

INTRODUCTION	XXXIX
STUDY GOAL AND OBJECTIVES	XXXIX
REASONS FOR DOING THE STUDY	XXXIX
CONTRIBUTION OF THE STUDY AND FOR WHOM	XL
SCOPE AND FORMAT	XLI
METHODOLOGY	XLII
INFORMATION SOURCES	XLII
RELATED BCC REPORTS	XLIII
BCC ONLINE SERVICES	XLIII
DISCLAIMER	XLIII
 SUMMARY.....	 XLIV
KEY FINDINGS FROM THE STUDY (SEE SUMMARY TABLE):.....	XLIV
<i>SUMMARY TABLE WORLD LNG INFRASTRUCTURE DEMAND BY CATEGORY,</i>	
<i>THROUGH 2010 (TCF/YEAR)</i>	<i>XLV</i>
<i>SUMMARY FIGURE WORLD LNG INFRASTRUCTURE DEMAND BY CATEGORY,</i>	
<i>2002-2010 (TCF/YEAR).....</i>	<i>XLVI</i>
 INDUSTRY OVERVIEW.....	 1
INTRODUCTION	1
IMPORTANCE OF THE LNG INFRASTRUCTURE INDUSTRY.....	1
<i>TABLE 1 AN OVERVIEW OF THE LNG VALUE CHAIN</i>	<i>1</i>
THE LNG SUPPLY CHAIN	2
Liquefaction	2
<i>FIGURE 1 THE LNG LIQUEFACTION INFRASTRUCTURE BLOCK FLOW DIAGRAM.....</i>	<i>2</i>
LNG Tankers	2
LNG Receiving Terminal.....	3
<i>FIGURE 2 LNG RECEIVING/REGASIFICATION PORT INFRASTRUCTURE</i>	
<i>CONFIGURATION.....</i>	<i>3</i>
Marketing And Distribution	3
<i>FIGURE 3 LNG MARKETING AND DISTRIBUTION INFRASTRUCTURE</i>	<i>4</i>
OVERVIEW OF CAPITAL COSTS OF LNG INFRASTRUCTURE.....	4
<i>TABLE 2 OVERVIEW OF LNG INFRASTRUCTURE CAPITAL COST BREAKDOWN (\$</i>	
<i>MILLION).....</i>	<i>5</i>
INDUSTRIALIZED REGIONS.....	5
DEVELOPING REGIONS	5
INTERNATIONAL TRADE.....	6
<i>TABLE 3 WORLDWIDE LNG AND TOTAL NATURAL GAS TRADE, THROUGH 2010</i>	
<i>(TCF/YEAR).....</i>	<i>6</i>
IMPORTANT ECONOMIC INDICATIONS FOR WORLD TRADE	
AND THE LNG INDUSTRY	6
RISKS	6
<i>TABLE 4 OVERVIEW OF WORLD KEY ECONOMIC INDICATORS; TRADE AND GDP,</i>	
<i>2002-2010 (GROWTH, %).....</i>	<i>7</i>
GLOBAL ECONOMY OVERVIEW	7
<i>TABLE 5 OVERVIEW OF WORLDWIDE GDP AND GDP GROWTH, 2002-2005</i>	<i>7</i>
LNG TRADE GROWTH.....	7

<i>TABLE 6 SHARE OF INTERNATIONAL LNG TRADE BY TYPE OF CONTRACT, 2002-2010 (%)</i>	8
OVERVIEW OF LNG IMPORTS.....	8
<i>TABLE 7 OVERVIEW OF LNG IMPORTERS BY COUNTRY, THROUGH 2010 (TCF/YEAR)</i>	9
OVERVIEW OF LNG EXPORTERS	10
<i>TABLE 8 OVERVIEW OF LNG EXPORTERS BY COUNTRY, THROUGH 2010 (TCF/YEAR)</i>	10
<i>TABLE 8 (CONTINUED)</i>	11
WHERE LNG INFRASTRUCTURE FITS IN THE GLOBAL ECONOMY	11
PETROLEUM.....	12
LNG TRADE.....	12
NATURAL GAS.....	12
NUCLEAR	12
COAL	13
RENEWABLES	13
<i>TABLE 9 OVERVIEW OF GLOBAL ENERGY CONSUMPTION BY FEEDSTOCK, THROUGH 2010 (QUADRILLION BTU/YEAR)</i>	14
INTERNATIONAL CURRENCY EXCHANGE RATES	14
<i>TABLE 10 RECENT EXCHANGE RATES</i>	14
<i>TABLE 11 OVERVIEW OF INTERNATIONAL CURRENCY EXCHANGE RATES, 2000-2004</i>	15
OVERVIEW OF THE METAL MARKET	15
STEEL	15
NICKEL.....	15
ALUMINUM.....	16
<i>TABLE 12 OVERVIEW OF METAL PRICES (INDEX; JANURY 1998=1.0)</i>	16
HISTORY OF THE LIQUEFIED NATURAL GAS INDUSTRY	16
HISTORY OF THE LIQUEFIED...(CONTINUED)	17
LIQUEFIED NATURAL GAS (LNG) TECHNOLOGY EVOLUTION.....	18
First Generation – 1960s.....	18
Second Generation – 1970s	18
Third Generation – 1980s	18
Fourth Generation – 1990s	19
Next Generation – 2000s.....	19
<i>TABLE 13 OVERVIEW OF LNG PLANT EVOLUTION</i>	19
CHANGING PATTERN OF LNG EXPORTS AND EVOLUTION OF REGIONAL LNG MARKETS	20
<i>TABLE 14 OVERVIEW OF GLOBAL NATURAL GAS RESERVES (GLOBAL RESERVES = 6,008 TCF)</i>	20
<i>TABLE 15 OVERVIEW OF CHANGING PATTERN OF LNG EXPORTS</i>	21
DESCRIPTION OF THE LNG INFRASTRUCTURE INDUSTRY	21
OVERVIEW OF OPERATING COST COMPONENTS OF THE LNG INFRASTRUCTURE CHAIN INDUSTRY.....	22
EXPLORATION AND PRODUCTION.....	22

LIQUEFATION AND STORAGE.....	23
MARINE TRANSPORTATION (SHIPPING)	23
RECEIVING AND REGASIFICATION TERMINAL.....	23
MARKETING AND DISTRIBUTION	23
<i>TABLE 16 OVERVIEW OF THE OPERATING COST COMPONENTS OF THE LNG</i> <i>INFRASTRUCTURE VALUE CHAIN INDUSTRY (\$/MMBTU).....</i>	<i>24</i>
OVERVIEW OF GLOBAL LNG INFRASTRUCTURE CAPITAL SPENDING BY SEGMENT.....	24
<i>TABLE 17 OVERVIEW OF GLOBAL LNG INFRASTRUCTURE CAPITAL SPENDING BY</i> <i>SEGMENT, THROUGH 2010 (\$ BILLIONS/YEAR).....</i>	<i>25</i>
EXPLORATION AND PRODUCTION.....	26
<i>TABLE 18 COST BREAKDOWN OF EXPLORATION AND DEVELOPMENT CHAIN</i>	<i>26</i>
LIQUEFACTION PLANTS.....	26
<i>TABLE 19 COST BREAKDOWN OF A MODERN BASE-LOAD LNG PLANT.....</i>	<i>26</i>
LNG TANKERS.....	27
<i>TABLE 20 COST BREAKDOWN OF A MODERN LNG VESSEL (%).....</i>	<i>27</i>
LNG IMPORT AND REGASIFICATION TERMINALS	27
<i>TABLE 21 COST BREAKDOWN OF A MODERN BASE-LOAD LNG REGAS PLANT.....</i>	<i>28</i>
MARKETING AND DISTRIBUTION	28
<i>TABLE 22 COST COMPONENTS OF PIPELINE DISTRIBUTION CONSTRUCTION</i>	<i>28</i>
THE FUTURE OF LNG INFRASTRUCTURE	29
 GOVERNMENT REGULATIONS AND LEGISLATION.....	 30
INTRODUCTION	30
INDUSTRY CONCERNS – SAFETY AND SECURITY	31
ARE THERE RISKS ASSOCIATED WITH LNG?	32
APPROVAL AND SITING AUTHORITY	32
APPROVAL AND SITING AUTHORITY (CONTINUED).....	33
ECONOMIC IMPACTS	34
LEGISLATIVE PROPOSALS.....	34
U.S. LNG REGULATORY AGENCIES	35
U.S. FEDERAL ENERGY REGULATORY COMMISSION (FERC):.....	35
U.S. DEPARTMENT OF TRANSPORTATION (DOT):.....	36
U.S. DEPARTMENT OF ENERGY (DOE)	36
U.S. COAST GUARD (USCG)	36
U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)	36
OTHER FEDERAL AGENCIES.....	36
KEY REGULATIONS AFFECTING LNG INFRASTRUCTURE.....	36
THE LIQUEFIED NATURAL GAS IMPORT TERMINAL DEVELOPMENT ACT OF 2004	37
THE MARITIME TRANSPORT SECURITY ACT OF 2004	37
THE PIPELINE SAFETY IMPROVEMENT ACT OF 2002	37
ENERGY POLICY ACT OF 2003 (H.R.1644)	37
ENERGY RESEARCH, DEVELOPMENT, DEMONSTRATION AND	37

