Commodities Research

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Energy Market Outlook:

Between scarcity and abundance

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PLEASE SEE ANALYST CERTIFICATIONS AND IMPORTANT DISCLOSURES STARTING AFTER PAGE 37

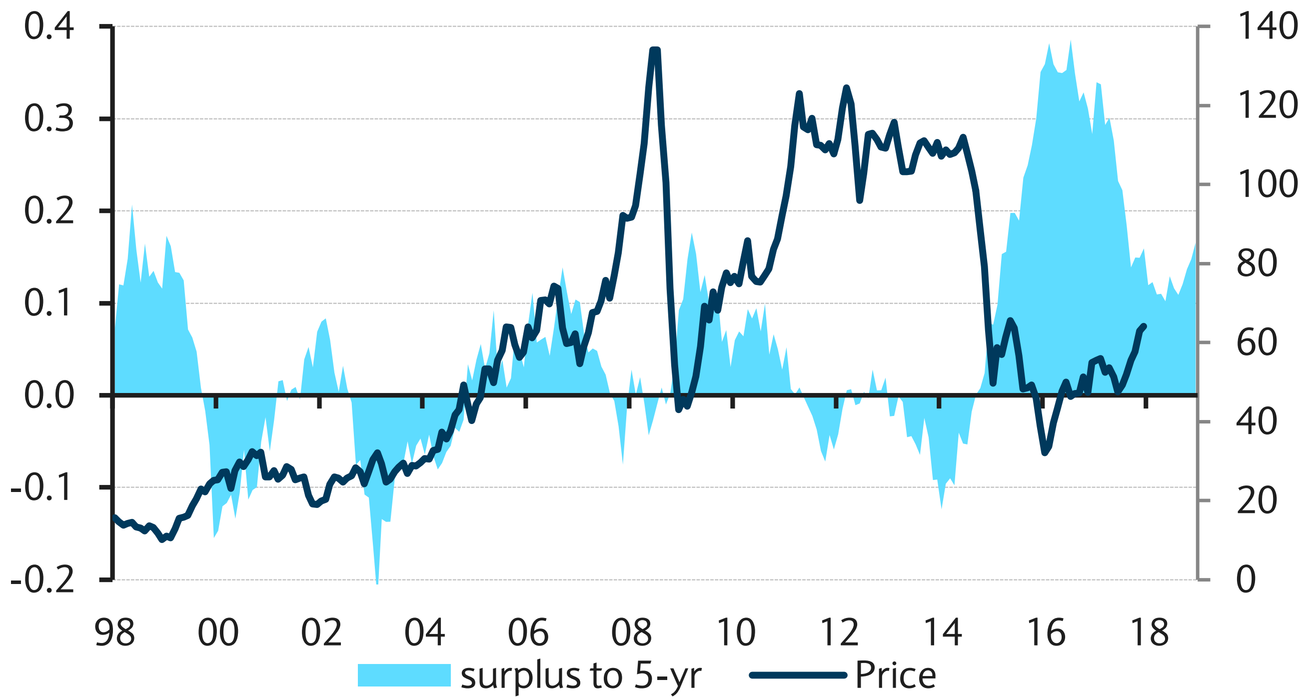
Oil market short-term overview

As inventories draw, geopolitical supply concerns emerge

Inventory drawdown continued through end of year. Market looking for clarity on situations in Venezuela and Iran, and OPEC policy

1. Prices have experienced justified strength as stocks draw, but high prices will create a hangover effect
2. We remain bearish on prices at current levels due to expected shale growth, global supply builds in ‘18, and the removal of temporary supply supports
3. OPEC strategy must balance short and long term revenue maximization: to that end it wants relatively high and stable prices not price fluctuations in a lower range

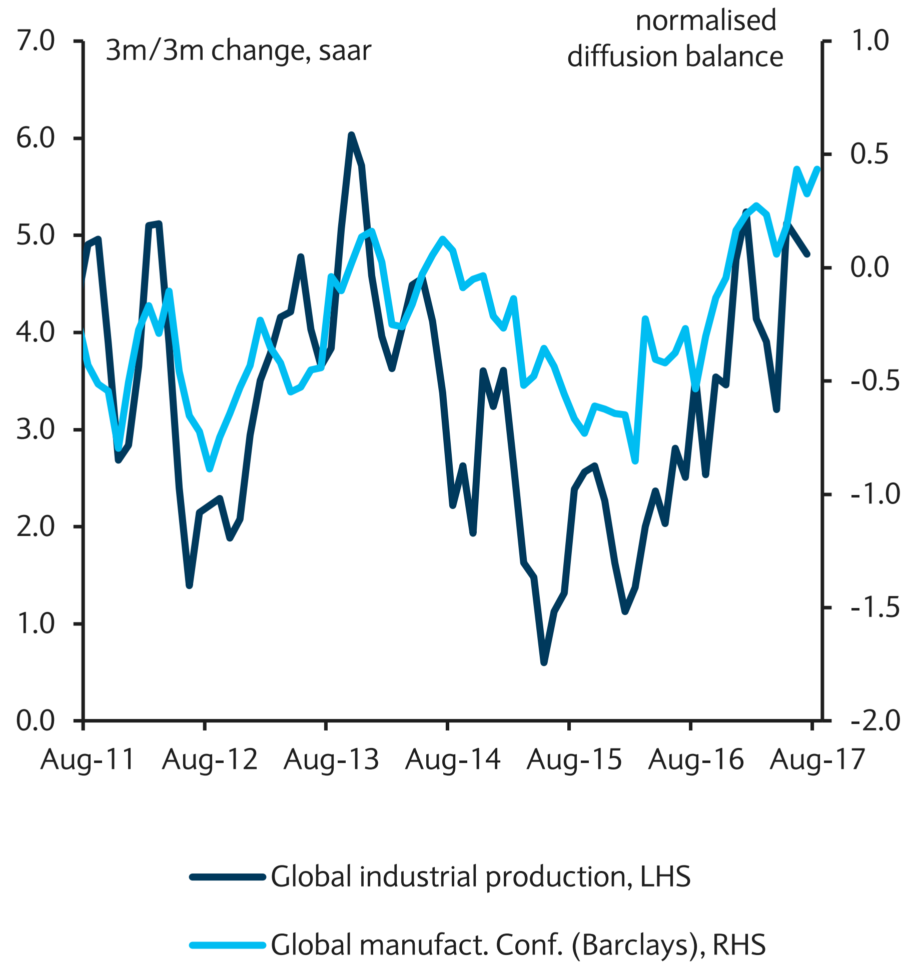
OECD industry petroleum stock levels vs 5-yr avg (Jan 1998-Dec 2018)



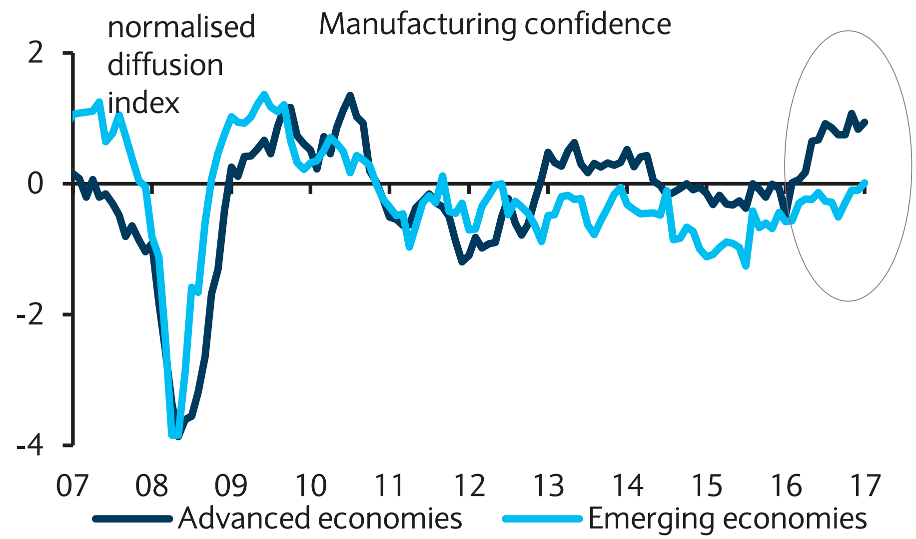
Source s: IEA, Bloomberg, Barclays Research

Synchronicity: global economic recovery across all regions…

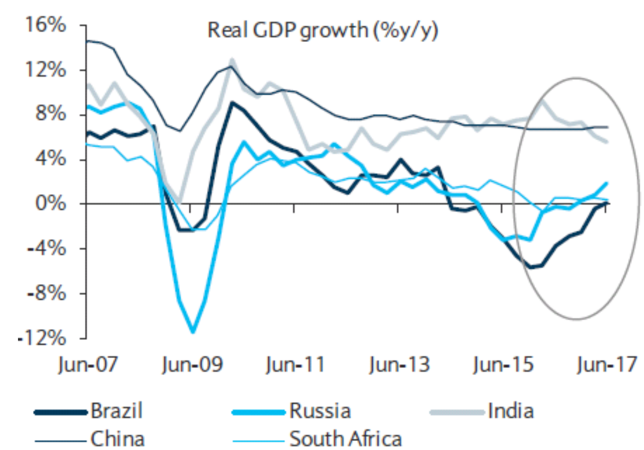
Solid outlook for global growth



Global growth being driven by developed economies and EM is catching up …



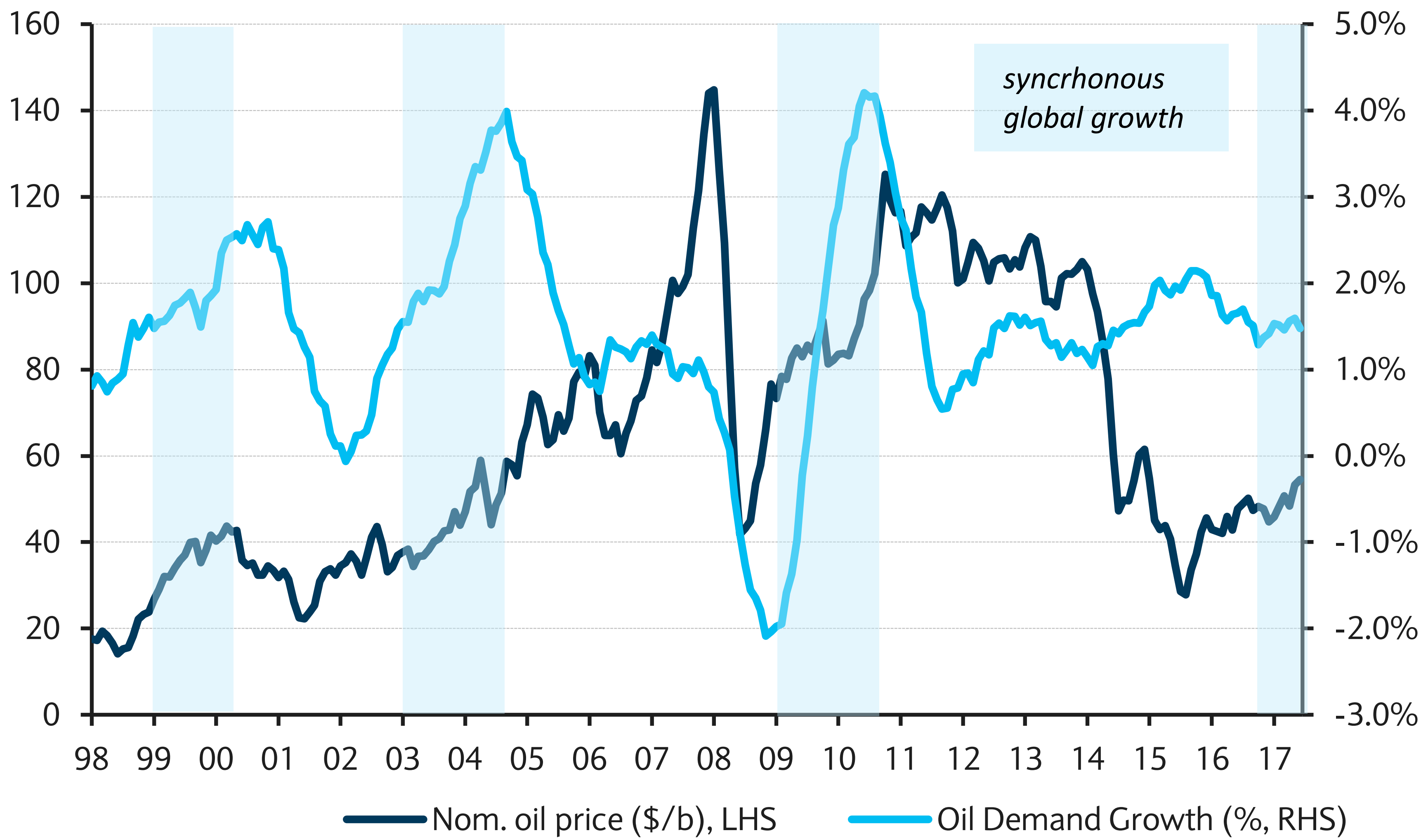
… and some commodity intensive economies still recovering



Source for all charts: IEA, Bloomberg, Barclays Research

…which is driving robust demand growth

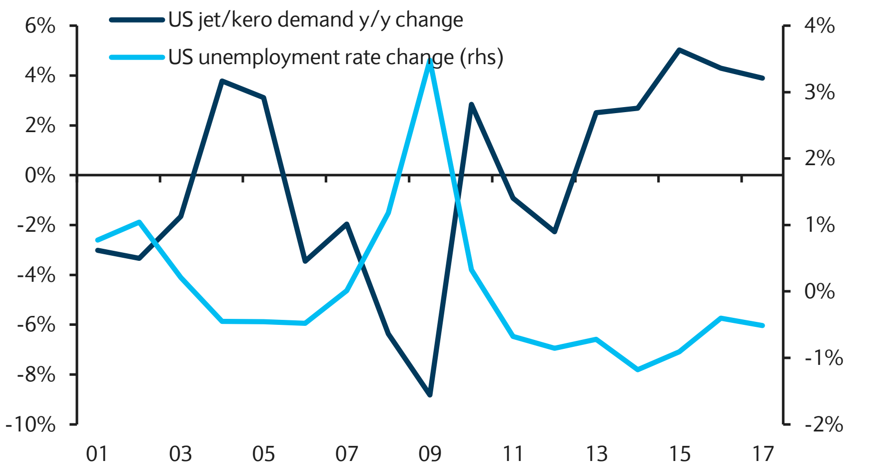
Timeframes of synchronous global economic growth consistent with acceleration in demand growth and rising oil prices (Jan 1998-Dec 2017)



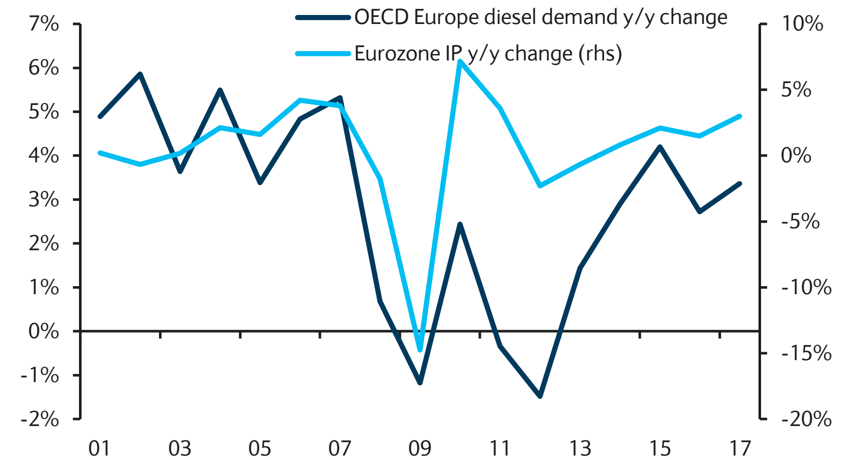
Source: Haver Analytics, IEA, EIA (Imported nominal average acq. cost), Barclays Research

Accelerating economic activity is helping tighten the oil market

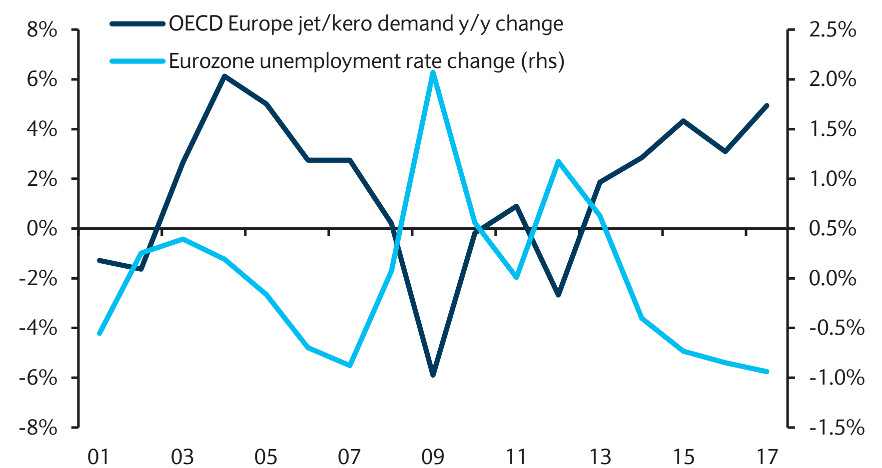
Lower unemployment rate helped lift jet/kero demand



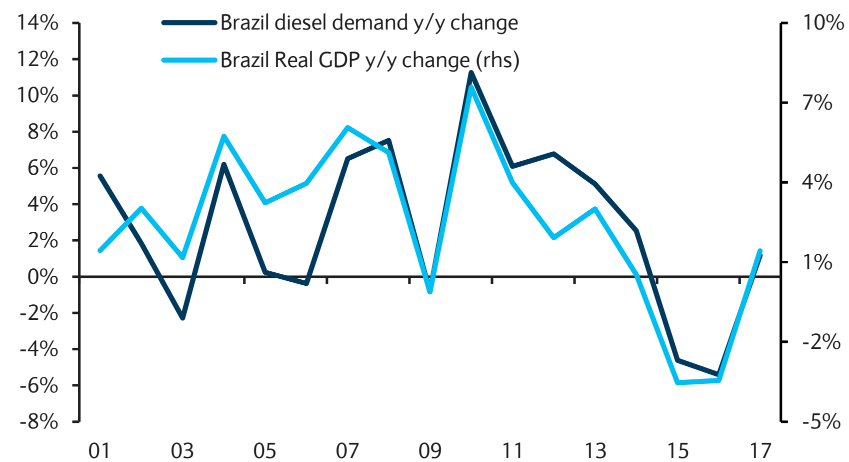
Higher industrial activity in the eurozone helped boost diesel demand there as well



Lower unemployment rate was favorable for jet/kero demand growth in OECD Europe



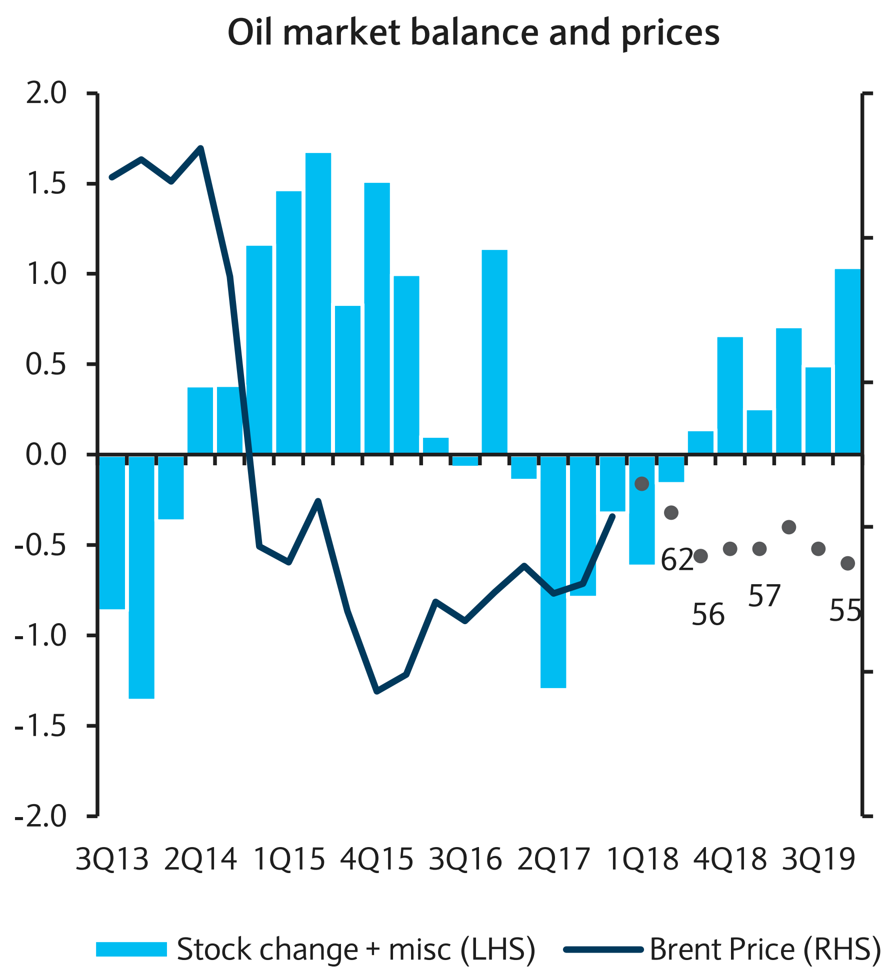
Higher commodity prices also helping lift activity in exporting countries like Brazil

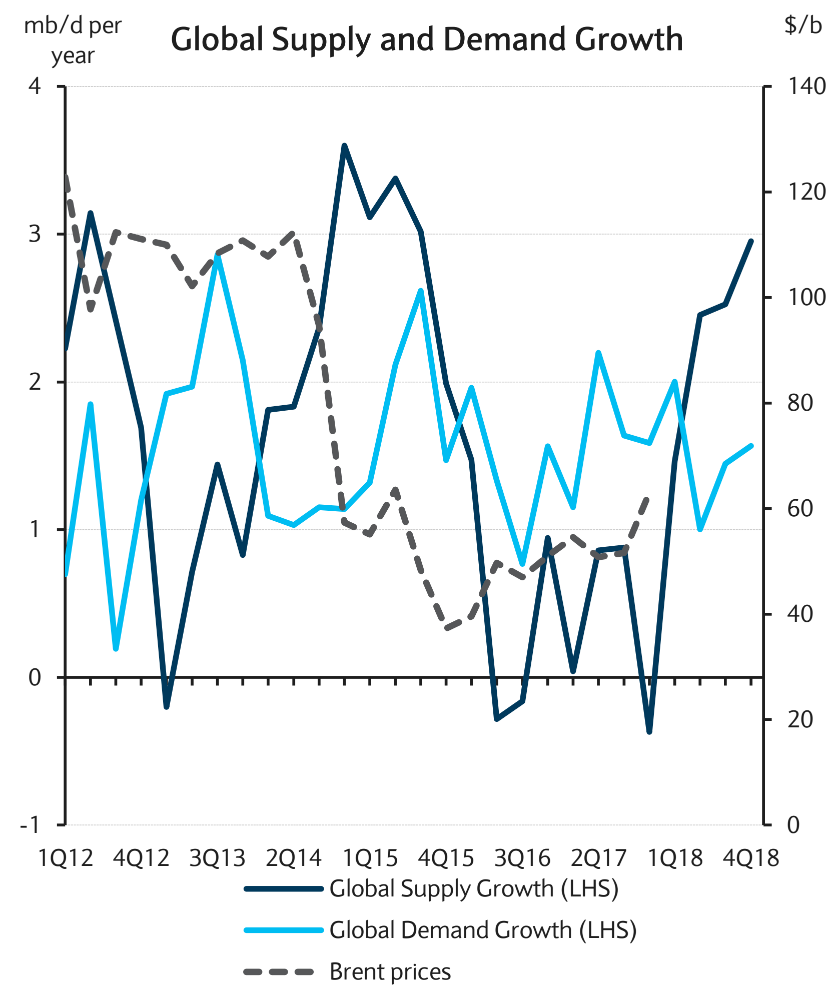


Source for all: Rystad Energy UCube, Petrologistics, EIA, Bloomberg, Barclays Research

But despite all this, surplus emerges later this year and next

We assume robust demand growth and continued declines in Venezuela's production, but strong US supply growth this year and next will push the market into surplus



