



STRATAS
ADVISORS
A HART ENERGY COMPANY



Energy – Future Sources and Challenges

John Paisie

Executive Vice-President

jpaisie@stratasadvisors.com

TEL +1.713.260.4628 / MOBILE +1.832.517.7544

September 14, 2017

UPSTREAM | MIDSTREAM | DOWNSTREAM | FUEL & TRANSPORT



Who We Are



STRATAS
ADVISORS
A HART ENERGY COMPANY

www.stratasadvisors.com

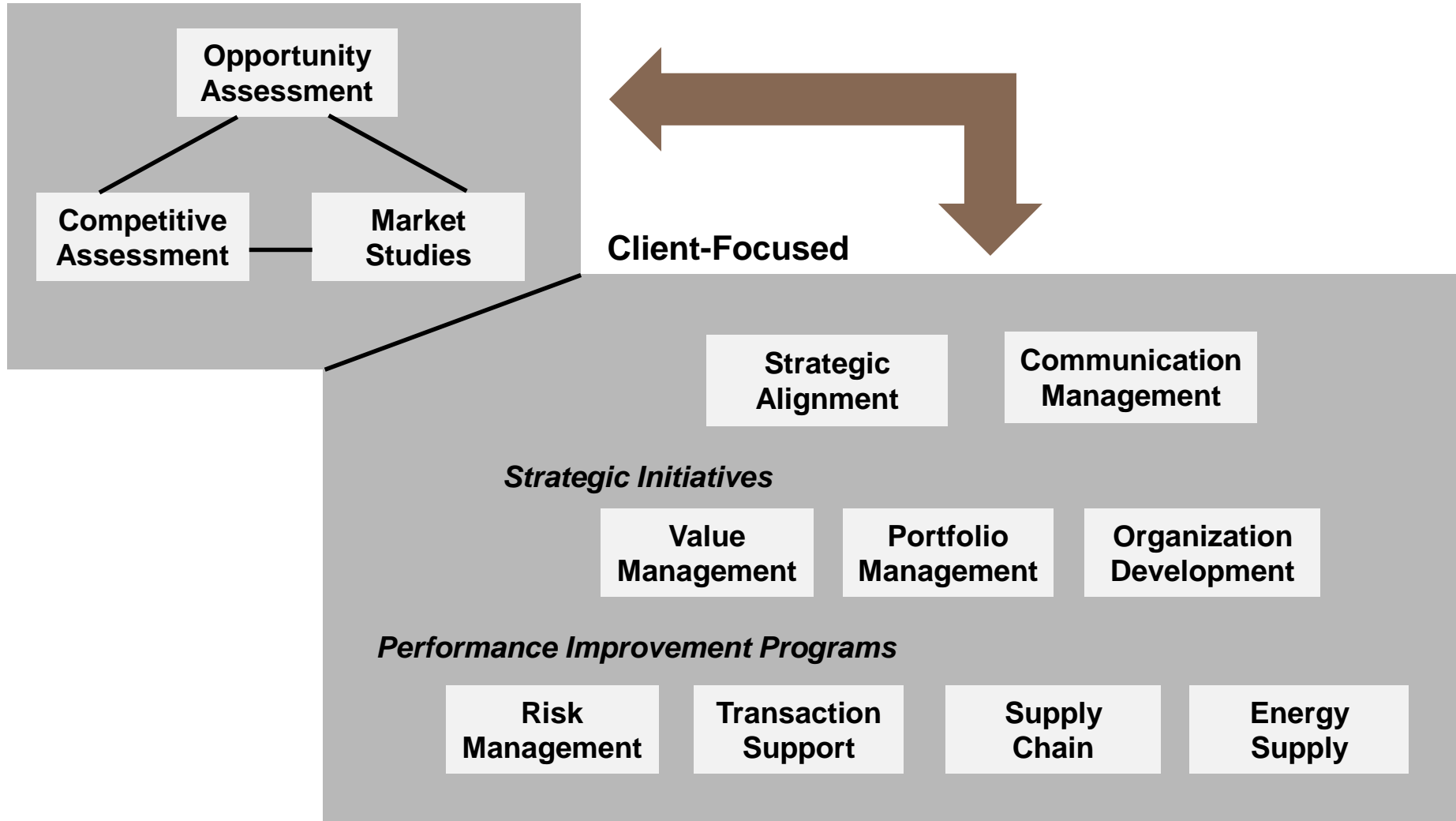
- Global consulting and advisory firm
- Coverage of the energy sector and related industries
- Focused on helping clients achieve tangible results
- Clients include IOCs, NOCs, independents, energy consumers, financial entities and policy-makers
- Research and consulting staff comprises professionals located in key global energy centers
- Combined, our team brings over 500 years of combined energy industry expertise, including
 - Technical (Petroleum Engineers, Geologists, Process Engineers)
 - Economists
 - Political Scientists
 - Financial Analysts

Service Matrix

Upstream	Midstream	Downstream	Fuel & Transportation	Executive Suite	By Region	By Industry
North American Shale	North American Shale-Related Infrastructure	Global Refining & Products	Global Fuel Specifications	The Executive Dialogue	Africa	Heavy Industries
International Shale Service	North American Oil	North American Refining & Products	Global Alternative Fuels	Global Risk Outlook	Asia	Logistics
Global Hydrocarbon Supply	North American NGL	Base Petrochemicals	Global Biofuels Assessment	Macroeconomic Outlook	Europe	Power
Global Heavy Crude Oil Outlook	North American Natural Gas	Catalyst Market Outlook	Global Biofuels Outlook	Global Energy Scenarios	Latin America	Petrochemical
Global Upstream Projects Analytics	Global Natural Gas Outlook	Global Syngas Conversion	Global Automotive	Long-term Price Forecasting	Middle East	Financial
	Global NGL Outlook			Short-term Price Forecasting	North America	
	Global LNG				Russia & CIS	

Examples of Consulting Offerings

External Assessment

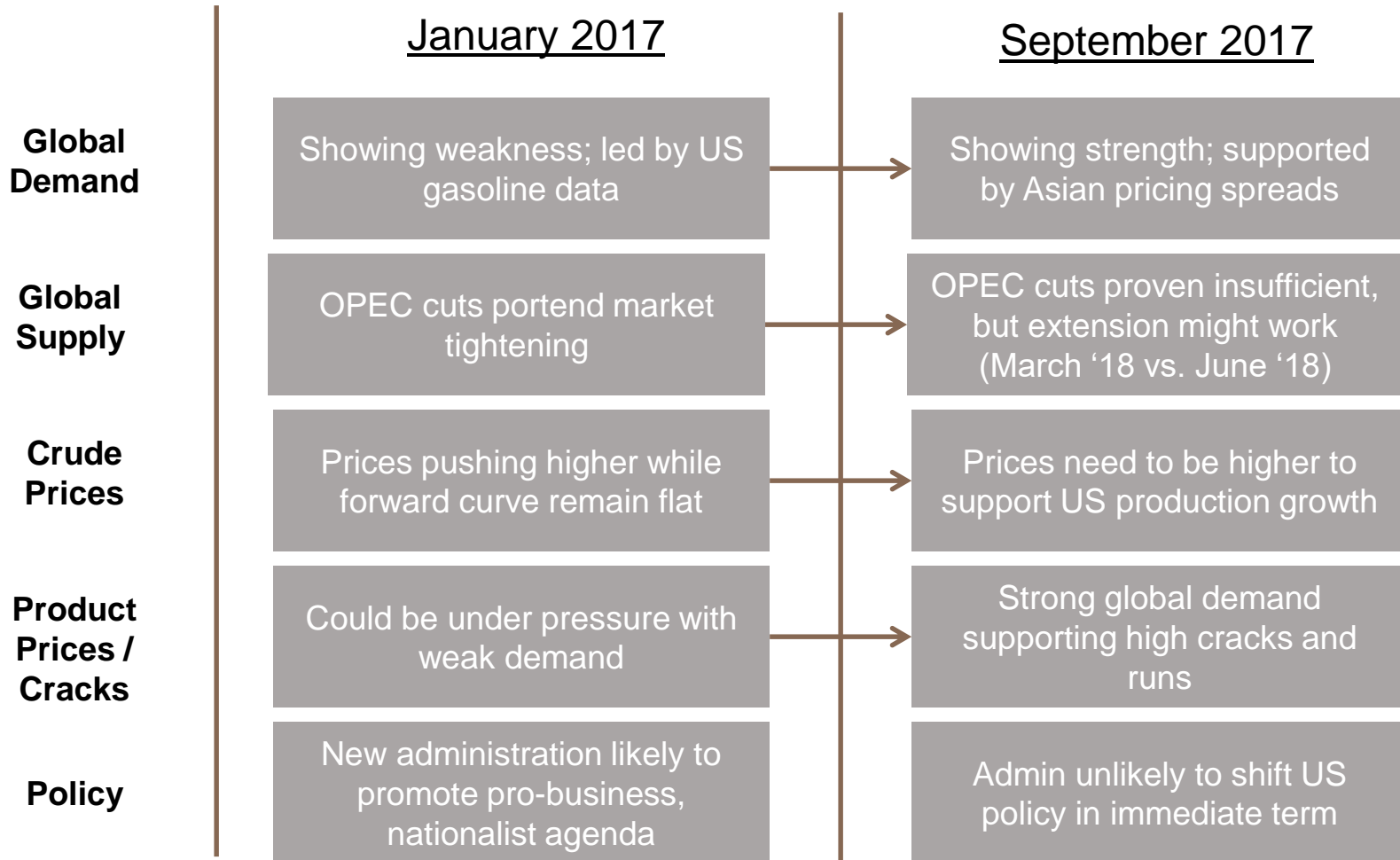




Short-term

Key Market Themes

How market thinking has progressed this year

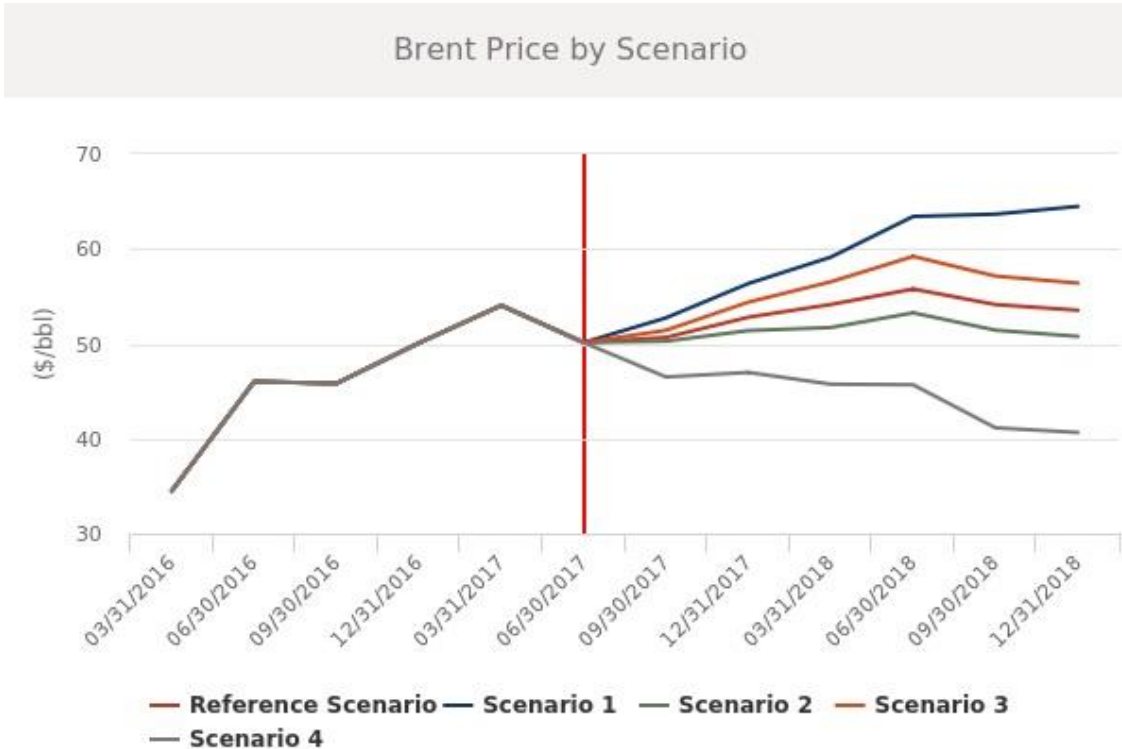


Scenarios

		Supply	
		Bull Case	Bear Case
		<ul style="list-style-type: none"> OPEC Extends cuts through 2018 at Nov meeting Compliance from core OPEC stays 100% Modest Increases from Libya / Nigeria 	<ul style="list-style-type: none"> OPEC compliance slips to 60% prior to November meeting Nov meeting ends cuts Strong Increases from Libya / Nigeria
Demand	Bull Case	<p>1.3 <u>mmb/d</u> this year and next</p> <p>Scenario 1: OPEC Deal holds with Strong Demand</p>	<p>Scenario 2: OPEC Deal collapses with Strong Demand</p>
	Bear Case	<p>1.0 <u>mmb/d</u> this year and next</p> <p>Scenario 3: OPEC Deal holds with Weak demand</p>	<p>Scenario 4: OPEC Deal collapses with Weak Demand</p>

