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The Outlook for the Global LPG Market

International LP Gas Seminar 2013

Ken Otto
February 28, 2012
Dai-Ichi Hotel
Tokyo, Japan

Global LPG/Energy Market Highlights



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- Many important issues exist in the global economy:
 - Euro-zone debt crisis
 - High unemployment levels in several regions
 - Currency issues/trade imbalances
 - Commodity price volatility
 - Political instability
 - Others
- Global oil & gas demand is rising—this is leading to higher LPG production.
- High LPG prices continue to exert pressure on several important LPG market sectors (incl. res/com) in Asia and in other world markets.
- Shale gas & shale oil development in North America continues to proceed at a fast pace—ethane & propane supply is rising fairly rapidly.
- Interest in new oil, gas & NGL supplies from unconventional resources continues to gain momentum around the world.



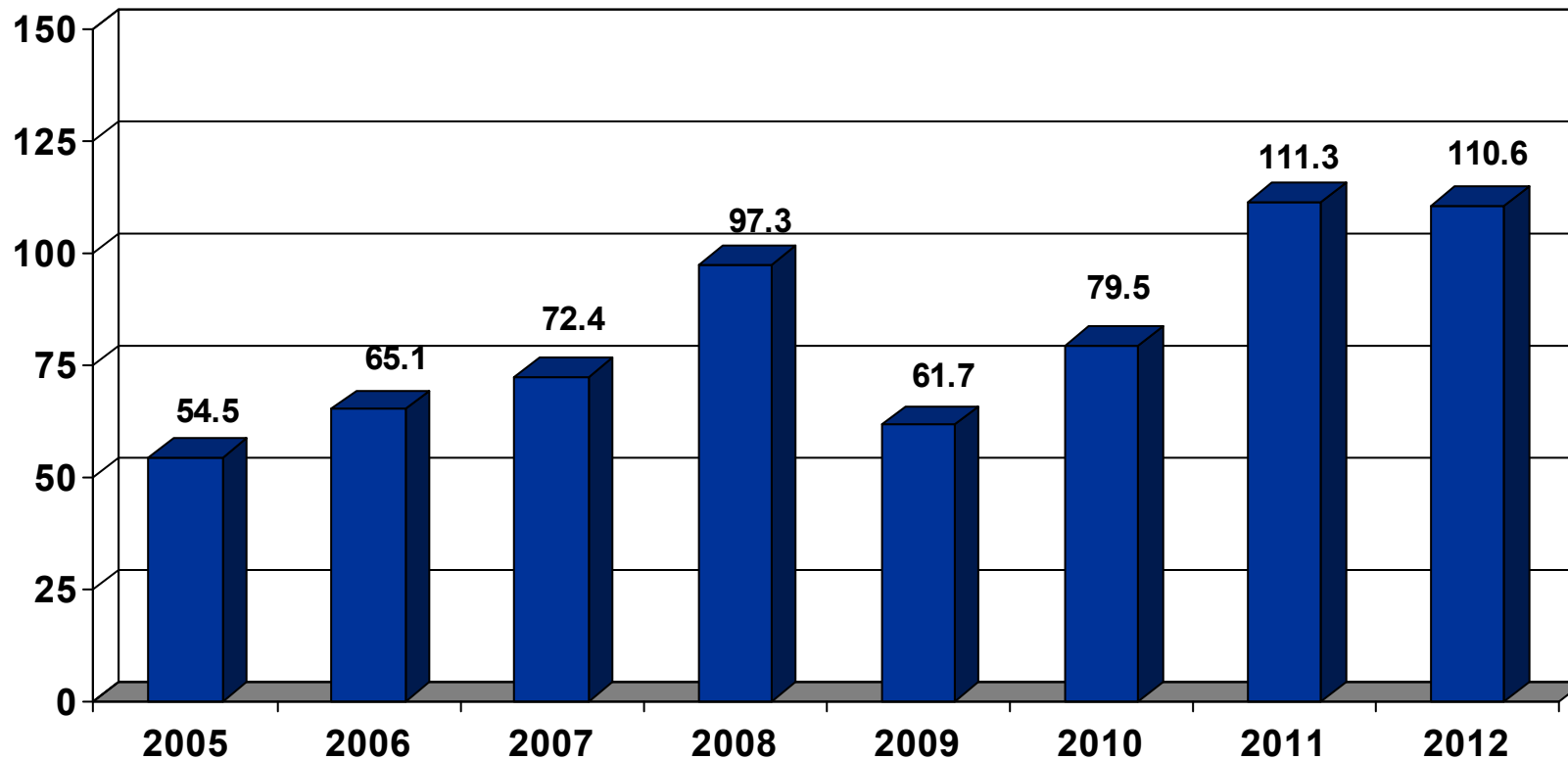
Crude Oil Prices Remain Strong In Spite of the Weak Global Economic Activity



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Spot Brent Crude Oil Pricing, US\$ per Barrel



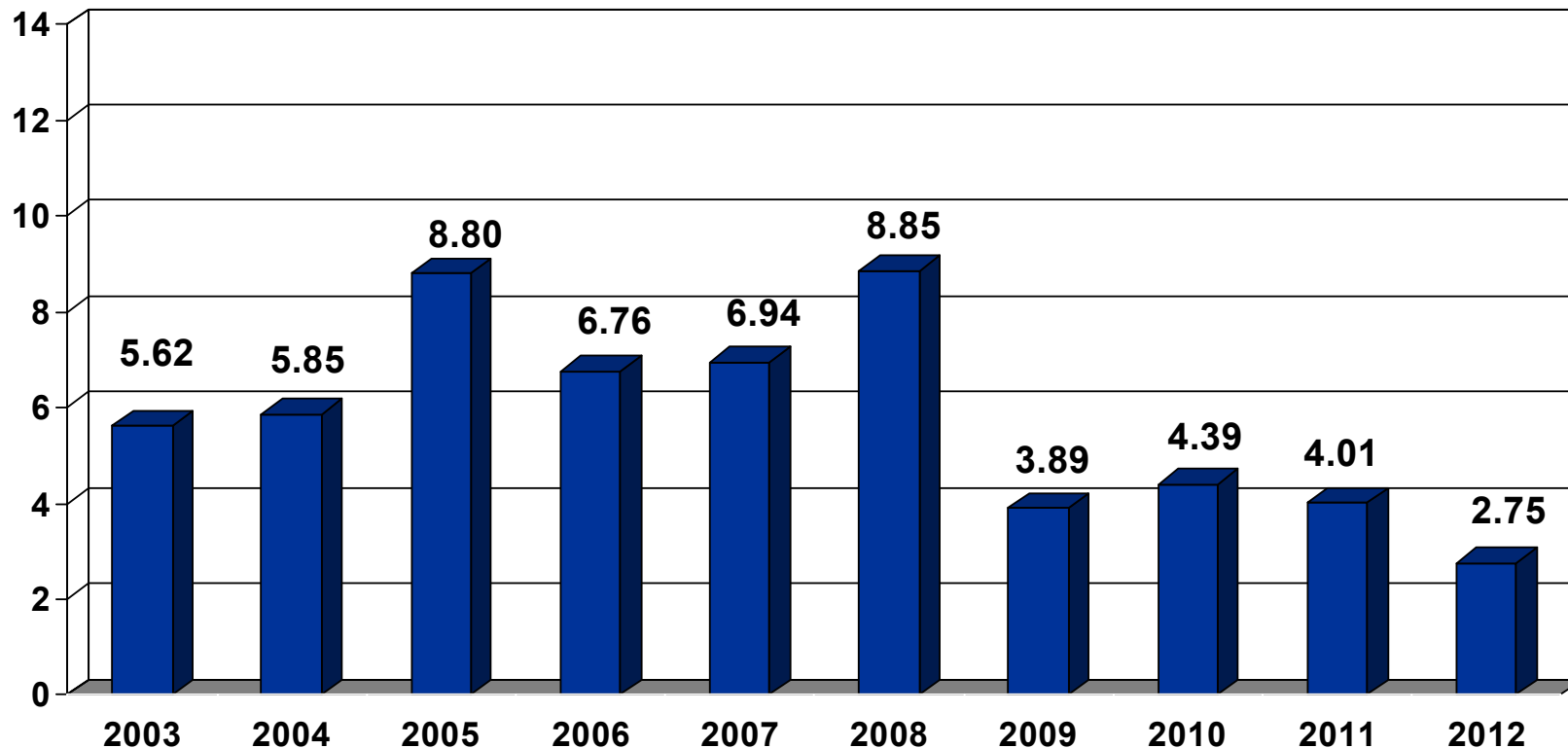
Natural Gas Prices Remain Weak in the U.S. and Reached Very Low Levels in 2012



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Spot Henry Hub Price (USA), US\$ per Million BTU



Global LPG Supply Growth is Linked to Changes in the International Oil & Gas Industry



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- LPG (Propane & Butane) is a BYPRODUCT—It is not an “on-purpose” product like crude oil or petrochemicals.
- Thus, the LPG industry is LARGELY SUPPLY-DRIVEN, that is increases in supply will stimulate development of new markets for LPG.
- The growth rate of LPG supply depends on developments in segments of the oil & gas industry—LPG is produced from:
 - Processing of associated gas (from crude oil wells)
 - Processing of non-associated gas (from gas wells)
 - Refining
- Changes in these industries will directly influence the availability of LPG supply.



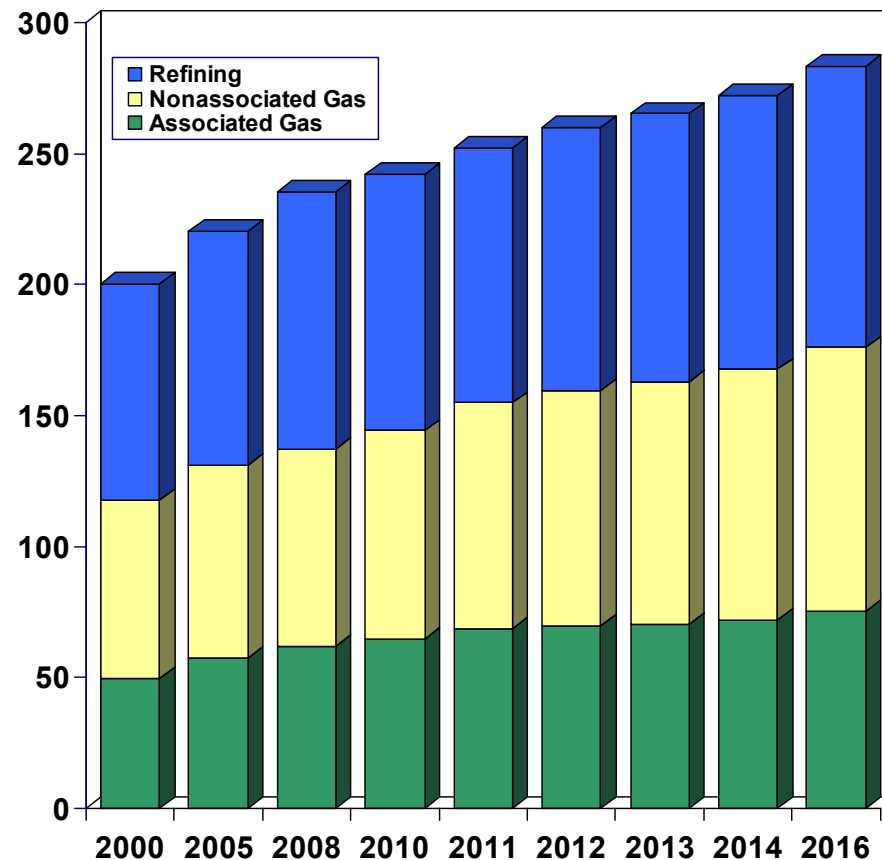
Global LPG Supply Continues to Rise—Led by Growth in LPG Production from Natural Gas



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World LPG Supply by Source, Million Tonnes



- LPG extracted from associated gas should rise by about 5.5 million tonnes/yr through 2016 (1.9%/yr) as crude oil production rates rise.
- Production from processing of non-associated gas is the fastest growing source of LPG supply
 - Should increase by about 11 million tonnes/yr by 2016 (3.0%/yr).
- Refinery expansions are also contributing to higher LPG production but at a slower growth rate
 - Expected to rise by around 6.8 million tonnes/yr through 2016 (1.7%/yr.).

