

MARKETS AND PROFITABILITY

Profitability Forecast: Vinyls - 2019

Global

September 2019



This Report was prepared by Nexant, Inc. ("Nexant"). Except where specifically stated otherwise in this Report, the information contained herein is prepared on the basis of information that is publicly available, and contains no confidential third party technical information to the best knowledge of Nexant. Aforesaid information has not been independently verified or otherwise examined to determine its accuracy, completeness or financial feasibility. Neither Nexant, Subscriber nor any person acting on behalf of either assumes any liabilities with respect to the use of or for damages resulting from the use of any information contained in this Report. Nexant does not represent or warrant that any assumed conditions will come to pass.

The Report is submitted on the understanding that the Subscriber will maintain the contents confidential except for the Subscriber's internal use. The Report should not be reproduced, distributed or used without first obtaining prior written consent by Nexant. Each Subscriber agrees to use reasonable effort to protect the confidential nature of the Report.

Copyright © by Nexant Inc. 2019. All rights reserved.



Contents

1	Executive Summary	1
1.1	Introduction.....	1
2	Economic Assumptions and Forecasting Methodology	2
2.1	Introduction.....	2
2.2	Scenarios	3
2.3	Crude Oil	4
2.3.1	Crude Oil Price Basis	4
2.3.2	Crude Oil Scenarios	5
2.3.3	Low Crude Oil Price	7
2.3.4	Medium Crude Oil Price	8
2.3.5	High Crude Oil Price	8
2.4	Economic Growth	9
2.4.1	Forecasting Methodology/Assumptions	9
2.4.2	Global Economic Growth	9
2.5	Inflation	12
2.6	Exchange Rates	13
2.6.1	Forecasting Methodology and Assumptions	13
2.6.2	Outlook for the Euro	13
2.7	Profitability Forecasting Methodology	14
2.7.1	Introduction.....	14
2.7.2	Price Influences.....	15
2.7.3	Petrochemical Production Costs	17
2.7.4	Driving Forces for Profitability	19
2.7.5	Cyclicality of the Petrochemical Industry	23
3	Petrochemical and Polymer Industry Profitability	25
3.1	Asia Pacific.....	25
3.2	United States.....	27
3.3	Western Europe	29
4	Petrochemical Feedstocks and Refined Products Pricing	31
4.1	Naphtha.....	33
4.2	Gasoline	34
4.3	Fuel Oil	35
4.4	Natural Gas	36
4.5	Ethane	37
4.6	Propane.....	38
4.7	Coal.....	39
5	Chlor-alkali.....	40
5.1.1	Introduction.....	40
5.1.2	Pricing Basis and Mechanism	40
5.1.3	Regional Price Definitions	41



5.2	Asia Pacific.....	42
5.2.1	Profitability Projections.....	42
5.2.2	Price Projections.....	43
5.3	United States.....	44
5.3.1	Profitability Projections.....	44
5.3.2	Price Projections.....	46
5.4	Western Europe.....	48
5.4.1	Profitability Projections.....	48
5.4.2	Price Projections.....	49
6	Ethylene Dichloride (EDC).....	51
6.1	Introduction.....	51
6.1.1	Pricing Basis and Mechanism.....	51
6.1.2	Regional Price Definitions.....	51
6.2	Asia Pacific.....	52
6.2.1	Profitability Projections.....	52
6.2.2	Price Projections.....	55
6.3	United States.....	56
6.3.1	Profitability Projections.....	56
6.3.2	Price Projections.....	59
6.4	Western Europe.....	60
6.4.1	Profitability Projections.....	60
6.4.2	Price Projections.....	62
6.5	Regional Price Spreads.....	63
7	Vinyl Chloride Monomer (VCM).....	64
7.1	Introduction.....	64
7.1.1	Pricing Basis and Mechanism.....	64
7.1.2	Regional Price Definitions.....	64
7.2	Asia Pacific.....	65
7.2.1	Profitability Projections.....	65
7.2.2	Price Projections.....	68
7.3	United States.....	70
7.3.1	Profitability Projections.....	70
7.3.2	Price Projections.....	72
7.4	Western Europe.....	73
7.4.1	Profitability Projections.....	73
7.4.2	Price Projections.....	76
7.5	Regional Price Spreads.....	77
8	Polyvinyl Chloride (PVC).....	79
8.1	Introduction.....	79
8.1.1	Pricing Basis and Mechanism.....	79
8.1.2	Regional Price Definitions.....	79
8.2	Asia Pacific.....	80
8.2.1	Profitability Projections.....	80



8.2.2	Price Projections	83
8.3	United States.....	84
8.3.1	Profitability Projections	84
8.3.2	Price Projections	86
8.4	Western Europe	87
8.4.1	Profitability Projections	87
8.4.2	Price Projections	90
8.5	Regional Price Spreads	91

