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Variable Margin Methodology: Polyethylene Latin America

ICIS
Independent Commodity Intelligence Services

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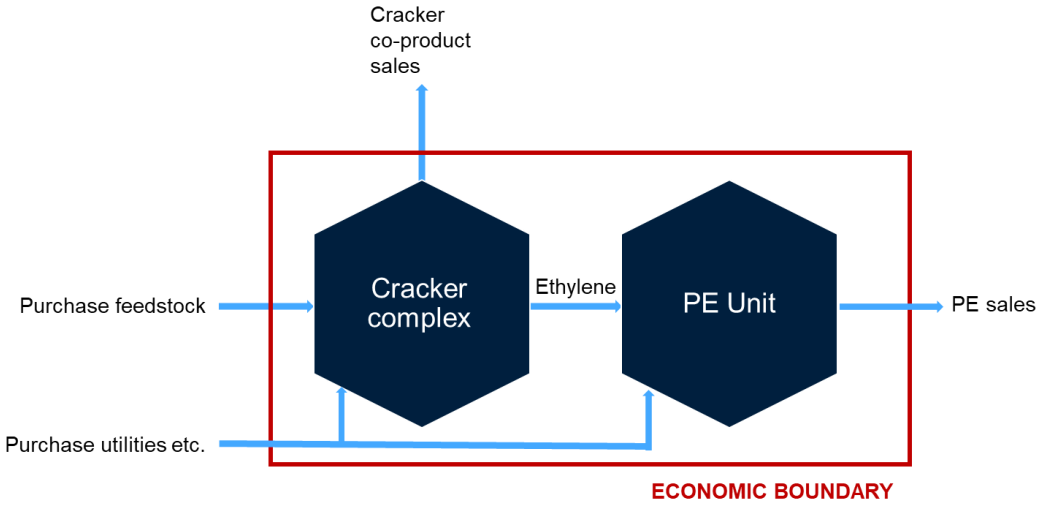
THE BUSINESS MODEL

Polyethylene (PE) is produced via the polymerisation of ethylene. The main feedstock for polyethylene in Latin America is naphtha.

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 piped to a PE plant, where it is further processed (polymerised) to make PE pellets for sale. Co-products are separated and sold for use in other chemical plants or used for fuel.



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.

- 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.

- For naphtha-based polyethylene margin calculations in Brazil, polypropylene values have been used to calculate propylene co-product contributions.

- 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).

- ICIS calculates margins for low-density polyethylene (LDPE), high-density polyethylene resin (HDPE), and linear low-density polyethylene (LLDPE) in the polyethylene variable margins model.

The calculation below shows how ICIS derives the LDPE margin (feedstock naphtha) for the US. The example is based on contract sales prices, is denominated in US dollars per tonne, and uses average prices for the year 2017.

Naphtha-based integrated margin ($/tonne)

LDPE contract price	1,923
Logistics costs/netbacks	(154)
LDPE product value	**1,769**
Co-product sales	**1,084**
Total income	**2,853**
Total chemical input costs	1,355
Utilities	109
Variable costs	**1,464**
LDPE margin	**2,853 – 1,464 = 1,389**

INTEGRATED AND STANDALONE

- Non-integrated or standalone market participants produce PE only. Our margin model assumes plants that are co-located and that ethylene is transferred as part of the process.
- Standalone analysis, which considers the polymer unit in isolation, helps to identify marginal opportunities, e.g. where ethylene could be more profitably used for other ethylene derivative products. No standalone analysis is carried out for margins in Brazil.
- Integrated market participants produce both ethylene and PE. The business model is to buy ethane, naphtha and/or LPG 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 the majority of manufacturing facilities in the US.
- Most US PE plants are integrated with cracker sources of ethylene (approximately 90% by capacity). These 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.
- The margin is measured across the supply chain from cracker feedstock through to PE and cracker co-products.
- Analysis of integrated plants demonstrates business volatility and the influence of price floors, which can lead to an uneconomic integrated margin, and generally force a reduction in supply.

MODEL YIELD PATTERN AND CALCULATION

Plant manufacturing data relates to the variable cost components of 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

approximately 1.5 tonnes of co-products (including propylene, butadiene, benzene, raffinate-1, pygas, fuel oil and fuel gas). ICIS calculations also take into consideration additional chemicals and catalysts required for the synthesis of PE.

- ICIS calculates polyethylene margins for HDPE, LLDPE and LDPE grades. Margins are calculated for the following production processes:

BRAZIL

  - Naphtha HDPE Solution
  - Naphtha LLDPE Solution
  - Naphtha LDPE High Pressure Tubular

- Due to the different cracker yield patterns when using naphtha, LPG or ethane feedstocks, a comparative analysis is not a simple case of comparing feedstock price differences but must take into account co-product credits.

- This analysis demonstrates the volatility of the business and the influence of price floors (as an uneconomic margin generally forces supply reductions).

ASSESSMENT INPUTS

The following ICIS inputs are used to generate the full content of the ICIS Polyethylene Latin America margins:

BRAZIL

- HDPE Blow Moulding spot FOT Brazil, Assessment, Domestic, 2-4 Weeks, Full Market Range, Weekly
- LLDPE Butene C4 spot FOT Brazil, Assessment, International, 2-4 Weeks, Full Market Range, Weekly
- LDPE Film Liner Grade spot FOT Brazil, Assessment, International, 2-4 Weeks, Full Market Range, Weekly
- Benzene in US Gulf Spot FOB Barges (ICIS pricing, Friday assessment) ($/gal converted to $/tonne)
- Naphtha in US Gulf Spot Del USG Paraffinic (ICIS pricing, weekly average) ($/tonne)
- Gasoline Premium Unleaded (Pipeline) in US Gulf Spot US Gulf (ICIS pricing, weekly average) (cts/gal converted to $/tonne)
- Residual Fuel Oil: FOB US Gulf (barges) Spot No 6 1.0% (ICIS pricing, weekly average) ($/bbl converted to $/tonne)
- Propylene (P Grade) in US Gulf Spot Pipeline (ICIS pricing, weekly average) (cts/lb, converted to $/tonne)

- Butadiene in US Gulf Spot CIF (ICIS pricing, weekly average) (cts/lb converted to $/tonne)

CONVERSIONS

The following conversion factors are used:

- Benzene: 299 US gal per tonne
- Gasoline: 358.8 US gal per tonne
- Residual Fuel Oil: 264 US gal per tonne (42 US gal/bbl)
- Natural Gas: 0.0173 tonnes of fuel oil equivalents per MMBtu

Where appropriate, ICIS adjusts reported contract prices to better reflect actual market conditions. In some cases this means applying a reduction to reported contract price levels for use in our calculations.

The methodology associated with each ICIS pricing individual 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 logistic costs (calculated through the ICIS logistics model), and utilities 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 made in US dollars, all data used in the ICIS Margin – Polyethylene Latin America model are denominated in USD unless specifically stated otherwise.

POLYETHYLENE LATIN AMERICA WEBPAGE

Filter data on the website using the following criteria.

- **Process**: Process type can be selected for each PE grade:
  - **HDPE**: Naphtha HDPE solution
  - **LDPE**: Naphtha LDPE high pressure tubular
  - **LLDPE**: Naphtha LLDPE solution
- **Price terms**: ICIS generates variable margins for spot price terms only.

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

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

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

PUBLICATION FREQUENCY

The ICIS Weekly Margin – Polyethylene Latin America 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 an update on some public holidays. Holiday dates and days of publication may be subject to revision.