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Variable Margin Methodology: Polyvinyl Chloride North America

ICIS
Independent Commodity Intelligence Services

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THE BUSINESS MODEL

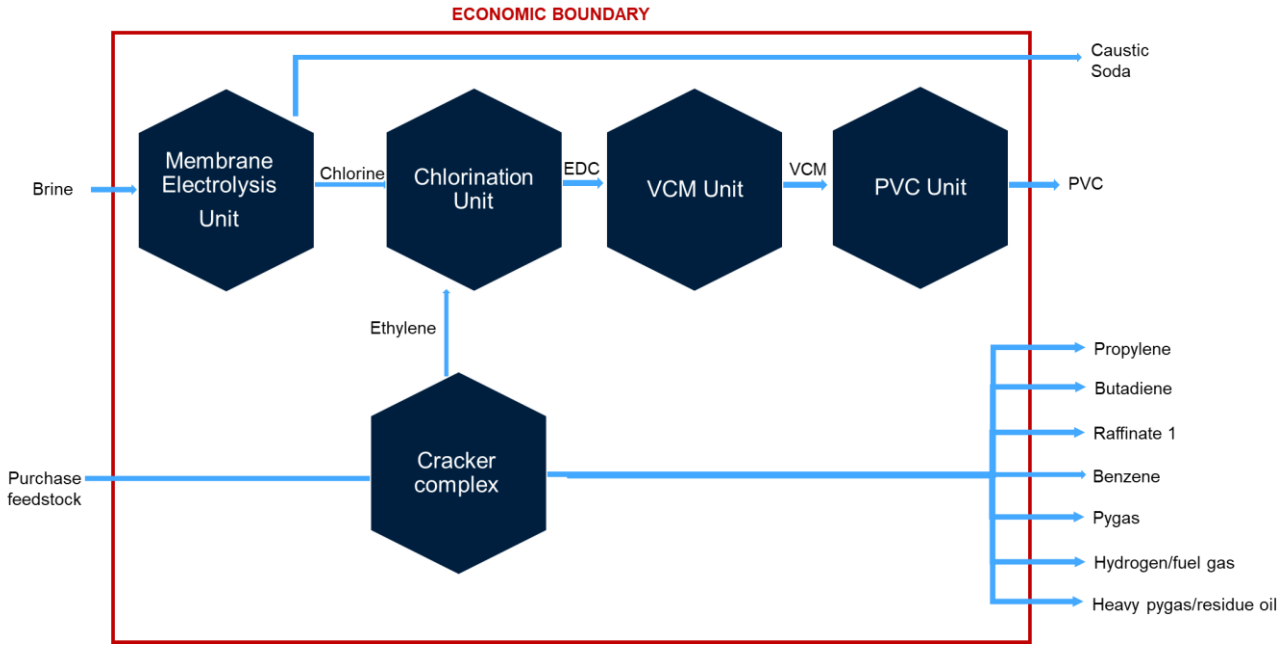
Polyvinyl Chloride (PVC) is produced by the polymerisation of Vinyl Chloride Monomer (VCM), which is made from Ethylene dichloride (EDC). This is produced by the chlorination of ethylene. The main inputs for EDC in North America are brine, electricity and ethylene. Salt is mined or produced from seawater.

ICIS calculates ethylene margins for naphtha and ethane feedstocks in North America. Naphtha is a product mainly derived from crude oil. Ethane is a gaseous feedstock derived via separation from natural gas or petroleum gas.

In the steam cracking process, the feedstock and steam are fed into a cracker unit, where ethylene and its co-products (such as propylene, butadiene and benzene) are made. Ethylene is separated from co-products and typically piped to other chemical plants, where it is further processed into derivative products such as polyethylene. Its co-products are also separated and, either sold for use in other chemical plants, or used as fuel.

In the model, it is assumed that there is a membrane electrolysis unit present to produce chlorine. The ethylene is modelled to come from a naphtha-based cracker, and also from the merchant market. Finally, margins are also modelled for EDC and VCM bought on the merchant market.

