

SPECIAL REPORT

High Pressure Polyethylene: Re-Emergence as a Specialty?

June 2012



44 South Broadway, White Plains, New York 10601, USA
Tel: +1 914 609 0300 Fax: +1 914 609 0399

Copyright© by Nexant, Inc. 2012

This report was prepared by Nexant, Inc ("NEXANT") and is part of the ChemSystems Topical Report Program. 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.

Contents

Section	Page
1 Executive Summary	1-1
1.1 INTRODUCTION	1-1
1.2 MACROECONOMIC ASSUMPTIONS	1-2
1.3 MARKET OVERVIEW	1-3
1.3.1 LDPE.....	1-3
1.3.2 EVA	1-6
1.3.3 LLDPE	1-9
1.4 PROCESS TECHNOLOGY	1-13
1.5 LEADER ECONOMICS	1-19
1.6 HISTORICAL MARGINS	1-20
2 Introduction.....	2-1
3 Macroeconomic Assumptions	3-1
3.1 BACKGROUND	3-1
3.2 MACROECONOMIC ASSUMPTIONS.....	3-1
3.3 CRUDE OIL SCENARIO	3-4
4 Market Overview	4-1
4.1 LDPE.....	4-1
4.1.1 End-Uses and Trends in Applications.....	4-1
4.2 EVA	4-3
4.2.1 End-Uses and Trends in Applications.....	4-5
4.3 LLDPE	4-11
4.3.1 End-Uses and Trends in Applications.....	4-12
4.4 REGIONAL DEMAND SUMMARY AND OUTLOOK.....	4-17
4.4.1 LDPE.....	4-17
4.4.2 EVA	4-36
4.4.3 LLDPE	4-55
5 Process Technology	5-1
5.1 INTRODUCTION	5-1
5.2 LDPE (INCLUDING EVA)	5-4

5.2.1	Introduction.....	5-4
5.2.2	Tubular Processes	5-9
5.2.3	Autoclave Processes.....	5-22
5.3	LLDPE	5-32
5.3.1	Introduction.....	5-32
5.3.2	Gas Phase Processes	5-35
5.3.3	Solution Processes	5-57
6	Leader Economics	6-1
6.1	METHODOLOGY	6-1
6.1.1	Cost of Production Definition and Basis	6-1
6.1.2	Investment Costs.....	6-5
6.1.3	Profitability Analysis and Basis.....	6-8
6.2	LEADER ECONOMICS	6-10
7	Historical Margins	7-1
Appendix		Page
A	List of Abbreviations Used in this Report	A-1
B	Global Demand Data	B-1
C	Global Capacity Listing for LDPE and LLDPE	C-1
D	Global Supply/Demand Data	D-1
E	Margin Tables	E-1

Figure	Page
1.1 Extrusion Coating	1-1
1.2 LDPE Global Demand by End-Use, 2011	1-3
1.3 Global LDPE Demand by Region.....	1-5
1.4 Global LDPE Consumption by Region.....	1-5
1.5 Global LDPE Supply, Demand, and Trade.....	1-6
1.6 Global EVA Demand by End-Uses, 2011	1-7
1.7 Global EVA Consumption by Region	1-8
1.8 Global EVA Supply/Demand Analysis	1-9
1.9 LLDPE Global Demand by End-Use, 2011.....	1-10
1.10 LLDPE Demand by Region, 2011	1-11
1.11 Global LLDPE Consumption by Region	1-11
1.12 Global LLDPE Supply, Demand, and Trade	1-12
1.13 Performance Balancing for Low Density Polyethylene.....	1-14
1.14 LLDPE Penetration into the Total LDPE/LLDPE Market, by Region.....	1-15
1.15 Installed LDPE Capacity by Process, 2011	1-15
1.16 Installed LLDPE Capacity by Technology, 2011	1-17
1.17 Installed LLDPE Capacity by Process, 2011	1-18
1.18 Cash Cost Margins	1-21
1.19 Return on Investment	1-22
2.1 Extrusion Coating	2-1
2.2 Foamed Plastic Shoes	2-2
2.3 Photovoltaic Cells	2-2
3.1 World Economic Performance Outlook.....	3-2
3.2 GDP Deflator	3-3
3.3 Crude Oil Price Scenarios.....	3-4
4.1 LDPE Global Demand by End-Use, 2011	4-1
4.2 Global EVA Demand by End-Uses, 2011	4-3
4.3 Use of EVAs in Flexible Packaging	4-5
4.4 LLDPE Global Demand by End-Use, 2011.....	4-11
4.5 North America LDPE Demand by End-Use, 2011	4-18

