21 September 2022

Variable Margin Methodology: Polypropylene Europe

ICIS
Independent Commodity Intelligence Services

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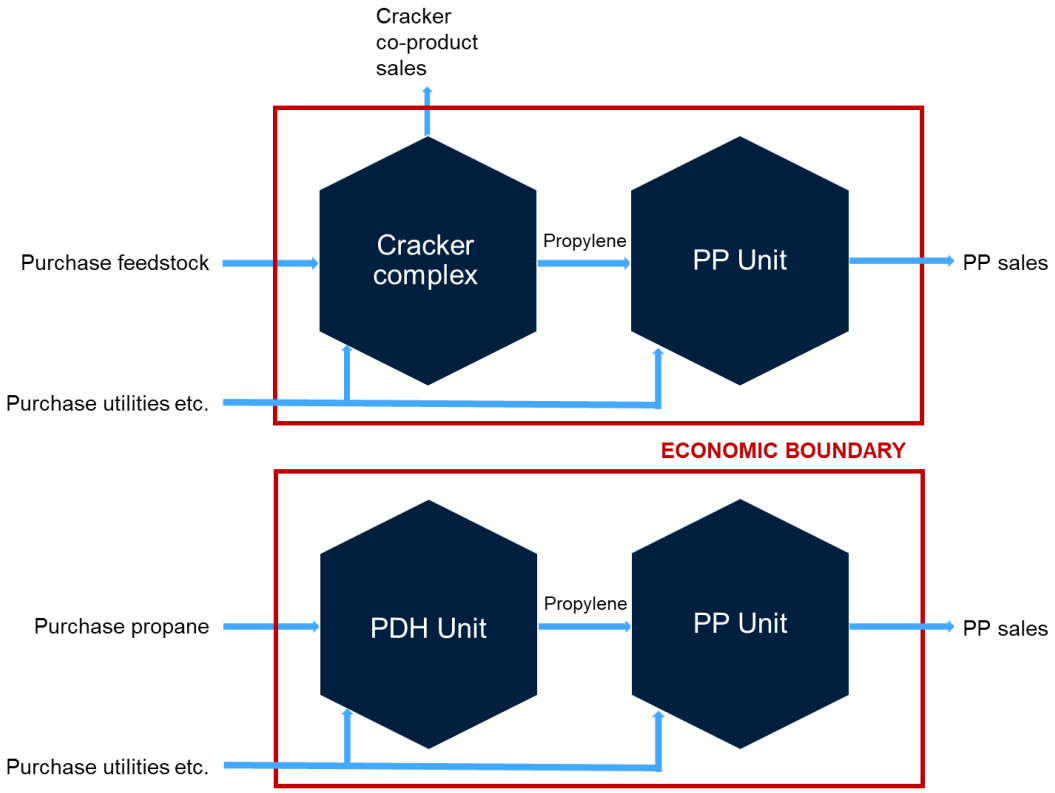
THE BUSINESS MODEL

In Europe, the dominant feedstocks in the production of polypropylene (PP) are naphtha and LPG, a product mainly derived from crude oil.

Naphtha or LPG and steam are fed into the cracker unit where ethylene, propylene and other co-products (such as butadiene and benzene) are made. Both of these feedstocks are derived from oil production or refining.

The second method of producing PP is the propane dehydrogenation (PDH) process. Propane is fed into a PDH unit over a catalyst to produce propylene. This propylene is then further processed to make PP.

The diagram below shows the process of making polypropylene from naphtha, and from propane feedstock.



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.

- 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 PP grade referenced in the ICIS Polypropylene Europe Margin report is PP homopolymer injection moulding grade.

The calculation below demonstrates how ICIS derives the PP margin for Europe. The examples given are based on contract sales prices, denominated in US dollars per tonne, and use average prices for the year 2017.

Naphtha-based integrated margin ($/tonne)

Polypropylene contract price		1,490
Logistic costs/netbacks		(148)
Polypropylene product value		**1,342**
Co-product sales		**401**
Total income		**1,743**
Total chemical input costs		972
Utilities		63
Variable costs		**1,035**
Polypropylene margin	1,786 – 1,035	**= 708**

Standalone margin ($/tonne)

Polypropylene contract price		1,490
Logistic costs/netbacks		(148)
Polypropylene product value		**1,342**
Total income		**1,342**
Total chemical input costs		974
Utilities		30
Variable costs		**1,004**
Polypropylene margin	1,342 – 1,004	**= 338**

PDH integrated margin ($/tonne)

Polypropylene contract price		1,490
Logistic costs/netbacks		(148)
Polypropylene product value		**1,342**
Co-product sales		**2**
Total income		**1,344**
Total chemical input costs		548
Utilities		130
Variable costs		**969**
Polypropylene margin	1,344 – 678	**= 817**

INTEGRATED AND STANDALONE

- Non-integrated or standalone market participants produce polypropylene only. Our margin model assumes plants that are co-located and the propylene is sourced from the open market. Standalone margins are not available for Russia.

- Integrated market participants produce propylene and polypropylene (as well as ethylene for a fully integrated supply chain). In a fully integrated supply chain, the business model is to buy naphtha, process it into propylene, benzene, butadiene and other cracker co-products. The propylene is then converted into polypropylene.

