Third Joint IEA-IEF-OPEC Technical Meeting on Interactions between Physical and Financial Energy Markets

DRAFT REPORT

OPEC Secretariat
28 March 2019

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List of Participants

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Mr. Michael Carolan	Editor, Argus
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Mr. Michael Eckhart	Managing Director, Global Head of Environmental Finance , Citigroup
Mr. Owain Johnson	Managing Director, Global Head of Research and Product Development, CME Group
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Mr. David Chang	Senior Managing Director, Wellington Management
Mr. Pedro Gomez	Head of Oil and Gas Practice, World Economic Forum
Mr. Fahad Alidi	Project Collaborator, Oil and Gas Industry, World Economic Forum

3rd Joint IEA-IEF-OPEC Technical Meeting
on the interactions between physical and financial energy markets

OPEC Secretariat
Helferstorferstrasse 17
Vienna, Austria

Agenda

Wednesday, 27 March 2019	
Pre-Meeting Welcome Reception *Hotel de France, Schottenring 3, 1010 Vienna* *18:00-20:00*	
Thursday, 28 March 2019	
08:30 to 09:00	Registration
09:00 - 09:20	**Welcome and opening remarks** OPEC IEF IEA
09:20 - 11:00	**Session I** **Review of interaction of financial markets and oil prices** <u>Moderator</u>: Mr. Harry Tchilinguirian, BNP Paribas <u>Presentations</u>: • Oil market volatility and the implementation of the Declaration of Cooperation – James Gooder, Argus • The Interaction Between Physical and Financial Energy Markets – Chaitanya Mehra, Echion Capital Management • Interactions of Financial Markets and Oil Prices – David Chang, Wellington Management • A Look at Late 2018 Crude Oil Futures Price Volatility - EU-Vienna approved – Jason Bloom, Invesco Capital • The Dynamics & Structure of Modern Crude Markets – Mike Davis, ICE Futures Europe *Followed by roundtable discussion*

11:00 - 12:50	**Session II** **Developments in crude oil futures exchanges** Emergence of new crude oil benchmarks and their impact on regional markets <u>Moderator</u>: Dr. Cornelia Meyer, MRL Corporation <u>Presentations</u>: • INE and the search for the third benchmark – Owain Johnson, CME Group • The Battle for a Gulf Crude Contract – Jonty Rushforth, Platts • The Evolution of North Sea Dated – Michael Carolan, Argus *Followed by roundtable discussion*
12:50 - 13:50	Lunch
13:50 - 15:50	**Session III** **Climate-related financial disclosures** Impact on global investment in the oil industry <u>Moderator</u>: Dr. Steven Knell, IHS Markit <u>Presentations</u>: • Climate-related financial disclosures: policy overview – Pedro Gomez Pensado, World Economic Forum • Investors' point of view – Michael Eckhart, Citigroup • Integrating climate into our strategy – Etienne Anglès d'Auriac, Total *Followed by roundtable discussion*
15:50 - 16:00	**Closing remarks** OPEC IEF IEA
	Note: The event is held under Chatham House Rule

Background

The Joint IEA-IEF-OPEC Technical Workshops/Meetings on the "Interactions between Physical and Financial Energy Markets" were first established at the 12th IEF Meeting in 2010 as an outcome of the Cancun Ministerial Declaration to bring together market experts and participants to address timely topics and exchange views on the interactions between physical and financial energy markets.

The first Technical Meeting was held in Vienna in 2015, with a subsequent Meeting held in 2017. Additionally, six joint technical meetings were held at the OPEC Secretariat in Vienna, Austria, in 2010, 2011, 2013, 2014, 2016 and 2018.

The **Third Joint IEA-IEF-OPEC Technical Meeting on the Interactions between Physical and Financial Energy Markets** was **co-chaired** by OPEC Secretary General, HE Mr. Mohammad Sanusi Barkindo, together with HE Dr. Sun Xiansheng, Secretary General of the IEF, and Mr. Neil Atkinson, Head of the Oil Industry and Markets Division at the IEA.

The event built upon the insights gained in the previous Technical Meetings and Workshops on the Interactions between Physical and Financial Energy Markets. Discussions were structured to foster an open and interactive dialogue among participants, including oil companies, trading houses, bankers and analysts, in order to provide a diversity of views on the evolving interactions between financial and physical energy markets. To this end, the meeting was held under **Chatham House Rule**.

In his welcoming remarks, **HE Barkindo** said: "The three organizations represented here today are prime examples of the powerful benefits that the strengthening consumer-producer dialogue continue to bring to the global energy markets." The Secretary General also noted that the dynamics and functioning of the oil market continue to evolve on a daily basis, with the increased financialization of the oil market exposing the physical oil market to increased levels of speculative activity and volatility.

Addressing participants, the Secretary General noted that dialogue and cooperation among industry stakeholders is rising to unprecedented levels, as most clearly displayed by the landmark Declaration of Cooperation which has been in place since the beginning of 2017. He added that "This spirit of openness and the sharing of perspectives and knowledge has been a major supporting factor to the market stability we have witnessed of late."

HE Dr. Xiansheng stressed the important role the joint IEA-IEF-OPEC events play in enriching the dialogue between consumers and producers, having just successfully concluded the Ninth IEA-IEF-OPEC Symposium on Energy Outlooks, alongside two meetings in partnership with the European Union and the King Abdullah Petroleum Studies and Research Centre (KAPSARC) this February in Riyadh.

He further observed that the dialogue on the Interactions between Physical and Financial Energy Markets, was launched after a period of increased oil market volatility, at the 12th IEF Ministerial Meeting in Cancun on 2010. He also said that "Just as comparing outlooks has become easier over successive meetings and dialogue is now better informed and more collegial, so too are physical and financial energy market dynamics better understood thanks to the meetings we held over the years."

