

MARKETS AND PROFITABILITY

Profitability and Price Forecast: Aromatics - 2022

October 2022



This Report was prepared by NexantECA, the Energy and Chemicals Advisory company ("NexantECA"). Except where specifically stated 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 and belief of NexantECA. The information has not been independently verified or otherwise examined to determine its accuracy, completeness or financial feasibility. Neither NexantECA, Subscriber nor any person acting on behalf of either shall have any liabilities for any loss or damage arising from or connected to the use of any information contained in this Report. NexantECA does not represent or warrant that any assumed conditions will come to pass.

The Report is for Subscriber's internal use only and shall be kept strictly confidential. The Report should not be otherwise reproduced, distributed or used without first obtaining prior written consent by NexantECA. Each Subscriber agrees to use reasonable effort to protect the confidential nature of the Report.

Copyright © by NexantECA (BVI) Ltd. 2022. All rights reserved.



Contents

1	Executive Summary	1
1.1	Introduction.....	1
2	Economic Assumptions and Forecast 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	7
2.3.5	High Crude Oil Price	7
2.4	Economic Growth.....	8
2.4.1	Forecasting Methodology/Assumptions	8
2.4.2	Global Economic Growth	8
2.5	Inflation.....	11
2.6	Exchange Rates	12
2.6.1	Forecasting Methodology and Assumptions	12
2.6.2	Outlook for the Euro	12
2.7	Profitability Forecasting Methodology	13
2.7.1	Introduction.....	13
2.7.2	Price Influences.....	14
2.7.3	Petrochemical Production Costs	16
2.7.4	Driving Forces for Profitability	18
2.7.5	Cyclicality of the Petrochemical Industry	22
3	Petrochemical and Polymer Industry Profitability	23
3.1	Asia Pacific.....	23
3.2	United States.....	25
3.3	Western Europe	27
4	Petrochemical Feedstocks and Refining Products Pricing	29
4.1	Naphtha.....	31
4.2	Gasoline	32
4.3	Fuel Oil	33
4.4	Natural Gas	34
4.5	Ethane	36
4.6	Propane.....	37
4.7	Coal	38
5	Gasoline Valuation of Aromatics	39
5.1	Introduction.....	39
5.2	Gasoline Blend Value Mechanism	41
5.2.1	Volatility Effect.....	41



5.2.2	Volumetric Effect	42
5.2.3	Octane Effect.....	42
5.2.3.1	Asian Octane Values	42
5.2.3.2	United States Octane Values.....	43
5.2.3.3	Western Europe Octane Values	44
6	Aromatics Rich Feedstocks (Reformate and Pygas).....	46
6.1	Introduction.....	46
6.2	Asia Pacific.....	47
6.2.1	Reformate Valuation Mechanism	47
6.2.2	Reformate Profitability Projections	47
6.2.3	Pygas Valuation Mechanism.....	49
6.3	United States.....	50
6.3.1	Reformate Valuation Mechanism	50
6.3.2	Reformate Profitability Projections	50
6.3.3	Pygas Valuation Mechanism.....	51
6.4	Western Europe	52
6.4.1	Reformate Valuation Mechanism	52
6.4.2	Reformate Profitability Projections	52
6.4.3	Pygas Valuation Mechanism.....	54
7	Benzene.....	55
7.1	Introduction.....	55
7.1.1	Pricing Basis and Mechanism	57
7.1.2	Regional Price Definitions	58
7.2	Asia Pacific.....	59
7.2.1	Profitability Projections	59
7.2.2	Price Projections	63
7.3	United States.....	64
7.3.1	Profitability Projections	64
7.3.2	Price Projections	67
7.4	Western Europe	68
7.4.1	Profitability Projections.....	68
7.4.2	Price Projections	71
7.5	Regional Price Spreads	72
8	Toluene.....	74
8.1	Introduction.....	74
8.1.1	Pricing Basis and Mechanism	74
8.2	Asia Pacific.....	76
8.2.1	Price Projections	76
8.3	United States.....	78
8.3.1	Price Projections	78
8.4	Western Europe	80
8.4.1	Price Projections	80
8.5	Regional Price Spreads	82



