Infield Systems’ new Offshore Arctic Oil and Gas Market Report To 2018 provides essential research and analysis on current and future offshore oil and gas developments within the Arctic Circle and in the three major “sub-Arctic” areas: Svalbard Island offshore Far East Russia, the Jeanne D'Arc Basin offshore Eastern Canada (Newfoundland and Labrador), and the Cook Inlet in Alaska. The report provides a comprehensive analysis of the key market drivers, technological requirements, and environmental challenges facing the region up to 2018. It also includes detailed sector-by-sector forecasts covering all aspects of the offshore Arctic market from fixed platforms to ‘Ice-Class’ vessels.

Operators are being drawn to the offshore Arctic by the region’s potentially vast oil and gas resources. Infield Systems’ data suggests that the region holds 136.6 billion barrels of oil equivalent (Bbboe) in discovered offshore reserves, with a 2008 United States Geological Survey (USGS) report indicating that there could be another 346Bbboe left undiscovered.

Whilst Arctic waters are extremely rich in reserves, those resources are not distributed evenly. Infield Systems’ estimates suggest that more than 116Bbboe is natural gas, whilst only 17Bbboe is oil. Of the region’s vast gas reserves, as much as 95Bbboe, or 82%, is located in Russia’s high-Arctic (excluding Sakhalin Island). The potential of the offshore Arctic is, therefore, substantial. However, bringing the region’s resources to production has historically been a real challenge. According to Infield Systems’ data, just 33 of the 174 discovered fields have been successfully developed, representing just a tiny fraction of the region’s resource potential. Those fields have also taken many years to bring to production. The average field development lag (the number of years between field discovery year and on-stream year) for the Arctic region is in excess of 13 years, the second longest in the world.

Of the region’s remaining undeveloped fields, many face a highly uncertain future. Infield Systems has identified 38 fields with production potential between 2012 and 2018, however, just seven are currently under development or have a ‘firm plan.’ This is not just because of the obvious engineering challenges posed by intense cold, ice, remoteness, and even seismic activity. It is also due to more stringent operational and environmental regulations implemented by many governments in the wake of the Deepwater Horizon disaster. New ‘best-practice’ obligations, such as, same season relief well capability and enhanced oil spill contingencies have substantially increased costs and logistical hurdles. Finally, and perhaps most importantly, offshore Arctic projects face increasing competition from shale gas and tight oil plays, which often represent more attractive economics. This is not just affecting North America’s Arctic developments; Gazprom’s flagship Shtokman Phase One project was kicked into the long grass in August 2012, largely because it could no longer find markets for its LNG in the gas-glutted USA.

Infield Systems anticipates that offshore Arctic Capex will rise fairly steadily until 2018, although the suspension of Shtokman Phase One now means that spending in the middle of the forecast period is much lower than previously expected. Norway will command around 34% of the total offshore spend. The majority of that will come in the latter half of the forecast period on the back of the Eni-operated Goliat project as well as the development of Statoil’s Askeladden, Skrugard, and Havis fields.

Next in terms of Capex, with 22% of the total, is Canada’s sub-Arctic (Newfoundland and Labrador). Here Infield Systems anticipates the integration of satellite developments at Hibernia and White Rose, as well as first oil from the Hebron/Ben Nevis development.

Fields surrounding Russia’s Sakhalin Island are expected to draw around 20% of total Capex. This will initially be focused on Kirinskoye (Sakhalin Three) and Arkutun Dagi (Sakhalin One), both of which are currently under development. North Chayvo (Sakhalin One) and Kirinskoye South (Sakhalin Three) should follow in 2015 and 2018 respectively. Meanwhile, approximately 18% of total Capex will be directed towards Russia’s high-Arctic where the flagship Prirazlomnoye oil development and the Obskoye gas field will be brought to production.