Reference:
OPEC Deal holds through March 2018, demand growth averages ~1 mmb/d both years

Brent Price by Scenario



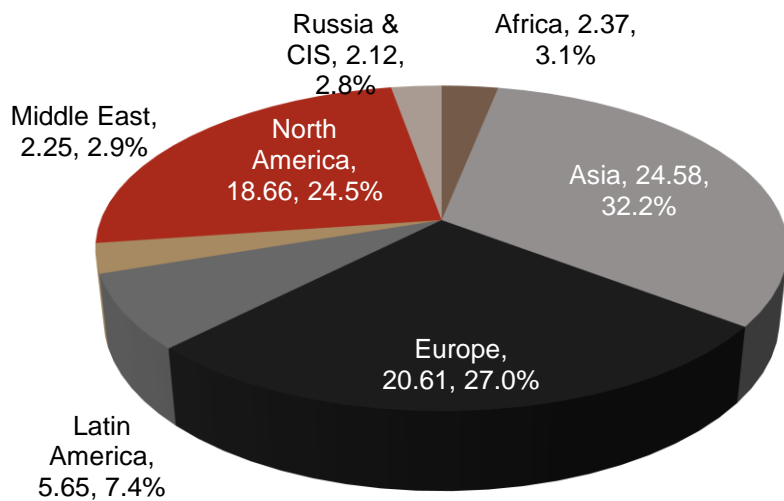
- **Scenario 1**
OPEC deal holds with strong demand
- **Scenario 2**
OPEC deal collapses with strong demand
- **Scenario 3**
OPEC deal holds with strong weak demand
- **Scenario 4**
OPEC deal collapses with weak demand



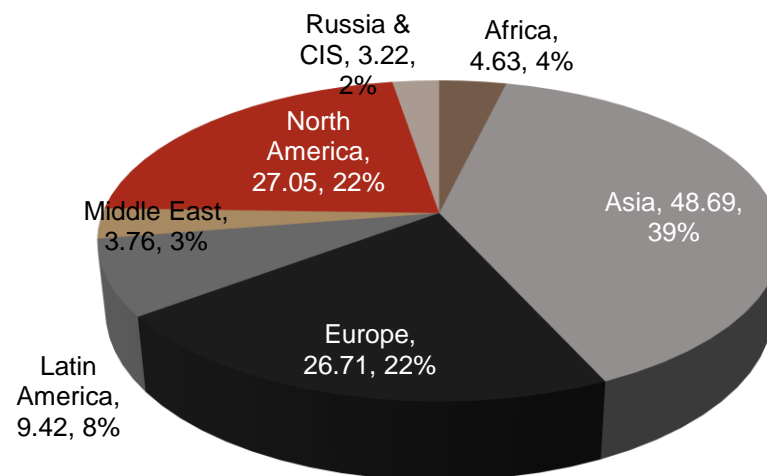
Looking Further Out

GDP Forecast

2016 Total GDP: 76.24 trillion USD

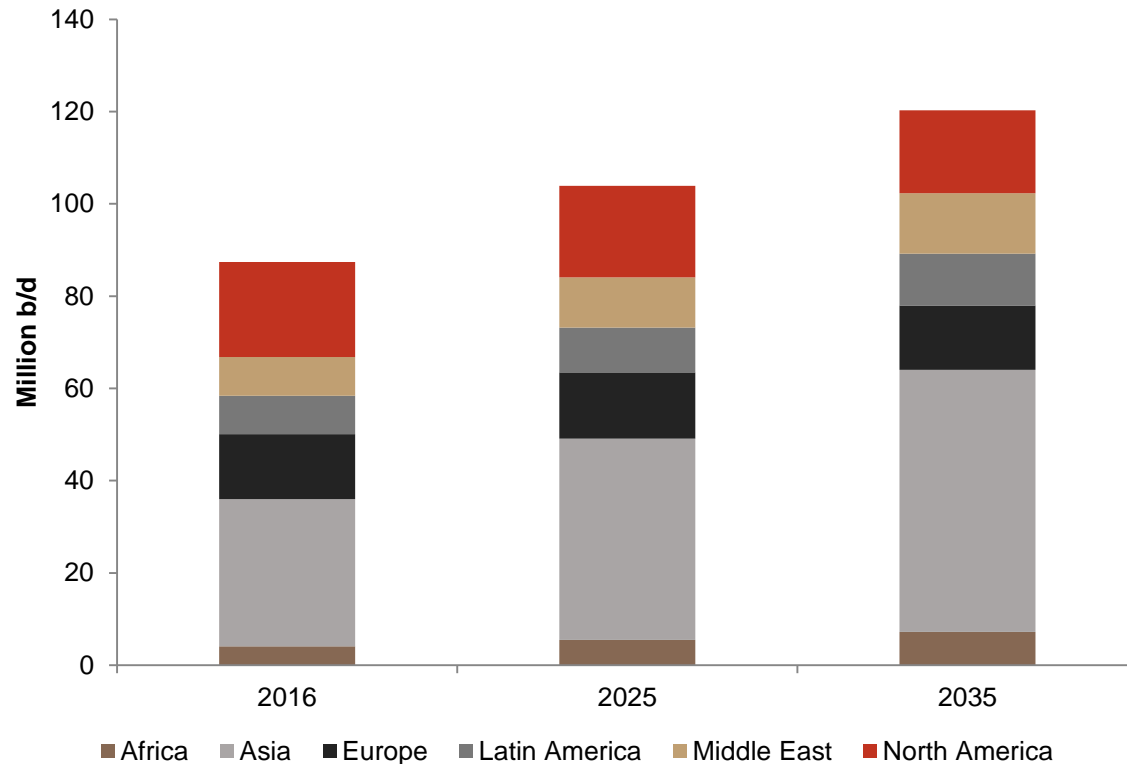


2035 Total GDP: 123.47 trillion USD



Source: *Stratas Advisors*, 2010 prices and exchange rates

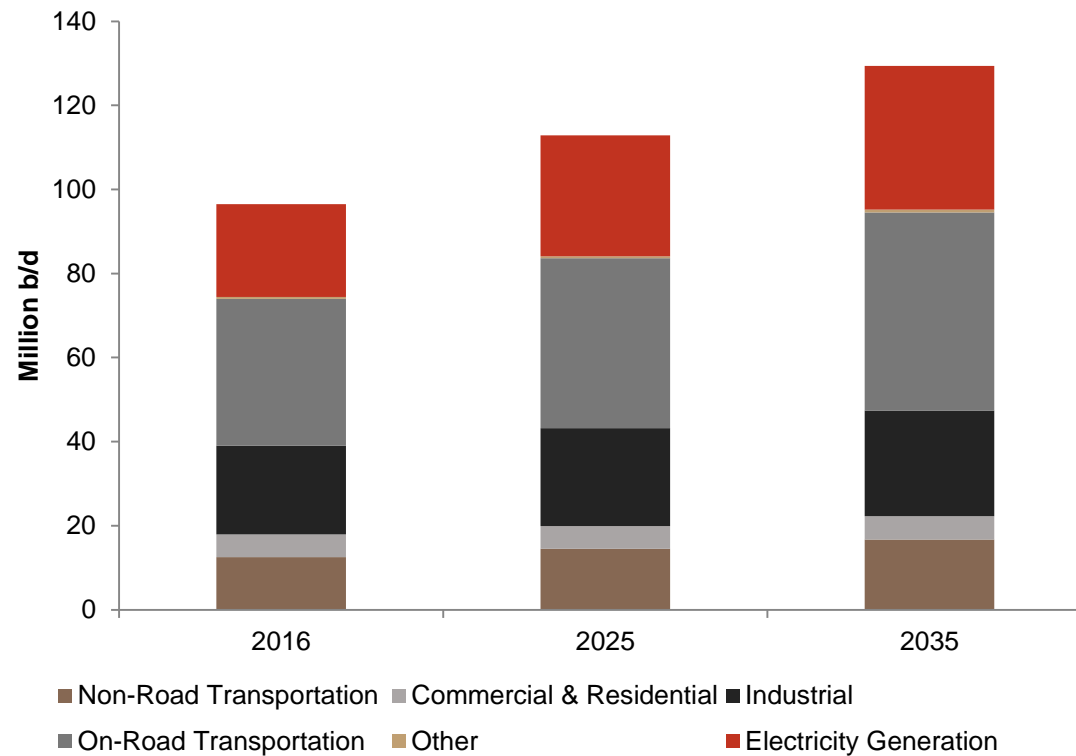
Oil Demand by Region



Source: Stratas Advisors

- Global oil demand is expected to continued to increase
- Asia will represent the overwhelming portion of future demand growth
- Demand in North America and Europe is expected to decline