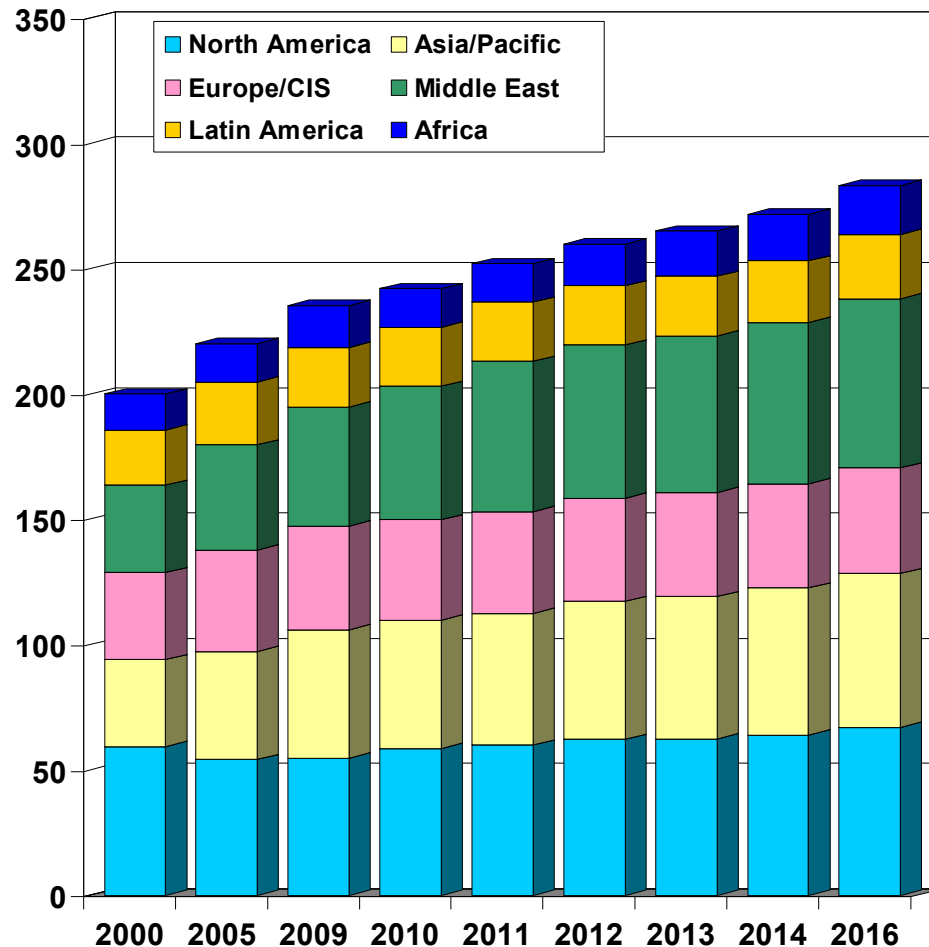
LPG Supply Is Expanding in Most Regions—Led by the Middle East, Asia & North America



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LPG Supply, Million Tonnes



- Global LPG production has generally been expanding since 2000—with year to year variation in the growth rate.
- Global LPG production declined in 2009 and grew fairly slowly in 2010—but is growing faster now.
- Total growth in global LPG supply by 2016 is projected to be about 28 million tonnes/yr.
- Strong growth is anticipated in the Middle East and Asia
- Supply is also expanding rapidly in the U.S.—due to shale gas development.

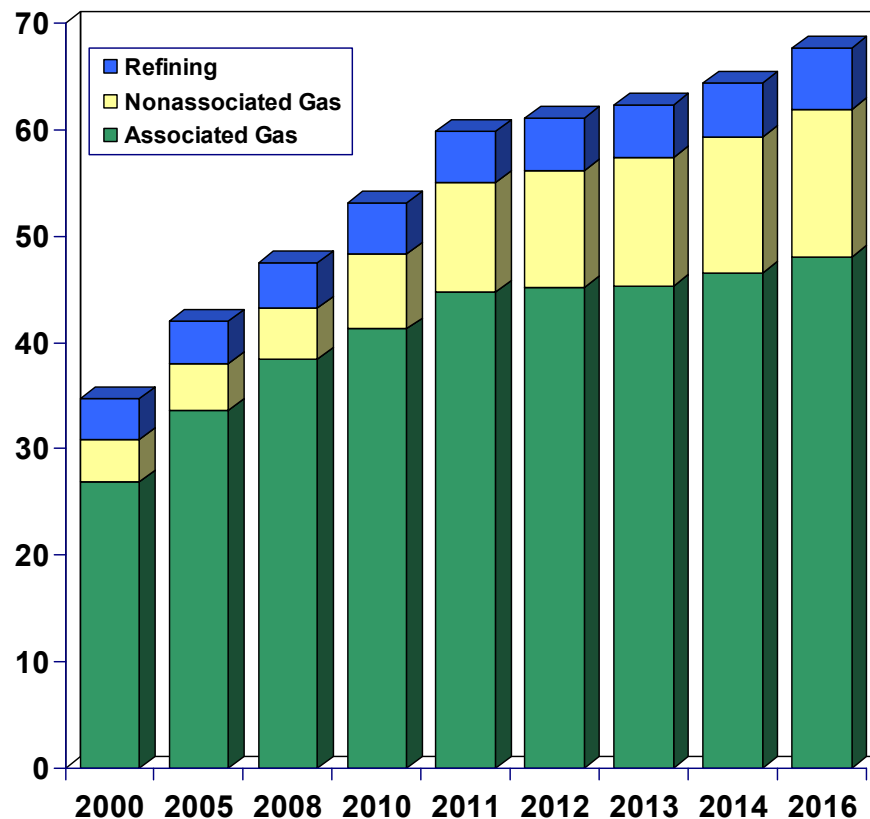
Middle East LPG Supply will Continue to Expand in the Future



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Mideast LPG Supply by Source, Million Tonnes



- Middle East LPG production generally expanded between 2000 and 2008.
- However, production was curtailed in 2009 due to cuts in crude oil production.
- Most of the LPG production in the Middle East is linked to oil.
- However, gas (non-associated gas) is now a key driver of LPG production in the region—accounting for over 50% of the supply growth since 2009.
- Regional growth in LPG production will average around 2.6%/year through 2016.

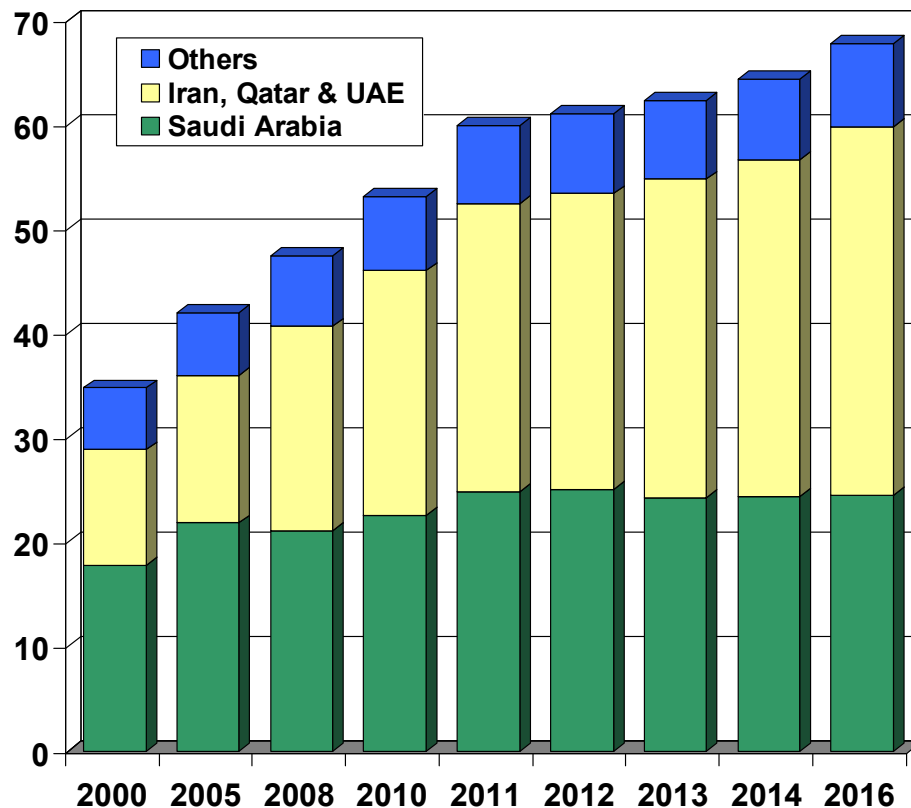
Most of the Increase in Middle Eastern LPG Production Will Come from Iran, Qatar & the UAE



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Mideast LPG Supply, Million Tonnes



- Total Middle East LPG production has increased around 13 million tonnes since 2008 (Growth of over 28%).
- Most of this increase has occurred in Qatar and the UAE.
- In the future, LPG supplies should expand the most in the UAE, Iran and Qatar.
- Of course, Iranian production could be significantly impacted by future geopolitical developments.
- LPG production will probably rise fairly slowly in Saudi Arabia—unless crude rates are higher than expected.

