Special Presentation

Market Watch Presentation

For IEF

Alexander Pögl

10 May 2018

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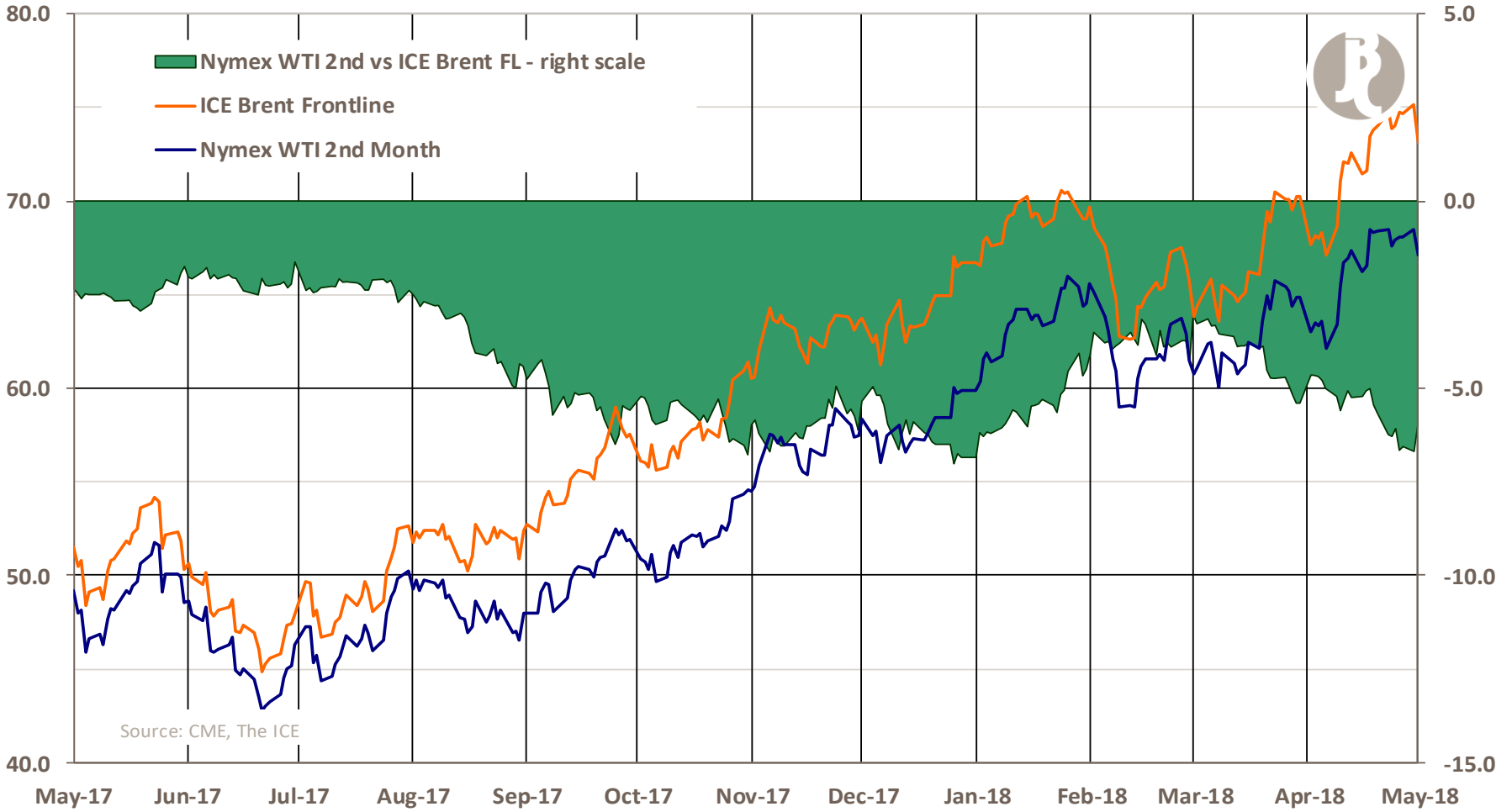
Topics

- Demand
- Supply & OPEC Strategy
- Repercussions of Crude Quality Change
- 2018: Tight Product Supply
- IMO – Status & Scenario

Intro

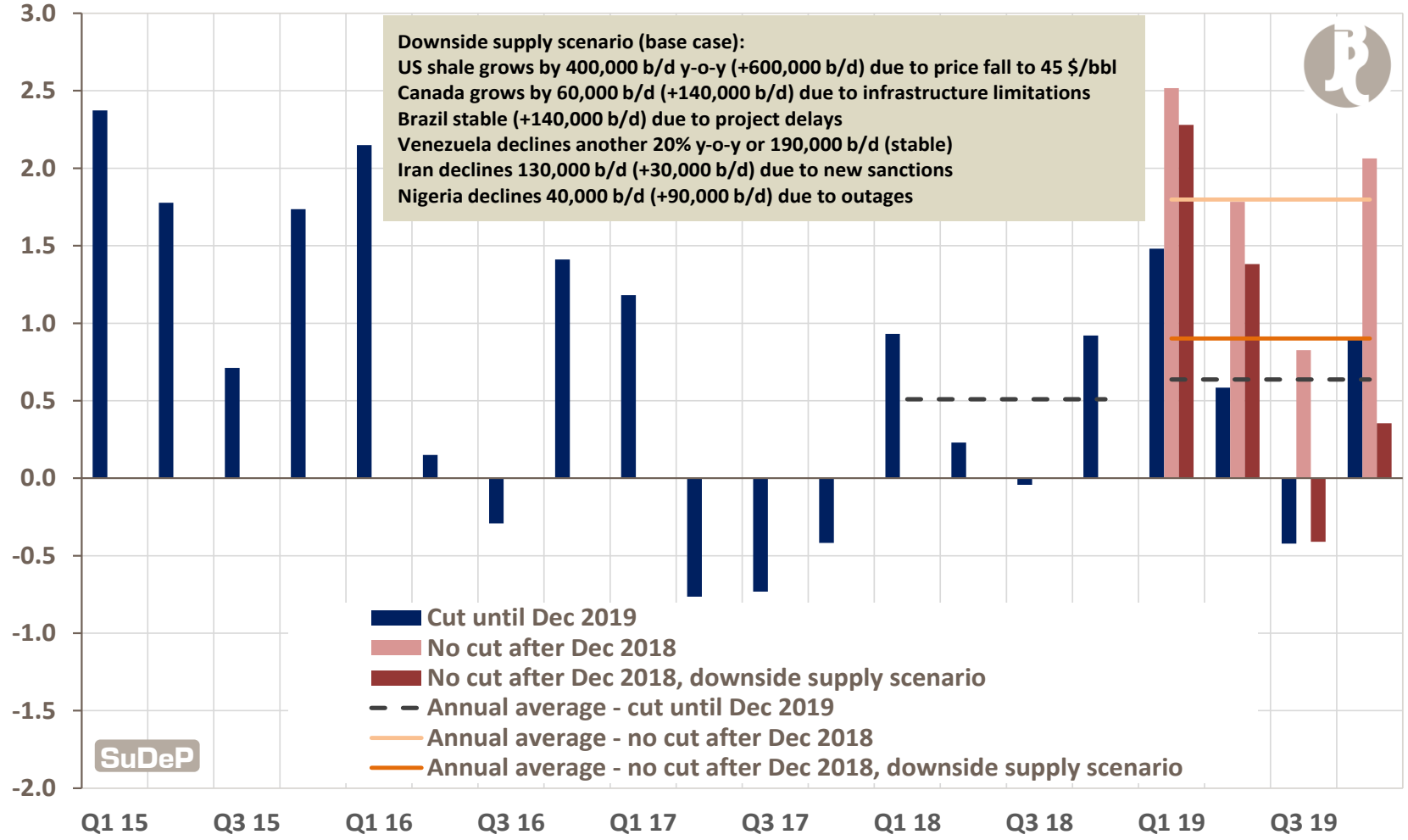
Nymex WTI 2nd Mth vs ICE Brent Frontline [$/bbl]



Crude settling at their highest levels since 2014, thanks to a mixture of bullish factors such as direction of fundamentals (inventories close to 5-year average), dollar weakness and thus incentives for commodities, backwardated markets pay long oil futures, and geopolitical factors, strong OPEC solidarity and bullish refining trends.

Intro

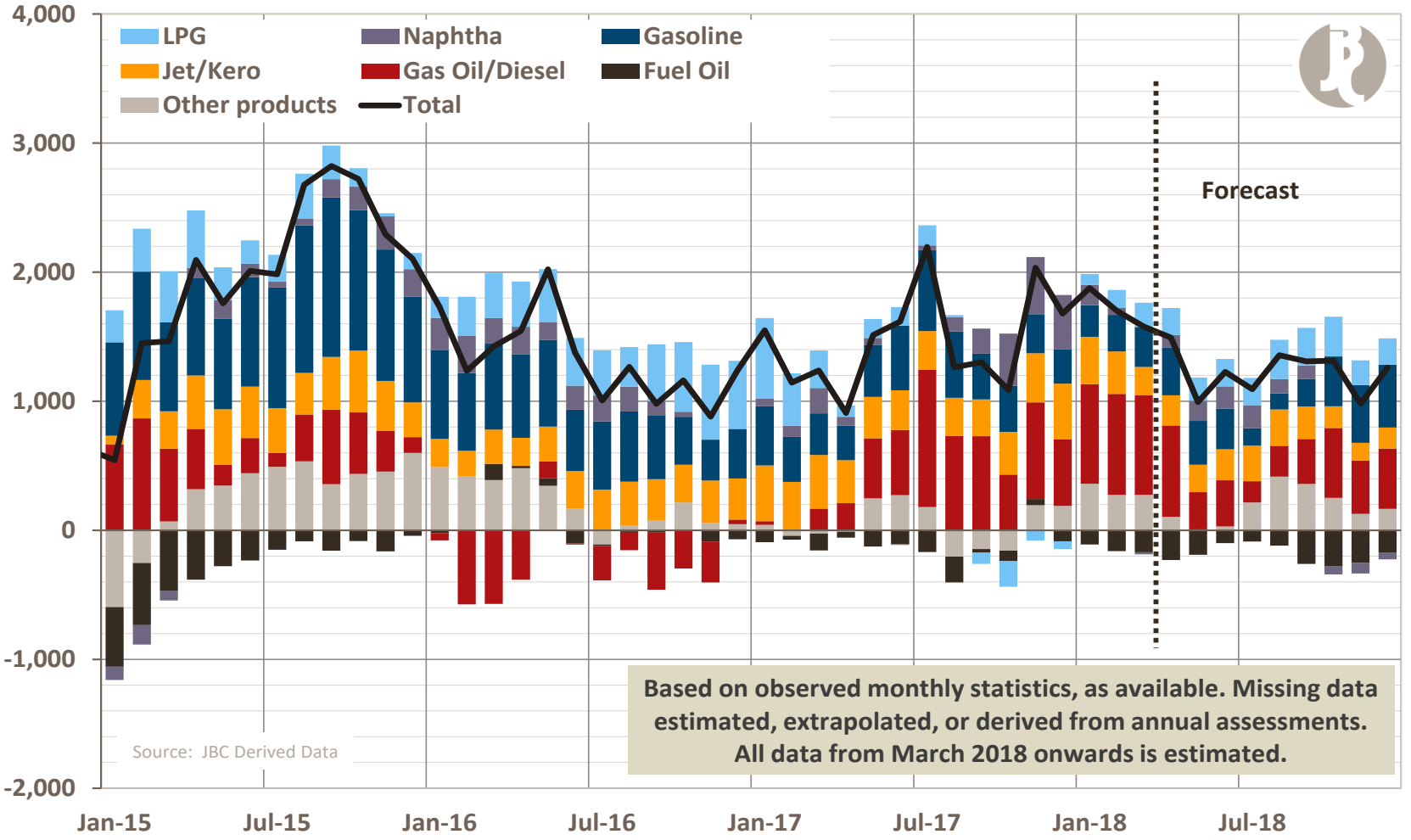
Total Liquids Implied Stockchange Scenarios [million b/d]



We see an extension of the agreement through 2019 as necessary to maintain price support and stop Brent from testing the $50 mark. We will make this our new base case from here onwards. Otherwise, we see a 1.8 million b/d surplus for 2019. Russian support is likely, but not a given.

Demand

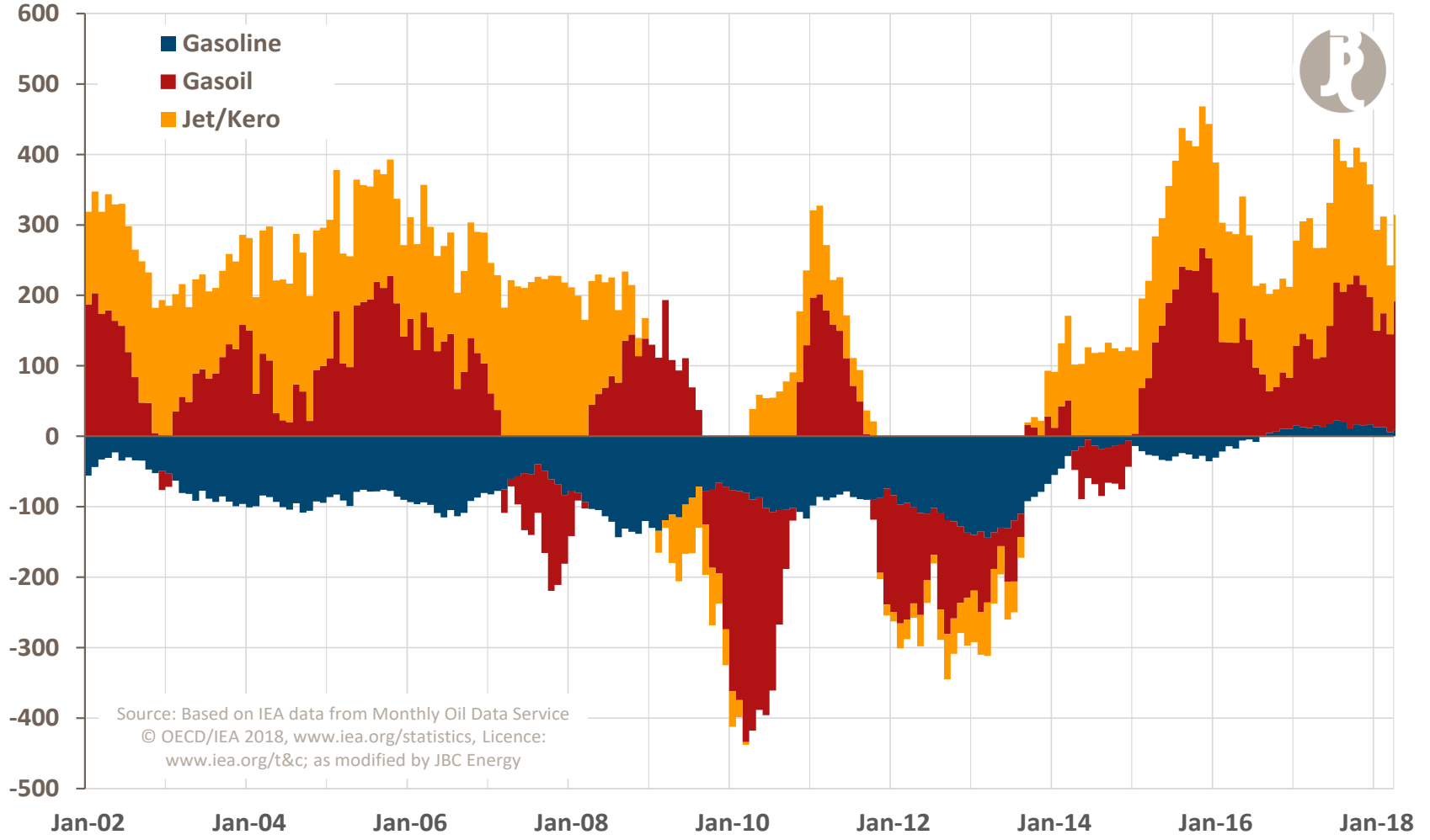
World: Y-o-y Change in Oil Demand (3-Month Moving Average) ['000 b/d]



Clean and dirty product demand outlook is diverging, with gasoline demand growth having weakened noticeably recently due to higher prices. Global gasoline demand growth averaged some 200,000 b/d y-o-y over Q1, the slowest quarterly pace since Q3-2014.

Demand

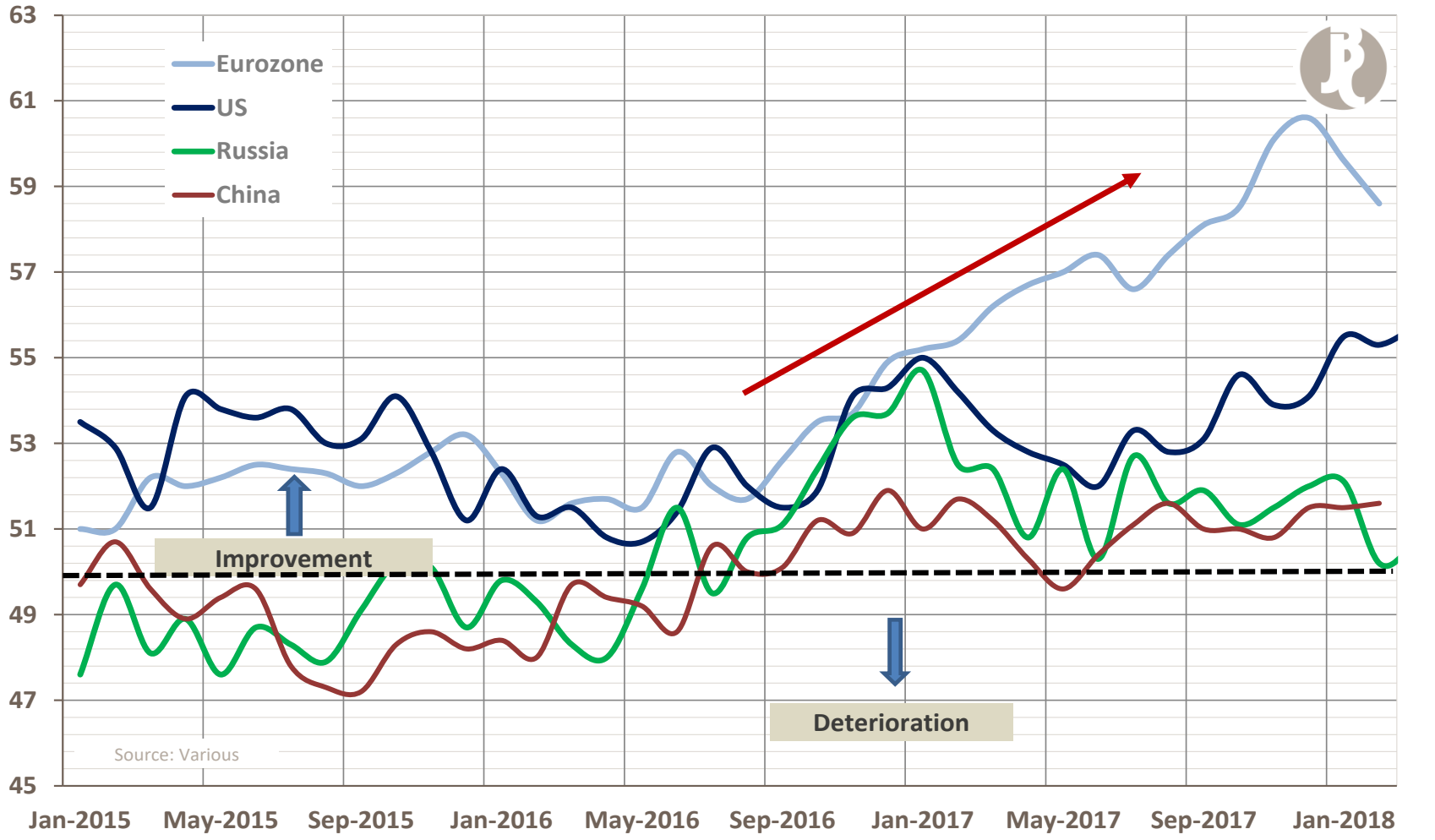
OECD Europe Y-o-y Demand Growth (12 MMA) ['000 b/d]



The past two years have also been spectacularly strong also for growth in transportation fuels in Europe

Demand

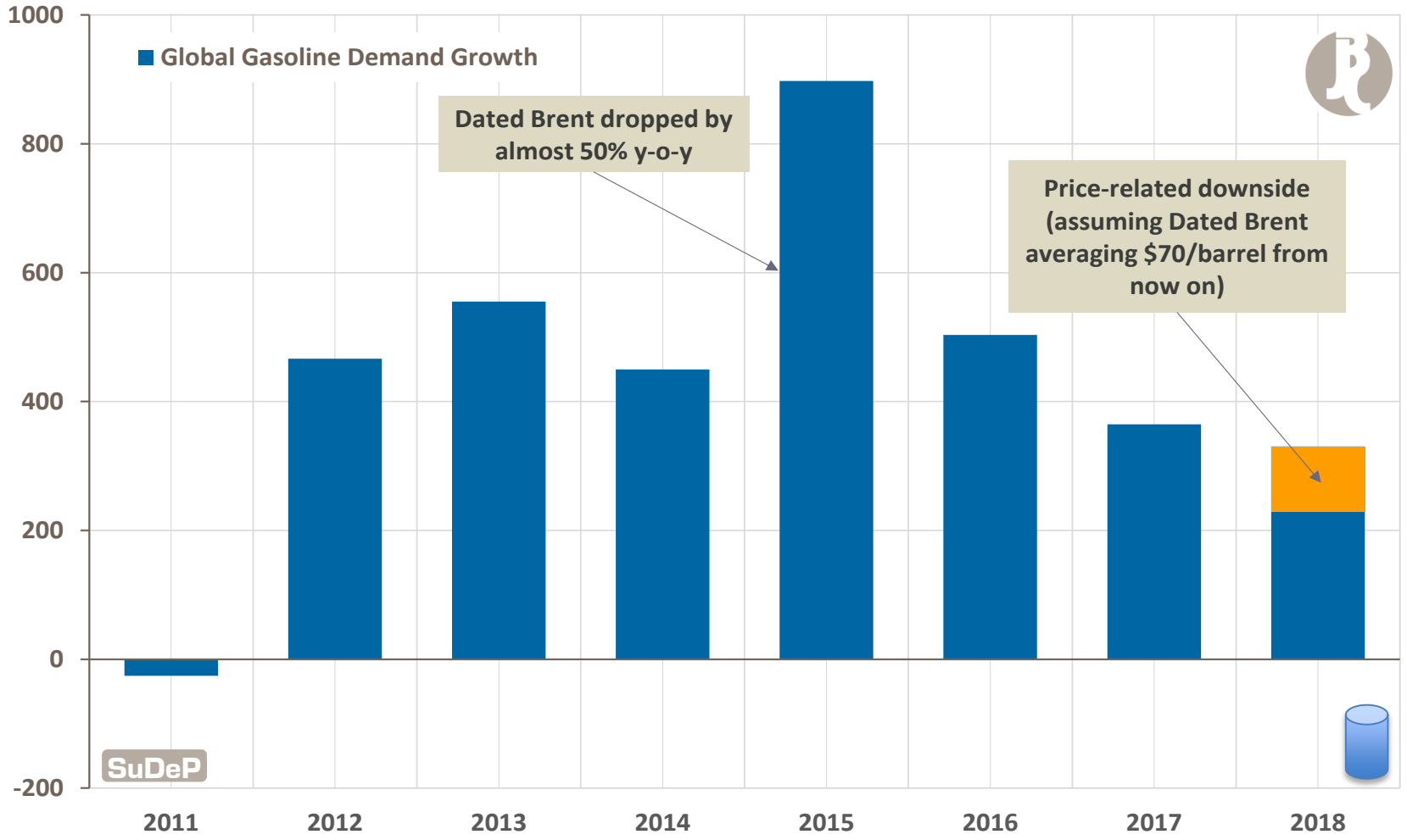
Selected Manufacturing PMI [index points]



Strong economic growth, but question on how long to last and whether a recession in the next 1-2 years is a possible scenario.

Demand - LD

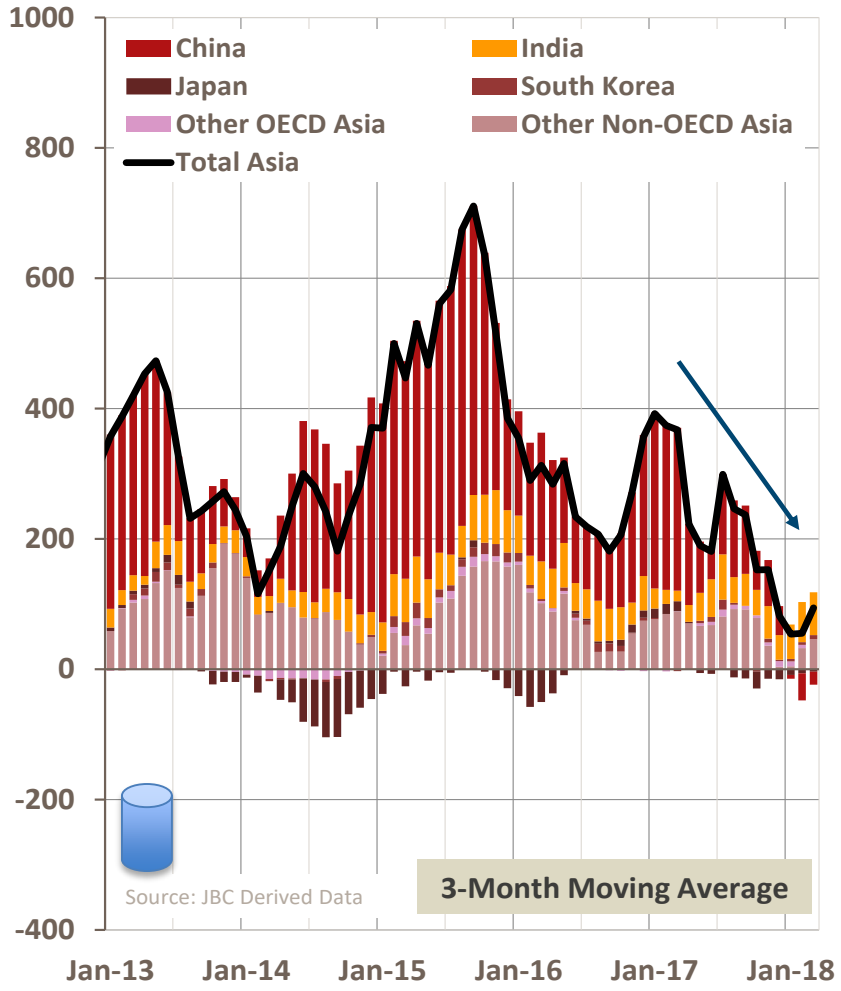
Y-o-y Change in Global Gasoline Demand: Price Related Downside Risk of 2018 ['000 b/d]

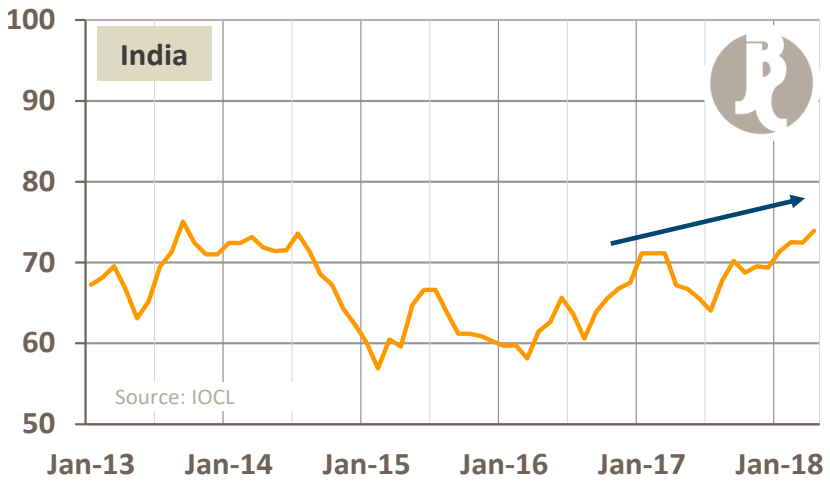


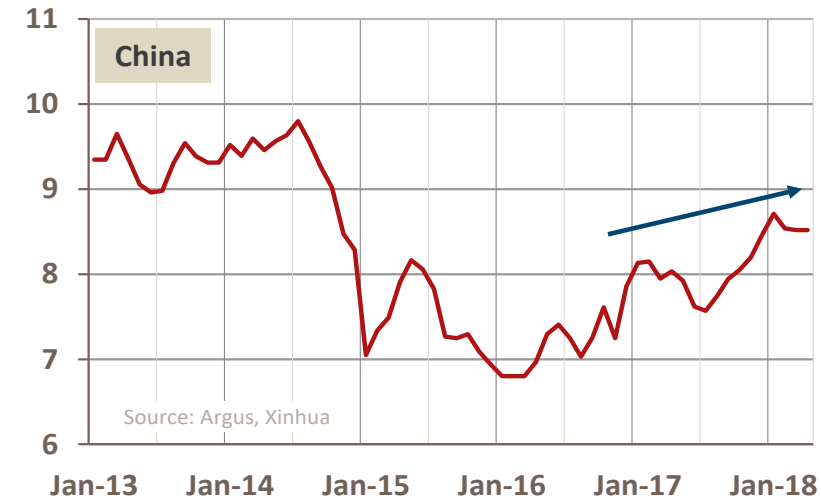
Meanwhile, gasoline demand is at risk from higher retail prices – in a higher oil price scenario we see about 100,000 b/d of potential demand growth dropping away. China and US have seen a 10% increase of retail prices y-o-y

Demand - LD

Total Asia: Y-o-y Change in Gasoline Demand vs. Price ['000 b/d, Rupee/L, '000 Yn/t]



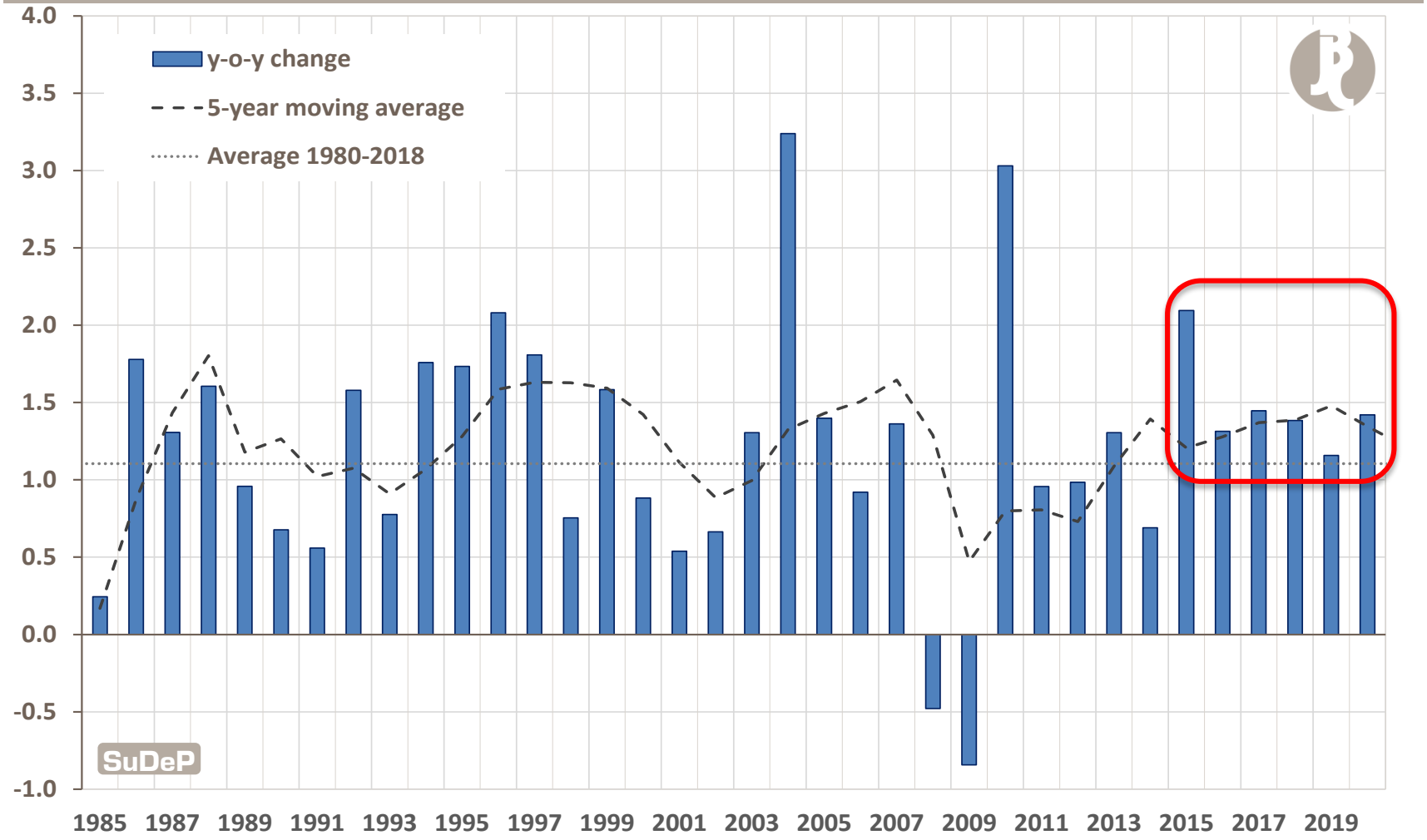




Gasoline demand growth in Asia is currently at its lowest point, and retail prices are at their highest in years in key countries.