Infield Systems anticipates that more than half of total Arctic Capex between 2012 and 2018 will be directed towards pipelines, reflecting the physical isolation of many projects in the region and the number of developments in the relatively deep waters of the Norwegian Barents Sea. Platforms will account for a further 31% of spend, with approximately 75% of this going towards fixed units.
Why You Should Buy This Report

- The report contains data developed by Infield Systems’ market modelling process, OFFPEX, which is based on a unique “bottom up approach” to forecasting. OFFPEX’s component by component and project by project forecasting process is robust and has a proven track record.
- The reader is given a comprehensive presentation of the offshore Arctic market from top-level analysis of key developments to individual sector forecasts covering everything from fixed platforms to Ice-Class vessels.
- The range and depth of research within the report provides a revealing insight into potential opportunities for operators, contractors and investors alike.

Online Database

Purchasers of the Offshore Arctic Oil & Gas Market Report will receive 12 months’ free access to an online database of fields being planned or considered for development in the current year and six years forward for projects within the Arctic circle.

Details about each project include:

- Field Operator
- Project Name
- Development Type
- Dates On Stream / Discovery / Depletion
- Reserves
- Field Production Rates
- Location
- Development Type
- Water Depths
- Project Status
- Numbers of Subsea & Surface Wells
- High Temperature / High Pressure

InfieldLive provides access to the previous day’s updates. Subscriptions can be upgraded to include other regions, time frames and other data sets from the Infield Offshore Energy Database or to include access to the Arctic Frontiers Online Mapping & Data Gateway.

Arctic Frontiers Mapping & Data Gateway

The Arctic Frontiers Oil & Gas Online Data & Mapping Gateway is designed to give visual and full data access to the challenging Arctic region of the offshore oil and gas industry. Full details about each field, platform and pipeline shown on the map is listed behind each symbol and can be searched, downloaded or exported from the EnergyGateway or through Infield Systems’ data portal, InfieldLive.

Regions covered:

- Alaska
- Northern Canada
- Greenland
- Iceland
- Northern Norway & Spitsbergen
- Northern Russia
- The Baltic & Barents Seas
Report Contents List

EXECUTIVE SUMMARY
- Arctic Capex by Region
- Arctic Capex by Market
- Arctic Capex by Operator
- Arctic Vessel Demand Days
- Arctic Vessels Market
- Arctic Drilling Rigs Market
- Supply and Demand of Arctic-capable Drilling Rigs

MACRO MARKET
- Introduction
- The Shale Gas Revolution
- Tension in the Middle East
- Oil Markets
- Short Term Oil Price Dynamics
- Long Term Oil Price Dynamics
- Market Risk Ahead
- Gas Markets
- Field Sanction Points
- Production Cost Curve
- Oil Companies & Contractors
- Oil Companies
- Offshore Services
- Offshore Production & Reserves
- Undeveloped Oil & Gas Reserves
- Five Key Trends
  - Deepwater
  - Harsh Environment
  - Further (Remote)
  - Smaller Developments
  - SURF vs. Conventional Field Developments
- Key Basins
  - The North Sea
  - US Production and the Gulf of Mexico Market
  - Brazil
  - East Africa, the Next LNG Province

REGIONAL MARKET OVERVIEW
- The Arctic Region’s Oil and Gas Supply Potential
  - USGS Circum-Arctic Resource Appraisal
  - Arctic and Sub-Arctic Discovered Reserves and Fields
  - Field Development Lag in Arctic and sub-Arctic Regions
- International Law and The Arctic Region
- The Arctic Region and The Global Oil And Gas Market
- Meeting the Growing Demand for Oil and Gas
- The Arctic Region as a Source of Supply
- Environmental Challenges In The Arctic Region
  - Ice
  - Waves
  - Light and Darkness
  - Remoteness
  - Regional Environmental Conditions
  - Exploration Drilling Windows
  - The Melting Polar Cap

OFFSHORE ARCTIC OIL AND GAS PROFILE
- Introduction
- Alaska (United States)
  - Offshore Oil and Gas Fields Profile
  - Offshore Licensing and Development Policy Status
- Canada
  - Offshore Oil and Gas Fields Profile
  - Offshore Licensing and Development Policy Status
- Greenland (Denmark)
  - Offshore Oil and Gas Fields Profile
  - Offshore Licensing and Development Policy Status
- Norway
  - Offshore Oil and Gas Fields Profile
  - Offshore Licensing and Development Policy Status
- Russia
  - Offshore Oil and Gas Fields Profile
  - Major Projects Offshore Russia
  - Offshore Licensing and Development Policy Status
- LNG Projects In Arctic and Sub-Arctic Regions
  - Existing LNG Projects
  - Proposed LNG Projects