Figures

Figure 1	Crude Oil Price Scenarios	6
Figure 2	World Economic Performance and Outlook	10
Figure 3	United States GDP Price Deflator	12
Figure 4	Euro Versus US Dollar	13
Figure 5	Petrochemical Simulator Forecast Methodology.....	14
Figure 6	Petrochemical Price Influences	16
Figure 7	Production Cost Elements	17
Figure 8	Price Influences in the Cost Curve	19
Figure 9	Return on Capital and Operating Rate	20
Figure 10	Western Europe Average Return on Investment	21
Figure 11	United States Average Return on Investment.....	21
Figure 12	Petrochemical Industry Profitability and Operating Rate.....	23
Figure 13	Asian Petrochemical Industry Profitability	25
Figure 14	United States Petrochemical Industry Profitability	27
Figure 15	Western Europe Petrochemicals Industry Profitability	29
Figure 16	United States Petrochemical Feedstock and Refined Product Prices	32
Figure 17	United States Petrochemical Feedstock Prices Relative to WTI Crude Oil	32
Figure 18	Global Naphtha Prices.....	33
Figure 19	Global Premium Gasoline Prices	34
Figure 20	Global High Sulphur Fuel Oil Prices	35
Figure 21	Global Natural Gas Prices	36
Figure 22	United States Ethane Prices	37
Figure 23	Global Propane Prices.....	38
Figure 24	China Coal Prices.....	39
Figure 25	Asia Chlor-Alkali Cash Cost	42
Figure 26	NE Asia Caustic Soda Price Scenarios.....	43
Figure 27	United States Chlor-alkali Return on Investment Projections	44
Figure 28	United States Chlor-alkali Cash Margin Projections	45
Figure 29	United States Chlor-alkali Cost Price Margin Projections	46
Figure 30	United States Chlorine Price Scenarios	47
Figure 31	United States Caustic Soda Price Scenarios	47
Figure 32	Western Europe Chlor-alkali Cash Cost Margins.....	48
Figure 33	Western Europe Caustic Soda Price Scenarios.....	49
Figure 34	Regional Caustic Soda Prices.....	50



Figure 35	Western Europe Chlorine Values	50
Figure 36	Asia EDC Return on Investment and Operating Rate	52
Figure 37	Asia EDC Cash Margins	54
Figure 38	Asia EDC Costs Margin and Price Projections.....	55
Figure 39	NE Asia EDC Price Scenarios.....	55
Figure 40	United States EDC Export Return on Investment and Operating Rate.....	56
Figure 41	United States EDC Cash Margin Projections	58
Figure 42	United States EDC Cost Margin and Price Projections.....	59
Figure 43	United States EDC Price Scenarios	59
Figure 44	Western Europe EDC Cash Margins.....	60
Figure 45	Western Europe EDC Cost Margin and Price Projections	62
Figure 46	Western Europe EDC Price Scenarios.....	62
Figure 47	EDC Global Prices.....	63
Figure 48	Asia VCM Return on Investment and Operating Rate	65
Figure 49	Asia VCM Cash Margins	66
Figure 50	China Ethylene Based VCM Cost Margin and Price Projections	68
Figure 51	China Coal to VCM Cost Margin and Price Projections	68
Figure 52	NE Asia VCM Price Scenarios	69
Figure 53	United States VCM Return on Investment and Operating Rate.....	70
Figure 54	United States VCM Cash Margin Projections.....	71
Figure 55	United States VCM Cost Margin and Price Projections	72
Figure 56	United States VCM Price Scenarios.....	72
Figure 57	Western Europe VCM Return on Investment and Operating Rate	73
Figure 58	Western Europe VCM Margins.....	75
Figure 59	Western Europe VCM Cost Price and Margin Projections.....	76
Figure 60	Western Europe VCM Price Scenarios	76
Figure 61	VCM Global Prices	77
Figure 62	Asia PVC Return on Investment and Operating Rate	80
Figure 63	Asia PVC Margins	81
Figure 64	Asia PVC Cost Margin and Price Projections.....	83
Figure 65	NE Asia PVC Price Scenarios.....	83
Figure 66	United States PVC Cash Margin Projections	85
Figure 67	United States PVC Cost Price Margin Projections	86
Figure 68	United States PVC Price Scenarios	86
Figure 69	Western Europe PVC Return on Investment and Operating Rate.....	87
Figure 70	Western Europe Integrated PVC/VCM Cash Margins	89
Figure 71	Western Europe PVC Cost Margin and Price Projections	90
Figure 72	Western Europe PVC Price Scenarios.....	90
Figure 73	PVC Global Prices.....	91



Tables

Table 1	World Economic Growth	10
Table 2	Asia Chlor-Alkali Cost Projections	42
Table 3	United States Chlor-alkali Cost, Profitability and Price Projections.....	45
Table 4	Western Europe Chlor-alkali Cost and Profitability Projections	48
Table 5	Asia EDC Cost Profitability and Price Projections.....	54
Table 6	United States EDC Cost Profitability and Price Projections	58
Table 7	Western Europe EDC Cost Profitability and Price Projections.....	61
Table 8	Asian VCM Cost Profitability and Price Projections	67
Table 9	United States VCM Cost Profitability and Price Projections.....	71
Table 10	Western Europe VCM Profitability Projections	75
Table 11	Asia PVC Cost Profitability and Price Projections	82
Table 12	United States PVC Cost Profitability and Price Projections	85
Table 13	Western Europe PVC Cost Profitability and Price Projections	89