COMMERCIAL APPLICATION ACT OF 2003.....	37
CLEAR ACT OF 2003	38
SECURING TRANSPORTATION ENERGY EFFICIENCY FOR TOMORROW ACT OF 2003	38
THE HOMELAND INFRASTRUCTURE POWER AND ASSURANCE INCENTIVES ACT OF 2003.....	39
ENERGY INDEPENDENCE AND SECURITY ACT OF 2003.....	39
ENERGY POLICY ACT OF 2003	39
ALTERNATIVE MOTOR FUELS ACT OF 1988 (AMFA)	40
EMISSION CONTROL REGULATIONS	40
 INDUSTRY STRUCTURE AND COMPETITIVE RATES.....	 41
INTRODUCTION	41
GLOBAL LNG INDUSTRY STRUCTURE AND MARKET	41
GLOBAL LNG SUPPLY CAPACITY	41
<i>TABLE 23 GLOBAL LNG LIQUEFACTION PLANTS COMMISSIONED, 2004</i>	<i>42</i>
MARKETS FOR NEW LNG CAPACITY	42
<i>TABLE 24 MARKETS FOR NEW LNG CAPACITY BY REGION, 2004-2008 (MILLIONS TONS/YEAR)</i>	<i>43</i>
ENOUGH LNG FOR THE U.S. MARKET.....	43
<i>TABLE 25 GLOBAL LNG LIQUEFACTION CAPACITY UNDER CONSTRUCTION AND MARKETS, (AS OF OCTOBER 2004)</i>	<i>43</i>
<i>TABLE 25 (CONTINUED)</i>	<i>44</i>
LNG LIQUEFACTION CAPACITY CONCENTRATION BY REGION/COUNTRY.....	44
<i>TABLE 26 CHARACTERISTICS OF GLOBAL LNG LIQUEFACTION CAPACITY BY REGION, 2003-2010 (BILLION CUBIC FEET/YEAR)</i>	<i>45</i>
LNG INDUSTRY MARKET CONCENTRATION BY POLITICS	45
<i>TABLE 27 POLITICAL CONCENTRATION OF GLOBAL NATURAL GAS RESERVES, CURRENT LNG PRODUCTION CAPACITY AND PROJECTED CAPACITY, 2003- 2010.....</i>	<i>46</i>
LNG MARKET CONCENTRATION BY LIQUEFACTION PROCESS.....	46
<i>TABLE 28 GLOBAL LNG LIQUEFACTION CAPACITY BY PROCESS TECHNOLOGY, 2003-2010 (BILLION CUBIC FEET/YEAR).....</i>	<i>46</i>
LNG PRODUCTION TECHNOLOGY CONCENTRATION (IN 5 TO 8 MILLION TONS PER YEAR CAPACITIES) BY LICENSOR.....	47
AIR PRODUCTS AND CHEMICALS, INC. (APCI)	47
SHELL	47
CONOCOPHILLIPS.....	48
STATOIL AND LINDE	48
AXENS.....	48
<i>TABLE 29 DEMAND FOR LNG PRODUCTION CAPACITY BY PROCESS TECHNOLOGY, THROUGH 2010 (TCF/YEAR)</i>	<i>48</i>
LNG PROJECT COMPARATIVE COSTS	49
<i>TABLE 30 LNG COMPARATIVE COSTS BY COUNTRY/PROJECT AND CAPACITY.....</i>	<i>49</i>

LNG TRADE GLOBALIZATION AND CHANGING PATTERN OF LNG IMPORTS.....	49
TABLE 31 REGIONAL SHARE OF GLOBAL LNG TRADE IMPORT MARKET, 2002- 2010.....	50
GLOBAL TANKER CAPACITY INFRASTRUCTURE	50
TABLE 32 LARGE (MEDIUM-SCALE) LNG TANKERS WITH CHARTERAGE CONTRACTS EXPIRING BY 2010, 2003-2010.....	51
Charter Fee.....	51
TABLE 33 SAMPLE CHARTERAGE FEES FOR OLDER LNG TANKERS.....	52
LNG Vessel Ordering, Total Capacity and Ship Cost.....	52
TABLE 34 NUMBER OF LNG SHIPS, ON ORDER, TOTAL CAPACITY AND SHIP COST, THROUGH 2010	53
LNG CONTRACTS	53
SPOT/SHORT-TERM CONTRACT	53
LONG-TERM FIXED CONTRACT	54
TABLE 35 LNG MARKET SEGMENTATION BY CONTRACT TYPE, THROUGH 2010 (MILLION METRIC TONS/YEAR).....	55
LNG INDUSTRY STRUCTURE EVOLUTION.....	55
FIGURE 4 FULLY INTEGRATED (TRADITIONAL) MODEL: SELLERS, BUYERS	56
FIGURE 5 BUYERS, SELLERS IN LNG SUPPLY CHAIN	57
CONTROL OVER SHIPPING	58
Sellers' Issues.....	58
Buyers' Issues	58
Producers' Issues	58
FIGURE 6 CHALLENGES FACING THE LNG INFRASTRUCTURE PLAYERS.....	59
TABLE 36 LNG NEWBUILDING DELIVERY SCHEDULE, 2002-2006	60
THE LNG BUSINESS MARKET MODEL.....	60
THE REQUIREMENT FOR LONG-TERM LNG CONTRACTS	60
LNG Project Costs	61
TRADITIONAL CONTRACTUAL FEATURES.....	61
LIQUEFIED NATURAL GAS INDUSTRY INFRASTRUCTURE SEGMENTATION	62
RISKS	62
HISTORICAL SEGMENTATION BY BASINS	63
Atlantic Basin LNG Imports.....	63
Pacific Basin LNG Imports	63
TABLE 37 GLOBAL LNG TRADE BY SEGMENTATION BY BASINS, THROUGH 2010 (TCF/YEAR).....	64
EVOLVING LNG BASIN SEGMENTATION BY GEOGRAPHY.....	64
TABLE 38 GLOBAL LNG TRADE BY REGION, THROUGH 2010 (TCF/YEAR).....	65
LNG PRICE FRAGMENTATION/CONVERGENCE.....	65
UNITED STATES LNG PRICES	66
EUROPE LNG PRICES	66
ASIA LNG PRICES.....	66
TABLE 39 LIQUEFIED NATURAL GAS PRICE FRAGMENTATION/CONVERGENCE, 2000-2005 (\$/MMBTU).....	66
CURRENTLY EVOLVING LNG VALUE CHAIN FRAGMENTATION.....	67