Mr. Atkinson of the IEA noted that " …[the IEA] is in regular dialogue with our member governments, non-member governments, energy companies, banks, trading companies, and other interested parties to exchange views on a wide range of topics; not least in trying to understand how the enormous weight of investor money is influencing the market and, of course, keeping up with the growing importance of machine learning, algorithmic trading, and many other developments."

The complete opening remarks of HE Barkindo, HE Dr. Xiansheng and Mr. Atkinson can be found in the annex.

Summary of discussions

As per the agenda, the content of the meeting was structured in **three main topics**:

- Interaction of financial markets and oil prices
- Developments in crude oil futures exchanges - Emergence of new crude oil benchmarks and their impact on regional markets
- Climate-related financial disclosures - Impact on global investment in the oil industry

1. **First session: Review of Interaction of financial markets and oil prices.**

   The session began with an **introduction** of the recent developments in oil price movements along with a snapshot of the high volatility seen at the end of the 2018, particularly for oil prices and equities. It was noted that the volatility at the front end of the curve was extremely high at that time.

   The **first presentation** in this session gave an overview of the various drivers affecting oil market volatility, such as changing market circumstances, uncertainty, exuberance, fear and poor and incomplete data. It was highlighted that poor information, especially with regard to data on demand from China adds significant uncertainty for decision makers. With regard to the difference in the volatility behaviour of physical and future prices, it was stressed that spot prices help to anchor forward markets. This view was supported by less volatility observed in Dated Brent than in the futures. The impact of the OPEC and Non-OPEC Declaration of Cooperation was described as effective in helping the oil market to recover, however, this has also exacerbated the shortage in the supply of heavier and sour crudes. Finally, crude differentials to Dated Brent are expected to widen as a result of the upcoming IMO 2020, though this impact is expected to fade over time.

   The **second presentation** explored the causes that exacerbated the downward trend in the oil price seen in November and December 2018. It was suggested that financial flows into the futures market have become more volatile, while at the same time risk capital has become more scarce in the market, which has amplified price and volatility moves. This phenomenon converged with the necessity of institutions acting as swap dealers to hedge their exposure resulting from sovereign hedge programmes along with risk management activities of shale oil producers, thus accelerating the fall in prices. Other factors contributing to the sell-off seen during this time were the negative performance of other assets, and diminished liquidity around the year-end holidays in the US.

The **third presentation** focused on the new composition of actors in the futures market, which shows that “systematic” participants have outgrown fundamental traders. It was reasoned that the systematic oil market community can destabilize short-term oil prices. In the specific case of algorithmic traders, while they dominate exchange-traded volumes, they can turn quickly from being liquidity providers into liquidity consumers. They carry more, and normally smaller, transactions but the overall result is less market depth, which impacts the ability to sustain large market orders without large price impacts. As the influence of systematic participants tends to be concentrated in the short term, the potentially resulting greater short-term volatility discourages capital investment by raising the required rate of return. Finally, it was stressed that the concept of “price stability” needs to be consistently communicated, and that the shape of the forward curve (“the carry”) is a powerful quantitative signal that can be managed through inventories.

The **fourth presentation** maintained that while fundamentals control price levels over medium to long-term time periods, however the speed at which algorithmic trading takes places reduces the time frame within which markets react to changing fundamentals, and thereby increases volatility. The volumes of WTI futures contracts have grown many times faster than the US physical crude oil market and there is a strong correlation between increases in trading volume and observed price volatility. In 4Q18, shorts were initially triggered by bearish counter-seasonal inventory builds. This was followed by the announcement of the US Administration for 8 sanction waivers. This then interacted with seasonal illiquidity, especially around the US Thanksgiving and also later at the year-end holidays, resulting in the increasing volatility observed.

The **final presentation** of this session highlighted that oil benchmarks have historically evolved driven by fundamentals and regulation. ICE Brent futures are linked to physical markets through the exchange of futures for physical and contract for differences instruments. ICE Brent and WTI have been evolving with underlying changes in the respective markets. Price benchmarks do the ‘heavy lifting’ for oil price discovery, enabling other grades to be traded in reference to the most liquid flat price instruments, providing security and liquidity to the whole market.

The **discussion** following this block of presentations included the potential impact of impending IMO regulation on price differentials. It was also mentioned that there could be some potential strengthening of sweet versus sour crudes and of heavier against light crudes, due to the supply adjustments as well as geopolitical restrictions. It was emphasized that the role of non-commercial actors continues to increase – however, these new actors have a risk-neutral view of the market and tend to trade in smaller volumes. This new automated group of investors have filled the vacuum left by discretionary funds which have stepped back from the market. It is worth noting that in general there was some degree of agreement that, in the medium-term, fundamentals drive market price actions. However, in the short term, prices could be increasingly volatile. This volatility also affected the investment decisions of shale producers, as was registered in 4Q18, at the time that annual budget decisions were made. Different views were also shared with regard to the impact of higher interest rates in the US, as some highly levered funds could be particularly sensitive to rising cost of capital. At the same time, while it was mentioned in three of the presentations that the majority of the open interest was increasingly found at the beginning of the forward curve, this could be related to both the increasing hedging necessity of shale producers which follow a short term cycle, and the fading presence of asset managers investing in the long end of the curve.

2. Second session: Developments in crude oil futures exchanges

The **first presentation addressed the recent developments in Asia with regard to creating a crude oil benchmark at the Shanghai International Exchange**. The presenter started by recalling the previous attempts to set a crude oil benchmark for the Asian and East Suez market, and explained why so many Asian crude oil contracts failed to emerge as benchmarks. He explained that the main reason for their failure was because most of them were only cash-settled, making them less attractive to oil companies who have, or require, physical exposure. The presenter highlighted the emergence of the Chinese INE contract as a new benchmark, arguing that it has seen a tremendously successful start. The contract's trading volumes are increasing quickly while it continues to enjoy strong official encouragement for Chinese firms to trade at the INE, and, at the same time, some of the teething problems were overcome. However, the presenter recognized that INE is still facing some headwinds, mainly due to a lack of sufficient physical exposure and hardly any trading taking place outside of the front month. Furthermore, settlement is not in line with other benchmarks, such as the DME or ICE.