SECTOR ANALYSIS & FORECASTS
- Introduction
- Fixed Platform Market
  - Fixed Platforms by Country
  - Fixed Platforms by Type
  - Fixed Platforms by Water Depth
  - Fixed Platforms by Total Weight
- Floating Production Systems Market
  - FPS by Country
  - Offshore Pipelines and Control Lines Market
  - Pipelines by Country
  - Pipelines by Water Depth
  - Pipelines by Market Segment
  - Control Lines by Country
- Subsea Infrastructure Market
  - Subsea Market by Country
  - Subsea Market by Sector
  - Drilling & Completion
  - Subsea Market by Water Depth
  - Equipment
  - Subsea Services by Manufacturer
- Operators In The Arctic
  - Vessel Days

ARCTIC VESSELS MARKET
- Vessel Suitability and Project Requirements In The Arctic
  - Ice Class Classifications for Vessels
  - Ice class OSVs
  - Ice class specialist vessels
  - Supply and Demand Dynamics for Arctic Vessels
  - Major players
  - Icebreakers

ARCTIC DRILLING RIGS MARKET
- Rig Suitability and Project Requirements In The Arctic
  - Overview
  - Existing Arctic Capable Drilling Rig Fleet
  - Supply and Demand of Arctic-capable Trees
  - Royal Dutch Shell Offshore Alaska
  - A Case Study
  - Arctic Lng Carriers

REQUIREMENTS FOR ARCTIC OFFSHORE OIL AND GAS INFRASTRUCTURE
- Floating Production Systems
- Fixed Platforms
- Pipelines and Control Lines
- Subsea Infrastructure
- Oil Spill Response

APPENDICES, MAPS & NOTES
- Defined Regions/Countries List
- Glossary
  - List of Acronyms & Abbreviations
  - List of Organisations and Geographical Place Names
- Regional Maps

Global & Regional Perspectives Market Reports
Infield Systems publishes a range of market reports covering various aspects and regions of the oil, gas, renewable energy and associated marine industries. Utilising comprehensive in-house project databases, industry models and research capacity, these reports are widely used by industry analysts and professionals:

- Deep & Ultra-deepwater
- Subsea
- Pipelines & Control Lines
- Fixed Platforms
- Floating Production Systems
- Specialist Vessels
- FPSO
- Accommodation
- Subsea Well Intervention
- Heavy Lift
- Heavy Marine Transport
- Remotely Operated Vehicles
- Offshore LNG
- Africa
- Arctic
- Asia
- Australasia
- Latin America
- Middle East & Caspian

About This Report
Number of Pages: 193
Number of Figures: 123
Number of Tables: 52

www.infield.com
Infield Systems Limited is an independent energy research and analysis company that is dedicated to the provision of accurate and up-to-date data, market reports, mapping, analysis and forecasts for the offshore oil and gas and associated marine industries. Infield Systems also prepares market due diligence on mergers, acquisitions and transactions for clients in the energy industry. Infield Systems services clients in over 40 countries, including: E&P companies, contractors, manufacturers, government agencies and financial institutions, and is widely acknowledged as the definitive independent source for information, research and analysis on the offshore energy sector.

Infield Systems has developed a variety of business tools to help companies make business decisions, all of which are supported by direct access to consultants, senior analysts and support staff:

- Offshore Energy Databases
- Marine Databases
- OFFPEX Market Modelling & Forecasting
- Mapping & GIS
- Energy Sector Market Reports
- Bespoke Forecast Reports
- Supply & Demand Models
- Market Due Diligence

About Infield Systems

Infield Systems accepts payment by bank transfer, credit card (Visa, MasterCard or American Express) or by cheque. Delivery is upon receipt of payment. For credit card purchases please supply the card’s billing address along with the billing Post Code/Zip Code and the four digit security code on the front of American Express cards, or the three digit code on the reverse of MasterCard and Visa cards. All European Union companies must supply their EU VAT number.