Demand

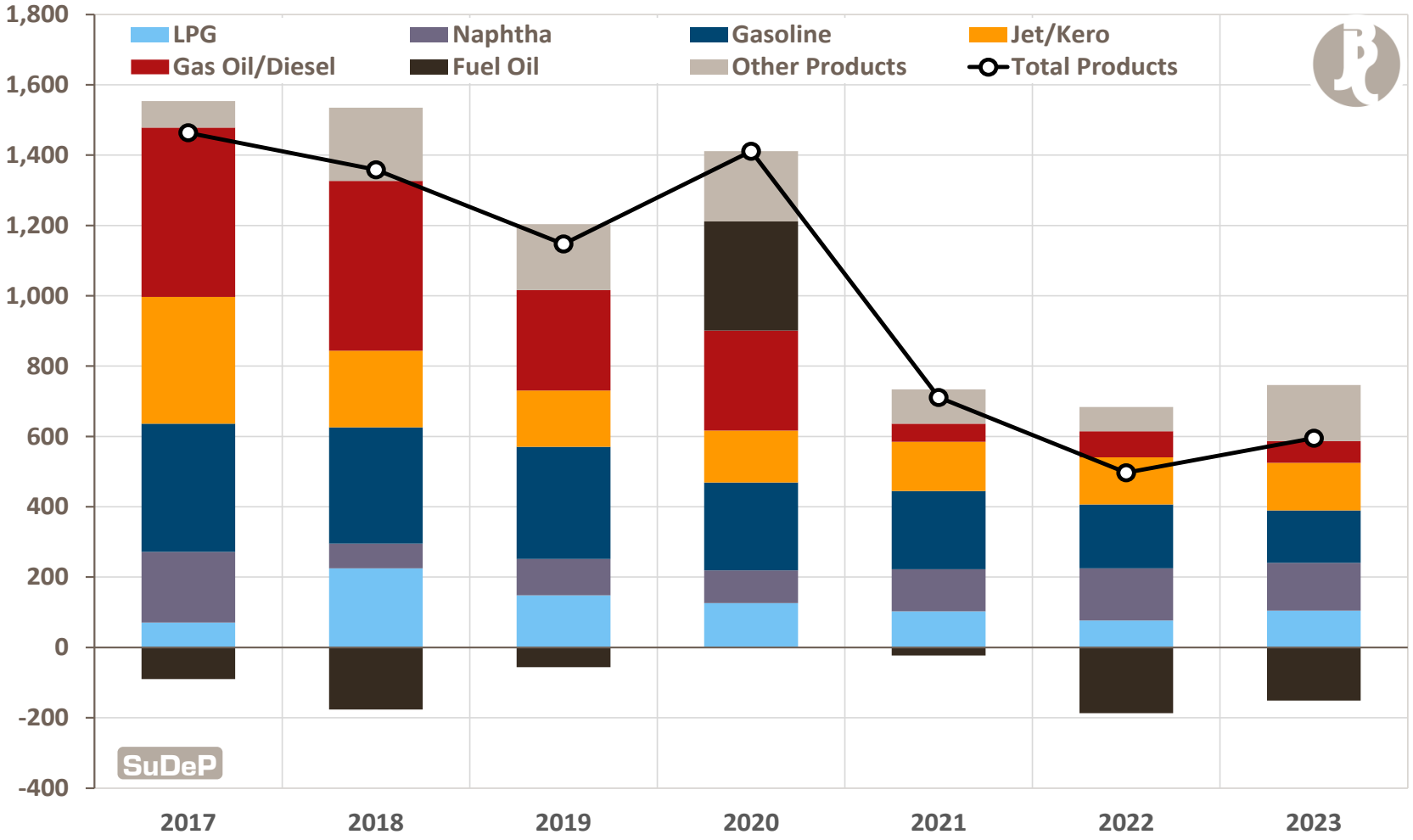
World Demand Growth [million b/d]



The current six years of strong demand growth are unprecedented in terms of consistency of above average demand growth year after year

Demand

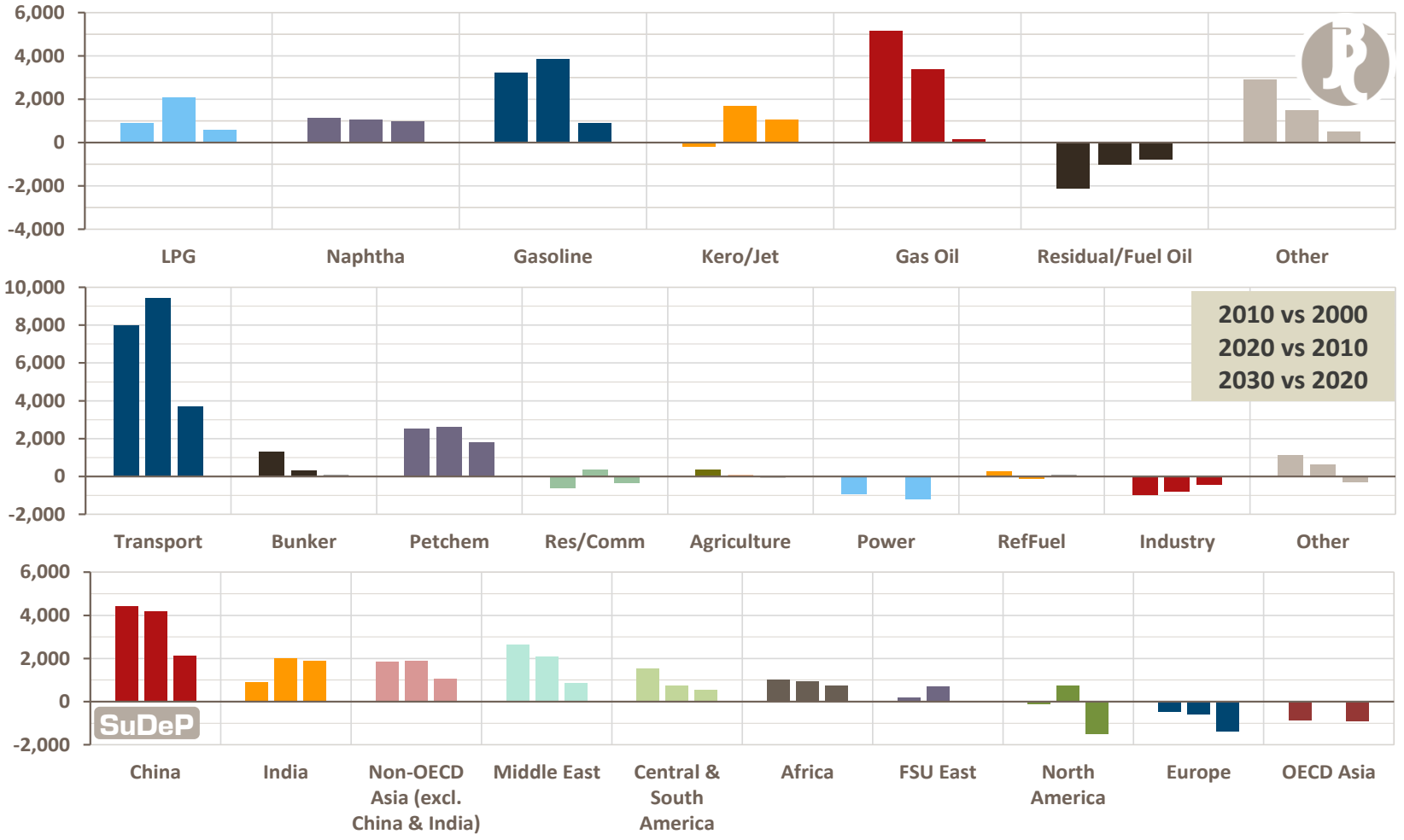
World Product Demand Y-o-y Growth ['000 b/d]



We see demand growth to slow down in the next decade, mainly coming form gasoil/diesel and a decline in fuel oil due to the IMO implementation.

Demand

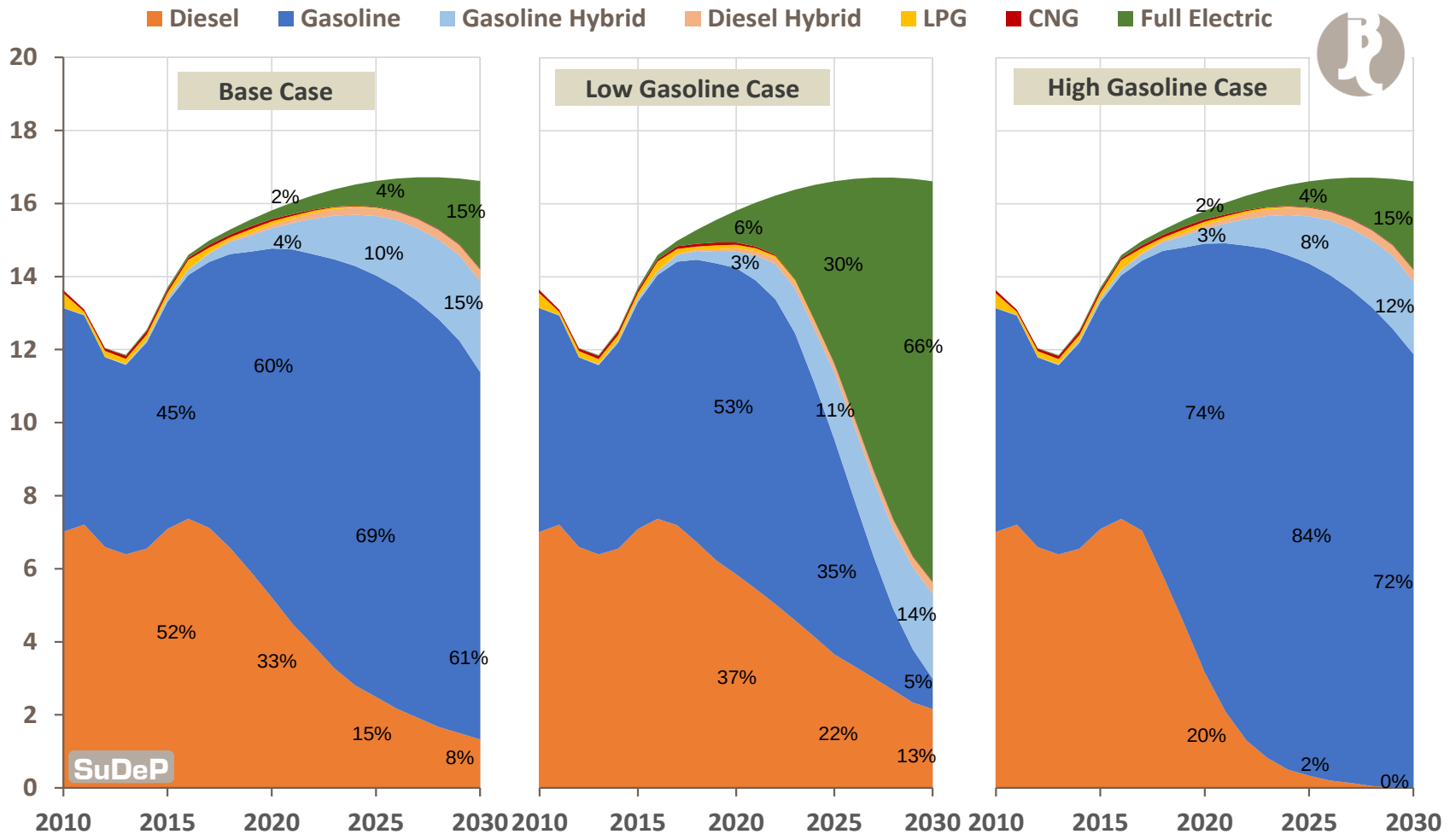
Global Oil Demand Growth by Product, Sector, and Region per Decade ['000 b/d]



Long-Term: Transportation fuel demand is forecast to remain the strongest force in demand dynamics, closely followed by light ends for petchem.

Transportation Fuel Developments

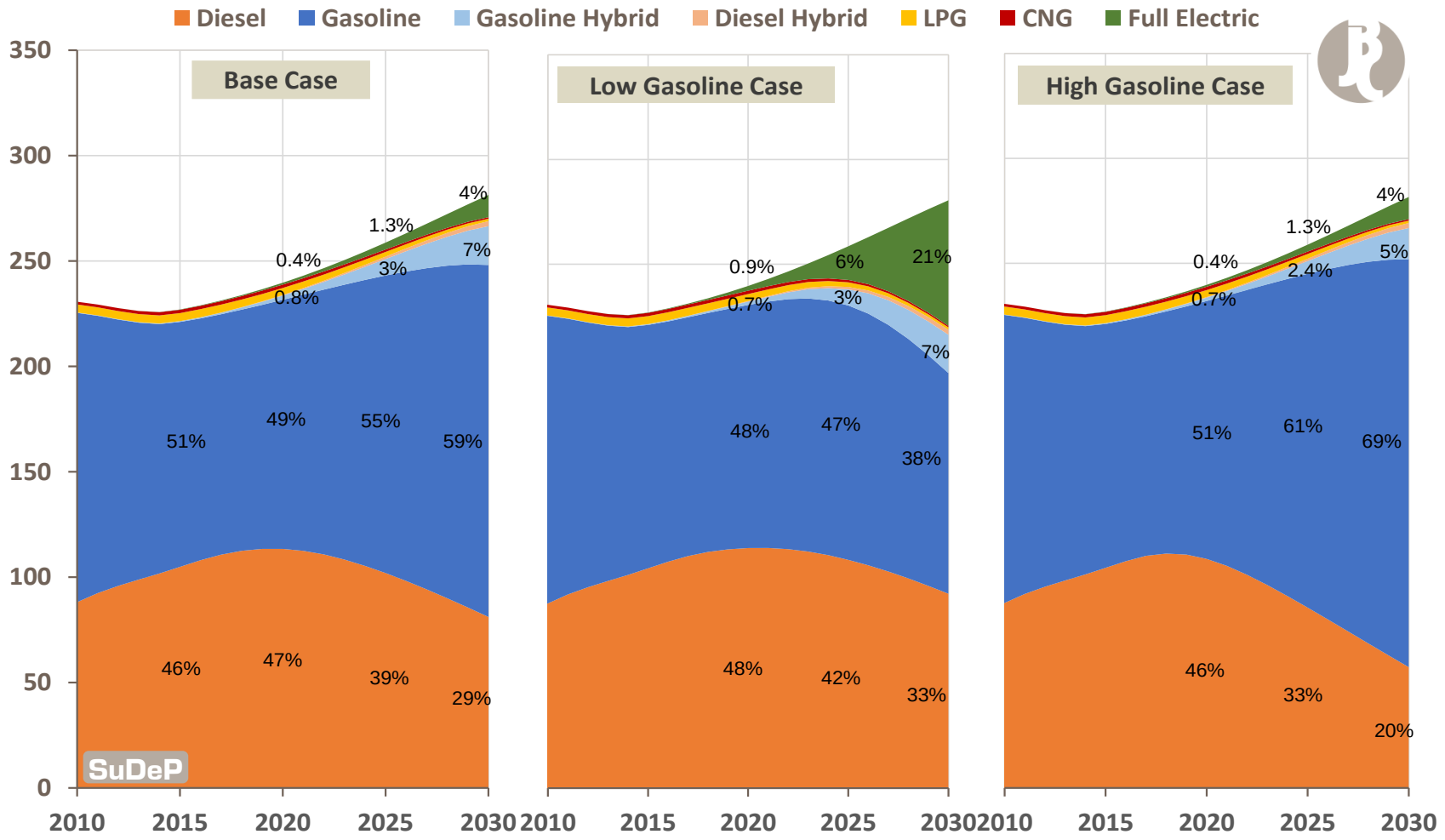
EU28 New Car Sales Scenarios [million units]



In our base case, pure gasoline car sales will be in the 60-70% range over the coming decade while gasoline hybrid and full electric will only pick up significantly after 2020

Transportation Fuel Developments

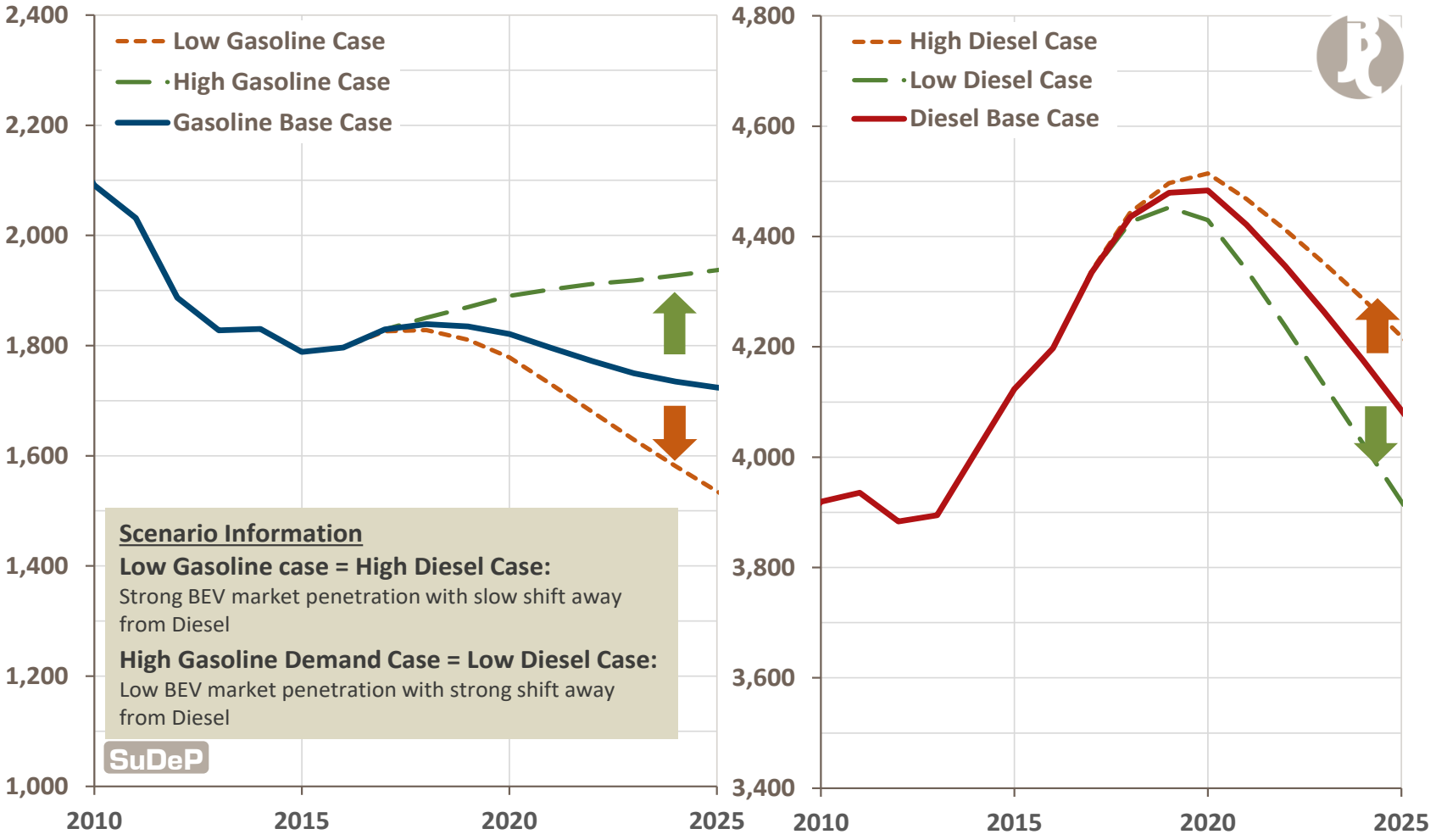
EU28 Car Fleet Composition Scenarios [million units]



It takes time for changes in sales patterns to filter through to the fleet level. The difference between the scenarios is up to 400,000 b/d, which would have an impact on refining operations

Transportation Fuel Developments

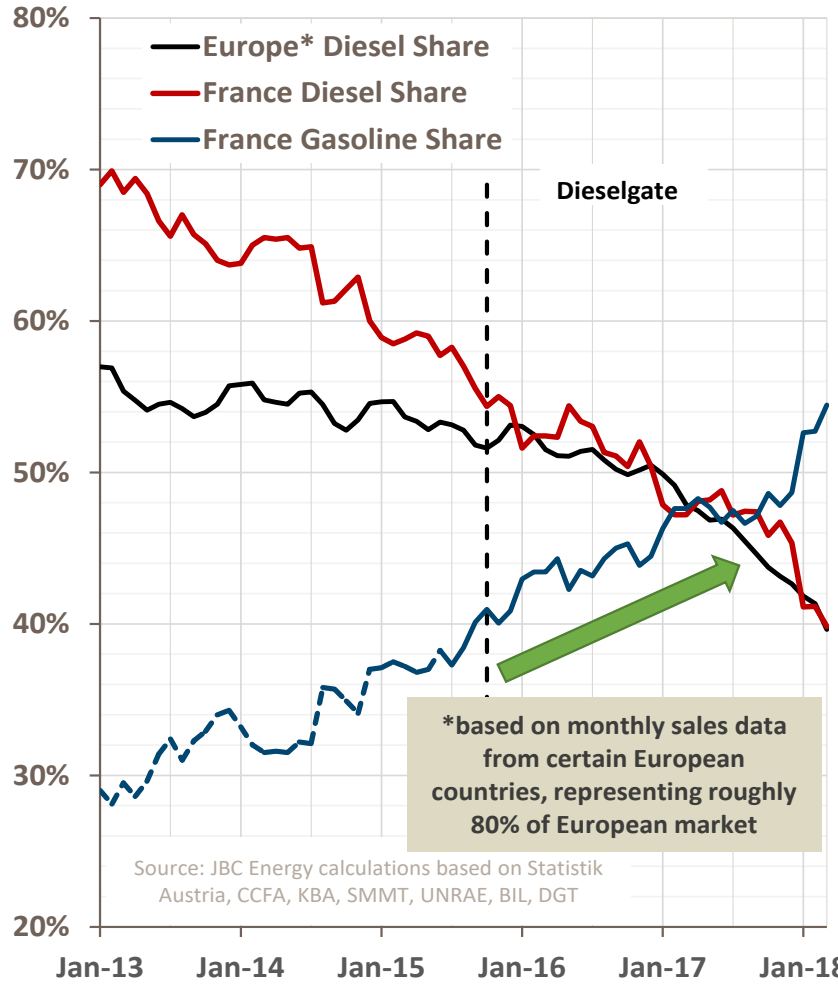
Europe Gasoline and Diesel Demand Scenario Analysis ['000 b/d]

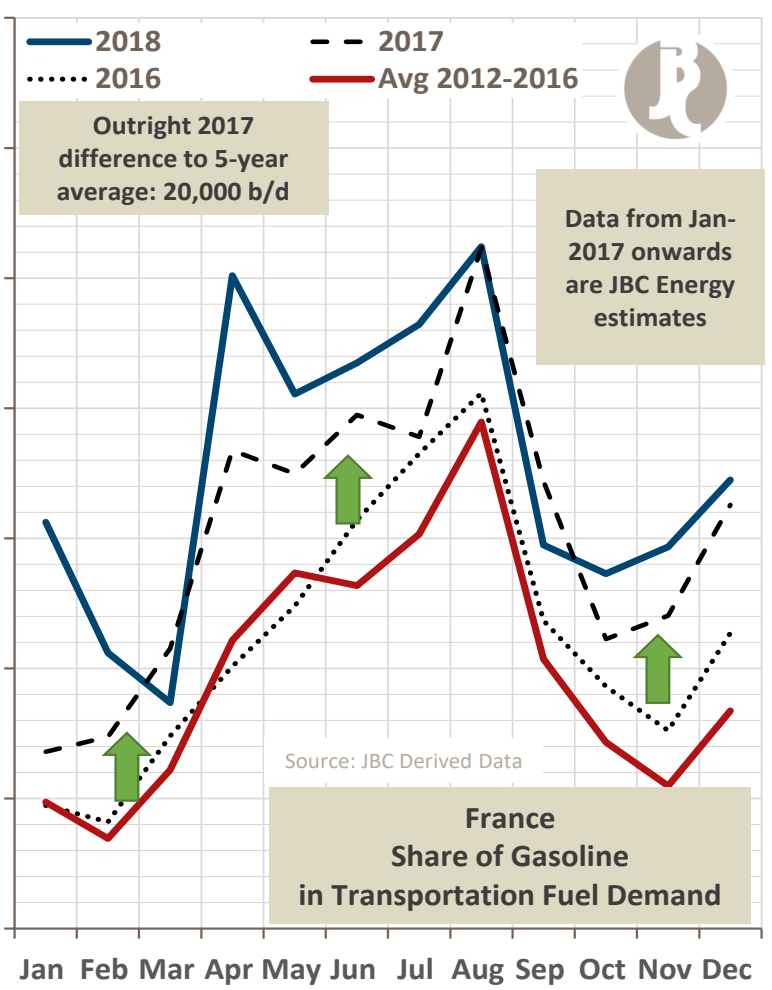


Largely diverging assumptions on car sales lead to a variability of close to 400,000 b/d in European gasoline demand by 2025, but this decade the impact is pretty limited.

Transportation Fuel Developments

Diesel and Gasoline Share in Car Sales and its Effect on Demand [% 3MMA, %]

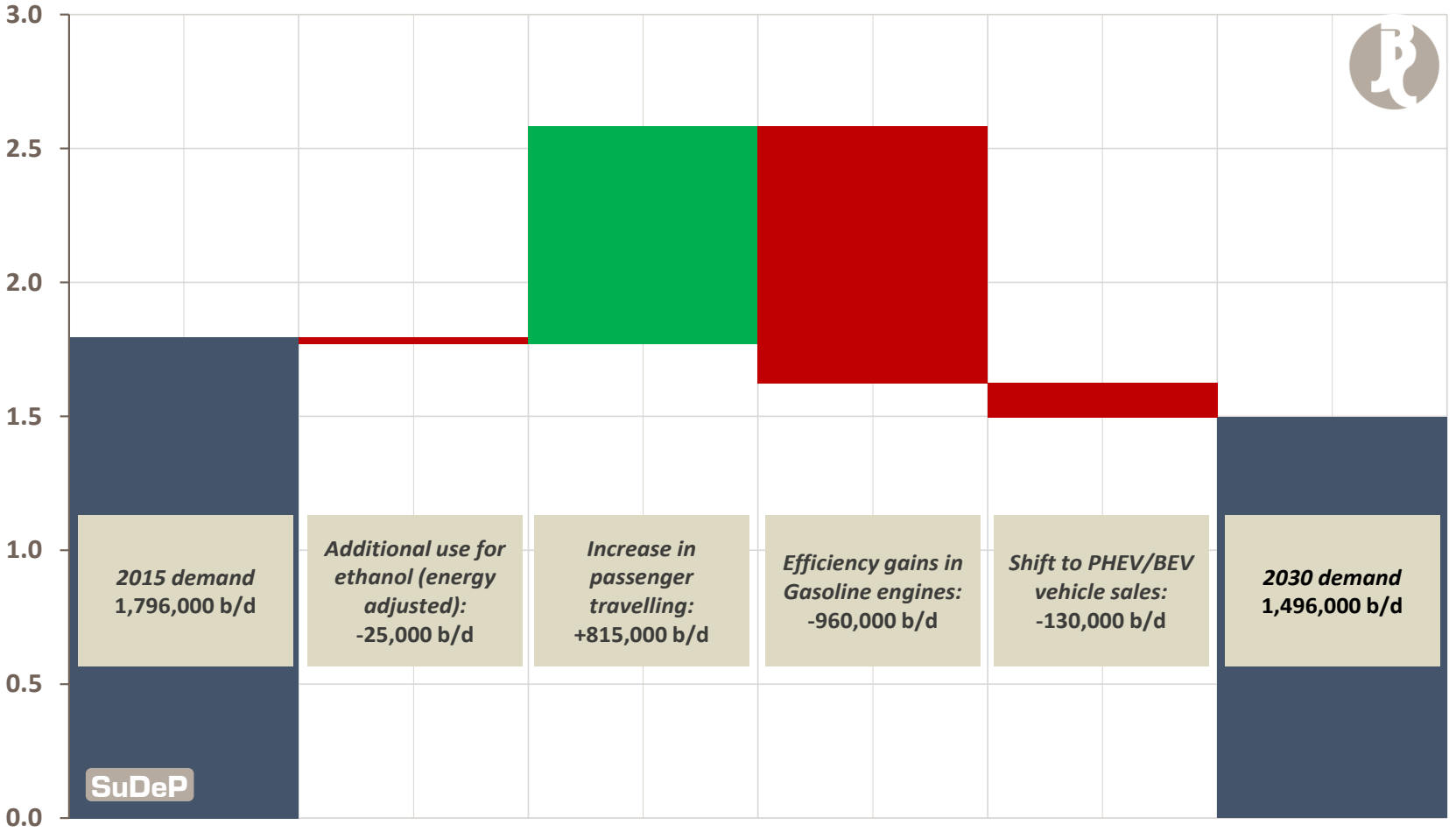




A huge shift in sales in France has led to growth of about 20,000 b/d for gasoline relative to the 5-year average.