The **discussion** was concentrated on the obstacles that could prevent INE from emerging as a new regional market, mainly due to its settlement in Renminbi instead of the US dollar like other benchmarks, making arbitrage difficult. In addition, the lack of international acceptance was discussed, because of the nature of the Chinese onshore market and its regulations.

The **second presentation focused on the growing importance of WTI at Houston,** highlighting the growing interest in pricing WTI crude oil referenced to Houston and the Permian, rather than the traditional hub at Cushing. This move is intended to meet market needs and reflect the new US trade flows amid booming US crude oil production and exports, and additional oil pipeline and loading port capacities, which are transforming the US Gulf Coast to become an important delivery point for oil produced in Permian Basin. The presenter recalled the persistent disconnection of WTI Cushing from Brent, which has led to a broader look at US crude pricing. The two most important exchanges, CME and ICE, have been increasingly competing for the US Gulf Coast light sweet crude contract, which presents a more relevant WTI crude benchmark to value US crude oil exports. The potential impact of increasing US crude oil exports to Northwest Europe with regard to the assessment of dated Brent was also addressed. Platts had confirmed that with effect from 1 October, 2019, competitive offers for BFOET crude oil cargoes on a CIF Rotterdam basis would be reflected in its Dated Brent crude oil benchmark. Nonetheless, Platts does not have any immediate plans to bring further grades into its Dated Brent crude oil basket. The presentation also explored Platts' assessment methodology for WTI and other US grades in several locations in the US.

Discussions focused on the potential impact of the new assessment of Dated Brent on the price structure, and how producers and traders should adjust their crude differentials and official selling prices to reflect the changes in the new benchmark.

The **third presentation highlighted the newly announced changes to the assessment of the North Sea Dated contract**. Beginning with a brief assessment of the current and future North Sea crude oil production level and available crude for trading, the presentation highlighted the dramatic decline in just this production and dwindling trade volumes in the North Sea benchmark assessment process, despite ongoing adding of other grades to the benchmark. This has created high volatility in the physical prices compared to the Brent futures contracts. Furthermore, increasing US crude oil exports to Northwest Europe has led to US crude becoming a significant component of the crude pool in Europe, which should be taken into account. A new price assessment of North Sea Dated has just recently been launched by Argus, based on CIF cargoes for not only BFOET grades, but also including other foreign crudes delivered into Northwest Europe.

3. Third session: Climate-related financial disclosures.

The session opened with the moderator giving an **overview** of the unprecedented political frameworks that have been ratified by a large international community and emphasized the scale of the challenge for energy demand that lies ahead. According to the moderator, global carbon emissions need to be reduced by roughly 50% over the next 20 years in order to meet the goal of reducing global warming. Pursuant to the Paris Agreement, Article 2(c) reads that global financial flows should be made consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. Furthermore, there is a need to understand what is required to make such a commitment happen, such as: what are the physical risks from climate change, what are some of the unintended consequences of climate change. So while there is a drive to divest away from fossil fuels, yet one must also consider the large number of new energy users "coming online" over the next years.

The **first speaker** in this session that the current drive for climate-related action was not so much a policy issue, but rather a grass-roots movement prompted by environmental concerns which has been taken up by several highly influential leaders and organizations. Several investment funds as well as organizations such as the World Bank are increasingly committed to not investing in fossil fuels, and while the impact so far has been very moderate, this could change soon. The speaker also explained that the Financial Stability Board (FSB)[1], had created a Task Force on Climate-related Financial Disclosures, which published a report in June 2017[2]. So, while environmental, social and governance (ESG) criteria are gaining traction, further supported by shareholder activism, this could, in turn become a challenge for energy security. (*discussion followed at the end of the presentations*)

The **second presentation** in this session covered the issue of climate risk and capital requirements to address these. The key issue identified to

[1] http://www.fsb.org/2017/06/task-force-publishes-recommendations-on-climate-related-financial-disclosures/
[2] https://www.fsb-tcfd.org/publications/final-recommendations-report/

alleviate climate change is the pursuit of a reduction of carbon emissions. It was suggested that oil companies could contribute to this by sharing and employing their extensive knowledge and expertise on carbon capture technologies. In addition, the oil industry could review its E&P processes to identify means and methods of reducing carbon emissions, also in terms of flaring. Taking a look at the capital need to finance climate change solutions, it was found that the current investment in clean energy (around $3.3 bn/year in 2017) would need to be tripled in order to be able to finance the required measures, with the largest burden placed on Developing Countries (DCs). While the OECD and BRIC countries would only need to double current efforts to reach the required investment levels, DCs would need to raise their current expenditure levels by a factor of 19. On the other hand, it was said that the funding of the energy transition will not come from the public, but from the private sector, with banks possibly playing an important leading role in channelling funds. ESG investment in the US is rapidly growing with an increasing awareness of fiduciary duty for long-term investments. Green bonds have been issued, totalling $167bn globally in 2018. These bonds represent a revolutionary change in bond markets as they issued by the industry – not governments - and their success will also depend on a wide-spread acceptance of a common definition of standards rather than strict national government regulation which could deter investment on a broader scale. (*discussion followed at the end of the presentations*)

The **third presentation** gave an overview of how climate issues are incorporated in the strategy of major energy company. This strategy focuses on seeking out oil projects with a low breakeven cost, expanding these along the value chain and developing and profitable and sizeable low carbon electricity business. Emissions that an energy company produces in its operations include flaring, emission of methane, energy use during production as well as electricity used in the process of distribution. At the same time, emissions are generated by the consumers' use of these energy products. It is the aim of the energy company to reduce the carbon intensity of the fuels provided, improve the efficiency of operations, promote sustainable biofuels and invest in carbon sink businesses.

