



NexantThinking™

Special Reports

Competitiveness of Middle East Refining and its Global Impact

November 2015





Special Reports

Competitiveness of Middle East Refining and its Global Impact

November 2015



This Report was prepared by Nexant, Inc. ("Nexant") and is part of the NexantThinking™ suite. 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. 2015. All rights reserved.

Contents

Section		Page
1	Executive Summary	1-1
1.1	BACKGROUND.....	1-1
1.2	GCC REFINERY COMPETITIVENESS.....	1-4
2	Regional Overview	2-1
2.1	INTRODUCTION.....	2-1
2.2	MIDDLE EAST DEMOGRAPHICS.....	2-4
2.2.1	Population	2-4
2.2.2	Median Age	2-7
2.2.3	Unemployment	2-9
2.2.4	GDP per Capita	2-11
2.2.5	Impact on the Hydrocarbon Industry	2-12
2.3	MIDDLE EAST ENERGY RESOURCES	2-13
2.3.1	Introduction.....	2-13
2.3.2	Crude Oil Production	2-13
2.3.3	Electricity Generation	2-15
2.3.4	SUMMARY	2-33
2.4	REGIONAL REFINED PRODUCTS DEMAND	2-34
2.4.1	Introduction.....	2-34
2.4.2	Middle East Vehicle Fleet Analysis	2-35
2.4.3	Refined Product Demand by Country	2-40
2.5	MIDDLE EAST EXPORTS	2-49
2.5.1	Crude Oil	2-49
2.5.2	Refined Products.....	2-52
2.5.3	Petrochemicals and Polymers.....	2-62
2.6	SUMMARY	2-64
3	The GCC Refining Industry	3-1
3.1	INTRODUCTION.....	3-1
3.2	REFINING CAPACITY BY COUNTRY	3-4
3.2.1	Bahrain	3-4
3.2.2	Oman.....	3-6
3.2.3	UAE	3-9
3.2.4	Saudi Arabia.....	3-13
3.2.5	Kuwait.....	3-19

3.2.6	Qatar.....	3-22
3.3	SUMMARY	3-24
4	Refining Competitiveness.....	4-1
4.1	INTRODUCTION.....	4-1
4.2	GCC REFINING MARGIN ANALYSIS	4-3
4.2.1	Introduction.....	4-3
4.2.2	Feedstock Pricing.....	4-3
4.2.3	Refined Product and Petrochemical Product Pricing	4-6
4.2.4	Variable Costs	4-7
4.2.5	Fixed Costs	4-12
4.2.6	Refining Configurations	4-13
4.2.7	GCC Refining Margins	4-13
4.3	SIZE AND COMPLEXITY OF REFINERIES.....	4-20
4.3.1	Size.....	4-20
4.3.2	Complexity.....	4-22
4.3.3	Competitiveness of Future Capacity Additions	4-26
4.3.4	Discussion	4-36
4.4	REFINERY PETROCHEMICAL INTEGRATION (RPI).....	4-37
5	Future Trends	5-1
5.1	FURTHER REGIONAL DEVELOPMENTS.....	5-1
5.1.1	Iraq – Growth of the Refining Industry	5-2
5.1.2	Iran – Further Growth	5-4
5.2	FUTURE SPECIFICATIONS CHANGES.....	5-6
5.2.1	Gasoline Specifications	5-6
5.2.2	Diesel Specifications	5-8
5.3	MIDDLE EAST REFINERIES IN A GLOBAL CONTEXT	5-9
5.3.1	Global Overview	5-9
5.3.2	Conclusions	5-13