By purchasing this document, your organisation agrees to Infield Systems Limited’s Standard Terms and Conditions of Business and your organisation will not copy, or allow to be copied, in part or whole or otherwise circulated in any form any of the contents without prior written consent and specific permission from Infield Systems Limited. Our standard terms and conditions are available either upon request or at infield.com

Infield Systems is an independent energy research and analysis company that is dedicated to the provision of accurate and up-to-date data, market reports, mapping, analysis and forecasts for the offshore oil and gas and associated marine industries. Infield Systems also prepares market due diligence on mergers, acquisitions and transactions for clients in the energy industry. Infield Systems services clients in over 40 countries, including: E&P companies, contractors, manufacturers, government agencies and financial institutions, and is widely acknowledged as the definitive independent source for information, research and analysis on the offshore energy sector.

Infield Systems has developed a variety of business tools to help

Order Form

To order The Regional Perspectives Arctic Oil & Gas Market Report To 2018, please complete the order form below or buy online at www.infield.com.

For reports supplied electronically, the file is restricted to a single user at a single site with a single print to hard copy. Additional single user copies may be purchased for use within a single organisation. A corporate licence provides two printed copies of the report and an open electronic file (PDF) for use within your organisation.

Infield Systems uses the LockLizard system to control the distribution and copyright of reports supplied as single user licence and you must be able to install LockLizard viewer and the LockLizard licence key which requires administrator rights. If you are not able, or permitted, to install the viewer or licence key then please contact Infield Systems.

All prices shown below are exclusive of VAT which will be charged at the prevailing rate, where applicable.

Please supply the Regional Perspectives Arctic Oil & Gas Market Report To 2018 (Printed Copy)

Please supply the Regional Perspectives Arctic Oil & Gas Market Report To 2018 (Single User Electronic File)

Upgrade my InfieldLive access to include the Arctic Frontiers Online Mapping & Data Gateway

Single Copy
£2,200

Additional Copy £500

Corporate Licence £4,400

Single Copy
£2,200

Additional Copy £500

Corporate Licence £4,400

Single Licence
£3,750

Additional Copy £1,000

Corporate Licence £5,000

Name: ____________________________

Company Name: ____________________________

Email: ____________________________

Delivery Address: ____________________________

Phone: ____________________________

Fax: ____________________________

EU Vat Number: ____________________________

Card Type: Master / Visa /American Express

Card Number: ____________________________

Expiry Date: ____________________________

Security Code: ____________________________

Billing Address: ____________________________

Signature: ____________________________

Delivery by courier of hard copy reports costs from £12 in the UK and £65 for the rest of the world. I have read and fully understand the Infield Systems Limited Standard Terms and Conditions of Business located at www.infield.com

Also available @ www.infield.com

Infield Systems Limited | Suite 502, 1 Alie Street, London E1 8DE. UK
T: +44 20 7423 5000 | F: +44 20 7423 5050 | E: data@infield.com | W: www.infield.com
CONTENTS LIST

1. EXECUTIVE SUMMARY ................................................................. 31
   1.1 Arctic Capex by Region .......................................................... 31
   1.2 Arctic Capex by Market ......................................................... 32
       1.2.1 Arctic Capex by Operator ................................................ 32
   1.3 Arctic Vessel Demand Days ................................................ 34
       1.3.1 Arctic Vessels Market ..................................................... 34
   1.4 Arctic Drilling Rigs Market .................................................. 36
       1.4.1 Supply and Demand of Arctic-capable Drilling Rigs ......... 36