BUYERS	67
NONINTEGRATED (CURRENTLY EVOLVING) LNG INFRASTRUCTURE SUPPLY CHAIN	68
<i>FIGURE 7 NONINTEGRATED (CURRENTLY EVOLVING) LNG INFRASTRUCTURE SUPPLY CHAIN</i>	69
OPEN ACCESS AT REGASIFICATION TERMINALS	70
<i>FIGURE 8 DEREGULATED GAS MARKET: NONOPEN ACCESS REGASIFICATION</i>	70
LNG EXPORTER NETBACKS AT REGASIFICATION TERMINAL WORLDWIDE	71
<i>TABLE 40 COMPARATIVE EVALUATION OF LNG EXPORTER NETBACKS AT REGASIFICATION TERMINALS WORLDWIDE, 2004 (\$/MMBTU)</i>	71
COMPANY EQUITY PARTICIPATION IN THE LNG BUSINESS	71
CHENIERE ENERGY, INC.	72
BG GROUP PLC	72
CHICAGO BRIDGE & IRON CO.	72
CONTANGO OIL & GAS	72
GOLAR LNG LTD	73
CHART INDUSTRIES	73
<i>TABLE 41 COMPANY EQUITY PARTICIPATION IN THE LNG BUSINESS, 2004</i>	73
<i>TABLE 41 (CONTINUED)</i>	74
LNG INFRASTRUCUTURE MARKET LEADERSHIP BY COMPANY/PRODUCT	74
LNG STORAGE TANK INSTRUMENTATION	75
LNG VESSEL SAFETY EQUIPMENT AND TECHNOLOGY	75
STRATIFICATION AND ROLLOVER PREDICTIVE SOFTWARE	76
SAFETY FEATURES IN LNG TRANSPORTATION AND RECEIVING TERMINALS	76
<i>TABLE 42 LNG INFRASTRUCTURE MARKET SHARE OF LEADING COMPANIES BY PRODUCT, 2004 (%)</i>	77
<i>TABLE 42 (CONTINUED)</i>	78
<i>TABLE 42 (CONTINUED)</i>	79
<i>TABLE 42 (CONTINUED)</i>	80
<i>TABLE 42 (CONTINUED)</i>	81
<i>TABLE 42 (CONTINUED)</i>	82
<i>TABLE 42 (CONTINUED)</i>	83
<i>TABLE 42 (CONTINUED)</i>	84
<i>TABLE 42 (CONTINUED)</i>	85
<i>TABLE 42 (CONTINUED)</i>	86
CONCENTRATED LNG INFRASTRUCTURE VALUE CHAIN TECHNOLOGICAL LEADERSHIP	86
NATURAL GAS EXPLORATION AND PRODUCTION	86
NATURAL GAS LIQUEFACTION	87
LNG SHIP CONSTRUCTION	87
LNG CONTAINMENT SYSTEMS	87
RECEIVING AND REGASIFICATION TERMINALS	88
NATURAL GAS MARKETING AND DISTRIBUTION	88

<i>TABLE 43 MARKET SHARE OF LEADING COMPANIES BY LNG INFRASTRUCTURE SEGMENT, 2004 (%)</i>	89
EARNINGS	89
<i>TABLE 44 EARNINGS (BEFORE INTEREST AND TAXES) OF SELECTED LNG PLAYERS, 2001-2004 (\$ MILLION/YEAR)</i>	90
PROFITABILITY	90
<i>TABLE 45 GROSS PROFIT OF MAJOR LNG VALUE CHAIN PLAYERS, 2001-2004 (\$ MILLION/YEAR)</i>	91
MARKET ENTRY AND BARRIERS.....	91
<i>TABLE 46 GREENFIELD AND EXPANSION LNG PROJECT "ENTRY FEE" FOR SELECTED PRODUCING COUNTRIES (\$ MILLION)</i>	92
CAPITAL AND EXPLORATION EXPENDITURES.....	92
TOTALFINAELF	93
CHEVRONTEXACO	93
ROYAL DUTCH/SHELL.....	94
<i>TABLE 47 CAPITAL AND EXPLORATION EXPENDITURES FOR SELECT COMPANIES, 2001-2004 (\$ BILLION/YEAR)</i>	94
PROXIMITY TO CUSTOMER	94
<i>TABLE 48 PROXIMITY TO CUSTOMER IS A KEY TO LNG SPOT SALES</i>	95
MARKETS IN TRANSITION.....	95
DEALS	95
PARADOX	96
LIBERALIZATION/CHALLENGES	96
NEW TECHNOLOGY	96
FULL COMMODITIZATION	96
IMPORTANT SHIFTS IN THE LNG INDUSTRY.....	97
CRUDE OIL SUPPLY THREATS	97
CRUDE OIL PRICE	97
RISK IN PROJECT FINANCING	97
Host Nation Involvement	98
Lenders Scramble for a Role	99
Consolidation Continues	99
COMPARATIVE ECONOMICS FOR LNG FACILITIES	100
<i>TABLE 49 COMPARATIVE REGIONAL LNG ECONOMICS FOR GREEFIELD FACILITIES (\$/1,000 CUBIC FEET)</i>	101
CAPACITY UTILIZATION.....	101
<i>TABLE 50 LNG TRADED CAPACITY AND UTILIZATION RATE, THROUGH 2010 (MMT/TONS, %)</i>	102
REVITALIZING LNG PLANTS	102
<i>TABLE 51 BOOSTING THE CAPACITY OF OLD AND NEW LNG PLANTS BY REJUVENATION</i>	102
LNG TRAIN CAPACITY/SIZE	103
<i>TABLE 52 SPECIFIC CAPITAL COST OF GREENFIELD LNG PLANT DEVELOPMENT</i>	103
Economies of Scale.....	103
<i>TABLE 53 NUMBER OF GREENFIELD LNG PLANT DEVELOPMENT</i>	104
REGULATION	104
<i>FIGURE 9 LNG SUPPLY CHAIN UNDER FERC'S "OPEN-ACCESS" REGIME</i>	105

<i>FIGURE 10 LNG SUPPLY CHAIN UNDER FERC'S NEW "NON-OPEN ACCESS"</i>	
REGIME.....	105
U.S. Maturity of Natural Gas Deregulation.....	106
TECHNOLOGY.....	106
Liquefaction Technology.....	106
LNG Tanker Construction Costs.....	107
Power Generation Technology.....	107
Computer Technology.....	108
Reservoir Evaluation Technology.....	108
COST REDUCTION IN THE LNG INFRASTRUCTURE CHAIN.....	108
MARKETING AND DISTRIBUTION.....	108
LNG.....	109
Exploration and Production.....	109
Ship Construction.....	109
Liquefaction.....	109
Project Economics.....	109
<i>FIGURE 11 THE LIQUEFIED NATURAL GAS CHAIN..... 110</i>	
COMPETITIVE PRESSURE.....	110
PRICES.....	111
LNG MARKET PRESSURES.....	111
LNG Ship Infrastructure.....	112
LNG Receiving Terminals, Storage and Vaporization Infrastructure.....	112
LNG IMPORT MARKET SHARE DOMINATION BY REGION.....	112
ASIA.....	112
Competitive Pressure on Japanese Imports.....	112
<i>TABLE 54 ASIAN LNG IMPORT MARKET SHARE DOMINATION, 2002-2010 (%)..... 113</i>	
ATLANTIC BASIN.....	113
The United Kingdom.....	113
Spain.....	114
United States of America.....	114
Mexico.....	114
<i>TABLE 55 ATLANTIC BASIN LNG IMPORT MARKET SHARE DOMINATION, 2002- 2010 (%)..... 115</i>	
Emerging Importers.....	115
<i>TABLE 56 EMERGING LNG IMPORT MARKET SHARE DOMINATION, 2002-2010 (%)..... 115</i>	
ELECTRIC RESTRUCTURING.....	115
<i>TABLE 57 COSTS OF ELECTRIC-POWER GENERATION BY PLANT TYPE..... 116</i>	
DRIVING FORCES FOR THE LIQUEFIED NATURAL GAS	
INDUSTRY.....	116
ENVIRONMENTAL LEGISLATION.....	116
ECONOMIC CONSIDERATIONS.....	116
A Continuing Growth in World Natural Gas Consumption ...	117
Average Distance Per Voyage.....	117
Availability.....	117
Technology.....	117

Political Factors	118
Oil Industry.....	118
Power Industry	118
STRONG IMPORT DEMAND	118
STRANDED RESOURCE MONETIZATION	118
TRENDS IN LNG INFRASTRUCTURE	119
TRENDS IN NUMBER OF LNG IMPORTING AND EXPORTING COUNTRIES.....	119
<i>TABLE 58 TRENDS IN THE NUMBER OF LNG IMPORTERS/EXPORTERS, 1960- 2010 (NUMBER).....</i>	<i>119</i>
North America	119
Europe	120
Asia.....	120
<i>TABLE 59 TRENDS IN THE NUMBER OF LNG IMPORTERS AND EXPORTERS BY REGION, 1960 THROUGH 2010 (NUMBER).....</i>	<i>120</i>
TRENDS IN LNG VALUE CHAIN COSTS	121
Machinery Costs	121
Design	121
Equipment	122
Engineering.....	122
Materials	122
Construction.....	122
Investment in Engineering Work	123
Modeling.....	123
<i>TABLE 60 TRENDS IN LNG INFRASTRUCTURE VALUE CHAIN COSTS, THROUGH 2030 (\$/TON LNG).....</i>	<i>124</i>
TRENDS IN THE COMMERCIAL LNG MODEL.....	124
<i>TABLE 61 REPRESENTATIVE LNG MERCHANT POSITIONS</i>	<i>125</i>
TRENDS IN LNG PRICING.....	126
Troubling Signals	126
The Current Fundamental Picture.....	126
<i>FIGURE 12 TRENDS IN NATURAL GAS PRICES IN THE U.S.</i>	<i>127</i>
TRENDS IN SHORT-TERM LNG TRADING	128
TRENDS IN “ORTHODOX” CONTRACTS VERSUS “NEW- STYLE” CONTRACTS.....	128
<i>TABLE 62 TREND IN TYPE OF NEWLY SIGNED LNG CONTRACT (%)</i>	<i>129</i>
MLNG Sato to Japan.....	130
<i>TABLE 63 MLNG SATU TO TEPCO (MT/YEAR)</i>	<i>130</i>
<i>TABLE 64 MLNG SATU TO TOKYO GAS (MT/YEAR).....</i>	<i>130</i>
MLNG Tiga to Japan.....	131
<i>TABLE 65 MLNG TIGA TO JAPAN GAS CONSORTIUM (MT/YEAR)</i>	<i>131</i>
Bayu-Undan To Japan	131
NWS and MLNG Tiga to Korea	132
NWS to China Guangdong	132
LNG INFRASTRUCTURE CHALLENGES	132
CHALLENGES FOR LNG BUYERS	132