Appendix		Page
A	Refinery Model Data.....	A-1

Figure	Page
1.1 GCC Hydrocarbon Reserves and Production	1-1
1.2 Historical Crude Oil Exports	1-1
1.3 Future Refinery Capacity Additions.....	1-2
1.4 Common Forces on Refining Investments	1-3
1.5 Key Drivers of Competitiveness	1-4
1.6 Size and Complexity of GCC Refineries	1-5
1.7 Size and Complexity of Future GCC Refineries.....	1-6
1.8 Ethylene Production from Refinery Sources	1-7
1.9 Global Net Trade in Petroleum Refined Products	1-8
1.10 Middle East Refined Product Net Trade.....	1-8
1.11 Global Diesel Trade Flows	1-9
1.12 Global Gasoline Trade Flows	1-9
2.1 Pressures Facing GCC Refiners	2-1
2.2 Total Middle East Crude Oil Production	2-4
2.3 Population by Country	2-5
2.4 Gender by Percentage of Population	2-6
2.5 Migrant Stock by Percentage of Population	2-7
2.6 Median Age by Country Map.....	2-8
2.7 Median Age by Country.....	2-8
2.8 Birth Rate.....	2-9
2.9 Unemployment in the Middle East	2-10
2.10 Youth Unemployment (Ages 15-24) by Country in 2013	2-11
2.11 GDP per Capita	2-11
2.12 GDP per Capita (Excluding Migrant Stock).....	2-12
2.13 Proved Oil and Natural Gas Reserves	2-13
2.14 Middle East Crude Oil Production	2-14
2.15 OPEC and Non OPEC Crude Oil Production	2-14
2.16 Electricity Generation by Country.....	2-15
2.17 Electricity Consumption per Capita by Country.....	2-16
2.18 Electricity Generation by Fuel in Bahrain	2-17
2.19 Electrical Consumption by Sector in Bahrain	2-18
2.20 Electricity Generation by Fuel in Iran	2-19
2.21 Electrical Consumption by Sector in Iran	2-20
2.22 Electricity Generation by Fuel in Iraq	2-21
2.23 Direct Crude Oil Use Seasonality.....	2-22

2.24 Electrical Consumption by Sector in Iraq	2-23
2.25 Electricity Generation by Fuel in Kuwait.....	2-24
2.26 Direct Crude Oil Use Seasonality.....	2-24
2.27 Electrical Consumption by Sector in Kuwait.....	2-25
2.28 Electricity Generation by Fuel in Oman.....	2-26
2.29 Electrical Consumption by Sector in Oman.....	2-27
2.30 Electricity Generation by Fuel in Qatar	2-28
2.31 Electrical Consumption by Sector in Qatar	2-29
2.32 Electricity Generation by Fuel in Saudi Arabia.....	2-30
2.33 Direct Crude Oil use Seasonality	2-30
2.34 Electrical Consumption by Sector in Saudi Arabia.....	2-31
2.35 Electricity Generation by Fuel in UAE	2-32
2.36 Electrical Consumption by Sector in UAE	2-33
2.37 Middle East Refined Products Demand by Country.....	2-34
2.38 Middle East Refined Products Demand by Product.....	2-35
2.39 Number of Vehicles by Country.....	2-35
2.40 Vehicles per Capita 2013	2-36
2.41 Share of Personal Vehicles versus Commercial Vehicles	2-37
2.42 Refined Products Demand in Bahrain.....	2-40
2.43 Refined Products Demand in Iran	2-41
2.44 Refined Products Demand in Iraq	2-42
2.45 Refined Products Demand in Kuwait	2-43
2.46 Refined Products Demand in Oman	2-44
2.47 Refined Products Demand in Qatar	2-45
2.48 Refined Products Demand in Saudi Arabia.....	2-47
2.49 Refined Products Demand in the UAE	2-48
2.50 Middle East Oil and Downstream Exports.....	2-49
2.51 Middle East Crude Oil Exports	2-50
2.52 Exports of Crude Oil	2-51
2.53 Exports of Refined Products by Country	2-52
2.54 Bahrain Refined Products Exports	2-53
2.55 Iran Refined Products Exports	2-54
2.56 Iran Refined Products Imports.....	2-54
2.57 Iraq Refined Products Exports	2-55
2.58 Iraq Refined Products Imports.....	2-56
2.59 Kuwait Refined Products Exports.....	2-56
2.60 Oman Refined Products Exports.....	2-57