Transportation Fuel Developments

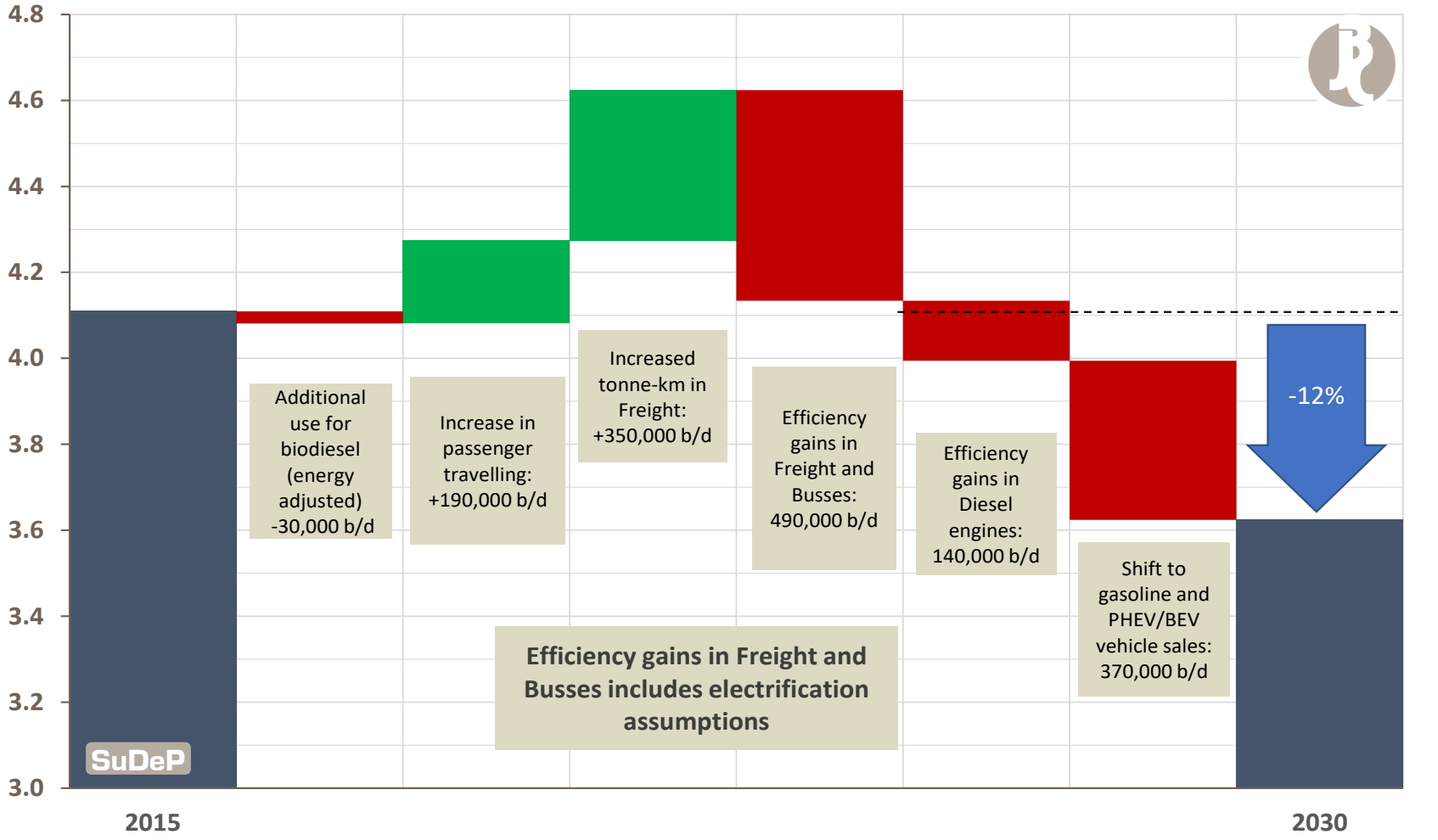
Components of EU-28 Transport Gasoline Demand 2015-2030 [million b/d]



Our base case for gasoline demand sees a decline of 300,000 b/d from 2015 to 2030

Transportation Fuel Developments

Components of EU-28 Transport Diesel Demand 2015-2030 [million b/d]



Diesel demand overall drop by 10-15% over the 15 year period. Changes in the freight sector can have the most impact on diesel demand given that it accounts for more than 50% of diesel demand in Europe.

Transportation Fuel Developments

Comparison of Fuels	Energy efficiency	System dimension	Model availability	System Price	Fuel Price	Range	Infrastructure	Re-fuelling	Maintenance costs	Emissions	Comments
Gasoline	3	1	1	1	2	1	1	1	3	3	low energy efficiency; supercharged engines emit PM
Diesel	3	1	1	1	2	1	1	1	3	3	exhaust gas treatment needed
LPG	3	1	2	1	2	1	1	1	3	3	emissions slightly better; energy efficiency a bit worse
LNG	2	1	3	2	1	1	3	2	3	2	feasable only for trucks
CNG	2	2	2	2	1	2	2	1	3	2	basically a gasoline car - biggest problem is tank size and range
Hydrogen	2	2	3	3	3	2	3	1	2	1	700 bar tanks; losses due to energy conversion
Electricity	1	3	2	2	1	3	2	3	1	1	heavy batteries needed; range highly dependent on conditions

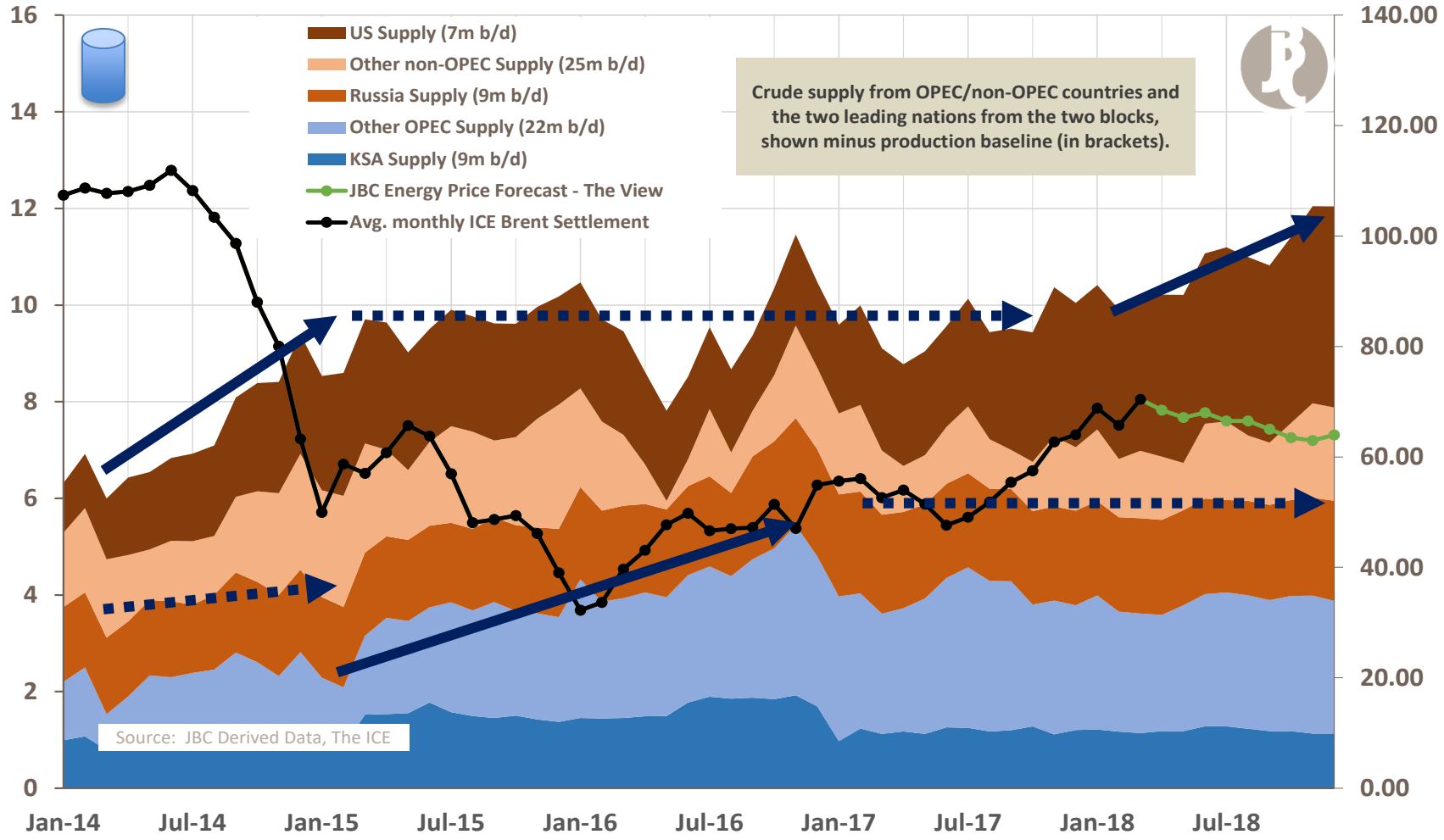
Source: JBC Energy

reasonable	1
some issues	2
problematic	3

Supply & OPEC Strategy

Supply & OPEC Strategy

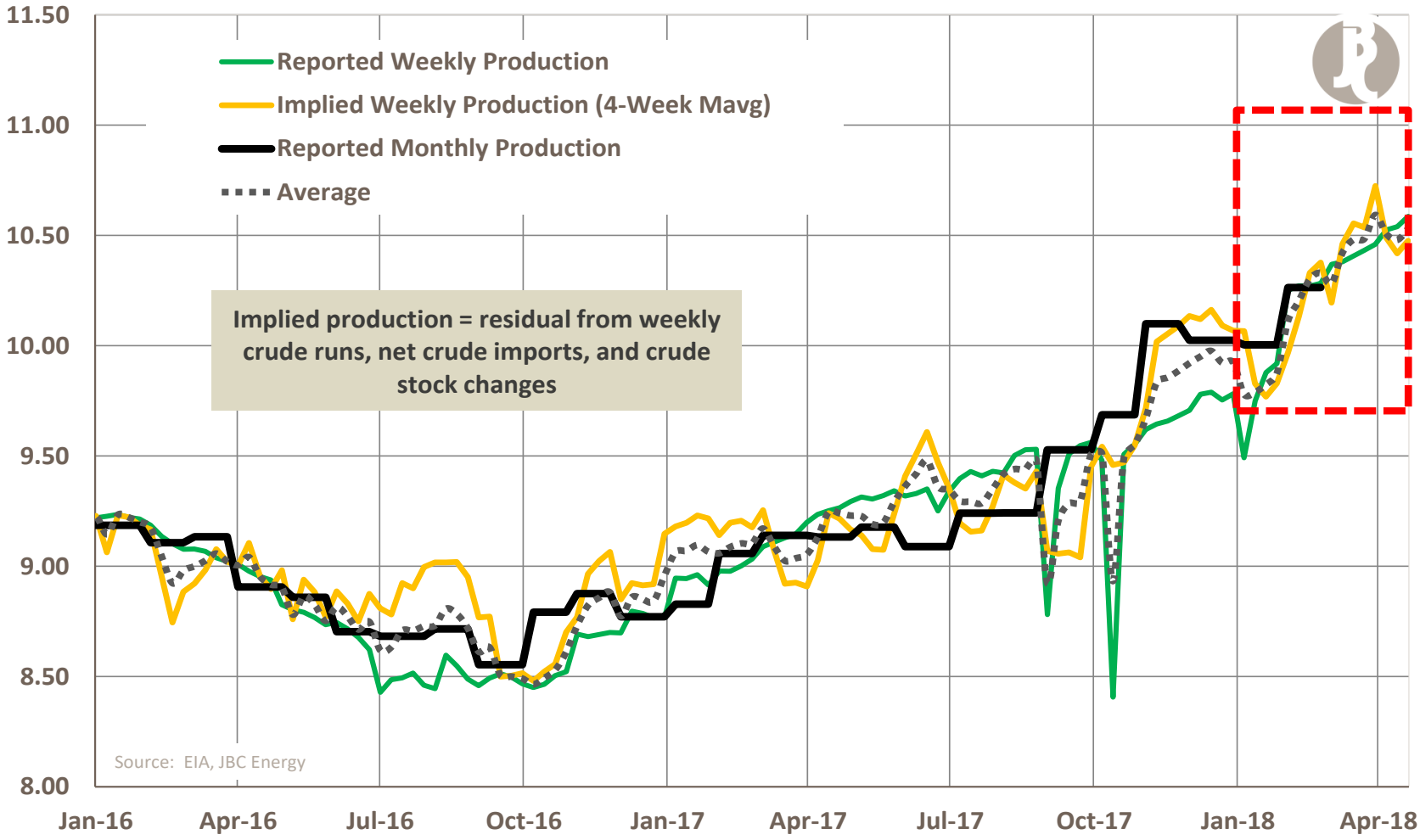
OPEC/Non-OPEC Supply above Baseline and ICE Brent Price [million b/d; $/bbl]



Looking only at changes to the marginal barrel and how closely prices have tracked them, it is clear that there will be downside pressure to come. Note the OPEC pressure over 2015/16 – could there be a re-run of this in the future?

Supply & OPEC Strategy

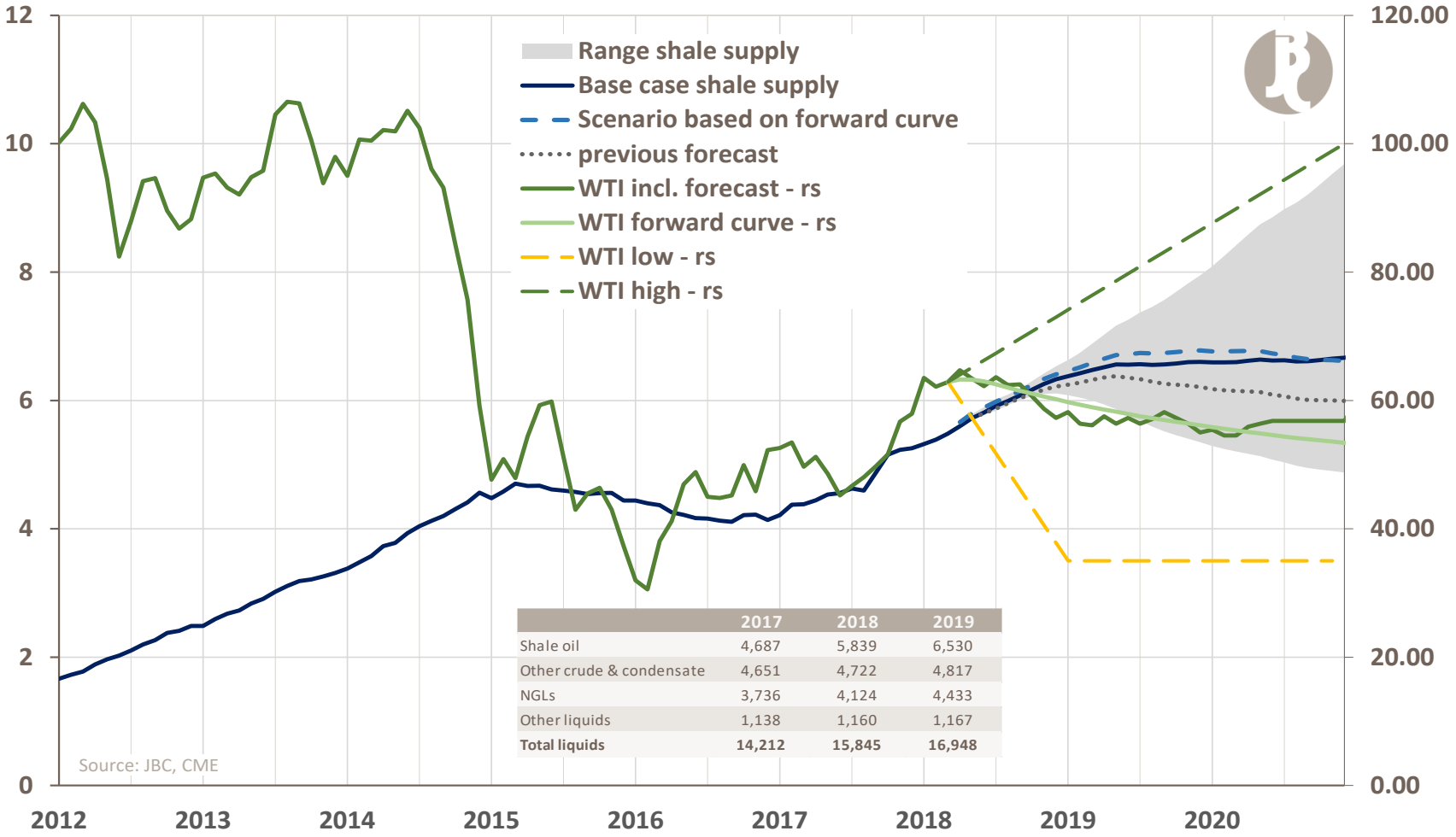
US Crude Production [million b/d]



Everything continues to point at a looming surge in US crude production. Expect pressure on crudes in producing areas (e.g. Permian) and a wider WTI/Brent spread. However, US exports and higher US intake may yet keep the spread from blowing out

Supply & OPEC Strategy

US: Shale Oil Outlook vs WTI Outlook [million b/d; $/bbl]

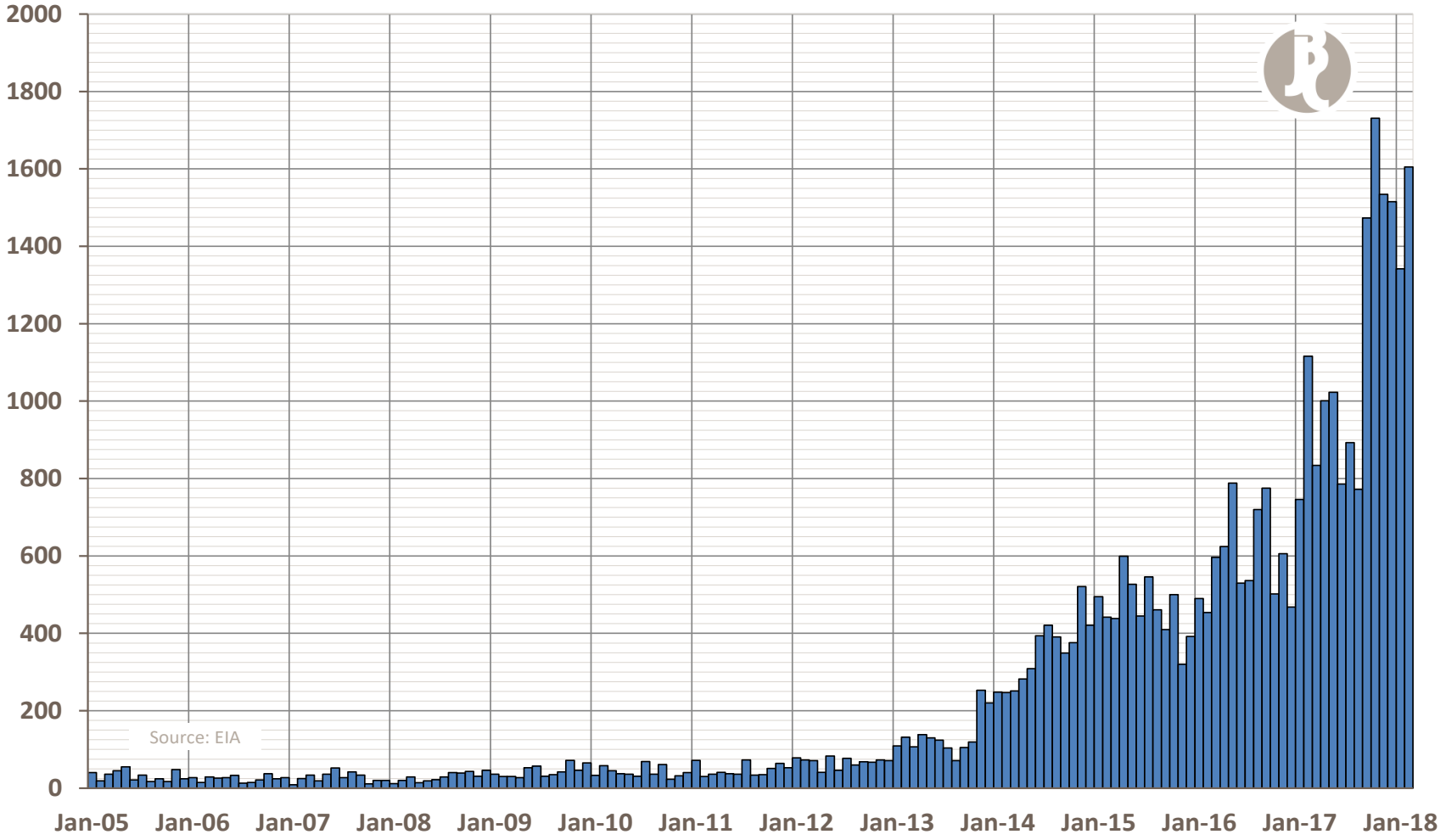


	2017	2018	2019
Shale oil	4,687	5,839	6,530
Other crude & condensate	4,651	4,722	4,817
NGLs	3,736	4,124	4,433
Other liquids	1,138	1,160	1,167
Total liquids	**14,212**	**15,845**	**16,948**

Based on massive supply additions, we forecast prices to ease over the next year, with the Q4-2017 price spike to yield more US shale production. The chart also shows potential future production paths based on prices between $35 and $100.

Supply & OPEC Strategy

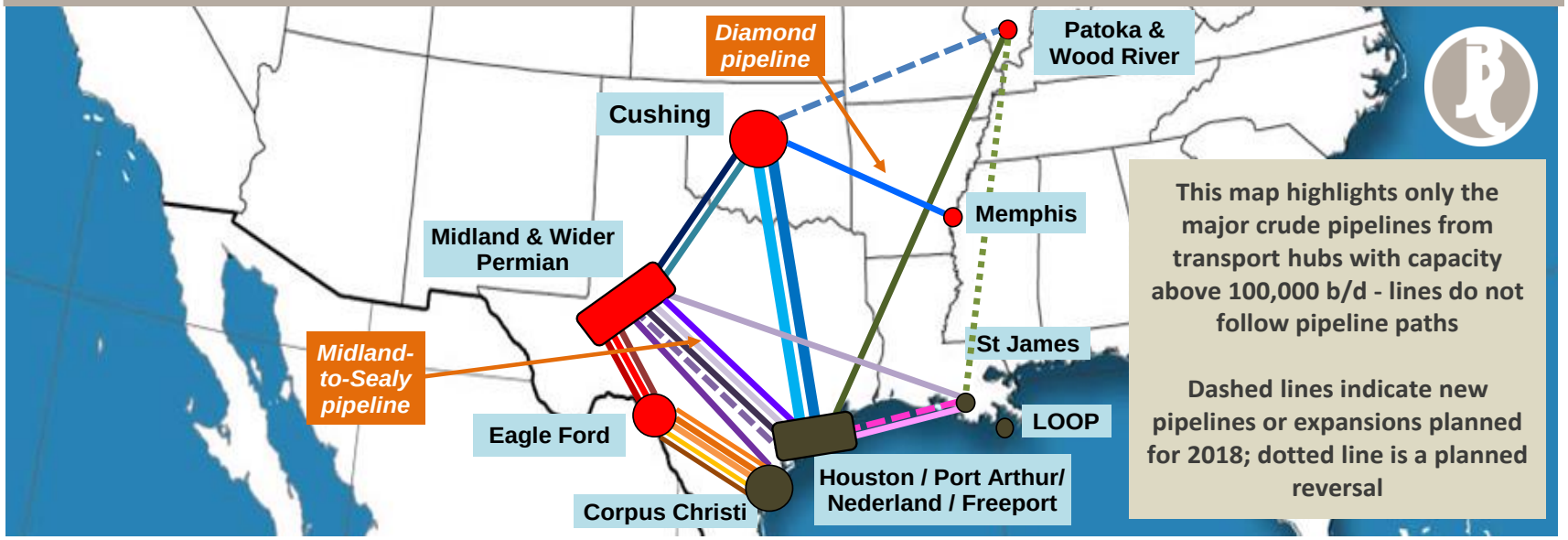
US Crude Exports ['000 b/d]



The oversupplied US market is now venting itself into the int'l market; VLCCs were recently again tested on the Texas gulf, while they are now operating out of LOOP

Supply – United States

US: Major Crude Pipelines in Southern Hubs ['000 b/d]



Out of Patoka and Wood River Region to:		
Houston Area	520	ETCO

Out of Cushing to:		
Houston Area	700	Keystone Market Link
	850	Seaway Twin (reversed)
Memphis	**200**	**Diamond**
Patoka & Wood River	**345**	**Ozark**

Out of Louisiana to:		
Patoka	**1200**	**Capline**

Out of Midland to:		
Cushing	140	Centurion
	450	Basin
Louisiana	100	Louisiana Extension
Corpus Christi	440	EPIC
Houston Area	100	Bridgetex
	450	**Permian Express**
	225	Longhorn
	450	**Midland to Sealy**
Eagle Ford	200	West Texas Gulf
	100	Longview
	390	Cactus

Out of Houston Area to:		
Louisiana	375	Zydeco
	480	**Bayou Bridge**

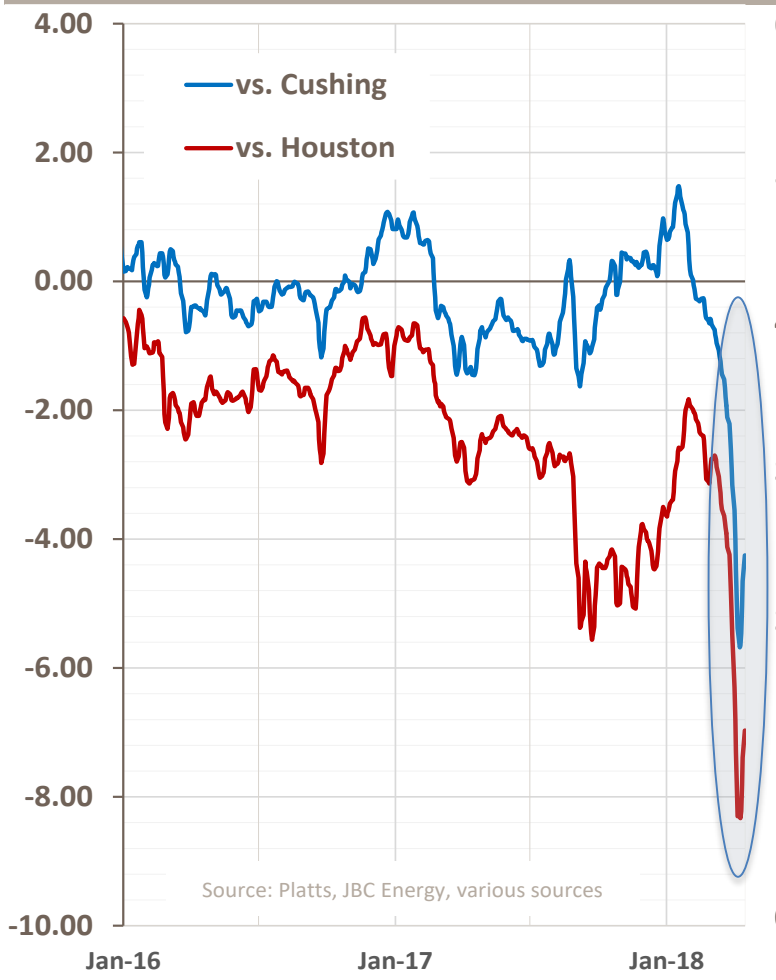
Out of Eagle Ford to:		
Corpus Christi	660	Eagle Ford JV
	100	Double Eagle
	250	Pettus-to-Corpus
	130	Victoria Express
	100	Rio Bravo

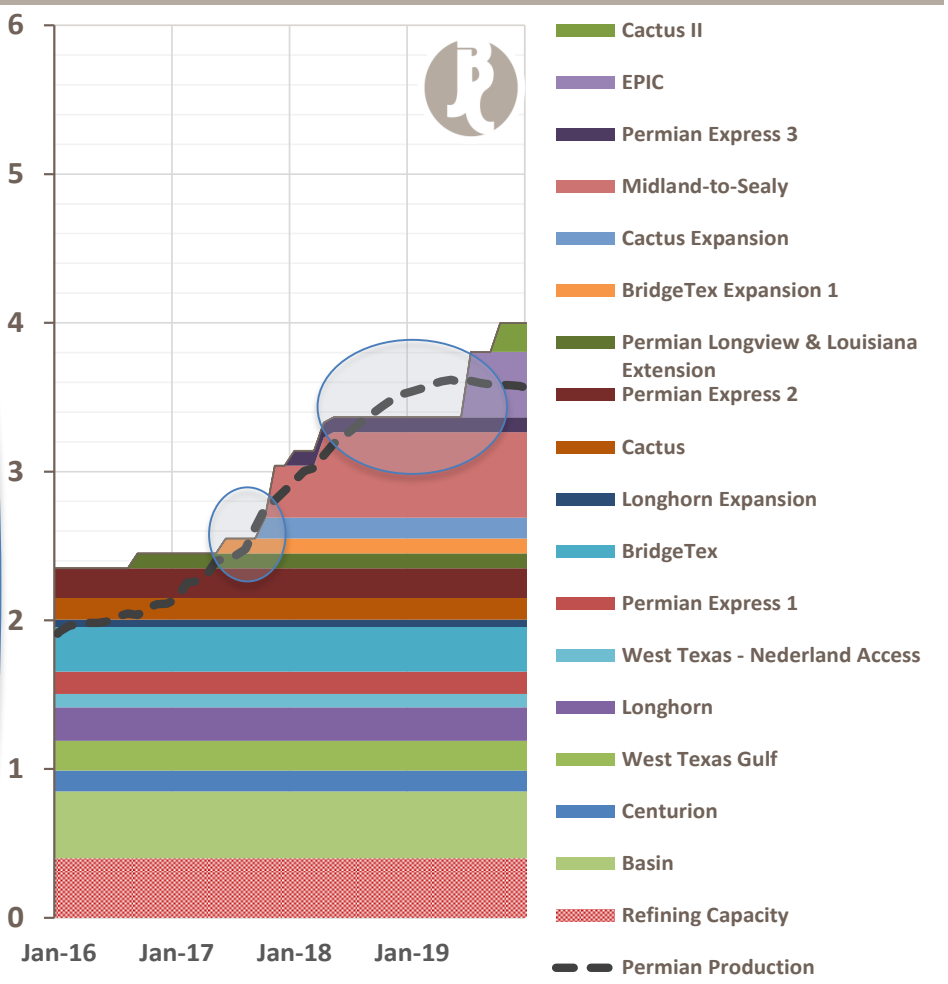
Source: JBC Energy, various

The significant draws at Cushing have been enabled by the Midland-Sealy and Diamond pipelines start-ups

Supply & United States

WTI Midland Price vs Other Locations and Pipeline Offtake Capacity Overview [$/bbl; million b/d]

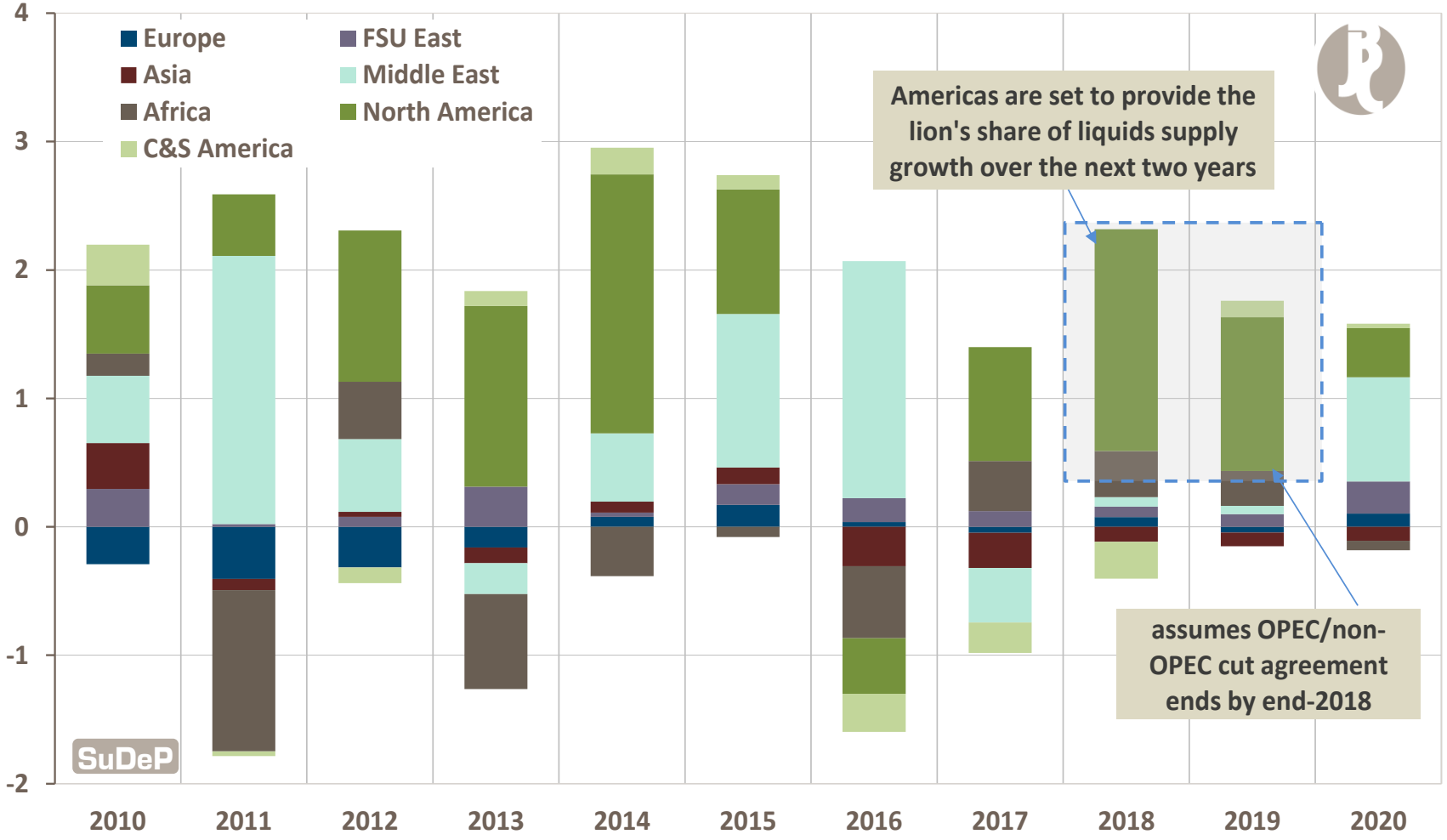




Increased offtake capacity has temporarily supported local Permian crude prices and reduced the marginal cost of delivery to the USGC, but we have already entered a period of constraints again. A renewed dislocation of WTI Midland, which is likely to eventually spread to the wider WTI complex and beyond amid rising US crude exports.