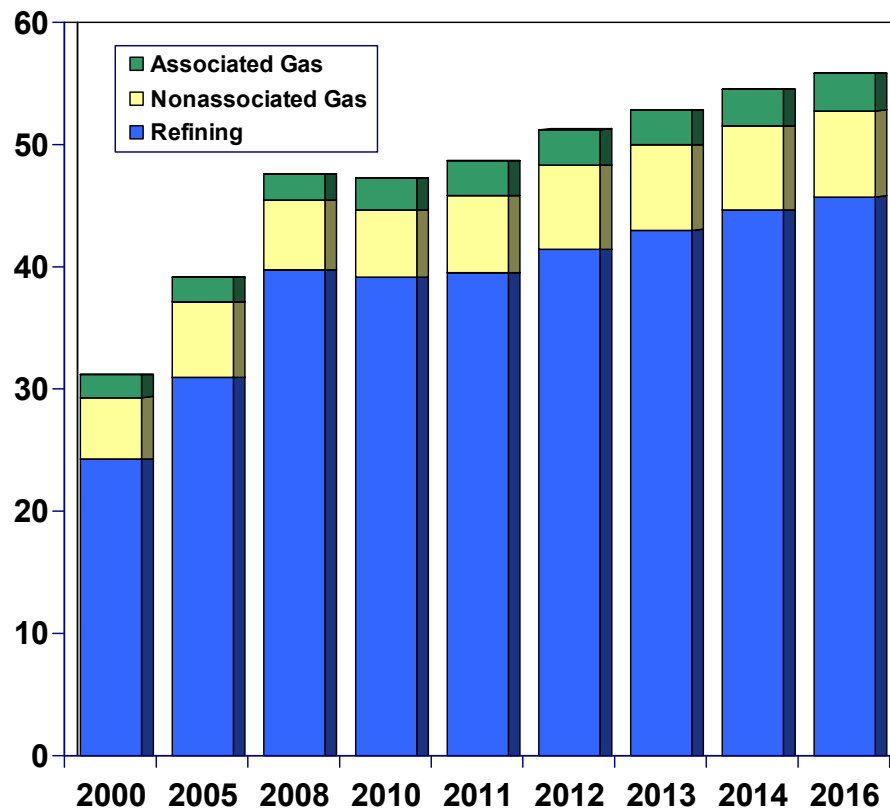
Asia LPG Supply Continues to Expand Due to Strong Economic Growth



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Asia LPG Supply by Source, Million Tonnes



- Refining is the largest source of LPG production in Asia—accounting for over 80% of total regional production.
- Natural gas production is limited in Asia—only a relatively small quantity of LPG is sourced from gas processing in the region.
- Significant refinery expansions have occurred since 2000 to meet rising demand for transportation fuels—gasoline and distillates.
- Refinery expansions will continue to be needed—this will lead to growth in regional LPG production.
- Regional supplies are expected to grow by about 5 million tonnes/yr by 2016.

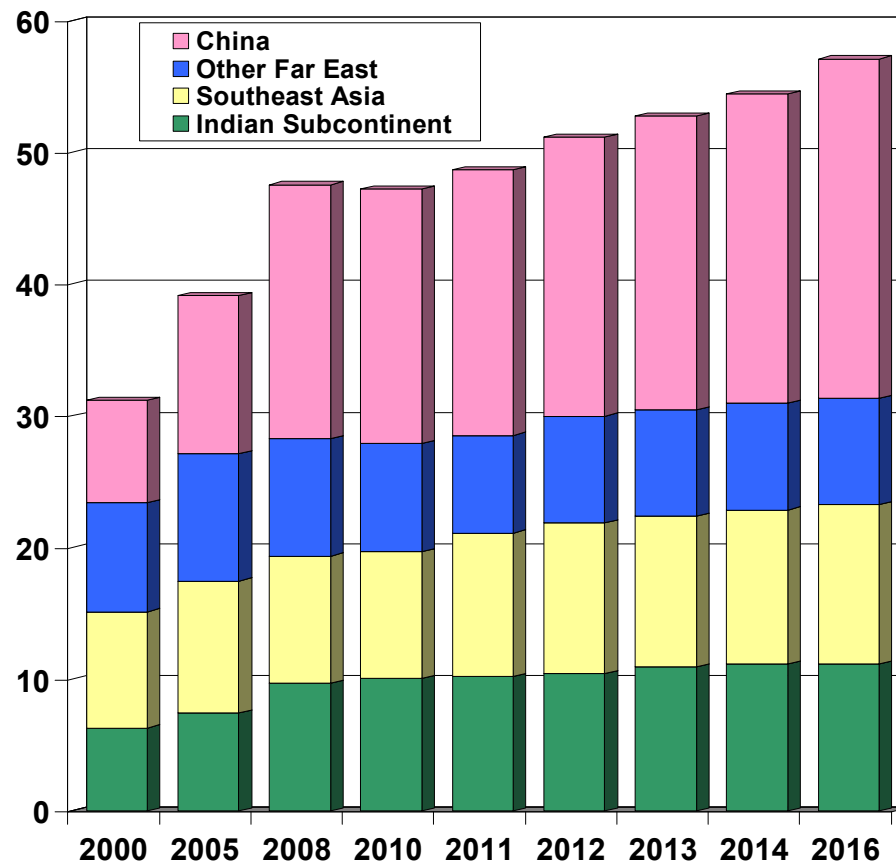
Asia LPG Supply Is Expanding Rapidly—Led by Growth in China



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Asia LPG Supply, Million Tonnes



- Regional LPG production has expanded by 20 million tonnes/yr (4.2 %/yr) since 2000.
- China has accounted for around 67% of the total growth in Asia.
- China will continue to expand faster than most countries in the region.
- LPG production will continue to expand in the region—rate will depend on economic growth & need for additional refinery expansions.
- In spite of this supply growth, Asia will remain a large net importer of LPG—due to strong demand.

There Are Numerous Shale Gas and Tight Oil Plays in the U.S.—Leading to a Rapid Rise in Gas & NGL Supply



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Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.
Updated: May 9, 2011

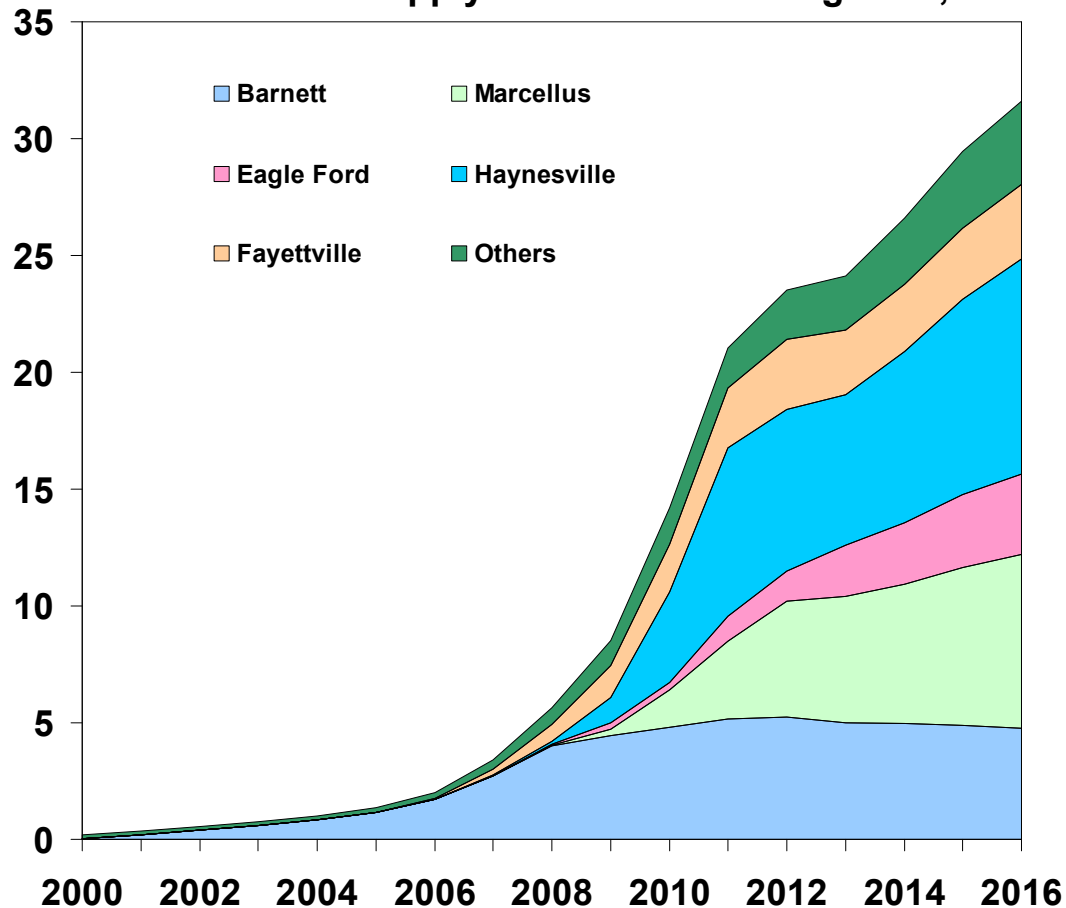
The Development of Shale Gas and Tight Oil Is Having a Dramatic Impact on the U.S., Natural Gas Market



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U.S. Natural Gas Supply from Shale Gas/Tight Oil, BCF/D



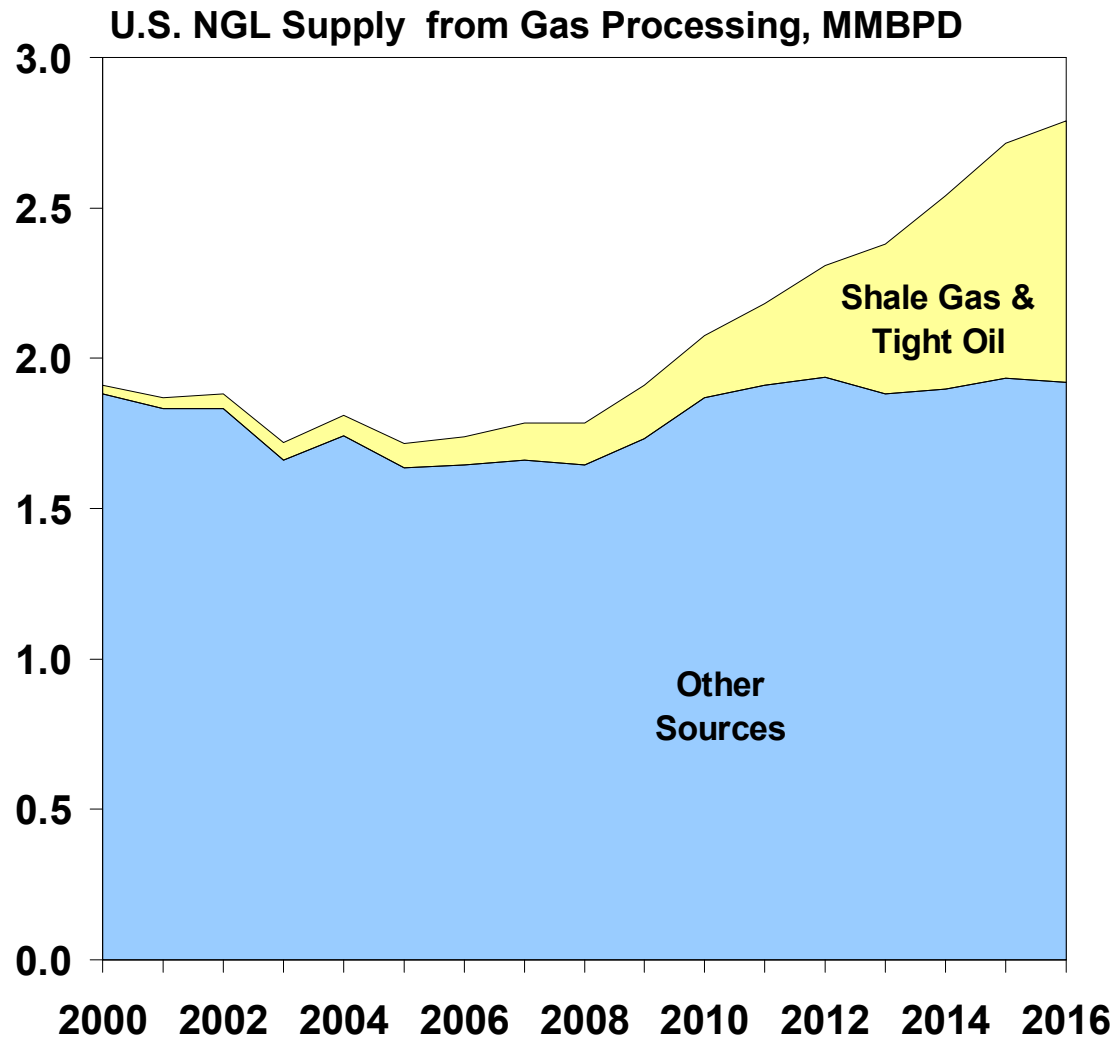
- Shale gas and associated gas from tight oil has significantly altered the U.S. natural gas market.
- These supplies are already a major portion of overall U.S. gas supply and production is climbing rapidly.
- The U.S. has gone from “gas-short” to a “gas-long” position and plans for LNG exports are well underway.
- This shift in market fundamentals has huge implications for natural gas liquids (NGLs) markets—including LPG.