CHALLENGES FOR LNG SUPPLIERS.....	133
CONTRACTUAL AND TECHNICAL CHALLENGES LIMIT	
SPOT CARGOS TO U.S. TERMINALS	133
U.S. LNG Btu Specification	133
<i>TABLE 66 HEAT CONTENT PLAYS A SIGNIFICANT ROLE IN LIMITING LNG</i>	
<i>SUPPLIES (BTU CONTENT).....</i>	<i>134</i>
COMPANY RESULTS	134
UPSTREAM COMPANIES.....	134
ChevronTexaco	135
ExxonMobil INC.	135
ConocoPhillips	135
DOWNSTREAM COMPANIES.....	136
INDEPENDENT EXPLORATION AND PRODUCTION FIRMS	136
McMoRan Exploration.....	137
Kerr-McGee Corp.....	137
Harvest Natural Resources Inc.....	137
Unocal	137
XTO	137
Burlington Resources Inc.	138
Range Resources Corp.	138
Vintage Petroleum Inc.....	138
<i>TABLE 67 U.S. BASED OIL AND GAS FIRM'S REVENUES, 2001-2004 (\$ MILLIONS)</i>	<i>139</i>
<i>TABLE 67 (CONTINUED)</i>	<i>140</i>
SERVICE SUPPLY COMPANY RESULTS.....	140
Transocean Inc.....	140
Baker Hughes Inc.	141
Smith International.....	141
Schlumberger Ltd.	141
Weatherford International Inc.....	141
Noble Corp.	142
<i>TABLE 68 COMPANY RESULTS FOR THE WORLD'S TOP SERVICE SUPPLY</i>	
<i>COMPANIES, 2001-2004 (REVENUES, \$MILLIONS).....</i>	<i>142</i>
PRIVATE/STATE COMPANIES BASED OUTSIDE THE	
UNITED STATES OF AMERICA.....	142
Royal Dutch/Shell.....	143
British Petroleum	143
Total	143
British Gas	144
Tractebel LNG	144
Statoil.....	144
BHP Billiton Petroleum Ltd.....	145
Woodside Petroleum	145
Gaz-prom.....	145
<i>TABLE 69 COMPANY RESULTS FOR THE WORLD'S TOP PRIVATE/STATE LNG</i>	
<i>COMPANIES OUTSIDE THE UNITED STATES OF AMERICA, 2001-2004</i>	
<i>(REVENUES, \$ BILLIONS)</i>	<i>146</i>

LNG INFRASTRUCTURE INSTRUMENTATION COMPANY	
RESULTS	146
Honeywell Process Solutions, Automation and Control	
Solutions	146
Danaher	147
Siemens Energy & Automation.....	147
Schneider ELECTRIC	147
Rockwell Automation	147
Flowserv.....	147
GE Fanuc Automation Americas, Inc.	148
Metso.....	148
MKS Instruments.....	148
National Instruments.....	148
Aspentech Engineering Solutions.....	149
Tyco	149
Roper Industries	149
MTS Systems Corporation	149
Crane Controls.....	150
Mettler Toledo.....	150
OPTO 22.....	150
FMC Corporation.....	150
Matrikon	150
Badger Meter	151
ICS Triplex.....	151
Pepperl+FUCHS	151

TABLE 70 COMPANY RESULTS FOR INSTRUMENTATION SUPPLIERS, 2001-2004
(WORLDWIDE REVENUES, \$MILLIONS/YEAR)..... 152

TABLE 70 (CONTINUED) 153

DEMAND BY PRODUCT..... 154

 INTRODUCTION

TABLE 71 LNG INFRASTRUCTURE PRODUCT/VALUE CHAIN LINK CHART..... 155

TABLE 71 (CONTINUED) 156

TABLE 71 (CONTINUED) 157

 PRODUCT CATEGORY

TABLE 72 WORLD LNG INFRASTRUCTURE DEMAND BY PRODUCT CATEGORY,
THROUGH 2010 (\$ MILLIONS/YEAR) 158

 LNG INFRASTRUCTURE SYSTEMS AND EQUIPMENT

 PRODUCTS

 COMPRESSION MACHINERY

 ACTUATORS.....

 ADHESIVES.....

 AIR SEPARATION UNITS.....

 ALTERNATIVE FUEL VEHICLES TECHNOLOGIES.....

 BOIL-OFF GAS HANDLING TECHNOLOGIES

 COATINGS

COLD BOXES	161
COMBUSTION SYSTEMS	161
COMPRESSOR AND COMPRESSION SYSTEMS.....	161
COUPLING SYSTEMS	162
CRYOGENIC SYSTEM COMPONENTS.....	162
ELECTRONIC CONTROL UNITS.....	163
EXPANDERS	163
FLANGES AND PIPING	164
FLEXIBLE HOSES/HOSES	164
FSO/FPSO UNITS.....	164
GAS/OIL/WATER SEPARATION UNITS	165
GAS PIPELINES.....	165
GAS PROCESSING SYSTEMS AND COMPONENTS.....	165
GAUGES.....	165
HEAT EXCHANGERS/HEAT TRANSFER TECHNOLOGY	165
HIGH PRESSURE CYLINDERS	166
INSTRUMENTATION.....	166
INSULATION SYSTEMS	166
LEVEL MEASUREMENT	167
LNG TANKER BERTH AND LNG LOADING ARMS	167
METERING/MEASUREMENT SYSTEMS	168
Pressure and Differential Pressure	168
Flow	168
Temperature	169
Analysis.....	169
Pressure Recording.....	169
Tank Gauging Systems	169
PEAK SHAVERS.....	170
PIPE SECTIONS.....	170
PIPE SUPPORTS	170
PRESSURE VESSELS (CRYOGENIC).....	170
PRE-TREATMENT SYSTEMS.....	171
Feedgas Receiving, Liquid Separation, Gas Metering and Pressure Reduction	171
Acid Gas Removal (Carbon Dioxide).....	171
Gas Dehydration and Carbon Adsorption Units	171
PROCESS COMPONENTS	172
Pumps/Cryogenic Pumps.....	172
RECONDENSER/FREGERATION/LIQUEFACTION SYSTEMS ...	172
SAFETY EQUIPMENT.....	173
SENSORS, DETECTORS, MONITORING SYSTEMS	173
SOLVENTS, LUBRICANTS AND OTHER CHEMICALS.....	173
JOINING AND PACKING.....	173
TANKS (FIELD-ERECTED STORAGE).....	174