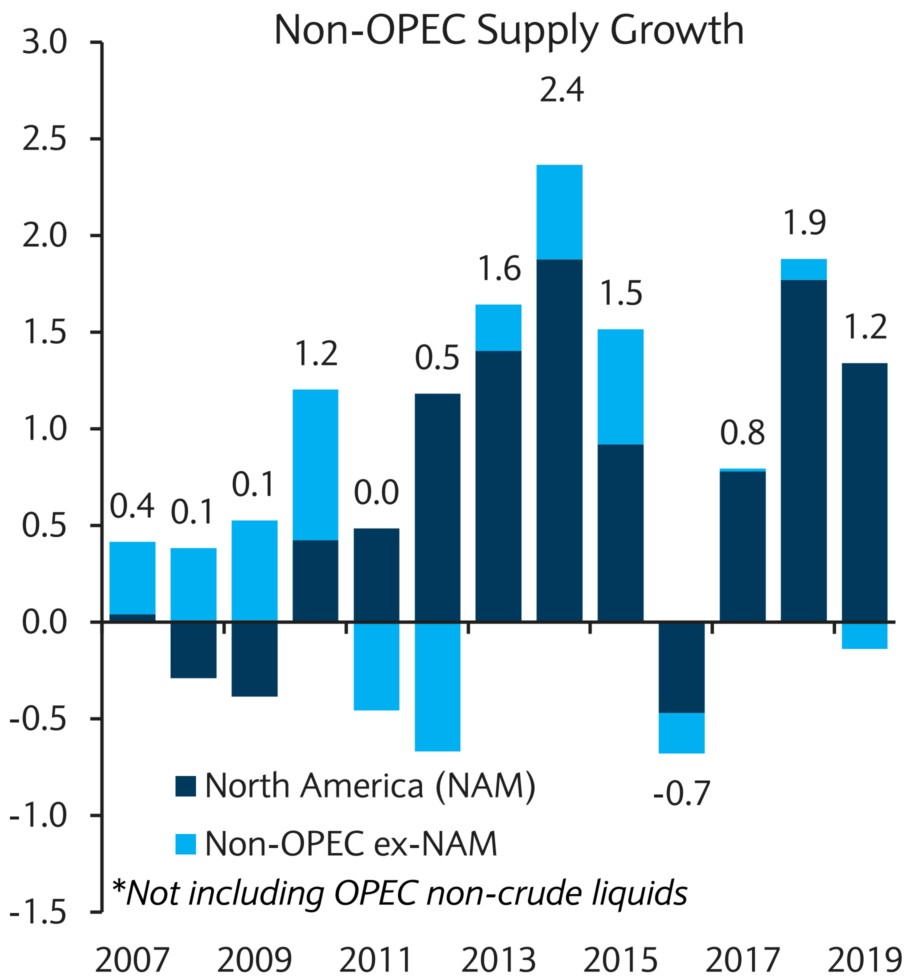


Source: Bloomberg, Barclays Research

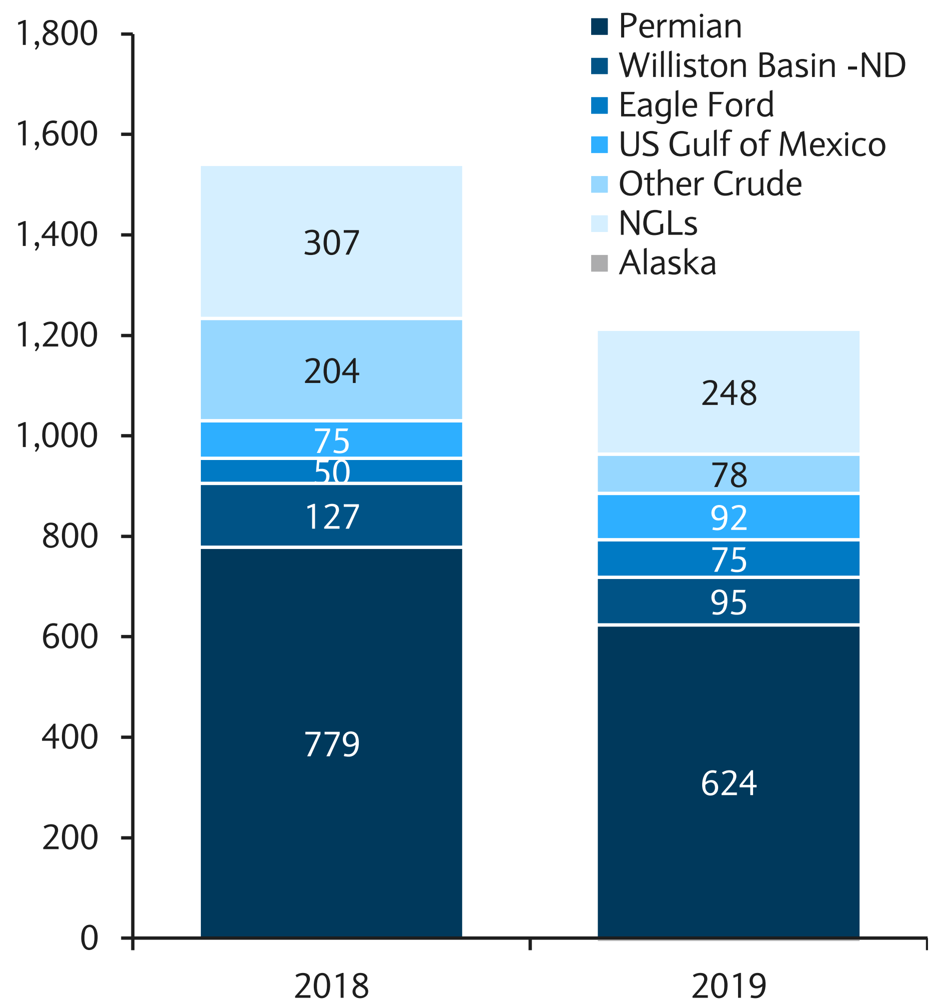
Oil outlook to 2019:
Between scarcity and abundance

We forecast 1.9 & 1.2 mb/d of non-OPEC growth in 2018-19

Non-OPEC supply growth centered entirely on North America in 2018 and 2019



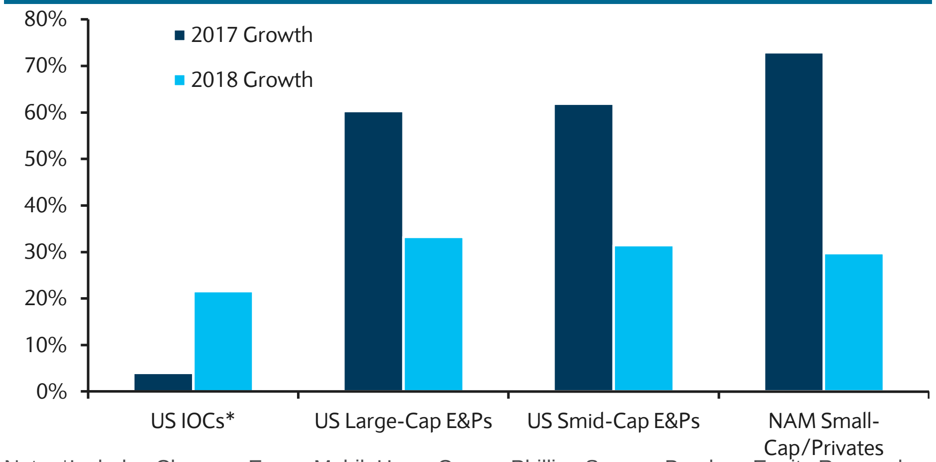
The Permian will drive production growth over the coming years (mb/d)



Source for all charts: IEA, EIA, Barclays Research

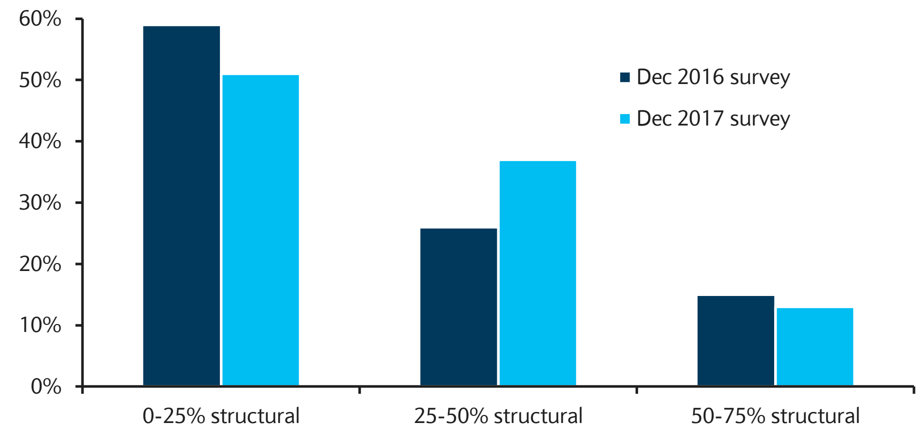
US output to grow to 11.8 mb/d on rising upstream spend

Most of NAM upstream expects to spend 30% more in 2018 y/y



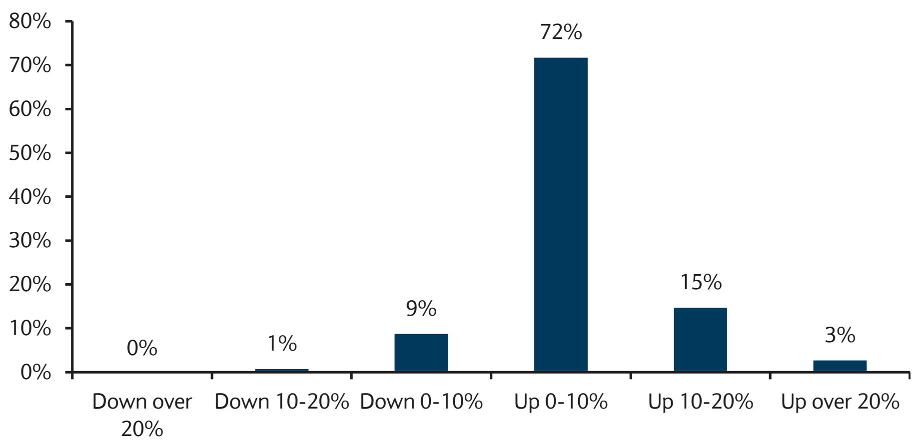
Note: *Includes Chevron, Exxon Mobil, Hess, ConocoPhillips Source: Barclays Equity Research

In 2017, more NAM producers viewed cost reductions as structural than in 2016…



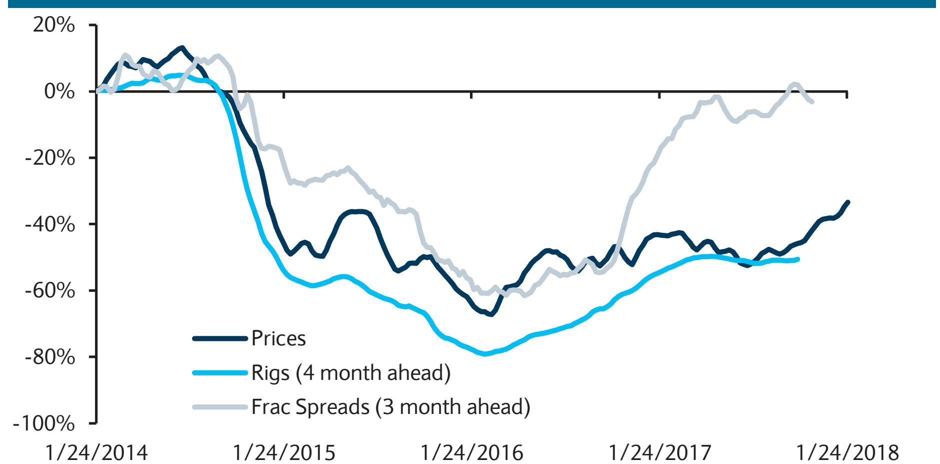
Source: Barclays Equity Research Global 2018 E&P Spending Outlook

…Yet 90% of producers expect some degree of cost inflation this year



Source: Barclays Equity Research Global 2018 E&P Spending Outlook

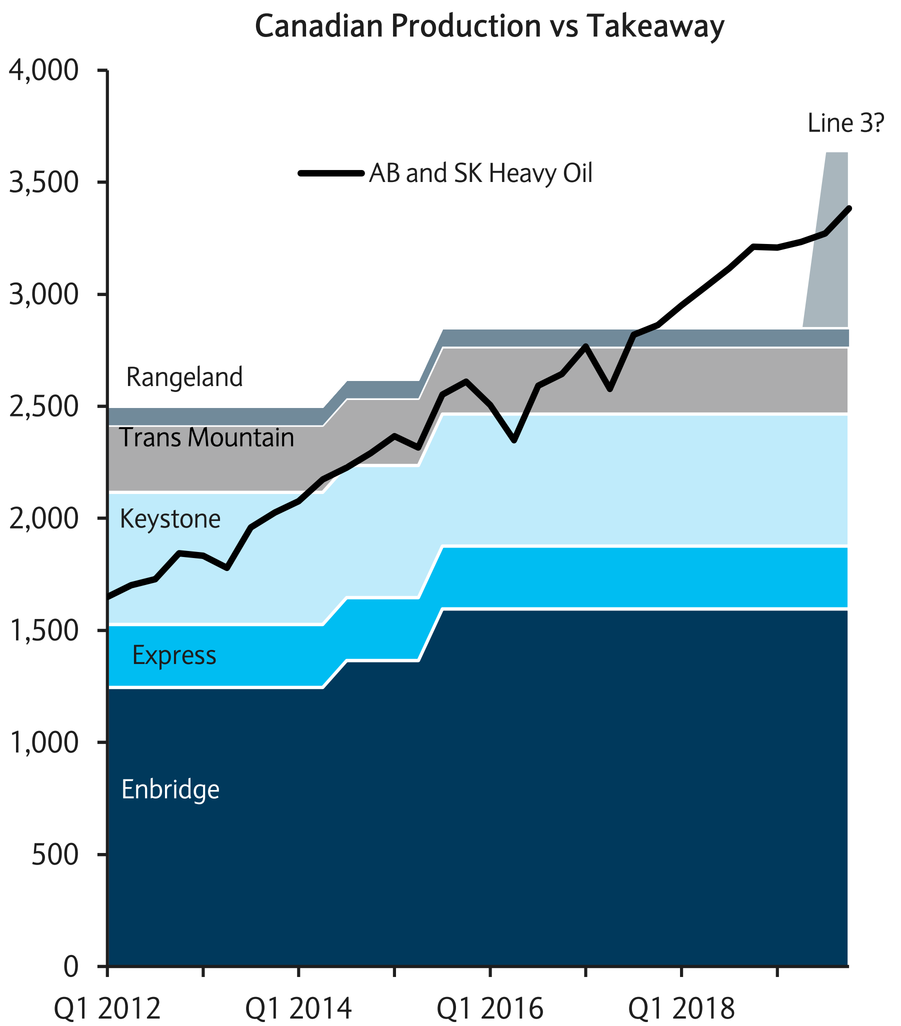
Ultimately, activity will be driven by oil prices



Source: Primary Vision Market Intelligence and Consulting, Baker Hughes, Bloomberg, Barclays Research

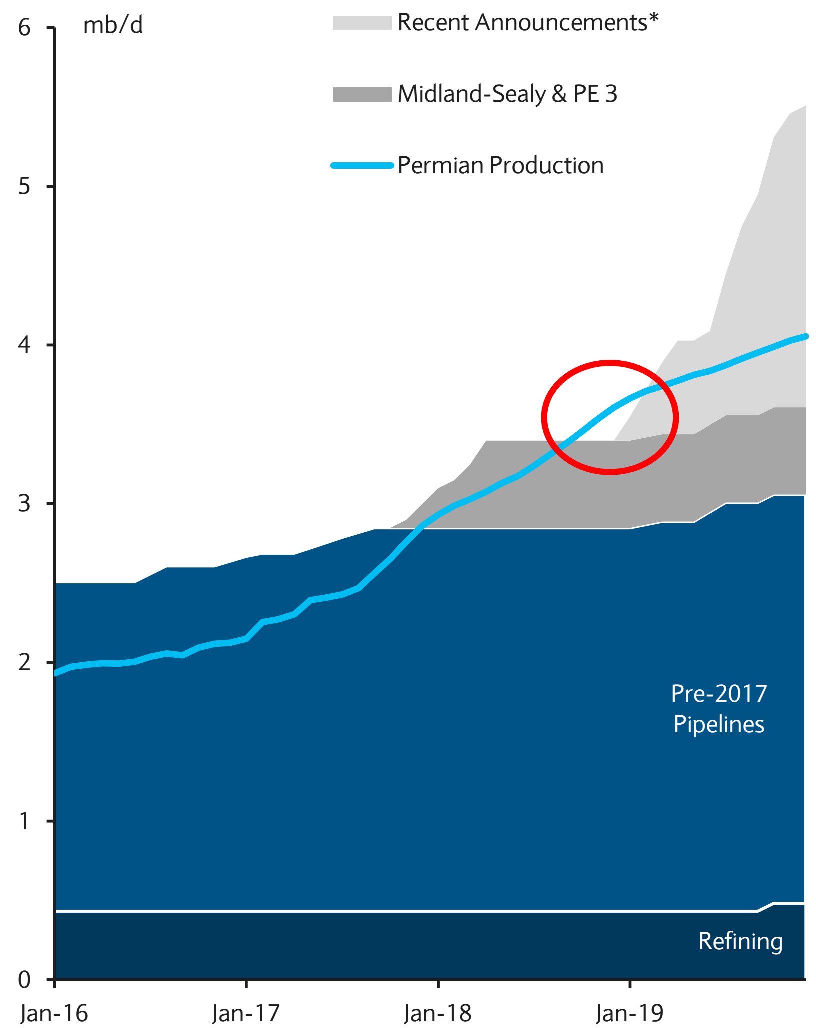
Leading to capacity constraints in strong growth areas

Canadian takeaway capacity looks constrained until 2019



Note: Assumes dilbit volumes (70/30)
Source: Company reports, AER, Barclays Research

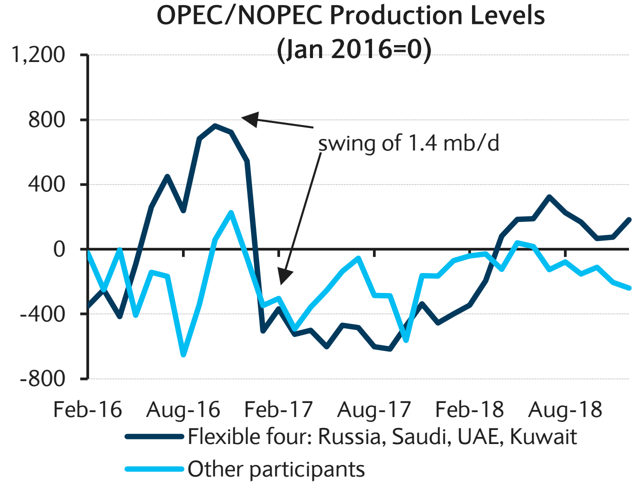
Tight takeaway capacity in the Permian should cause Midland-USGC weakness in late 2018



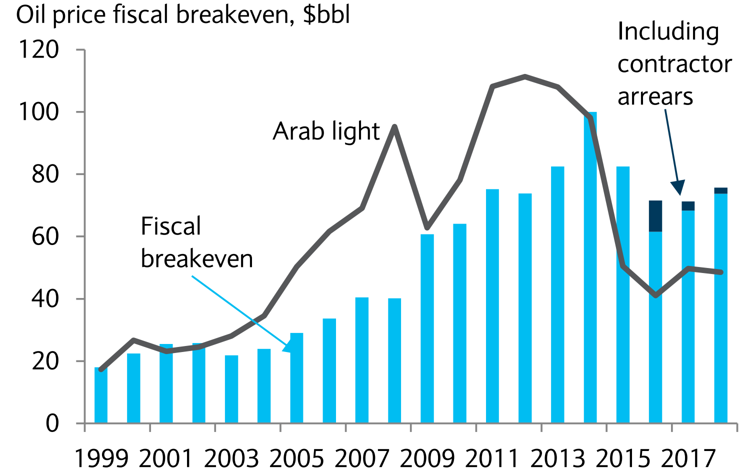
Source: Company Reports, EIA, DrillingInfo, Barclays Research

Pillars of OPEC strategy #1: Tradeoff between long/short term revenue maximization

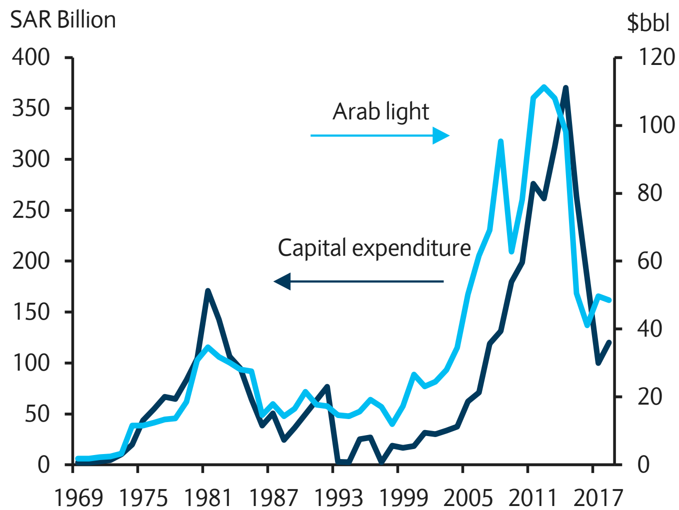
Focus on the flexible four: UAE, Kuwait, Saudi Russia. Most others producing at status quo



Saudi fiscal breakeven at around $74/b

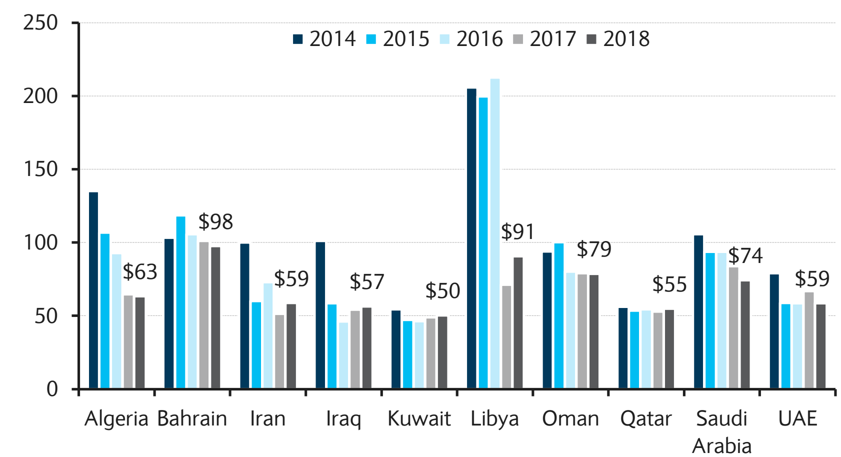


Saudi public expenditures have already been sharply cut post-2014



Source: Haver Analytics, SAMA, Barclays Research

Most MENA countries have fiscal BEs around current price levels



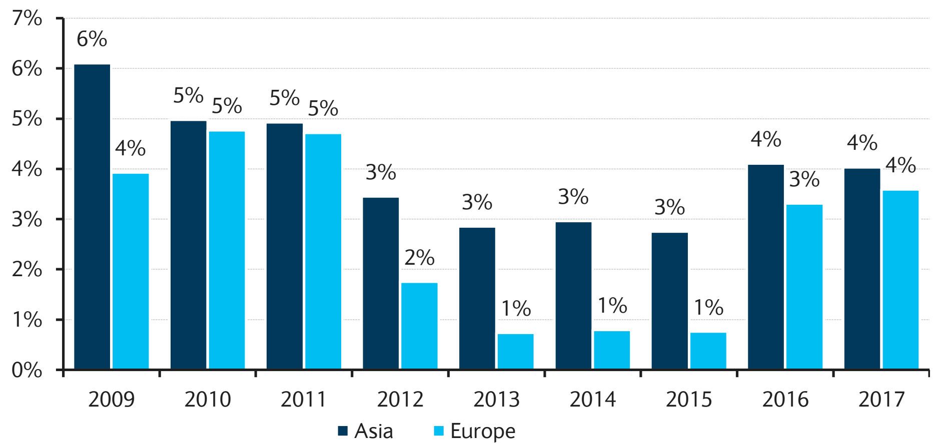
Source: IMF, 2017, Barclays Research.