U.S. NGL Supply Will Continue to Expand as More Shale Gas and Tight Oil Is Developed



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- Currently, NGL production from shale gas and tight oil fields represents around 24% of total U.S. supply.
- Note that NGL includes ethane, propane, butane and natural gasoline.
- Most of the future growth in NGL supply is tied to continued development of shale gas and tight oil fields.
- The significant increase in ethane production is driving a wave of new olefin plants.
- Increased propane supplies will support new PDH capacity and increased exports.

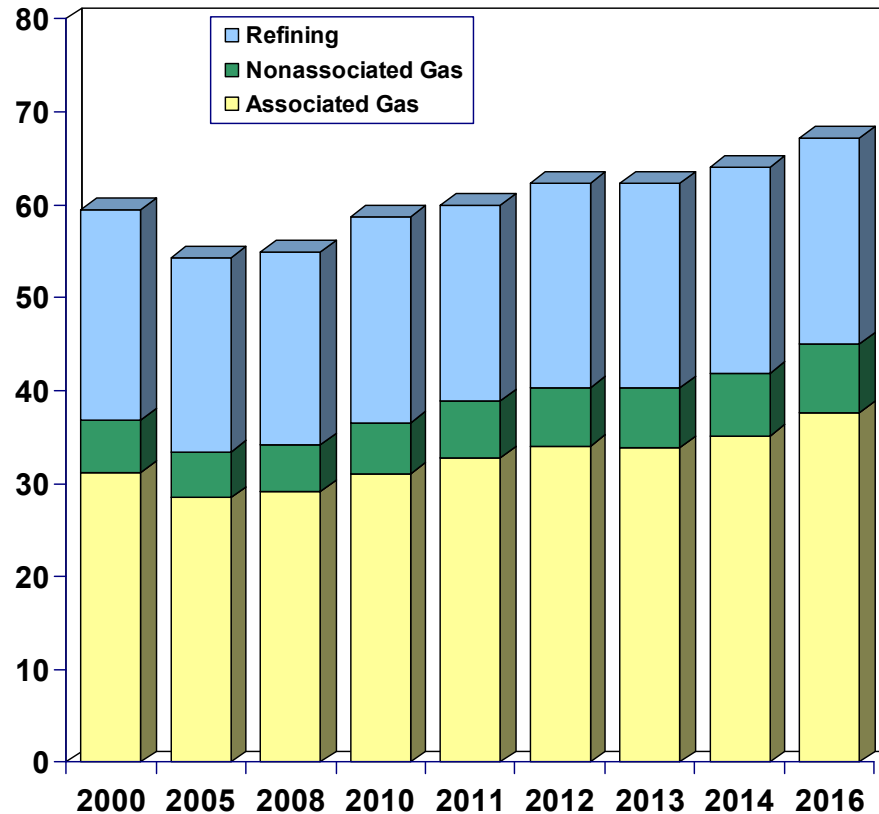
LPG Supply in North America is Ramping Up Due to the Surge in Shale Gas Production



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North America LPG Supply by Source, Million Tonnes



- LPG production was in decline in North America until 2005/2006.
- Production has already increased by around 7 million tonnes/yr since 2008.
- Another 5-6 million tonnes/yr of additional supply are expected by 2015.
- Shale gas is providing a new source LPG supply for domestic markets and exports.
- LPG markets are not growing very fast—so exports are rising rapidly.

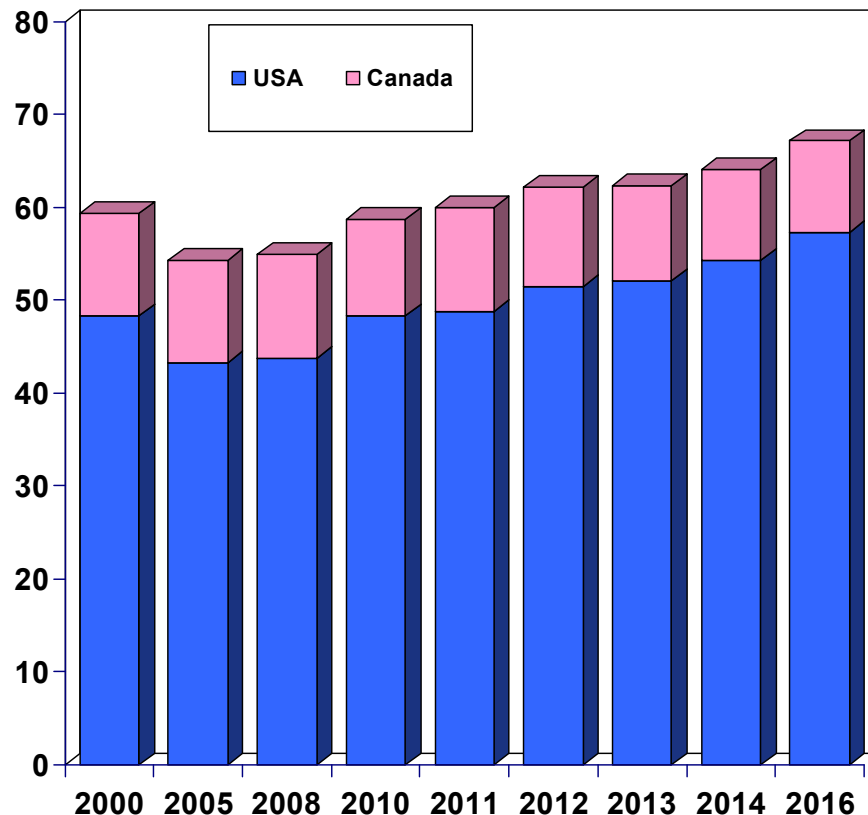
Production is Rising Quickly in the U.S.—And Gradually Declining in Canada



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North America LPG Supply, Million Tonnes



- U.S. LPG production has increased by around 7.7 million tonnes/yr (18%) since 2008.
- U.S. LPG production will continue to rise in the future as more shale gas and tight oil is developed.
- Canadian LPG production is slowly declining in short term.
- Over the longer term, Canadian LPG production will start to rise as unconventional oil and gas development increases.

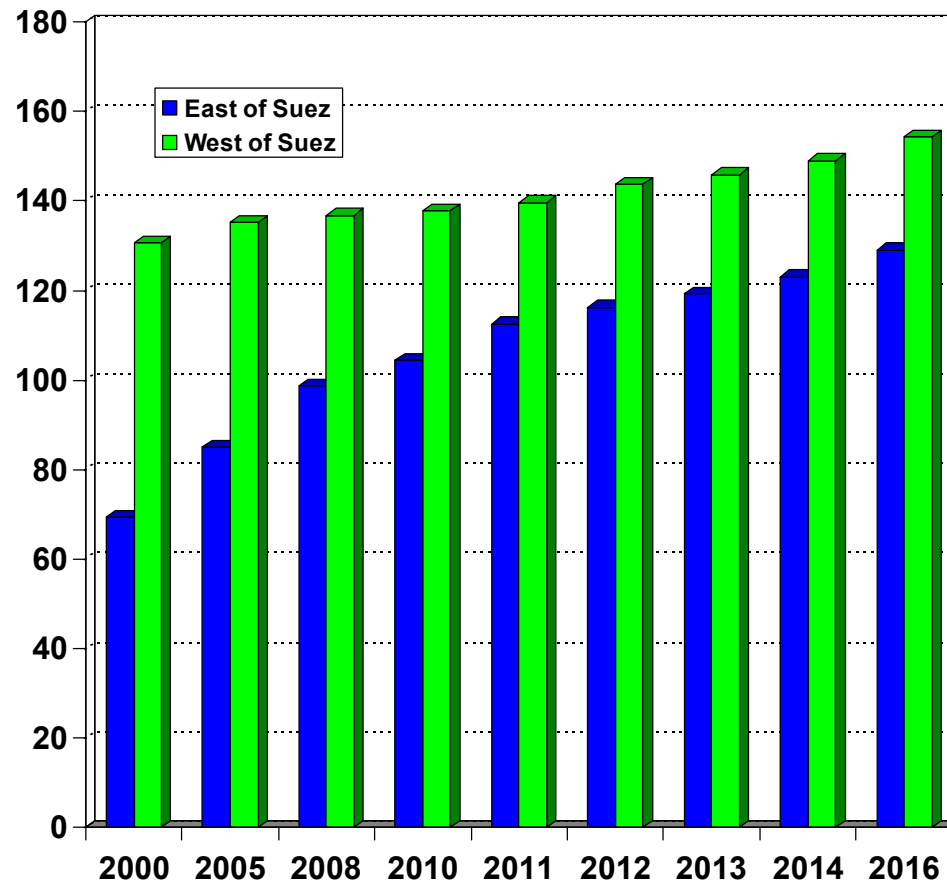
The Expansion of Global LPG Supplies is Primarily Occurring in the East of Suez Region



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LPG Supply, Million Tonnes



- LPG supply continues to expand rapidly in the East of Suez region.
 - Middle East, Asia
- However, LPG supply is expanding in the West of Suez region again.
 - U.S. (shale gas), CIS, Africa
- This is important with the U.S. becoming a new source of supply for Asian LPG markets.
- Global LPG trade patterns may shift significantly in the future.

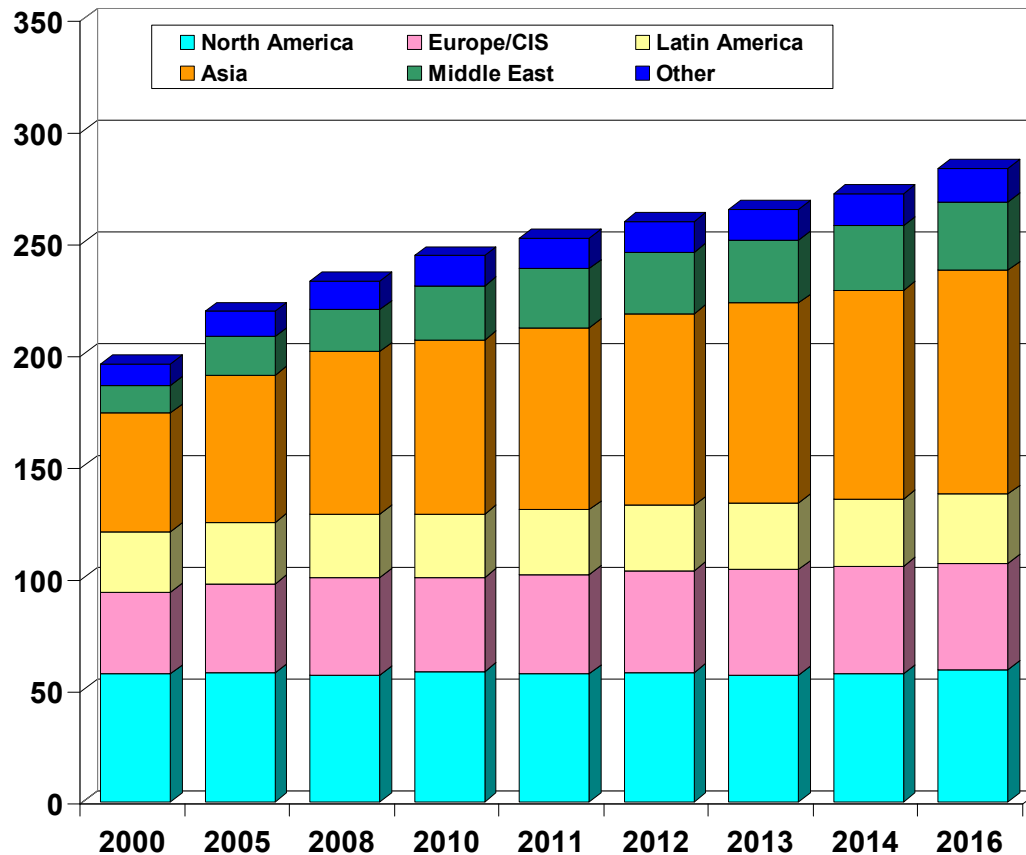
Asia and the Middle East Are the Strongest Growth Markets for LPG



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LPG Demand, Million Tonnes



- Demand growth in Asia and the Middle East has accounted for around 75% of global LPG demand growth since 2005.
- Asia is already the largest LPG consuming region and demand will continue to expand in the region.
- The Middle East has become a significant LPG consumer due partly to the rapid expansion of the petrochemical industry.