4.6	North America LDPE Demand.....	4-18
4.7	North America LDPE Supply, Demand, and Trade	4-19
4.8	South America LDPE Demand by End-Use, 2011	4-20
4.9	South America LDPE Demand.....	4-20
4.10	South America LDPE Supply, Demand, and Trade	4-21
4.11	Western Europe LDPE Demand by End-Use, 2011	4-22
4.12	Western Europe LDPE Demand	4-22
4.13	Western Europe LDPE Supply, Demand, and Trade.....	4-23
4.14	Central and Eastern Europe LDPE Demand by End-Use, 2011	4-24
4.15	Central and Eastern Europe LDPE Demand.....	4-24
4.16	Central and Eastern Europe LDPE Supply, Demand, and Trade	4-25
4.17	Middle East LDPE Demand by End-Use, 2011.....	4-26
4.18	Middle East LDPE Demand.....	4-26
4.19	Middle East LDPE Supply, Demand, and Trade	4-27
4.20	Africa LDPE Demand by End-Use, 2011.....	4-28
4.21	Africa LDPE Demand.....	4-28
4.22	Africa LDPE Supply, Demand, and Trade	4-29
4.23	China LDPE Demand by End-Use, 2011	4-30
4.24	China LDPE Demand	4-30
4.25	China LDPE Supply, Demand, and Trade	4-31
4.26	Asia Pacific (excluding China) LDPE Demand by End-Use, 2011.....	4-32
4.27	Asia Pacific (excluding China) LDPE Demand.....	4-32
4.28	Asia Pacific (excluding China) LDPE Supply, Demand, and Trade	4-33
4.29	Global LDPE Demand by End-Uses, 2011.....	4-34
4.30	Global LDPE Demand by Region, 2011.....	4-34
4.31	Global LDPE Consumption by Region.....	4-35
4.32	Global LDPE Supply, Demand and Trade.....	4-36
4.33	North America EVA Demand by End-Use, 2011.....	4-37
4.34	North America EVA Demand.....	4-37
4.35	North America EVA Supply, Demand, and Trade	4-39
4.36	Western Europe EVA Demand by End-Use, 2010.....	4-40

4.37 Western Europe EVA Demand.....	4-40
4.38 Western Europe EVA Supply, Demand, and Trade	4-42
4.39 China EVA Demand by End-Use, 2011	4-43
4.40 China EVA Demand	4-43
4.41 China EVA Supply, Demand and Trade.....	4-45
4.42 Asia Pacific (excl. China) EVA Demand, 2011	4-46
4.43 Asia Pacific (excl. China) EVA Demand	4-46
4.44 Asia Pacific (excl. China) EVA Supply, Demand, and Trade	4-49
4.45 Rest of World EVA Demand	4-50
4.46 Rest of World EVA Demand	4-50
4.47 Rest of World Supply, Demand, and Trade.....	4-52
4.48 Global EVA Demand by End-Uses, 2011	4-53
4.49 EVA Demand by Region, 2011	4-53
4.50 Global EVA Consumption by Region	4-54
4.51 Global EVA Supply/Demand Analysis	4-55
4.52 North America LLDPE Demand by End-Use, 2011	4-56
4.53 North America LLDPE Demand	4-56
4.54 North America LLDPE Supply, Demand, and Trade	4-57
4.55 South America LLDPE Demand by End-Use, 2011	4-58
4.56 South America LLDPE Demand	4-58
4.57 South America LLDPE Supply, Demand, and Trade	4-59
4.58 Western Europe LLDPE Demand by End-Use, 2011.....	4-60
4.59 Western Europe LLDPE Demand.....	4-60
4.60 Western Europe LLDPE Supply, Demand, and Trade	4-61
4.61 Central and Eastern Europe LLDPE Demand by End-Use, 2011	4-62
4.62 Central and Eastern Europe LLDPE Demand	4-62
4.63 Central and Eastern Europe LLDPE Supply, Demand, and Trade	4-64
4.64 Middle East LLDPE Demand by End-Use, 2011	4-64
4.65 Middle East LLDPE Demand	4-65
4.66 Middle East LLDPE Supply, Demand, and Trade.....	4-66
4.67 Africa LLDPE Demand by End-Use, 2011	4-66