Pillar #2: Fragile producers deliver high overall compliance

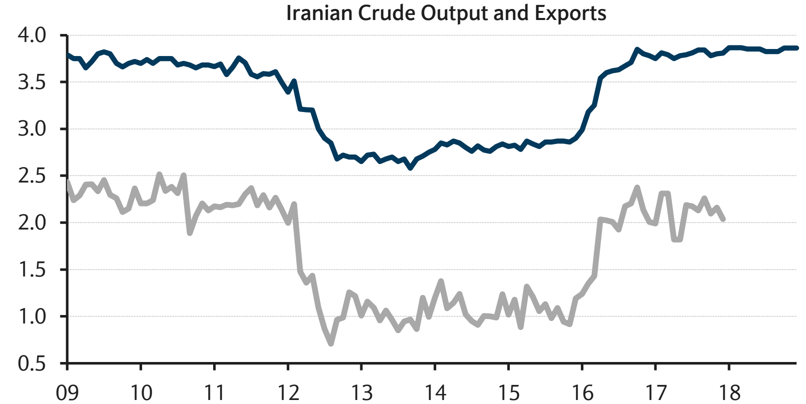
Trump's Iran policy – death by a thousand cuts to the JCPOA. Working class protests pose a more serious problem to the regime and some protests centered near energy infrastructure

	Top annual exports	2017 Ave	Wiggle Room
China	602	584	18
France	127	127	-
Greece	86	86	-
India	467	446	22
Italy	196	196	-
Japan	348	119	229
Malaysia	17	1	15
Netherlands	117	31	86
Pakistan	35	0	35
South Africa	119	0	119
South Korea	237	104	133
Spain	110	93	17
Sri Lanka	39	0	39
Taiwan	65	39	25
Syria, Turkey, Phillippines	312	270	42

Iran Market Share in Asia and Europe (2009-16)



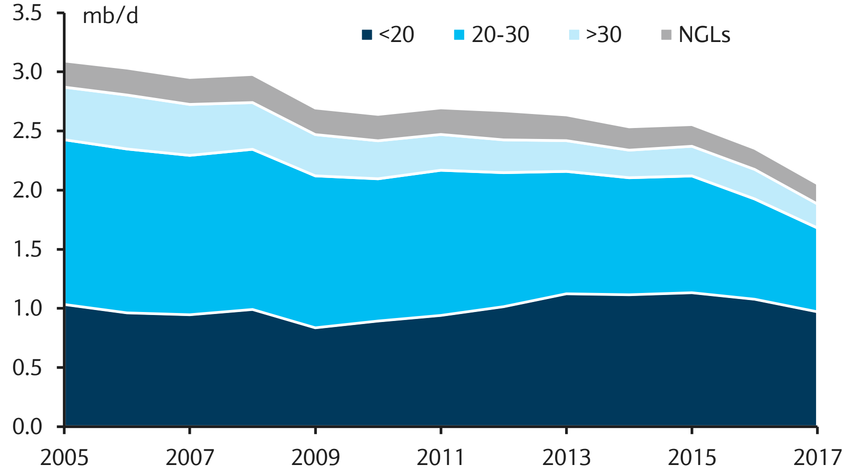
Iranian Crude Output and Exports



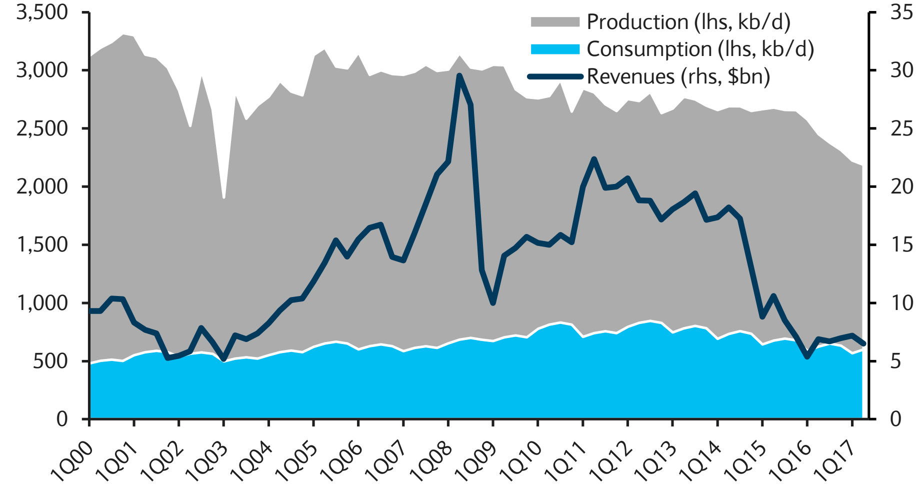
Source: EIA (map), IEA (production), Petrologistics (exports), Barclays Research

Sanctions accelerating Venezuela's production decline

Production is expected to decline 50-100 kb/d m-o-m in 2018.



Revenues remain depressed as production declines have offset higher prices



Markets likely better prepared for a Venezuela disruption than it was in 2002

Energy security metric	Unit	Nov-02	Jun-17	Better/Worse*
Spare Capacity	mb/d	3.68	2.01	Worse
Spare Capacity/Demand	ratio	5%	2%	Worse
OECD Inventory cover	days	32.7	30.3	Worse
US crude throughput cover	days	17.5	25.1	slightly better**
US crude and cond. output	kb/d	7,975	13,294	Better
US Import share	ratio	13%	8%	Better
US oil imports from Venezuela	kb/d	1,447	796	Better
Venezuela Production	kb/d	2,745	2,000	Better
Venezuela output as share of global heavy output	ratio	18%	14%	Better

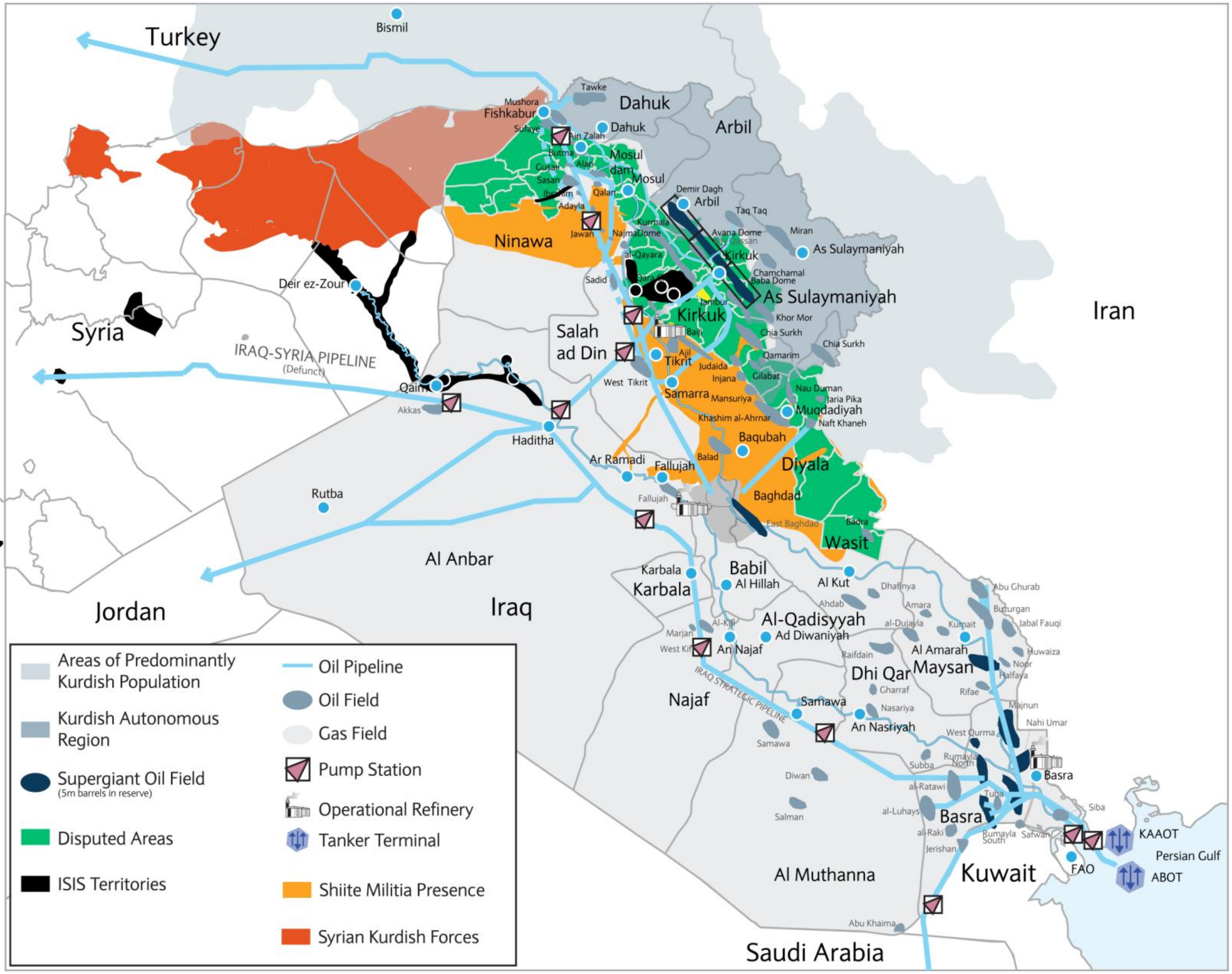
*in terms of being better/worse off in the case of a disruption. **though inventory levels are higher, some of the increase is due to higher inventory needs for more pipeline and infrastructure capacity.

PDVSA controls the lion's share of production (kb/d)

Company	2010	2011	2012	2013	2014	2015	2016
Shell	10	20	20	20	20	20	20
Chevron	80	80	90	90	90	90	80
Repsol	20	30	30	30	20	30	30
CNPC	10	20	20	20	20	30	30
PetroChina	20	20	20	30	30	30	30
Total	40	40	40	40	40	40	30
Rosneft	40	40	50	60	60	60	70
Gazprom	100	90	90	80	90	60	50
Others	70	80	80	110	110	130	130
PDVSA	2,220	2,260	2,210	2,150	2,050	2,060	1,880

Source: for all: Rystad Energy UCube, Petrologistics, EIA, Barclays Research,

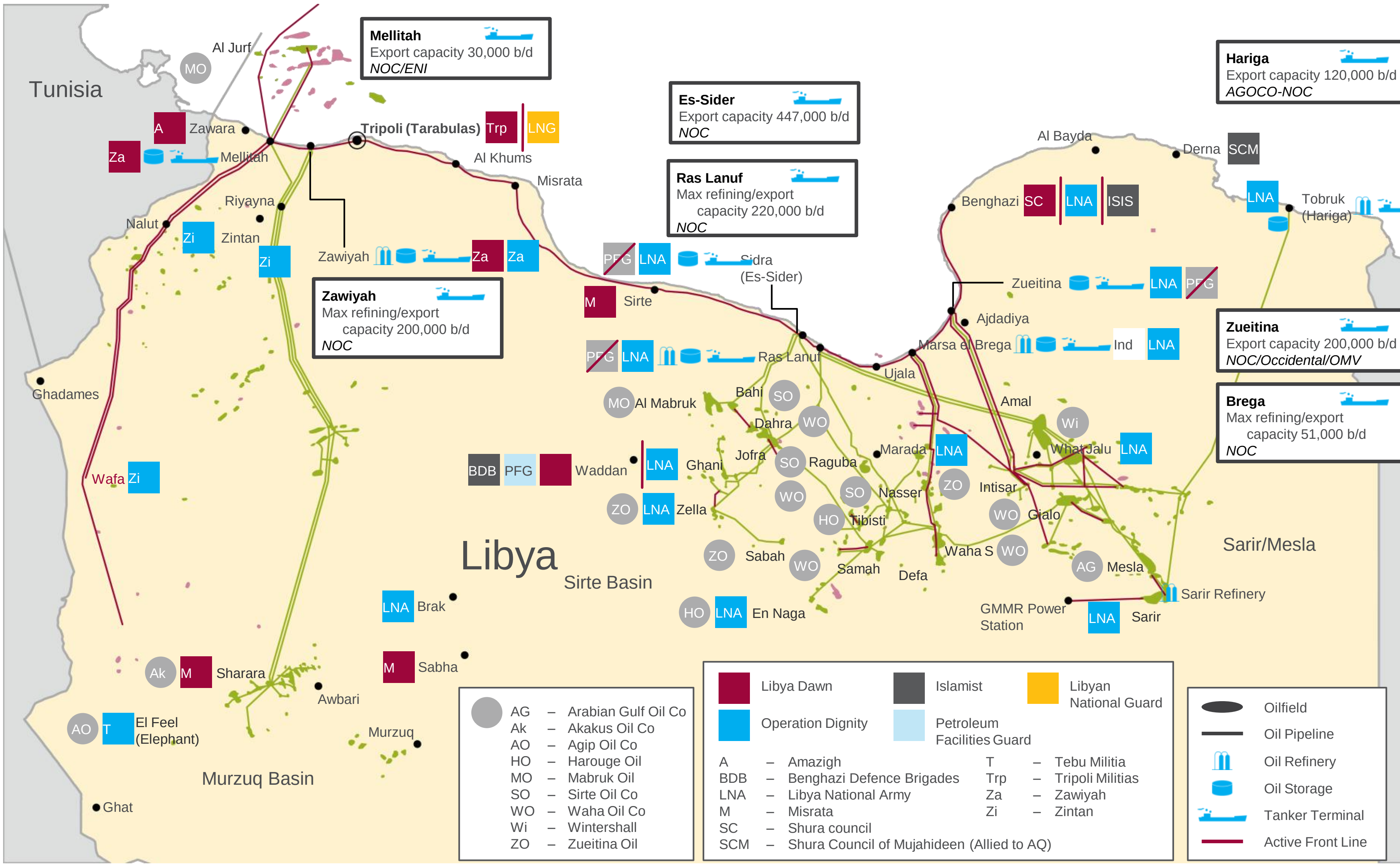
Iraq: Elections in 2018 likely to cause unrest



Source: ISW, Barclays Research

Libya: Output likely to improve/decline in fits and starts

Libya's western exports are captive to the free flow of oil to Zawiyah, while the Sirte basin fields have more alternatives



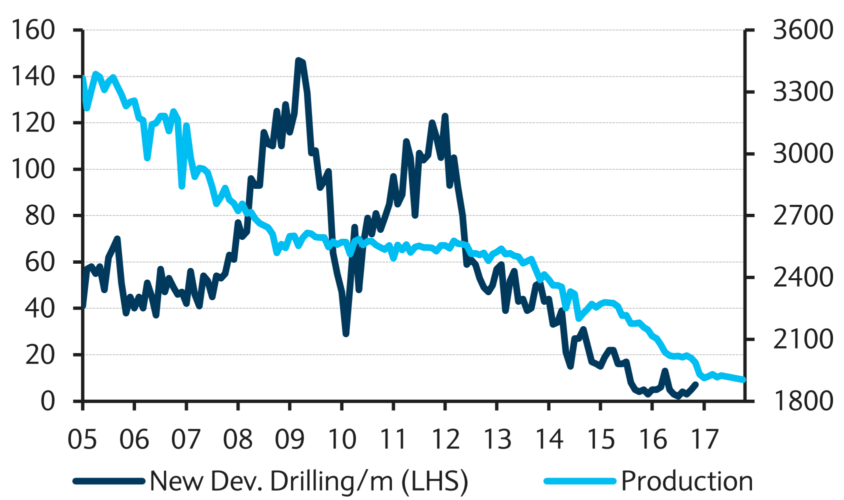
Note: Military dispositions represent location of forces, not their relative strength which is variable. Source: Petroleum Economist, Barclays Research

Pillar #3: Include as many non-OPEC countries as possible

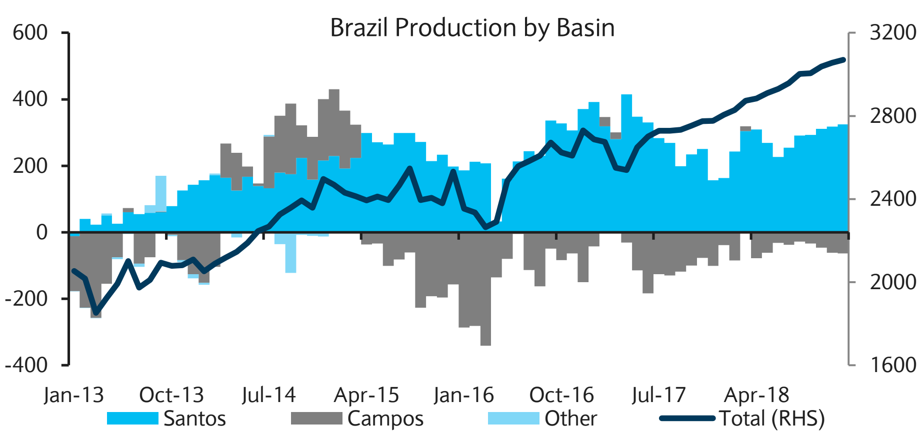
Russia has substantial incremental output potential but subject to brownfield declines

Field	Operator	2017	2018	2019	18 Growth	19 Growth
Urengoy (Rospan), Cond.	Rospan International	29	74	96	45	21
Novoportovskoye	Gazpromneft-Yamal	90	120	128	30	8
Vladimir Filanovski	LUKOIL Nizhnevolzhskneft	90	114	126	24	12
Odoptu-More (Sakhalin)	ExxonMobil	43	66	71	22	5
East Urengoy	Rospan International	4	26	38	22	12
Yurubcheno-Tokhomskoye	Vostsibneftegaz	12	32	90	20	58
East Messoyakhskoye	Messoyakhaneftegaz	40	60	85	20	25
Srednebotuobinskoye Cntl	Taas-Yuryakh	27	47	78	20	31
Prirazlomnoye (TP)	Gazprom neft shelf	50	65	75	15	10
Orenburg (East)	Gazpromneft-Orenburg	37	52	67	15	15
	Total*	423	657	853	233	196

Mexico's production declining anyway



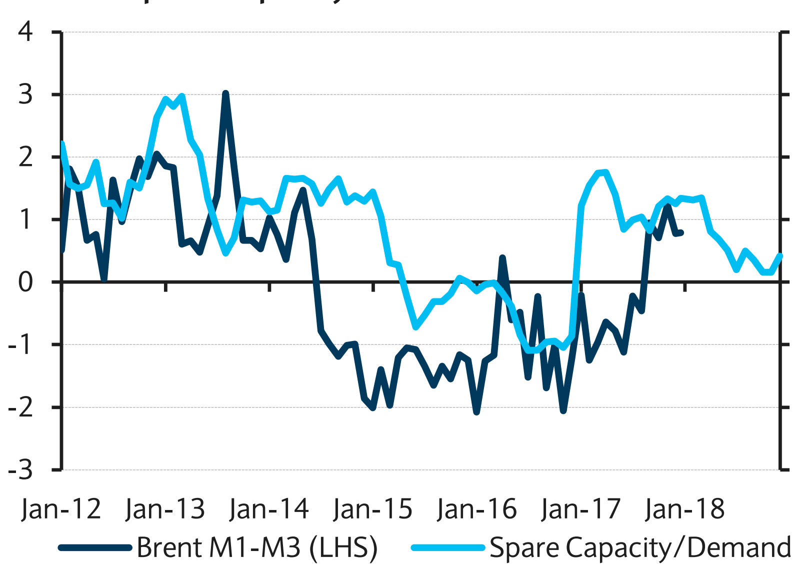
Canada and Brazil to pose challenges in 2018



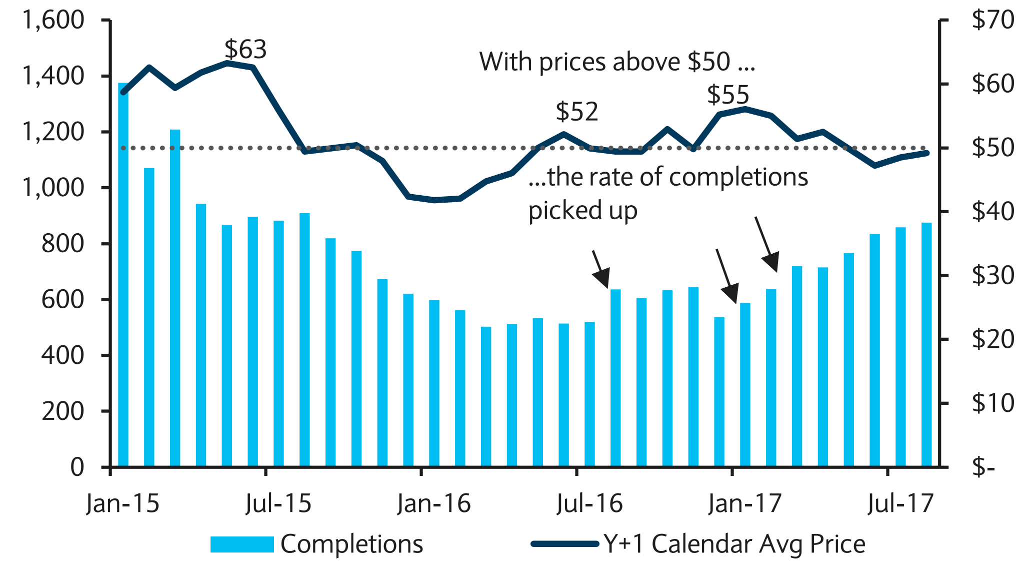
Source for all charts: Bloomberg, CDU-TEK, IEA, CNH, ANP, WoodMackenzie, Barclays Research

2018 outlook: OPEC strategy for the shale age still evolving

Higher spare capacity in 2017. May decline in 2018 and induce contango



US supply is more elastic than assumed: 1+ mb/d of US tight liquids growth in 2018

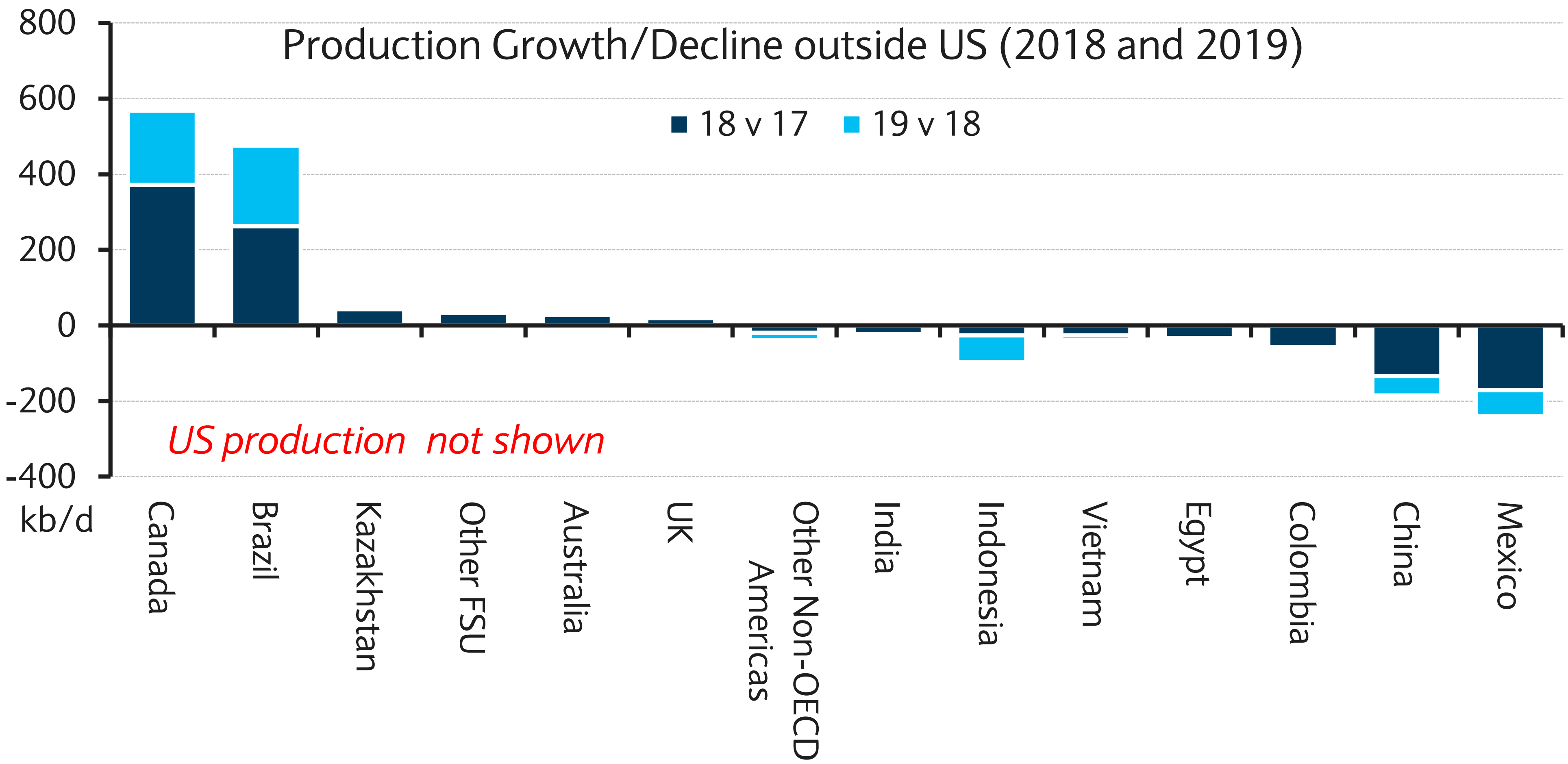


Source : Bloomberg, EIA, Barclays Research

1. Commentary should focus more on demand drivers
2. OPEC/Non-OPEC Dec. of Cooperation is signaling mechanism that won't be scrapped
3. Just as during price decline, OPEC testing symmetry and degree of shale response.
4. OPEC strategy balancing short and long term revenue maximization, collectively. Seeking relatively high and stable prices not price fluctuations.