2. MACRO MARKET ......................................................................... 39
   2.1 Introduction ........................................................................... 39
       2.1.1 The Shale Gas Revolution ................................................ 39
       2.1.2 Tension in the Middle East .............................................. 40
   2.2 Oil Markets .......................................................................... 42
       2.2.1 Short Term Oil Price Dynamics ...................................... 42
       2.2.2 Long Term Oil Price Dynamics ...................................... 43
       2.2.3 Market Risk Ahead .......................................................... 46
   2.3 Gas Markets .......................................................................... 48
   2.4 Field Sanction Points .............................................................. 50
   2.5 Production Cost Curve .......................................................... 51
   2.6 Oil Companies & Contractors ............................................... 52
       2.6.1 Oil Companies ............................................................... 52
       2.6.2 Oilfield Services ............................................................. 52
   2.7 Offshore Production & Reserves .......................................... 55
       2.7.1 Undeveloped Oil & Gas Reserves ................................ 56
   2.8 Five Key Trends .................................................................... 58
       2.8.1 Deepwater ................................................................. 58
       2.8.2 Harsh Environment ....................................................... 59
       2.8.3 Further (Remote) ........................................................... 59
       2.8.4 Smaller Developments .................................................. 60
       2.8.5 SURF vs. Conventional Field Developments ............. 61
   2.9 Key Basins ............................................................................ 62
       2.9.1 The North Sea ............................................................... 62
       2.9.2 US Production and the Gulf of Mexico Market ............. 65
       2.9.3 Brazil ................................................................. 68
       2.9.4 East Africa, the Next LNG Province .............................. 70
3. REGIONAL MARKET OVERVIEW

3.1 The Arctic Region’s Oil and Gas Supply Potential
  3.1.1 USGS Circum-Arctic Resource Appraisal
  3.1.2 Arctic and Sub-Arctic Discovered Reserves and Fields
  3.1.3 Field Development Lag in Arctic and Sub-Arctic Regions

3.2 International Law and the Arctic Region

3.3 The Arctic Region and the Global Oil and Gas Market
  3.3.1 Meeting the Growing Demand for Oil and Gas
  3.3.2 The Arctic Region as a Source of Supply

3.4 Environmental Challenges in the Arctic Region
  3.4.1 Ice
  3.4.2 Waves
  3.4.3 Light and Darkness
  3.4.4 Remoteness
  3.4.5 Regional Environmental Conditions
  3.4.6 Exploration drilling windows
  3.4.7 The Melting Polar Cap

3.5 LNG Projects in Arctic and sub-Arctic Regions

4. OFFSHORE ARCTIC OIL AND GAS PROFILE

4.1 Introduction

4.2 Alaska (United States)
  4.2.1 Offshore Oil and Gas Fields Profile
  4.2.2 Offshore Licensing and Development Policy Status

4.3 Canada
  4.3.1 Offshore Oil and Gas Fields Profile
  4.3.2 Offshore Licensing and Development Policy Status

4.4 Greenland (Denmark)
  4.4.1 Offshore Oil and Gas Fields Profile
  4.4.2 Offshore Licensing and Development Policy Status

4.5 Norway
  4.5.1 Offshore Oil and Gas Fields Profile
  4.5.2 Offshore Licensing and Development Policy Status

4.6 Russia
  4.6.1 Offshore Oil and Gas Fields Profile
  4.6.2 Major Projects Offshore Russia
  4.6.3 Offshore Licensing and Development Policy Status