TUBES/TUBING	174
TURBINES	174
VALVES (CRYOGENIC)/REGULATORS	175
<i>TABLE 73 WORLD LNG SYSTEM AND EQUIPMENT INFRASTRUCTURE DEMAND BY TYPE, THROUGH 2010 (\$MILLIONS/YEAR)</i>	<i>175</i>
<i>TABLE 73 (CONTINUED)</i>	<i>176</i>
SERVICES AND PRODUCTS	176
COMMUNICATIONS EQUIPMENT AND SERVICES	177
DATA ACQUISITION AND MANAGEMENT	177
INFORMATION TECHNOLOGY HARDWARE	177
SIMULATION AND DECISION SUPPORT SYSTEMS	178
SOFTWARE	178
COMPLIANCE SERVICES	178
SAFETY EQUIPMENT AND SERVICES	178
ENVIRONMENTAL ENGINEERING SERVICES	179
MONITORING AND TESTING SERVICES	179
BUSINESS CONSULTING	179
FINANCIAL LENDING AND INVESTORS	180
INSURANCE SERVICES	180
LEGAL SERVICES	181
STAFFING	181
REPAIR AND MAINTENANCE SERVICES	181
INSPECTION SERVICES	181
MARINE SERVICES	182
PEAK SHAVING SERVICES	182
R&D SERVICES	182
TRAINING	183
TRANSPORTATION, CERTIFICATION AND CONSTRUCTION SERVICES	183
<i>TABLE 74 WORLD LNG SERVICE INFRASTRUCTURE DEMAND BY TYPE, THROUGH 2010 (\$MILLIONS/YEAR)</i>	<i>184</i>
DEMAND BY APPLICATION	185
INTRODUCTION	185
<i>TABLE 75 WORLD LNG INFRASTRUCTURE DEMAND BY APPLICATION, THROUGH 2010 (TCF/YEAR)</i>	<i>186</i>
APPLICATION IN INTERNATIONAL LNG TRADE	186
Western Hemisphere	186
<i>TABLE 76 LNG APPLICATION IN INTERMANTIONAL TRADE; EXPORTS BY WESTERN HEMISPHERE, THROUGH 2010 (TCF/YEAR)</i>	<i>187</i>
Pacific	187
<i>TABLE 77 LNG APPLICATION IN INTERMANTIONAL TRADE; EXPORTS BY PACIFIC BASIN, THROUGH 2010 (TCF/YEAR)</i>	<i>187</i>
ROW Basin	188
<i>TABLE 78 LNG APPLICATION IN INTERMANTIONAL TRADE; EXPORTS BY ROW BASIN, THROUGH 2010 (TCF/YEAR)</i>	<i>188</i>
APPLICATION IN MERCHANT LNG SUPPLY	189

<i>TABLE 79 WORLD APPLICATION IN MERCHANT LNG SUPPLY BY TYPE, THROUGH 2010 (TCF/YEAR)</i>	189
LNG PEAKSHAVING PLANTS (LIQUEFACTION, STORAGE AND REGASIFICATION)	189
North America	190
Europe	190
Asia.....	190
ROW	190
<i>TABLE 80 WORLD LNG APPLICATION IN PEAKSHAVING BY REGION, THROUGH 2010 (TCF/YEAR)</i>	191
LNG VEHICLE FUEL	191
North America	191
Europe	192
Asia.....	193
ROW	193
<i>TABLE 81 WORLD LNG APPLICATION IN VEHICLE FUEL BY REGION, THROUGH 2010 (TCF/YEAR)</i>	193
LNG SATELITE PLANTS (LNG STORAGE AND REGASIFICATION) BY REGION	193
North America	194
Europe	194
Asia.....	194
ROW	194
<i>TABLE 82 WORLD LNG APPLICATION IN SATELLITE PLANTS BY REGION, THROUGH 2010 (TCF/YEAR)</i>	195
TECHNOLOGY	196
INTRODUCTION	196
<i>FIGURE 13 ELEMENTS OF THE NATURAL GAS INFRASTRUCTURE VALUE CHAIN</i>	196
EXPLORATION AND DEVELOPMENT INVESTMENT FOR LNG INFRASTRUCTURE.....	196
EXPLORATION AND DEVELOPMENT INVESTMENT FOR LNG INFRASTRUCTURE BY ELEMENT	197
Finding.....	197
Development	198
Production.....	198
<i>TABLE 83 WORLD EXPLORATION AND PRODUCTION INVESTMENTS FOR LNG INFRASTRUCTURE BY ELEMENT, THROUGH 2010 (\$ BILLIONS/YEAR)</i>	199
EXPLORATION AND PRODUCTION INVESTMENTS FOR LNG INFRASTRUCTURE	199
North America	200
Europe	200
Norway	200
Russia	200
Asia.....	201
ROW	201

<i>TABLE 84</i>	<i>WORLD EXPLORATION/PRODUCTION INVESTMENTS FOR LNG INFRASTRUCTURE BY REGION, THROUGH 2010 (\$ BILLIONS/YEAR)</i>	202
	ECONOMICS OF NATURAL GAS EXPLORATION AND PRODUCTION.....	202
	DEMAND FOR LNG LIQUEFACTION TECHNOLOGY.....	202
<i>TABLE 85</i>	<i>WORLD LNG LIQUEFACTION INVESTMENT BY ELEMENT TECHNOLOGY, THROUGH 2010 (\$MILLIONS/YEAR)</i>	203
	DEMAND BY TYPE OF LIQUEFACTION HEAT EXCHANGER TECHNOLOGY.....	203
	Spiral-Wound.....	203
	Plate-Fin	203
	Kettle-Type	203
	Printed Circuit.....	204
<i>TABLE 86</i>	<i>WORLD DEMAND BY TYPE OF HEAT EXCHANGER TECHNOLOGY, THROUGH 2010 (\$MILLIONS/YEAR)</i>	204
	DEMAND FOR LNG LIQUEFACTION INFRASTRUCTURE INVESTMENT BY REGION.....	204
<i>TABLE 87</i>	<i>WORLD LNG LIQUEFACTION INFRASTRUCTURE INVESTMENT, BY REGION, THROUGH 2010 (\$ MILLIONS/YEAR)</i>	205
	NORTH AMERICA	205
<i>TABLE 88</i>	<i>NORTH AMERICA LNG LIQUEFACTION CAPACITY</i>	205
	EUROPE.....	205
	Norway	206
	Russia.....	206
<i>TABLE 89</i>	<i>EUROPE LNG LIQUEFACTION CAPACITY</i>	206
	ASIA.....	207
	Australia	207
<i>TABLE 90</i>	<i>AUSTRALIA LNG LIQUEFACTION CAPACITY</i>	208
	Indonesia.....	208
<i>TABLE 91</i>	<i>INDONESIA LNG LIQUEFACTION CAPACITY</i>	208
	Malaysia.....	209
<i>TABLE 92</i>	<i>MALAYSIA LNG LIQUEFACTION CAPACITY</i>	209
	Brunei	209
<i>TABLE 93</i>	<i>BRUNEI LNG LIQUEFACTION CAPACITY</i>	210
	ROW.....	210
	South and Central America.....	210
	Trinidad and Tobago.....	210
<i>TABLE 94</i>	<i>TRINIDAD AND TOBAGO LNG LIQUEFACTION CAPACITY</i>	211
	Bolivia.....	211
<i>TABLE 95</i>	<i>BOLIVIA LNG LIQUEFACTION CAPACITY</i>	212
	Venezuela	212
<i>TABLE 96</i>	<i>VENEZUELA LNG LIQUEFACTION CAPACITY</i>	212
	Peru	212
<i>TABLE 97</i>	<i>PERU LNG LIQUEFACTION CAPACITY</i>	213
	Brazil	213
<i>TABLE 98</i>	<i>BRAZIL LNG LIQUEFACTION CAPACITY</i>	214
	Africa.....	214
	Algeria	214

TABLE 99 ALGERIAN LNG LIQUEFACTION CAPACITY	215
Nigeria	215
TABLE 100 NIGERIAN LNG IMPORT CAPACITY	216
Egypt	216
TABLE 101 EGYPT LNG LIQUEFACTION CAPACITY.....	217
Libya	217
TABLE 102 LYBIAN LNG LIQUEFACTION CAPACITY.....	217
Angola.....	218
TABLE 103 ANGOLAN LNG LIQUEFACTION CAPACITY	218
Equatorial Guinea	218
TABLE 104 EQUATORIAL GUINEA LNG LIQUEFACTION CAPACITY.....	219
Middle East.....	219
Oman	219
TABLE 105 OMAN LNG LIQUEFACTION CAPACITY.....	219
Iran	220
TABLE 106 IRAN LNG LIQUEFACTION CAPACITY.....	220
Abu Dhabi	220
TABLE 107 ABU DHABI LNG LIQUEFACTION CAPACITY.....	221
Qatar	221
TABLE 108 QATAR LNG LIQUEFACTION CAPACITY.....	222
Yemen.....	222
TABLE 109 YEMEN LNG LIQUEFACTION CAPACITY	223
ECONOMICS FOR BASELOAD LIQUEFACTION PLANT PROJECTS.....	223
TABLE 110 COMPARISON OF EFFICIENCIES FOR DIFFERENT REFRIGERATION CYCLES.....	223
TABLE 111 COMPARISON OF NECESSARY EQUIPMENT, COST AND LNG PRODUCTION.....	224
Costs	224
TABLE 112 BASE-LOAD LNG LIQUEFACTION PLANT COSTS.....	225
TABLE 113 THE RELATIVE LIQUEFACTION PLANT COSTS.....	226
LNG PEAK-SHAVING AND VEHICLE FUEL PLANT ECONOMICS	226
TABLE 114 THE RELATIVE LIQUEFACTION PLANT COSTS.....	227
DEMAND FOR MARINE LNG SHIP INFRASTRUCTURE INVESTMENT.....	227
TABLE 115 WORLD INVESTMENT BY SHIPPING ELEMENT TECHNOLOGY, THROUGH 2010 (\$MILLIONS/YEAR)	228
DEMAND FOR SHIPPING CONTAINMENT SYSTEMS FOR LNG INFRASTRUCTURE TECHNOLOGY.....	228
TABLE 116 COMPARISON OF LNG CARGO CONTAINMENT SYSTEM TECHNOLOGY.....	229
TABLE 117 WORLD DEMAND FOR LNG TRANSPORTATION BY CONTAINMENT TECHNOLOGY, THROUGH 2010 (TCF/YEAR)	230
DEMAND FOR LNG SHIP PROPULSION INFRASTRUCTURE TECHNOLOGY.....	230
Steam Propulsion	230
Dual-Fuel Diesels	230