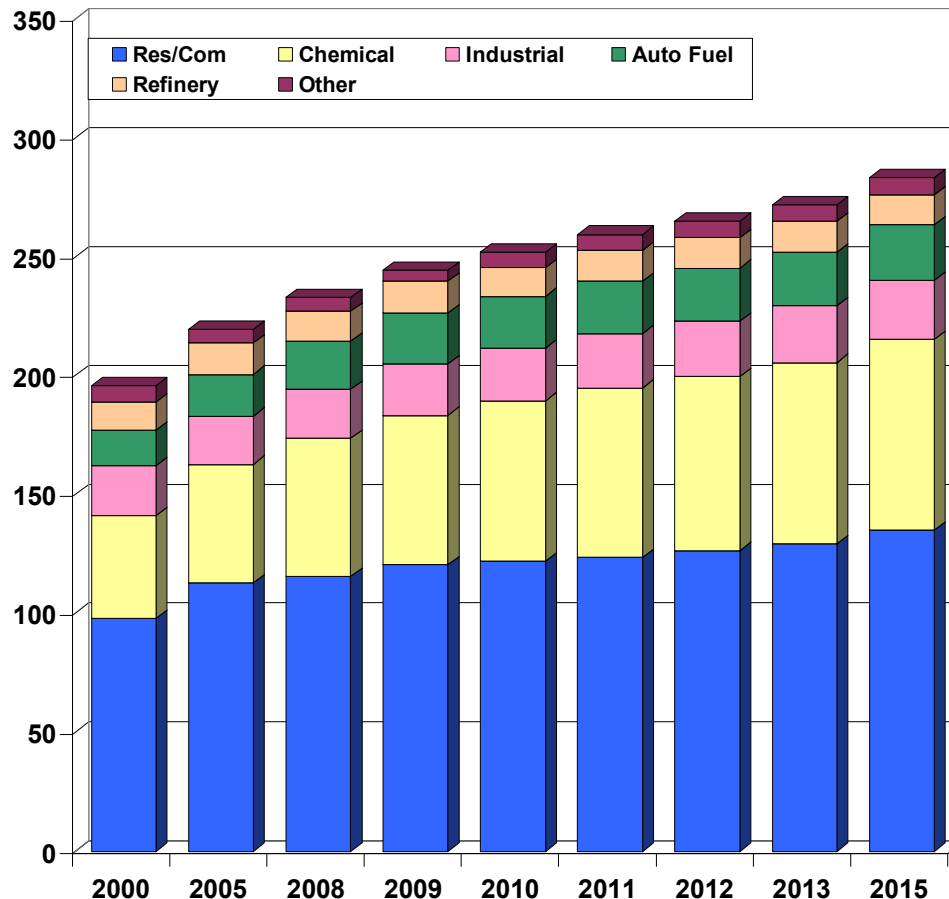
The Residential/Commercial and Chemical Sectors are the Largest End-Use Markets for LPG



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World LPG Demand, Million Tonnes



- The residential/commercial and chemical sectors represent around 75% of total global LPG consumption.
- High consumer prices & weak economic conditions have slowed growth in the res/com sector in some regions.
- Growth in LPG consumption in the chemical sector is expanding faster than most end-use markets.
- Chemical industry serves to re-balance the overall LPG market by consuming LPG as a price sensitive olefin plant feedstock.

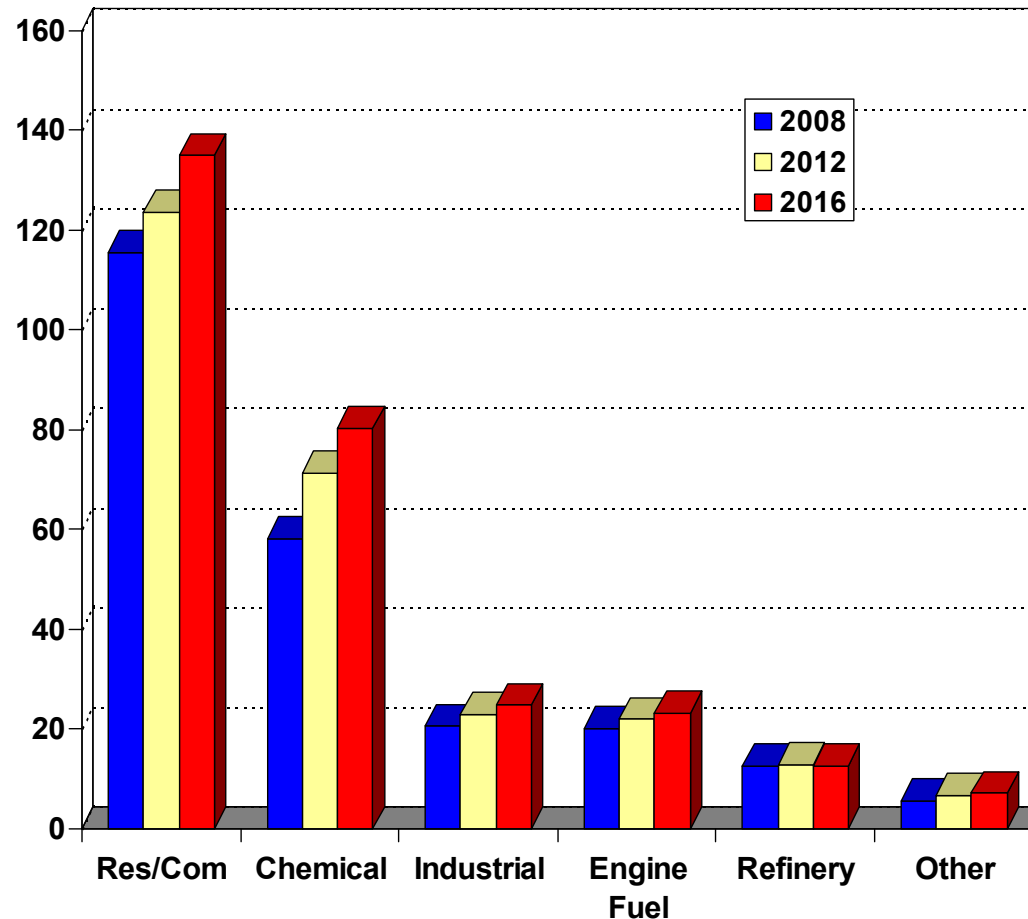
Demand Growth in the Res/Com & Chemical Sectors will Have a Large Impact on Future LPG Markets



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LPG Demand by End-use, Million Tonnes



- Over 85% of total LPG demand growth through 2016 is expected to occur in just two end-use sectors—the res/com and chemical markets.
- Only modest growth is expected in the other end-use markets for LPG.
- Thus, changes in the res/com and chemical markets may have a dramatic impact on LPG trade flows and regional prices.

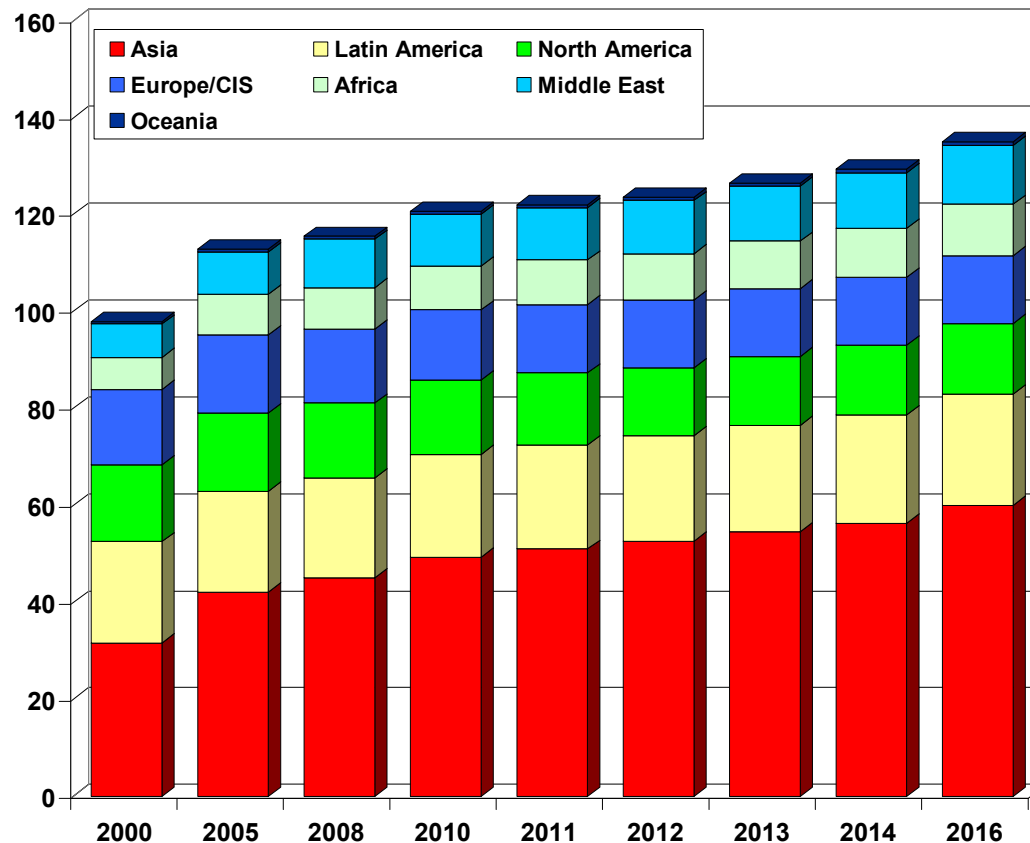
Utilization of LPG as Fuel in the Res/Com Market will Continue to Expand in Developing Economies



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Residential & Commercial LPG Demand, Million Tonnes



- Most regions will continue to experience demand growth in the res/com market sector.
- The majority of the growth will occur in developing economies in Asia and other locations.
- Growth has slowed in some countries, but not in all locations.
- Some countries are insulated from market forces with subsidies and consumers have not been impacted as much by high LPG prices.