9	Mixed Xylenes	84
9.1	Introduction	84
9.1.1	Pricing Basis and Mechanism	84
9.1.2	Regional Price Definitions	85
9.2	Asia Pacific	86
9.2.1	Profitability Projections	86
9.2.2	Price Projections	89
9.3	United States	91
9.3.1	Profitability Projections	91
9.3.2	Price Projections	94
9.4	Western Europe	95
9.4.1	Profitability Projections	95
9.4.2	Price Projections	98
9.5	Regional Price Spreads	100
10	<i>para</i>-Xylene	102
10.1	Introduction	102
10.1.1	Pricing Basis and Mechanism	103
10.1.2	Regional Price Definitions	103
10.2	Asia Pacific	104
10.2.1	Profitability Projections	104
10.2.2	<i>Price Projections</i>	108
10.3	United States	109
10.3.1	Profitability Projections	109
10.3.2	Price Projections	112
10.4	Western Europe	113
10.4.1	Profitability Projections	113
10.4.2	Price Projections	117
10.5	Regional Price Spreads	118
11	<i>ortho</i>-Xylene	120
11.1	Introduction	120
11.1.1	Pricing Basis and Mechanism	120
11.1.2	Regional Price Definitions	120
11.2	Asia Pacific	121
11.2.1	Profitability Projections	121
11.2.2	Price Projections	121
11.3	United States	122
11.3.1	Profitability Projections	122
11.3.2	Price Projections	122
11.4	Western Europe	123
11.4.1	Profitability Projections	123
11.4.2	Price Projections	123
11.5	Regional Price Spreads	124



Figures

Figure 1	Crude Oil Price Scenarios	6
Figure 2	World Economic Performance and Outlook	9
Figure 3	United States GDP Price Deflator	11
Figure 4	Euro Versus U.S. Dollar	12
Figure 5	Petrochemical Simulator Forecast Methodology	13
Figure 6	Petrochemical Price Influences	15
Figure 7	Production Cost Elements	16
Figure 8	Price Influences in the Cost Curve	18
Figure 9	Return on Capital and Operating Rate	19
Figure 10	Western Europe Average Return on Investment	20
Figure 11	United States Average Return on Investment	20
Figure 12	Petrochemical Industry Profitability and Operating Rate	22
Figure 13	Asian Petrochemical Industry Profitability	23
Figure 14	United States Petrochemical Industry Profitability	25
Figure 15	Western Europe Petrochemicals Industry Profitability	27
Figure 16	United States Petrochemical Feedstock and Refined Product Prices	30
Figure 17	United States Petrochemical Feedstock Prices Relative to WTI Crude Oil	30
Figure 18	Global Naphtha Prices	31
Figure 19	Global Premium Gasoline Prices	32
Figure 20	Global High Sulphur Fuel Oil Prices	33
Figure 21	Global Natural Gas Prices	34
Figure 22	United States Ethane Prices	36
Figure 23	Global Propane Prices	37
Figure 24	China Coal Prices	38
Figure 25	Asia Aromatics Prices & Gasoline Prices	40
Figure 26	United States Aromatics Prices & Gasoline Prices	40
Figure 27	West European Aromatics & Gasoline Prices	40
Figure 28	South-East Asia Octane Value Projections	42
Figure 29	United States Octane Value Projections	44
Figure 30	Western Europe Octane Value Projections	45
Figure 31	Asia Reformate Cash Margin Projections	48
Figure 32	United States Reformate Margin Projections	51
Figure 33	Western Europe Reformate Cash Margin Projections	53
Figure 34	Western Europe Pygas: Naphtha Value Ratios	54
Figure 35	Asia Benzene Production by Source (2022)	55
Figure 36	United States Benzene Production by Source (2022)	56
Figure 37	Western Europe Benzene Production by Source (2022)	57
Figure 38	Asia Benzene Extraction Cash Margin Projections	59
Figure 39	Asia Benzene Toluene Conversion Cash Margin Projections	59
Figure 40	North-East Asia Benzene Cost Profitability and Price Projections	63
Figure 41	North-East Asia Benzene Price Scenarios	63
Figure 42	United States Benzene Cash Margin Projections	64