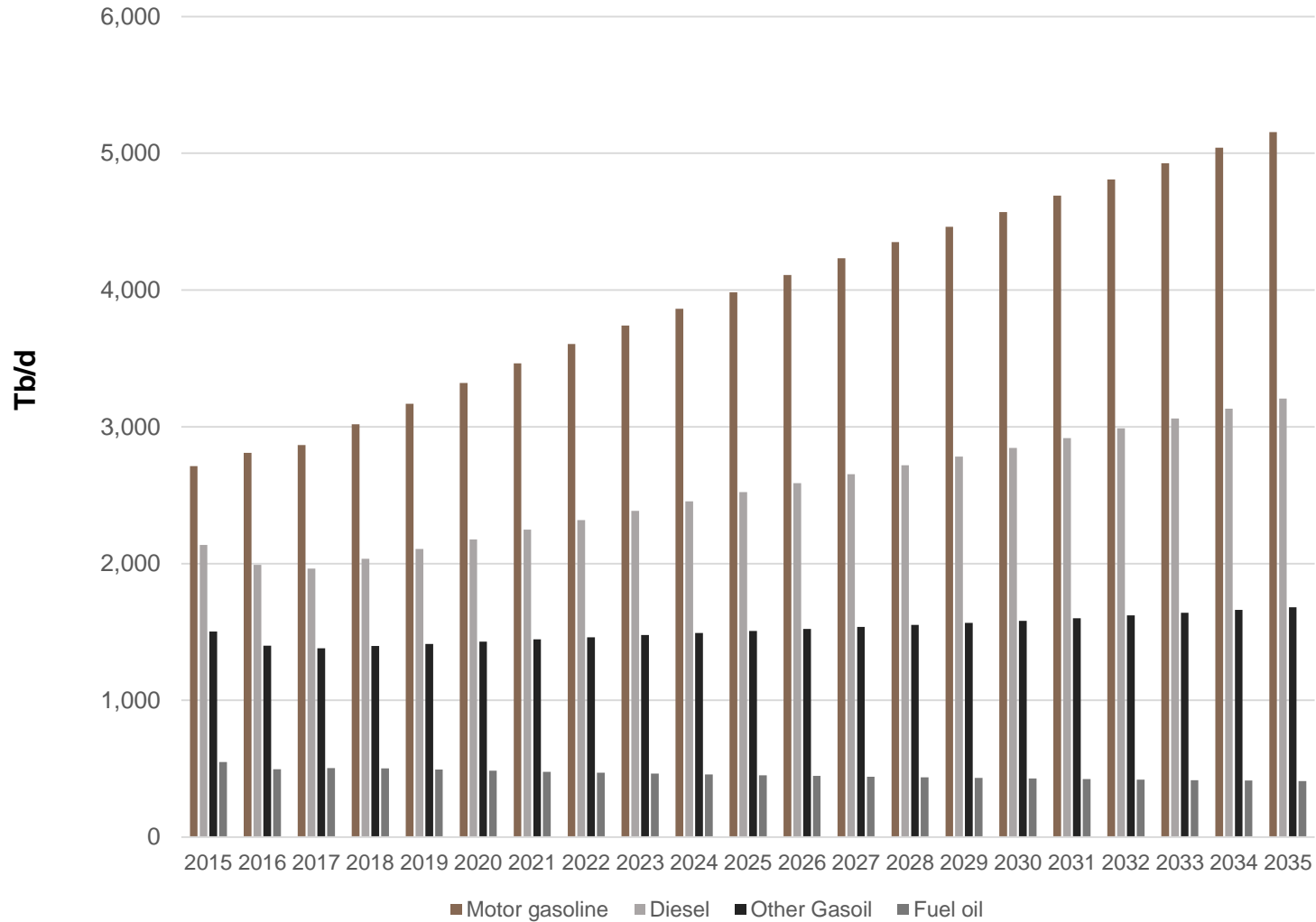
Oil Demand by Sector



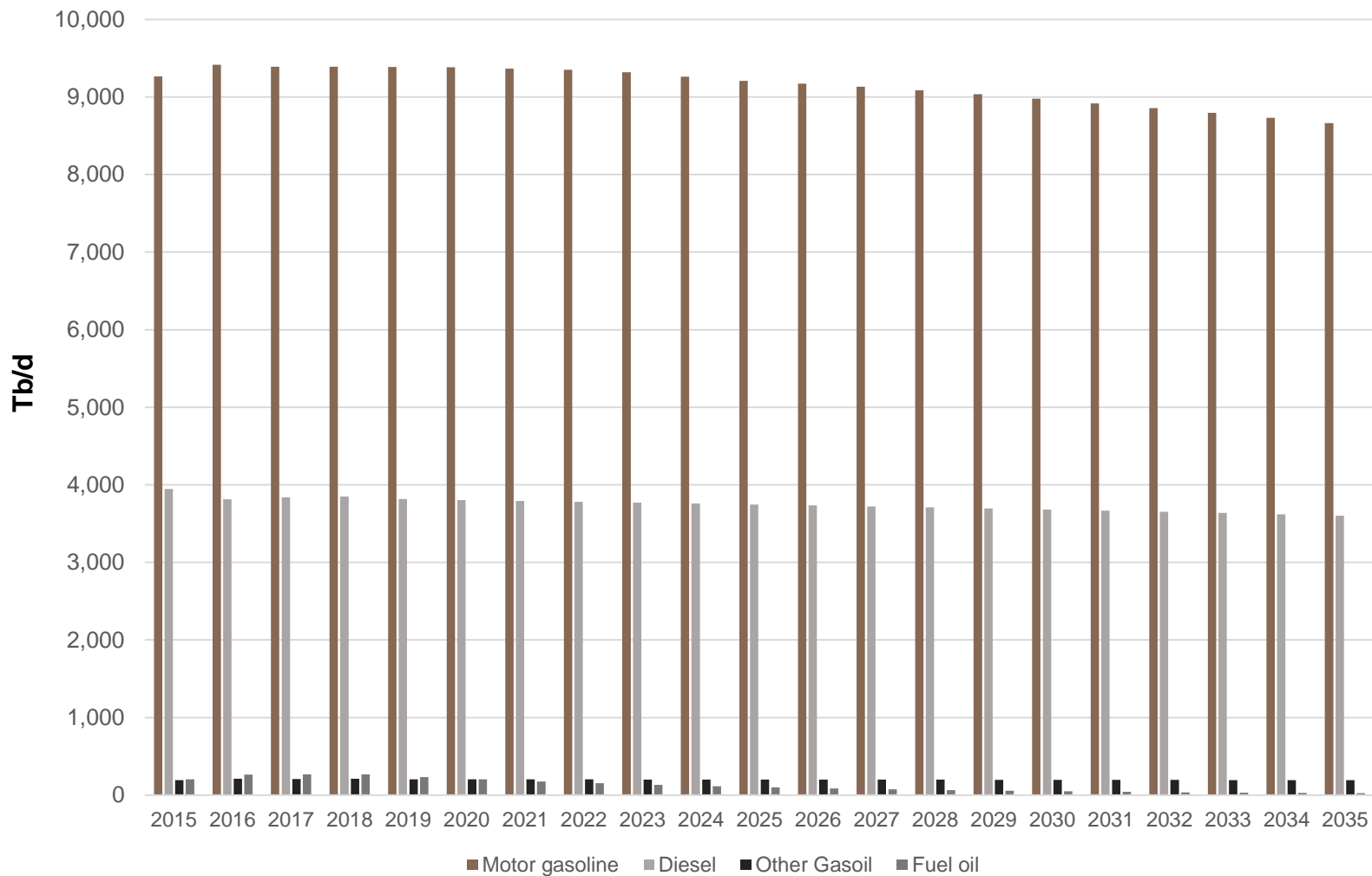
Source: Stratas Advisors

- The transportation sector will represent an increasing portion of overall oil demand
- Furthermore, the bulk of incremental demand will stem from the transportation sector