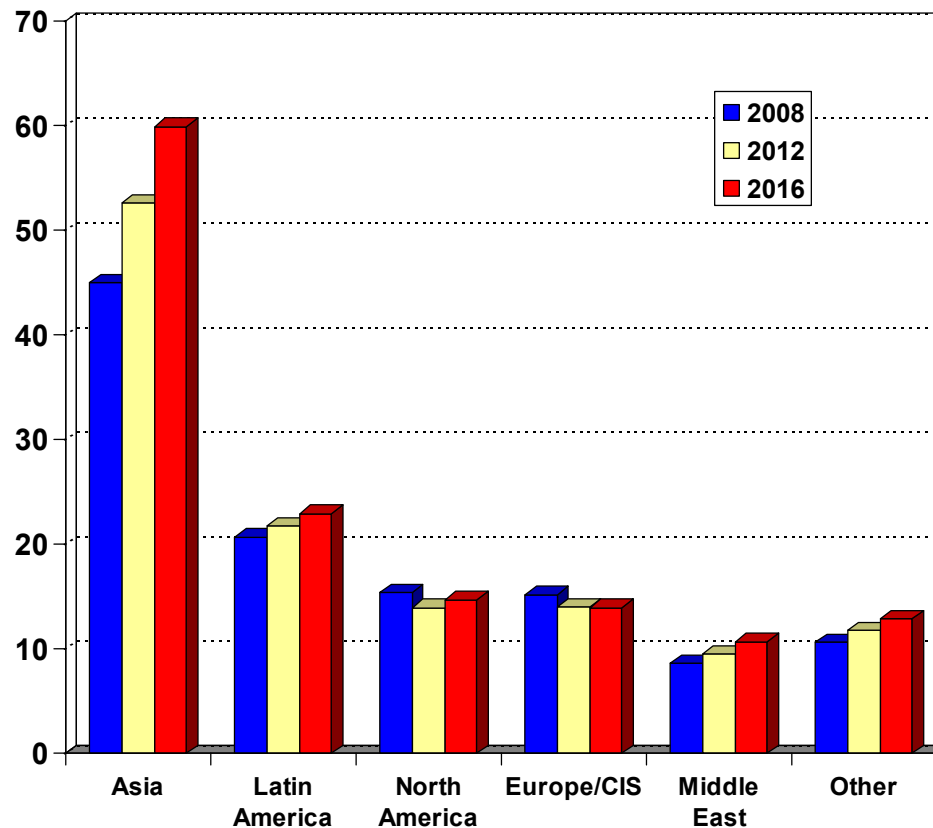
Asia will Continue to Lead the Global Expansion of Res/Com Demand for LPG



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Residential & Commercial LPG Demand, Million Tonnes



- Asia is clearly the largest user of LPG for residential & commercial applications—accounting for 43% of global res/com LPG consumption.
- Between 2012 and 2016, Asian res/com demand is projected to expand by about 7.3 million tonnes per year.
- This is around 65% of total worldwide LPG demand growth in this sector.
- Latin America is the second largest consuming region in this sector.
- The Middle East market is growing fairly fast.

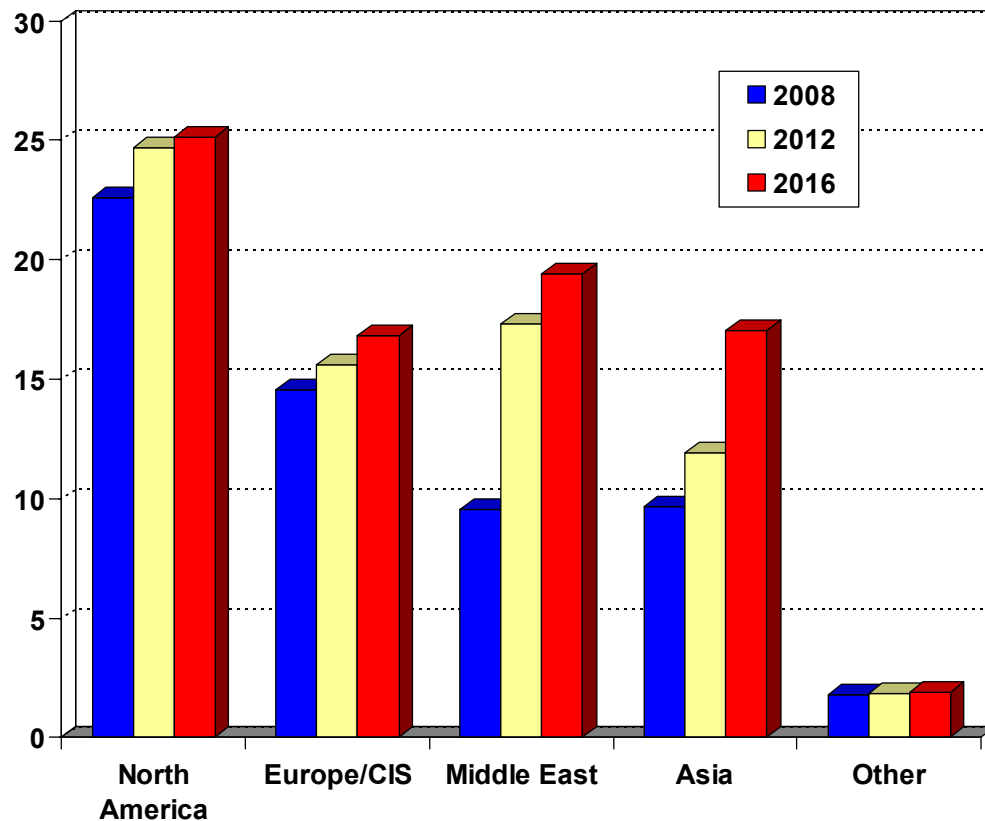
LPG Consumption as Chemical Feedstock is Expanding Rapidly in the Middle East



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Chemical LPG Demand, Million Tonnes



- Worldwide chemical consumption of LPG is expected to increase by about 9 million tonnes/yr from 2012 to 2016.
- LPG use in the chemical industry is expected to expand fast in the Middle East and Asia.
- Demand growth is also expected to occur in Europe and North America if global/regional supplies expand as much as expected.

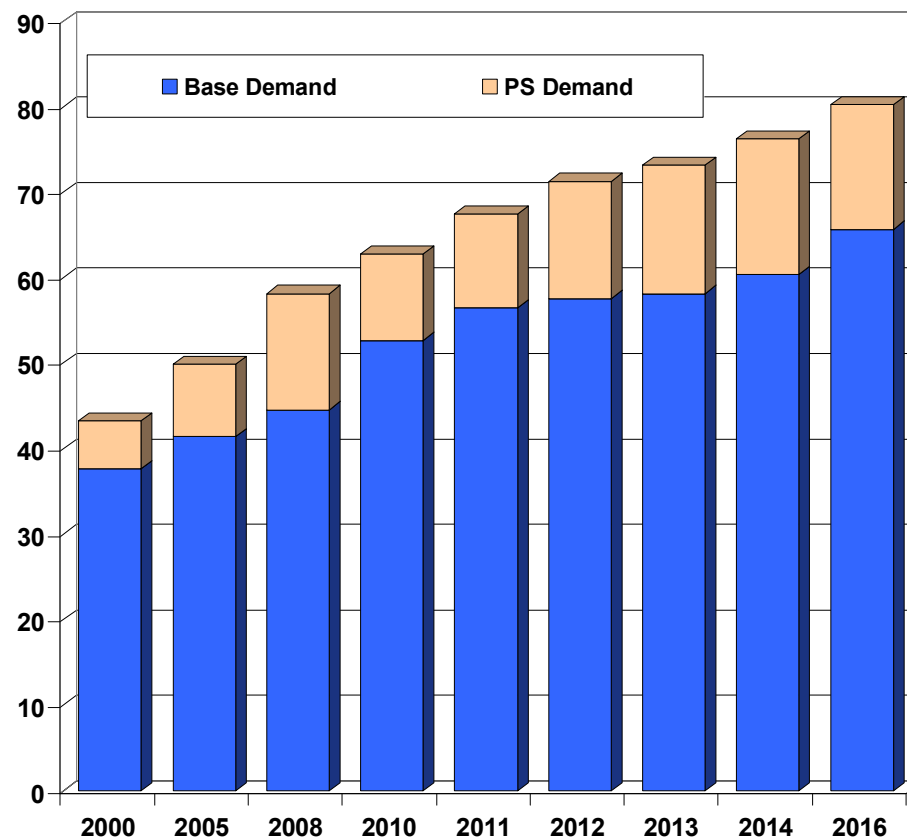
Global Consumption of LPG as Chemical Feedstock Should Increase Fairly Rapidly



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Chemical LPG Demand, Million Tonnes



- The quantity of LPG supply available for chemical feedstock markets is expected to expand fairly quickly.
- Thus, LPG consumption as chemical feedstock will rise by about 9 million tonnes/yr by 2016.
- Base demand is rising with increased consumption in the Middle East.
- Increased use of propane as propane dehydrogenation (PDH) feedstock to produce propylene is also rising.
- Price sensitive demand should increase in Europe and Asia.

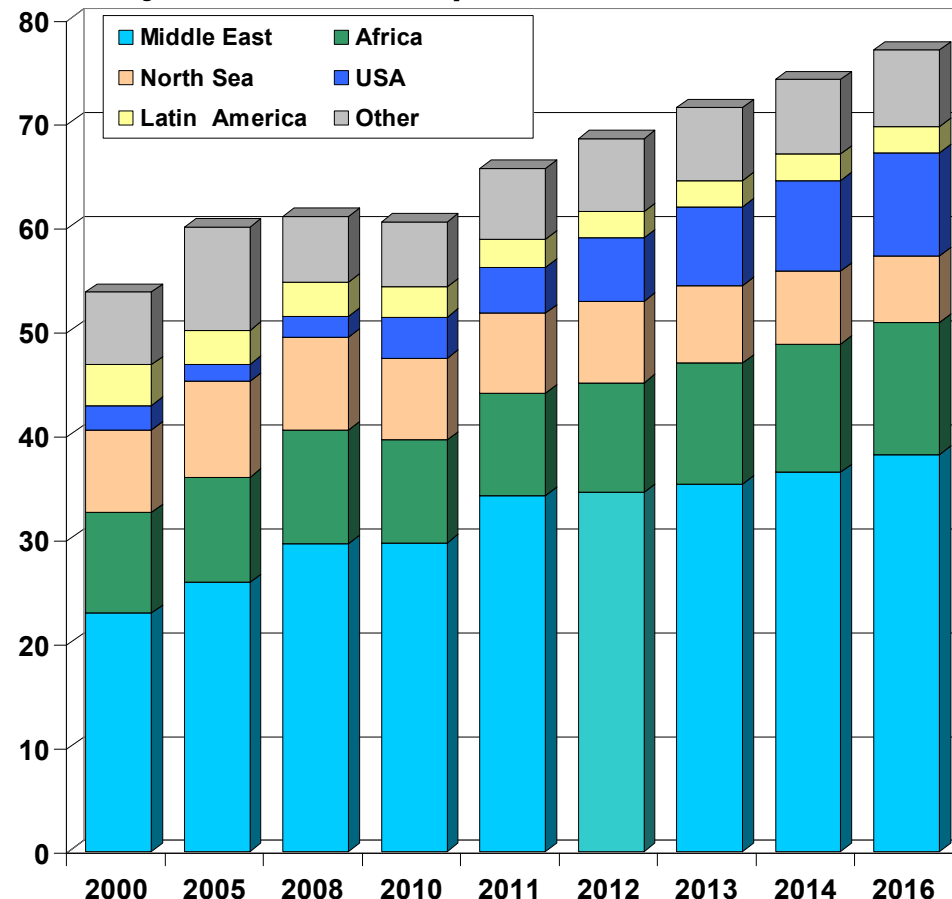
Global LPG Exports Are Expected to Continue to Build Over the Next Few Years