The PVC production process is the one that is modelled here.



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.

- 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 are linked to ICIS pricing quotations for large volume commodity products with netbacks assessed using typical logistic cost assessments.

- 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 PVC margin ex naphtha for the US Gulf. The example is based on spot sales prices, is denominated in US dollars per tonne, and uses average prices for the year 2017.

Variable margin ($/tonne)

PVC spot price	979
Logistics costs/netbacks	(10)
PVC product value	**969**
Co product sales	**785**
Total income	**1,754**
Purchase feedstock (naphtha)	605
Utilities	205
Variable costs	**810**

PVC margin **1,754 - 810 = 944**

MODEL YIELD PATTERN AND CALCULATION

Plant manufacturing data relates to the variable cost components of plant operations. Yield pattern data relates to the overall material balance of the unit. For example, for each tonne of PVC produced, a plant will use approximately 1 tonne of VCM. ICIS calculations also take into consideration additional chemicals and catalysts required for the synthesis of PVC.

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 pricing inputs are used to generate the full content of the ICIS Vinyl Chloride Monomer North America margins:

US GULF

- Polyvinyl Chloride Spot US Gulf DEL US (ICIS pricing, weekly range) (US cts/lb converted to $/tonne)
- Vinyl Chloride Monomer US Gulf Spot FOB US Gulf (ICIS pricing, weekly range) ($/tonne)
- Ethylene dichloride US Gulf Spot FOB US Gulf (ICIS pricing, weekly range) ($/tonne)
- Caustic soda in US Gulf Spot FOB US Gulf (ICIS pricing, weekly range) ($/dry metric tonne)

- Ethane Mt Belvieu FOB USG Spot (weekly average) (cts/US gal converted to $/tonne)
- Naphtha in US Gulf Spot Del USG Paraffinic (weekly average) ($/tonne)
- Ethylene in US Gulf Spot Del (Pipeline) (weekly average) (cts/lb converted to $/tonne)
- Propylene (P Grade) in US Gulf Spot Pipeline (weekly average) (cts/lb converted to $/tonne)
- Butadiene in US Gulf Spot CIF (weekly average) (cts/lb converted to $/tonne)
- Crude C4s in US Gulf Spot CIF (weekly average) ($/tonne)
- Benzene in US Gulf Spot FOB Barges (Friday assessment) ($/US gal converted to $/tonne)
- Gasoline Premium Unleaded (Pipeline) in US Gulf Spot US Gulf (weekly average) (cts/US gal converted to $/tonne)
- Residual Fuel Oil: FOB US Gulf (barges) Spot No 6 1.0% (weekly average) (cts/bbl converted to $/tonne)
- NYMEX Henry Hub Natural Gas forward month (ICIS energy, weekly average) ($/MMBtu converted to $/tonne)

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 in US dollars, all data used in the ICIS Margin – Polyvinyl Chloride North America model are denominated in USD unless specifically stated otherwise.

POLYVINYL CHLORIDE NORTH AMERICA WEBPAGE

Filter data on the website using the following criteria.

- **Area**: Select US Gulf.
- **Price terms**: Variable margins are generated only for spot price terms.
- **Frequency**: Viewable with weekly, monthly, quarterly, or yearly granularity.
- **Currency**: Allows prices to be displayed in either EUR or USD.
- **Unit**: Allows conversion from displayed unit to unit of choice in data download only.

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

The website deploys the following data, all per tonne of PVC:

- **Main product value, ex-works**: the estimated PVC 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, quarter 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 VCM variable margin.

PUBLICATION FREQUENCY

The ICIS Weekly Margin – Polyvinyl Chloride North America model is based on the latest data at the close of business in Europe on Friday and released to customers on the following Monday, subject to schedule planning. Updates are not published on some public holidays. Holiday dates and days of publication may be subject to revision.