4.68 Africa LLDPE Demand	4-67
4.69 Africa LLDPE Supply, Demand, and Trade	4-68
4.70 China LLDPE Demand by End-Use, 2011	4-69
4.71 China LLDPE Demand	4-69
4.72 China LLDPE Supply, Demand, and Trade	4-70
4.73 Asia Pacific (excluding China) LLDPE Demand by End-Use, 2011	4-71
4.74 Asia Pacific (excluding China) LLDPE Demand	4-71
4.75 Asia Pacific (excluding China) LLDPE Supply, Demand, and Trade	4-72
4.76 Global LLDPE Demand by End-Uses, 2011	4-73
4.77 LLDPE Demand by Region, 2011	4-73
4.78 Global LLDPE Consumption by Region	4-74
4.79 Global LLDPE Supply, Demand, and Trade	4-74
5.1 Performance Balancing for Low Density Polyethylene	5-2
5.2 LLDPE Penetration into the Total LDPE/LLDPE Market, by Region	5-3
5.3 LDPE Technology Competition	5-4
5.4 Installed LDPE Capacity by Process, 2011	5-5
5.5 Installed LDPE Capacity by Technology, 2011	5-5
5.6 Installed LDPE Capacity by Process	5-7
5.7 LDPE Tubular Process	5-10
5.8 LDPE Autoclave Process	5-23
5.9 LLDPE and Swing Technology Competition	5-34
5.10 Installed LLDPE Capacity by Technology, 2011	5-34
5.11 Installed LLDPE Capacity by Process, 2011	5-35
5.12 INNOVENE G Fluidized Bed Polyethylene Process, Reactor System	5-41
5.13 SPHERILENE S Fluidized Bed Polyethylene Process, Reactor System	5-46
5.14 UNIPOL Fluidized Bed Polyethylene Process, Reactor System	5-55
5.15 SCLAIRTECH Solution Polyethylene Technology, Reactor System	5-63
6.1 Production Cost Elements	6-1
7.1 Cash Cost Margins	7-2
7.2 Return on Investment	7-3

Table	Page
1.1 Economic Growth Projection.....	1-2
1.2 LDPE Autoclave versus Tubular Reactors	1-16
3.1 Economic Growth Projection.....	3-2
4.1 North American EVA Production Capable Capacity, 2010 - 2012	4-38
4.2 Western Europe EVA Production Capable Capacity, 2010 - 2012	4-41
4.3 China EVA Production Capable Capacity, 2010 - 2012.....	4-44
4.4 Asia Pacific (excl. China) EVA Production Capable Capacity, 2010 - 2012.....	4-48
4.5 Rest of World EVA Production Capable Capacity, 2010 - 2012	4-52
5.1 LDPE Autoclave versus Tubular Reactors	5-8
5.2 ExxonMobil Tubular LDPE Plants.....	5-12
5.3 LUPOTECH T LDPE Plants.....	5-15
5.4 SABTEC CTR Tubular LDPE Plants	5-18
5.5 Versalis/Polimeri Europa/Enichem Autoclave LDPE Plants	5-21
5.6 ExxonMobil Autoclave LDPE Plants	5-25
5.7 LUPOTECH A LDPE Plants	5-27
5.8 Versalis/Polimeri Europa/Enichem Autoclave LDPE Plants	5-30
5.9 INNOVENE G Polyethylene Plants	5-37
5.10 SPHERILENE Polyethylene Plants	5-44
5.11 UNIPOL PE Polyethylene Plants.....	5-51
5.12 SCLAIRTECH and Advanced SCLAIRTECH Polyethylene Plants.....	5-59
6.1 Cost of Production Estimate for LLDPE Process: Gas Phase, Butene-1.....	6-11
6.2 Cost of Production Estimate for LDPE Process: Tubular.....	6-12
6.3 Cost of Production Estimate for EVA (18%) Process: Tubular	6-13
6.4 Cost of Production Estimate for EVA (18%) Process: Autoclave.....	6-14
6.5 Cost of Production Estimate for EVA (28%) Process: Autoclave.....	6-15