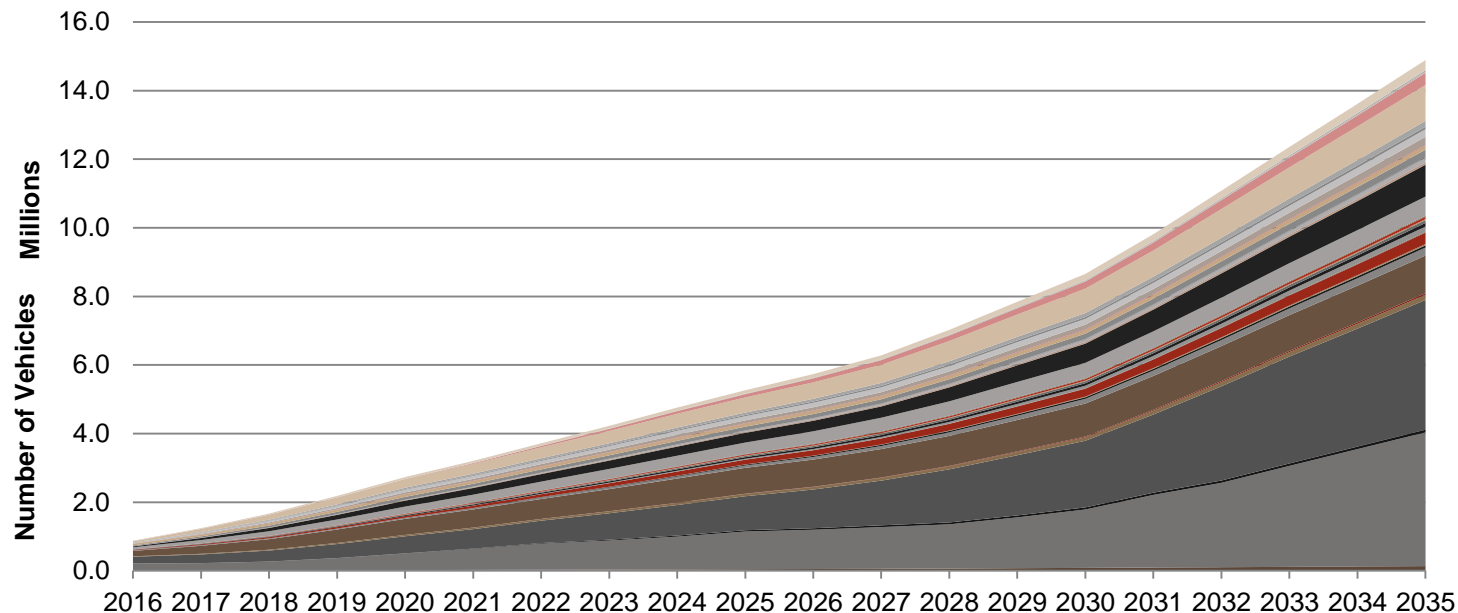
China Product Demand



US Product Demand

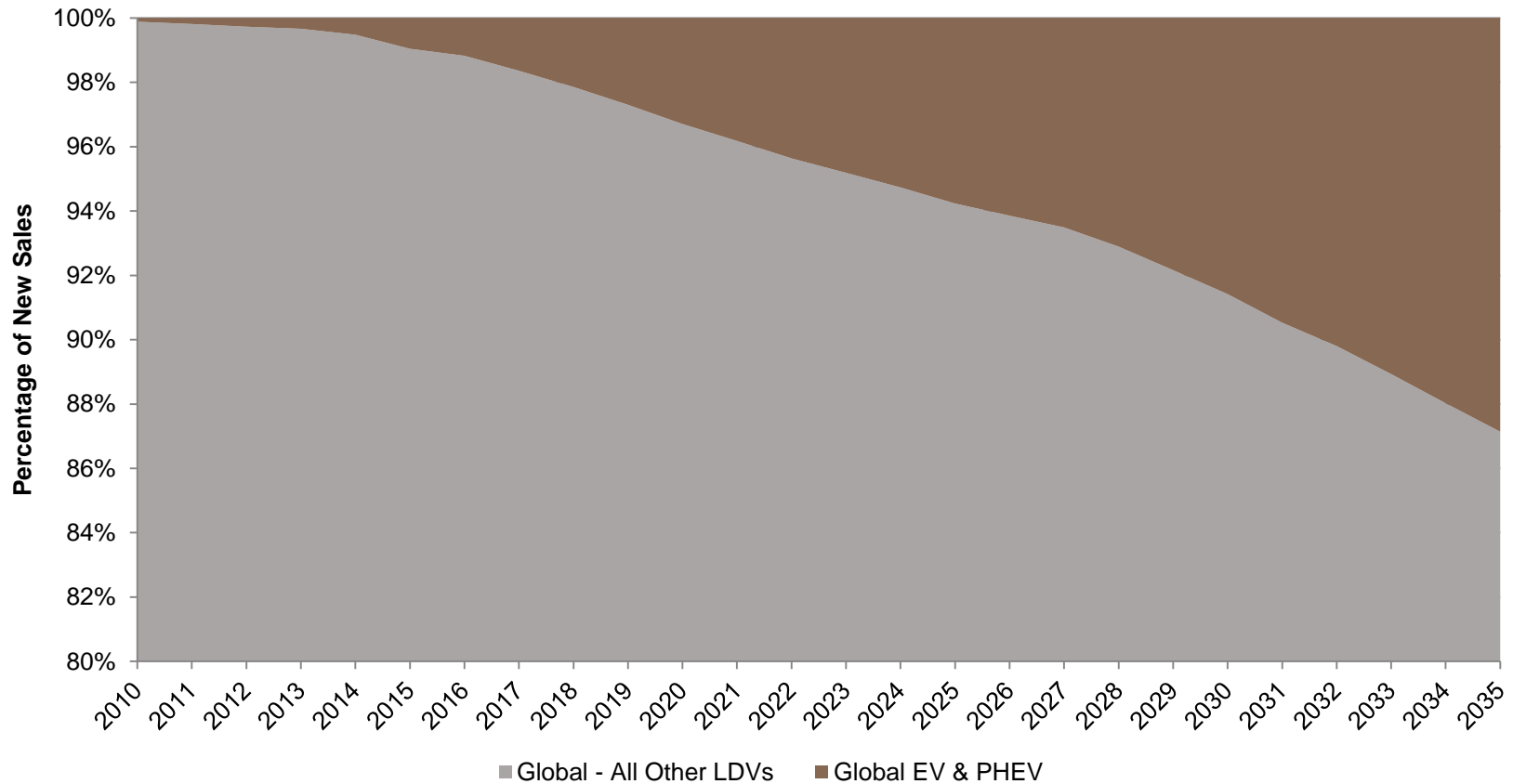


Global Electric Vehicle Sales

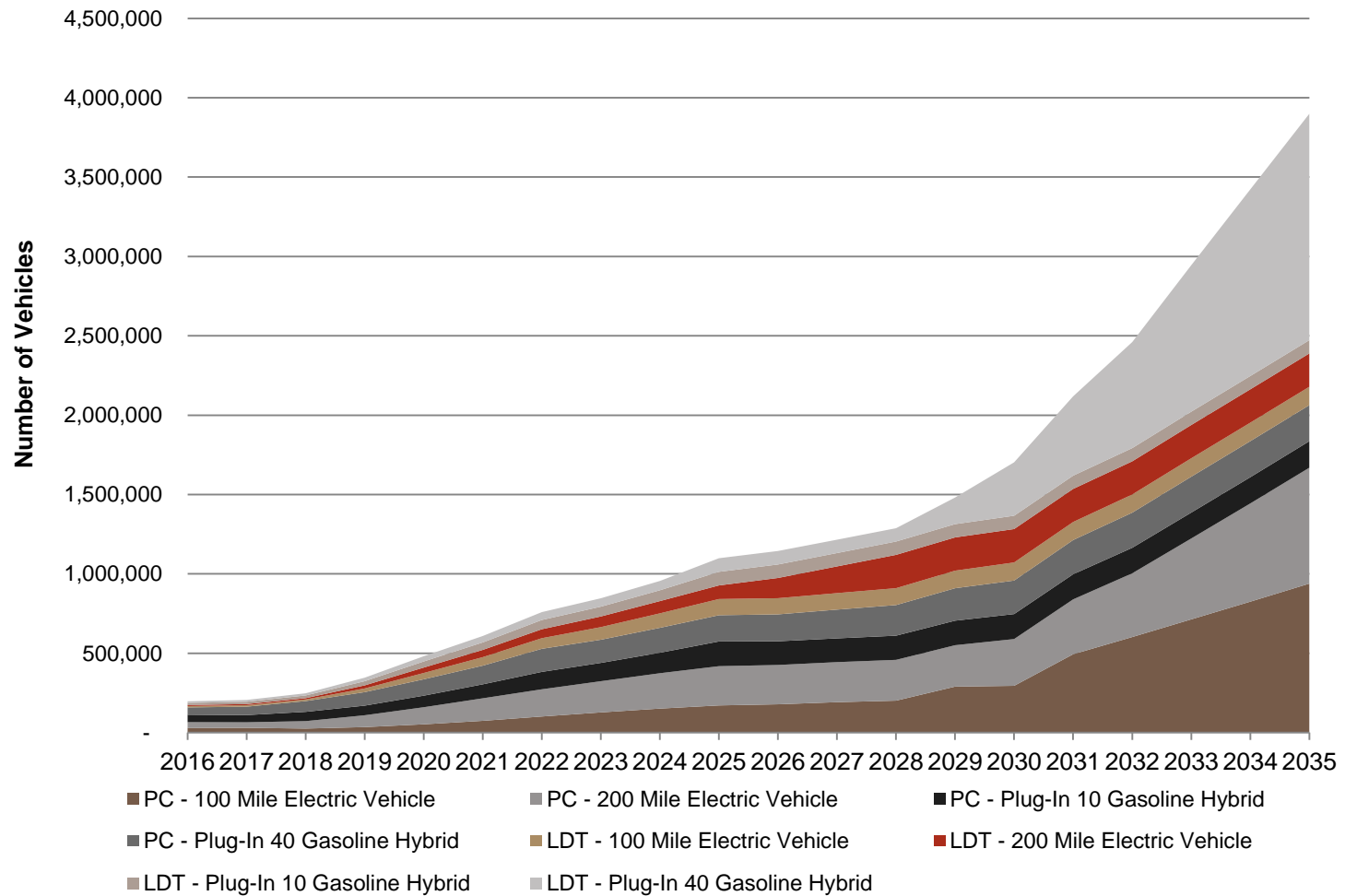


- | | | | | |
|-------------|------------------|---------------|-----------------------------|------------------|
| ■ Canada | ■ United States | ■ Australia | ■ China - People's Republic | ■ India |
| ■ Indonesia | ■ Japan | ■ Malaysia | ■ Pakistan | ■ Philippines |
| ■ Russia | ■ South Korea | ■ Taiwan | ■ Thailand | ■ Austria |
| ■ Belgium | ■ Czech Republic | ■ Denmark | ■ Finland | ■ France |
| ■ Germany | ■ Greece | ■ Hungary | ■ Iceland | ■ Ireland |
| ■ Italy | ■ Luxembourg | ■ Netherlands | ■ Norway | ■ Portugal |
| ■ Spain | ■ Sweden | ■ Switzerland | ■ Turkey | ■ United Kingdom |
| ■ Poland | ■ Argentina | ■ Brazil | ■ Chile | ■ Colombia |
| ■ Mexico | ■ Peru | ■ Venezuela | | |

Global EV & PHEV % of Sales

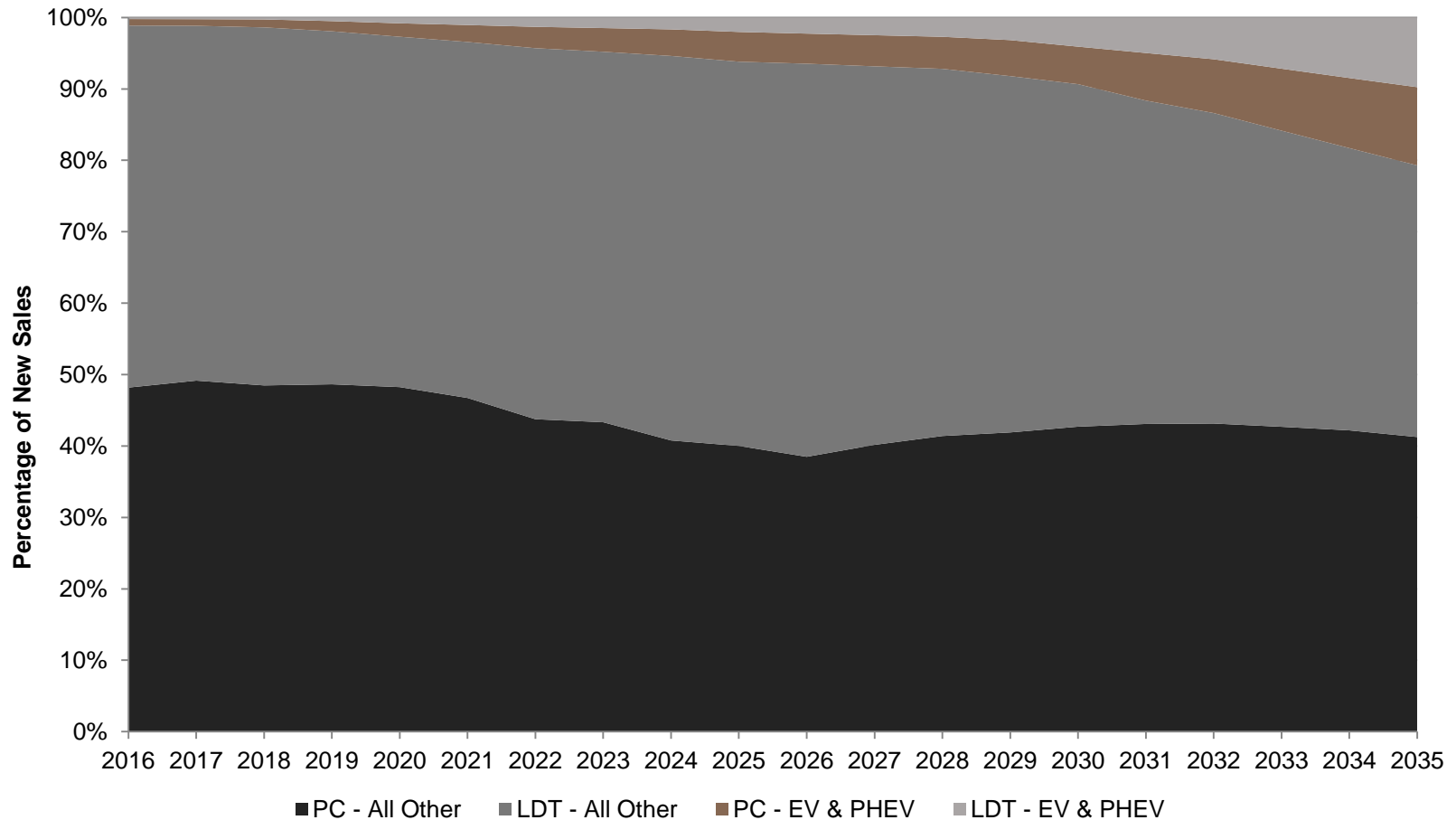


US Electric Vehicle Sales

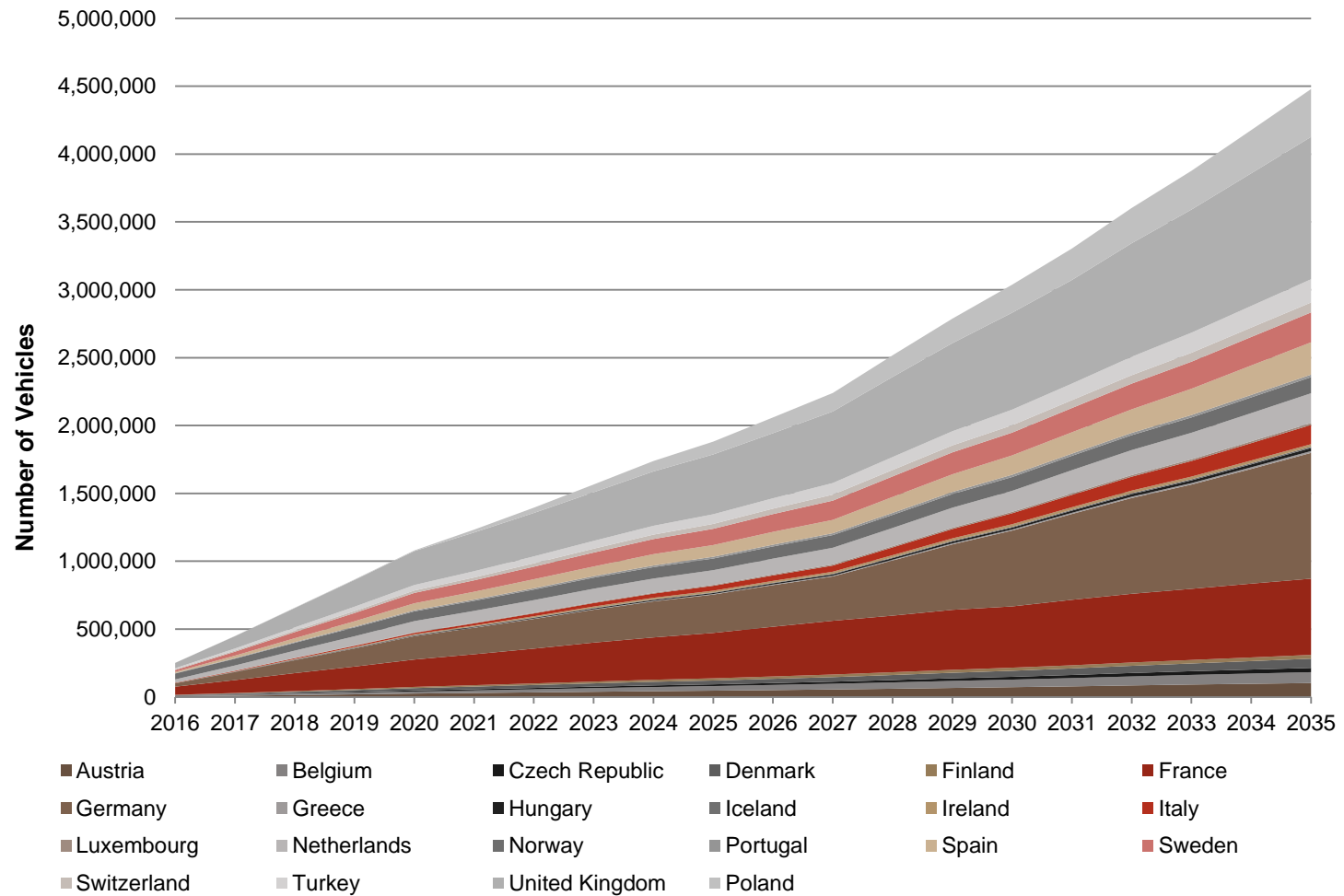


United States: EV & PHEV Sales % (2016-2035)