The ensuing **discussion covering all the statements and presentations made in this session**, explored possible differences between the US and Europe in terms of the relationship between businesses and governance and the historical context of these. While some participants argued a profound demand destruction may lie ahead due to climate-related challenges, others were of the opinion that oil demand has seen steady growth of around 1-1.2 mb/d over the last 30 years and will continue along the same lines in future. On the other hand, should investment in oil supply fall short of the required levels – it was said that some $400-500 billion need to invested globally every year just to prevent a decline – this could lead to a shortage of supply in the years to come. Furthermore, it seems that while carbon capture may well have potential to help mitigate climate change, yet only few pilot projects so far are being undertaken. On green bonds, while there was some volatility seen from the investor side in recent months, yet the total amount of such bonds is forecast to reach around $1 trillion by 2025.

Conclusion

At the conclusion of the meeting, the three co-hosting organizations thanked the experts and analysts that had convened at the OPEC Secretariat in Vienna for their active participation to make this meeting "a huge success". Their valuable insights, expert evaluations and open discussions on the complex and evolving issues helped further a common understanding among participants. The organizations expressed their ongoing commitment to the dialogue process – and said they looked forward to convening the next Joint Workshop scheduled to take place in **March 2020**.

Annex

Speaker/Moderator Bios

Harry Tchilinguirian

Mr. Harry Tchilinguirian is Head of Commodity Research and Senior Oil Market Economist with BNP Paribas' Markets 360 Group in London. His area of coverage includes short term oil markets. Harry joined BNP Paribas in August of 2006 from the International Energy Agency (IEA) in Paris, France where he worked for 6 years in the Oil Markets and Industry Division.

As Senior Oil Market Analyst, he was a contributor to the IEA's benchmark monthly Oil Market Report where he covered prices, refinery activity, oil inventories and statistics and maintained and developed the division's extensive contacts with industry and governments alike.

Harry's responsibilities at the IEA also included regular presentations to the various IEA government committees and the office of the Executive Director as well as market analysis in support of Agency's assessment of potential use of strategic stocks in emergency situations. He also represented the IEA at various international forums, conferences and workshops. Prior to joining the IEA, Harry worked with the Organisation for Economic Co-operation and Development, (OECD), in the Economic Departments.

James Gooder

Mr. James Gooder works to develop commodity price reporting agency Argus' crude and refined product price assessments, and to encourage their adoption as industry benchmarks.

James has been with Argus since 2004 performing several editorial roles, including editing the daily Argus Crude report. Since 2010 he has been in Argus' business development team, working closely with energy companies and government authorities in Europe, Africa and beyond.

Prior to joining Argus, James worked as a teacher, speechwriter and journalist and he holds degrees in literature and journalism. He has lived and worked in France, Portugal, Japan, Switzerland and Qatar, as well as his native UK, where he is currently based.

Chaitanya Mehra

Mr. Chaitanya Mehra is the Portfolio Manager for Echion Capital Management, a Millennium platform company. Echion's focus is fundamental and systematic investing across the commodity space with a emphasis on global energy markets. Previously, he was Managing Director and Head of Global Commodities for Och-Ziff (OZ) Capital Management, with a specific focus on global energy, and he oversaw the Firm's fundamental analysis of those markets.

Prior to joining OZ, he was a Vice President at Goldman, Sachs & Co., where he worked most recently on the acquisition and integration of a physical U.S. natural gas asset, infrastructure and trading business into Goldman's commodities group. Mr. Mehra started his career as an Analyst at Goldman, Sachs & Co., and held various roles throughout his tenure, including trading and asset-based transaction management in the natural gas, crude oil and refined product markets. He graduated from Yale University.

David A. Chang
As a commodities portfolio manager, Mr. David A Chang manages long-only and long/short commodity approaches on behalf of our clients. He collaborates with Wellington Management's investment resources, including natural resource-focused global industry analysts and macroeconomists, to analyse the fundamental drivers of commodity markets. David is the Vice Chair of the Wellington Management Foundation Board, the Sponsor to the Wellington Young Professionals business network, and a member of Wellington's Upstanders Group. The Upstanders is a grassroots effort composed of over 150 Partners and Managing Directors, who are engaging in sponsorship, mentorship and other activities aimed at improving diversity and inclusion at the firm.

David joined Wellington Management in 2001 after earning his BA in quantitative economics and international relations, magna cum laude, from Tufts University (2001). Additionally, he holds the Chartered Financial Analyst designation and is a member of the CFA Society Boston and the CFA Institute. He is fluent in French, Italian, Mandarin, and Spanish.

Jason Bloom
Mr. Jason Bloom is the Global Market Strategist that represents the PowerShares family of exchangetraded funds (ETFs). In his role, Jason is responsible for providing a macro market outlook across all asset classes globally, in addition to leading the team's specialized efforts in fixed income, commodity, currency, and alternatives research and strategy. He joined PowerShares in 2015. Prior to joining PowerShares, Jason served as an ETF strategist for six years with Guggenheim Investments and then River Oak ETF Solutions, where he helped launch several funds focused on both energy and volatility related strategies. Previously, Jason spent eight years as a

professional commodities trader specializing in arbitrage strategies in both the energy and US Treasury markets. Jason earned a BA in Economics from Gustavus Adolphus College and a JD from the University of Iowa College of Law.

Mike Davis

Mr. Mike Davis has over 30 years of experience in the trading and analysis of a wide diversity of global energy and derivatives markets.