Production outside the US comes from multiple locations

Oil fields naturally decline, but new additions mitigate the field/basin/country-level declines

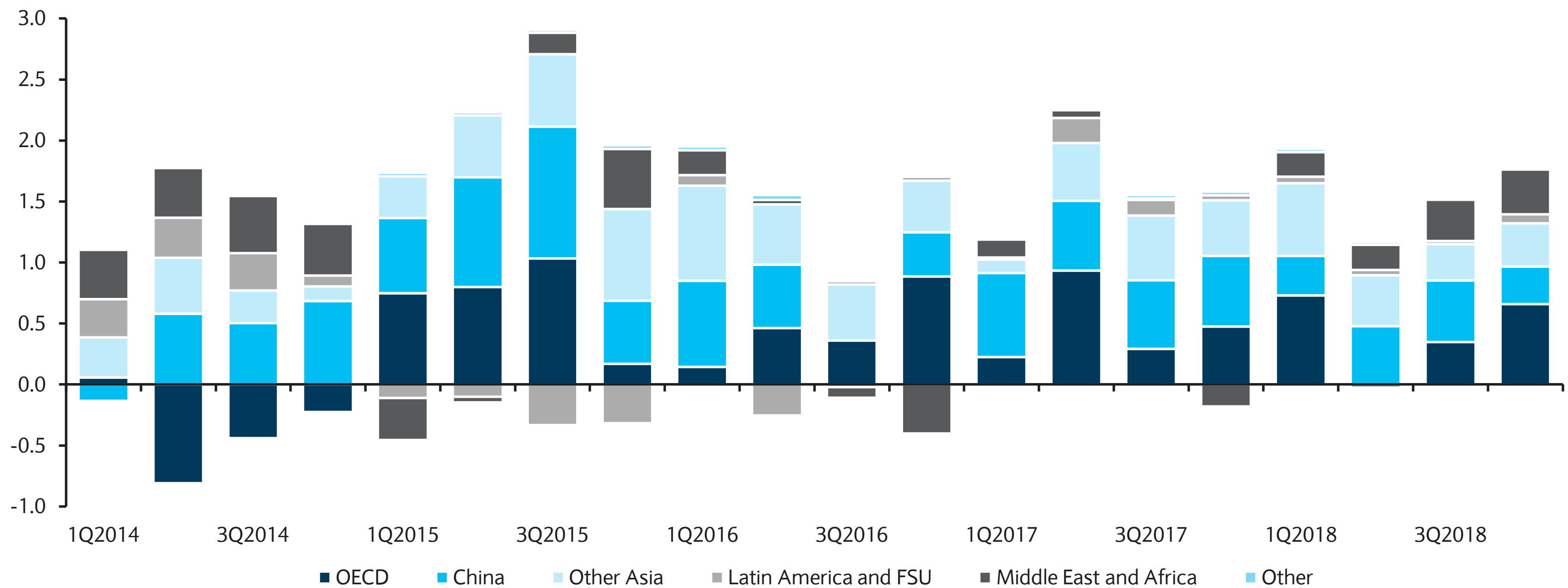


Source: IEA (history), Barclays Research

Global oil demand growth: A rising tide…

- Robust outlook for global economic activity supporting oil demand.
- GDP estimates revised up: China - 6.4% to 6.7%, US - 2.4% to 2.9%, Advanced economies - 2.1% to 2.5%.
- Elasticity higher due to structural changes in energy commodities pricing in non-OECD countries.
- Energy intensity of global GDP growth has also been declining over the years.

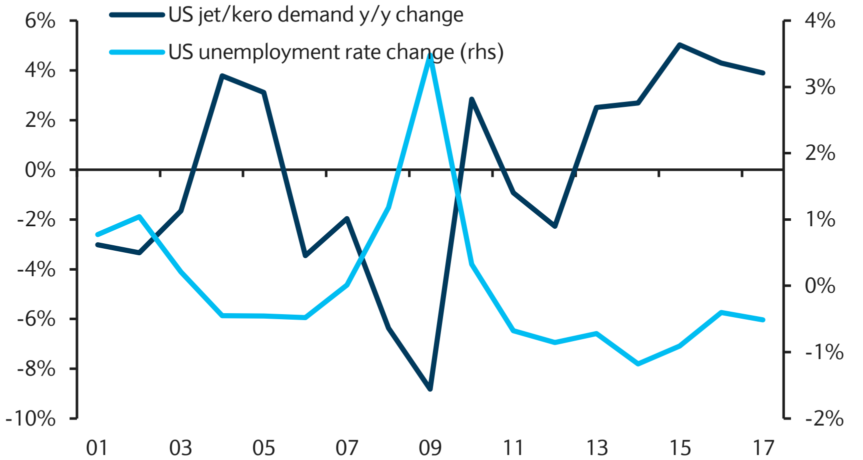
World total products demand y/y change by region (mb/d)



Source: IEA, Bloomberg, Barclays Research

Accelerating economic activity is helping tighten the oil market

Lower unemployment rate helped lift jet/kero demand



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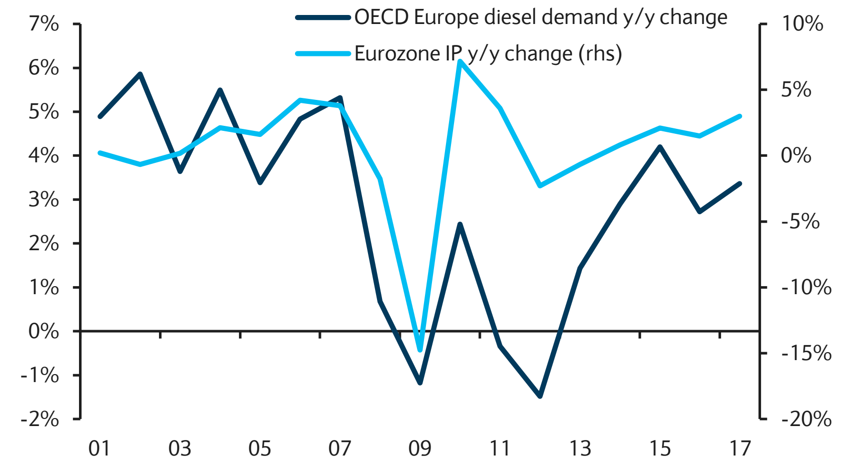
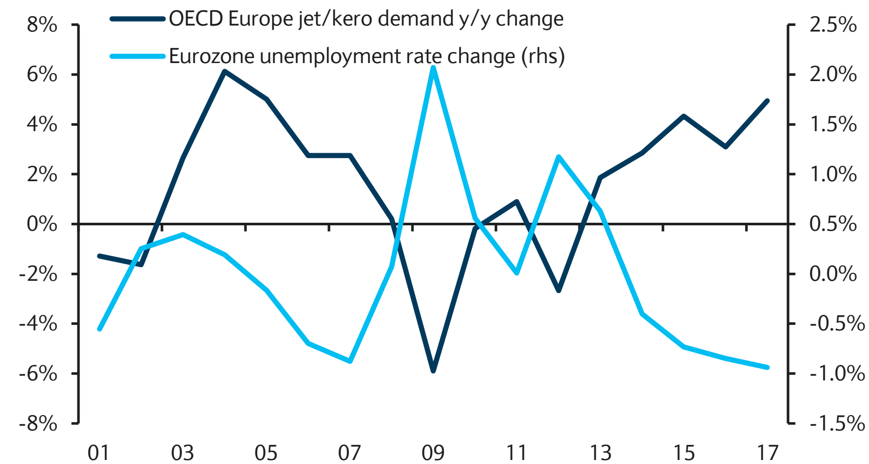
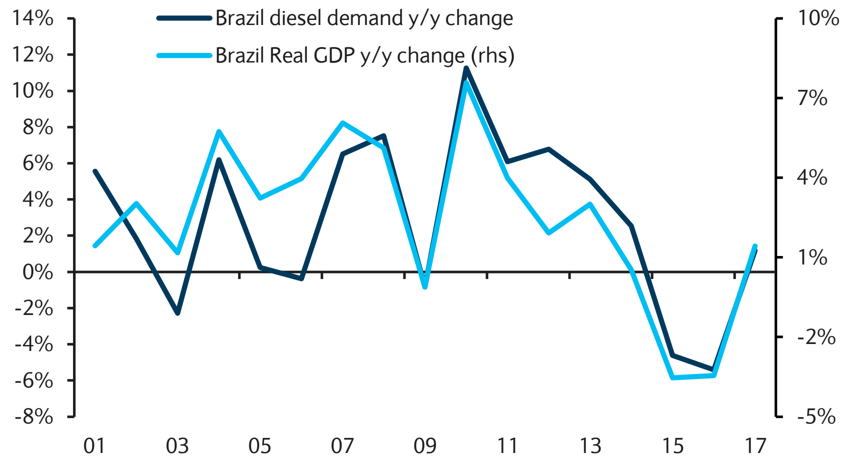


Lower unemployment rate was favorable for jet/kero demand growth in OECD Europe



Higher commodity prices also helping lift activity in exporting countries like Brazil

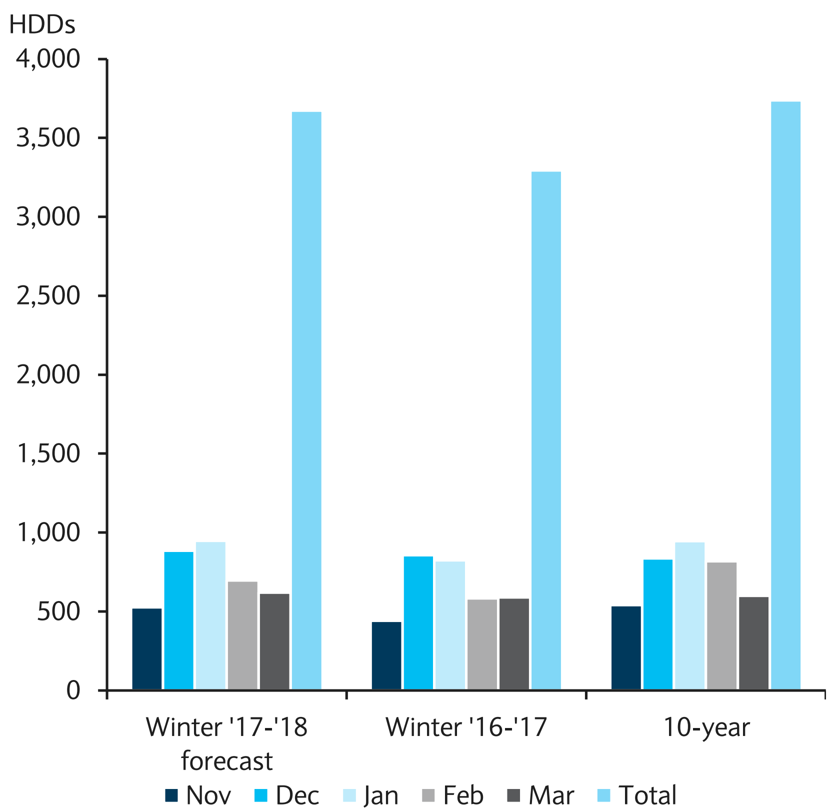


Source for all: Rystad Energy UCube, Petrologistics, EIA, Bloomberg, Barclays Research

Natural Gas Outlook

Storage levels are on pace to end March at their lowest level since 2014

Current March forecasts suggest a total winter 2017-18 that will come in 2% warmer than the 10-year average but 12% colder than last winter

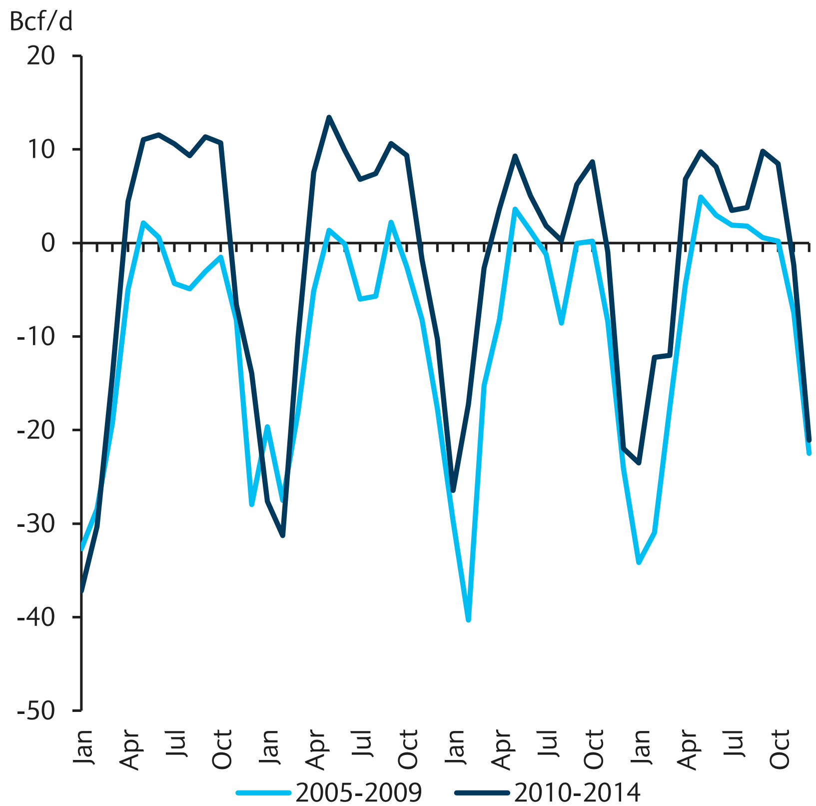


Storage levels entered winter (end October) at 5% above the five-year average and are now 16% below the five-year average

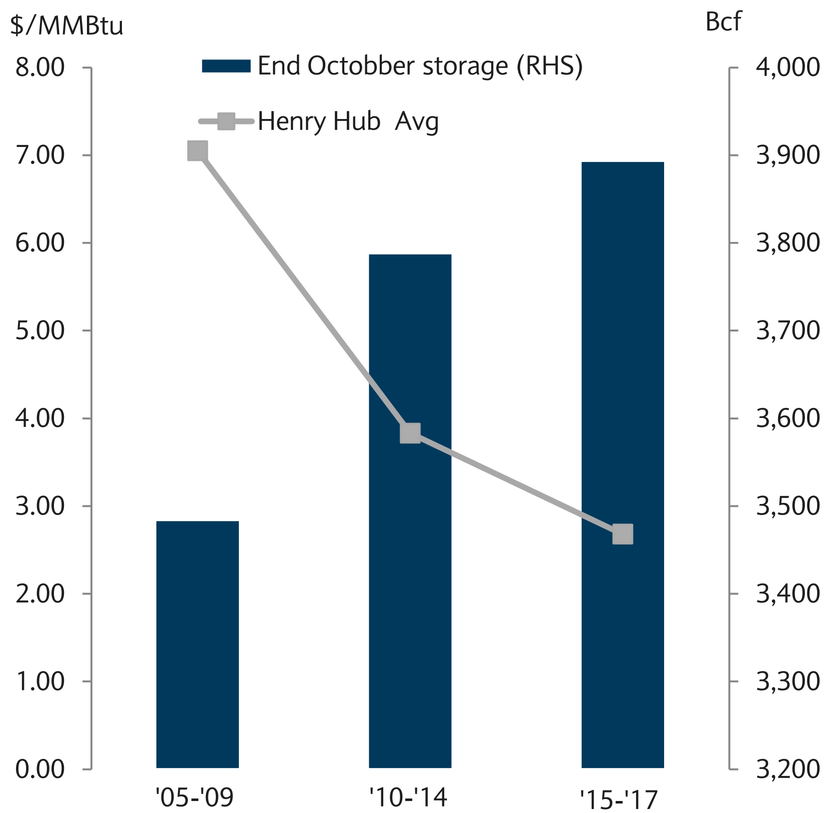
Source for both charts: EIA, Bloomberg, Barclays Research

The eternal struggle for US gas: Too much gas not enough demand

The shale revolution has increased the spread between total supply and total demand…



…resulting in more gas in storage, which has, in turn, weighed on prices

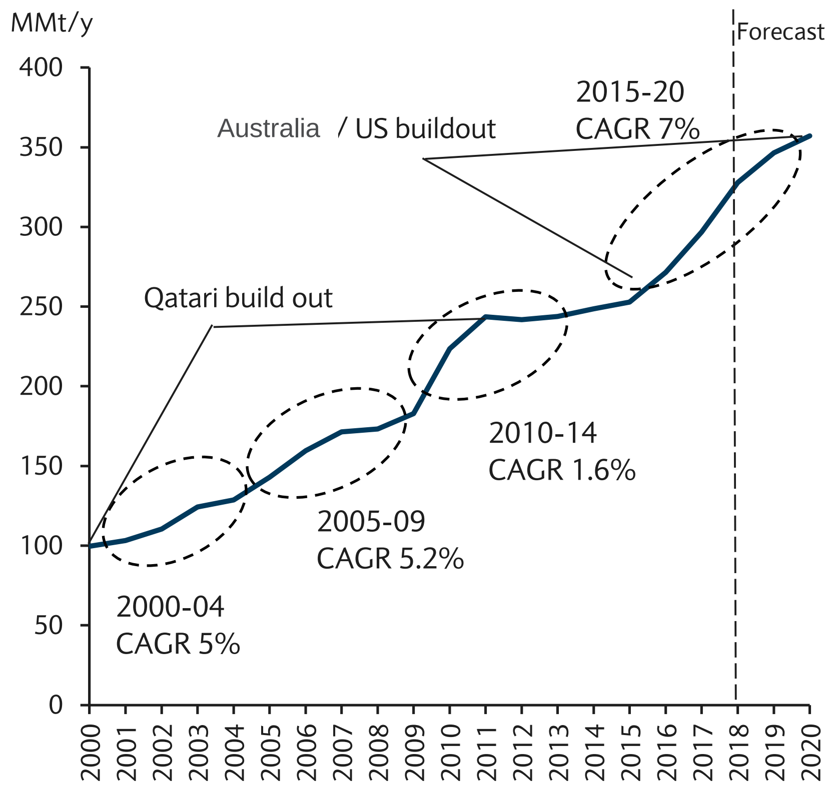


Source for both charts: EIA, Bloomberg, Barclays Research

The global LNG industry is in the middle of one of the larger build outs ever

We forecast global LNG supply to grow from 295MMt in 2017 to around 354 MMt in 2020

The build out in the US will make it a top three global LNG exporter by 2020

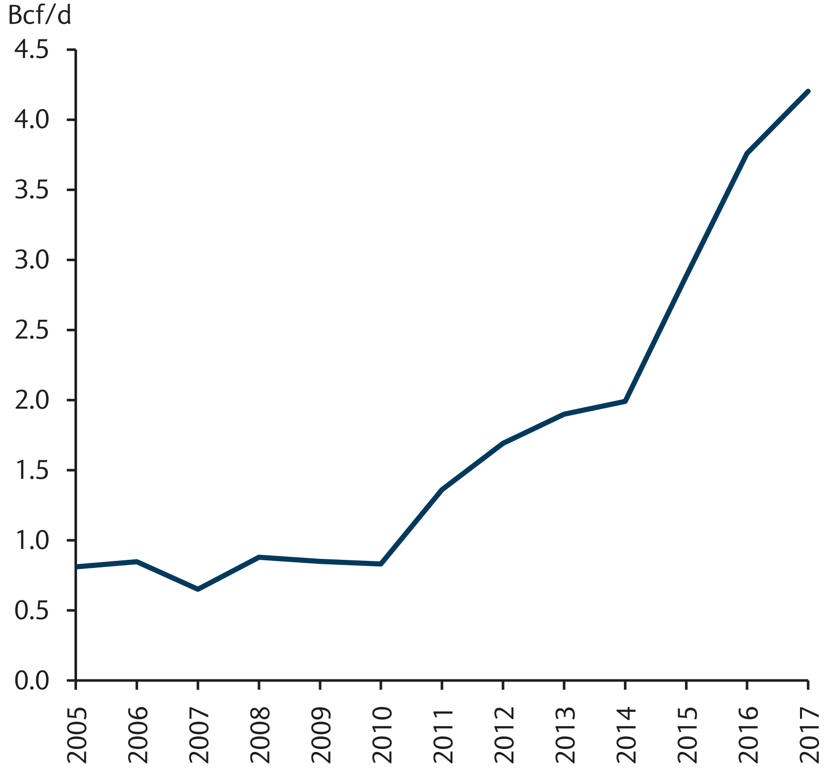


Country	2015 market	Country	2020 market
Qatar	32%	Australia	22%
Australia	12%	Qatar	21%
Malaysia	10%	US	14%
Nigeria	8%	Malaysia	8%
Indonesia	7%	Nigeria	6%
Algeria	5%	Russia	4%
Trinidad	5%	Indonesia	4%
Russia	4%	Trinidad	4%
Oman	3%	Algeria	3%
Papua NG	3%	Oman	2%

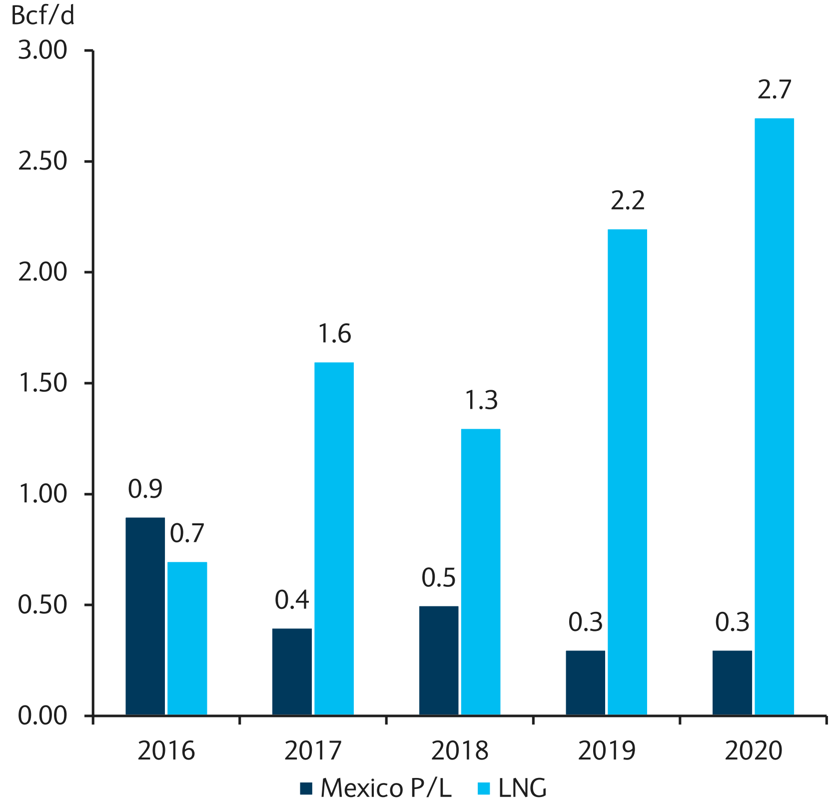
Source for both charts: GIIGNL, Barclays Research

Exports to Mexico and power burn have also offered incremental demand for gas

Exports to Mexico have increased steadily but are limited by downstream pipes and CCGTs in Mexico