U.S. EV & PHEV New Sales Penetration Rates – Driven by CAFE Compliance

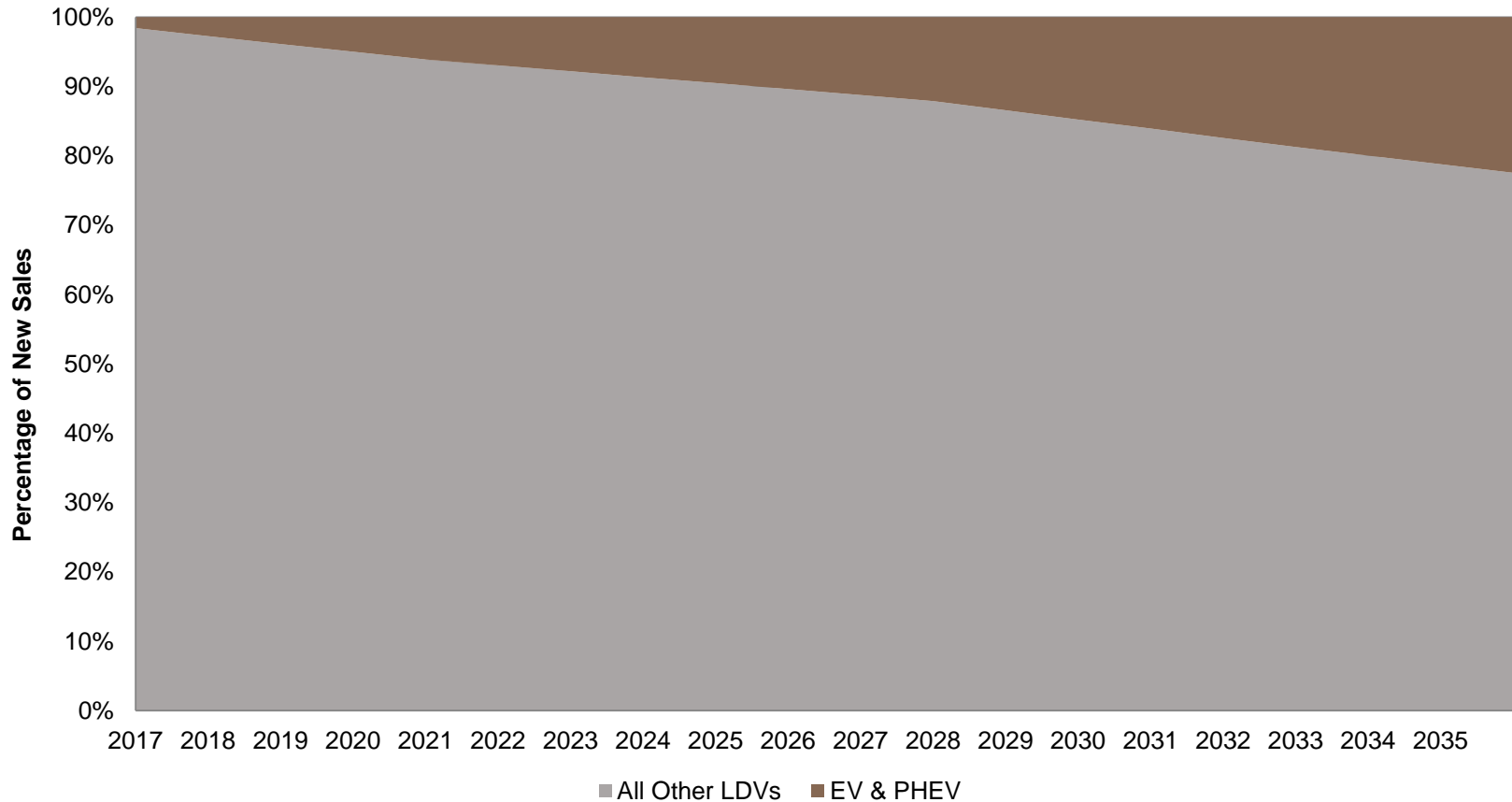


Europe Electric Vehicle Sales

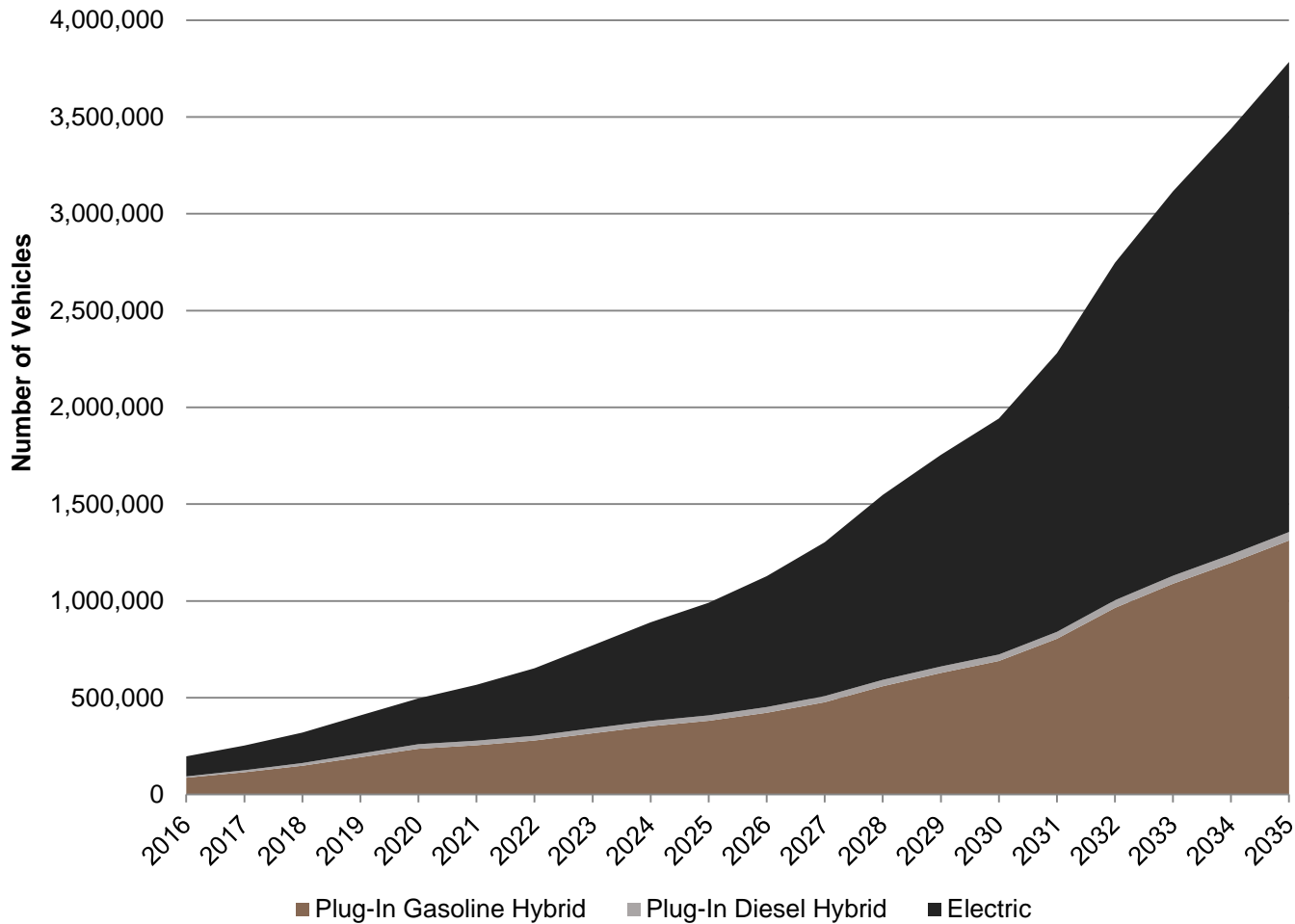


Europe: EV & PHEV Sales % (2016-2035)

Europe EV & PHEV New Sales Penetration Rates – Driven by E.C. Target (2021- 95 gCO2/Km); Additionally driven by country level legislative bans (France, Germany, etc.)