Figure 43	United States Benzene Cost Profitability and Price Projections	67
Figure 44	United States Benzene Price Forecast Scenarios	67
Figure 45	Western Europe Benzene Cash Margin Projections	68
Figure 46	Western Europe Benzene Cost Profitability and Price Projections	71
Figure 47	Western Europe Benzene Price Forecast Scenarios	71
Figure 48	Global Benzene Prices	72
Figure 49	North-East Asia Alternative Toluene Valuations	76
Figure 50	North-East Asia Toluene Price Scenario	77
Figure 51	United States Alternative Toluene Valuations	78
Figure 52	United States Toluene Price Scenarios	79
Figure 53	Western Europe Alternative Toluene Values	80
Figure 54	Western Europe Toluene Price Forecast Scenarios	81
Figure 55	Global Toluene Price Projections	83
Figure 56	North-East Asia Mixed Xylenes Cash Margin Projections	87
Figure 57	North-East Asia Mixed Xylenes Cost Profitability and Price Projections	89
Figure 58	North-East Asia Alternative Mixed Xylenes Valuations	89
Figure 59	North-East Asia Mixed Xylenes Price Scenarios	90
Figure 60	United States Mixed Xylenes Cash Margin Projections	92
Figure 61	United States Mixed Xylenes Cost Profitability and Price Projections	94
Figure 62	United States Mixed Xylenes Price Scenarios	94
Figure 63	Western Europe Mixed Xylenes Cash Margin Projections	96
Figure 64	Western Europe Mixed Xylenes Cost Profitability and Price Projections	98
Figure 65	Western Europe Alternative Mixed Xylenes Valuations	98
Figure 66	Western Europe Mixed Xylenes Price Scenarios	99
Figure 67	Global Mixed Xylenes Prices	100
Figure 68	<i>para</i> -Xylene Plant Configuration	102
Figure 69	Asia <i>para</i> -Xylene Return on Investment and Operating Rate	104
Figure 70	Asia <i>para</i> -Xylene Cash Margins	105
Figure 71	Asia Integrated <i>para</i> -Xylene Cash Margins	105
Figure 72	China <i>para</i> -Xylene Cost Margin and Price Projections	108
Figure 73	North-East Asia <i>para</i> -Xylene Price Scenarios	108
Figure 74	United States <i>para</i> -Xylene Return on Investment and Operating Rate	109
Figure 75	United States <i>para</i> -Xylene Extraction Cash Margins	110
Figure 76	United States Integrated <i>para</i> -Xylene Cash Margins	110
Figure 77	United States <i>para</i> -Xylene Cost Margin and Price Projections	112
Figure 78	United States <i>para</i> -Xylene Price Scenarios	112
Figure 79	Western Europe <i>para</i> -Xylene Return on Investment and Operating Rate	113
Figure 80	Western Europe <i>para</i> -Xylene Extraction Cash Margins	114
Figure 81	Western Europe Integrated <i>para</i> -Xylene Cash Margins	114
Figure 82	Western Europe <i>para</i> -Xylene Cost Margin and Price Projections	117
Figure 83	Western Europe <i>para</i> -Xylene Price Scenarios	117
Figure 84	Global <i>para</i> -Xylene Price Projections	118
Figure 85	Asia <i>ortho</i> -Xylene / <i>para</i> -Xylene Price Ratio	121
Figure 86	North-East Asia <i>ortho</i> -Xylene Price Scenarios	121



Figure 87	United States Xylene Isomers Prices	122
Figure 88	United States <i>ortho</i> -Xylene Price Scenarios	122
Figure 89	Western Europe <i>ortho</i> -Xylene Price Ratio to Mixed Xylenes	123
Figure 90	Western Europe <i>ortho</i> -Xylene Price Scenarios	123
Figure 91	Global <i>ortho</i> -Xylene Prices	124

Tables

Table 1	World Economic Growth	9
Table 2	Asian Reformate Blend Value Parameters in Gasoline	47
Table 3	Asia Reformer Cost and Margin Projections	48
Table 4	United States Reformer Cost and Margin Projections	51
Table 5	Western Europe Reformate Blending Value Parameters	52
Table 6	Western Europe Reformer Cost and Margin Projections	53
Table 7	Asia Benzene Cost Profitability and Price Projections	60
Table 8	United States Benzene Cost Profitability and Price Projections	66
Table 9	Western Europe Benzene Cost Profitability and Price Projections	70
Table 10	Asia Toluene Blending Value Parameters	74
Table 11	Western Europe Toluene Blending Value Parameters	74
Table 12	Asia Mixed Xylenes Blending Values to Gasoline	84
Table 13	Western Europe Mixed Xylenes Blending Values to Gasoline	84
Table 14	Mixed Xylenes Cost Profitability and Price Projections	87
Table 15	United States Mixed Xylenes Profitability and Price Projections	92
Table 16	Western Europe Mixed Xylenes Cost Profitability and Price Projections	96
Table 17	Asia <i>para</i> -Xylene Cost Profitability and Price Projections	106
Table 18	United States <i>para</i> -Xylene Cost Profitability and Price Projections (Xylenes Isomerisation and Extraction)	111
Table 19	United States Integrated <i>para</i> -Xylene Cost Profitability and Price Projections	111
Table 20	Western Europe <i>para</i> -Xylene Cost Profitability and Price Projections (Xylenes Isomerisation and Extraction)	115
Table 21	Integrated <i>para</i> -Xylene Cost Profitability and Price Projections	115