Supply & OPEC Strategy

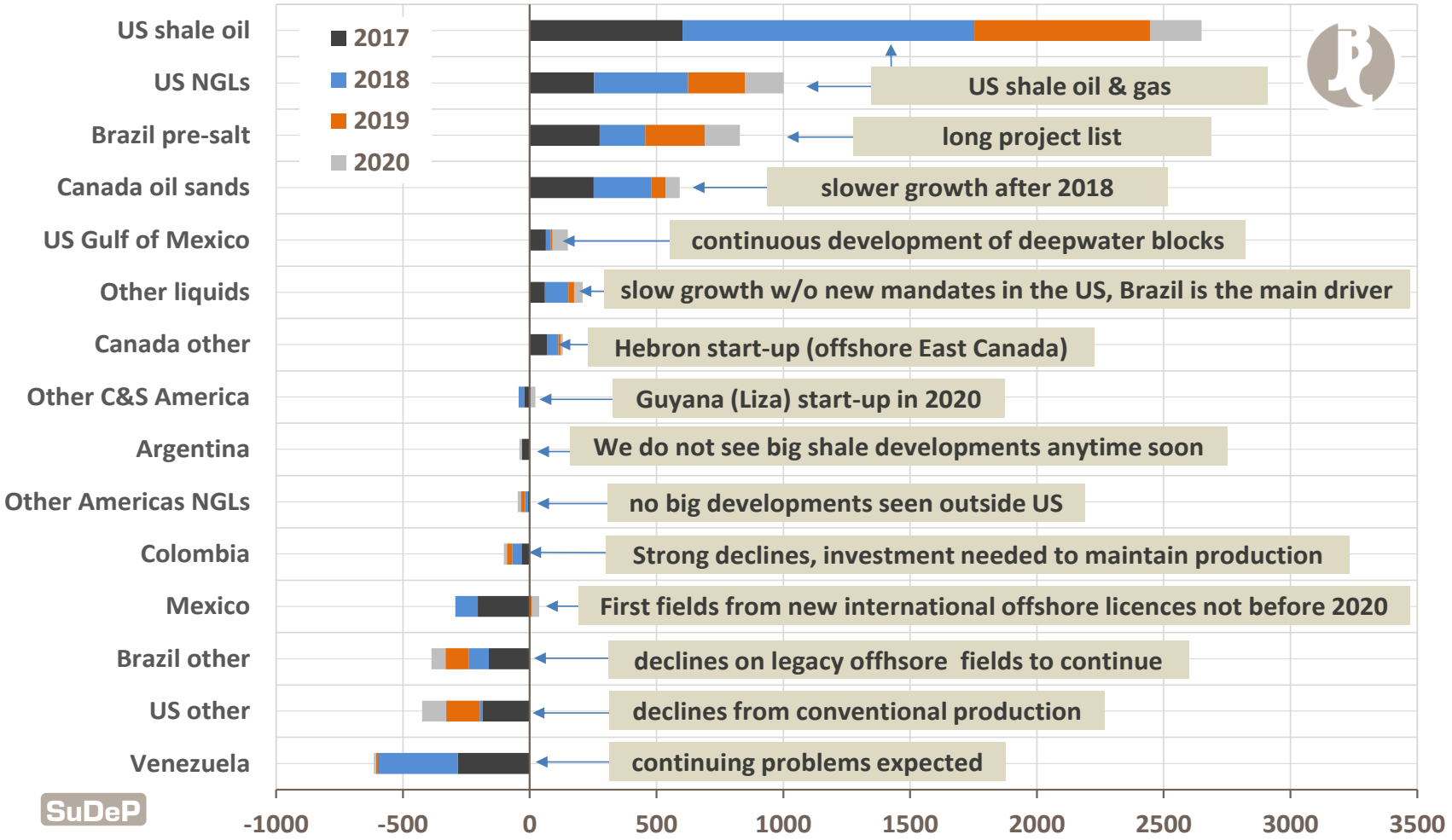
World Total Liquids Supply Change By Region [million b/d]



Americas liquids supply growth easily outweighed the OPEC/non-OPEC cuts in 2017, and with slightly higher prices there does not seem an end to it anytime soon.

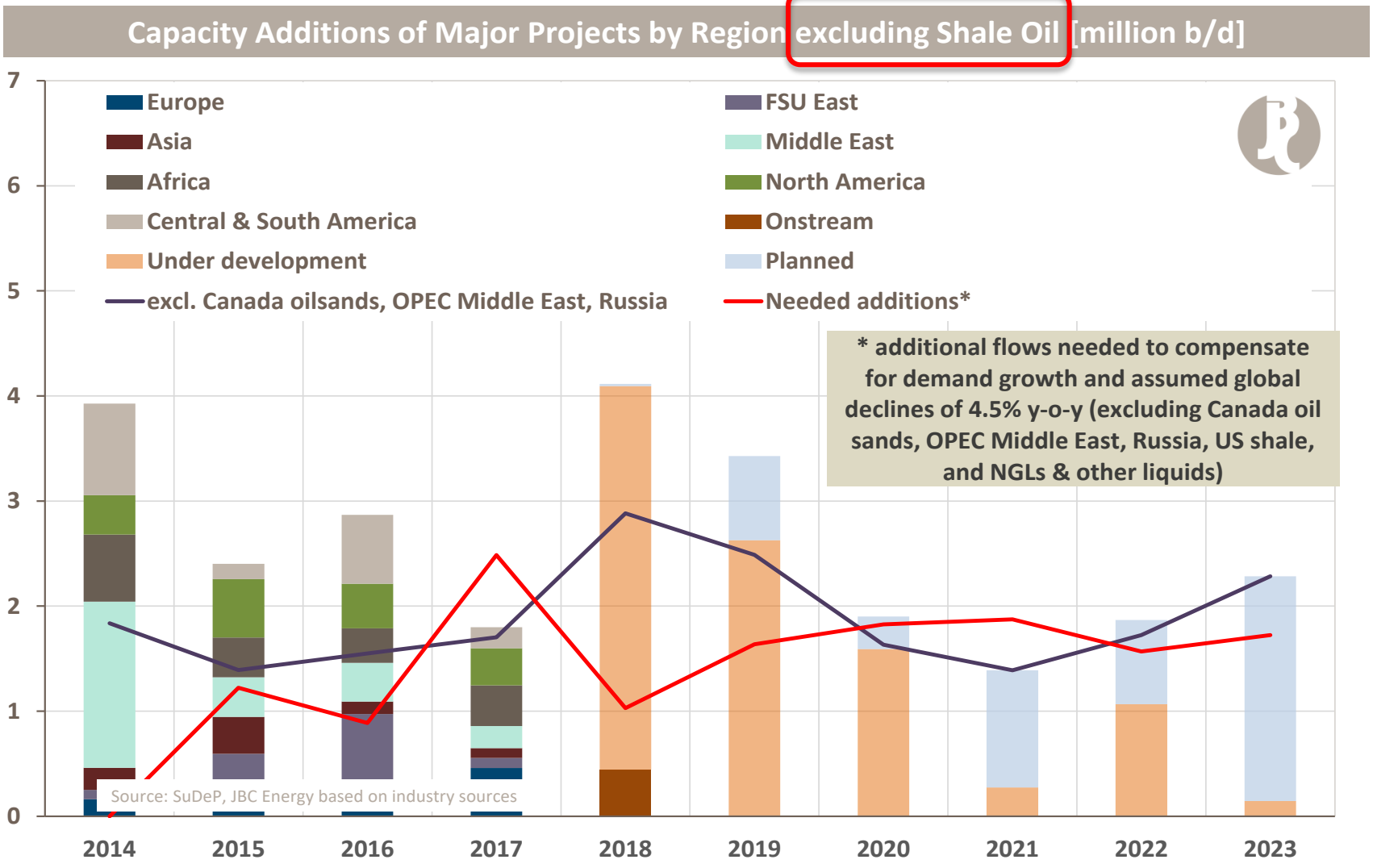
Supply & OPEC Strategy

Americas Liquids Supply Change by Source ['000 b/d]



According to our assessments, US shale oil and US NGLs supply make up 2.1 million b/d of growth over the next three years

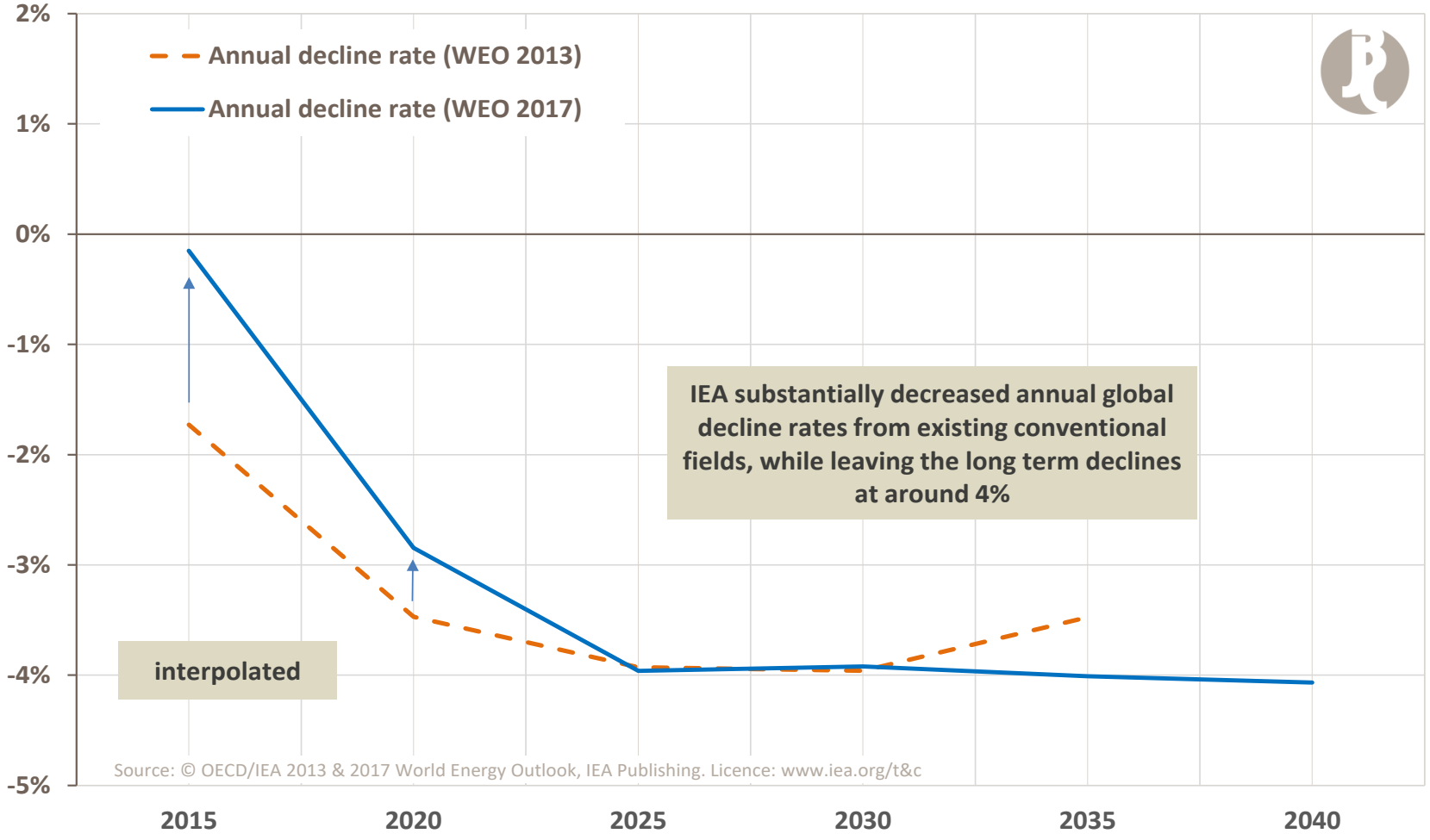
Supply & OPEC Strategy



We are sceptical about how much upside support there can be when considering the full supply picture – 2018 (and potentially 2019) will see as much new supply – excluding shale oil - coming online as there was in 2014, when the price fall was triggered. (Detailed expansion list in Appendix.)

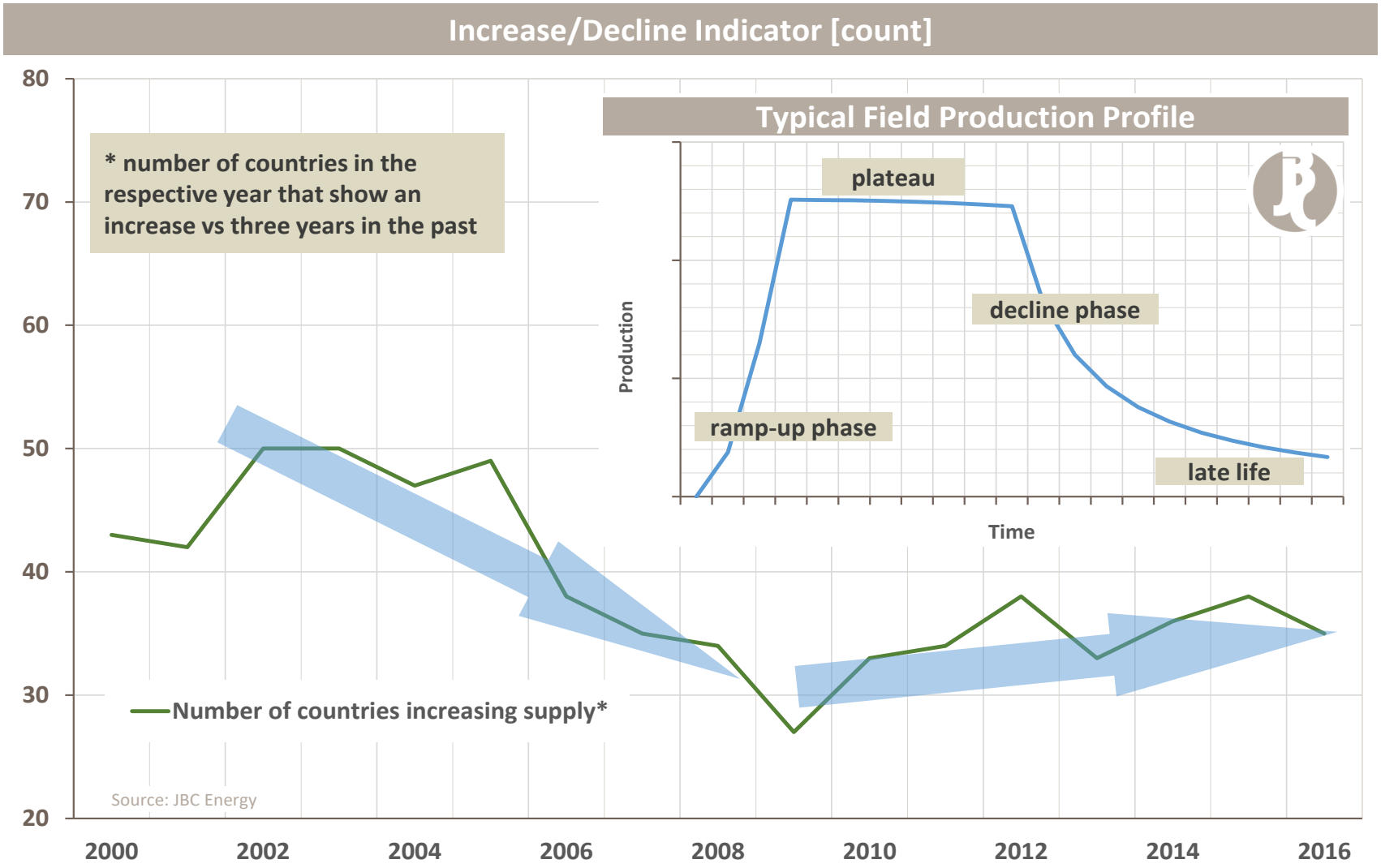
Impact of Technology

IEA WEO Decline Rates [%]



Historic decline rates have apparently been much lower than expected – also a factor of technology

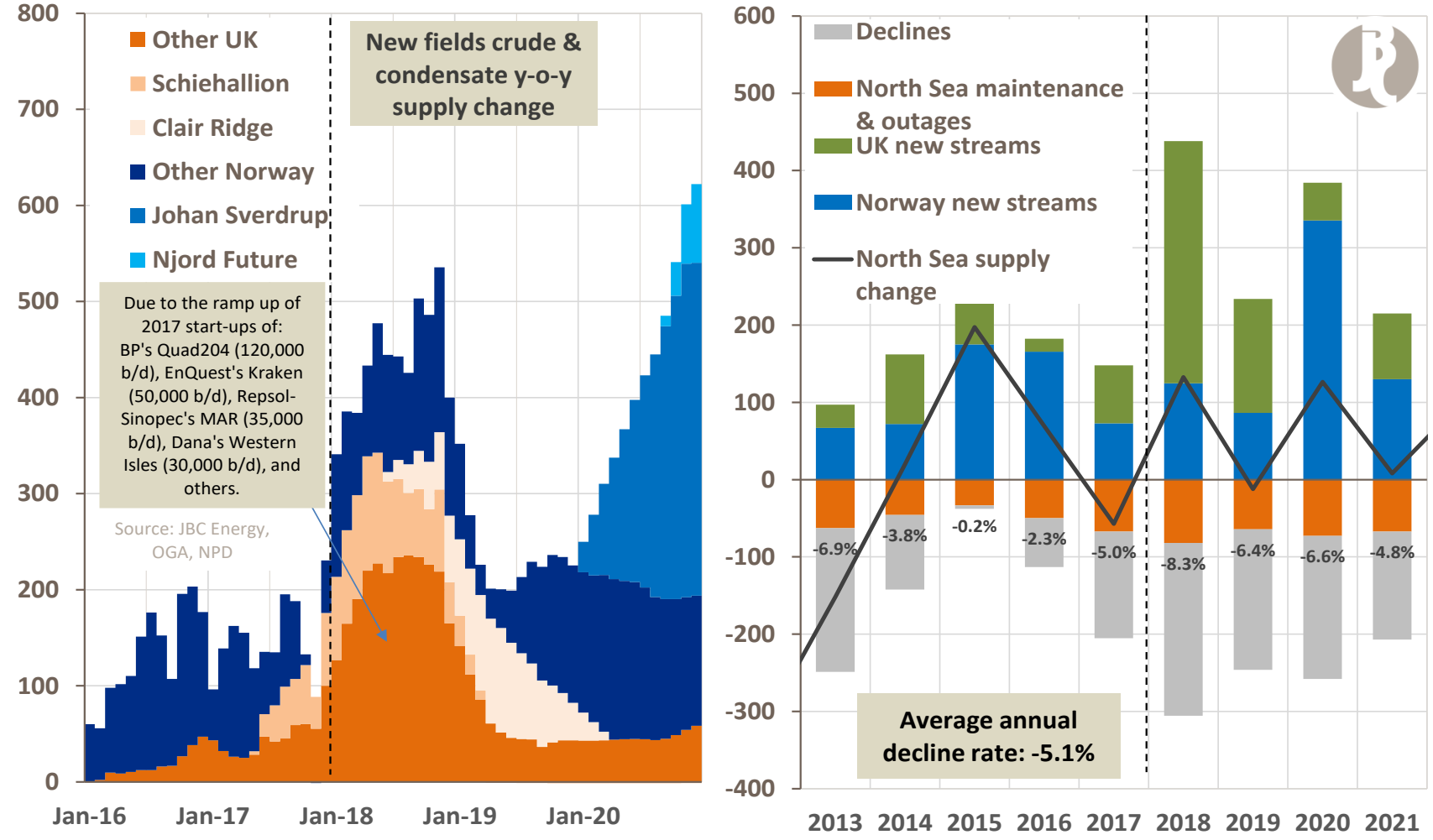
Impact of Technology



A large proportion of fields are already in their 'late life' stage, so only small additions to supply would be enough to offset declines from those mature fields. Technology has also improved substantially over the last decade(s) and low oil prices do force oil companies to employ them.

Impact of Technology

North Sea: Crude & Condensate Production Outlook Y-o-y ['000 b/d]



One area which highlights this is the North Sea, where we are entering a phase of net growth, reversing long term declines – even though decline rates are assumed to stage a massive comeback after a period where the focus was on maximising current output.

Impact of Technology

Standardisation & Other Improvements:

Push for efficiency in the upstream sector due to the price fall

- Streamline logistics and supply chain
  - Standardisation (e.g.: joint programme by BP, Chevron, Shell to standardise production equipment)
  - Unified well design (e.g.: Statoil success at Snorre B: 3 wells drilled in a row with costs for additional capacity put below 10$/bbl)
  - Investment into subsea boosting systems to maximize utilisation of offshore installations and debottleneck processing capacities
  - Increased rig efficiency: rigs drill about 50% more wells per months compared to 2012 thanks to pad drilling and multi-laterals
  - Slimmer designs that are closer to reality: Use of "lower" production capacity FPSOs, platforms etc lead to cost capex cuts of 30-40%, but do not have an impact on future production. Examples: Shell's Bonga SW, Statoil's Johan Castberg
  - Recent example: EnQuest was able to reduce costs for the offshore UK Kraken heavy oil project (50,000 b/d, first oil achieved in June) by over $800 million from originally $3.2 billion (-25%)
- Well performance optimization
  - Longer laterals (e.g. Pioneer increased lateral lengths by 1,000 m over the last two years)
  - Improved well stimulation methods (fracking) and optimization of well placement through geo-steering
- Portfolio optimization – different strategies
  - Focus on sweet spots
  - But also: focus on existing assets/unlock additional volumes through Enhanced Oil Recovery (EOR)

- Efficiency gains facilitated through better "more costly" technology
  - E.g.: unified well design needs more general casing design, but cost savings on logistics make up for higher cost
- Additional costs are counterbalanced by improved output and hence lower costs per barrel
  - E.g.: geo-steering needs advanced measurement while drilling (MWD), such tools are very expensive
  - EOR: the costs of the process of e.g. polymer injection and recapturing must be seen in context of additional flows

→ More "expensive" technology might lead to lower costs per barrel!

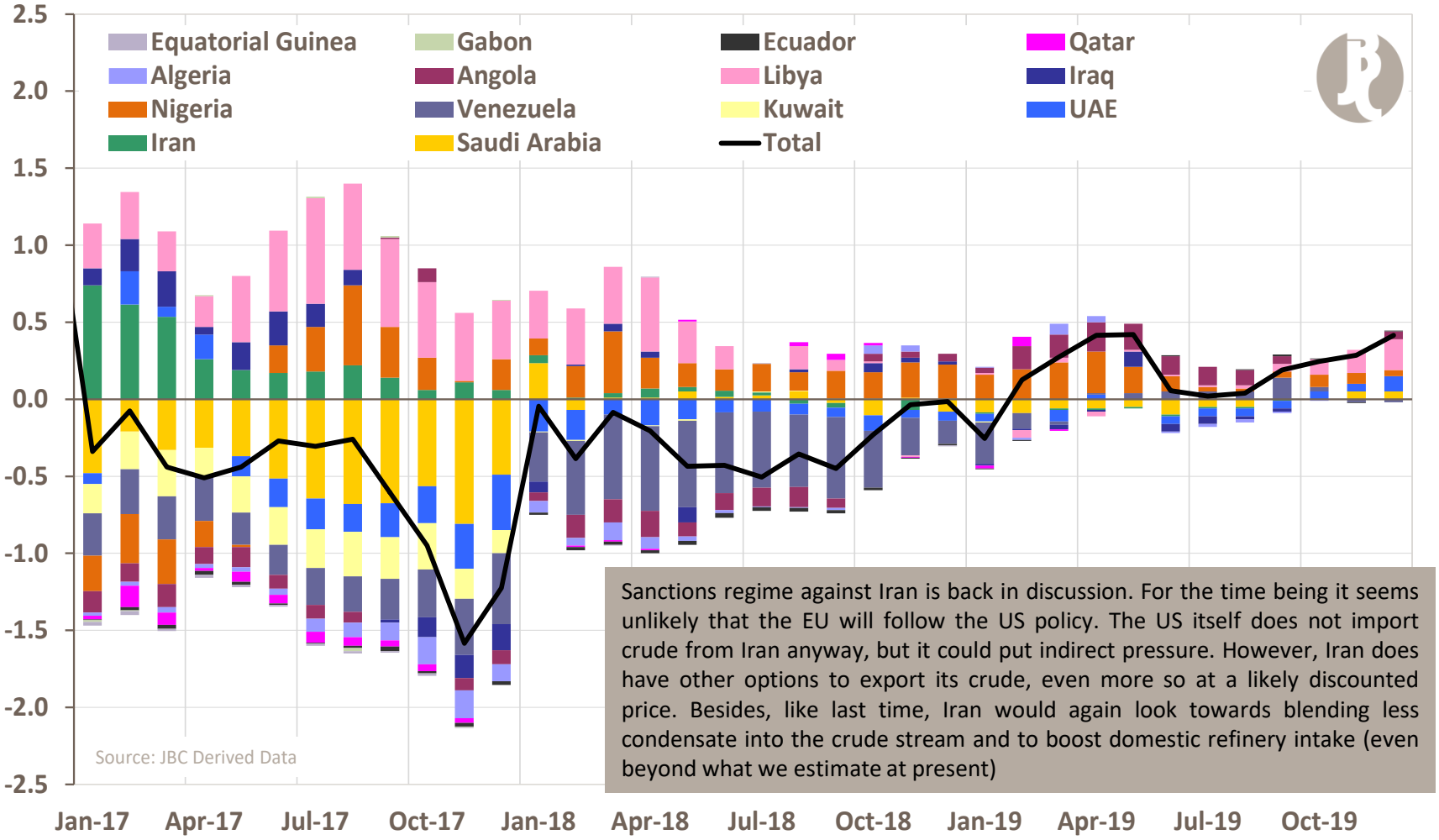
Impact of Technology

The cost of planned projects fell dramatically over the last couple of years. A number of previously shelved projects have been revisited and lower price tags have been achieved. Some prominent examples:

- Mad Dog 2 (BP, Gulf of Mexico, 140,000 b/d)
  - Original breakeven: $100/bbl
  - Current breakeven estimates: $50/bbl
- Johan Castberg (Statoil, Barents Sea, 190,000 b/d)
  - Original breakeven: $80/bbl
  - Current breakeven estimates: $35/bbl
- Tengiz Expansion (Chevron, Kazakhstan, 260,000 b/d)
  - Current breakeven estimates: $50/bbl
- Peregrino Phase 2 (Statoil, Brazil, 100,000 b/d)
  - Original breakeven: $70/bbl
  - Current breakeven estimates: $45/bbl
- Kraken (EnQuest, UKCS, 50,000 b/d)
  - Original breakeven: $75/bbl
  - Current breakeven estimates: $35/bbl
- Veslefrikk (Statoil, North Sea, online since 1989, current output: 6,500 b/d)
  - Was planned to be shut down in 2018 due to costs
  - Extension project: first until 2020, now until 2025

Supply & OPEC Strategy

OPEC Crude Production Change Y-o-y [million b/d]

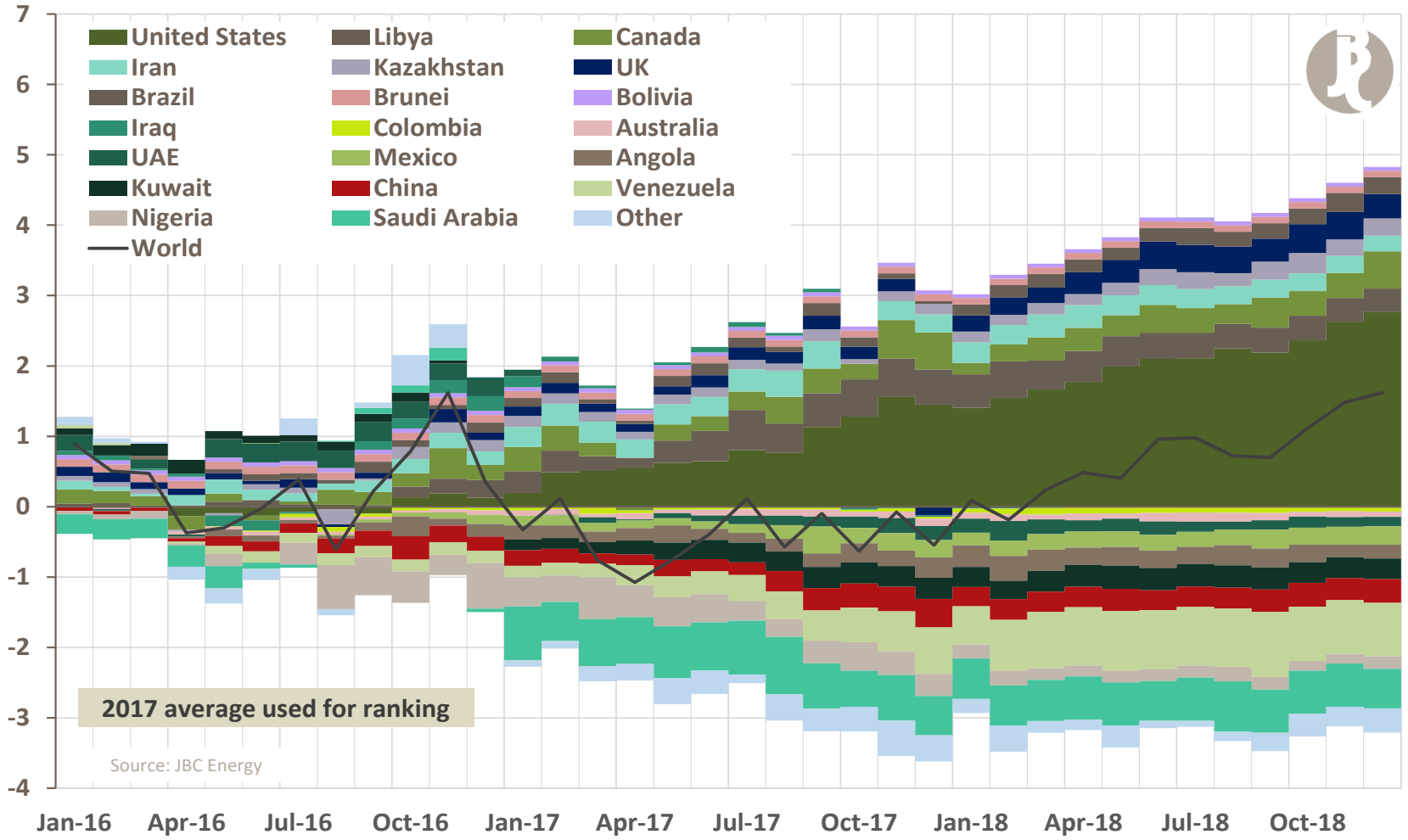


Sanctions regime against Iran is back in discussion. For the time being it seems unlikely that the EU will follow the US policy. The US itself does not import crude from Iran anyway, but it could put indirect pressure. However, Iran does have other options to export its crude, even more so at a likely discounted price. Besides, like last time, Iran would again look towards blending less condensate into the crude stream and to boost domestic refinery intake (even beyond what we estimate at present)

We expect OPEC a) OPEC to continue the cut also beyond 2018 and b) compliance to remain high over the course of 2018 at least. Additions are expected from Libya and Nigeria, while we see Venezuela declining further.

Supply & OPEC Strategy

Top 20 Crude & Condensate Supply Revisions vs June 2016 [million b/d]



The downside revisions to OPEC supply made as a result of the cut agreement have been largely counterbalanced by revisions elsewhere, even with the help of lower-than-expected Venezuelan and Angolan supply. From here on US shale might make the difference.