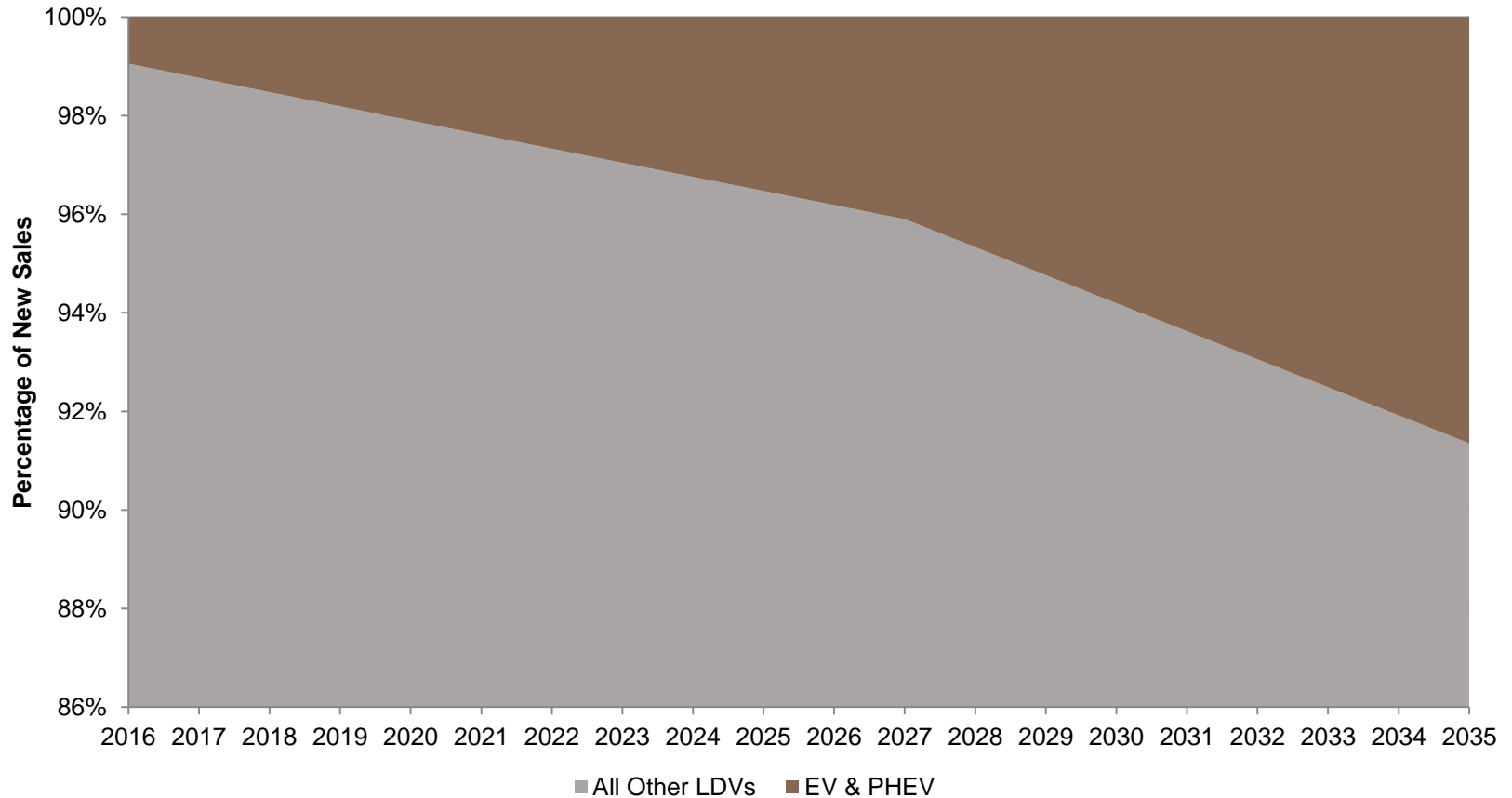


China Electric Vehicle Sales

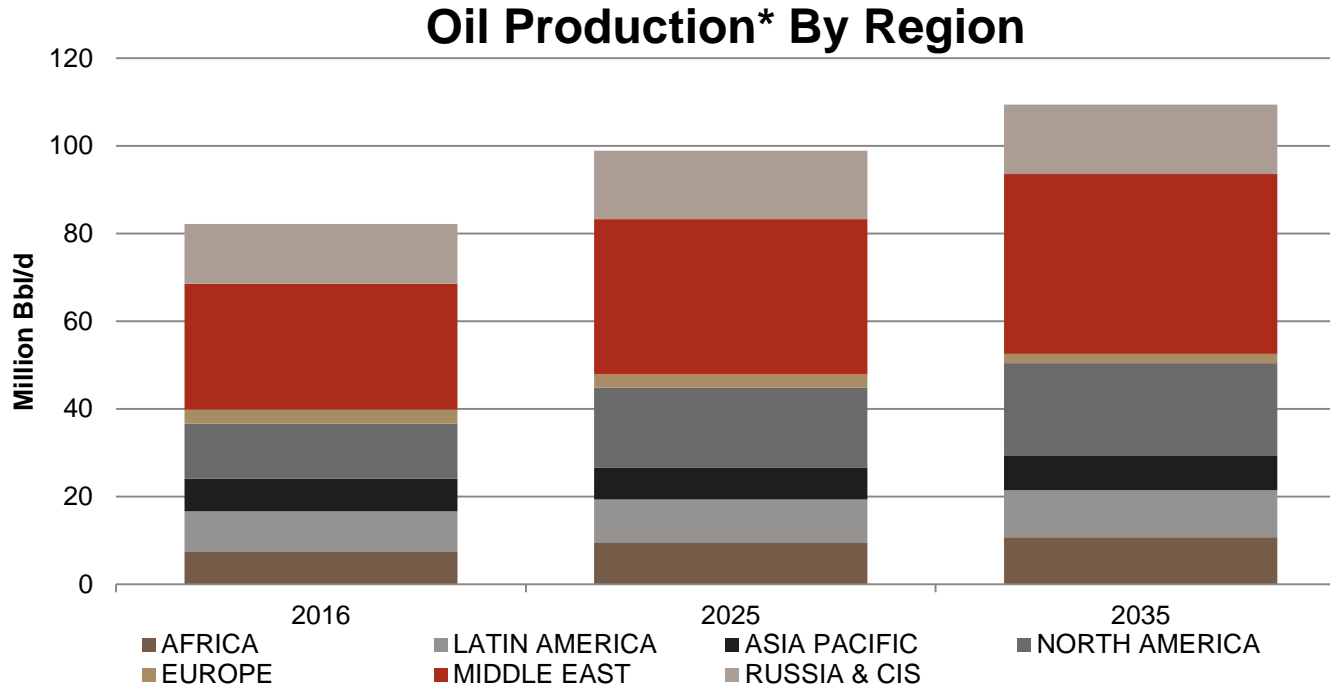


China: EV & PHEV Sales % (2016-2035)

China EV & PHEV New Sales Penetration Rates – Driven by ‘NEV’ Program



Oil Production

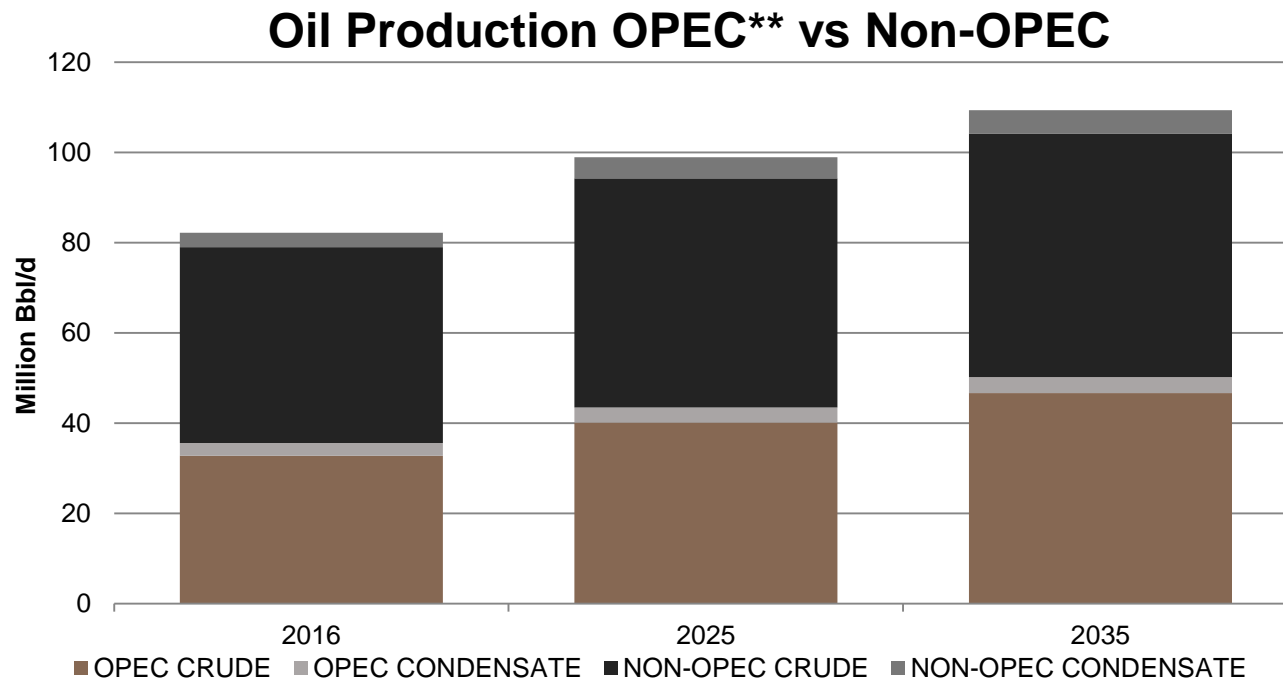


Source: Stratas Advisors

*: Oil Production Include Crude Oil and Field Condensate

- North American production is forecasted to increase substantially during the next 20 years – increasing from 12.6 MMBPD to 21.2 MMBPD
- Production from the Middle East will increase even more – from 28.7 MMBPD to nearly 41.0 MMBPD

Oil Production

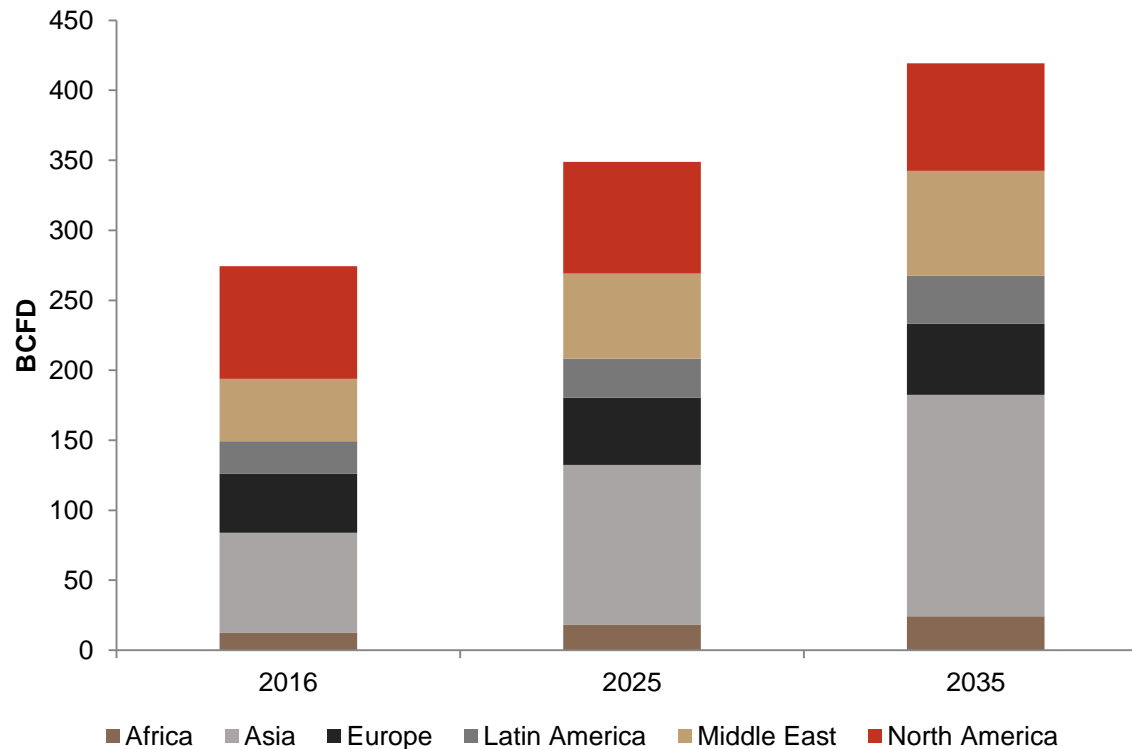


** : OPEC Group: Algeria, Angola, Libya, Nigeria, Gabon, Ecuador, Venezuela, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, UAE

Source: Stratas Advisors

- OPEC will continue to play an important role over the next 20 years
- OPEC's share of production will increase from around 40% to 43%

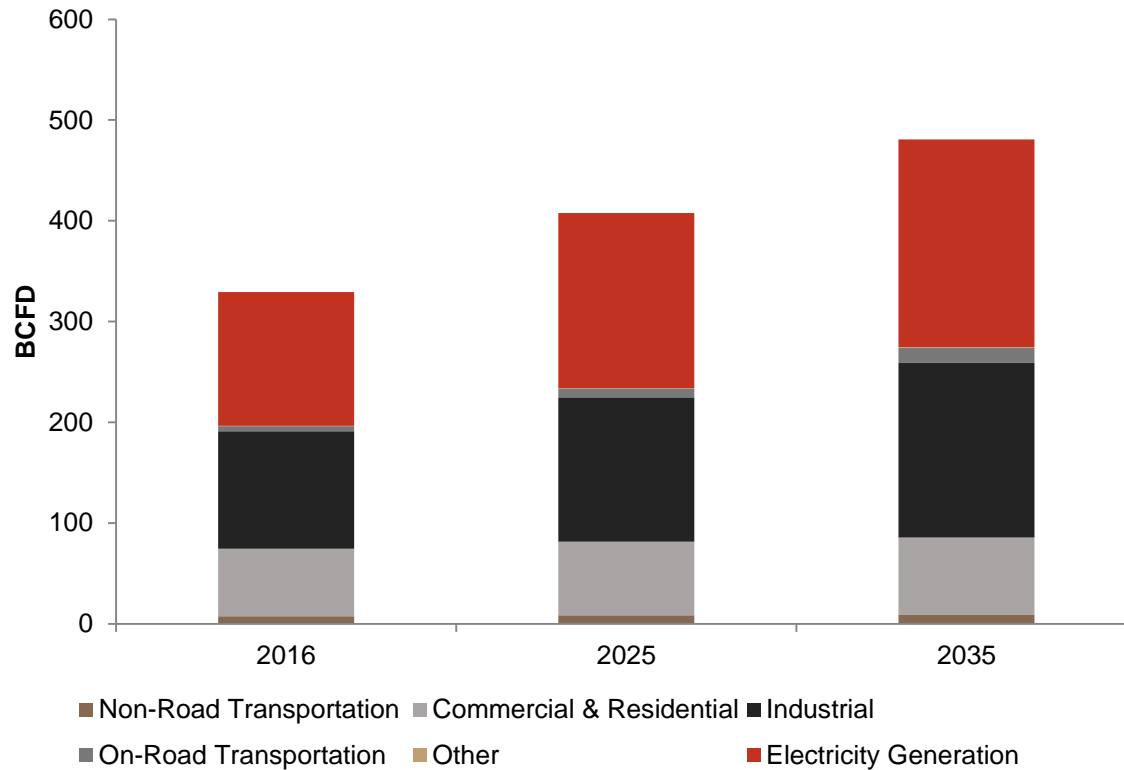
Natural Gas Demand by Region



Source: Stratas Advisors

- Global demand for natural gas is expected to continued to increase
- Asia will represent the overwhelming portion of future demand growth