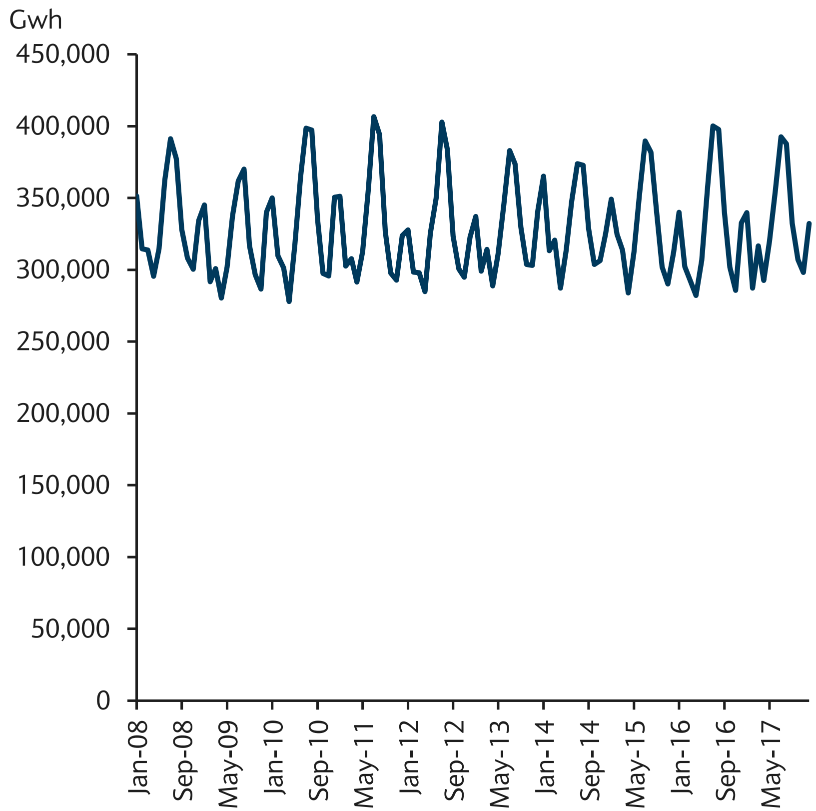
Incremental demand growth will slow in 2018 relative to 2017. Price rebound in 2020 is highly dependent on LNG export levels



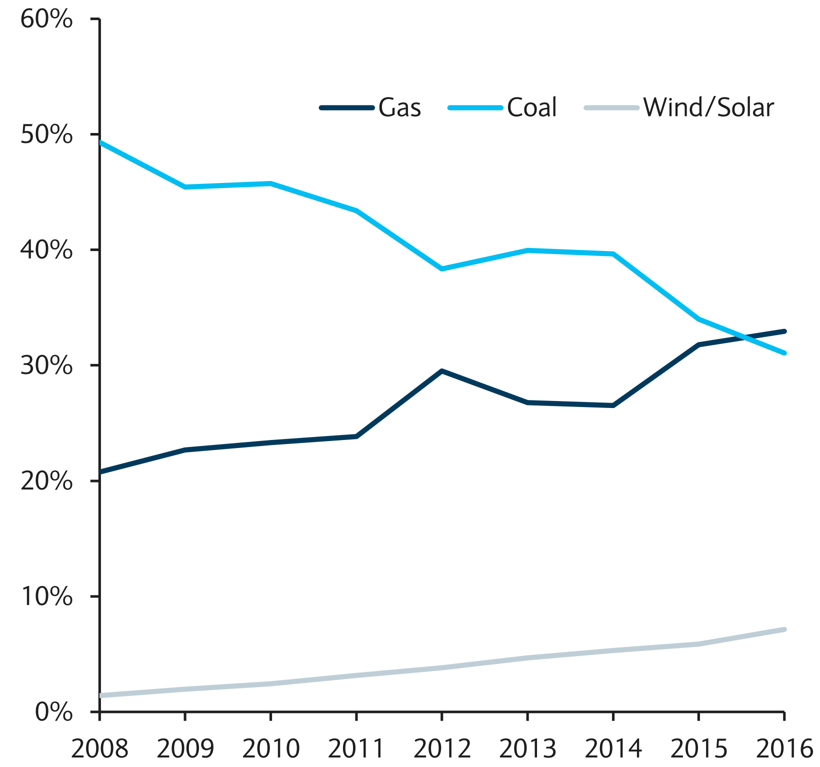
Source for both charts: EIA, Bloomberg, Barclays Research

Overall, electricity demand in the US has been relatively static

Total generation in the US has showed limited growth



Gas and renewables have gained as coal generation has moved lower



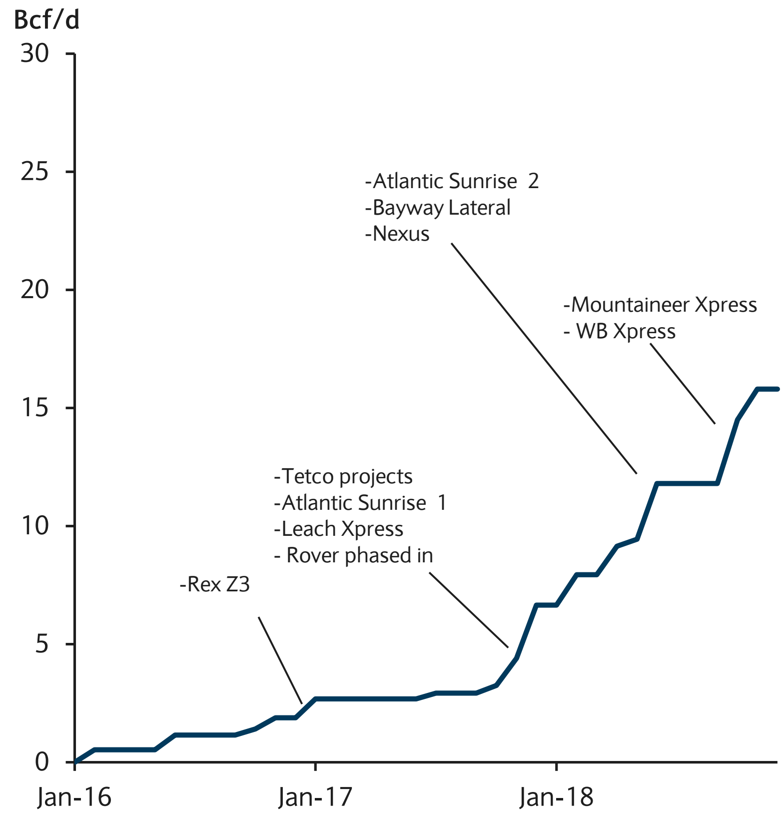
Source for both charts: EIA, Bloomberg, Barclays Research

Northeast production grows as increased levels of take away capacity come online

After some 2017 delays, major northeast pipes seem ready to ramp up in 2018

2017 additions	Capacity (MMcf/d	Status	Date
Access South	320	Online	
Adair Southwest	200	Online	
Lebanon Extension	102	Online	
Leach Xpress	1500	Online	
Rover 1A & 1B	1625	Online	
Total	**3,747**		
2018			
Rover	1625	Full approvals for phase two except Tuscawaras	Q2 '18
Nexus	1500	Under Construction	2H '18
Atlantic Sunrise	1700	Under Construction	Summer '18
Bayway Lateral	300	Awaiting FERC	2H '18
Mountaineer Xpress	2700	Waiting on approvals	Q4 '18
Mountain Valley	650	Received FERC notice to proceed in early Jan	Q4 '18
Total	**8,475**		

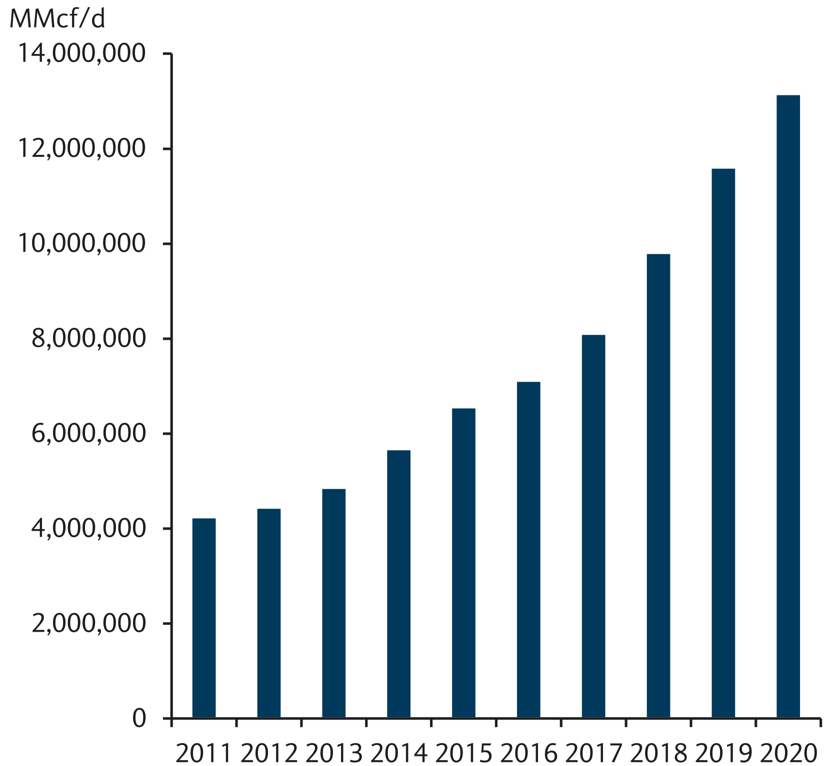
Large y/y ramp up in pipeline capacity will support higher production levels out of the Northeast



Source: Bloomberg, EIA, Platts, Barclays Research

Permian associated gas production continues to move higher as the oil directed rig count has grown

We expect that Permian production will cross 10 Bcf/d this year



Proposed Pipelines	Capacity (MMcf/d)	Date	Origin	Destination
Pecos Trail	1850	2Q 19	Reeves County	Agua Dulce
Gulf Coast Express	1700	2H19	Waha	Agua Dulce
Enterprise Unnamed	1500	2H19	Waha	Agua Dulce

Over 10 Bcf/d of takeaway capacity from the Permian

North Outlet	Capacity (MMcf/d)	Utilization
NGPL	150	
NNG	500	
EPNG	300	
Total North	**950**	**~30%**
Mexico Outlet		
Roadrunner	570	
Comanche	1100	
Trans-Pecos	1400	
Total Mexico	3070	~5%
West outlet		
EPNG	2400	
Transwester	500	
Total West	**2900**	**~80%**
East Outlet (Houship/Katy)		
Oasis	1200	
KMTP	200	
EDP/DCP	800	
East-Dallas		
Atmos-Texas	800	
EDP Texas-ETP Fuel	800	
Total East	3800	**~80%**

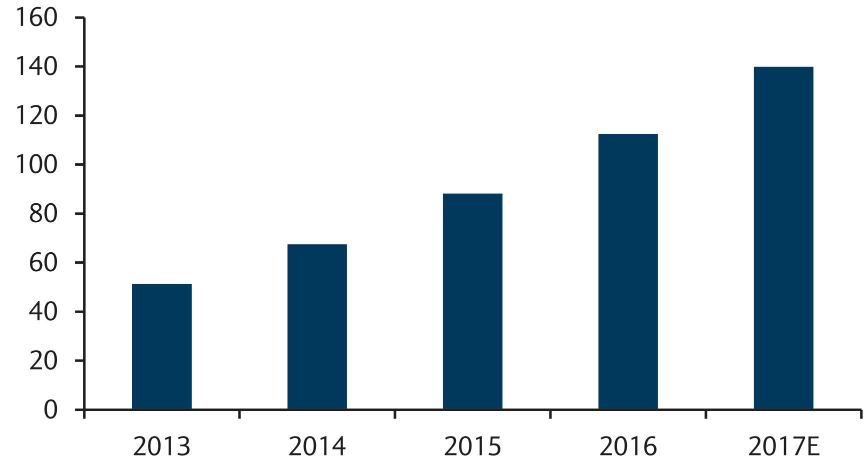
Source: Barclays Research

Associated gas production: How sensitive to oil?

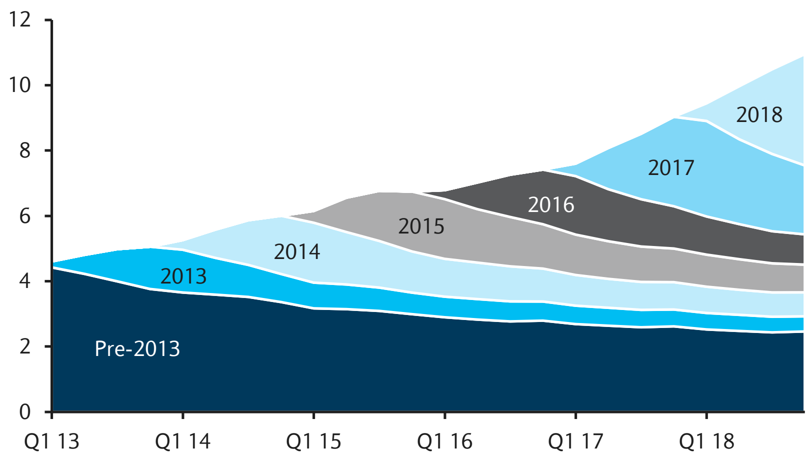
We expect associated gas production growth of almost 3.2 bcf/d this year

Associated gas production (bcf/d)				Y/y change	
Region	2016	2017E	2018E	2017E	2018E
Permian	7.12	8.31	10.21	1.18	1.90
Rockies	8.12	7.96	8.29	(0.16)	0.33
Eagle Ford	7.01	6.15	6.39	(0.87)	0.24
Bakken	1.71	1.82	2.20	0.11	0.38
Scoop/Stack	2.78	3.05	3.36	0.27	0.31

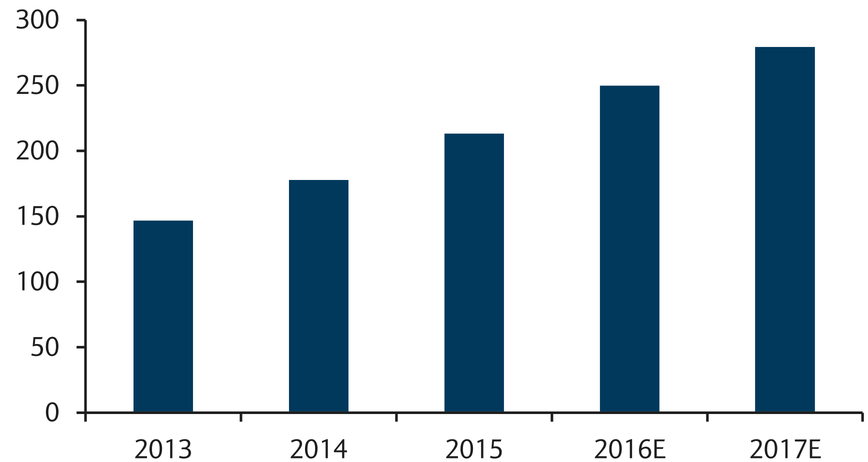
An average horizontal well in the Permian yields about 140 kb of oil over 12 months…



Most of this growth will come from increased activity in the Permian region

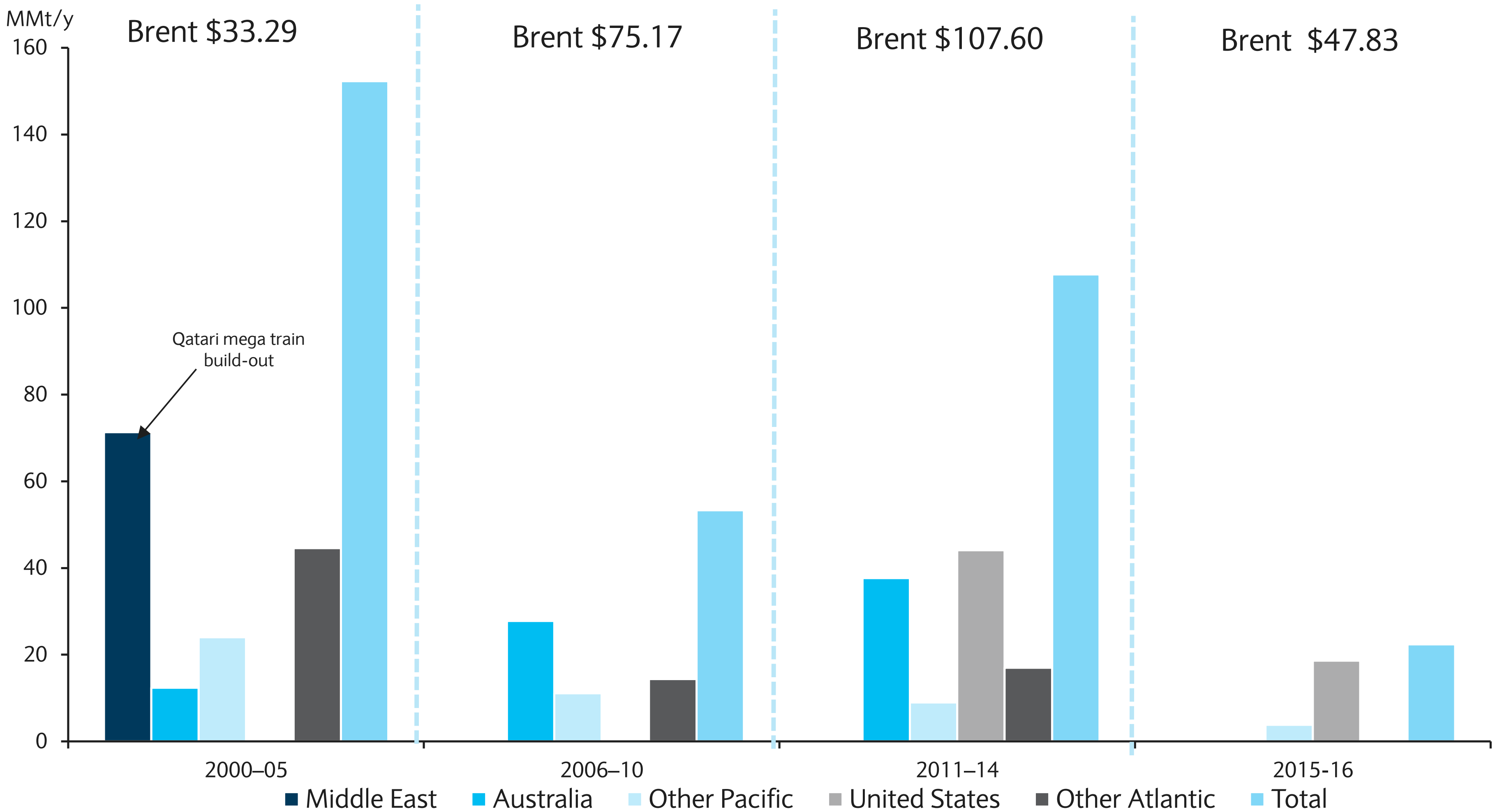


…and about 300 MMcf of associated gas production



Source for all charts: DrillingInfo, EIA, Barclays Research

Lower oil prices have slowed LNG FIDs. Just one FID in 2017 (Coral LNG 3.4 MMt)



Source for both charts: GIIGNL, Barclays Research

Natural gas balances

	Annual average						y/y change					
	2013	2014	2015	2016	2017	2018E	2013	2014	2015	2016	2017	2018E
Supply - total (Bcf/d)	**69.0**	**73.2**	**75.8**	**73.8**	**72.3**	**76.7**	**0.1**	**4.2**	**2.6**	**(2.0)**	**(1.5)**	**4.4**
US L-48 production	65.4	70.0	73.2	71.9	72.6	79.1	0.7	4.6	3.2	(1.3)	0.7	6.4
Canadian Exports to US, net	5.1	5.1	5.3	5.9	5.6	5.6	(0.3)	(0.0)	0.2	0.6	(0.3)	(0.0)
US LNG imports, net	0.3	0.1	0.2	(0.3)	(1.7)	(3.2)	(0.1)	(0.1)	0.1	(0.4)	(1.5)	(1.5)
Exports to Mexico	1.8	(2.0)	(2.9)	(3.8)	(4.2)	(4.7)	0.1	(3.8)	(0.9)	(0.9)	(0.5)	(0.5)
Demand - total (Bcf/d)	**71.7**	**73.0**	**74.8**	**75.1**	**74.2**	**76.6**	**4.6**	**1.2**	**1.8**	**0.3**	**(0.9)**	**2.4**
Residential & Commercial	22.5	23.6	21.6	20.4	20.9	21.3	3.3	1.0	(2.0)	(1.2)	0.5	0.4
Industrial	20.4	21.0	20.6	21.1	21.7	22.0	0.6	0.6	(0.3)	0.5	0.6	0.3
Power	22.4	22.3	26.3	27.3	25.3	26.3	(2.5)	(0.1)	4.0	0.9	(2.0)	1.0
Other	6.4	6.2	6.3	6.4	6.4	7.0	0.5	(0.3)	0.1	0.1	0.0	0.6
Storage Inventories (Tcf)												
End of March	1.7	0.9	1.5	2.5	2.1	1.4	(0.8)	(0.9)	0.6	1.0	(0.4)	(0.6)
End of October	3.8	3.6	3.9	4.0	3.8	3.9	(0.1)	(0.2)	0.4	0.1	(0.2)	0.1

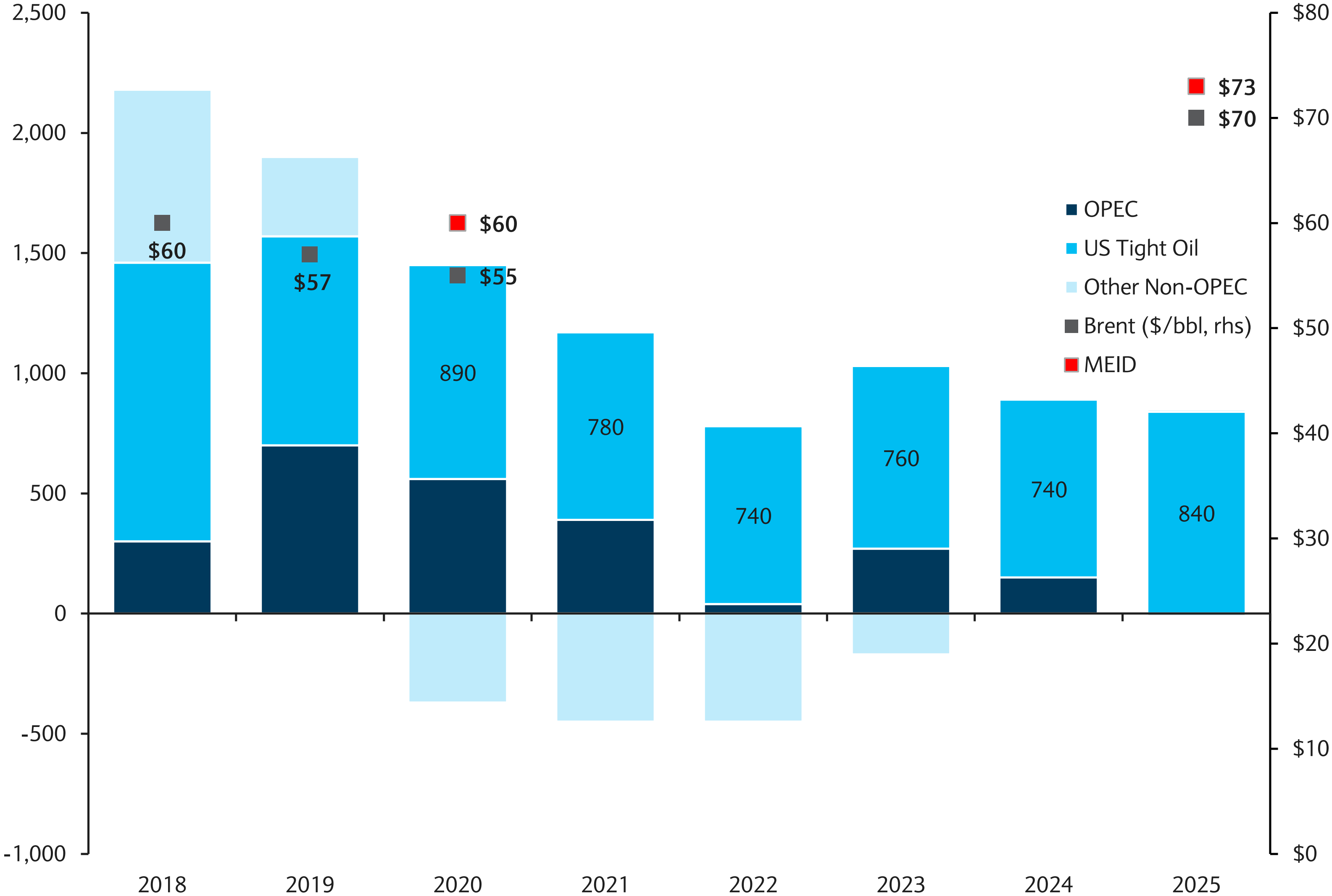
	Annual average						2017		2018E			
Natural gas price ($/MMBtu)	2013	2014	2015	2016	2017	2018E	Q3	Q4	Q1	Q2	Q3	Q4
	3.73	4.37	2.61	2.48	2.96	3.01	2.94	2.89	3.12	3.23	3.01	2.69