He joined ICE in November 2008. He has responsibility for the development of both new and existing futures and OTC markets, clearing services and derivative products for all ICE global oil markets. He is a member of ICE Futures Europe Senior Management team and the Brent Index Oversight Committee.

In recent years he has guested on Russia's RBC Business News channel, China's CCTV News channels, Sky TV News primetime 'Live at 5' evening news, Channel News Asia, CNBC Asia's 'Squawk box', BBC TV's 'Working Lunch' and BBC World Service Radio news, as well as numerous speaking engagements across the Americas, Europe and Asia. He leads ICE's ongoing global program of energy risk and trading events.

Dr. Cornelia Meyer

Dr. Cornelia Meyer is a business consultant, macro-economist, energy expert and media commentator. She is Chairman and Chief Executive Officer of MRL Corporation and Chairman and Chief Economist of LBV Asset Management. MRL advises a multitude of multilateral organisations and multinational corporations on a wide range of geo-economic issues. Dr Meyer's experience stretches over five continents as an economist, a financier, adviser, regulator, manufacturer and principal in the energy and other industries.

Dr Meyer was economic policy adviser to then Minister of International Trade and Industry of Japan, Yoshiro Mori. She held several senior positions in investment banking covering Asia, Russia, Eastern Europe and the Middle East for UBS, the ADB and Citigroup. Her industry experience includes GE Energy and BP.

She held various non-executive board memberships in commercial and not for profit organisations. She also used to chair the business and economic group of a US government funded "Track II" diplomatic mechanism for Middle East Security.

Dr Cornelia Meyer is a member of Oxford Energy Policy Club, serves on the Advisory Boards of the Istanbul Finance Summit and Euromoney. She was a member of the World Economic Forum's Global Agenda Council for Energy Security.

She was educated at the St. Gallen University, the London School of Economics and Tokyo University and speaks seven languages.

Owain Johnson

Mr Owain Johnson is the Global Head of Research and Product Development at the CME Group. The research and product development team develops new risk management products as well as ensuring the continued relevance of CME Group's current suite of key benchmarks. The team also produces original research into financial and commodity derivatives and their underlying markets around the world.

Mr Johnson previously served as CME Group's Managing Director of Energy Research and Product Development where he ensured the integrity of CME Group's existing energy futures benchmarks, which include WTI, Henry Hub, DME Oman, RBOB and NYH ULSD. Within CME Group, he was previously the Managing Director of the Dubai Mercantile Exchange, as well as Executive Director of CME Group Singapore. Before joining CME Group in 2010, he served as Asia Business Development Manager for Argus Media.

Mr Johnson is the author of "The Price Reporters: A Guide to PRAs and Commodity Benchmarks" and co-edited the Oxford Energy Forum's report on oil benchmarks. Furthermore he is a member of the International Association for Energy Economics and earned his master's degree from Cambridge University.

Jonty Rushforth

Mr Jonty Rushforth works at Platts as the Senior Director, Energy Price Group, managing a global team of analysts that ensure the robustness of Platts oil and energy assessments worldwide.

He is currently based in the London office of Platts, and has been with the company for more than ten years. Prior to that, Mr Rushforth was based in the Singapore office for seven years, most recently as Editorial Director for Asia and Middle East Oil Markets, managing the market reporting team that assesses crude and products prices across the region. Previously he covered power, gas and LNG markets at Platts in London and Singapore.

Mr Rushforth has a BA in Philosophy, Politics and Economics from Oxford University and an MA from Cardiff University in International Journalism.

Michael Carolan
Mr. Michael Carolan is the editor of the daily Argus Crude report published by commodity price reporting agency Argus. He takes direct responsibility for price assessments, market commentary and news in the North Sea, Russia-Caspian, West African and Mediterranean markets, while helping to coordinate Argus crude coverage from around the world.

Mr Carolan has been with Argus since 2011, first covering European gas markets before moving on to the crude market, with a focus on the North Sea.

Prior to joining Argus, Michael worked as a business journalist, most recently covering equity markets for Dow Jones and the Wall Street Journal.

Steven Knell
Dr. Steven Knell, Director, IHS Markit Energy Wide Perspectives, is a specialist in low carbon energy transitions. His principal expertise lies in analysis of environmental regulatory frameworks and their impacts on company strategy and the energy market landscape. He is the lead for the Climate and Carbon research capability at IHS Markit and is a main contributor to global climate policy and GHG emissions research across IHS Markit.

Dr Knell's current research and consulting work focus is on company responses to the recommendations of the Task Force on Climate-Related Financial Disclosures; the implications of the Paris Agreement and national climate policy on conventional energy production and consumption; the features of low emissions cases and 1.5/2°C global energy scenarios; carbon capture, use and storage; and the role of carbon pricing, emissions markets, and low-carbon technology strategies for oil and gas, power, and industrial sectors.

Dr Knell has previously served in the Canadian Federal Ministry of Environment and with the United Nations Development Program in Croatia. He holds a BA from the University of Kent at Canterbury, an MSc from the London School of Economics, and a PhD from the University of Sussex.

Pedro Gomez
Mr. Pedro Gomez acts as the primary interface between the Forum and key oil and gas sector decision makers including CEOs, senior corporate executives, relevant government ministries and subject matter experts and coordinates their involvement in Forum activities.

He also provides direction and oversight to the oil and gas action and research agenda. Mr Gomez has spent his entire career in the energy sector and prior to joining the World Economic Forum he was a Partner at the Shipbroking firm 1.89 Shipping GmbH.

As a Civil Servant, Mr Gomez was Director for Energy Sector Studies at the Mexican Ministry of Energy, and worked in Finance and Gasoline Trading Execution at PEMEX International.

In Academia, he was Chevening Fellow at the University of Edinburgh and Research Fellow at the Oxford Institute for Energy Studies.