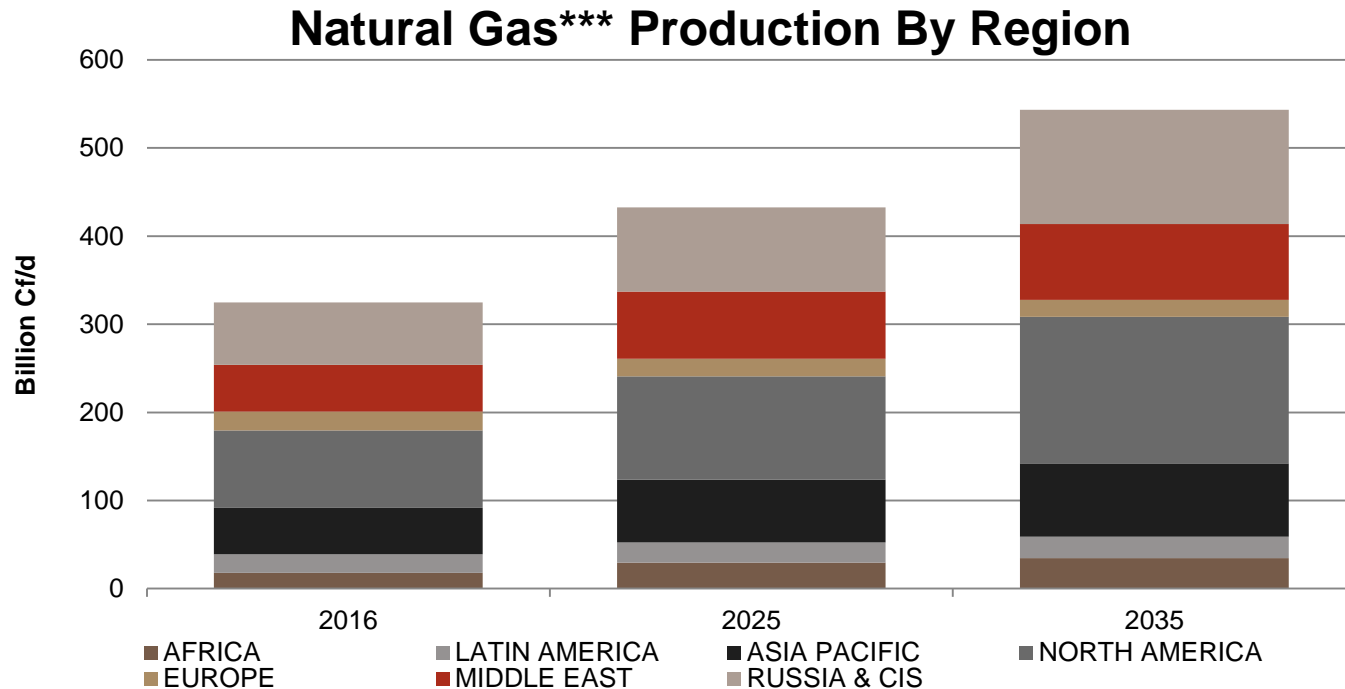
Natural Gas Demand by Sector



Source: Stratas Advisors

- The bulk of future demand growth will come from the industrial and electricity generation sectors
- Demand associated with electricity generation will increase by 55%

Natural Gas Production



***: Marketed Dry Natural Gas Production

Source: Stratas Advisors

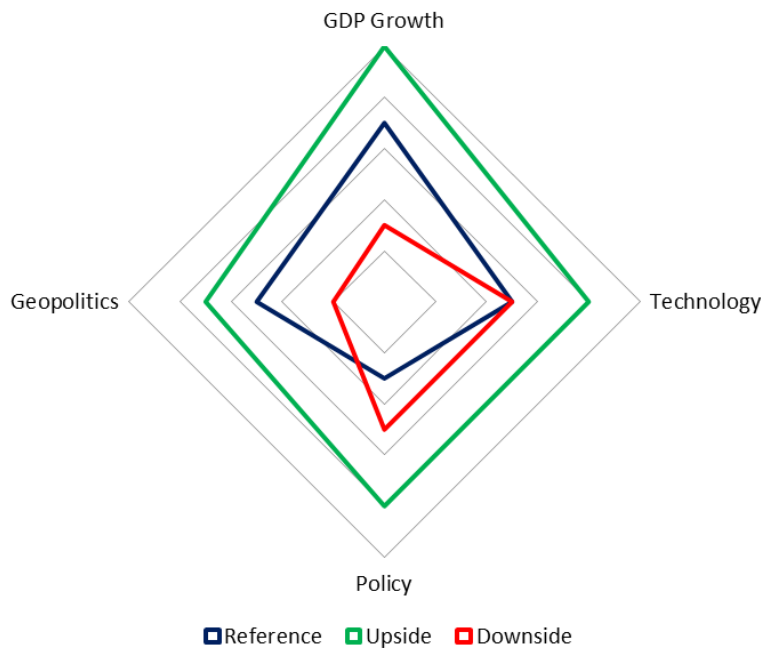
- The bulk of future supply will come from North America and Russia & CIS
- Production from North America is forecasted to nearly double over the next 20 years

Scenario Narratives

- **Upside Case: Shifting to a New Global Framework**
 - Technology / carbon reduction focus
- **Reference Case: Muddling Through**
 - Business as usual / focus on efficiency
- **Downside Case: Breakdown into Multi-Polarization**
 - Energy Security Focus

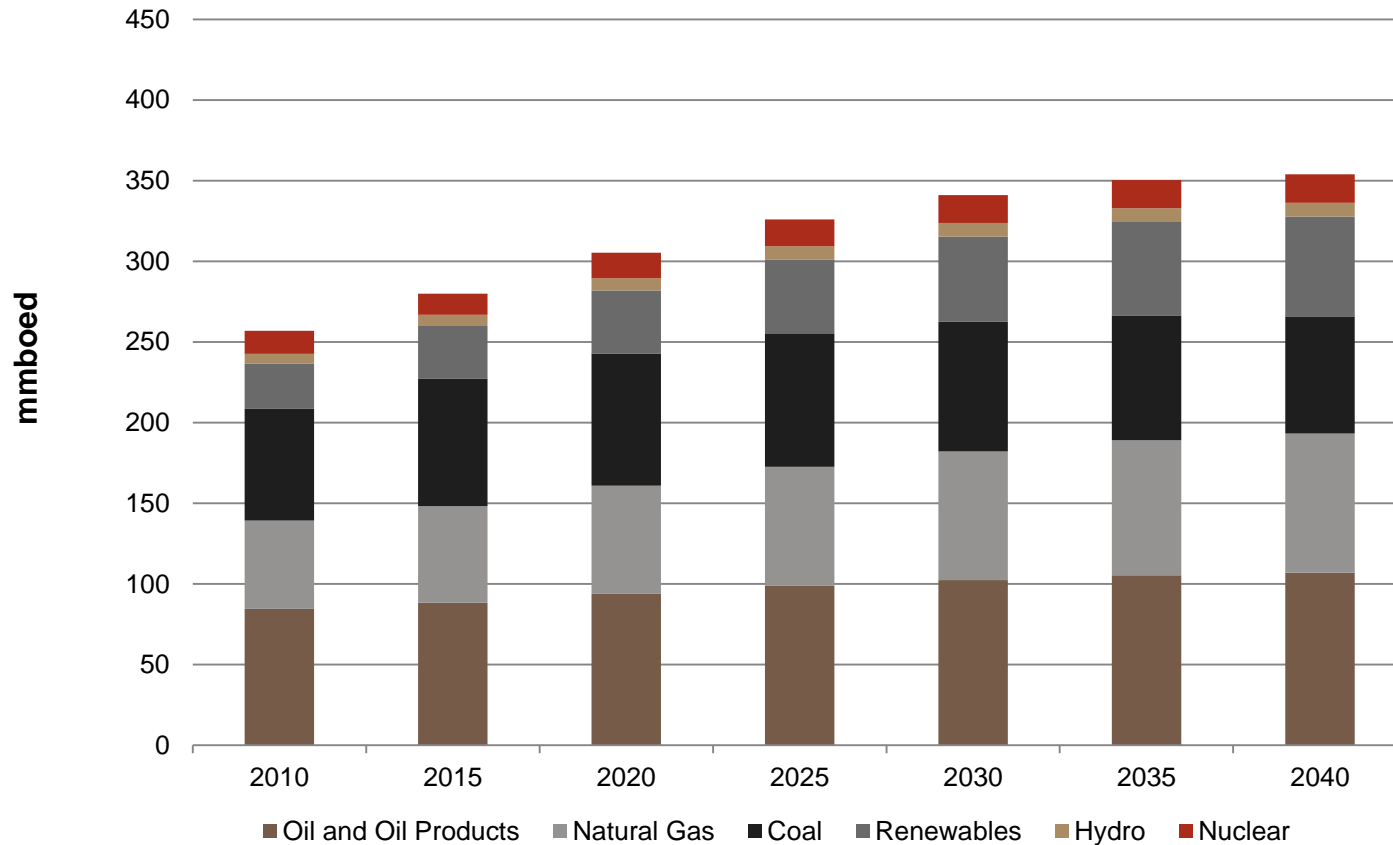
Scenario Inputs

Relative Impact of Factors

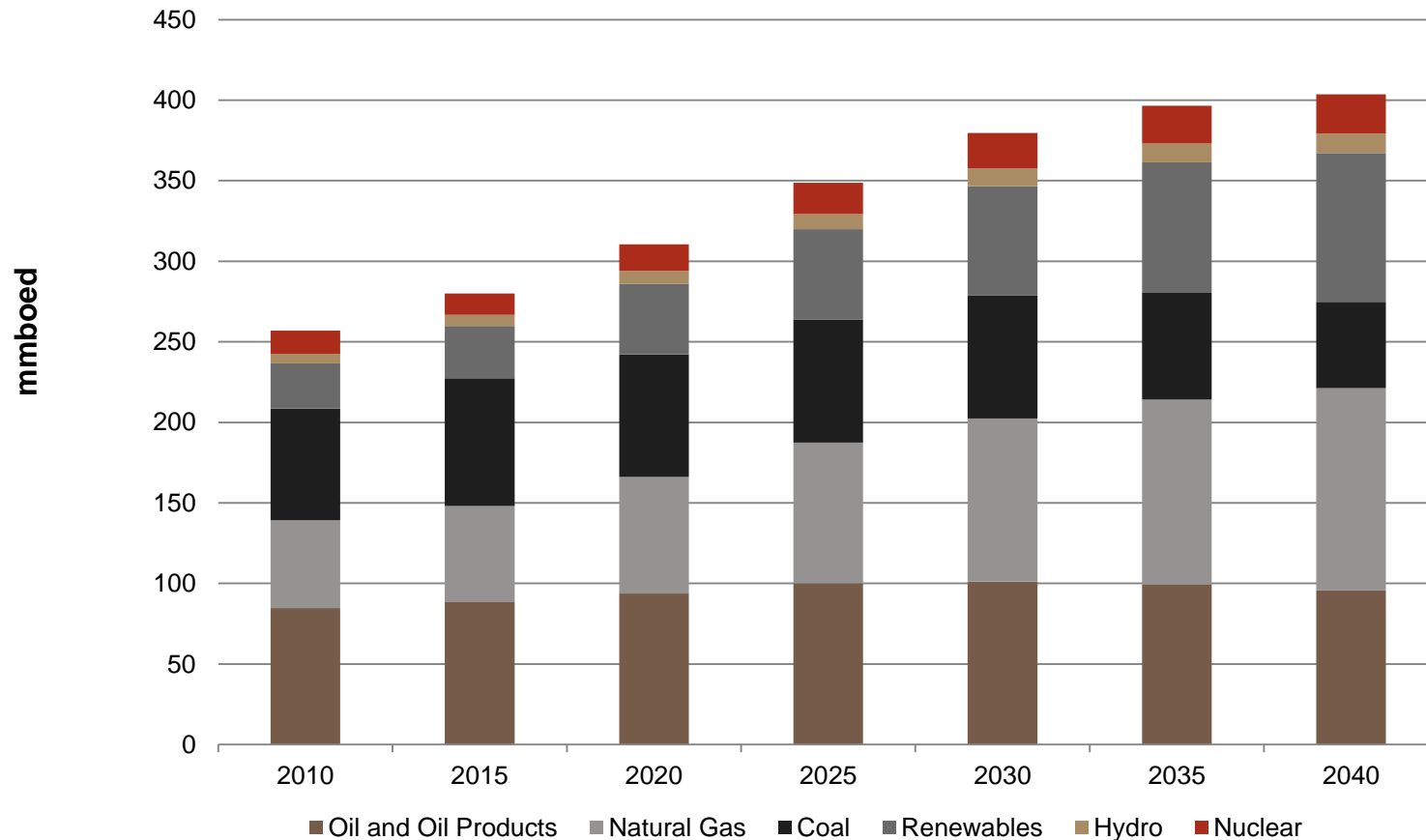


Factor	Reference	Upside	Downside
GDP Growth	Moderate	Strong	Weak
Technology penetration	Power-focused; efficiency gains strong but new tech minimal on transportation	Aggressive penetration of renewables and EVs; strong efficiency gains	Moderate, but based on energy security, not carbon
Geopolitical stability	Regional conflicts	Focus on global cooperation	Trade wars, conflict ridden
Policy	Limited meaningful action; some countries take action	Widespread carbon-reduction focus	Energy-security focused