4.7 LNG Projects in Arctic and sub-Arctic Regions
  4.7.1 Existing LNG Projects
  4.7.2 Proposed LNG Projects
<table>
<thead>
<tr>
<th>5. SECTOR ANALYSIS &amp; FORECASTS</th>
<th>121</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Introduction</td>
<td>121</td>
</tr>
<tr>
<td>5.2 Fixed Platform Market</td>
<td>123</td>
</tr>
<tr>
<td>5.2.1 Fixed Platforms by Country</td>
<td>123</td>
</tr>
<tr>
<td>5.2.2 Fixed Platforms by Type</td>
<td>124</td>
</tr>
<tr>
<td>5.2.3 Fixed Platforms by Water Depth</td>
<td>125</td>
</tr>
<tr>
<td>5.2.4 Fixed Platforms by Total Weight</td>
<td>125</td>
</tr>
<tr>
<td>5.3 Floating Production Systems Market</td>
<td>126</td>
</tr>
<tr>
<td>5.3.1 FPS by Country</td>
<td>126</td>
</tr>
<tr>
<td>5.4 Offshore Pipelines and Control Lines Market</td>
<td>127</td>
</tr>
<tr>
<td>5.4.1 Pipelines by Country</td>
<td>127</td>
</tr>
<tr>
<td>5.4.2 Pipelines by Water Depth</td>
<td>130</td>
</tr>
<tr>
<td>5.4.3 Pipelines by Market Segment</td>
<td>132</td>
</tr>
<tr>
<td>5.4.4 Control Lines by Country</td>
<td>134</td>
</tr>
<tr>
<td>5.5 Subsea Infrastructure Market</td>
<td>136</td>
</tr>
<tr>
<td>5.5.1 Subsea Market by Country</td>
<td>136</td>
</tr>
<tr>
<td>5.5.2 Subsea Market by Sector</td>
<td>137</td>
</tr>
<tr>
<td>5.5.3 Drilling &amp; Completion</td>
<td>138</td>
</tr>
<tr>
<td>5.5.4 Subsea Market by Water Depth</td>
<td>139</td>
</tr>
<tr>
<td>5.5.5 Equipment</td>
<td>140</td>
</tr>
<tr>
<td>5.5.6 Subsea Trees by Manufacturer</td>
<td>141</td>
</tr>
<tr>
<td>5.6 Operators in the Arctic</td>
<td>142</td>
</tr>
<tr>
<td>5.7 Vessel Days</td>
<td>144</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. ARCTIC VESSELS MARKET</th>
<th>147</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Vessel Suitability and Project Requirements in the Arctic</td>
<td>147</td>
</tr>
<tr>
<td>6.1.1 Ice Class Classifications for Vessels</td>
<td>148</td>
</tr>
<tr>
<td>6.1.2 Ice class OSVs</td>
<td>149</td>
</tr>
<tr>
<td>6.1.3 Ice class specialist vessels</td>
<td>150</td>
</tr>
<tr>
<td>6.1.4 Supply and Demand Dynamics for Arctic Vessels</td>
<td>151</td>
</tr>
<tr>
<td>6.1.5 Major players</td>
<td>152</td>
</tr>
<tr>
<td>6.1.6 Icebreakers</td>
<td>153</td>
</tr>
</tbody>
</table>
7. ARCTIC DRILLING RIGS MARKET ........................................... 157
   7.1 Rig Suitability and Project Requirements in the Arctic .............................................. 157
       7.1.1 Overview ........................................................................................................ 157
       7.1.2 Existing Arctic Capable Drilling Rig Fleet ......................................................... 159
       7.1.3 Supply and Demand of Arctic-capable Drilling Rigs ............................................. 159
   7.2 Royal Dutch Shell Offshore Alaska — A Case Study ................................................. 163
   7.3 Arctic LNG Carriers .................................................................................................. 166

8. REQUIREMENTS FOR ARCTIC OFFSHORE OIL & GAS INFRASTRUCTURE .......... 169
   8.1 Floating Production Systems ......................................................................................... 169
   8.2 Fixed Platforms ......................................................................................................... 170
   8.3 Pipelines and Control Lines .......................................................................................... 171
   8.4 Subsea Infrastructure .................................................................................................. 172
   8.5 Oil Spill Response ....................................................................................................... 173

9. APPENDICES, MAPS & NOTES .................................................................................. 179
   9.1 Defined Regions/Countries List ................................................................................. 179
   9.2 Glossary, Acronyms & Abbreviations ......................................................................... 180
       9.2.1 Product/Service Definitions ............................................................................... 181
       9.2.2 Abbreviations & Standards of Measurement ....................................................... 182
       9.2.3 List of Organisations and Geographical Place Names ......................................... 183
   9.3 Regional Maps .......................................................................................................... 184
LIST OF FIGURES