Source: Barclays Research

Medium-term oil price outlook

Global supply is set to grow at an average pace of 1 mb/d through 2025

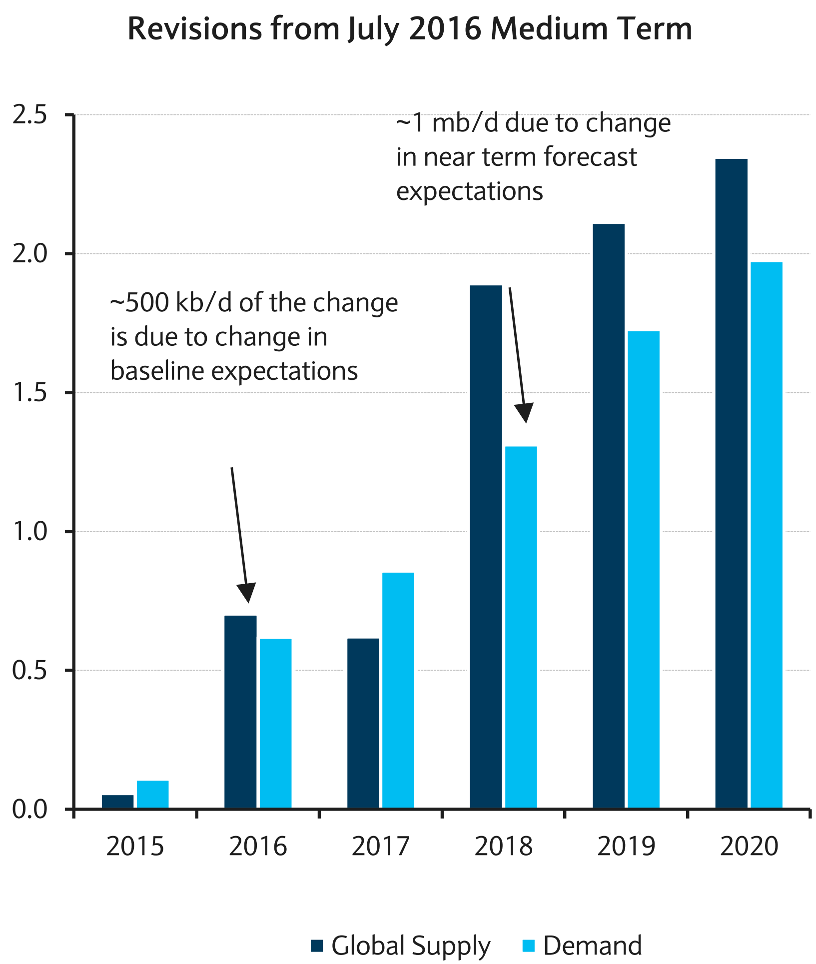
Most of the growth will come from US tight oil (+810 kb/d y/y); OPEC is expected to add 240 kb/d y/y on average, while the rest of the supply stack is set to remain flat



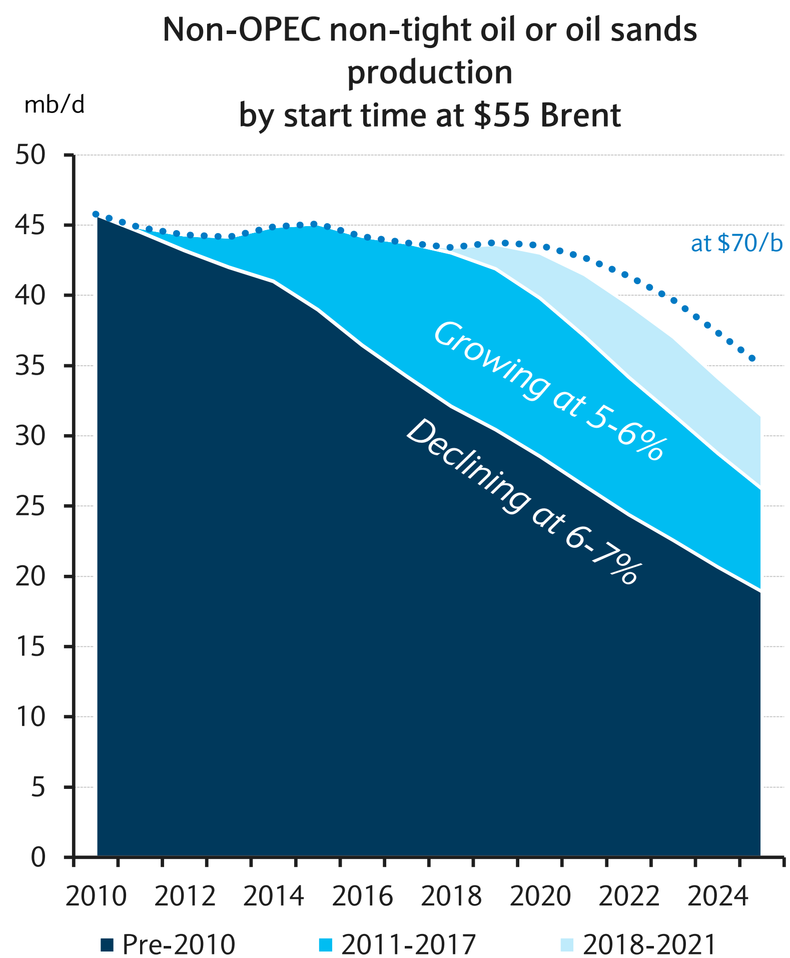
Source: Barclays Research

Supply gap thesis is valid, but it is deferred and not as big

Annual supply revisions continue to outpace higher demand expectations



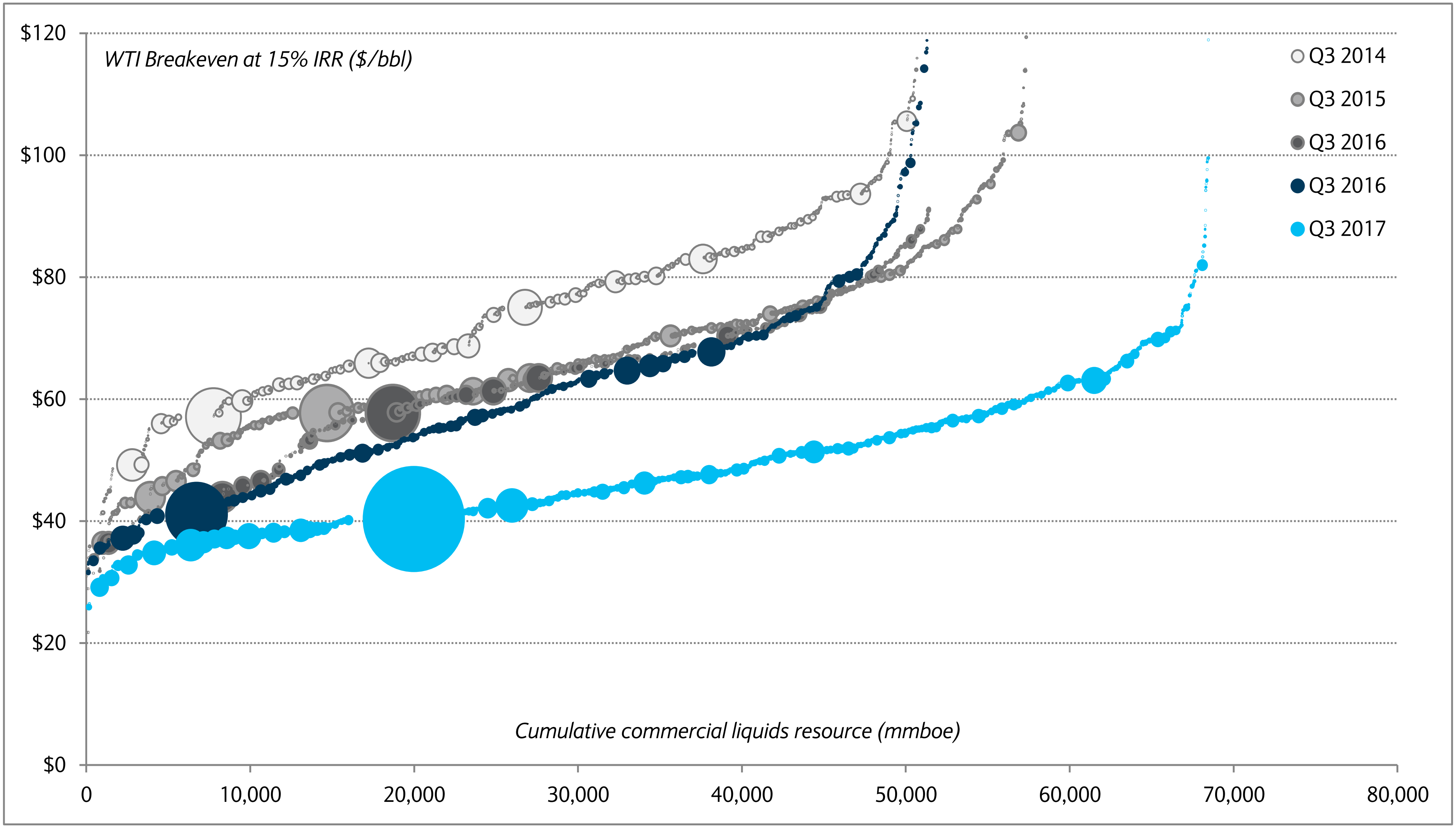
Non-OPEC supply (ex US tight oil and Canadian Oil Sands) remains flat through 2021



Source for all charts: IMF, IEA, Bloomberg, Barclays Research

Woodmac resource base assessments keep growing y/y

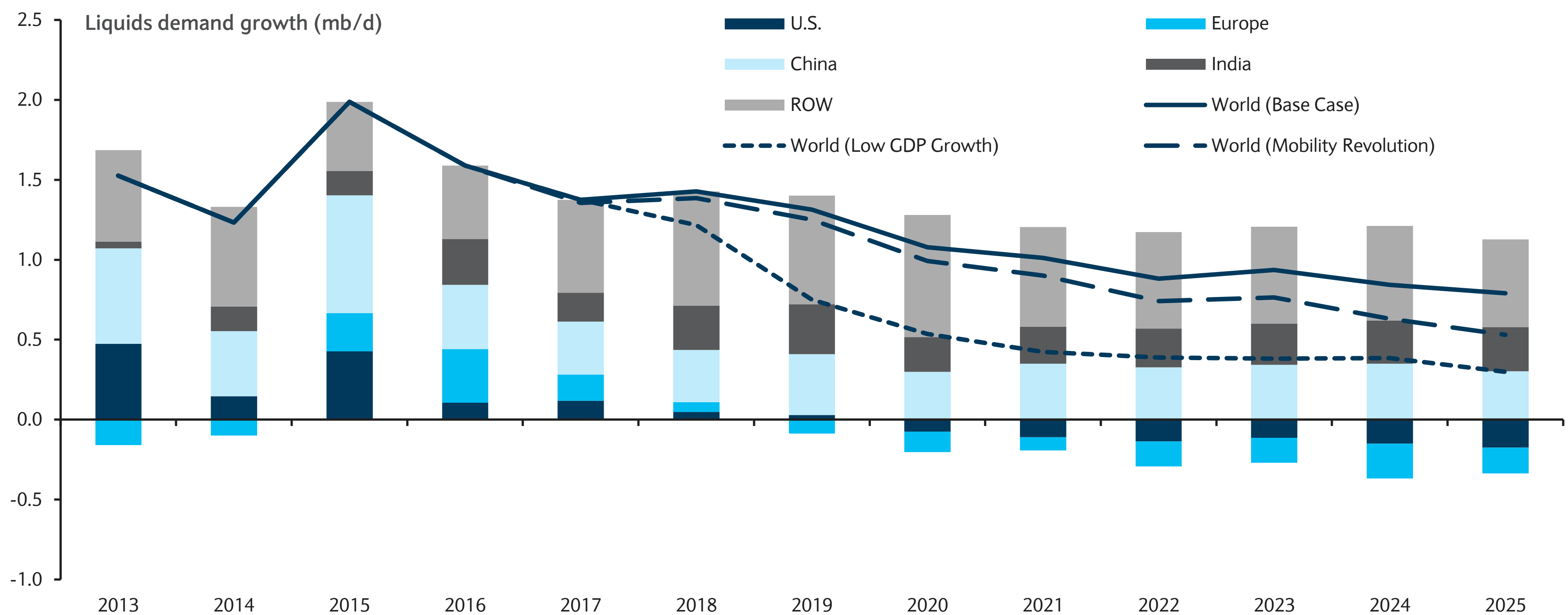
Nearly 85% of the cost base is below $60/bl at a 15% IRR; breakevens have fallen a further 15% just in the last year



Note: WoodMackenzie assumes 15% cost of capital, WTI equivalent prices, half cycle breakeven. Source: WoodMackenzie, Barclays Research.

In our base case, we expect global liquids demand to grow to about 106.2 mb/d by 2025

- Our estimates are based on higher world GDP growth, coupled with lower unemployment rates in developed countries and rising per capita income levels in the developing world.
- Transport remains the key growth driver, contributing more than three-fourths to the net consumption increase, as increasing private vehicles density, trucking and air miles travelled more than offset the effect of growing electric vehicle sales and fuel efficiency.

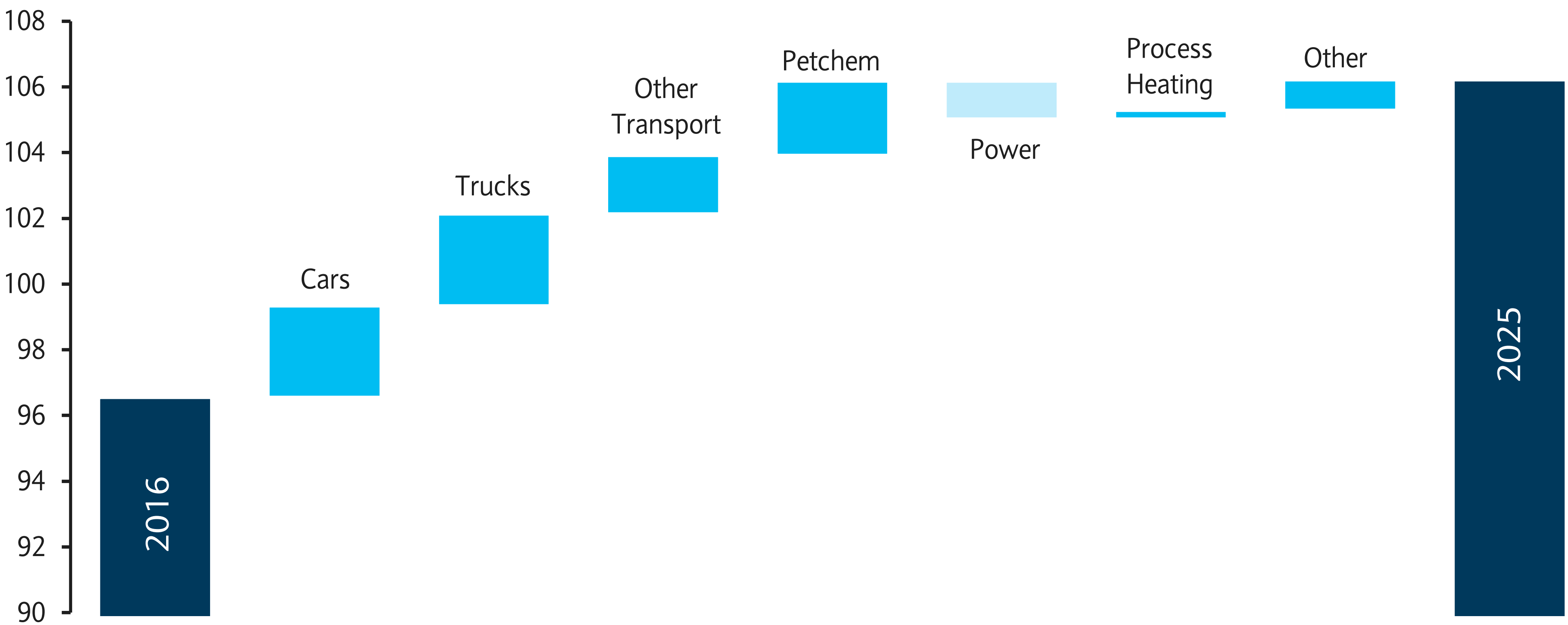


Source: IEA, WIND , Bloomberg, Barclays Research

In our base case, we expect global liquids demand to grow to about 106.2 mb/d by 2025

- Use of oil products to produce petrochemicals to grow at 2% CAGR over the medium term

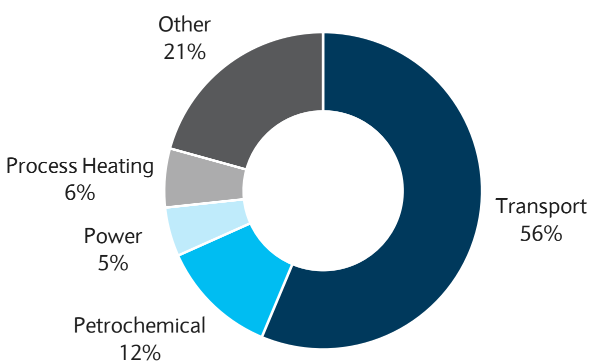
- Aviation: growing air passenger miles resulting from improved affordability around the world due to declining unemployment in the developed world, rising per capita income levels in developing countries and lower fuel costs

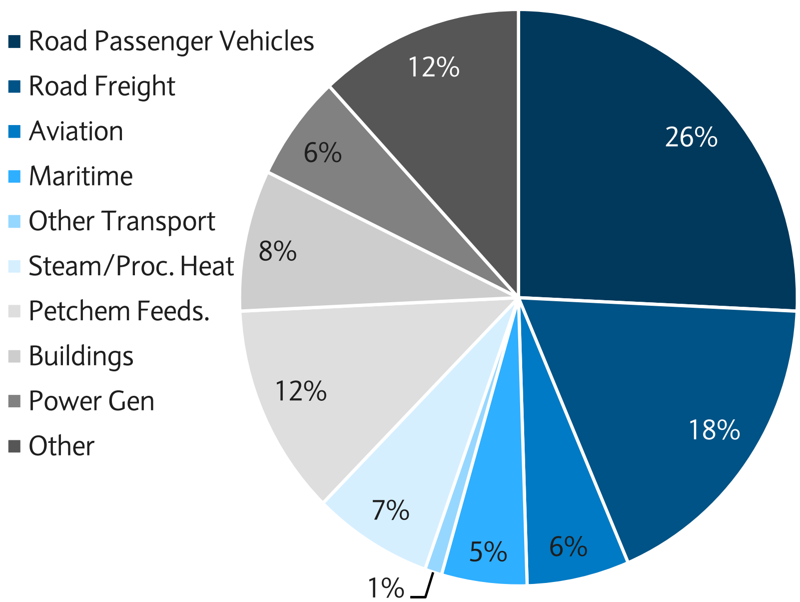


Source: IEA, WIND , Bloomberg, Barclays Research

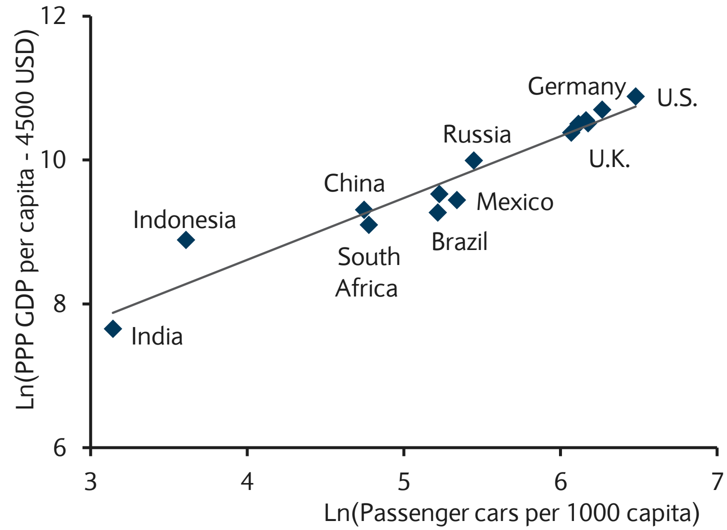
Transport drives most of the demand growth in our base case, despite fuel efficiency gains and rapid growth in EVs

2016 Oil demand by end-use

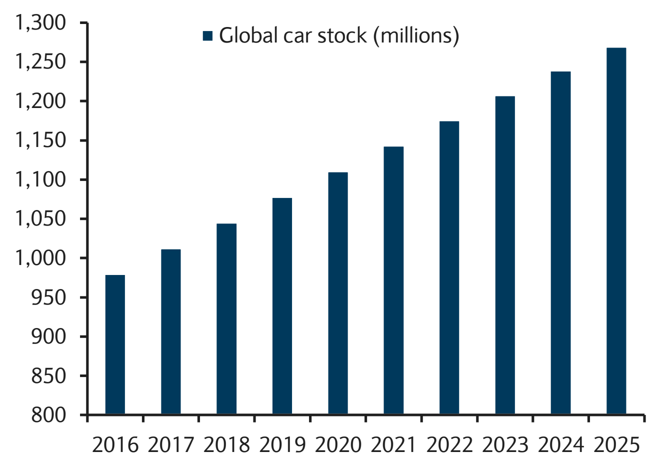




Ownership increases as income rises



Higher ownership rates drive continued increase in car stock



Source for all charts: IMF, IEA, BP, Bloomberg, Barclays Research

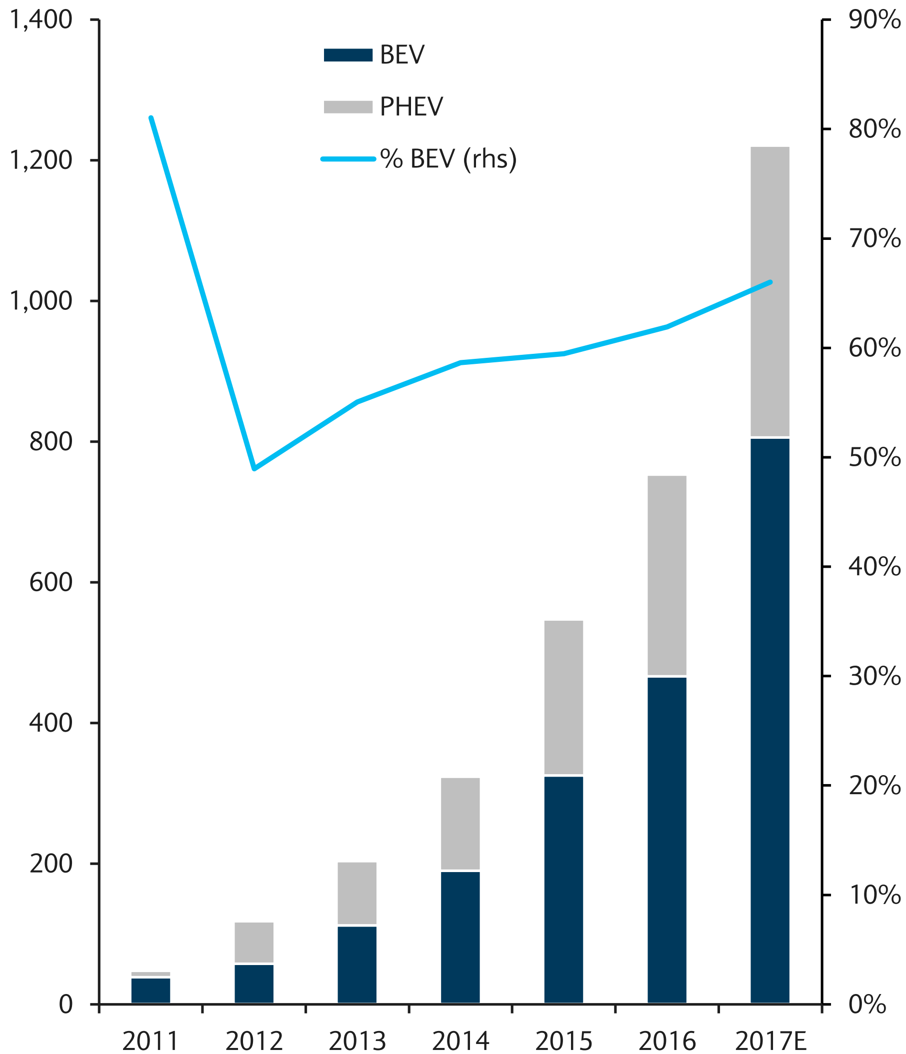
Electric vehicle summary

- Road passenger transport and road freight account for roughly 45% of oil demand.
- Electric vehicles are making inroads into passenger and freight fleets but have too little market share today to move the needle on oil demand.
- Fuel efficiency improvements will likely play a much larger role than EV penetration in demand destruction over the next 5-10 years.
- We estimate that oil demand from passenger transport should increase 2.7 mb/d from 2016-25 after accounting for EV penetration (-1 mb/d) and fuel efficiency gains (-2.6 mb/d).
- EV penetration (% of car fleet) should increase twenty-fold from 2016-25 to 4.3% despite declining subsidy programs (Barclays estimate). There are several factors that will drive this trend
  - Government policies discourage ICE vehicle usage through restrictions and bans
  - Battery technology should continue to improve, helping lower EV costs to levels competitive with ICE counterparts
  - The number of EV models will likely expand rapidly in the coming years as auto manufacturers dedicate more resources to this growing market
  - Transport-as-a-service, pooling, and autonomous driving technology should lower the overall cost of EV usage and could significantly alter the current individual vehicle ownership model.