Additionally, he worked at Deloitte where he helped to develop the Firm’s energy sector practice. He has also been an external advisor to Chatham House’s Good Governance of the National Petroleum Sector Project.

Opening Remarks

Mohammad Sanusi Barkindo, Secretary General, OPEC

Vienna, Austria
28 March 2019

Distinguished colleagues, ladies and gentlemen,

Good morning and welcome to Vienna and the OPEC Secretariat for this Third Joint IEA-IEF-OPEC Technical Meeting on interactions between the physical and financial energy markets.

I want to offer a special welcome to our distinguished moderators and high-level experts who have journeyed from far and wide to be with us here today and share their far-reaching insights and experience. For the first time ever, one of our experts will be joining us via video conference as part of our discussions in the last session. This underpins our evolving efforts at the Secretariat to harness the latest technology to ensure we provide the highest quality content for our various meetings and events.

Allow me to also warmly welcome our dear colleagues and co-hosts.

From the International Energy Forum, I would like to welcome His Excellency, the Secretary General, Dr. Sun Xiansheng, my good friend and colleague whom I like to call my twin brother. Dr. Sun, your steadfast efforts and dedication to the producer-consumer dialogue are deeply appreciated by all. The IEF, in its facilitative and strategic role, continues to be a vital builder of bridges and advocate of dialogue and cooperation. We at OPEC wish you many years of continued success.

I would also like to welcome the delegation from the International Energy Agency, which is headed by Mr. Neil Atkinson, Head of the Oil Industry and Markets Division. Neil is a longtime colleague and friend, having covered OPEC and the oil industry for many years, and more recently, in his role at the IEA, he has been with us for many of these joint meetings.

The three organizations represented here today are prime examples of the powerful benefits that the strengthening consumer-producer dialogue continue to bring to the global energy markets.

Colleagues, ladies and gentlemen,

This meeting is the continuation of a series of annual meetings in which we strive to increase our understanding of the complex developments and interlinkages shaping the dynamics of physical and financial energy markets.

Today’s deliberations follow on the heels of another successful joint event held one month ago at the IEF headquarters in Riyadh — the 9th IEA-IEF-OPEC Symposium on Energy Outlooks. We had the opportunity to exchange outlooks on short, medium and long-term developments, while also considering various industry viewpoints and investment developments.

It is also worth mentioning another joint activity we hold each year, which is the Gas and Coal Symposium, the fourth edition of which was held in Paris on 6 November 2018. This event provides a yearly opportunity for us to gather and assess the latest developments in the coal and gas industries, while exchanging outlooks from our respective organizations.

These joint activities, attended by energy ministers, industry leaders, top analysts and experts, are part of the trilateral work programme established by the IEA, IEF and OPEC at the 12th International Energy Forum in Cancún, Mexico, held in March 2010. They have become highly successful pillars of the producer-consumer dialogue.

Ladies and gentlemen, esteemed colleagues,

We gather here today at a time in which dialogue and cooperation among industry stakeholders continues to rise to unprecedented levels.

This is most clearly displayed by the landmark Declaration of Cooperation, which has been in place since the beginning of 2017. This spirit of openness and the sharing of perspectives and knowledge has been a major supporting factor to the market stability we have witnessed of late.

Just last week, we convened in Baku, Azerbaijan, for the 13th Meeting of the Joint Ministerial Monitoring Committee (JMMC), where all participating countries reiterated their support for the highly successful Declaration and assured the Committee that they will exceed their voluntary production adjustments over the coming months. The JMMC acknowledged the critical role the Declaration has played and will continue to play in supporting a sustained stability in the global oil market.

I am pleased to see with us here today delegations from participating countries of the Declaration. We look forward to your valuable viewpoints and expertise during our discussions.

One of the great benefits of this collaboration has been to gather together and discuss complex and evolving issues, such as the one on our agenda here today.

Let us remember that it was just under 15 years ago that oil emerged as an asset class, with considerable implications for the market.

Since that time, we have witnessed the increasing financialization of the oil market with a major jump in the number of oil futures and options being traded on the world's exchanges.

Looking at the evolution of average daily traded volumes of futures and options, the NYMEX WTI increased from around 530,000 contracts in 2008 to 1.2 million in 2018, and ICE Brent increased from around 260,000 contracts in 2008 to more than 900,000 in 2018. Additionally, looking at it from the perspective of volumes, we are currently at a daily global consumption of roughly 100 million barrels of oil per day, however, when we look at the volumes of crude oil futures being traded, we see a very different picture--with the daily aggregate traded volume at 2 million futures contracts or about 2 billion barrels per day of crude oil.

Technology also continues to play an increasingly influential role in the financialization of the oil market in terms of electronic trading through algorithms and digitization. According to a study released this week by the US Commodity Futures Trading Commission, the share of automated trades entered in futures markets across all commodity groups increased from 2013 to 2018. The average percentage increase was 19% for energy, metals, gains, oilseeds, and livestock.

As this study confirms, these developments can expose the physical oil market to increased levels of speculative activity and volatility.

This was perhaps most evident in 2008, when we witnessed crude oil prices jump dramatically from around \$90/b in January to over \$145/b mid-year, then drop back down to around \$30/b in December.

These drastic movements in price can create extreme volatility that is counter-productive in the oil market and certainly not in the interest of oil producers or consumers.

OPEC recognized the importance and magnitude of this issue early on and began to discuss it with industry stakeholders in meetings and within the EU-OPEC Energy Dialogue.

In fact, in December of 2006, I had the honour, in my role as OPEC's Acting Secretary General, of Co-Chairing the two-day joint OPEC-EU Workshop on the Impact on the Financial Markets on the Oil Price. That meeting recognized both the positive and adverse aspects of the increasing integration of the physical and financial oil markets. It also stressed the need for adequate regulation and high levels of transparency in terms of market data.