2.61	Oman Refined Products Imports	2-58
2.62	Qatar Refined Products Exports.....	2-58
2.63	Qatar Refined Products Imports.....	2-59
2.64	Saudi Arabia Refined Products Exports	2-60
2.65	Saudi Arabia Refined Products Imports	2-60
2.66	United Arab Emirates Refined Products Exports	2-61
2.67	Petrochemical and Polymers Exports by Product.....	2-62
2.68	Exports of Petrochemicals and Polymers	2-63
2.69	The Role of the Modern Middle East Refinery	2-64
3.1	Middle East Refining Capacity Growth.....	3-1
3.2	Middle East Refining Capacity by Country	3-2
3.3	Middle East Residue Conversion Capacity	3-2
3.4	Current GCC Refineries	3-3
3.5	Location of the Bahrain Sitra Refinery	3-4
3.6	Bahrain Refining Capacity	3-4
3.7	Oman Refinery Locations.....	3-6
3.8	Oman Refining Capacity	3-6
3.9	UAE Refining Locations	3-9
3.10	Refining Capacity - UAE.....	3-10
3.11	Saudi Arabia Refining Locations	3-13
3.12	Refining Capacity – Saudi Arabia	3-14
3.13	Kuwait Refinery Locations	3-19
3.14	Refining Capacity – Kuwait	3-19
3.15	Qatar Refinery Locations.....	3-22
3.16	Qatar Refining Capacity	3-22
3.17	Future Refinery Capacity Additions	3-24
3.18	Percentage of Refining Capacity.....	3-25
3.19	Percentage of Refining Capacity.....	3-25
3.20	Major EU Refining Capacity Compared with GCC Refinery Capacity	3-26
4.1	Middle East Crude Oil Exports	4-4
4.2	Saudi Arabian Crude Formula Pricing.....	4-5
4.3	GCC Electricity Prices with Other Regions	4-9
4.4	GCC Natural Gas Prices with Other Regions	4-12
4.5	Variable Cost Margin	4-14
4.6	Crude Oil – Refined Products Spread	4-16
4.7	Global Refining Margins	4-18
4.8	U.S. Unconventional Crude Oil Production	4-19

4.9	GCC Refining Margins – Global Benchmarks.....	4-19
4.10	Average CDU Capacity	4-21
4.11	Size and Complexity of Middle East Refineries	4-23
4.12	Middle East Refining Capacity in a Global Context	4-25
4.13	Pressures Facing Kuwaiti Refining Industry.....	4-28
4.14	Size and Complexity of Al-Zour Refinery	4-29
4.15	Size and Complexity of the Ruwais Refinery Expansion	4-30
4.16	Size and Complexity of Sohar Refinery	4-31
4.17	Size and Complexity of Bapco Refinery	4-32
4.18	Size and Complexity of the Duqm Refinery (+)	4-33
4.19	Size and Complexity of the Fujairah Refinery (+)	4-34
4.20	Size and Complexity of Jazan Refinery (+)	4-35
4.21	Cost of Production of Ethylene from Ethane and Naphtha	4-37
4.22	Degree of Petrochemical Integration by Region	4-38
4.23	Refinery Integrated Naphtha Cracker	4-39
5.1	Proven Reserves versus Refining Capacity.....	5-1
5.2	Size and Complexity of Refineries in Iraq	5-2
5.3	Daily Oil Production.....	5-3
5.4	Size and Complexity of Refineries in Iran	5-4
5.5	Global Net Trade in Petroleum Refined Products	5-11
5.6	Middle East Refined Product Net Trade.....	5-12
5.7	Global Diesel Trade Flows	5-12
5.8	Global Gasoline Trade Flows	5-13

Table		Page
2.1	Key Drivers for Refined Product Growth	2-3
2.2	Population by Country	2-6
3.1	Current Middle East Refinery Details	3-3
4.1	Saudi Arabian Crude Oil Pricing.....	4-3
4.2	Arab Light and Heavy Values.....	4-4
4.3	Super and Premium Gasoline Prices in the GCC	4-6
4.4	Pricing Basis for Refined Products.....	4-6
4.5	Cost of Electricity to Industries in the GCC	4-8
4.6	Cost of Natural Gas to Industries in the GCC	4-11
4.7	GCC Refineries Modelled.....	4-13
4.8	GCC Refineries – Grouping	4-14
4.9	Historical Ras Gas Condensate Pricing, 2005 – 2014.....	4-15
4.10	Nelson Complexity Indices	4-23
5.1	Gasoline Specification in the GCC	5-6
5.2	Diesel Specifications Compared to Euro V	5-8
5.3	Global Refined Product Demand.....	5-9
5.4	Global Refined Product Demand by Region	5-10
5.5	Global Refined Product Supply by Region	5-10