Supply & OPEC Strategy

OPEC/non-OPEC - Compliance ['000 b/d; %]

	Q1 2018 average	Original cut pledge*	Reference*	Current target production level	Change compared to reference	Compliance
Algeria	1,007	-50	1,091	1,041	-84	169%
Angola	1,525	-78	1,745	1,667	-220	282%
Ecuador	512	-26	543	541	-31	121%
Equatorial Guinea	130	-12	140	128	-10	83%
Gabon	200	-9	203	194	-3	33%
Iran	3,817	90	3,707	3,797	110	82%
Iraq	4,467	-210	4,571	4,361	-104	50%
Kuwait	2,702	-131	2,848	2,717	-146	112%
Qatar	590	-30	645	615	-55	183%
Saudi Arabia	9,945	-486	10,566	10,080	-621	128%
UAE	2,842	-139	3,068	2,929	-226	163%
Venezuela	1,623	-95	2,072	1,977	-449	472%
OPEC-12	**29,358**	**-1,176**	**31,199**	**30,023**	**-1,841**	**157%**
Azerbaijan	805	-35	832	797	-27	78%
Bahrain	207	-10	211	201	-4	37%
Brunei	91	-4	108	104	-17	415%
Kazakhstan	1,894	-20	1,766	1,746	128	-639%
Malaysia	628	-20	638	618	-11	53%
Mexico	1,901	-100	2,105	2,005	-204	204%
Oman	966	-45	1,012	967	-46	101%
Russia	10,960	-300	11,215	10,915	-255	85%
Sudan	80	-4	78	74	3	-64%
South Sudan	116	-8	113	105	4	-47%
Non-OPEC-10	**17,649**	**-546**	**18,077**	**17,531**	**-428**	**78%**
Total OPEC / non-OPEC	**47,007**	**-1,722**	**49,276**	**47,554**	**-2,269**	**132%**

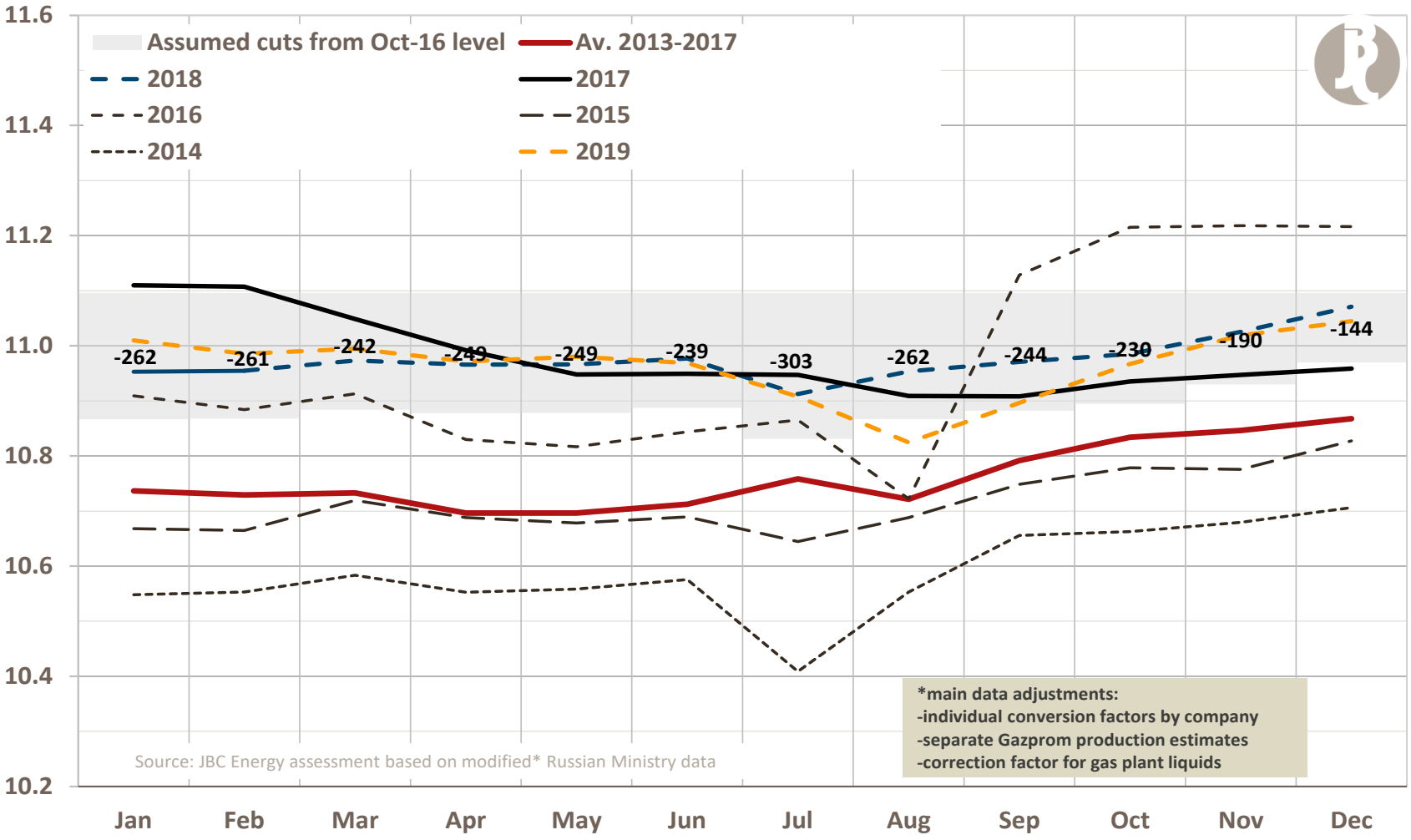
**OPEC cut pledge and references according to "Vienna agreement" from 30-Nov-16; Iran is allowed to increase output by 90,000 b/d compared to reference; total non-OPEC cut pledge according to ministerial meeting on 10-Dec-16; non-OPEC cut allocations according to individual reported statements, which do not add up to total; non-OPEC reference is JBC Energy crude and condensate production assessment for Oct-16 (Kazakhstan: Nov-16; Azerbaijan Jan-16 to Nov-16 average); Equatorial Guinea part of OPEC since Jun-17; Ecuador changed target production to 541,000 b/d in August.*

Source: JBC Energy

In contrast to OPEC, non-OPEC compliance is lacking.

Supply & OPEC Strategy

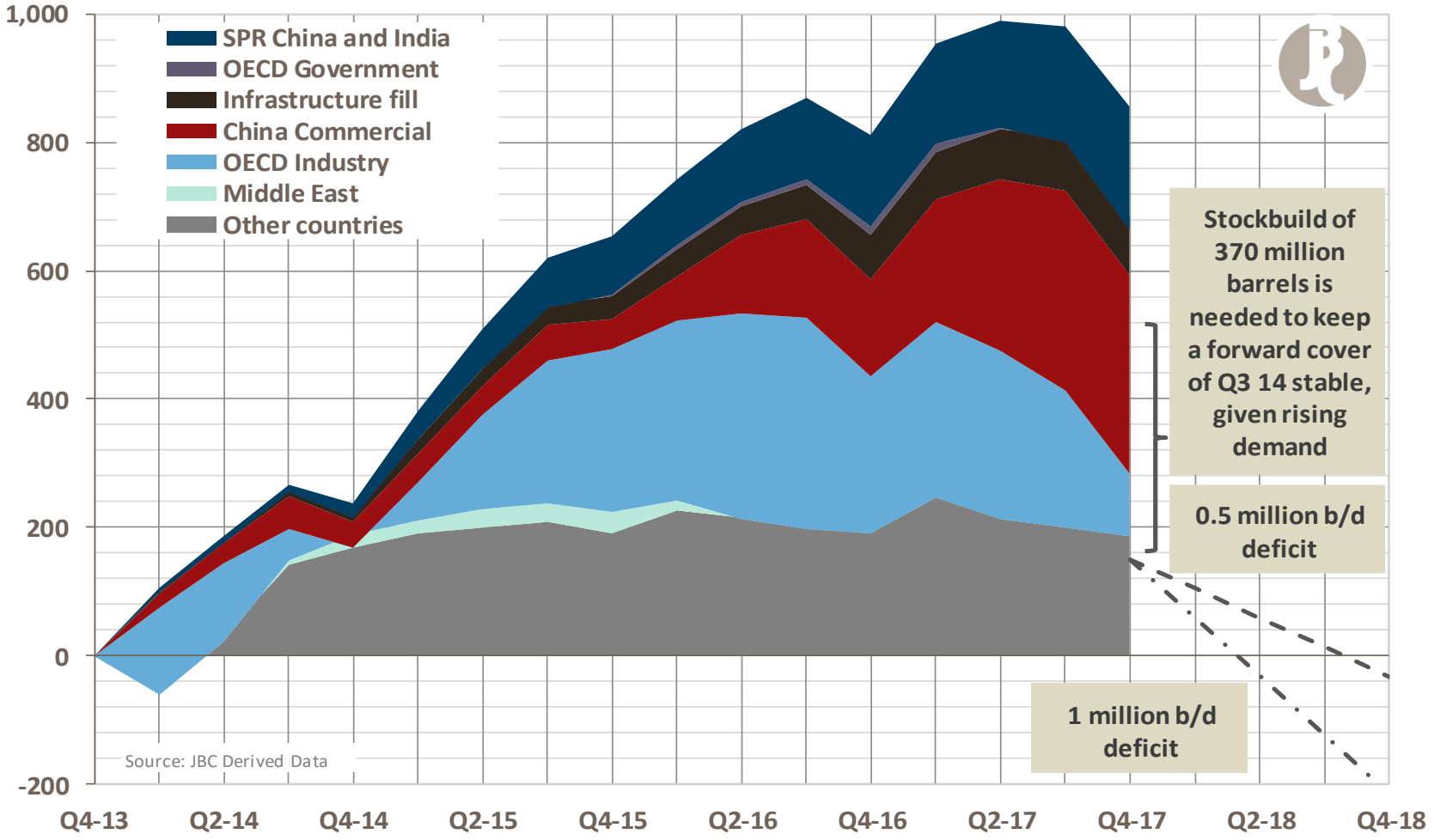
Russia: Crude & Condensate Output [million b/d]



Particularly in Russia – with new streams coming online – compliance is becoming increasingly difficult.

Supply & OPEC Strategy

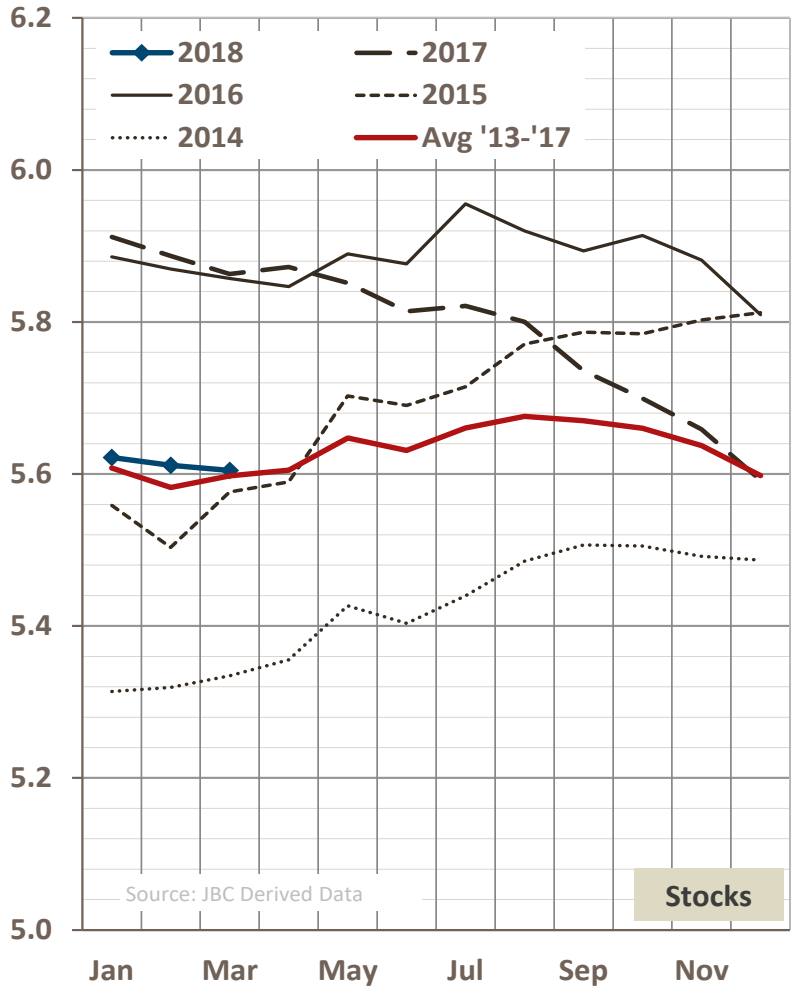
Global Stocks Surplus to Q4 2013 [million barrels]

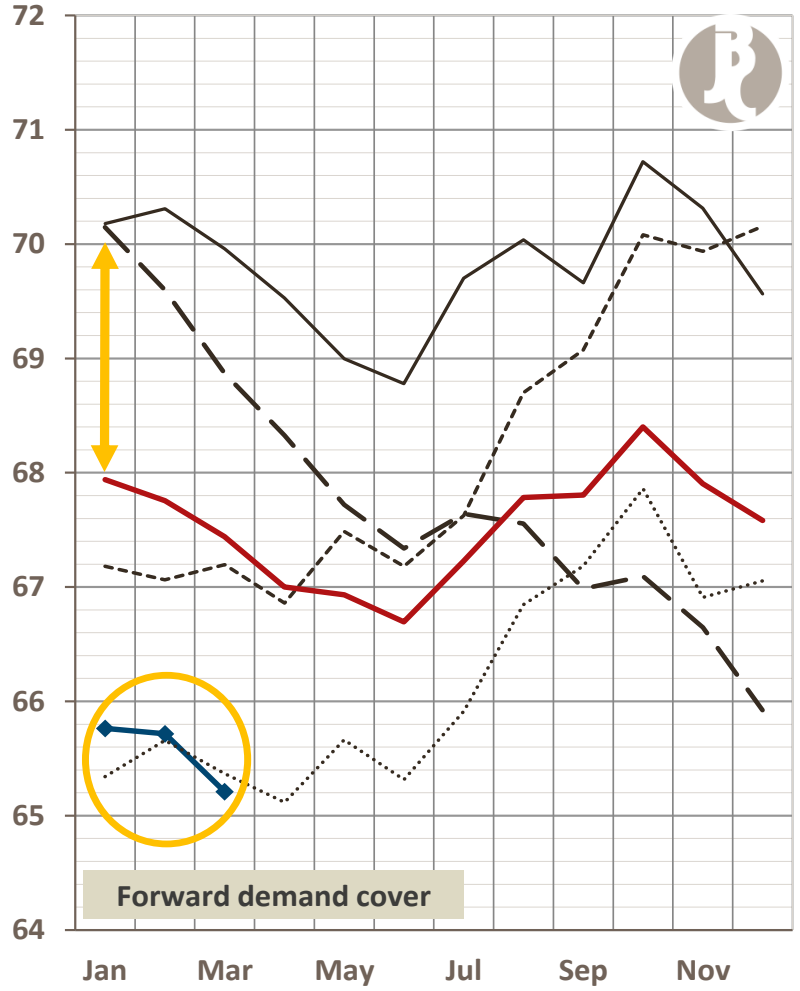


Global stock levels are getting close to were OPEC has set its target to…

Supply & OPEC Strategy

Total Global Observed Oil Stocks, Excluding China: Level vs. Forward Demand Cover [billion barrels,

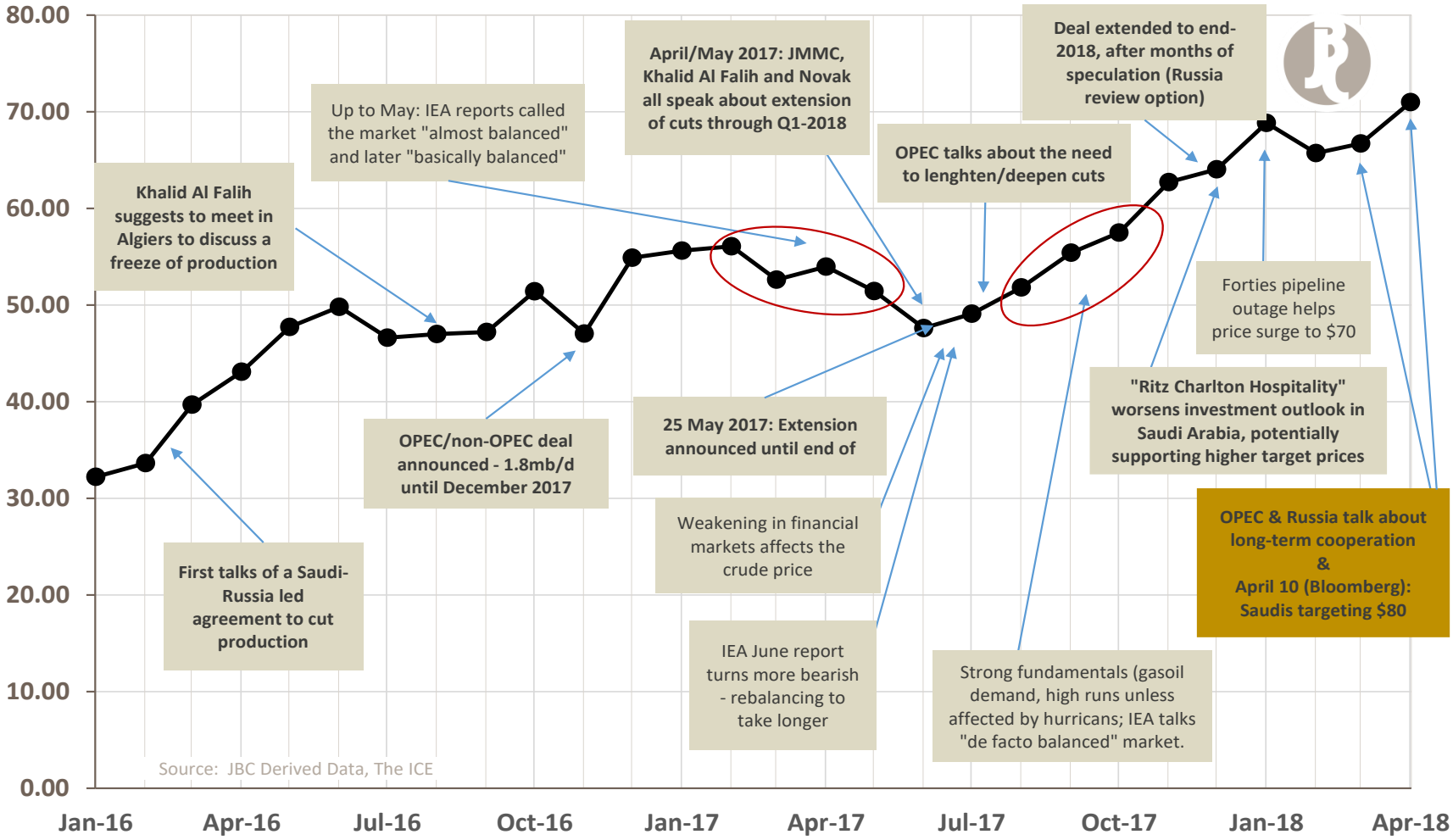




…but OPEC is not yet fully satisfied with the market tightening observed so far, considering adjusted measures (e.g. 7-year average). Meanwhile, excluding China from our inventory calculations, forward cover is already massively below the 5-year average.

Supply & OPEC Strategy

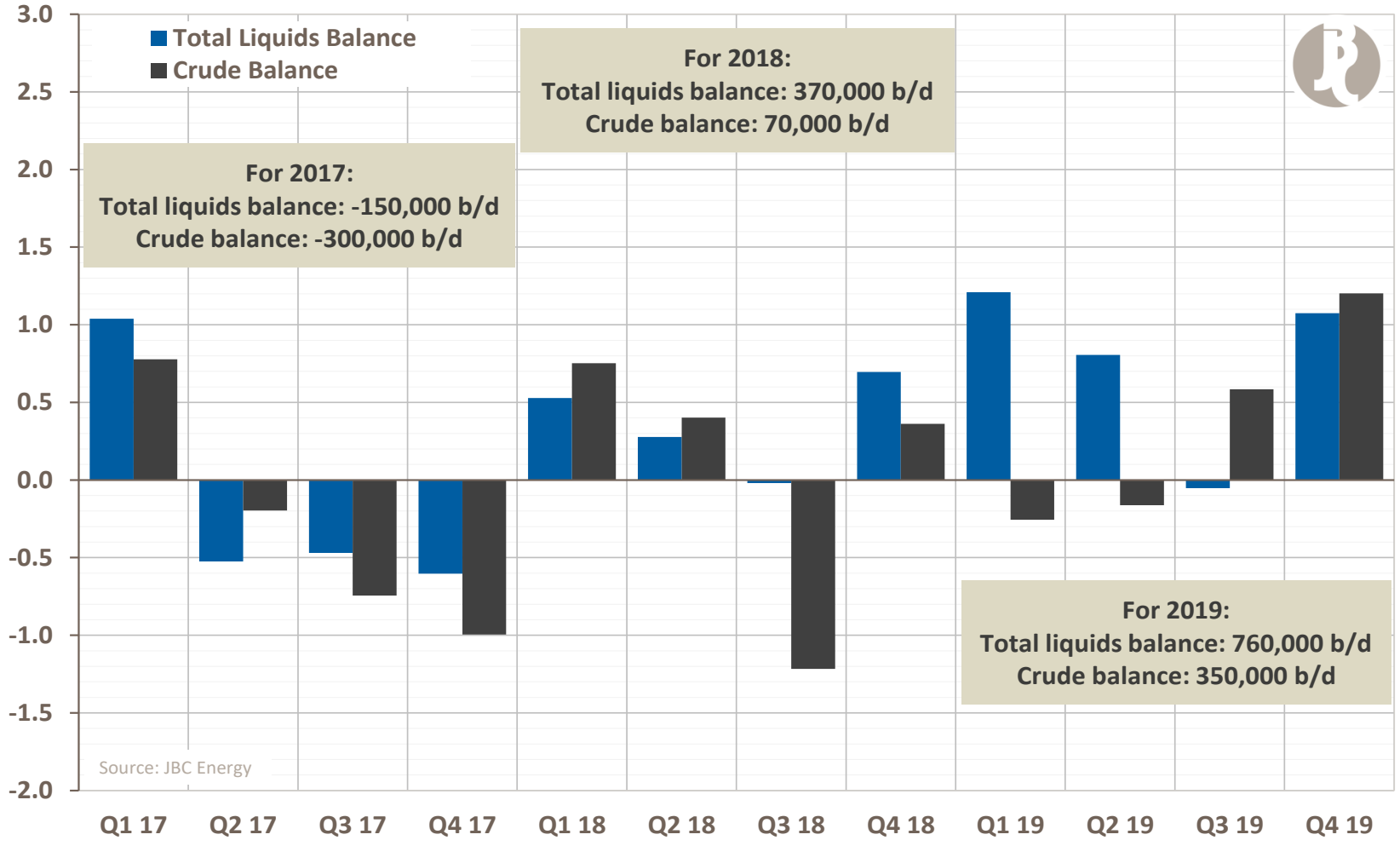
ICE Brent Reaction to Selected Market News [$/bbl]



Even though the upwards path of prices is in line with a fundamental improvement, the market has also been pretty reactive to OPEC talk. The price target appears to now be $80+ instead of the initial $40-60.

Supply & OPEC Strategy

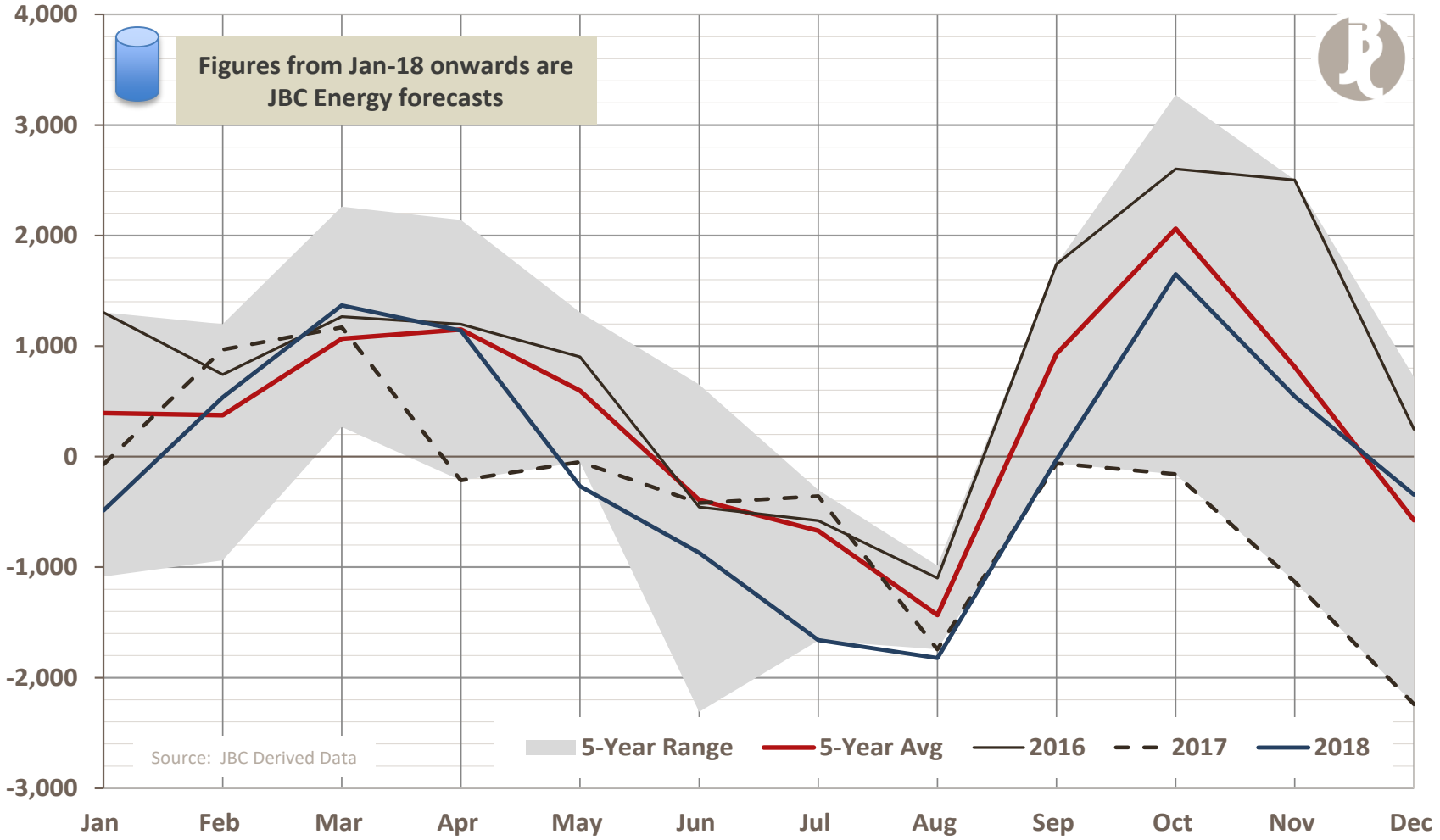
Total Liquids Balance and Crude Balance [million b/d]



Partly there are significant differences between our total liquids balance and the crude/condensate balance.

Supply & OPEC Strategy

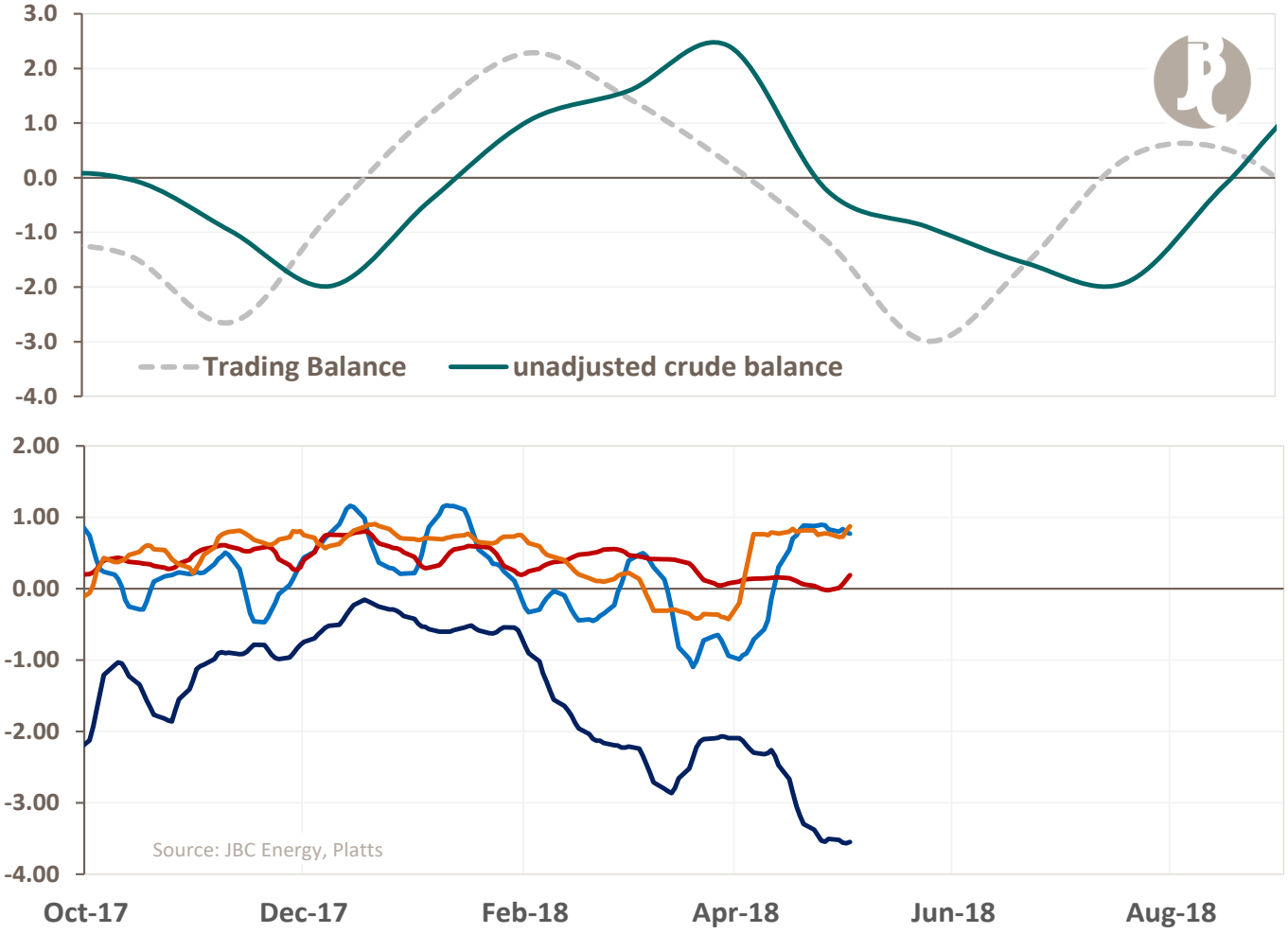
World: Crude Balance ['000 b/d]



By now the crude balance picture looks pretty supportive and also starts to feed through slowly into physical crude markets, which most support expected from next month onwards.

