

Polyethylene China Margin Report Methodology

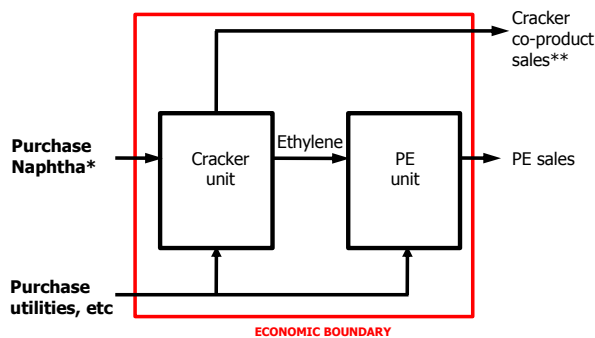
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This document is intended to provide methodology support for customers receiving the ICIS Weekly Margin – PE China report.

THE BUSINESS MODEL

The diagram below shows the main method of making PE from naphtha, a product mainly derived from crude oil. Naphtha with steam is fed into the cracker unit where ethylene and other co-products (propylene, butadiene and benzene) are made. The ethylene from the cracker unit is then further processed (polymerised) in the PE plant to make the PE pellets for sale.



*Naphtha is dominant feedstock in China

**Includes propylene, butadiene, raffinate-1, fuel gas, 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, which are not included.
- 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.lindeengineering.com) is a leading international chemical plant designer, process engineering, procurement and construction contractor. It has extensive experience in ethylene and PE 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 naphtha is the main feedstock adopted for ethylene manufacture in China. As such, the cost model is broadly applicable to the China commodity PE business.
- Ex-works product price assessments are linked to ICIS pricing quotations for large volume commodity products with netbacks assessed using typical logistic cost assessments.
- The PE grades referenced in the ICIS PE China Margin report are low density polyethylene (LDPE) film grade, and high density polyethylene (HDPE) injection grade. The ex-warehouse PE quote in East China is referenced as this is broadly representative of the China LDPE and HDPE market.

Below is a detailed calculation of how the integrated margin is calculated. The figures refer to averages for film-grade LDPE for 2012; the calculation for injection -grade HDPE is similar. Figures indicated in red are those found in the tables of the margin report; others relate to underlying assumptions of the model.

LDPE margin calculation (\$/tonne) – averaged for 2012

Integrated margin

LDPE film-grade price	1,470
Logistics/ bagging & palletising costs	<u>(20)</u>
Net selling price	1,450
Purchase feedstock (naphtha) ¹	(3,196)
Co-product sales/tonne of LDPE produced ^{2,3}	2,308
Variable cost of PE unit ⁴	<u>(160)</u>
	<u>(1,048)</u>
Integrated margin	402

Standalone margin

LDPE film-grade price	1,470
Logistics/ bagging & palletising costs	(20)
Net selling price	1,450
Ethylene in China ex-works price	(1,283)
Net ethylene price paid /tonne LDPE produced ³ , ie Purchase feedstock (ethylene)	(1,296)
Co-product sales/tonne of LDPE produced	–
Variable cost of PE unit ⁴	(160)
	(1,456)
Standalone margin	(6)

¹The model assumes 3.278 tonnes of naphtha are required to produce 1 tonne of ethylene and 1.01 tonnes of ethylene are required to produce 1 tonne of LDPE. The average net naphtha price (including handling costs) for 2012 was \$965/tonne.

²Co-product sales include credits for propylene, butadiene, raffinate-1, benzene, pygas and a fuel export balance.

³The model assumes 1.01 tonnes of ethylene are required to produce 1 tonne of LDPE.

⁴Includes power, catalysts and other auxiliary chemicals.

DIFFERENCE BETWEEN NON-INTEGRATED AND INTEGRATED

- Non-integrated or standalone: Market participant involved with PE production only. The business model is to buy ethylene, convert it into PE and sell the PE. Our margin model assumption is that the plants are co-located and that the ethylene is transferred at ex-works value.

Note: At present there are no standalone LDPE plants in China, and almost all the HDPE plants in China are integrated except one plant in Shanghai. The purpose of analysis on standalone PE is to provide information which can help integrated PE producers to understand marginal opportunities where optimization processes could result in ethylene being preferentially used for other ethylene derivative products.

- Integrated: market participant involved with both ethylene and PE production. The business model is to buy naphtha feedstock, process it into ethylene and cracker co-products, convert the ethylene into PE, and sell both the PE and cracker co-products. This business model is applicable to almost all manufacturing facilities in China.

WHY INTEGRATED ANALYSIS

- Integrated analysis provides the key reason (or 'raison d'être') for being in the commodity PE business.
- Almost all China PE plants (more than 95% by capacity) are integrated back to cracker sources of ethylene. Sinopec and China National Petroleum Corporation (CNPC) are state owned enterprises which have a large share of domestic PE production.
- The margin is therefore measured across the supply chain from cracker feedstock (naphtha) through to PE 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.
- In contrast, a non-integrated or standalone analysis that considers the polymer unit in isolation may be useful for understanding marginal opportunities where optimization processes could result in ethylene being preferentially used for other ethylene derivative products. However, analysis of non-integrated historical data does show inadequate margins to 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 tonne of ethylene produced, a cracker requires 3.2 tonnes of naphtha feedstock, and will produce co-products (including, but not limited to propylene, butadiene and benzene) of 2.2 tonnes in addition to the 1 tonne of ethylene. The plant manufacturing and feedstock yield model data have been provided by Linde Engineering, a division of Linde AG.

The exact yield pattern of the cracker used cannot be published in an unrestricted document such as this methodology statement. However, for PE 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 pricing inputs are used to generate the full content of the ICIS Weekly Margin – PE China report.

- Polyethylene LDPE (film) in China assessment price in East China (ICIS weekly assessment) (\$/tonne)
- Polyethylene HDPE (injection) in China assessment price in East China (ICIS 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 methodology associated with each ICIS pricing individual pricing quotation referenced above can be found on the [ICIS Compliance and Methodology](#) website.

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 price quotations are not available for individual days or weeks due to public holidays, then prior day or 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 – PE China report is denominated in US dollars.

SHORT-TERM VIEWS:

These provide ethylene and PE margins based on the ICIS naphtha cracker model.

LONGER RANGE VIEWS:

PE MARGINS

The ICIS Weekly – PE China report will provide a comparative data chart for LDPE film and HDPE injection on alternate weeks. The ethylene and PE margins are based on the ICIS China naphtha cracker model.

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 PE (yellow) and the standalone PE margin (blue). Where the standalone margin is a loss (red), the integrated margin is read as the top of the yellow wedge.

PUBLICATION FREQUENCY

The ICIS Weekly Margin – PE China report is produced on a Monday morning 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 in China. The report is not published on some public holidays. Holiday dates and days of publication may be subject to revision.

For information on ICIS' full portfolio of margin reports, visit:

<http://www.icis.com/pages/margin-reports/>