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Variable Margin Methodology: Vinyl Chloride Monomer Europe



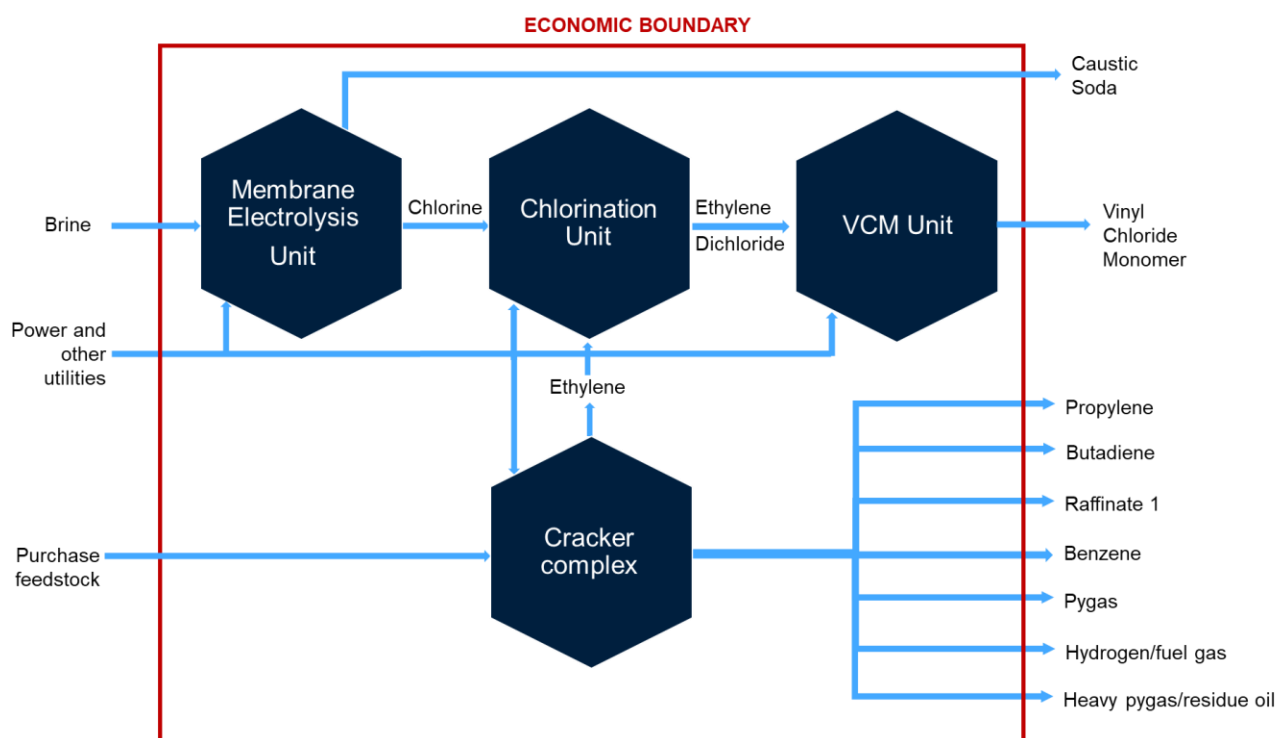
THE BUSINESS MODEL

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 Europe are brine, electricity and ethylene. Salt is mined or produced from seawater.

The main ethylene feedstock in Europe 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 Europe. 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	701
Logistics costs/netbacks	(0)
VCM product value	701
Co product sales	785
<u>Total income</u>	<u>1,486</u>
Purchase feedstock (naphtha)	616



Utilities	178
<u>Variable costs</u>	<u>794</u>

<u>VCM margin</u>	<u>1,486 - 794 = 692</u>
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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 Europe margins:

NORTH WEST EUROPE

- Vinyl Chloride Monomer in Europe Spot FOB NWE (ICIS pricing, weekly range) (\$/tonne)
- Ethylene dichloride in Europe Spot FOB NWE (ICIS pricing, weekly range) (\$/tonne)
- Caustic soda in Europe Spot FOB NWE (ICIS pricing, weekly range) (\$/dry metric tonne)
- Sulphuric Acid in Europe Spot FD North West Europe, 98% grade (ICIS pricing, weekly range) (€/tonne converted to \$/tonne)
- Naphtha in Europe Spot CIF NWE (weekly average) (\$/tonne)
- Gasoline: Unleaded Premium in Europe Spot FOB Barges NWE (weekly average) (\$/tonne)
- Natural Gas, TTF Price Assessment, October '22, Bid/Offer Range, Daily, DEL TTF (€/MWh, converted to \$/MmBTU)
- Fuel Oil 3.5% in Europe Spot CIF Cargoes NWE (weekly average) (\$/tonne)
- Ethylene in Europe Spot, Assessment, Pipeline, 0-6 Weeks, Full Market Range, Weekly, FD NWE (€/tonne)
- Propylene (Polymer Grade) in Europe Spot CIF NWE (converted from €/tonne to \$/tonne)
- Butadiene in Europe Spot FD NWE (\$/tonne)
- Benzene in Europe Spot CIF ARA (\$/tonne)



- Raffinate-1 in Europe Spot CIF NWE (\$/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 – Vinyl Chloride Monomer Europe model are denominated in US dollars unless specifically stated otherwise.

VINYL CHLORIDE MONOMER EUROPE WEBPAGE

Filter data on the website using the following criteria.

- **Area:** Select North West Europe.
- **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 VCM variable margin.

PUBLICATION FREQUENCY

The ICIS Weekly Margin – Vinyl Chloride Monomer 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, subject to schedule planning. Updates are not published on some public holidays. Holiday dates and days of publication may be subject to revision.