Supply & OPEC Strategy

Implied Global Crude Trading Balance & Key Physical Crude Indicators ['000 b/d]



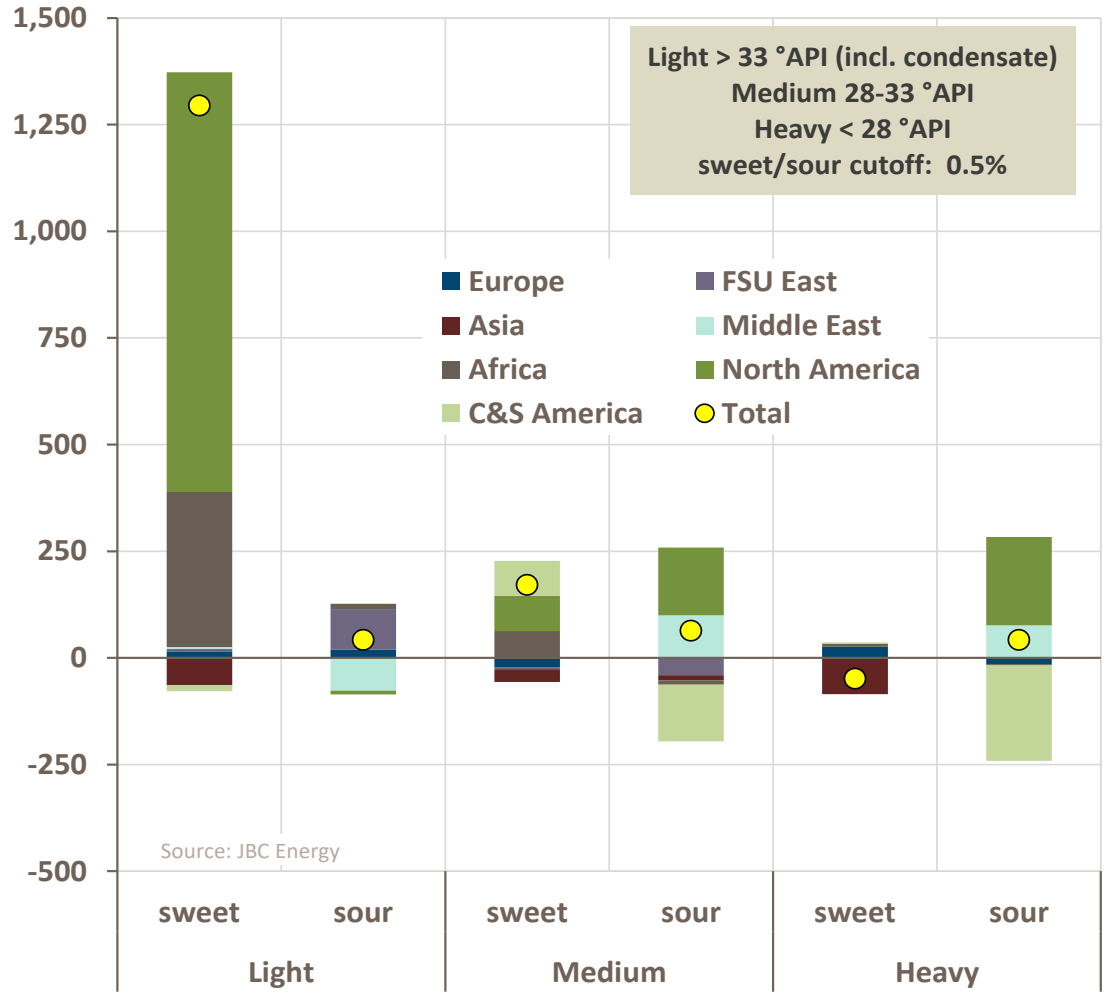
The implied trading balance is intended to incorporate time adjustments done to more accurately reflect the fact that in any given month crude already produced is traded against demand in the future (based on shipping times and factors influencing crude runs).

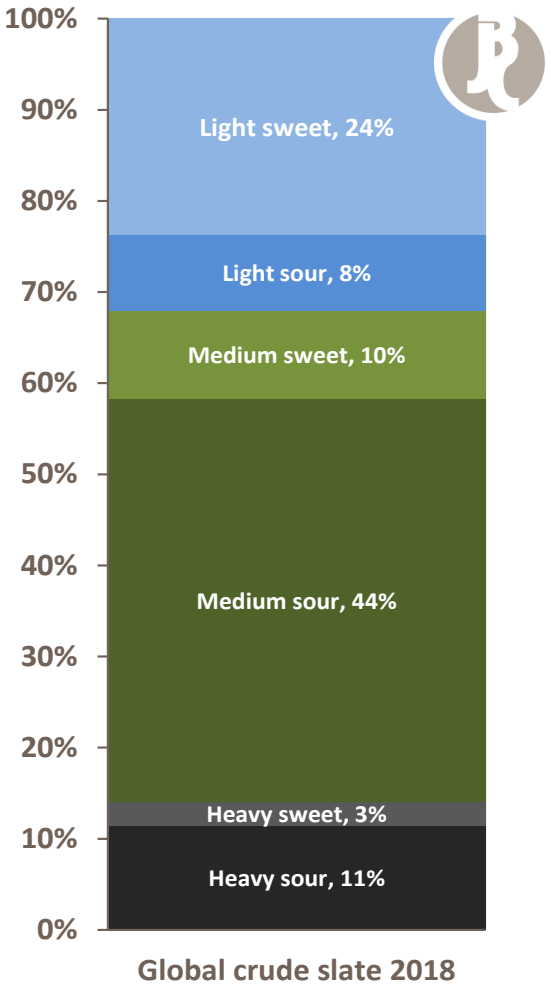
By now this also starts to feed through slowly into physical crude markets, which most support expected from next month onwards.

Repercussions of Crude Quality Change

Repercussions of Crude Quality Change

Development of Crude Qualities by Region 2018 vs 2017 ['000 b/d]

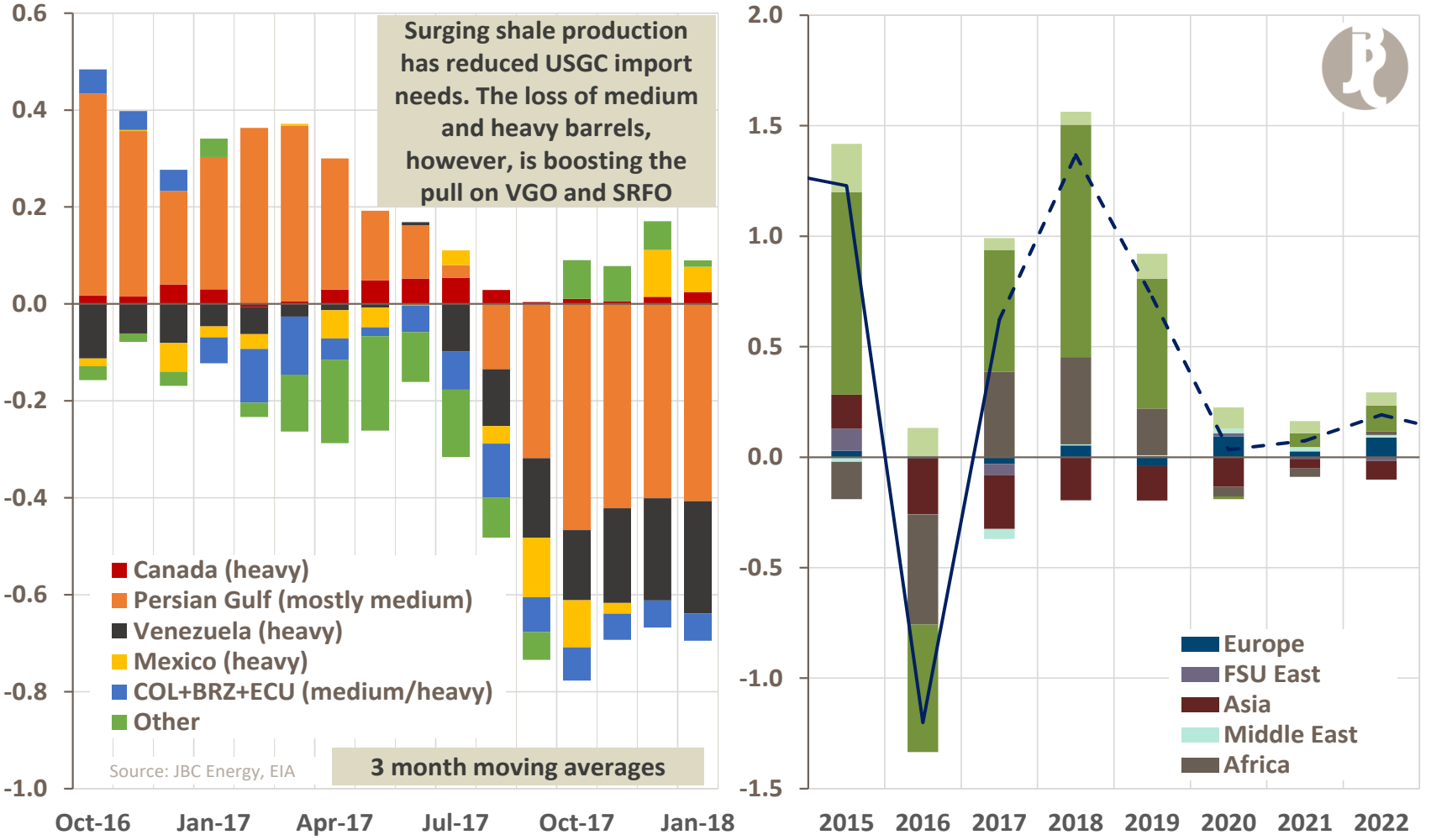




Global crude qualities are changing strongly, based on OPEC action, Venezuela disappointments and the US shale boom

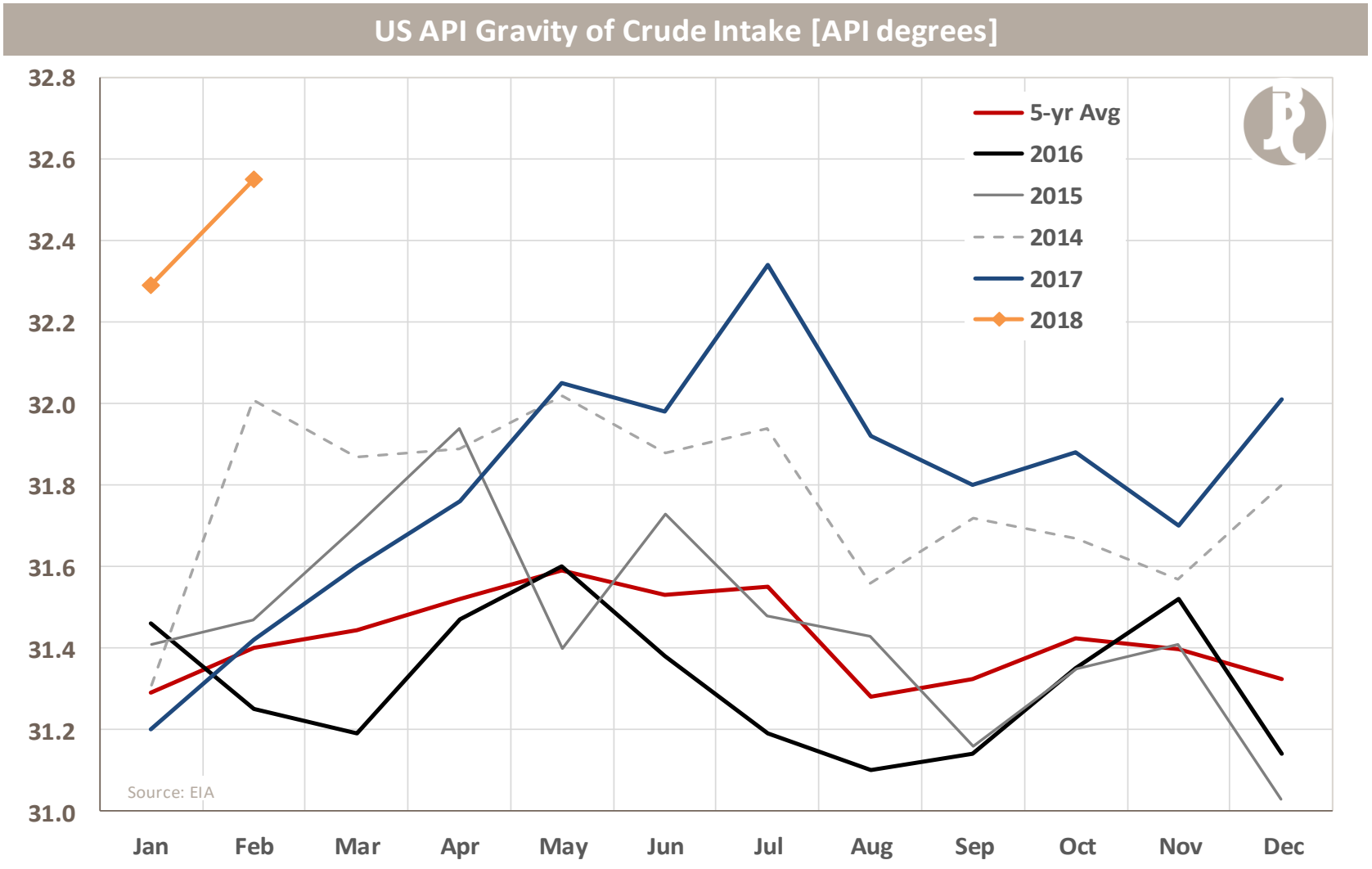
Repercussions of Crude Quality Change

Y-o-y Change in US Gulf Coast (PADD-3) Crude Imports & Sweet Crude Supply by Region [million b/d]



This is exposing the high-conversion US Gulf Coast particularly to swift change.

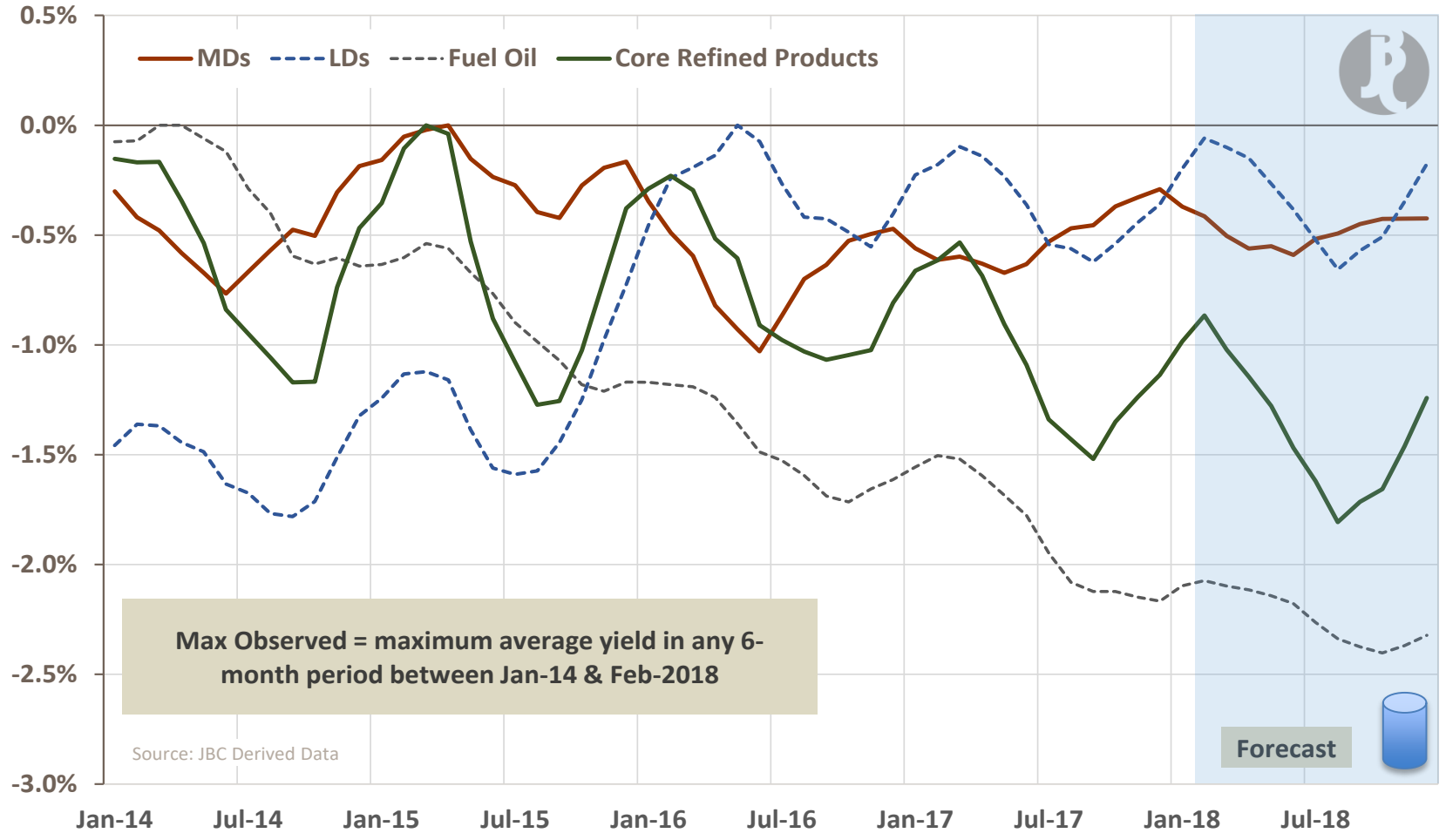
Repercussions of Crude Quality Change



A lightening crude slate on the back of soaring production hints at a overall decline in conversion gains and make it more difficult to fill conversion units given their low residue yields, hence enhanced need for secondary feedstock => more LD output, less MD output

Repercussions of Crude Quality Change

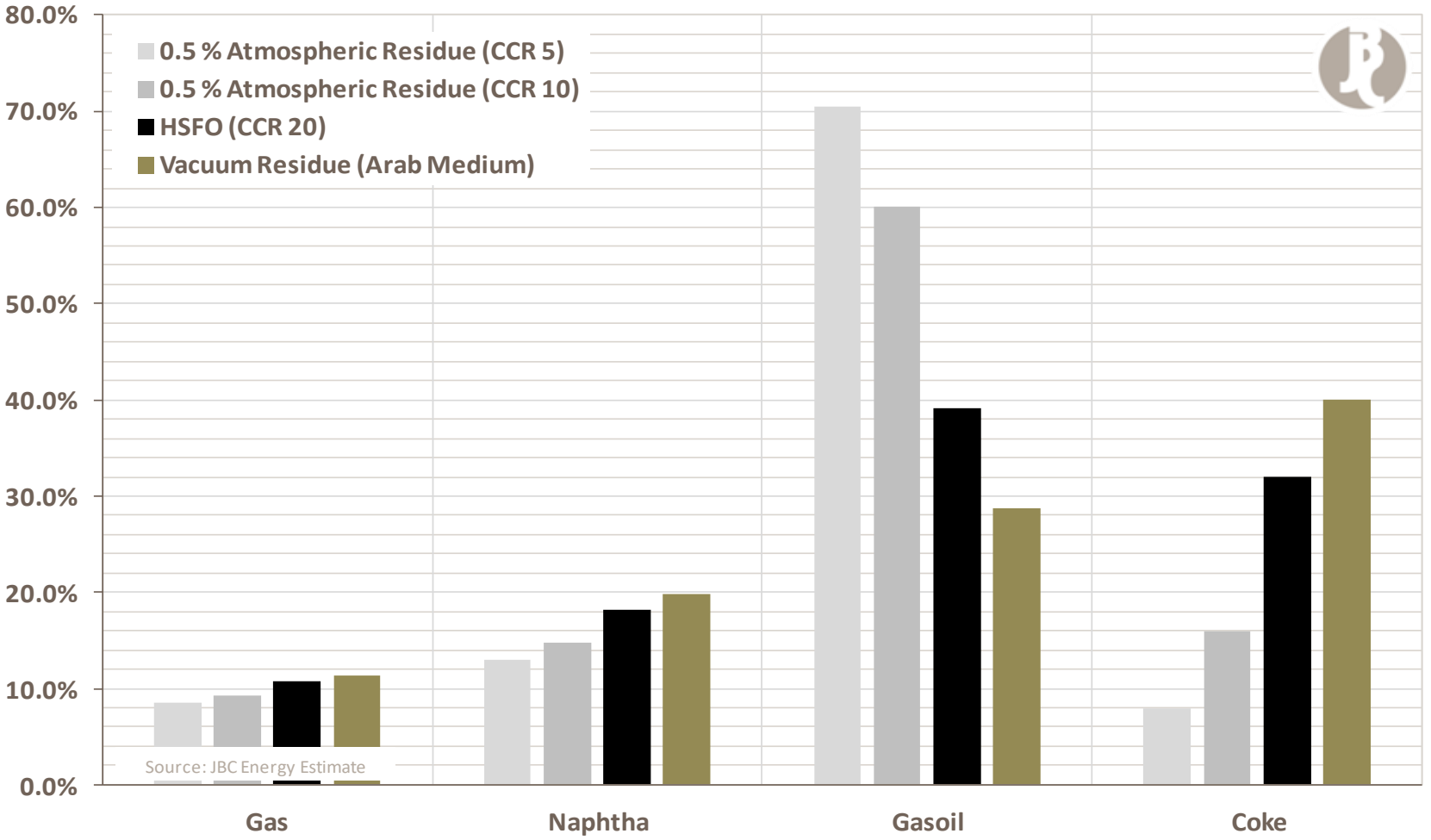
Global Crude Yields vs Max Observed (6MMA) [pp]



At the same time globally a lot of conversion capacity has been added, largely eliminating an international market for straight-run fuel oil as a feedstock. This (higher coke & bitumen supply) as well as a lightening crude slate (→ fewer conversion gains) lead to lower core refined product yields.

Repercussions of Crude Quality Change

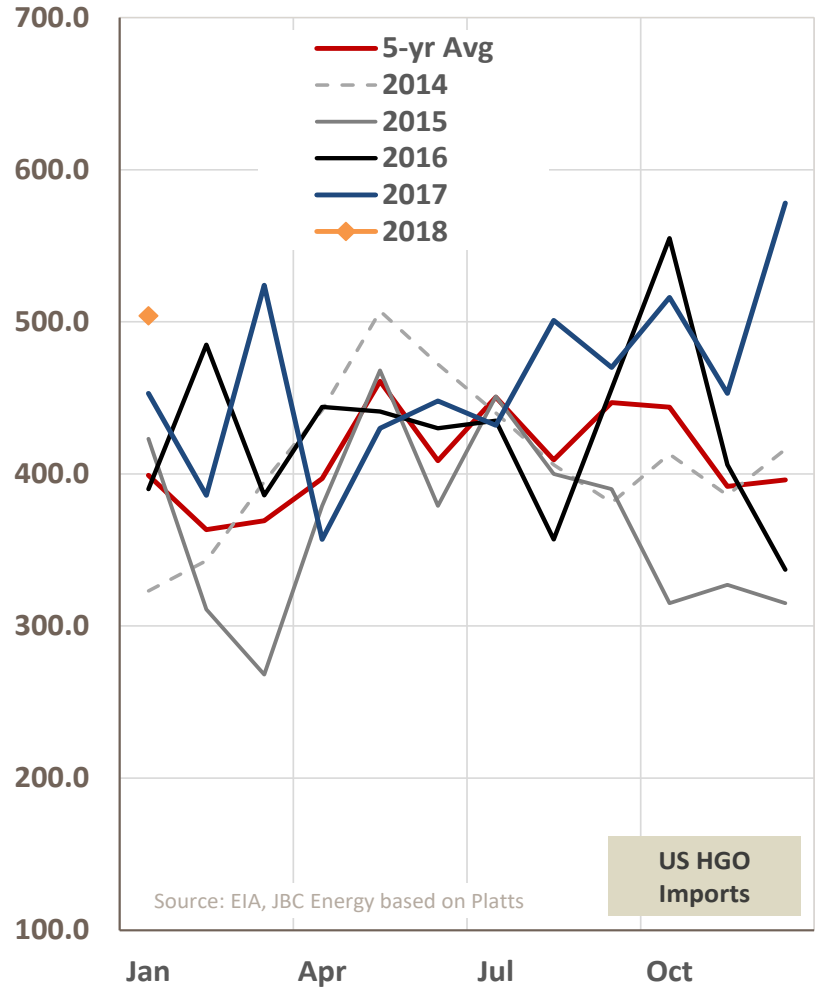
Typical Coking Yields by Feedstock Type [wt %]

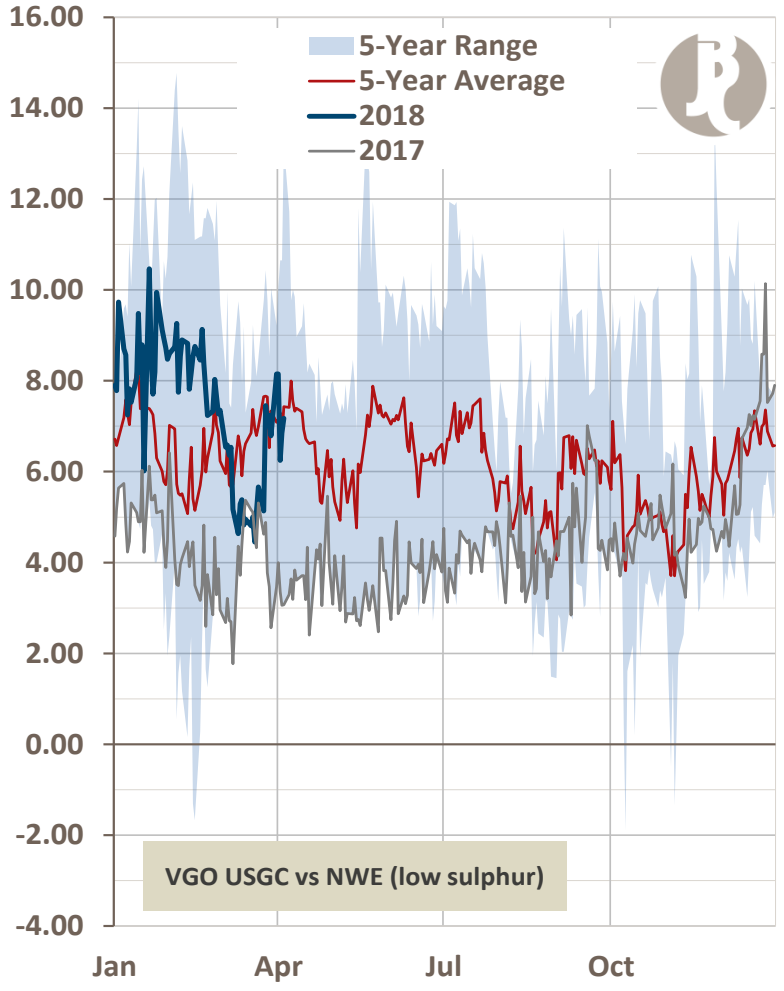


It might well be that something we expected for 2020 (IMO) is already happening now: the increased use of cracked fuel oils (HSFO) as coker feedstock (as more suitable feeds move towards other conversion units) – resulting in higher LPG, naphtha and coke yields, but less gasoil.

Repercussions of Crude Quality Change

US Imports of Heavy Gas Oils & Regional VGO Spreads ['000 b/d; $/bbl]



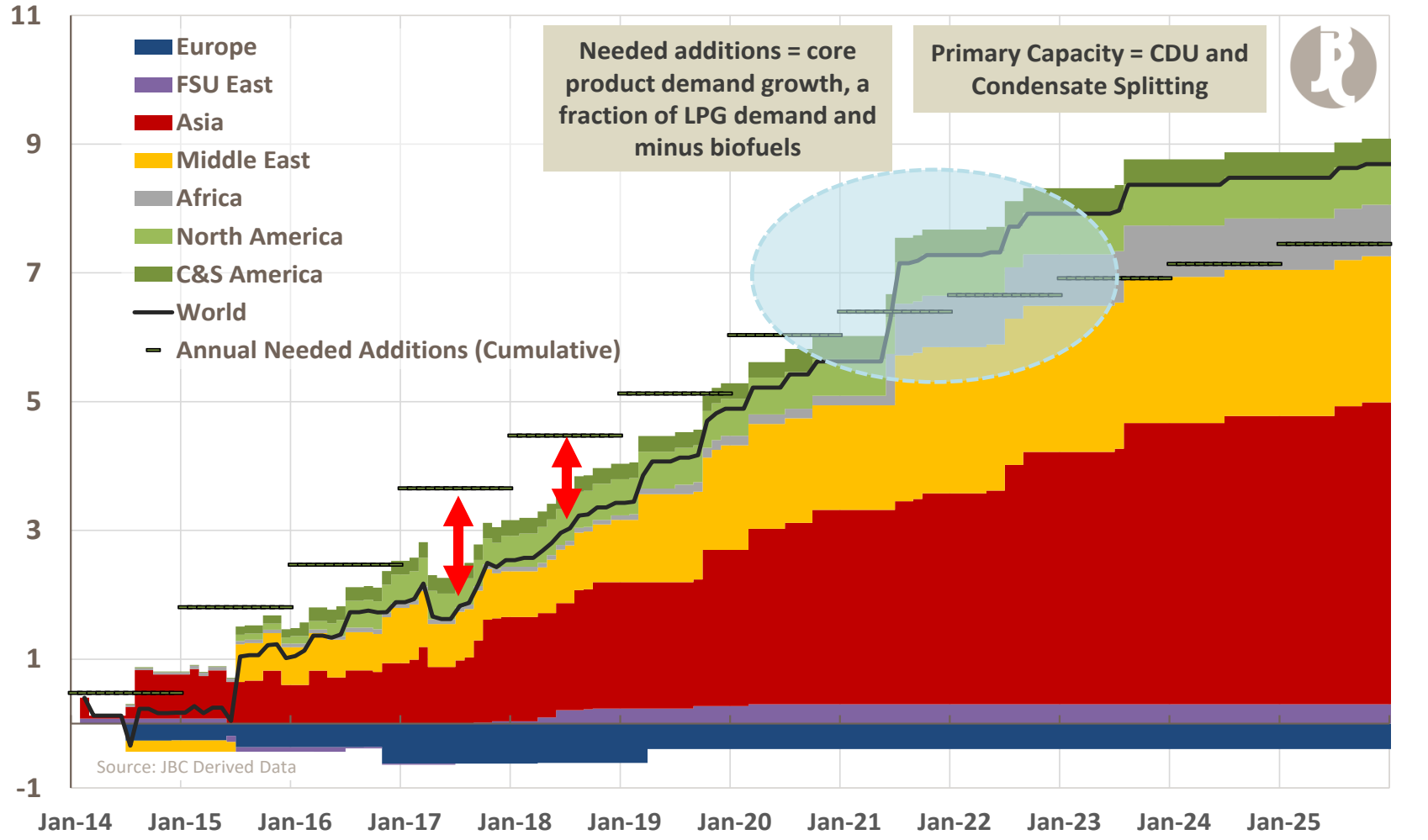


US heavy gas oil imports surged since last summer (heavy crude imports falling strongly) to make up for the lack of secondary feeds. By now this has led to much higher pricing illustrating the limitations. Ultimately atmospheric gasoil will land more frequently in conversion units, weighing on diesel yields.

2018: Tight Product Supply

2018: Tight Clean Product Supply

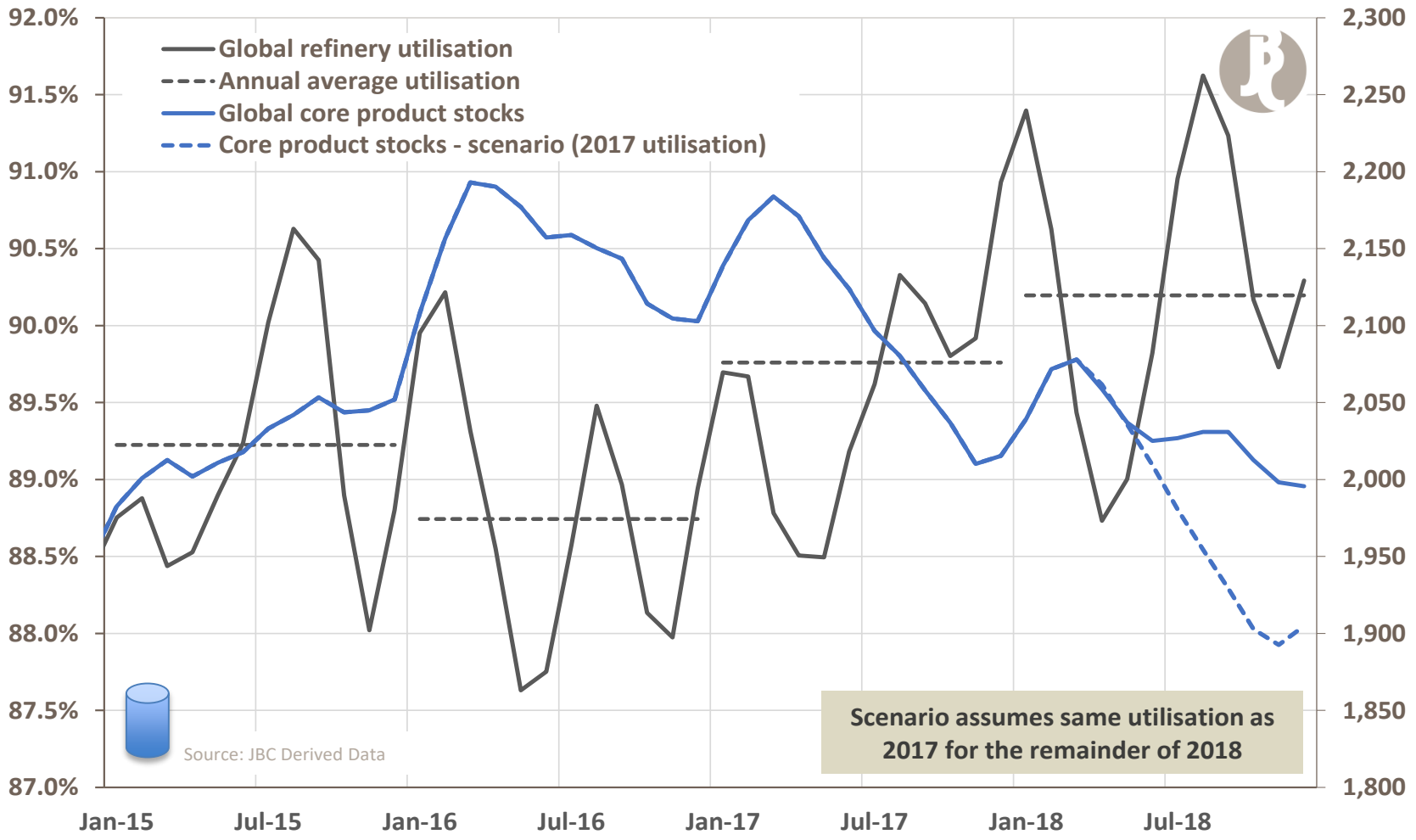
Cumulative Global Primary Capacity Additions Since Jan-14 [million b/d]



We should be slowly moving out of a tight refining environment, which in our base case sticks up to and including 2020. Post-2020, there is considerable refining capacity to come onstream while the long-term demand outlook is weakening. This implies pressure on margins.

