

# NexantThinking™

## Petroleum and Petrochemical Economics

### Petroleum Profitability Forecast

United States  
November 2016



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. 2016. All rights reserved.

# Contents

---

Section	Page
1 Executive Summary .....	1-1
1.1 INTRODUCTION.....	1-1
1.2 SCENARIOS .....	1-4
1.3 REFINING MARGINS .....	1-5
1.4 PRICE PROJECTIONS.....	1-8
1.5 KEY PETROLEUM PRODUCT ISSUES.....	1-9
1.5.1 Gasoline .....	1-9
1.5.2 Naphtha.....	1-11
1.5.3 Diesel .....	1-12
1.5.4 Fuel Oils .....	1-13
2 Forecasting Methodology .....	2-1
2.1 INTRODUCTION.....	2-1
2.2 ASSUMPTIONS .....	2-2
2.2.1 Scenarios .....	2-2
2.2.2 Price Basis .....	2-5
2.3 PRICE SETTING MECHANISMS .....	2-6
2.3.1 Refining Configurations.....	2-7
2.3.2 Refining Industry Margin Drivers.....	2-14
2.3.3 Pricing Relationships.....	2-15
3 Crude Oil .....	3-1
3.1 CRUDE OIL SCENARIOS .....	3-1
3.2 REGIONAL CRUDE OILS.....	3-5
4 Oil Refinery Margins.....	4-1
4.1 HISTORICAL UNITED STATES REFINERY PROFITABILITY .....	4-1
4.2 GLOBAL OIL REFINING MARGINS .....	4-6
4.2.1 Global Trends.....	4-6
4.2.2 Western Europe .....	4-9
4.2.3 Asia Pacific.....	4-10
4.3 UNITED STATES OIL REFINERY MARGIN PROJECTIONS .....	4-12
5 Price Projections .....	5-1
5.1 REFINED PRODUCT PRICES .....	5-1
5.1.1 Gasoline .....	5-3

5.1.2	Naphtha .....	5-8
5.1.3	Diesel/No. 2 Heating Oil .....	5-10
5.1.4	Jet Fuel/Kerosene .....	5-13
5.1.5	Residual Fuel Oils .....	5-15
5.2	NATURAL GAS .....	5-18
5.2.1	Price-Setting Mechanisms .....	5-18
5.2.2	Historical Pricing Trends .....	5-19
5.2.3	Price Outlook.....	5-20
5.3	NATURAL GAS LIQUIDS (NGLS) AND LIQUEFIED PETROLEUM GAS (LPG) ....	5-23
5.3.1	Price-setting Mechanisms .....	5-23
5.3.2	Ethane .....	5-24
5.3.3	Propane.....	5-27
5.3.4	Butane .....	5-30
<b>Appendix</b>		<b>Page</b>
A	Petroleum & Petrochemical Feedstock Prices .....	A-1

<b>Figure</b>	<b>Page</b>
1.1 Crude Oil Price Scenarios .....	1-4
1.2 Refining Margin Forecasts – Medium Oil Scenario.....	1-6
1.3 United States Gulf Coast Refined Product Price Projections – Medium Oil Scenario.....	1-8
1.4 U.S. Gulf Coast & NWE Premium Gasoline Prices – Medium Oil Scenario.....	1-9
1.5 U.S. Gulf Coast Gasoline and Light Naphtha Prices – Medium Oil Scenario.....	1-11
1.6 U.S. Gulf Coast Gasoline & Diesel Prices – Medium Oil Scenario.....	1-12
1.7 U.S. Gulf Coast No. 2 Heating Oil & High Sulphur Fuel Oil Prices – Medium Oil Scenario .....	1-13
2.1 Simplified Flow Diagram of a Typical Hydroskimming Refinery.....	2-8
2.2 Simplified Flow Diagram of a Typical Complex Refinery .....	2-10
2.3 Simplified Flow Diagram of a Typical Deep Conversion Refinery .....	2-13
2.4 Typical Refinery Yields.....	2-14
2.5 USGC Refined Product Prices and LLS Crude Oil Price .....	2-15
3.1 Crude Oil Price Scenarios.....	3-3
4.1 U.S. Gulf Coast Refining Margins .....	4-1
4.2 United States Upgrading Cash Cost Margin .....	4-4
4.3 Global Refining Margin Comparison – Medium Oil Scenario.....	4-6
4.4 Annual Changes in Global Refining Capacity and Oil Demand.....	4-7
4.5 U.S. Refining Margin Forecasts – Medium Oil Scenario.....	4-12
4.6 U.S. Refinery Fuel Cost Advantage <sup>1</sup> .....	4-13
5.1 United States Refined Product Price Projections – Medium Oil Scenario .....	5-1
5.2 Regular Unleaded Gasoline Price Scenarios.....	5-4
5.3 Premium Unleaded Gasoline Price Scenarios .....	5-4
5.4 U.S. Gulf Coast & NWE Premium Gasoline Prices – Medium Oil Scenario.....	5-5
5.5 Gasoline Sulphur Specifications .....	5-7
5.6 Light Virgin Naphtha Price Scenarios .....	5-8
5.7 U.S. Gulf Coast Gasoline & Light Naphtha Prices – Medium Oil Scenario .....	5-9
5.8 Diesel Price Scenarios .....	5-10
5.9 No. 2 Heating Oil Price Scenario .....	5-11
5.10 No. 2 Heating Oil & Diesel Prices – Medium Oil Scenario.....	5-11
5.11 Gasoline and Diesel Prices – Medium Oil Scenario .....	5-12
5.12 Jet Fuel/Kerosene Price Scenarios.....	5-13
5.13 Jet Fuel/Kerosene – No. 2 Heating Oil Price Difference – Medium Oil Scenario .....	5-14
5.14 High Sulphur Fuel Oil Price Scenarios.....	5-15
5.15 Heating Oil & High Sulphur Fuel Oil Prices – Medium Oil Scenario .....	5-15

5.16	Low Sulphur Fuel Oil Price Scenarios.....	5-16
5.17	LSFO & HSFO Prices – Medium Oil Scenario.....	5-17
5.18	U.S. East Coast Natural Gas <sup>1</sup> versus Fuel Oil Prices .....	5-19
5.19	Henry Hub Natural Gas Prices.....	5-21
5.20	U.S. East Coast Natural Gas <sup>1</sup> versus Fuel Oil Prices .....	5-22
5.21	Ethane Price Scenarios.....	5-24
5.22	Ethane Price Relative to Natural Gas Value .....	5-25
5.23	Ethane Price Trends – Medium Oil Scenario.....	5-26
5.24	Relative Value of Ethane – Medium Oil Scenario .....	5-26
5.25	Propane Price Scenarios .....	5-27
5.26	Propane Price Trends – Medium Oil Scenario.....	5-27
5.27	Relative Value of Propane – Medium Oil Scenario.....	5-28
5.28	<i>n</i> -Butane Price Scenarios .....	5-30
5.29	Butane Price Trends – Medium Oil Scenario.....	5-30
5.30	Relative Value of Butane – Medium Oil Scenario.....	5-31

	<b>Table</b>	<b>Page</b>
3.1	Crude Oil Price Scenarios.....	3-4
5.1	United States Refined Product Price Projections – Medium Oil Scenario.....	5-2