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Major World LPG Exports, Million Tonnes



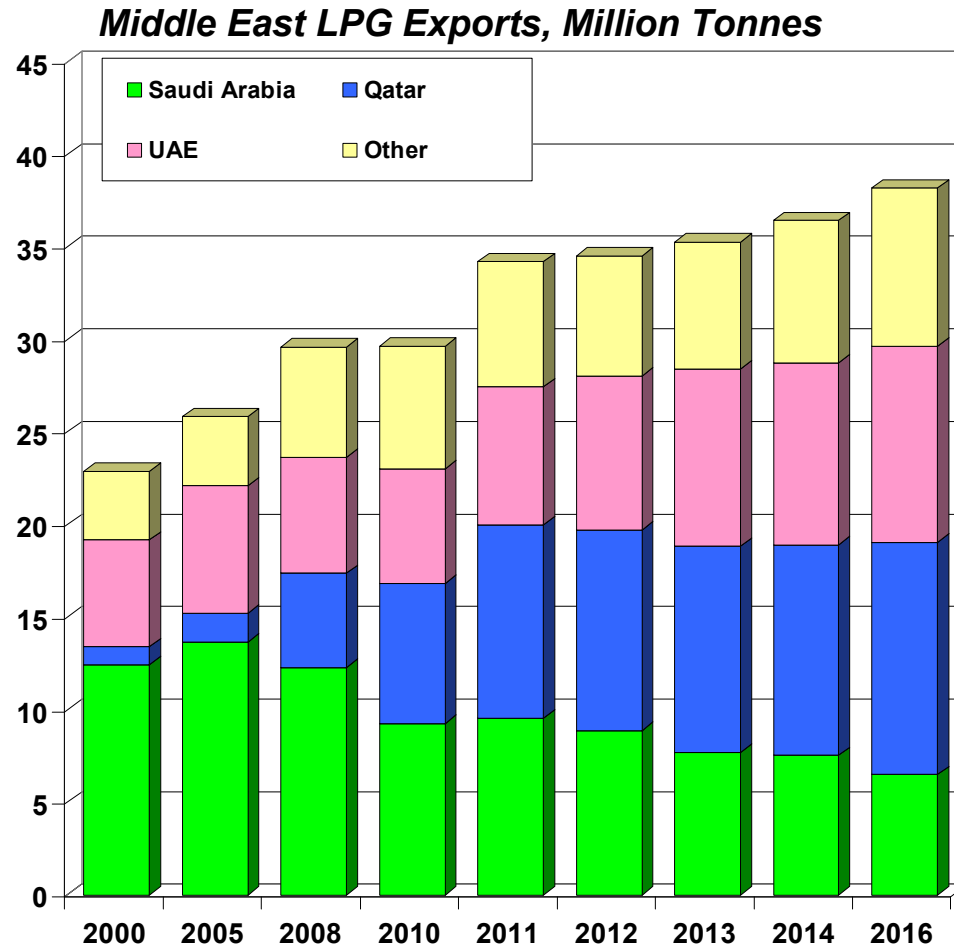
- Global LPG exports ramped up between 2002 and 2008—then declined in 2009 as supplies contracted.
- The Middle East will continue to have the largest impact on global LPG trade—exports should continue to expand.
- African LPG exports are expected to increase—but slowly.
- U.S. exports should continue to expand.
- Overall, global LPG exports are expected to rise around 8 to 9 million tonnes per year by 2016.

Middle East LPG Exports Will Gradually Rise Over the Next Four Years



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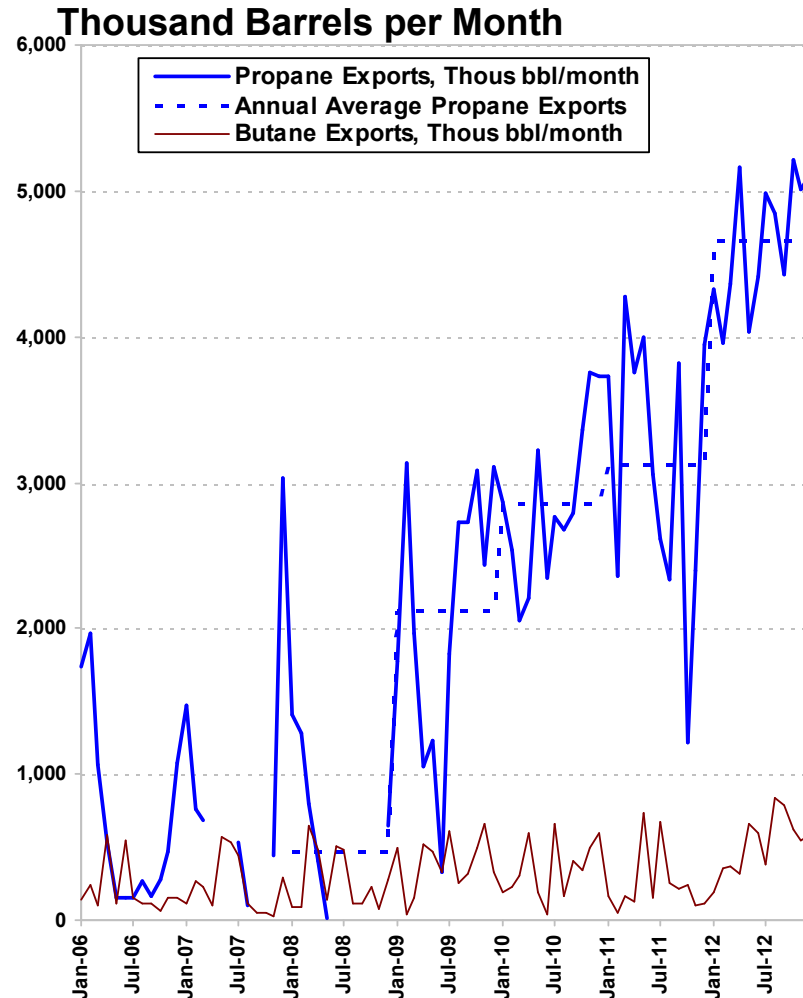
- Middle East exports expanded sharply after the drop in 2009. Exports rose by about 5 million tonnes/yr over this period.
- Exports will continue to rise-but only gradually.
- Saudi Arabian exports will likely decline due to higher use of LPG in the Kingdom.
- Most of the expansion in Qatari exports has already occurred.
- Iranian exports are being impacted by international sanctions.
- UAE exports will continue to rise in the future.

Waterborne Exports of **Propane** from the U.S. Have Significantly Expanded



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- Annual exports of propane totaled only 5.5 to 7.0 million (MM) BBL barrels (0.4-.6 MM Tonnes/yr) in 2007/08.
- Propane exports soared to 37 MM barrels (3.0 MM tonnes) in 2011 and 56 MM barrels (4.5 MM tonnes) in 2012.
- The driver behind this sharp jump has been rising U.S. production and low propane prices relative to the rest of the world.
- Exports are expected to continue to rise & several new export terminal projects have been announced.

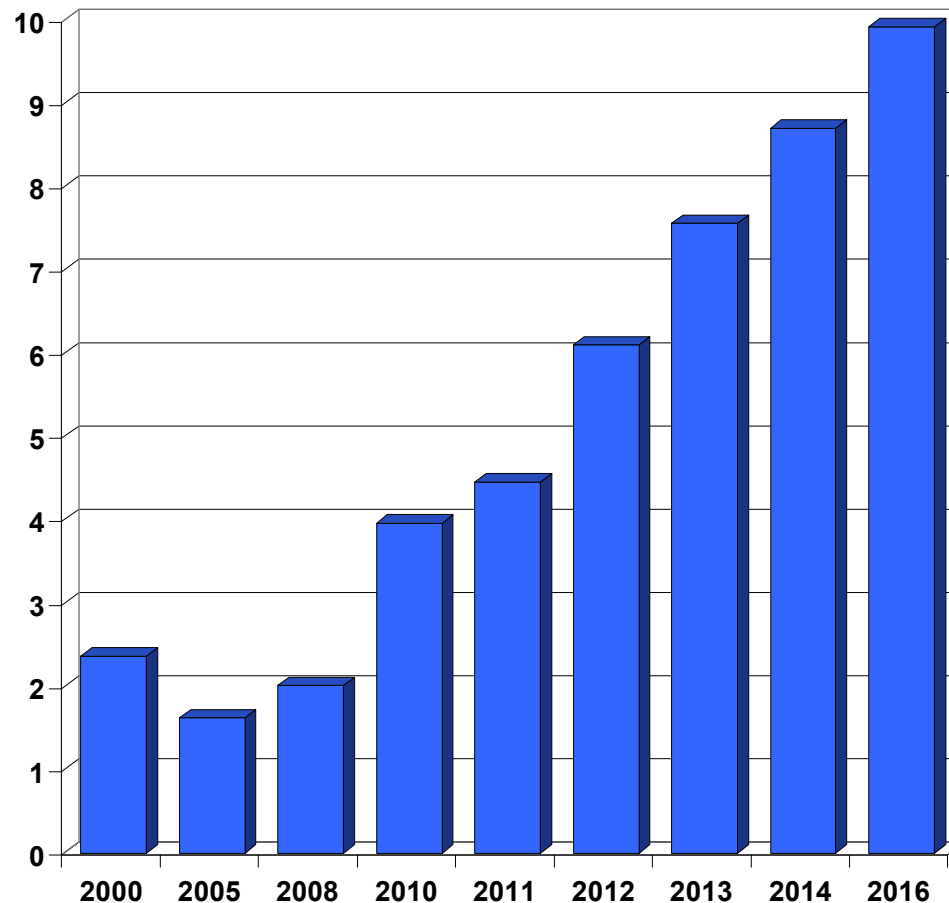


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U.S. LPG Exports Are Rising Rapidly