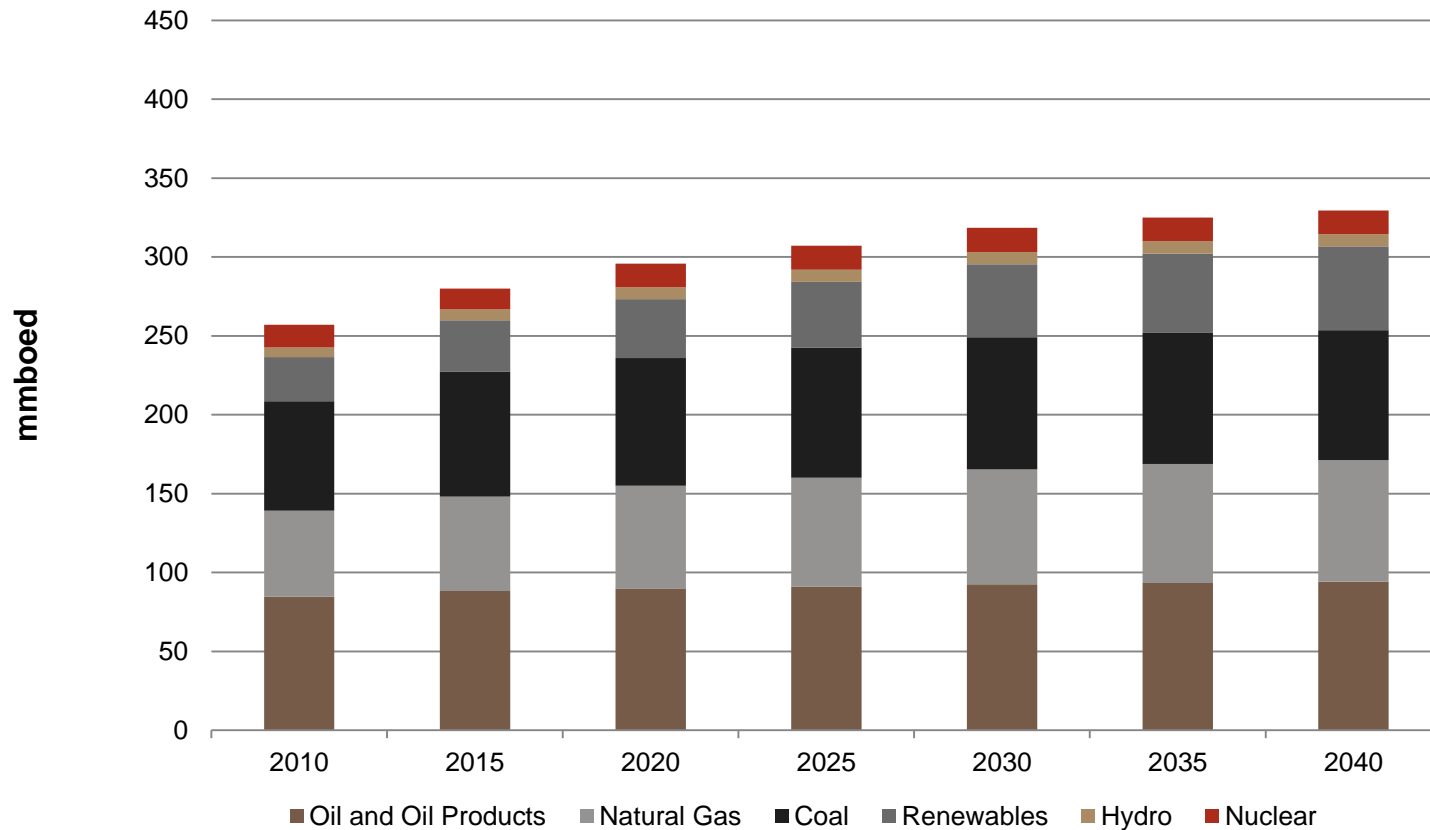
Reference Case – Muddling Through



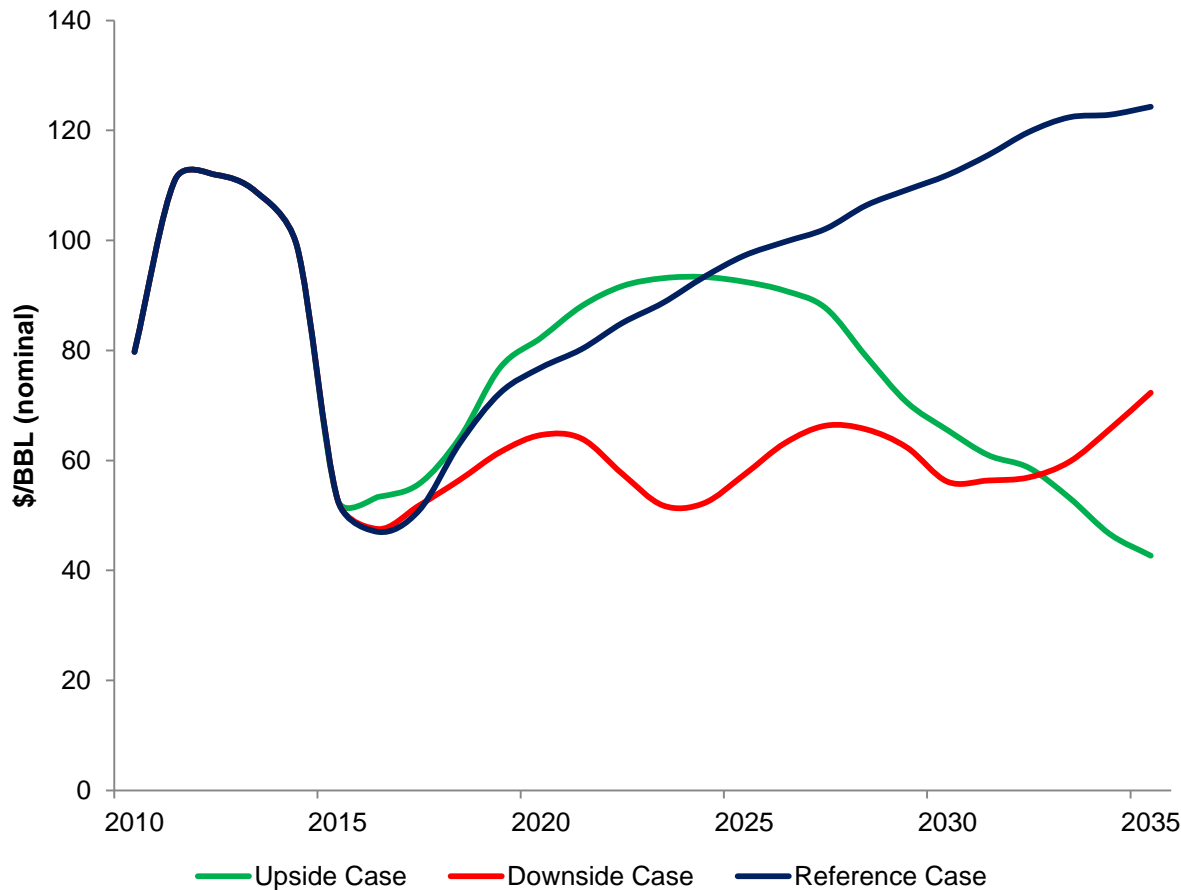
Upside Case – New Global Framework



Downside Case – Breakdown in Multi-Poles



Oil Price Outlook – Brent Crude

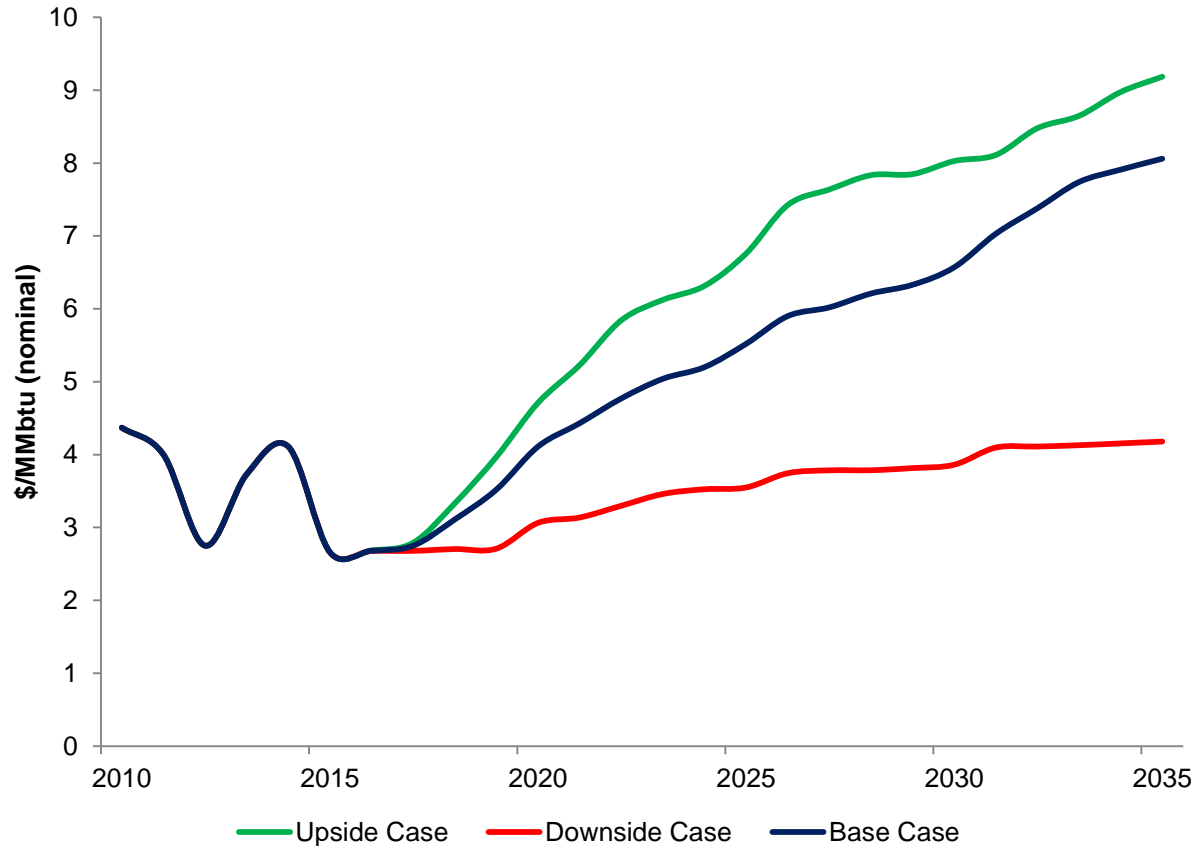


Business as usual – increasing demand with cost inflation

Demand weak; price oscillates as OPEC invests to suppress new investment and gain share

Demand pops on strong growth, but wanes as fracking spreads and world moves away from CO₂

Natural Gas Price Outlook – Henry Hub



Strong gas demand as world becomes more CO2 focused; price increases temper as fracking spreads

Exports drive greater demand – both through LNG and pipeline – setting marginal price

Price remains US centric as trade is stymied and carbon reduction remains of minimal concern



Conclusion

Key Takeaways

- Non-OECD demand and demand growth – across the value chain – will continue to grow in importance
- Sales of electric vehicles are increasing – but a major upward shift is not expected until the second half of the 2020s
- OPEC is not going away – even with increasing North American shale-related production
- The US energy sector is becoming more integrated with and dependent on the rest of the world
- Utilization of alternative fuel sources will continue to grow – but hydrocarbons will still play a major role
- There will be more volatility with respect to the oil market in comparison to the natural gas market

STRATAS ADVISORS

A HART ENERGY COMPANY

Stratas Advisors, a Hart Energy company, is a global consulting and advisory firm that covers the full spectrum of the energy sector and related industries. We can help you develop a deeper understanding of the developments that are shaping the future of oil & gas. Our support includes customized consulting that is focused on a client's specific strategic objectives, competitive challenges and asset base. Additionally, we offer support through subscription services and comprehensive market studies

UPSTREAM | MIDSTREAM | DOWNSTREAM | FUEL & TRANSPORT

1616 South Voss Road Suite 675 | Houston, TX 77057 United States | TEL +1.713.260.6426 | stratasadvisors.com

Bogotá | Brussels | Denver | Houston | London | Melbourne | Mexico City
New Delhi | New York | San Diego | São Paulo | Singapore | Washington, D.C.