Diesel Engines	231
Gas Turbines.....	231
Diesel Electric Systems	231
Azimuth Thrusters	232
Water Jet Propulsion Engines	232
<i>TABLE 118 WORLD DEMAND FOR LNG TANKER INVESTMENT BY PROPULSION TECHNOLOGY, THROUGH 2010 (\$MILLIONS/YEAR)</i>	<i>232</i>
TECHNO-ECONOMIC COMPARISON OF SHIP PROPULSION SYSTEMS.....	233
<i>TABLE 119 TECHNO-ECONOMIC COMPARISON OF SHIP PROPULSION SYSTEMS.....</i>	<i>233</i>
<i>TABLE 119 (CONTINUED)</i>	<i>234</i>
MARINE LNG SHIP INFRASTRUCTURE INVESTMENT BY REGION	234
<i>TABLE 120 WORLD MARINE LNG SHIP INFRASTRUCTURE INVESTMENT, BY REGION, THROUGH 2010 (\$ BILLIONS/YEAR).....</i>	<i>235</i>
EAST OF SUEZ LNG SHIP INFRASTRUCTURE REQUIREMENTS	235
Asia-Pacific	235
Middle East.....	235
Australia	235
<i>TABLE 121 EAST OF SUEZ TANKER REQUIREMENTS, THROUGH 2010 (\$ BILLIONS/YEAR)</i>	<i>236</i>
WEST OF SUEZ LNG SHIP INFRASTRUCTURE REQUIREMENTS	236
Mediterranean Supply.....	236
Sub-Saharan African Supply	236
Caribbean Supply	237
<i>TABLE 122 WEST OF SUEZ TANKER REQUIREMENTS, THROUGH 2010 (\$ BILLIONS/YEAR)</i>	<i>237</i>
DEMAND FOR LNG RECEIVING AND REGASIFICATION INFRASTRUCTURE INVESTMENT.....	237
<i>TABLE 123 WORLD INVESTMENT BY RECEIVING TERMINAL ELEMENT TECHNOLOGY, THROUGH 2010 (\$MILLIONS/YEAR)</i>	<i>238</i>
LNG RECEIVING TERMINAL STORAGE TANK INFRASTRUCTURE DEMAND BY TYPE	238
Single Containment.....	239
Double Containment.....	239
Full Containment	239
Membrane	240
<i>TABLE 124 WORLD DEMAND FOR LNG INFRASTRUCTURE BY STORAGE TECHNOLOGY, THROUGH 2010 (\$ MILLIONS/YEAR)</i>	<i>240</i>
DEMAND FOR LNG REGASIFICATION TECHNOLOGY.....	240
Open Rack Vaporizers (ORV).....	241
Submerged Combustion Vaporizers (Scv)	241
Shell and Tube Vaporizers (STV).....	241
Combined Heat and Power (CHP)	242

<i>TABLE 125 WORLD DEMAND FOR LNG REGASIFICATION BY HEAT EXCHANGE TECHNOLOGY, THROUGH 2010 (\$ MILLIONS/YEAR)</i>	242
ECONOMICS OF LNG RECEIVING/REGASIFICATION	
INFRASTRUCTURE TECHNOLOGY.....	242
Means of Facility Expansion	242
Number of Berths	243
Contractual Arrangements for Shipping	243
Number of LNG Sources and Cargo Activity	243
Size of Receiving Tanks.....	244
Capacity of Vaporizers.....	244
Variability in Sendout	244
Capacity of Sendout Lines.....	245
Capacity of Local and Regional Systems	245
Schedule Discretion in Truck Deliveries	245
LNG RECEIVING/REGASIFICATION INFRASTRUCTURE	
INVESTMENT BY REGION.....	245
<i>TABLE 126 WORLD LNG RECEIVING/REGASIFICATION INFRASTRUCTURE INVESTMENT, BY REGION, THROUGH 2010 (\$ MILLIONS/YEAR)</i>	246
NORTH AMERICA	246
United States	247
<i>TABLE 127 EXISTING CAPACITY AND PLANNED EXPANSIONS AT LNG INPORT TERMINALS IN THE LOWER 48 U.S. STATES (AS OF APRIL 27, 2005)</i>	248
Canada	248
Bear Head (Granted Environmental Approval by Canadian and Provincial Governments)	249
Canaport (Approved by Canadian and Provincial Governments)	249
<i>TABLE 128 CANADA LNG IMPORT CAPACITY</i>	250
EUROPE.....	250
<i>TABLE 129 EXISTING CAPACITY AND PLANNED EXPANSIONS AT LNG INPORT TERMINALS IN WESTERN EUROPE</i>	251
France	251
Spain	251
Italy	252
Belgium	252
Greece.....	252
Portugal.....	253
Netherlands	253
United Kingdom	253
Turkey	254
<i>TABLE 130 EUROPEAN LNG IMPORT CAPACITY</i>	254
<i>TABLE 130 (CONTINUED)</i>	255
ASIA.....	255
<i>TABLE 131 EXISTING CAPACITY AND PLANNED EXPANSIONS AT LNG INPORT TERMINALS IN ASIA</i>	256
Japan.....	256
<i>TABLE 132 JAPAN LNG IMPORT CAPACITY</i>	256

<i>TABLE 132 (CONTINUED)</i>	257
South Korea	257
<i>TABLE 133 SOUTH KOREAN LNG IMPORT CAPACITY</i>	258
Taiwan	258
<i>TABLE 134 TAIWAN LNG IMPORT CAPACITY</i>	258
New Zealand	259
<i>TABLE 135 NEW ZEALAND LNG IMPORT CAPACITY</i>	259
China	259
<i>TABLE 136 CHINA LNG IMPORT CAPACITY</i>	260
India	260
<i>TABLE 137 INDIAN LNG IMPORT CAPACITY</i>	261
ROW	261
<i>TABLE 138 EXISTING CAPACITY AND PLANNED EXPANSIONS AT LNG IMPORT TERMINALS IN THE REST OF THE WORLD</i>	261
Central and South America	262
Mexico	262
<i>TABLE 139 MEXICO LNG IMPORT CAPACITY</i>	262
Bahamas.....	263
<i>TABLE 140 BAHAMAS LNG IMPORT CAPACITY</i>	263
Dominican Republic.....	263
<i>TABLE 141 DOMINICAN REPUBLIC LNG IMPORT CAPACITY</i>	263
Puerto Rico	263
<i>TABLE 142 PUERTO RICO LNG IMPORT CAPACITY</i>	264
Honduras.....	264
<i>TABLE 143 HONDURAS LNG IMPORT CAPACITY</i>	264
Brazil	264
Brazil (Continued).....	265
<i>TABLE 144 BRAZIL LNG IMPORT CAPACITY</i>	266
MARKETING AND DISTRIBUTION OF REGASIFIED LNG INFRASTRUCTURE INVESTMENT.....	266
MARKETING AND DISTRIBUTION OF REGASIFIED LNG INFRASTRUCTURE INVESTMENT, BY ELEMENT	267
Equipment and Material	267
Labor	267
Storage/Land.....	267
<i>TABLE 145 INVESTMENT BY PIPELINE CONSTRUCTION COST ELEMENT TECHNOLOGY, THROUGH 2010 (\$BILLION/YEAR)</i>	268
REGASIFIED LNG MARKETING AND DISTRIBUTION INFRASTRUCTURE INVESTMENT, BY REGION.....	268
<i>TABLE 146 WORLD REGASIFIED LNG MARKETING AND DISTRIBUTION INFRASTRUCTURE INVESTMENT, BY REGION, THROUGH 2010 (\$ BILLIONS/YEAR)</i>	269
NORTH AMERICA	269
<i>TABLE 147 NATURAL GAS PIPELINE CONSTRUCTION IN NORTH AMERICA, 2005-2010 (MILES)</i>	270
EUROPE.....	270
France	271
Spain	271