U.S. LPG Exports, Million Tonnes



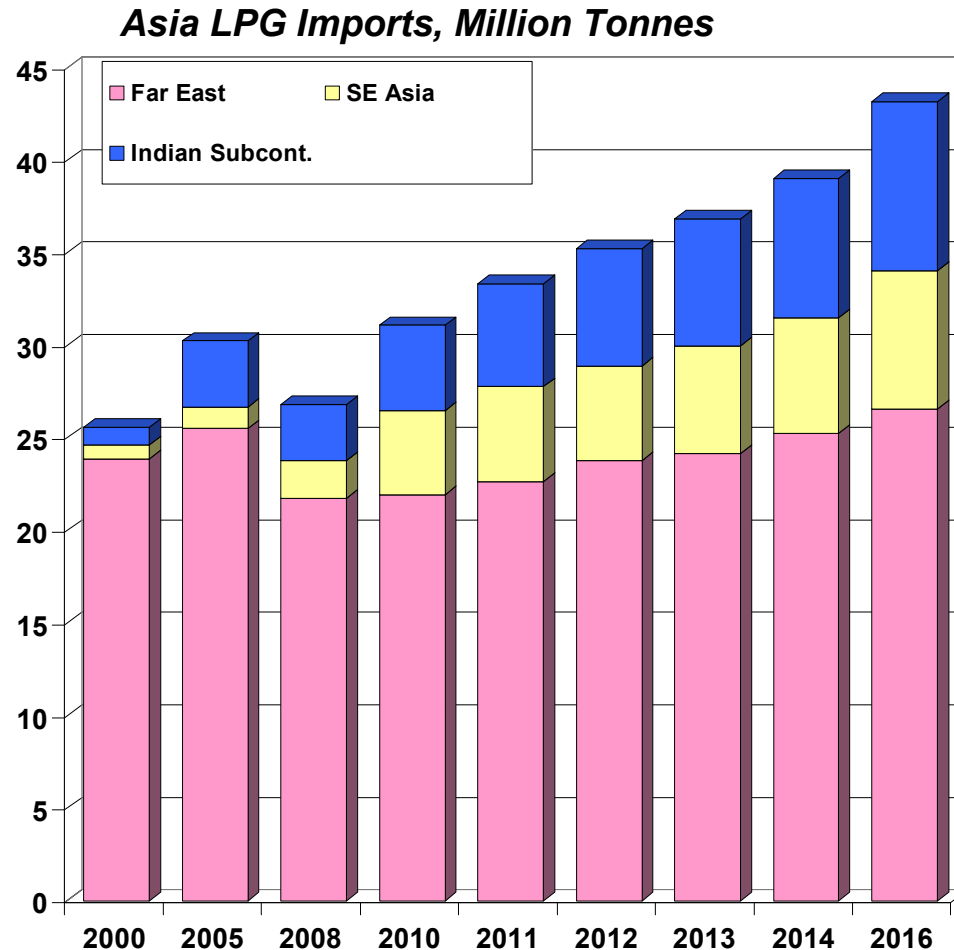
- U.S. propane and butane production is increasing fast due to development of shale gas and tight oil resources.
- Domestic propane (and butane) demand is not growing very fast.
- Propane exports have already expanded by 200% since 2008.
- Total LPG exports are expected to reach 9-10 million tonnes per year by 2015.
- LPG marketers and traders will need to find new markets for U.S. exports in the future as the volume of LPG available for export increases.

Asia LPG Imports Are Expected to Increase Over the Next Few Years



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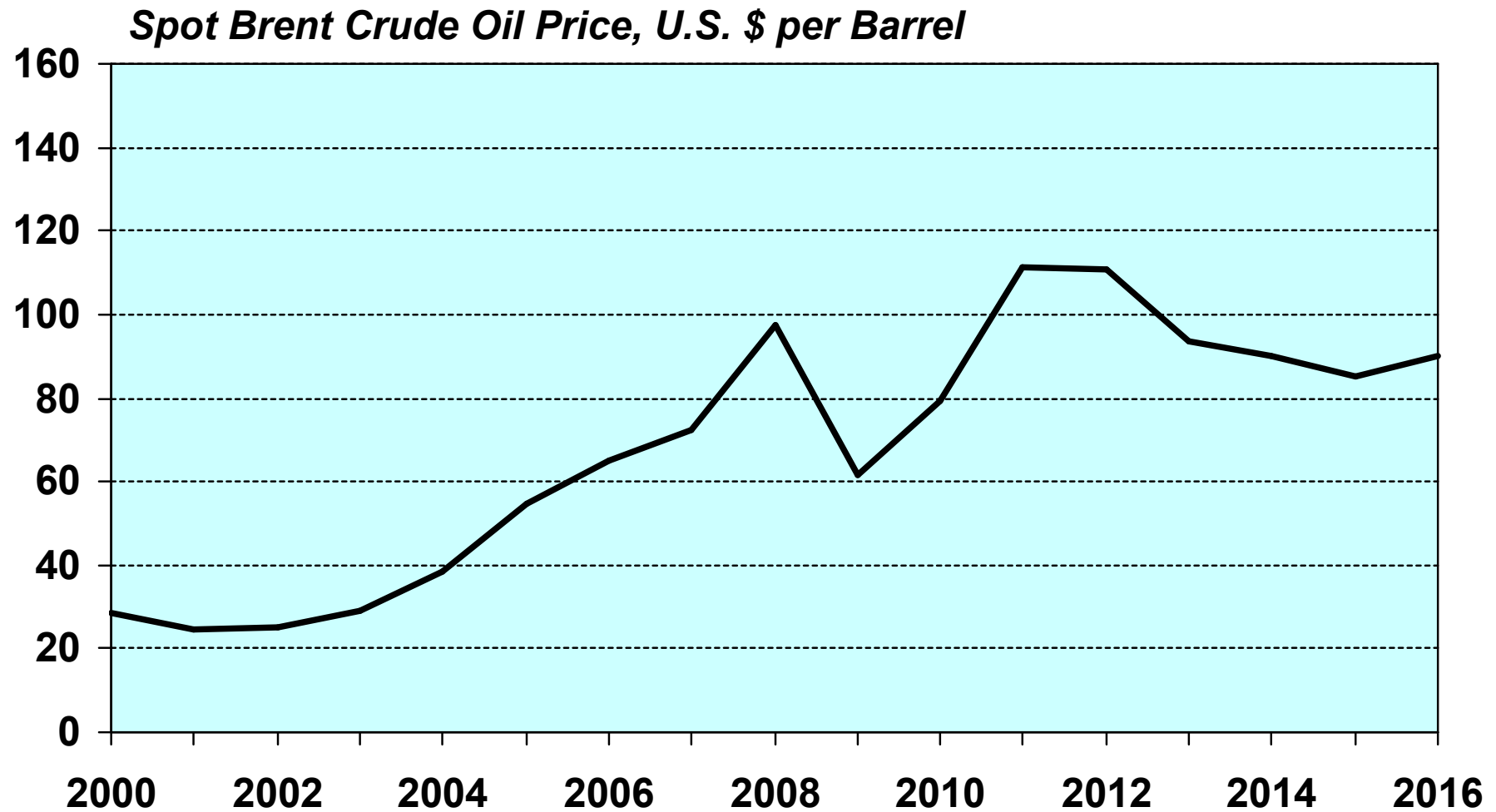
- Res/com demand growth should cause imports to increase in Southeast Asia and the Indian Subcontinent.
- Imports are also expected to rise in the Far East—but this is tied to higher levels of LPG use as price sensitive feedstock in the petrochemical industry.
- Use of propane as feedstock for propane dehydrogenation (PDH) feedstock in China will also contribute to the trend of higher import levels.

Crude Oil Prices Are Expected to Soften Somewhat Over the Next Few Years—As a Result of Rising Non-OPEC Crude Oil Production



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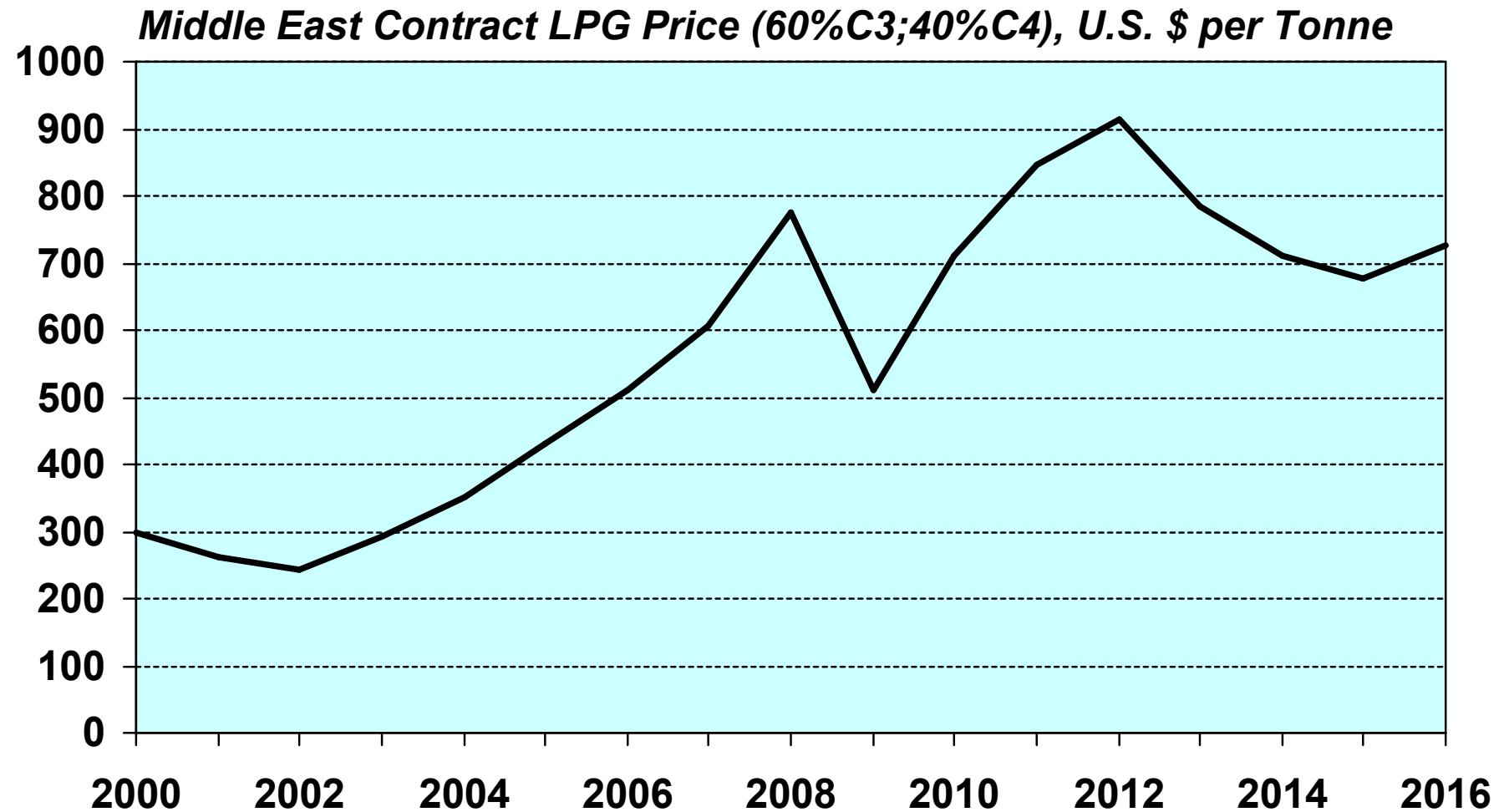


LPG Prices Are Expected to Moderate Somewhat as Global Supplies Increase and Crude Oil Prices Weaken



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Conclusions



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- Global LPG supplies are expected to grow fairly quickly—particularly in the Middle East, Asia and the U.S.
 - Middle East growth is dependent on the quantity and type of oil and gas supply developed to meet rising world energy needs
 - U.S. supply growth is dependent on the pace of unconventional oil & gas resources (tight oil and shale gas) and the quality of the natural gas produced.
 - Asia growth is linked to refinery expansions and refined product demand growth.
- Global demand for LPG in the res/com sector is increasing—but high prices and weakness in the economy is slowing growth in some countries.
 - Low-priced natural gas is a threat in many markets.
- Use of LPG as chemical plant feedstock will rise rapidly in the future.
 - Additional base demand in the Middle East
 - Increased price sensitive demand in Europe and Asia
 - New petrochemical plants in North America
- Global trade will continue to expand as additional supply is brought on line over the next few years.



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