Figure 1 - 1: Arctic Capex (US$m) by Country 2009-2018 .......................................................... 31
Figure 1 - 2: Arctic Capex (US$m) by Market 2009-2018 ............................................................ 32
Figure 1 - 3: Operators Market Share (%) 2013-2018 ................................................................ 32
Figure 1 - 4: Specialist Arctic Vessel Demand (Days) by Country 2009-2018 ......................... 34
Figure 1 - 5: Specialist Arctic Vessel Supply/Demand 2009-2018 ............................................ 34
Figure 1 - 6: Arctic Pipelay Vessel Supply/Demand 2009-2018 .................................................. 34
Figure 1 - 7: Future Development Wells and Available Harsh-Environment Drilling Rigs 2009-2018 .......................................................................................................................... 36
Figure 2 - 1: Iran Timeline vs. Oil Price ...................................................................................... 41
Figure 2 - 2: Brent/WTI 52-Week Price ...................................................................................... 42
Figure 2 - 3: Brent/WTI 52-Week Spread .................................................................................... 42
Figure 2 - 4: Brent Volatility and VIX ....................................................................................... 43
Figure 2 - 5: Global Oil Demand and Supply ............................................................................. 43
Figure 2 - 6: GDP Growth Rate [US/EU/China] ....................................................................... 44
Figure 2 - 7: US Dollar Index vs. Brent Price. ............................................................................ 44
Figure 2 - 8: Three Oil Price Scenarios ..................................................................................... 45
Figure 2 - 9: Downside Risk Scenarios ..................................................................................... 46
Figure 2 - 10: Oil Price Scenarios: Drivers and Consequences ................................................ 47
Figure 2 - 11: Gas Price Forecast ............................................................................................ 48
Figure 2 - 12: Global Gas Demand .......................................................................................... 48
Figure 2 - 13: OECD and non-OECD Gas Demand ................................................................ 49
Figure 2 - 14: Field Sanction Points by Water Depth Group ...................................................... 50
Figure 2 - 15: Average Field Sanction Point by Water Depth Group ........................................ 50
Figure 2 - 16: Production Cost Curves ...................................................................................... 51
Figure 2 - 17: Super Major Upstream Capital Expenditure (US$m) and 2012 Budgets ............... 52
Figure 2 - 18: Q2 2012 Backlogs for Technip, Subsea 7 and Saipem (*Acery Combine with Subsea7 Jan 2011). ................................................................................................................... 52
Figure 2 - 19: Number of Rigs Under Contract Globally ............................................................ 53
Figure 2 - 20: Global Rig Fleet by Operational Status ................................................................. 53
Figure 2 - 21: Major Shipyard Order Backlog vs. Oil Price ....................................................... 54
Figure 2 - 22: Oil Production Trends — Onshore vs. Offshore .................................................. 55
Figure 2 - 23: 2P Undeveloped Gas Reserves by Region .......................................................... 56
Figure 2 - 24: 2P Undeveloped Oil Reserves by Region ............................................................. 57
Figure 2 - 25: Oilfields by On-Stream Year, Reserve Size and Water Depth. ................................. 58
Figure 2 - 26: Undeveloped Deepwater Reserves by Country ................................................... 58
Figure 2 - 27: Intermediate & Harsh Environment Field Developments ..................................... 59
Figure 2 - 28: Increasing Tieback Lengths .................................................................................. 60
Figure 2 - 29: Small Field Developments ................................................................................... 60
Figure 2 - 30: Fields On-stream by Development Type ............................................................... 61
Figure 2 - 31: UKCS Oil Production by Field, 1975-2011 (million m3/year) ............................. 62
LIST OF TABLES