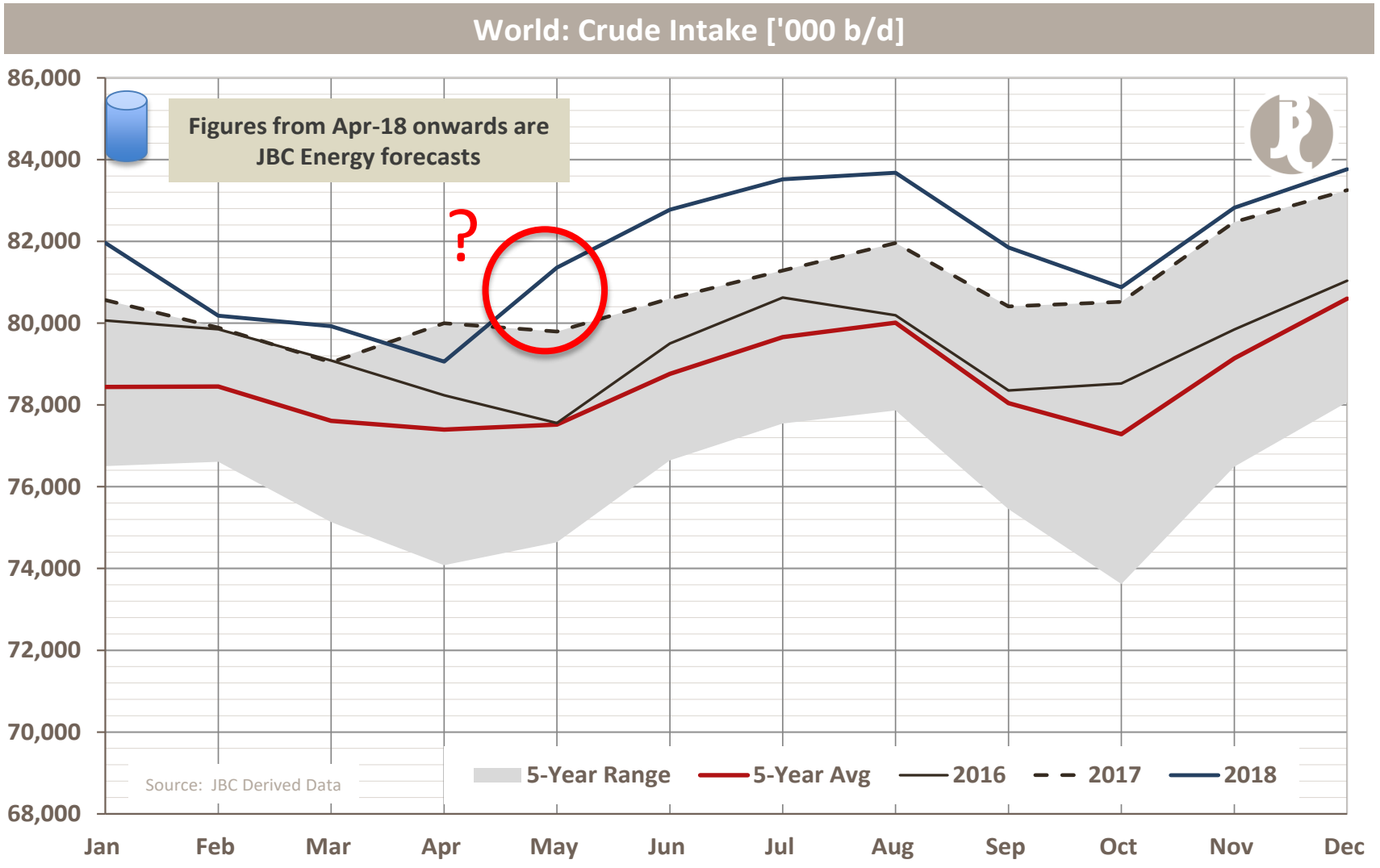
2018: Tight Clean Product Supply

Global Refinery Utilisation & Core Product Stocks (3MMA) [%; million barrels]



If we don't see any y-o-y growth in utilisation, refined product stocks will again fall strongly. But is another rise in utilisation feasible? It would result in the highest outright utilisation level in a decade.

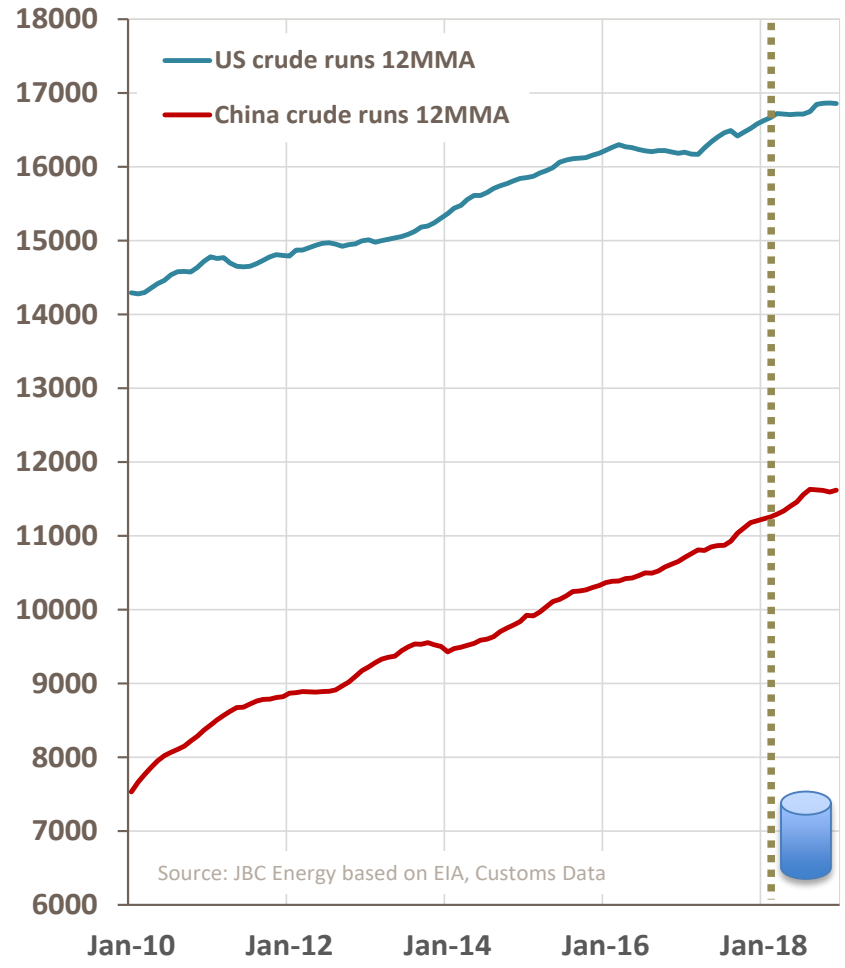
2018: Tight Clean Product Supply

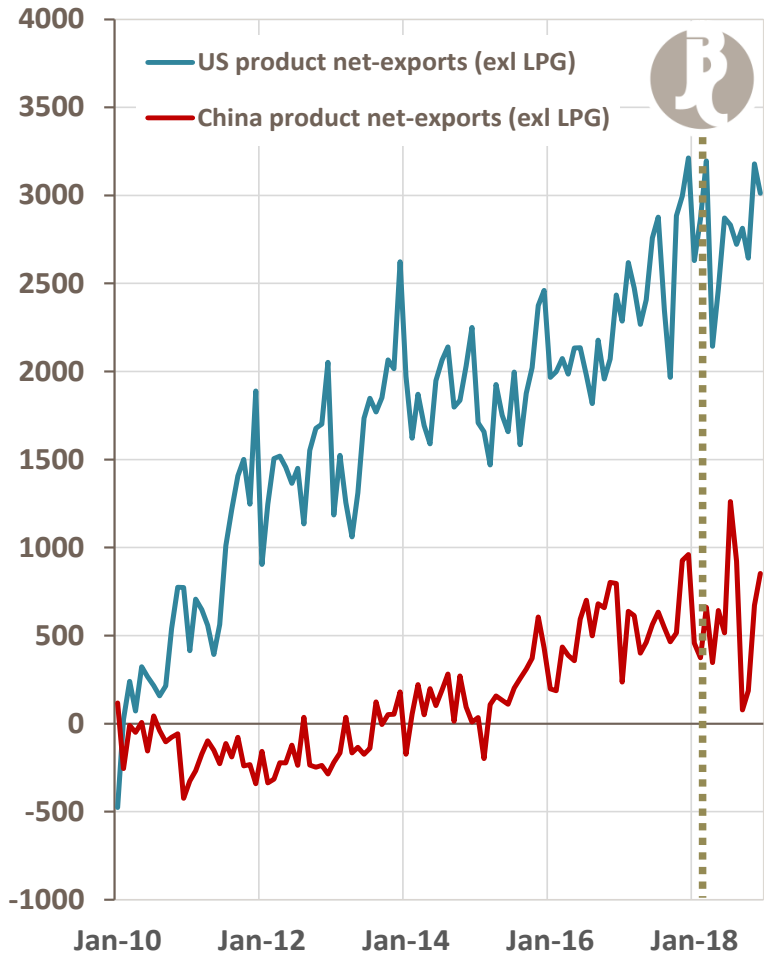


If we begin to see strong crude runs in May once maintenance eases, we may see cracks dampened a bit for the summer. However, any disappointment or outage could spell a strong few months as early inventory draws have lowered FWDC.

2018: Tight Clean Product Supply

US & China Crude Intake and Product Net-Exports ['000 b/d]

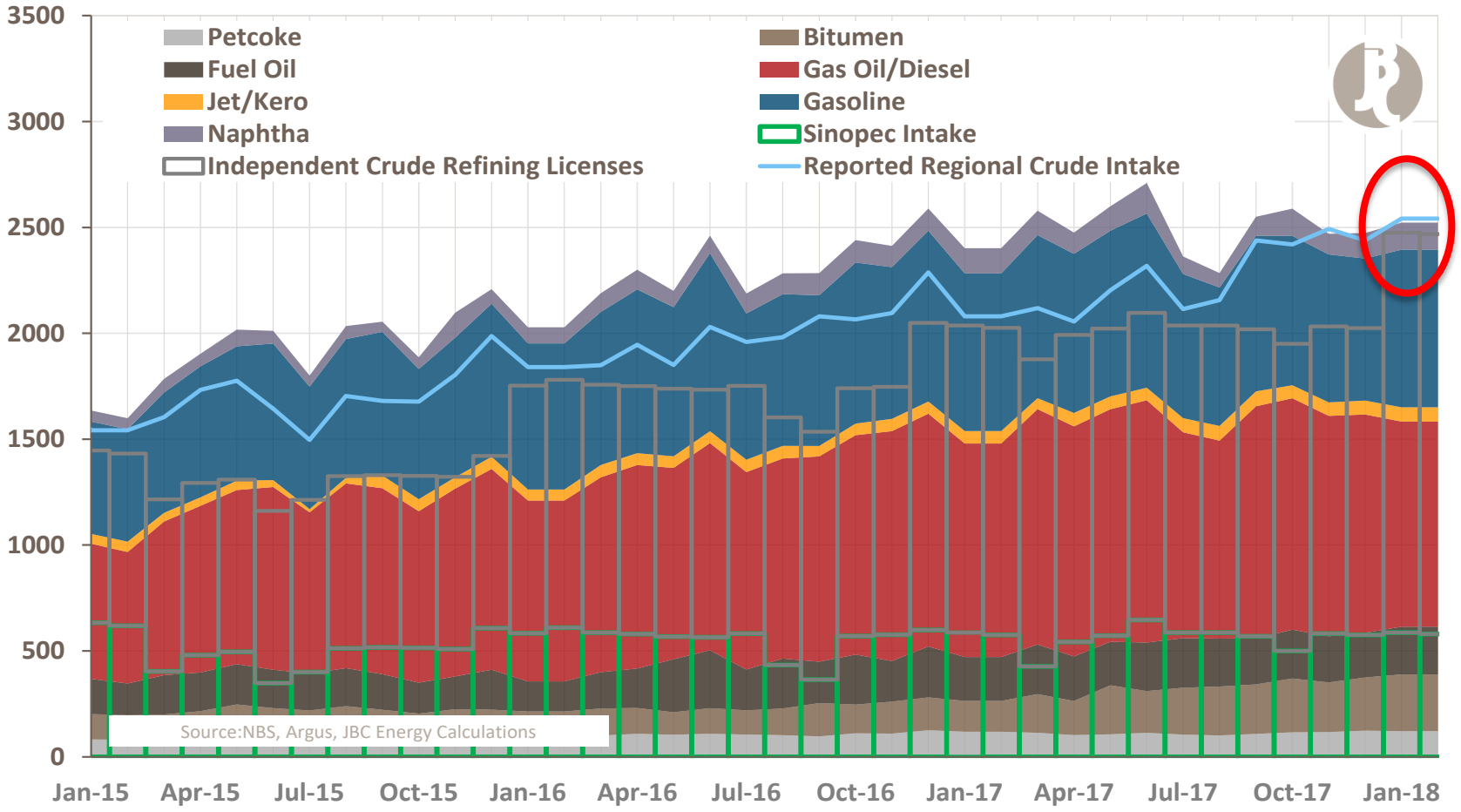




Both the US and China have rapidly expanded core refined product exports on the back of high runs. However, this has been easily digested by regions such as Latin America. Chinese exports may be at risk from new tax regimes, but the market is likely to need marginal barrels from these two places.

2018: Tight Clean Product Supply

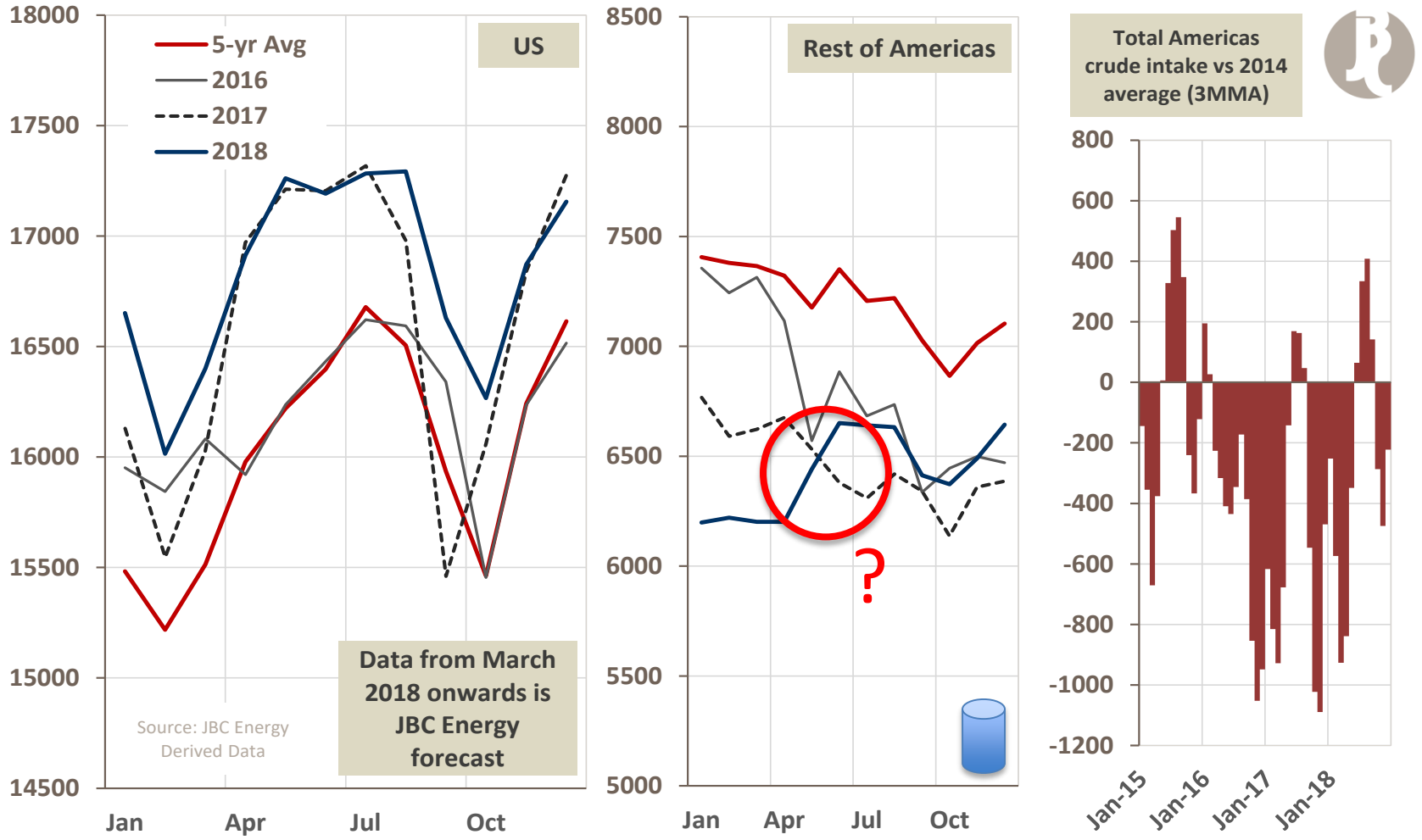
China: Shandong Crude Intake and Product Supply ['000 b/d]



Quotas granted for 2018 should allow Shandong refiners to maintain last year's levels, but increased difficulties for refiners without licenses/quotas to source crude should weigh on the potential upside to refinery runs. Chinese data should now be much better than in the past.

2018: Tight Clean Product Supply

Americas Crude Intake ['000 b/d]



While the US has been able to increase refinery runs so far ytd, we question how much room there is to run higher vs last year in the key summer months. Overall it is striking to see that all US crude run upside over recent years has been "consumed" by LatAm markets.

IMO – Status & Scenario

IMO Update

Multi Client Study

2020 Bunker Regulation - "A Refined View"

JBC ENERGY

- Limiting sulphur emissions from bunker fuel use to 0.5% globally in 2020 will impose **substantial challenges on the industry**, with a sustainable solution only likely to develop over a number of years. But the high level of uncertainty and presumably sharp and volatile price reactions will provide **healthy margins to those in the industry who are positioned on the right side** at the right time.
- The **refining sector will be key to the provision of compliant bunker fuel in 2020**, as scrubbers will not find widespread implementation by 2020 and thus will need time to re-establish HSFO as the main bunker fuel.
- **Refiners will be able to provide sufficient compliant bunker fuel oil based on the available set-up and crude diet**. But the **knock-on effect of altered operations** on crude and other product fundamentals will be significant, with strong price signals needed to provide the required incentives. The **use of surplus HSFO will be one of the critical components** in finding short-term and longer-term equilibria.

Deliverable & Scope

- JBC Energy will provide a **100+ page study** in pdf format, consisting of text and charts as well as some xls material. A brief scope is available on the back page.
- **JBC Energy is an independent research centre**, with no affiliation to the shipping, refining or related sectors. The analysis will be based upon JBC Energy's proprietary *SuDeP* modelling framework, applying detailed fundamental and refining analysis. We apply our usual critical, comprehensive and structured approach to analysing this topic.

Costs: -> **€5,500** for existing clients -> **€7,000** for non-clients

Add On: -> ***€1,000*** *for 1-hour TelCo* -> ***€2,500*** *Onsite Presentation (excl. travel)*

For orders or more details,
please contact your Account Manager or research@jbcenergy.com

IMO Update

2020 Bunker Regulation - "A Refined View"

Multi-Client Study - SCOPE
15 Mar. 18

Executive Summary

Assumptions & Approach
- *Brief Introduction - status after IMO decision*
- *Basic demand assumptions (more details in appendix)*
  - Scrubber availability in 2020
  - Compliance assumptions
  - Demand by Fuel & by Region
- *Line of Thought & Modelling Approach*

The Refining Industry & its Ability to Supply
- *Bigger Picture & Historical Context*
  - Refining capacity availability, usability & outlook by main unit type
  - Relevant aspects of global product balances & refinery utilisation
- *Paths to compliant bunker fuel production*
  - Overview: Simulated current global fuel oil production & stream pattern
  - Compliant bunker fuel oil potential from crude in atmospheric distillation
  - Desulphurisation options
  - Exchange of secondary feedstocks in refineries
  - Blending
- *First estimates of compliant bunker fuel production potential in 2020*
  - Composition by stream
  - Considerations on fuel quality
  - Repercussions for other products & price implications

Balancing Process 2020 & Beyond
- *Defining the call on HSFO destruction over time*
  - Potential for stimulating additional HSFO demand
  - Use of scrubbers & non-compliance
  - Potential help from storage plays
- *Refining industry adjustments*
  - Final assumptions and setting of residue conversion units
  - Refinery crude intake adjustments by region and set-up
  - Other reconfigurations & yield shifts

Fundamental implications – New Base Case Forecast
- *Bunker Supply by stream and region*
- *Demand & supply implications for other products*
- *Implications for crude fundamentals and markets*
- *Price outlook (crude, compliant bunker fuel, HSFO, SRFO, VGO, main other products, refining margins)*

Conclusions
- *Implications for the Shipping Industry*
- *Challenges and opportunities for Refiners*
- *Opportunities for Trader*
- *Knock-on Effects on Crude Suppliers*
- *Implications for Investors and Financers*

Appendix

Medium-Term Bunker Demand Outlook
- *GDP and trade assumptions*
- *Expectations of fleet composition*
- *Main operational factors defining fuel requirements*
- *Resulting demand by year, ship type, fuel type, and region*

Alternatives to compliant bunker fuel
- *Exhaust scrubbers*
  - Technical overview
  - Logistical considerations
  - Basic payback/profitability estimations
  - Scrubber uptake forecast
- *Non-Compliance*
  - General comments on enforcement and compliance
  - Main non-compliance paths
  - Basic comments status of penalty schemes
- *LNG*
  - Technical overview
  - Logistical considerations
  - LNG supply outlook and price forecast
  - Basic payback/profitability estimations
  - LNG uptake forecast

Deliverables:

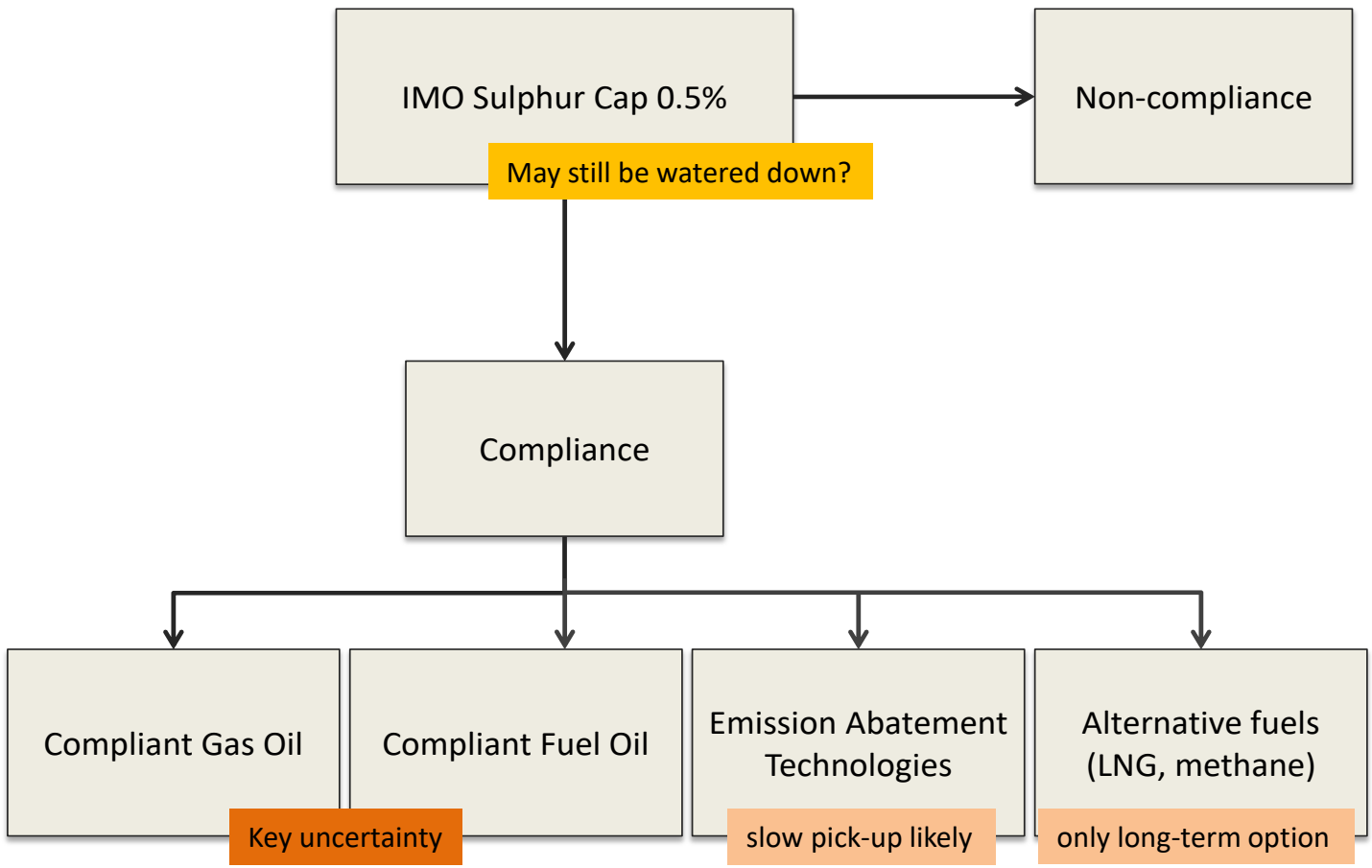
100+ page report in pdf consisting of text and charts

Basic xls data compilation (consisting of supply/demand/trade tables on an annual basis from 2015-2025 for fuel oil (as of 2019 split into 0.5% and high-sulphur fuel oil), gas oil, jet/kero, gasoline, naphtha, LPG and other products, as well as crude and refining capacity data; additionally for 2016, 2020 and 2025 bunker fuel supply by components, such as SRFO, cracked FOs and cutter stocks)

Extended xls data compilations & other tailor-made follow-up available on request (e.g. country data, more detailed stream analysis, crude price forecasts for different grades).

IMO – Status & Scenario

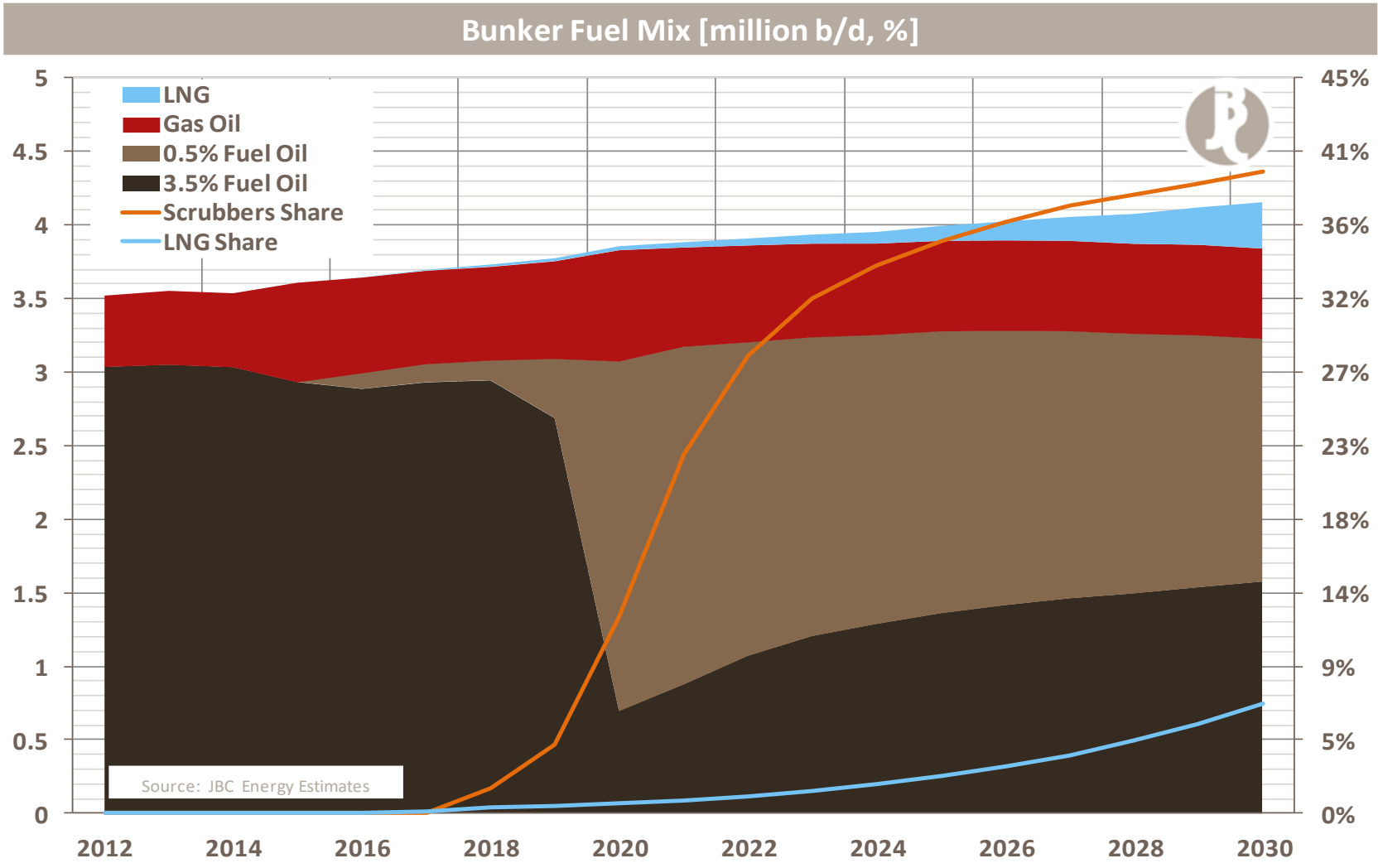
Post-2020 Options for Ship Operators



Source: JBC Energy

The 2020 bunker fuel legislation (fuel or emissions from ships around the world are limited to 0.5% sulphur) will pose a huge challenge to the market, with various options for the shipping industry and no need for the refining industry to react (unlike national spec changes).

IMO – Status & Scenario



We are convinced that fuel oil will remain the solution in the short-term (primarily LSFO) and also in the long run with a significant contribution from scrubbers (return to increasing volumes of HSFO).

