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Variable Margin Methodology: Vinyl Chloride Monomer Asia



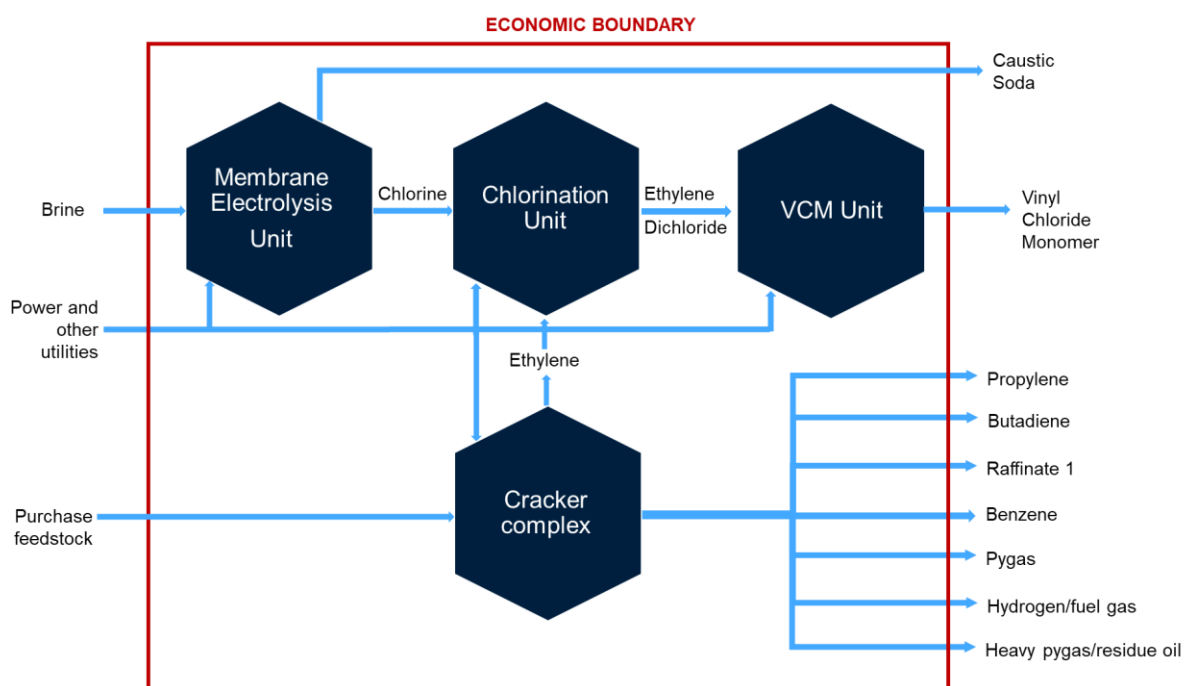
THE BUSINESS MODEL

Vinyl Chloride Monomer (VCM) is produced by the dehydrogenation of Ethylene Dichloride. Ethylene dichloride (EDC) is produced by the chlorination of ethylene. The main inputs for EDC in Asia are brine, electricity and ethylene. Salt is mined or produced from seawater.

The main ethylene feedstock in Asia 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 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 for 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.

The VCM 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 VCM margin ex naphtha for North East Asia. 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)

VCM spot price	717
Logistics costs/netbacks	(0)
VCM product value	717
Co product sales	775
<u>Total income</u>	<u>1,492</u>
Purchase feedstock (naphtha)	679



Utilities	174
<u>Variable costs</u>	<u>853</u>

VCM margin **1,492 - 853 = 639**

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 VCM produced, a plant will use approximately 1.6 tonnes of EDC. ICIS calculations also take into consideration additional chemicals and catalysts required for the synthesis of VCM.

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 Asia margins:

NORTH EAST ASIA

- Vinyl Chloride Monomer in Asia Pacific Spot CFR NE Asia (ICIS pricing, weekly range) (\$/tonne)
- Ethylene dichloride in Asia Pacific Spot CFR NE Asia (ICIS pricing, weekly range) (\$/tonne)
- Caustic soda in Asia Pacific Spot FOB NE Asia (ICIS pricing, weekly range) (\$/dry metric tonne)
- Ethylene in Asia Pacific Spot CFR NE Asia (ICIS pricing, weekly average) (\$/tonne)
- Sulphuric Acid in Asia Pacific Spot FOB China, 98% grade (ICIS pricing, weekly range) (\$/tonne)
- Naphtha in Asia Pacific Spot CFR Japan (ICIS pricing, Friday assessment) (\$/tonne)
- Propylene in Asia Pacific Spot CFR China Main Port (ICIS pricing, weekly average) (\$/tonne)
- Butadiene in Asia Pacific Spot CFR NE Asia (ICIS pricing, weekly average) (\$/tonne)
- Benzene in Asia Pacific Spot CFR Main China Ports (ICIS pricing, Friday assessment) (\$/tonne)
- Gasoline 92 Spot CFR China (ICIS pricing, weekly average) (\$/bbl)
- 180 CST FOB Singapore Spot (weekly assessment) (\$/tonne)



SOUTH EAST ASIA

- Vinyl Chloride Monomer in Asia Pacific Spot CFR SE Asia (ICIS pricing, weekly range) (\$/tonne)
- Ethylene dichloride in Asia Pacific Spot CFR SE Asia (ICIS pricing, weekly range) (\$/tonne)
- Caustic soda in Asia Pacific Spot FOB SE Asia (ICIS pricing, weekly range) (\$/dry metric tonne)
- Ethylene in Asia Pacific Spot CFR SE Asia (ICIS pricing, weekly average) (\$/tonne)
- Sulphuric Acid in Asia Pacific Spot CFR SE Asia, 98% grade (ICIS pricing, weekly range) (\$/tonne)
- Naphtha in Asia Pacific Spot FOB Singapore (ICIS pricing, Friday assessment) (\$/bbl)
- Propylene in Asia Pacific Spot CFR SE Asia (ICIS pricing, weekly average) (\$/tonne)
- Butadiene in Asia Pacific Spot CFR SE Asia (ICIS pricing, weekly average) (\$/tonne)
- Benzene in Asia Pacific Spot FOB SE Asia (ICIS pricing, Friday assessment) (\$/tonne)
- Toluene in Asia Pacific Spot CFR SE Asia (ICIS pricing, Friday assessment) (\$/tonne)
- Xylene (Solvent Grade) in Asia Pacific spot CFR SE Asia (ICIS pricing, Friday assessment) (\$/tonne) [from 5 January 2018]
- Gasoline 95 Unleaded FOB Singapore spot (C1 Energy, weekly average) (\$/bbl)
- 180 CST FOB Singapore Spot (weekly assessment) (\$/tonne)

The methodology associated with each ICIS pricing individual pricing quotation referenced above can be found 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 in US dollars, all data used in the ICIS Margin – Vinyl Chloride Monomer Asia model are denominated in USD unless specifically stated otherwise.

VINYL CHLORIDE MONOMER ASIA WEBPAGE

Filter data on the website using the following criteria.

- **Area:** Select from North East Asia and South East Asia.
- **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 VCM:

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



PUBLICATION FREQUENCY

The ICIS Weekly Margin – Vinyl Chloride Monomer Asia 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.