, and generally forcing a reduction in supply.

WHY NON-INTEGRATED ANALYSIS

- Approximately 2% (by capacity) of Chinese PP plants are considered as standalone or non-integrated.

- Standalone analysis considers the polymer unit in isolation, which may be useful for understanding marginal opportunities where optimisation processes could result in propylene being preferentially used for other propylene derivative products. However, analysis of standalone historical data does show lower margins, which may not justify fresh business investment to meet growing market demands.

MODEL YIELD PATTERN AND CALCULATION

Plant manufacturing data relates to the variable cost components of the chemical unit operations. Yield pattern data relates to the overall material balance of the cracker unit, for example for 1.0 tonne of ethylene and propylene produced, a cracker requires 2.1 tonnes of naphtha feedstock, and will produce other co-products (butadiene, benzene, etc.) of 0.7 tonnes. The plant manufacturing and feedstock yield model data have been provided by Linde Engineering, a division of Linde AG.

The exact yield pattern used cannot be published in an unrestricted document such as this methodology statement. However, for PP China Margin report subscribers with a specific requirement to see this data, it can be shared on a case-by-case basis. Please contact the [Global ICIS Customer Support Centre](#) if this data is required.

ASSESSMENT INPUTS

The following ICIS pricing inputs are used to generate the full content of the ICIS Weekly Margin - PP China report:

- Polypropylene (Flatyarn) in China assessment Price in East China (ICIS China weekly assessment) (\$/tonne)
- Naphtha in China ex-works price (ICIS China monthly assessment) (\$/tonne)
- Ethylene in China ex-works price (ICIS China weekly assessment) (\$/tonne)
- Propylene in China ex-works price (ICIS China weekly assessment) (\$/tonne)
- Butadiene in China ex-works price (ICIS China weekly assessment) (\$/tonne)
- Benzene in China ex-works price (ICIS China weekly assessment) (\$/tonne)
- Toluene in China ex-works price (ICIS China weekly assessment) (\$/tonne)
- Gasoline 90 Unleaded China ex-works price (ICIS China weekly assessment) (\$/tonne)
- Fuel Oil in China ex-works price (ICIS China weekly assessment) (\$/tonne)

Note: assessed prices are for a typical producer in China, denominated in Chinese RMB converted to USD, adjusted to remove VAT and weekly exchange rates.

The ICIS pricing methodology associated with each individual pricing quotation referenced above can be found in the free access methodology area of www.icis.com/margins.

A key objective of the calculation procedure is to provide a weekly summary that is most strongly aligned to the reported market price positions on the date of publication.

Where ICIS price quotations are not available for individual weeks due to public holidays, then prior week data is carried forward for the specific purpose of populating the model and preventing model inconsistency. This form of data interpolation is inferring some limited data points that may not be market derived, and customers should be aware of this assumption.

All data in the ICIS Weekly Margin – PP China report is denominated in US dollars.

READING THE CHARTS

In the short-term charts and longer range margin view, the integrated margin is derived by reading the top of the wedge, the sum of the ethylene margin per tonne of PP (yellow) and the standalone PP margin (blue). Where the standalone margin is a loss (red), the integrated margin is read as the top of the yellow wedge or, where there is no yellow wedge, the bottom of the red.

COMBINING PE AND PP MARGINS

It should be noted that, to assess a petrochemical complex margin, for a petrochemical producer engaged in both the PE and PP businesses, requires looking at the integrated PE margin (from the ICIS Weekly Margin - PE China report) and adding the standalone PP margin from this report.

PUBLICATION FREQUENCY

The ICIS Weekly Margin - PP China report is produced on a Monday using prices from close of business the previous Friday in China and distributed to customers on the Monday afternoon, subject to schedule planning. When the Monday is a public holiday in the China, the report is distributed on the following working day. The report is not published on some public holidays. Holiday dates and days of publication may be subject to revision.

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