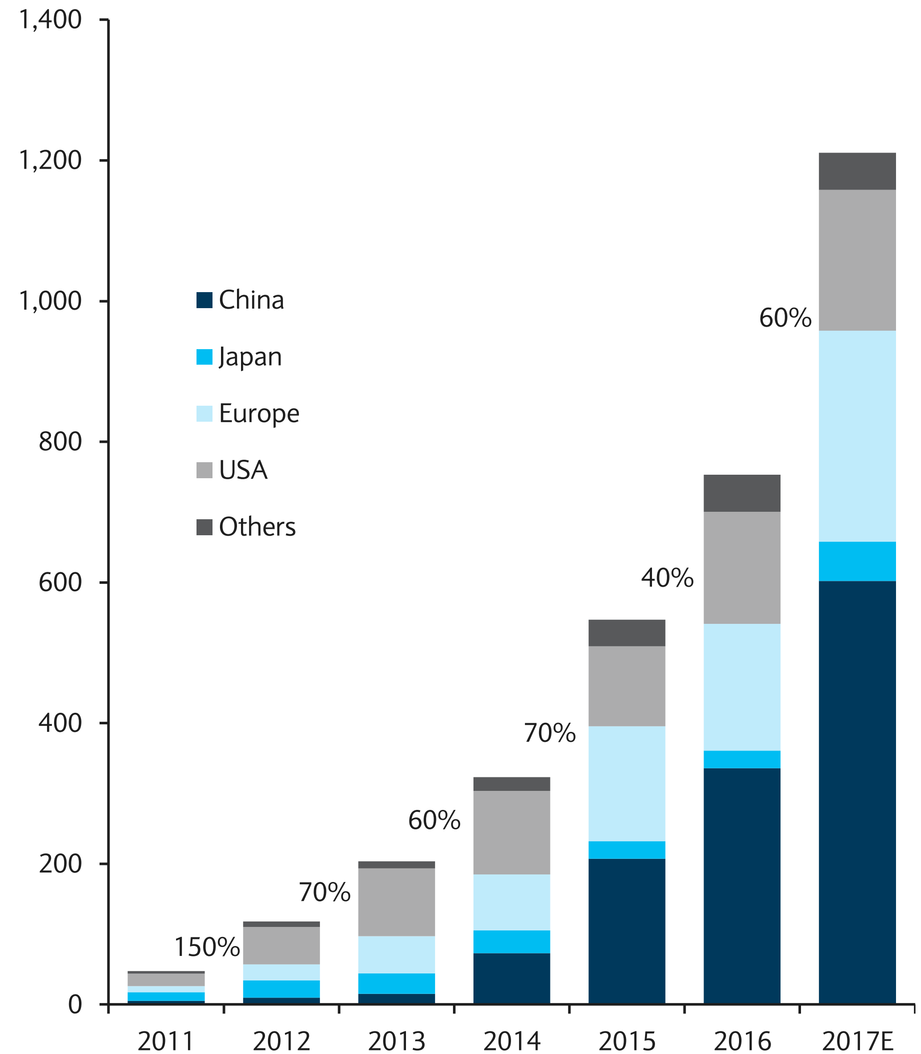
The authoring analysts would like to thank Amarpreet Singh for his assistance with the preparation of this presentation.

EV car sales have gone parabolic…

BEVs have been gaining market share versus PHEVs in recent years



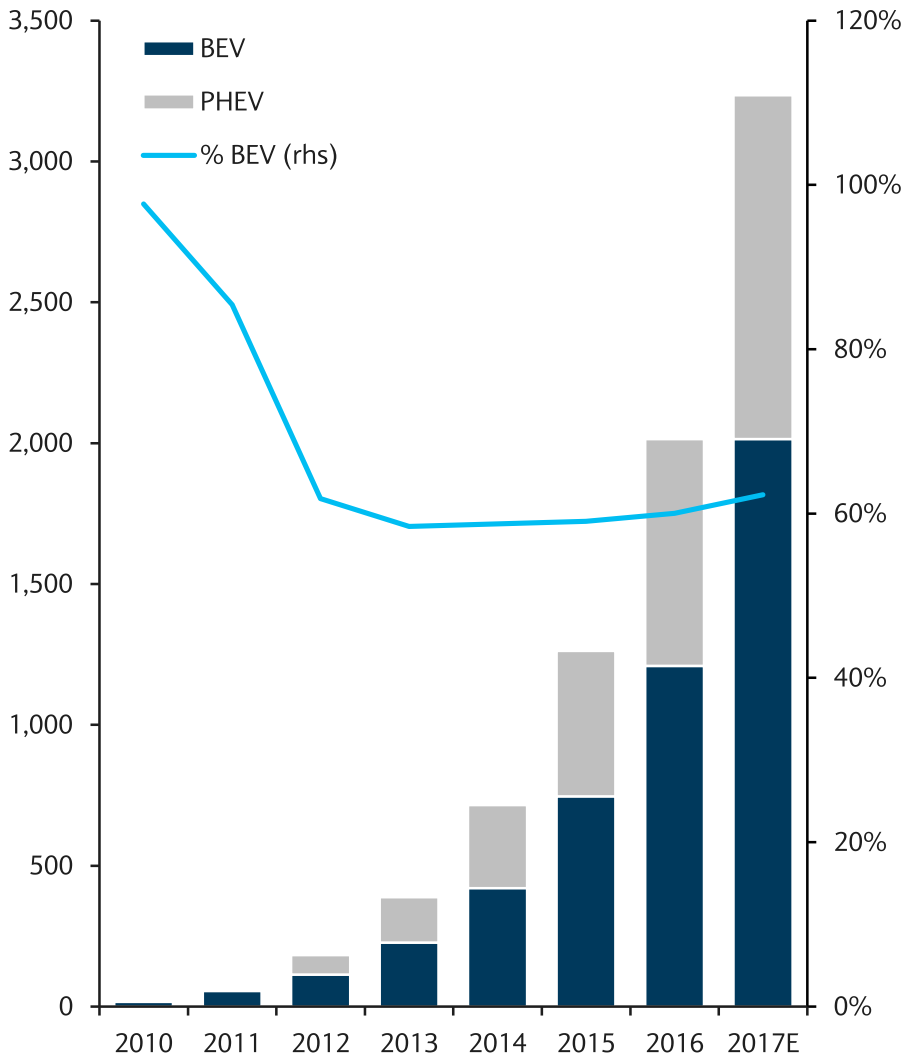
China accounted for roughly half of EV sales in 2017



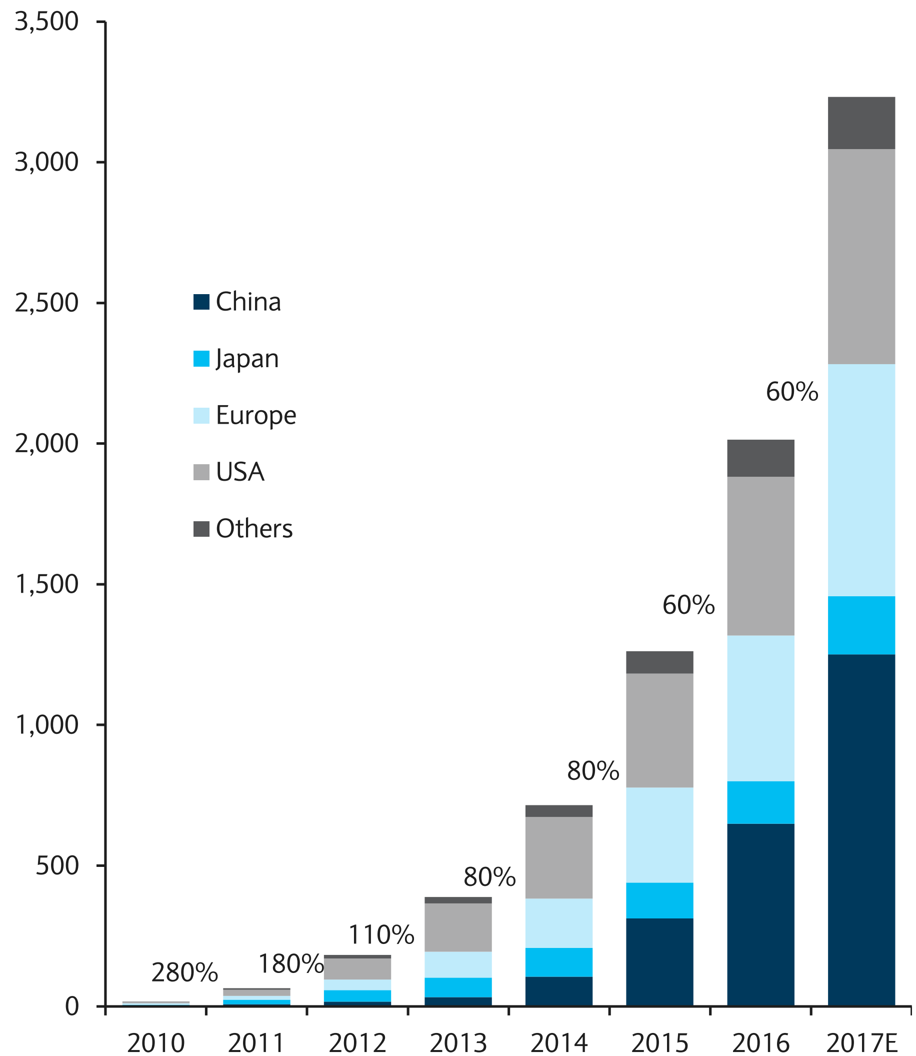
Source for both charts: Based on IEA data from Global EV Outlook 2017 © OECD/IEA 2017, www.iea.org/statistics. License: www.iea.org/t&c; as modified by Barclays Research, EV-Volumes.com, Barclays Research

… and the EV car fleet is expanding at a rapid pace…

The global EV fleet more than doubled since 2015



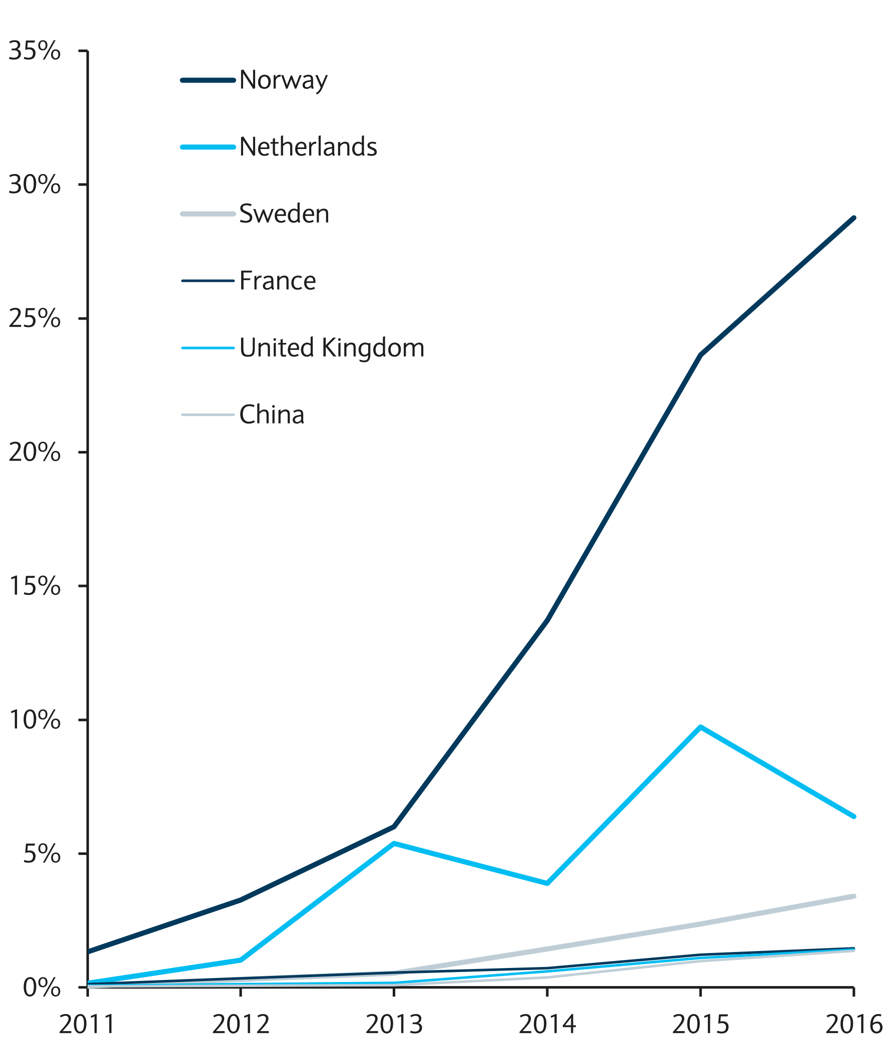
China's EV fleet surpassed the US and Europe in 2016



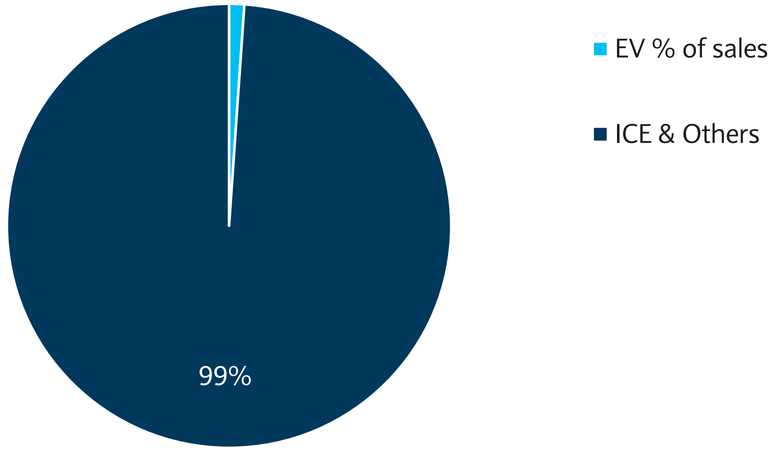
Source for both charts: Based on IEA data from Global EV Outlook 2017 © OECD/IEA 2017, www.iea.org/statistics. License: www.iea.org/t&c; as modified by Barclays Research, EV-Volumes.com, Barclays Research

… but perspective is needed

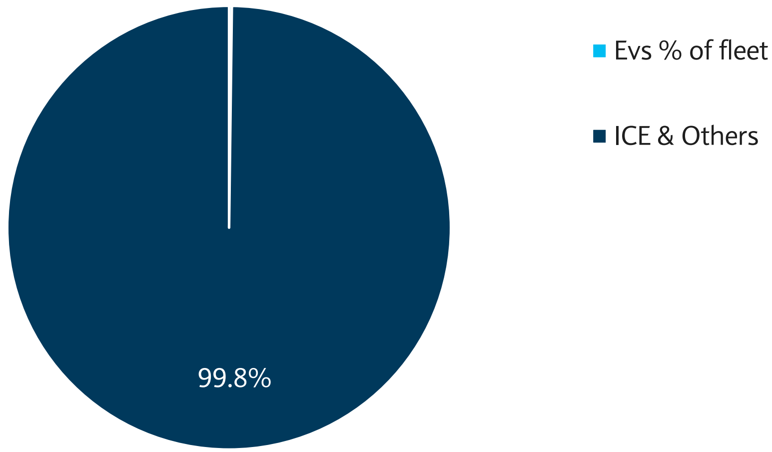
EVs have gained sizable market share in some countries (% of sales)…



… but EVs represented only 1% of the total car sales in 2016…



… and represent a small fraction of the total car fleet



Source for both charts: Based on IEA data from Global EV Outlook 2017 © OECD/IEA 2017, www.iea.org/statistics. License: www.iea.org/t&c; as modified by Barclays Research, EV-Volumes.com, Barclays Research

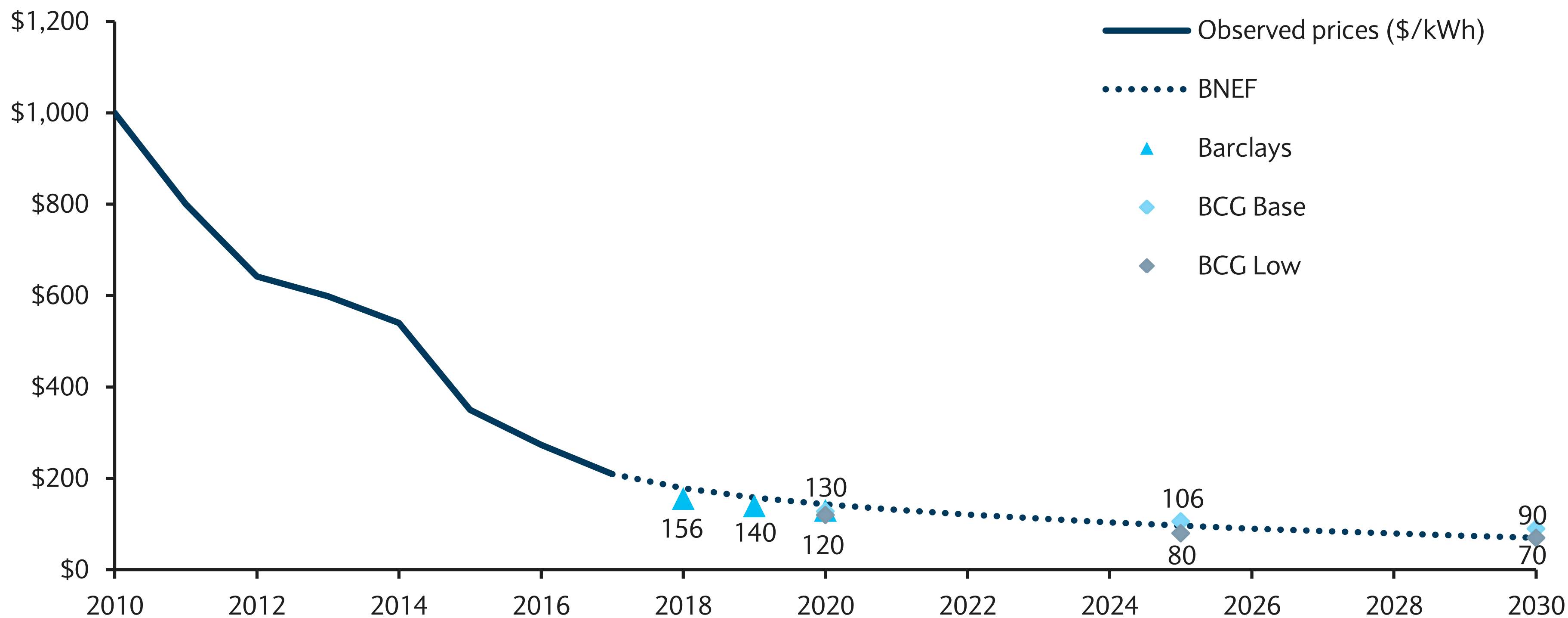
EV uptake has relied on government incentive programs

Country	Purchase Incentives*	Other incentives*
Canada	Provincial incentives of $6-13k	Various provincial exemptions from fees including on toll roads, parking, etc.
China	Tax exemptions of up to ~$8k, with local tax exemptions as well. Certain programs provide free license plates to EV purchasers (normally $15,000, allotted by lottery system)	Increased road access and free parking
Denmark	Registration tax reductions	
France	Bonus of up to $11k for BEVs when diesel car retired. Up to $4k for PHEV when diesel car retired.	
Germany	Up to $4.4k for BEV and $3.3k for PHEV. Subsidy funding split between government and automaker	Increased road access and free parking
India	Rebates or exemptions from VAT and registration tax exist but vary by state level	
Japan	Up to $7.7k subsidy, dependent on battery size	Increased road access and fee waivers
Netherlands	BEVs exempt from registration tax and ownership tax, PHEVs receive 50% reduction in ownership tax	
Norway	Exempt from purchase tax, and BEVs exempt from VAT	Toll- and ferry-fee waivers and free parking
South Korea	National subsidies of $12.3k for BEVs and $4.4k for PHEVs. Local subsidies ranging from $2.7k to $10.6k. Tax reductions of $3.5k for BEVs and $2.4k for PHEVs.	
Sweden	Rebates of $4.5k for BEVs and $2.3k for PHEVs. Circulation tax exemptions for low emissions EVs of up to $340 per year	
United Kingdom	Subsidies of $5.8k for BEVs and $3.3k for PHEVs. Excise tax exemption for BEVs and reduction for PHEVs	Increased road access, exemption from congestion fees, and free parking
United States	National tax credits of $2.5-7.5k. State level rebates and tax exemptions also offered	

Note. *May not include all incentives or recent changes to subsidy programs. Source: Based on IEA data from Global EV Outlook 2017 © OECD/IEA 2017, www.iea.org/statistics. License: www.iea.org/t&c; as modified by Barclays Research, Government websites, Barclays Research

Continued cost reductions and rising utility

Forecasts call for battery costs to decline ~40% by 2020 and ~55% by 2025 as scale of production increases and technology improves

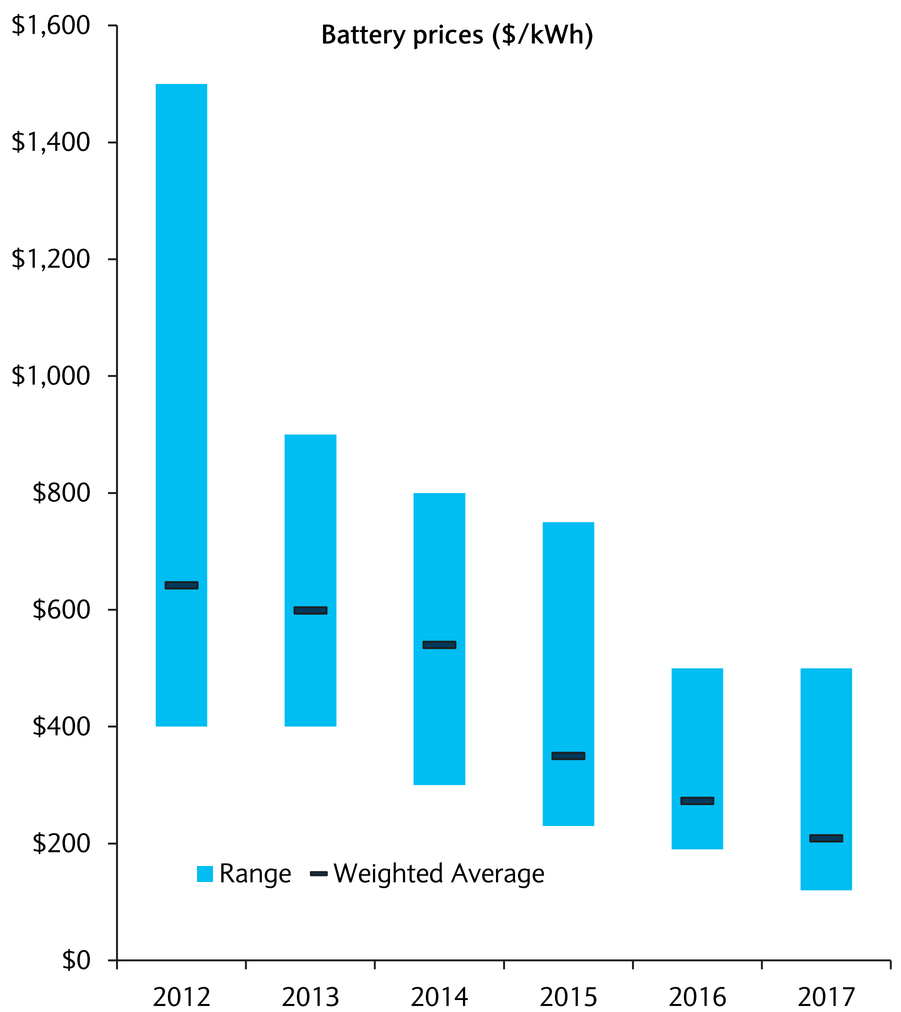


Source: Bloomberg New Energy Finance, Boston Consulting Group, Tesla, Ford, Barclays Equity Research The Battery Revolution September 2015