Since then, OPEC has always managed this issue through a measured and balanced approach, understanding the essential and productive role of the financial sector, while also acknowledging that it is but one of many factors that can impact market stability.

The impacts of financialization on the dynamics and functioning of the oil market continue to evolve on a daily basis, thus requiring continual monitoring and analysis, in addition to close engagement with market players in both the physical and financial markets.

Earlier this month, at CERA Week in Houston, we had an opportunity to meet once again with asset managers, commodity funds, as well as private equity and macro funds. This was a natural follow-up to similar meetings held at CERA Week in 2017 and 2018. This ongoing dialogue in an open and transparent manner is clearly in the interests of all stakeholders as we seek to navigate this complex and multi-faceted topic. Indeed, we will have the opportunity to build upon these rich discussions at our meeting today.

Before we proceed, allow me to provide an overview of today's three sessions.

The first session, moderated by Mr. Harry Tchilinguirian of BNP Paribas, will provide a review of the interaction between financial markets and oil prices. The recent oil market volatility will be highlighted in an effort to understand the underlying market dynamics that have impacted the most recent trends. We will also be looking at algorithmic trading and how this is increasingly affecting financial markets. Finally, we will hear an update on how swaps dealing has evolved given a rapidly changing market environment.

The second session, moderated by Dr. Cornelia Meyer of the MRL Corporation, will cover developments in crude oil futures exchanges with a focus on the emergence of new crude oil benchmarks and their impacts on regional markets. Our friends from both Argus and Platts have just recently announced new assessments for Dated Brent, or North Sea Dated, and will present the changes to us today. We will also hear an update on the new International Energy Exchange in Shanghai and the growing importance of WTI in Houston. It is also worth mentioning here, in the context of this session, the important recent developments going on in the United Arab Emirates and the very important Fujairah bunker fuel hub, which is strategically located at a crossroads between east and west, about 70 nautical miles from the vital Straits of Hormuz shipping corridor. I had the opportunity to visit this extremely impressive hub last September. It was announced this week that Argus has just launched the first price assessments for low-sulphur fuel oil in the Fujairah market. These are the first assessments to be launched for the quality of fuel needed to comply with the International Maritime Organisation's new sulphur limits for marine fuel. This new price assessment, which will come into effect in 2020, presents a strong opportunity for the development of independent pricing in Fujairah, the region's largest trading and bunkering hub.

After our luncheon, the third and final session, moderated by Dr. Steven Knell of IHS Markit, will highlight climate-related financial disclosures and the impact on global investment in the oil industry. This is a very timely subject and likely to impact investment, particularly in long-term cycles of the oil industry, given the slow recovery in investment outside of the US shale industry.

To ensure an open and productive discussion, today's deliberations will be held under the Chatham House rule. Each session will begin with an introduction by the moderator, followed by short presentations on each session topic. This will set the scene for the interactive deliberations, which will also feature remarks by the discussants and other participating experts.

Now, I would like to invite my distinguished friends and fellow organizers from the IEF and the IEA to deliver their remarks, starting with His Excellency, the Secretary General of the IEF, Dr. Sun Xiansheng.

****

Dr Sun Xiansheng,
Secretary General, IEF

28 March 2019 Vienna, Austria

Your Excellency, Ladies and Gentlemen!

It is a great pleasure to be so graciously hosted by my good friend His Excellency Mohammed Sanusi Barkindo, Secretary General of the Organization of the Petroleum Exporting Countries, today at this Third Joint IEA-IEF-OPEC Technical Meeting on Physical and Financial Energy Market Interactions.

Your Excellency, Dear Mohammed, in this age of change and uncertainty, allow me to compliment and thank you here in your headquarters for your unwavering dedication and unrelenting efforts on behalf of the Organisation of Petroleum Exporting Countries to energy market stability. A strong and healthy global economy benefits from your steady and visible hand on the steering wheel.

Having just concluded the Ninth IEA-IEF-OPEC Symposium on Energy Outlooks, alongside two meetings in partnership with the European Union and the King Abdullah Petroleum Studies and Research Centre late February in Riyadh, it is good to see so many new and old friends in the beautiful city of Vienna.

This includes of course Neil Atkinson, Head of the Oil Markets and Industry Division of the International Energy Agency, and Editor of the IEA Oil Market Report, representing IEA here today.

Dear Neil, I would like to take this opportunity to congratulate you with the launch of the IEA's medium-term Oil 2019 report just two weeks ago in Houston, and with the rich analysis and interesting outlooks it provides.

We do hope that you will one day join us at the next 10th IEA-IEF-OPEC Symposium on Energy Outlooks in Riyadh, you are welcome any time!

We launched this dialogue on the Interactions between Physical and Financial Energy Markets, after a period of increased oil market volatility, at the 12th IEF Ministerial Meeting in Cancun on 2010.

They form the third pillar of the Trilateral Work Programme that the Cancun Ministerial Declaration established between our three organisations to enhance energy market transparency and deepen collective insight into these complex physical and financial interactions.

Just as comparing outlooks has become easier over successive meetings and dialogue on is now better informed and more collegial, so too are physical and financial energy market dynamics better understood thanks to the meetings we held over the years.

Energy market and policy developments will continue to surprise. A continued commitment to global dialogue to strengthen energy security world-wide therefore remains essential to all stakeholders.

Alongside our work in the trilateral work programme, and exchanges with knowledge partners far and wide, the energy dialogue has gained vibrancy and reach. We look forward to the

- 8th Asian Ministerial Energy Roundtable that the United Arab Emirates will host in Abu Dhabi on 9-10 September 2019 with India as co-host, and the
- 17th International Energy Forum Ministerial taking pace in China in 2020 with Morocco as co-hosting country.

Your Excellencies, Ladies, and Gentleman let me share my observations on current energy market developments.