Table 4 - 1: Offshore Fields by OCS Area ................................................................. 99
Table 4 - 2: Offshore Alaska Federal Lease Sales 2005-2016 .............................. 101
Table 4 - 3: Canadian High-Arctic Reserves by Region ........................................ 102
Table 4 - 4: C-NLOPB Licensing Rounds 2011 and 2012 ................................. 104
Table 4 - 5: Offshore Greenland Exploration Licences ........................................ 106
Table 4 - 6: NCS Undiscovered Offshore Resources .............................................. 108
Table 4 - 7: Barents Sea Licensing Rounds 2006-2012 .................................... 109
Table 4 - 8: Rosneft’s Offshore Arctic Exploration Agreements ....................... 111
Table 5 - 1: Fixed Platform Capex (US$m) by Country 2009-2013 ..................... 124
Table 5 - 2: Fixed Platform Capex (US$m) by Country 2014-2018 ..................... 124
Table 5 - 3: Floating Production Systems Capex (US$m) by Country 2009-2013 .... 126
Table 5 - 4: Floating Production System Capex (US$m) by Country 2014-2018 .... 126
Table 5 - 5: Pipeline Capex (US$m) by Country 2009-2013 ............................... 128
Table 5 - 6: Pipeline Capex (US$m) by Country 2014-2018 .................................. 128
Table 5 - 7: Pipeline Length (km) Installed by Country 2009-2013 .................... 129
Table 5 - 8: Pipeline Length (km) Installed by Country 2014-2018 .................... 129
Table 5 - 9: Pipeline Capex (US$m) by Country 2009-2013 ............................... 130
Table 5 - 10: Pipeline Capex (US$m) by Country 2014-2018 ............................. 130
Table 5 - 11: Pipeline Length (km) Installed by Country 2009-2013 ................... 131
Table 5 - 12: Pipeline Length (km) Installed by Country 2014-2018 ................... 131
Table 5 - 13: Pipeline Length (km) by Market Segment 2009-2013 .................. 133
Table 5 - 14: Pipeline Length (km) by Market Segment 2014-2018 .................. 133
Table 5 - 15: Pipeline Capex (US$m) by Market Segment 2009-2013 ............... 133
Table 5 - 16: Pipeline Capex (US$m) by Market Segment 2014-2018 ............... 133
Table 5 - 17: Control Line Length (km) by Country 2009-2013 ......................... 134
Table 5 - 18: Control Line Length (km) by Country 2013-2017 ......................... 134
Table 5 - 19: Control Line Capex (US$m) by Country 2009-2013 ....................... 135
Table 5 - 20: Control Line Capex (US$m) by Country 2014-2018 ....................... 135
Table 5 - 21: Control Line Capex (US$m) by Type 2009-2013 ......................... 135
Table 5 - 22: Control Line Capex (US$m) by Type 2014-2018 .......................... 135
Table 5 - 23: Subsea Capex (US$m) by Country 2009-2013 .............................. 136
Table 5 - 24: Subsea Capex (US$m) by Country 2014-2018 .............................. 136
Table 5 - 25: Drilling & Completion Capex (US$m) by Country 2009-2013 ......... 138
Table 5 - 26: Drilling & Completion Capex (US$m) by Country 2014-2018 ......... 138
Table 5 - 27: Number of Subsea Trees by Water Depth (m) 2009-2013 .......... 139
Table 5 - 28: Number of Subsea Trees by Water Depth (m) 2014-2018 .......... 139
Table 5 - 29: Subsea Equipment Capex (US$m) by Type 2009-2013 ................. 140
Table 5 - 30: Subsea Equipment Capex (US$m) by Type 2014-2018 ................. 140
Table 5 - 31: Subsea Tree Awards by Manufacturer 2009-2013 ................................................................. 141
Table 5 - 32: Subsea Tree Awards by Manufacturer 2014-2016 ................................................................. 141
Table 5 - 33: Operators by Capex (US$m) 2009-2013 ............................................................................. 143
Table 5 - 34: Operators by Capex (US$m) 2014-2018 ............................................................................. 143
Table 5 - 35: Arctic Vessel Demand (Days) by Country 2009-2013 ......................................................... 144
Table 5 - 36: Arctic Vessel Demand (Days) by Country 2014-2018 ......................................................... 144
Table 6 - 1: Requirements for Vessels Operating in the Arctic ................................................................. 147
Table 6 - 2: IACS Unified Requirements for Polar Ships ......................................................................... 148
Table 6 - 3: IACS Polar Classification and DNV ice class equivalents .................................................... 148
Table 6 - 4: High Ice-Class Vessel Operators .......................................................................................... 152
Table 7 - 1: Arctic-Capable Offshore Drilling Rigs .................................................................................. 162
Table 7 - 2: Ice Alert Levels and Procedures ......................................................................................... 163
Table 7 - 3: Royal Dutch Shell Alaskan Exploration Campaign OSVs by Function ................................ 165
Table 7 - 4: Arctic-capable LNG Carriers ................................................................................................. 166