Italy	271
Greece.....	272
United Kingdom	272
Russia.....	272
Norway	272
<i>TABLE 148 NATURAL GAS PIPELINE CONSTRUCTION IN EUROPE, 2005-2010</i>	
(MILES).....	273
ASIA.....	273
Japan.....	273
South Korea	273
China	274
India	274
<i>TABLE 149 NATURAL GAS PIPELINE CONSTRUCTION IN ASIA, 2005-2010</i>	
(MILES).....	274
ROW.....	275
Brazil.....	275
Mexico	275
Trinidad & Tobago.....	275
Peru	276
<i>TABLE 150 NATURAL GAS PIPELINE CONSTRUCTION IN SOUTH AMERICA, 2005-</i>	
<i>2010 (MILES).....</i>	<i>276</i>
West African Gas Pipeline Project (WAGP)	276
<i>TABLE 151 NATURAL GAS PIPELINE CONSTRUCTION IN AFRICA, 2005-2010</i>	
(MILES).....	277
Abu Dhabi	277
UAE/Qatar	277
Iran/Azerbaijan.....	277
Iran/Armenia	278
<i>TABLE 152 NATURAL GAS PIPELINE CONSTRUCTION IN THE MIDDLE EAST,</i>	
<i>2005-2010 (MILES).....</i>	<i>278</i>
ECONOMICS OF GAS DISTRIBUTION.....	278
<i>TABLE 153 NATURAL GAS PIPELINE CONSTRUCTION COSTS BY LOCATION,</i>	
<i>2000-2004 (\$ MILLION/MILE).....</i>	<i>279</i>
COST COMPONENTS.....	279
Land	279
Material.....	279
Labor	279
Miscellaneous	279
Right-of –Way	280
<i>TABLE 154 NATURAL GAS LAND PIPELINE CONSTRUCTION COSTS</i>	
<i>COMPONENTS, 2000-2004 (\$ MILLION/MILE)</i>	<i>280</i>
Offshore.....	280
Material.....	280
Labor	280
Miscellaneous	280
Right-of-Way	281

TABLE 155 NATURAL GAS OFFSHORE PIPELINE CONSTRUCTION COSTS	
COMPONENTS, 2000-2004 (\$ MILLION/MILE)	281
HEALTH AND SAFETY TECHNOLOGY OF LNG	
INFRASTRUCTURE	281
HEALTH AND SAFETY...(CONTINUED).....	282
TABLE 156 COMPARISON OF PROPERTIES OF LIQUID FUELS	283
TABLE 157 SELECTED SAFETY CHARACTERISTICS OF NATURAL GAS AND	
RELATED PRODUCTS	284
LNG INFRASTRUCTURE TECHNOLOGY DEVELOPMENT.....	284
TABLE 158 LNG INFRASTRUCTURE TECHNOLOGY DEVELOPMENT	284
TABLE 158 (CONTINUED)	285
TABLE 158 (CONTINUED)	286
TABLE 158 (CONTINUED)	287
TABLE 158 (CONTINUED)	288
TABLE 158 (CONTINUED)	289
TABLE 158 (CONTINUED)	290
TABLE 158 (CONTINUED)	291
TABLE 158 (CONTINUED)	292
TABLE 158 (CONTINUED)	293
LNG INFRASTRUCTURE PRODUCT DEVELOPMENT/IMPORTANT	
APPROACH	294
TABLE 159 LNG INFRASTRUCTURE PRODUCT DEVELOPMENT/IMPORTANT	
APPROACH.....	294
TABLE 159 (CONTINUED)	295
TABLE 159 (CONTINUED)	296
TABLE 159 (CONTINUED)	297
LNG INFRASTRUCTURE PROCESS/APPLICATION	297
TABLE 160 LNG INFRASTRUCTURE PROCESS/APPLICATION.....	297
TABLE 160 (CONTINUED)	298
EMERGING/NEW LNG INFRASTRUCTURE TECHNOLOGIES.....	298
NATURAL GAS CONDITIONING.....	298
Supersonic Gas Separation	299
Membrane Contactor	299
Silica Gel Hydrocarbon Dewpointing.....	299
Biodesulphurization Process.....	300
STORAGE TECHNOLOGY.....	300
LNG STORAGE TANKS.....	300
Floating Production, Storage and Off-loading (FPSO)	300
Liquefaction Cycle	301
Process Design Challenges.....	301
Development	302
The Energy Bridge System	302
U.S DOE Support	303
FIGURE 14 CGI'S PROPOSED TECHNOLOGY FOR LNG IMPORT AND STORAGE	
BASED ON THE BISHOP PROCESS.....	304
FUEL CELLS	304
DISTRIBUTION TECHNOLOGY	305
LNG Transportation Technology	306

LNG INFRASTRUCTURE TECHNOLOGY APPLICATION	
ENVELOPES	306
GAS TRANSPORTATION APPLICATION ENVELOPES	306
TABLE 161 SIMPLE PAYBACK COMPARISON OF GAS TRANSPORTATION	
OPTIONS	307
LNG INFRASTRUCTURE TECHNOLOGY CHALLENGES AND	
REFINEMENT	307
SYSTEMS SIMPLIFICATION	308
VACUUM INSULATED PIPE VERSUS MECHANICALLY	
INSULATED PIPE FOR LNG TRANSFER	308
TECHNOLOGY ADAPTATION IN OFFSHORE	
APPLICATIONS (“MARINIZATION”)	308
TABLE 162 UNIT OPERATIONS AND EQUIPMENT/SYSTEMS TYPE — LNG VS	
GAS CONVERSION	309
LNG INFRASTRUCTURE INVESTMENT BY COMPANY	309
BRITISH PETROLEUM	309
ROYAL DUTCH/SHELL	310
EXXONMOBIL	311
TOTALFINAELF	311
CHEVRONTEXACO	311
CONOCOPHILLIPS	312
OTHER	312
TABLE 163 LNG INFRASTRUCTURE INVESTMENT BY COMPANY, THROUGH 2010	
(\$BILLION/YEAR)	312
TABLE 164 STATE-OWNED COMPANIES	313
TABLE 165 PRIVATE OIL AND GAS COMPANIES	313
TABLE 166 GAS/POWER COMPANIES	314
TABLE 167 STATE-OWNED OIL/GAS COMPANIES	314
TABLE 168 CHEMICAL COMPANIES	315
LNG INFRASTRUCTURE PATENT EVALUATION AND LEADERS	
IN RESEARCH AND DEVELOPMENT BY COMPANY	315
ROYAL DUTCH/SHELL	316
BRITISH PETROLEUM	316
CEHEVRONTEXACO	316
CONOCOPHILLIPS	316
AIR PRODUCTS AND CHEMICALS	316
HITACHI	317
CHART INDUSTRIES	317
OTHER	317
TABLE 169 LNG INFRASTRUCTURE PATENTS/R&D LEADERS BY COMPANY,	
2001-2004 (NUMBER/YEAR)	317
TABLE 169 (CONTINUED)	318
COMPANY PROFILES	319
LNG INFRASTRUCTURE REGULATORY AGENCIES	319
THE UNITED STATES COAST GUARD	319

THE UNITED STATES DEPARTMENT OF TRANSPORTATION	319
THE UNITED STATES FEDERAL ENERGY REGULATORY COMMISSION	319
THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY	320
THE UNITED STATES DEPARTMENT OF ENERGY	320
LNG RECEIVING TERMINAL OPERATORS.....	321
AMERICAN ELECTRIC POWER CO.....	321
FPL GROUP	321
ELECTRABEL	322
KOREA ELECTRIC	322
ENEL SPA	323
IBERDROLA SA.....	323
TOKYO ELECTRIC	323
AES CORPORATION	324
KANSAI ELECTRIC	324
TOKYO GAS.....	325
OFFSHORE LNG TERMINALS	325
EXCELERATE ENERGY	325
MARINTEK (USA) INC.....	326
BLUEWATER.....	326
COMPRESSION MACHINERY	327
SIEMENS AG	327
GE POWER SYSTEMS.....	328
ADHESIVES	328
HUNTSMAN	328
AIR SEPARATION UNITS	328
CRYOSTAR	328
ALTERNATIVE FUEL VEHICLES TECHNOLOGIES	329
NEXTGEN FUELING.....	329
BOIL-OFF GAS HANDLING TECHNOLOGIES.....	329
HAMWORTHY PLC.....	329
COLD BOXES	330
AIR PRODUCTS AND CHEMICALS, INC.	330
COMBUSTION SYSTEMS.....	331
COUPLING SYSTEMS.....	331
PARKER HANNIFIN.....	331
CRYOGENIC SYSTEM COMPONENTS	332
CHART INDUSTRIES	332
ELECTRONIC CONTROL UNITS	332
ENERGY CONVERSIONS, INC.	332
EXPANDERS	333
EBARA INTERNATIONAL CORPORATION	333