- EV battery costs expected to fall further
- ‘Transport as a Service’ to cut cost per mile traveled, challenge traditional vehicle ownership model
- Autonomous technology to increase utility

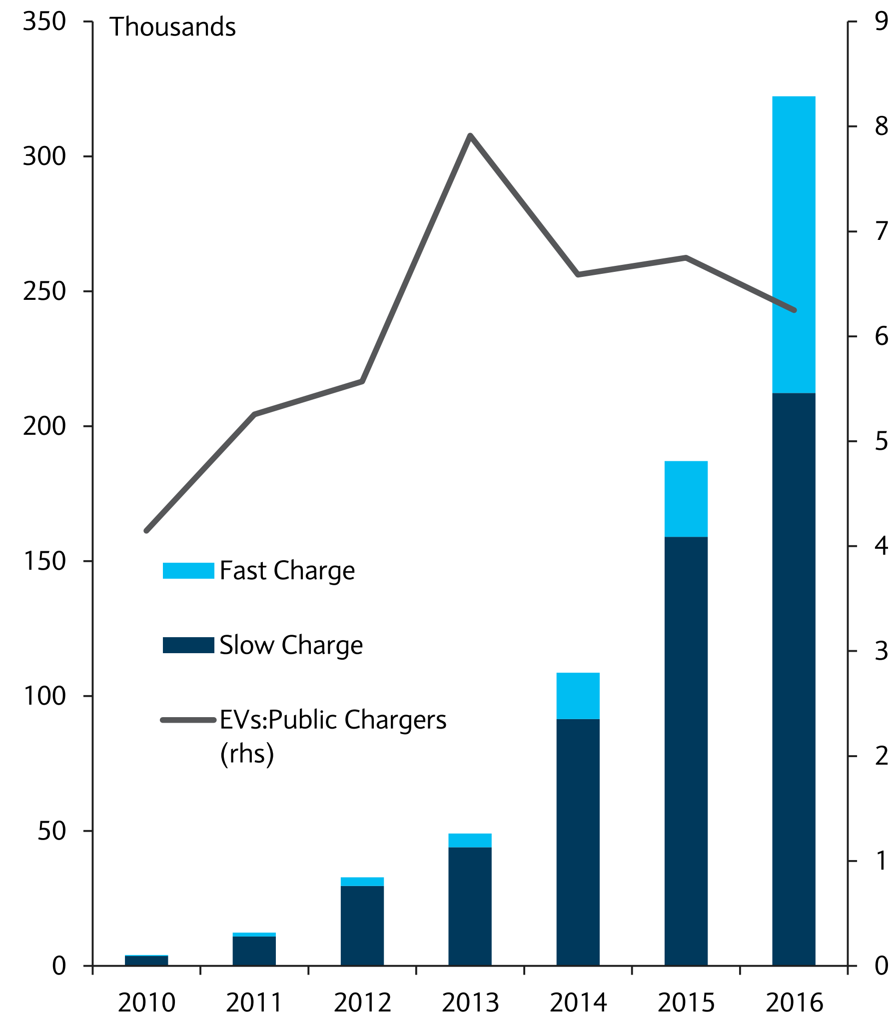
Falling battery costs and expanding charging infrastructure

Battery costs have fallen by 2/3 since 2012



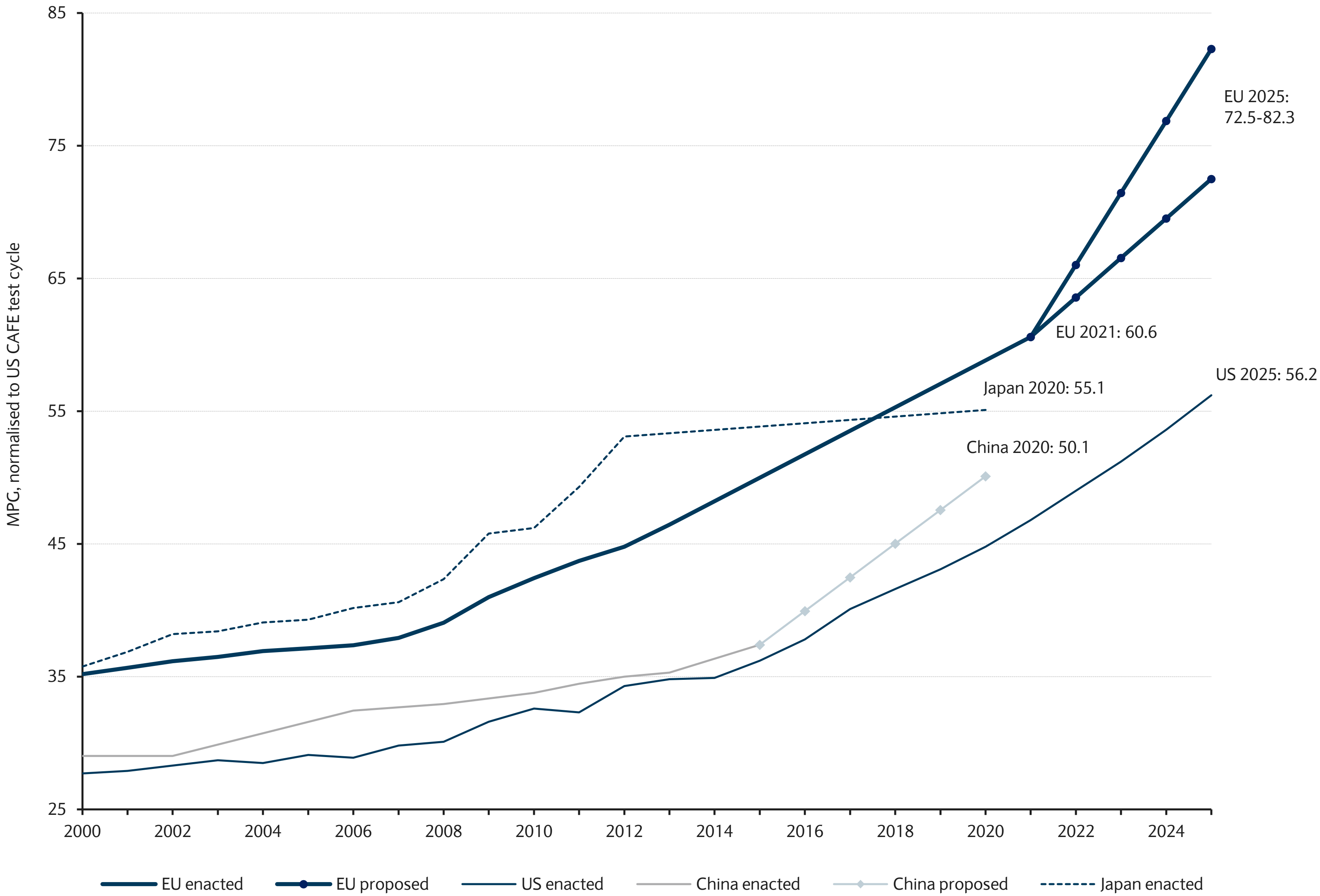
Source: Bloomberg New Energy Finance, Barclays Research

Charging capacity continues to expand



Source: Based on IEA data from Global EV Outlook 2017 © OECD/IEA 2017, www.iea.org/statistics. License: www.iea.org/t&c; as modified by Barclays Research, Barclays Research

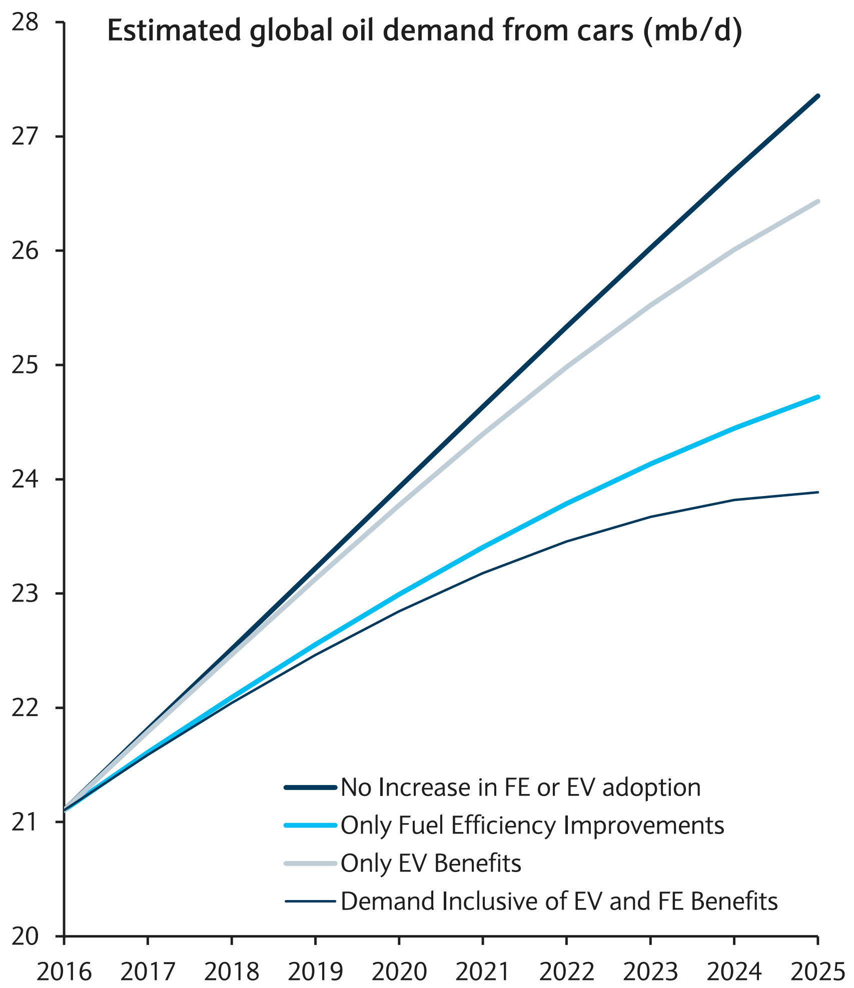
Fuel economy standards inflect post-2020



Note: China's target reflects gasoline fleet scenario. If including other fuel types, the target will be higher. Source: ICCT, Barclays Research

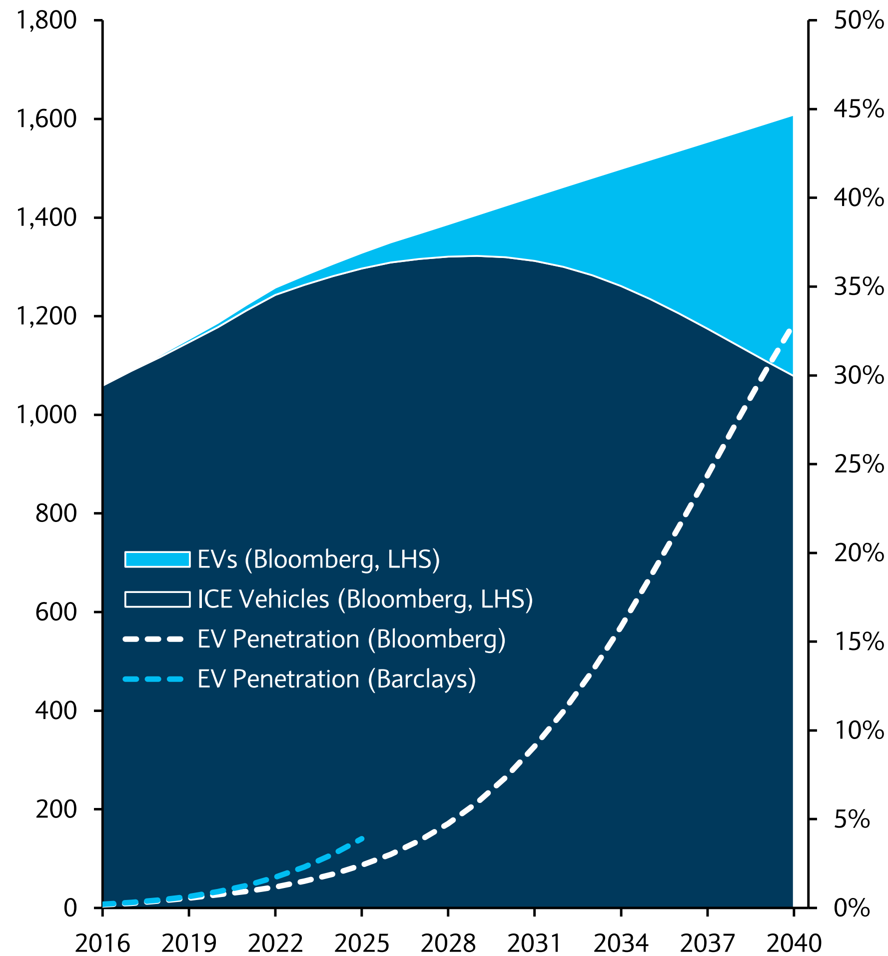
Electronic vehicles should make inroads into oil demand over the medium term

In our analysis, EV uptake and increased fleet fuel efficiency could cut oil demand by ~ 3.5 mb/d in 2025 (mb/d)



Source: Barclays Commodities Research Disruptive Stability Report (July 2017)

33% EV penetration by 2040 could affect oil demand by ~ 9 mb/d

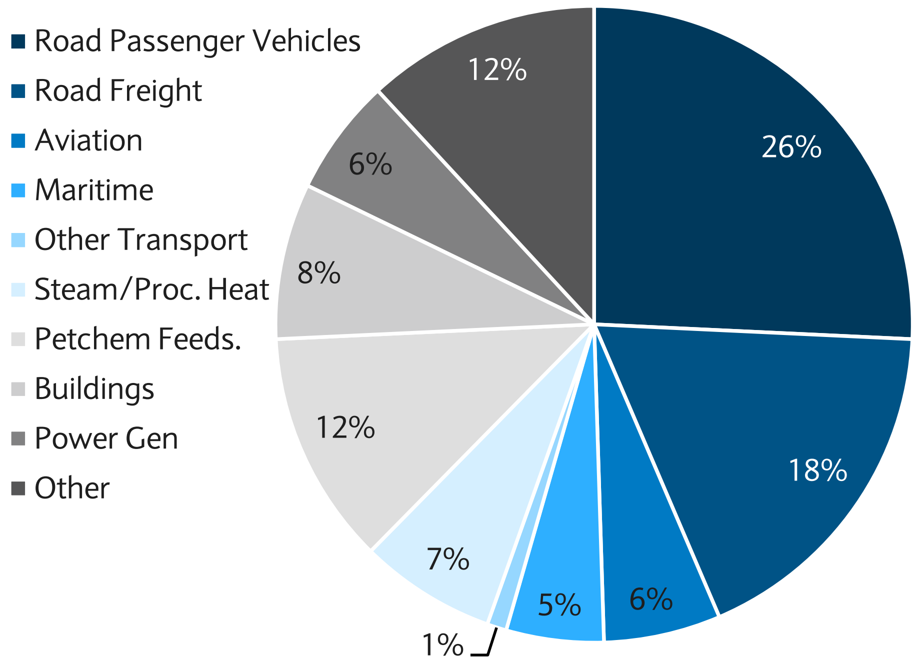


Source: Bloomberg, Barclays Commodities Research

Appendix

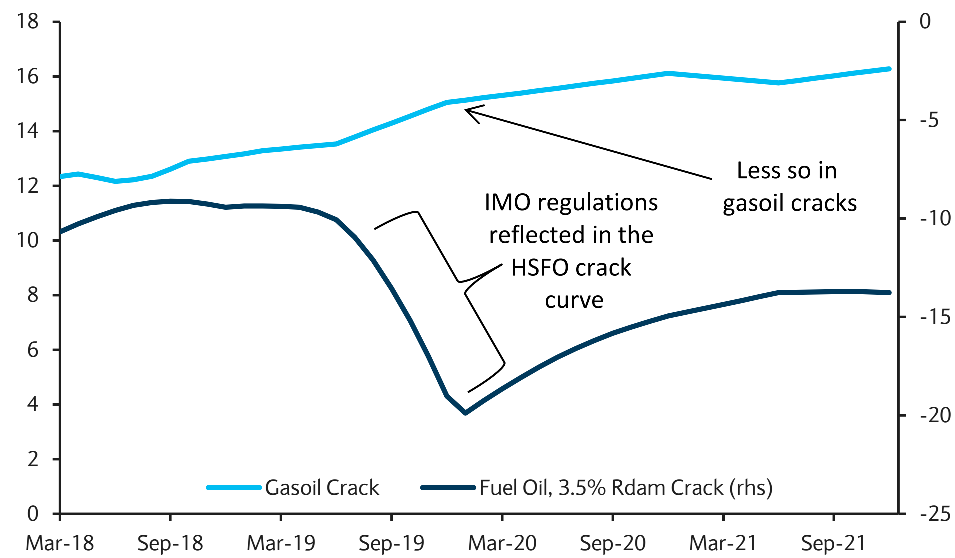
IMO 2020: Marine bunker fuel sulfur limits lowered to 0.5%

The maritime industry consumes ~ 5% of global liquid fuels



Source: Based on IEA data from The Future of Trucks: Implications for energy and the environment © OECD/IEA 2017, www.iea.org/statistics. License: www.iea.org/t&c; as modified by Barclays Research.

The regulation has had a visible impact on fuel oil cracks



Source: Bloomberg, Barclays Research.

The maritime industry has several options in order to comply with this rule:

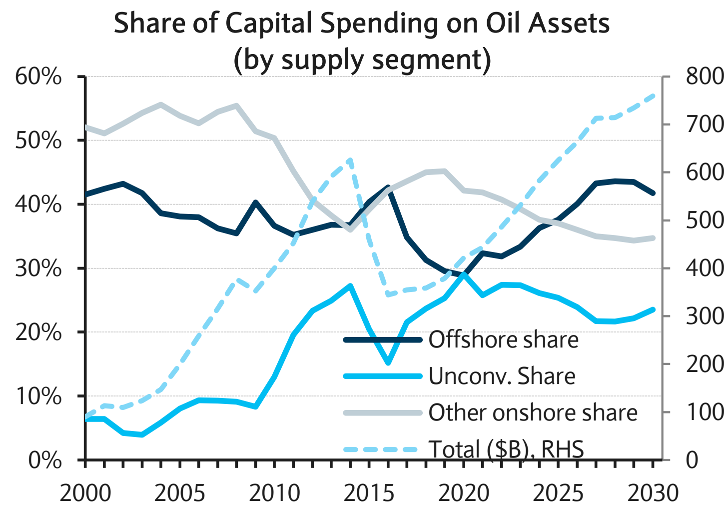
•Ultra low sulfur (.5%) fuel oil
•Ultra low sulfur (.5%) marine gasoil
•LNG conversion
•Scrubber installation

This regulation will have several affects on the market:

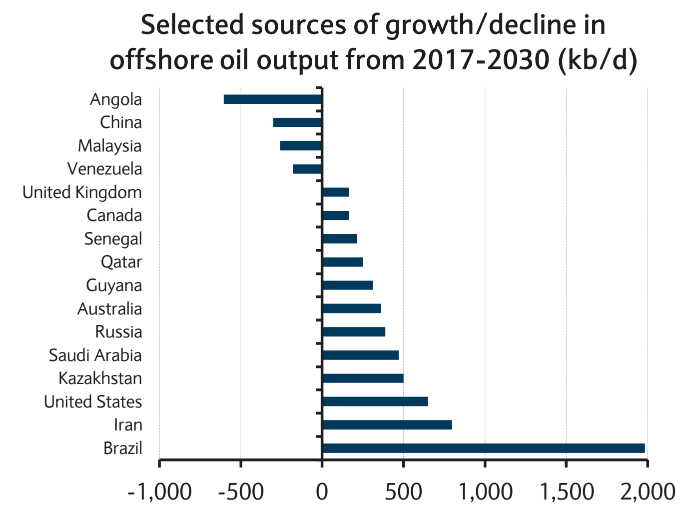
•Wider light-heavy spreads (all else equal)
•Positive for ULSD/gasoil cracks
•Negative for HSFO cracks
•More expensive bunkers, and thus wider waterborne crude and product differentials
•Positive for complex refiners that produce minimal HSFO
•Negative for coastal refineries producing HSFO

Offshore oil output accounts for one-third of global supplies; capex on the offshore cedes share to unconventionals

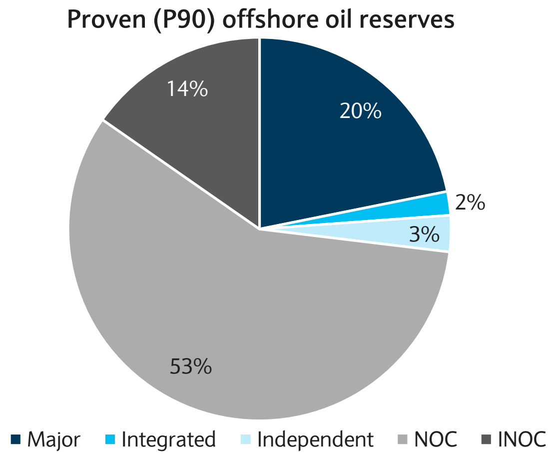
Capex on offshore exp & development to fall, but then rebound with rising prices



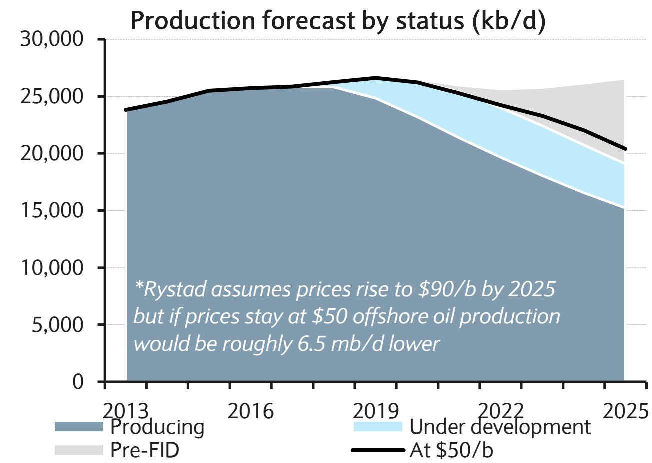
Growth concentrated in certain countries



And the majority of the proven reserves controlled by NOCs



If prices stay close to $50/b, reduction in offshore supplies by ~6 mb/d



Source for all charts: Rystad Energy Ucube, Barclays Research

Auto manufacturers planning big expansions to EV offerings

Expect the electric vehicle offering to expand significantly in the coming years

Company	Planned electric vehicle offerings
BMW	Provide 12 BEVs and 13 hybrids by 2025
GM	Offer at least 20 electric vehicles by 2023
Daimler	Offer 10 BEVs by 2022
Fiat Chrysler	Incorporate electrification into half of its fleet by 2022
Ford	Launch 13 new electrified vehicles over the next five years
Honda	Launch two fully electric vehicles in 2018 and electrify two-thirds of its offerings by 2030
Jaguar Land Rover	Every new Jaguar or Land Rover launched from 2020 will be electrified
Renault-Nissan	Launch 12 new ZEVs by 2022
Toyota	Provide solid state battery electric cars by 2022
Volkswagen	Eighty new electric vehicles by 2025
Volvo	Every model launched from 2019 onward will be electrified

Note: List not all inclusive.
Source: Company reports, BBC, Reuters, Bloomberg, Barclays Research

Sales targets are still a drop in the bucket (IEA data)

Company	Electric vehicle sales targets
BMW	100,000 electric car sales in 2017 and 15-25% of BMW group sales by 2025
GM	30,000 annual electric car sales by 2017
Chinese OEMs	4.52 million electric car sales by 2020
Daimler	0.1 million annual electric car sales by 2020
Renault-Nissan	1.5 million cumulative sales of electric cars by 2020
Tesla	500,000 annual electric car sales by 2018. 1 million annual electric care sales by 2020
Volkswagen	2-3 million annual electric car sales by 2025
Volvo	1 million cumulative electric car sales by 2025

Note: List not all inclusive. Source: IEA Global EV Outlook 2017

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