IMO Update

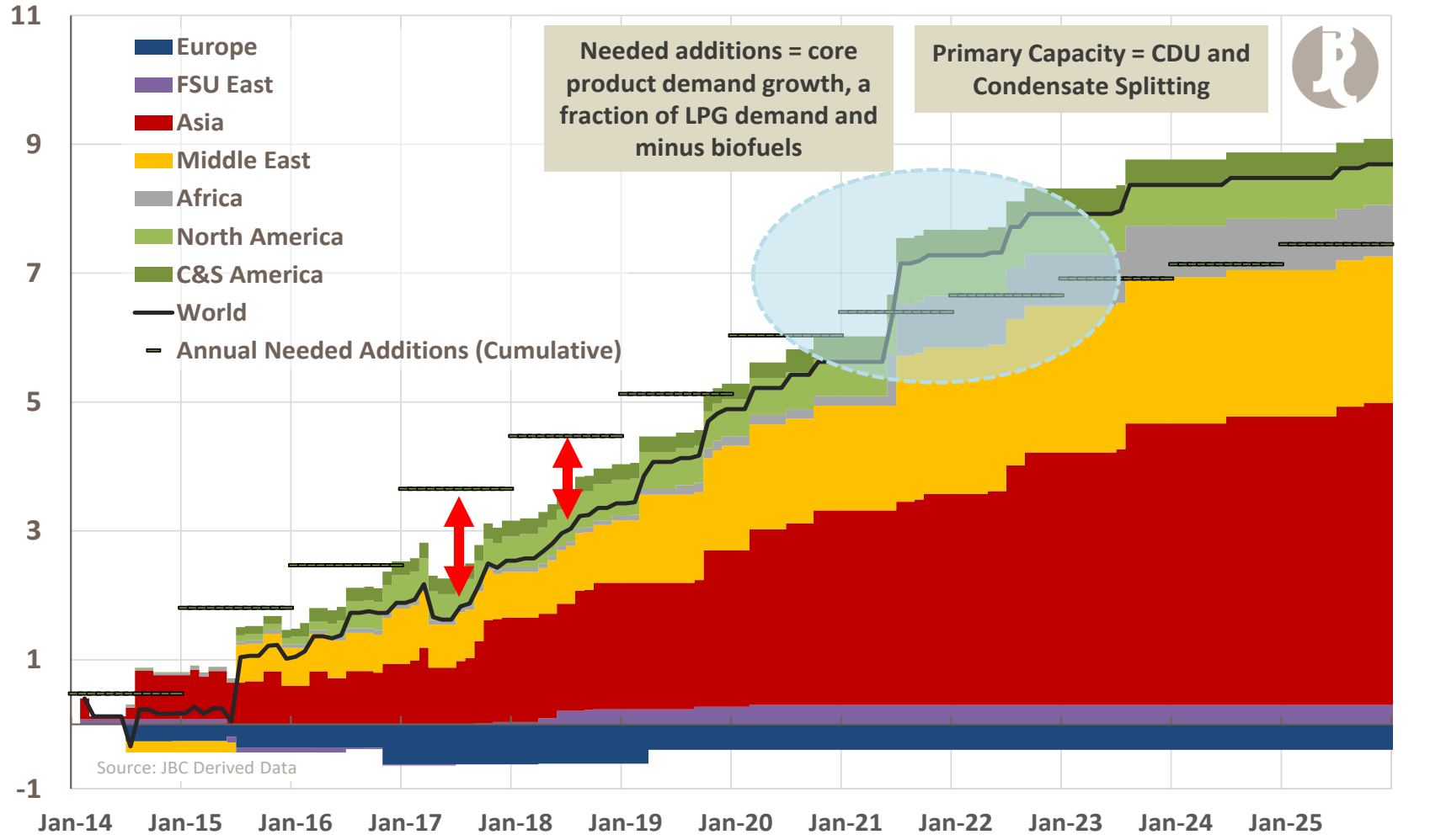
- Fuel oil/bunker operations are not business-essential for most refiners
- The refining industry is operating close to (realistic) capacity limits
  - Unlikely to change by 2020 as project pipeline is relatively thin and delays are frequent
  - It is impossible to build new conversion units between now and 2020

→ IMO challenge to be handled with existing system (incl. 2018/19 additions)

  - New bunker fuel requirement to be met by adjusting product yields or qualities to demand pattern, requiring a fuel oil solution due to the lack of spare conversion capacity
  - The alternative of adding bunker gas oil on top of current product slate is not viable because:
    - What happens to the unused HSFO?
    - Hiking crude runs substantially is not feasible due to capacity limitations
    - Even if so: what happens with 50%+ share of other product supply additions?

IMO – Status & Scenario

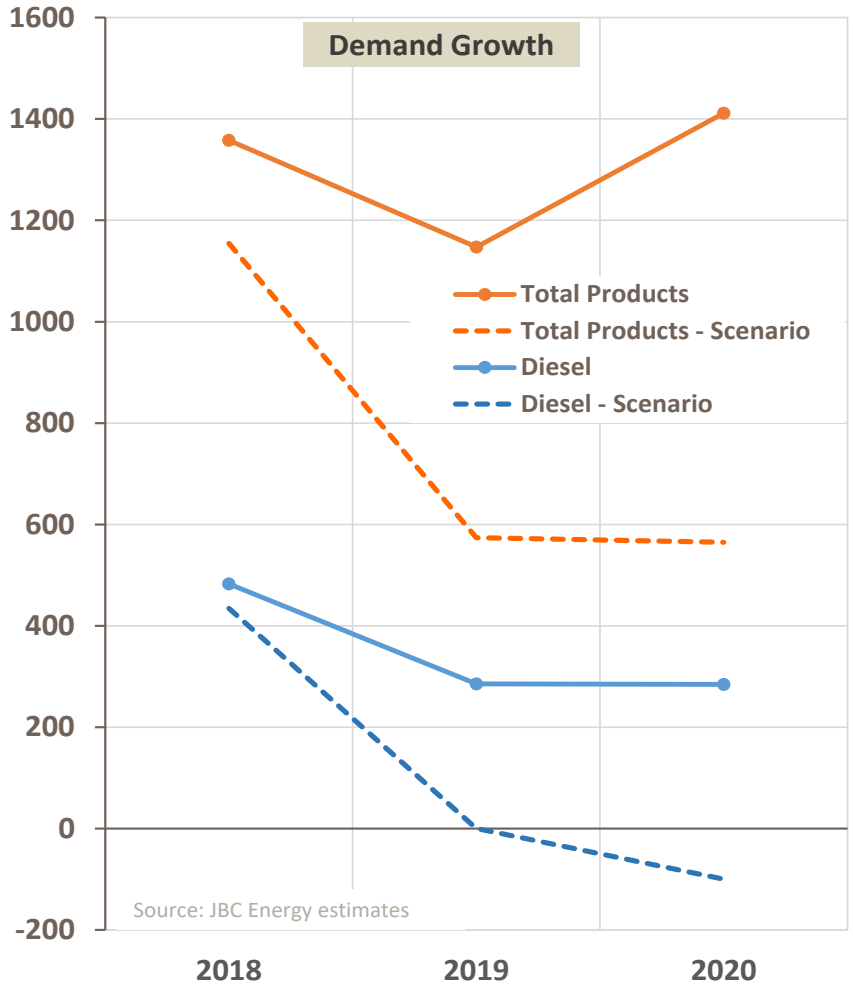
Cumulative Global Primary Capacity Additions Since Jan-14 [million b/d]

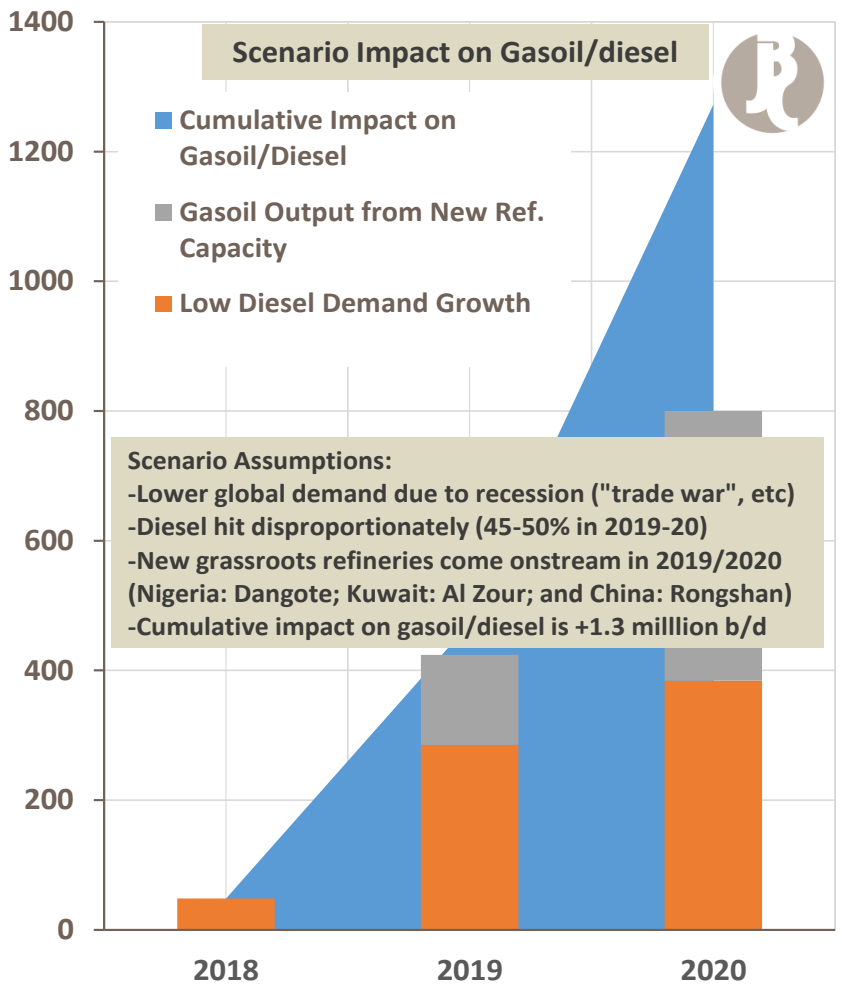


We should be slowly moving out of a tight refining environment, which in our base case sticks up to and including 2020. Post-2020, there is considerable refining capacity to come onstream while the long-term demand outlook is weakening. This implies pressure on margins.

IMO – Status & Scenario

Scenario Analysis - Demand Growth and Diesel Availability ['000 b/d]

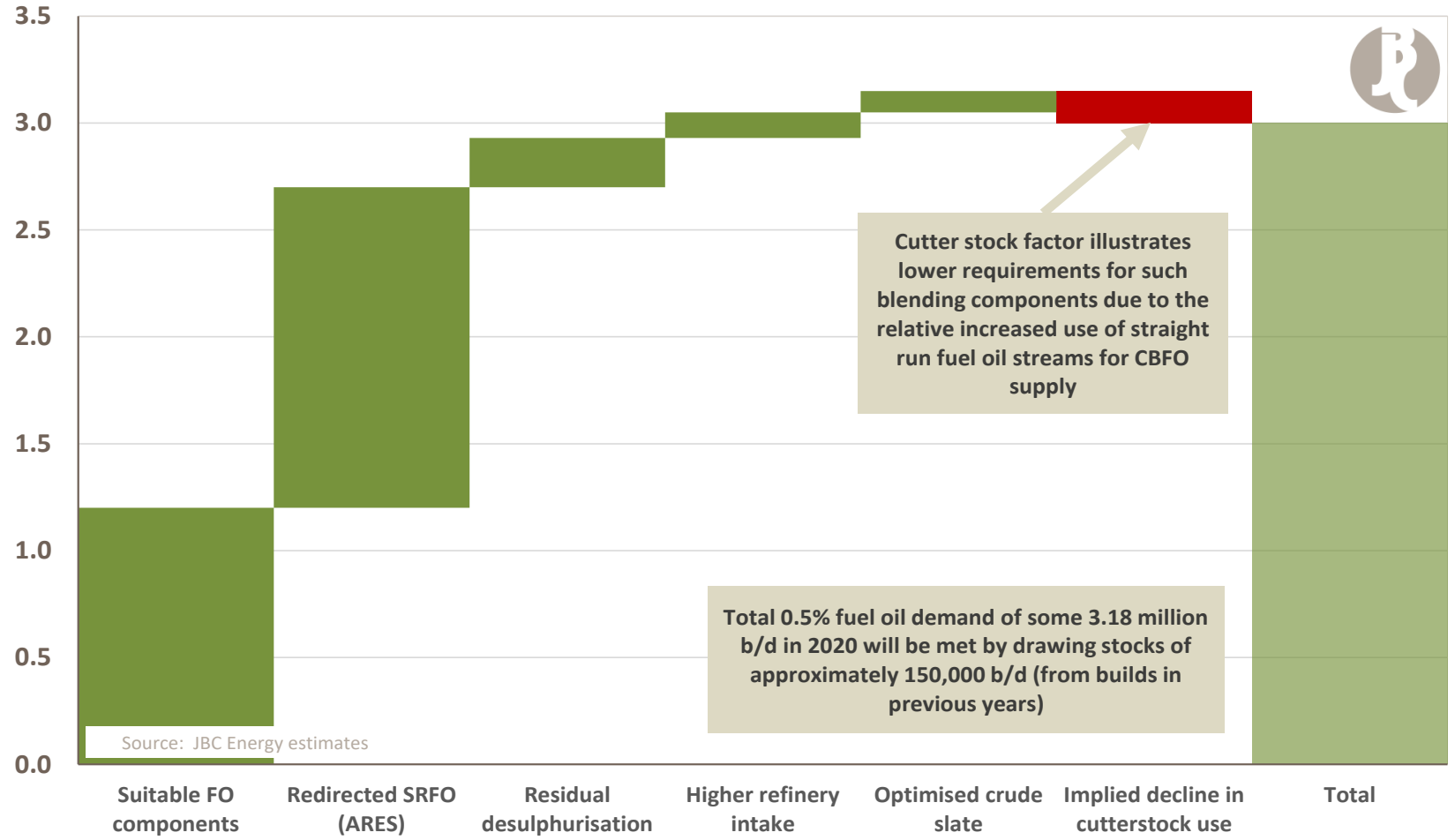




While our view on a fuel oil-based solution is becoming the consensus view, there is still a chance that markets develop differently. We have built a scenario highlighting risks to the global core product demand outlook which could leave more room for gasoil in bunkering.

IMO – Status & Scenario

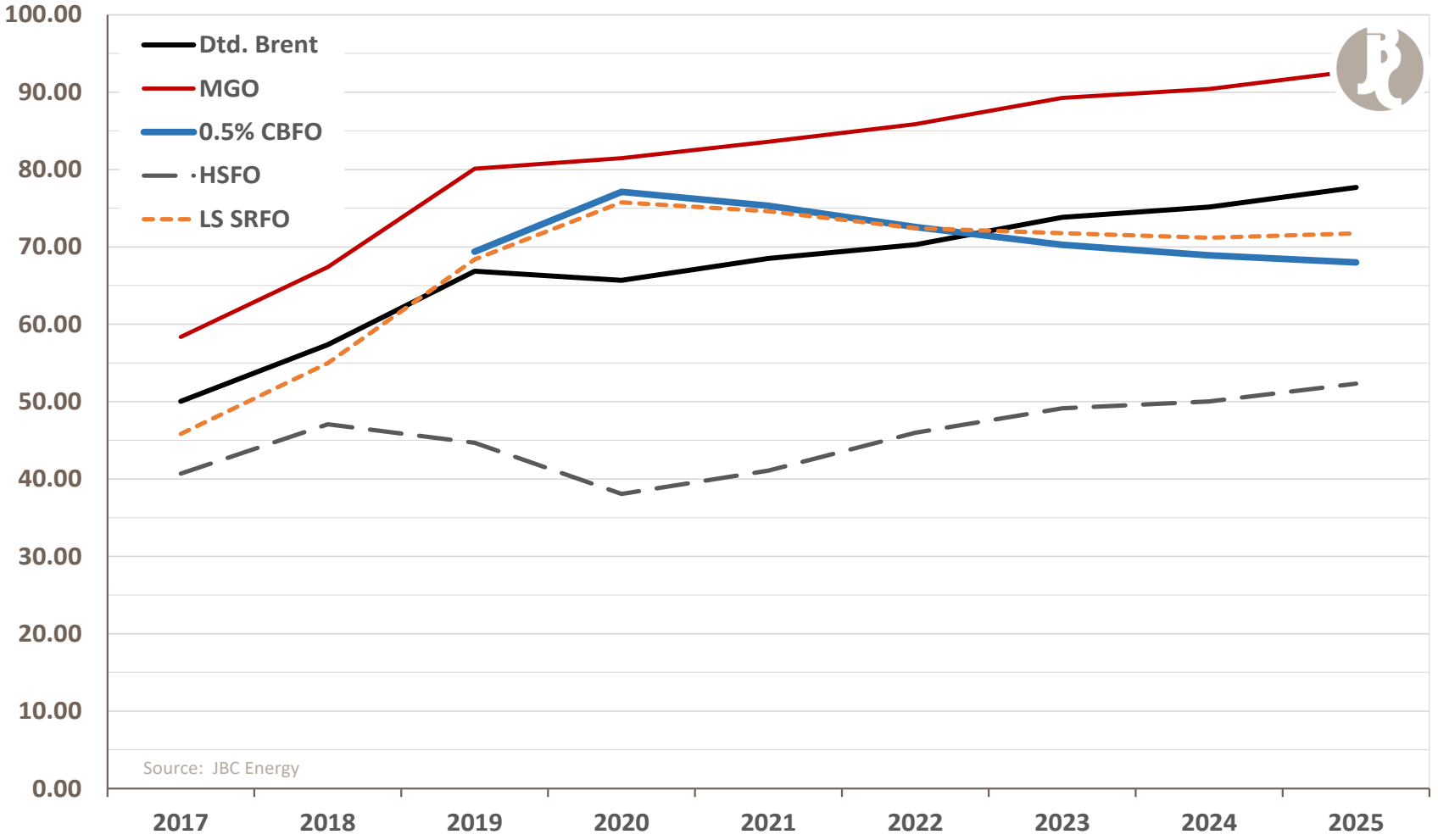
Approximate Contributing Factors to 0.5% Fuel Oil Production in 2020 [million b/d]



Theoretically there are abundant low-sulphur fuel oil streams in refining. It is a question of what prices are required to adjust operations and how to handle changed feedstock flows and higher sulphur levels technically.

IMO – Status & Scenario

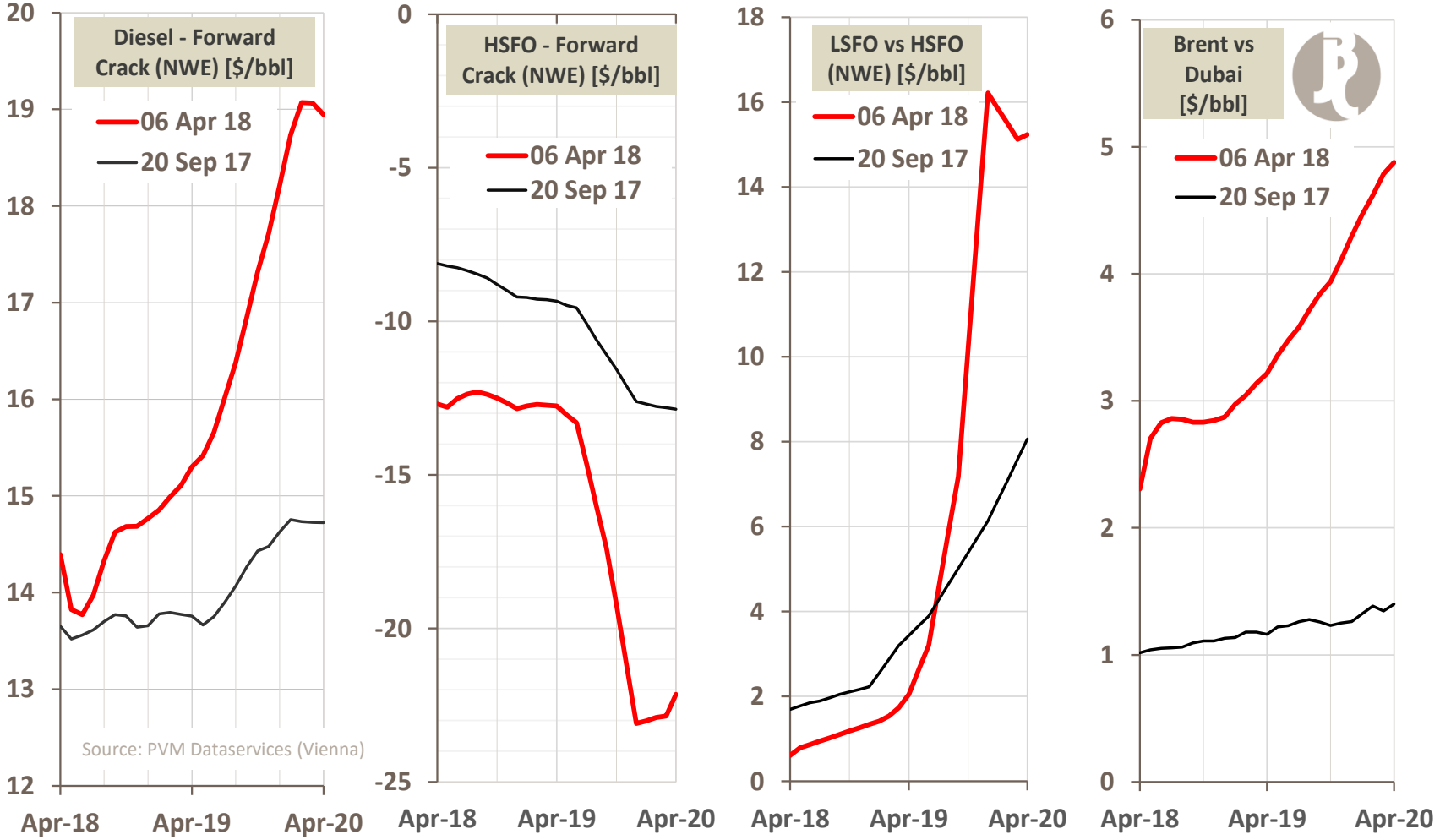
JBC Energy Price Forecast - NWE [$/bbl]



The necessary price incentives to cope with the 2020 bunker challenge include deep discounts for HSFO and initially strong premiums for low-sulphur fuel oil, which nonetheless still prices significantly below marine gas oil.

IMO – Status & Scenario

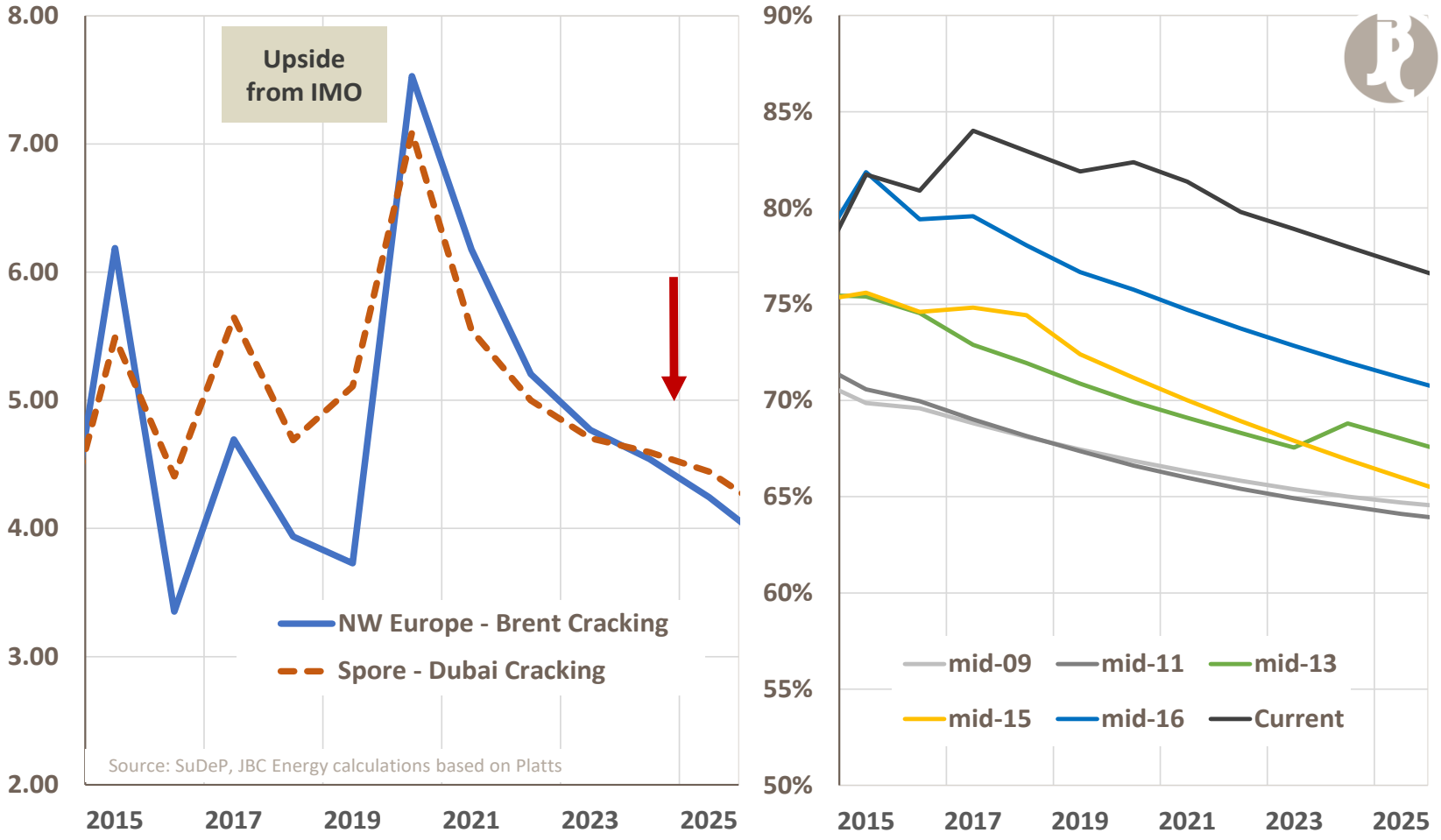
Evolution of Forward Cracks [$/bbl]



We are already seeing the effects of the upcoming IMO regulations in forward pricing in various differentials, largely in line with the findings of our IMO study.

IMO – Status & Scenario

Selected Cracking Margins & European Utilisation Forecasts [$/bbl, %]



We have had to revise up our estimates for European utilisation in light of delays to expansions in recent years. But substantial pressure should come to reduce runs in the post-2020 period.

IMO – Status & Scenario

JBC ENERGY

JBC Energy study view so far solidly confirmed:

- The refining industry **is able to supply compliant fuel**
  - It is also the most likely candidate to take care of the majority of the HSFO problem
  - But it will be a huge challenge
- Diesel cracks and refining margins in general will benefit from the IMO shift
- Ultimately, the compliant bunker fuel will be a 0.5% fuel oil (blend)
  - It should not be possible to sell both a gasoil-based and a largely fuel oil-based bunker fuel in the same location at different prices.

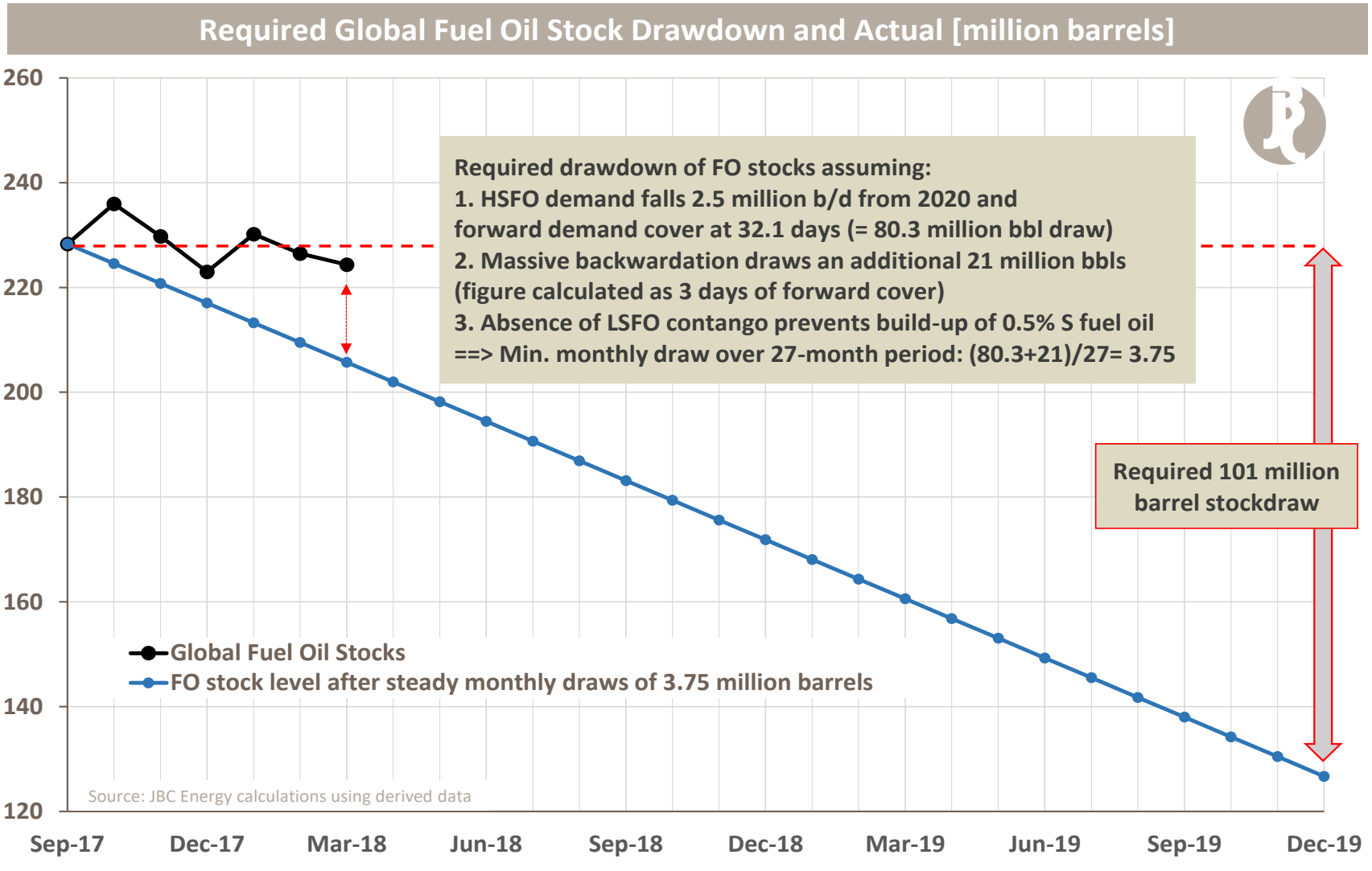
…But challenges remain

- Scrubber uncertainty
- Implementation uncertainty
- Compliance

IMO – Status & Scenario

- Scrubber Viability
  - **High Adoption** (according to our economic calculations)
    - HSFO demand comeback and long-term stability in price
    - Refining industry normalises over time with lower incentives to install conversion capacity
  - **Low Adoption**
    - What is the actual viability of open-loop & closed-loop systems?
    - Concerns about long-term HSFO quality and further specification changes coming up
    - The post-2020 refining path is one of high conversion and residue desulphurisation. HSFO largely disappears
- Implementation
  - **Delays to IMO regulations**?
    - Some precedent – Ballast Water Management Systems (delayed by 2 years, 2 months before implementation)
  - **Are too many parties not subject to regulation**?
    - Ability to bunker HSFO in non-party states. **But IMO may ban all ships from carrying HSFO unless they have an scrubber installed**
- Compliance
  - **Costs/benefits**:
    - Benefit: short-term fuel cost savings
    - Costs (potential): reputational damage, ship banning, penalties (minor), reputational interest of ports, bunkering insurance companies, captains are personally liable
  - Ship tracking easily available and can spot bunkering in non-party states
  - Overall relevance of a few non-compliant market participants is probably marginal

IMO – Status & Scenario



The necessary liquidation of stocks will offset any tightness in the market, keeping FO cracks depressed

Seminar: JBC Energy Matters - VIENNA

Location:
Vienna, Austria
6-7 September 2018

- The 2018 **JBC Energy Matters Seminar** will be held in **Vienna** on **6th – 7th September 2018**
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Thank you!

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