FLANGES AND PIPING	333
INTERNATIONAL STEEL SUPPLIES INC.	333
FLEXIBLE HOSES/HOSES	334
MARINTEK	334
FSO/FPSO UNITS	334
BLUEWATER ENERGY SERVICES B.V.....	334
GAS/OIL/WATER SEPARATION UNITS	335
ACS INDUSTRIES, INC.....	335
GAS PROCESSING SYSTEMS AND COMPONENTS	335
MARLBORO ENTERPRISES, INC.....	335
HEAT EXCHANGERS/HEAT TRANSFER TECHNOLOGY	335
ALFA LAVAL INC.	335
INSULATION (CRYOGENIC) SYSTEMS.....	336
INSULATIONS, INC.	336
LNG TANKER BERTH AND LNG LOADING ARMS.....	336
FMC TECHNOLOGIES.....	336
ADVANCED PRODUCTION AND LOADING AS	337
FMC CORPORATION.....	337
LNG PEAKSHAVING AND SATELLITE SYSTEMS.....	338
CH-IV CRYOGENICS CORPORATION	338
CLEAN ENERGY FUELS CORP.	338
GAS TECHNOLOGY INSTITUTE (GTI).....	339
CROYOGENIC INDUSTRIES.....	339
MARLIN GAS TRANSPORT, INC.	340
UNITED STATES DEPARTMENT OF ENERGY (U.S. DOE)	340
PIPE SECTIONS	341
CHIYODA CORPORATION	341
PIPE SUPPORTS.....	342
NAVARRO CHEMICALS PTY LTD.....	342
PRESSURE VESSELS (CRYOGENIC)	342
CROMPTON TECHNOLOGY GROUP LTD.	342
CRYOGENIC PUMPS	343
CRYOSTAR-FRANCE SA.....	343
TURBINES.....	343
SEIMENS WESTINGHOUSE.....	343
FLOW METERS, FLOW COMPUTERS AND FLOW INDICATORS.....	343
INVENSYS	343
EMERSON PROCESS MANAGEMENT	344
SAGE METERING, INC.....	344
YOKOGAWA CORPORATION OF AMERICA.....	345
IMPCO TECHNOLOGIES, INC.....	345
SIEMENS ENERGY & AUTOMATION, INC.	345
ALICAT SCIENTIFIC.....	346

ANALYZERS, DETECTORS, SENSORS, CONTROLS AND INSTRUMENTATION	346
PARKER INSTRUMENTATION	346
DAVIDSON INSTRUMENTS.....	347
EXTECH INSTRUMENTS, INC.	347
OCCUPATIONAL HEALTH DYNAMICS	348
LNG VALUE CHAIN COMPANIES	348
SEMPRA ENERGY LNG CORP.....	348
EXXONMOBIL CORP.	348
ROYAL DUTCH/SHELL PETROLEUM COMPANY.....	349
BP PLC	349
TOTALFINAELF SA.....	350
CHEVRONTEXACO CORP.	350
ENI SPA.....	351
REPSOL-YPF SA	351
CONOCOPHILLIPS.....	352
BG GROUP	352
NATURAL GAS EXPLORATION AND PRODUCTION COMPNIES	353
MARATHON OIL COMPANY.....	353
E.ON AG.....	353
SERVICE SUPPLY COMPANIES	354
SCHLUMBERGER.....	354
DEN NORSKE STATS OLJESELSKAP AS (STATOIL)	354
HALLIBURTON CO.	355
AMEC PROCESS AND ENERGY LTD.	355
ENGINEERING AND CONSTRUCTION COMPANIES	356
ABS	356
CHICAGO BRIDGE & IRON COMPANY	356
STORK ENGINEERS AND CONTRACTORS BV	357
PITT-DES MOINES, INC.	357
FLUOR DANIEL.....	358
ABB LUMMUS GLOBAL GMBH.....	358
BAKER HUGHES, INC.	359
BLACK AND VEATCH PRITCHARD, INC.....	359
INVESTMENT ADVISORY COMPANIES.....	360
THE MITCHELL GROUP INC.	360
GAS TRANSMISSION/DISTRIBUTION.....	360
THE WILLIAMS COMPANIES, INC.....	360
EL PASO GLOBAL LNG	361
ENCANA GAS STORAGE INC.	361
NISOURCE INC.....	361
LNG SHIP CONSTRUCTION/PROPULSION SYSTEMS	362
HYUNDAI HEAVY INDUSTRIES.....	362

DAEWOO SHIPBUILDING & MARINE ENGINEERING COMPANY	362
MCDERMOTT INTERNATIONAL, INC.	363
ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES	363
MITSUBISHI HEAVY INDUSTRIES (MHI).....	364
MITSUMI ENGINEERING AND SHIPBUILDING COMPANY.....	364
CHANTIERS DE L'ATLANTIQUE	364
IZAR CONSTRUCCIONES NAVALES S.A.....	365
LNG TANKER OPERATORS.....	365
MITSUMI OSK LINES	365
LNG PROCESS TECHNOLOGY LICENSORS	366
AIR PRODUCTS AND CHEMICALS, INC.	366
TECHNIP	366
LNDE	367
LEGAL ADVISRY SERVICE	367
WHITE & CASE LLP.....	367
FIRE PROTECTION SYSTEMS AND MATERIALS.....	368
MARIOFF CORPORATION OY	368
PPG INDUSTRIES, INC.....	368
FLARE SYSTEMS AND EQUIPMENT.....	369
ELMAC GROUP.....	369
ABB GAS TECHNOLOGY AS.....	369
HYDRAULICS AND ELECTROCHEMICAL EQUIPMENT	370
BHP PETROLEUM (BHPP) PTY LTD	370
HYDROGRAPHIC, METEOROLOGICAL AND SEISMIC SURVEY.....	370
PIC ENERGY GROUP	370
ASAMS LTD.	371
LIFTING EQUIPMENT, CRANES AND WINCHES.....	371
INGERSOLL-RAND.....	371
HYDRALIFT ASA	372
MOLDECRANE.....	372
LIGHTING	373
CEAG SICHERHEITSTECHNIK GMBH.....	373
CHINA LIGHT & POWER HOLDINGS	373
LININGS, SEALS AND GASKETS	374
BAL SEAL ENGINEERING COMPANY, INC.....	374
PIPELINES AND PIPING COMPONENTS	374
CECO PIPELINE SERVICES COMPANY, INC.	374
3M	375
NKT FLEXIBLES	375
TIMET	376
POWER GENERATION AND PROPULSION MACHINERY	377
ORMAT.....	377
PROCESSING AND SEPARATION SYSTEMS.....	377

FOSTER WHEELER CORPORATION.....	377
PETRECO INTERNATIONAL.....	377
CHICAGO BRIDGE & IRON COMPANY	378
KVAERNER PROCESS SYSTEMS.....	378
MINOX TECHNOLOGY AS	379
PROJECT MANAGEMENT, CONSULTANCY AND CERTIFICATION....	379
ABS MARINE SERVICES	379
MULTIPHASE SOLUTIONS, INC.	380
SCHLUMBERGER OILFIELD SERVICES	380
VIKING ENERGY ROYALTY TRUST.....	381
PUMPS (NON-CRYOGENIC)	381
CAT PUMPS.....	381
RECRUITMENT AND PERSONNEL	382
OMEGA SELECTION SERVICES LTD	382
ROCK DUMPING	382
VAN OORD ACZ BV	382
STEEL, SPECIAL METALS AND WELDING.....	383
WEIR MATERIALS & FOUNDERIES	383
KRUPP THYSSEN NIROSTA (KTN)	383
SUPPORT VESSELS, SUPPLY AND CONTAINERS.....	384
SETEC CONTRACTING AS.....	384
SURPLUS AND USED EQUIPMENT.....	384
ACM ENGINEERING, LTD	384
ZEUS SALES & SERVICES LTD	385
SURVIVAL, SAFETY AND PROTECTION	385
BRADY CORPORATION.....	385
SANDIA NATIONAL LABORATORIES.....	386
GEXCON.....	386
WELL EQUIPMENT	387
WELLTEC	387