- 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 the cracker operations. Yield pattern data relates to the overall material balance of the cracker unit. For example, for one tonne of propylene produced, a cracker will use approximately two tonnes of naphtha as feedstock. In addition to the one tonne of propylene, the cracker will produce around 1.5 tonnes of co-products (including butadiene, benzene, raffinate-1, pygas and a fuel export balance). A PDH unit will use approximately 1.2 tonnes of propane per tonne of propylene. These calculations also take into consideration power, and additional chemicals and catalysts required for the synthesis of PP.

- Naphtha is the dominant cracker feedstock in Europe. ICIS also models propane and LPG (propane and butane) feedstocks as some cracker units are flexible, and able to increase LPG usage when economically favourable.

- European polypropylene margins are calculated for the following production processes in North West and Mediterranean Europe:
    - LPG Polypropylene
    - Naphtha Polypropylene Bulk
    - Propane Polypropylene Bulk (PDH)
    - Standalone Polypropylene Bulk

  Russia only has calculated margins for Naphtha Polypropylene Bulk processes

- Due to the different cracker yield patterns when using naphtha, propane, or LPG 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

The following ICIS inputs are used to generate the full content of the ICIS Polypropylene Europe margins:

MEDITERRANEAN AND NORTHWEST EUROPE

- Polypropylene PP (Homopolymer Injection) in Europe domestic FD EU (converted from €/tonne to $/tonne)
- Polypropylene PP (Homopolymer Injection) in Europe spot FD NWE (converted from €/tonne to $/tonne)
- Naphtha in Europe Spot CIF NWE (weekly average) ($/tonne)
- Naphtha in the Mediterranean Spot FOB ($/tonne)
- Butane in Europe Spot CIF NWE 3000mt+ (Friday assessment) (converted from €/tonne to $/tonne)
- Butane Bethouia Contract FOB (monthly assessment) ($/tonne)
- Propane in Europe Spot CIF NWE 3000mt+ (Friday assessment) (converted from €/tonne to $/tonne)
- Propane Bethouia Contract FOB (monthly assessment) ($/tonne)
- Gasoline: Unleaded Premium in Europe Spot FOB Barges NWE (weekly average) ($/tonne)
- Fuel Oil 3.5% in Europe Spot CIF Cargoes NWE (weekly average) ($/tonne)
- Natural Gas, TTF Price Assessment, October '22, Bid/Offer Range, Daily, DEL TTF (€/MWh, converted to $/MmBTU)
- Propylene in Europe Monthly Contract FD NWE (converted from €/tonne to $/tonne)
- Propylene (Polymer Grade) in Europe Spot CIF NWE (converted from €/tonne to $/tonne)
- Butadiene in Europe Monthly Contract FD NWE (converted from €/tonne to $/tonne)
- Butadiene in Europe Spot FD NWE ($/tonne)
- Benzene in Europe Monthly Contract FOB NWE (converted from €/tonne to $/tonne)
- Benzene in Europe Spot CIF ARA ($/tonne)
- Raffinate-1 in Europe Spot CIF NWE ($/tonne)

RUSSIA

- Homopolymer Raffia, Ex-works, Assessment, 2-4 Weeks, Full Market Range, Weekly

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 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.

Where price inputs are unavailable for Mediterranean Europe, ICIS calculates costs by applying logistics fees to prices given in North West Europe.

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 – Polypropylene Europe model are denominated in USD unless specifically stated otherwise. Where the original assessed price is in euros, ICIS uses the USD/EUR mid-market exchange rate issued at 16:00 UTC (GMT) on the date of the ICIS price report publication by XE (www.xe.com). When converting contract prices, the mid-market exchange rate quoted on first day of the given month is used. In the case that the first day of any month falls on a weekend, the mid-market exchange rate of the previous Friday is used.

The basis on which ICIS pricing data is used for the calculation of spot and contract prices is summarised in the table below. For detailed information about these quotations, please refer to the Assessment Inputs section above.

ICIS price	**North West Europe**		**Mediterranean Europe**
	Spot margin	**Contract margin**	**Spot margin**
Polypropylene	Spot	Domestic	Domestic
Naphtha	Spot	Spot	Spot
Butane	Spot	Spot	Contract
Propane	Spot	Spot	Contract
Gasoline	Spot	Spot	Spot
Fuel Oil	Spot	Spot	Spot
Ethylene	Spot	Contract	Spot
Propylene	Spot	Contract	Spot
Butadiene	Spot	Contract	Spot
Benzene	Spot	Contract	Spot
Raffinate-1	Spot	Spot	Spot

POLYPROPYLENE EUROPE WEBPAGE

Filter data on the website using the following criteria.

- **Area:** Select Mediterranean Europe, North West Europe or Russia
- **Process**: Select from LPG polypropylene, naphtha polypropylene bulk, propane polypropylene bulk, and standalone polypropylene bulk.
- **Price terms**: Variable margins are generated for both contract and spot price terms. Russia only has spot margins available.

Variable margins data is available online from January 2014 onwards. Six months trailing data shows as default.

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

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

PUBLICATION FREQUENCY

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