First on one hand, we note that markets are rebalancing thanks to the supply adjustments under the Declaration of Cooperation OPEC and non-OPEC producing countries agreed to extend at the:

- 175th Meeting of the OPEC Conference, and the
- 5th OPEC and non-OPEC Ministerial Meeting on 6 and 7 December 2018 and reviewed just recently at the
- 13th Joint Ministerial Monitoring Committee in Baku, Azerbaijan on 18 March 2019.

On the other hand, further market balancing may suffer delays due to:

- Stellar growth of US shale production,
- Rising risks of an economic slow-down,
- Financial market imbalances, and
- Geopolitics.

Our meetings have proven their relevance over the years.

While oil market volatility is better understood, the capricious nature of oil and financial markets, on which so much depends, remains. Physical and financial energy market interactions must be kept under close review, through open and well informed dialogue therefore.

Our objective is not to arrive at fixed conclusions, but rather to share views and identify shifts and new emerging issues as physical and financial energy markets evolve.

Today physical and financial energy market interactions are driven by the:

- Recent oil market swings that reward cost reductions and enable unconventional producers to hedge production,
- The evolving role of financial and trading firms that have altered risk management options available to all,
- The impact of financial policy and regulation that affect credit lines, and position limits
- And finally, developments in market structure, such as the shift in oil trade to Asia giving rise to new price discovery mechanisms here

I look forward learning more about the developments in crude oil futures exchanges and the emergence of new crude oil benchmarks and their impact on regional markets.

Many new policy developments are taking place too, as the challenge to keep climate change within acceptable thresholds commands attention.

We are compelled to view physical financial energy market interactions not only through the lens of energy market stability, but with sustainability in mind as well.

It is therefore that we explore the issue of climate-related financial disclosures and their impact on global investment in the oil industry with great care for energy security and the legacy we leave.

Thank you, I look forward to our discussions.

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Neil Atkinson,
Head of the Oil Industry and Markets Division, IEA

Vienna, 28 March 2019

On behalf of the Executive Director of the IEA, Dr Fatih Birol, as the joint host of the workshop would like to join my distinguished colleagues HE Mr Barkindo and He Dr Sun in welcoming our participants to the OPEC headquarters. This is the latest in a series of workshops on today's theme that I have attended since I joined the IEA and I am sure that today's event will be as excellent as the previous ones.

This meeting is of course not the only occasion when the host organisations interact with market players. We note that His Excellency the Secretary-General of OPEC has made great efforts to improve communication, and his recent dinner meeting in Houston with US oil producers was a well- reported example. Financial actors are also regular participants in events attended by IEA/OPEC/IEF officials .

As far as the IEA is concerned, our full members and associate members now represent about 70% of global oil consumption and our inter-action is expanding. We are in regular dialogue with our member governments, non-member governments, energy companies, banks, trading companies, and other interested parties to exchange views on a wide range of topics; not least in trying to understand how the enormous weight of investor money is influencing the market and, of course, keeping up with the growing importance of machine learning and algorithmic trading and many other developments.

Our friends in the IEF do a valuable job in bringing together many of the contacts that OPEC and the IEA have in common in their experts' meetings around the world, most notably the IEA-IEF-OPEC Symposium on Energy Outlooks held in February in Saudi Arabia.

It is true to say that there is never a dull year in oil markets and since last year's edition of this meeting geopolitical factors have once again played a very important role. The latter part of 2018 saw significant market volatility with Brent prices climbing to $86/b and thirty five days later falling to $50/b. Efforts are being made to re-balance the market and restore stability and Brent prices have, for now, settled in a relatively narrow range around $65/b. In fact, prices are almost exactly the same as when we met in March last year.

Finally, I would like to say how much the IEA welcomes the session in this meeting devoted to climate-related issues. A core part of the IEA's work is devoted to the broad theme of the clean energy transition, and there are major challenges for the oil companies in playing their part in this long-term process.

So, there is no shortage of willingness to talk and learn, and there is more than ever to talk about. I'm looking forward to a successful meeting.

Thank you.

****

Presentations

1. **Oil market volatility and the implementation of the Declaration of Cooperation** – *James Gooder, Argus*

2. **The Interaction Between Physical and Financial Energy Markets** – *Chaitanya Mehra, Echion Capital Management (no permission for publication)*

3. **Interactions of Financial Markets and Oil Price**s – David Chang, Wellington Management

4. **A Look at Late 2018 Crude Oil Futures Price Volatility - EU-Vienna approved** – *Jason Bloom, Invesco Capital (no permission for publication)*

5. **The Dynamics & Structure of Modern Crude Markets** – *Mike Davis, ICE Futures Europe*

6. **INE and the search for the third benchmark** – *Owain Johnson, CME Group (no permission for publication)*

7. **The Battle for a Gulf Crude Contract** – *Jonty Rushforth, Platts*

8. **The Evolution of North Sea Dated** – *Michael Carolan, Argus*

9. **Investors' point of view** – *Michael Eckhart, Citigroup*

10. **Integrating climate into our strategy** – *Etienne Anglès d'Auriac, Total*

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Oil market volatility and the implementation of the Declaration of Cooperation

3rd Joint IEA-IEF-OPEC Technical Meeting on the Interactions between Physical and Financial Energy Markets
OPEC Secretariat
Vienna

James Gooder (VP Crude)
28 March 2019

London
Houston
Moscow
Singapore
Dubai
New York
Beijing
Kiev
Tokyo
Astana
Shanghai
Rio de Janeiro
Washington DC
Riga
Calgary
Brussels
Cape Town
Mexico City
Berlin
San Francisco
Sydney

Market Reporting
Consulting
Events

illuminating the markets

The Argus view

- One of the world's leading PRAs, Argus is a team of more than 900 staff members in 22 global offices
- Publishing more than 11,000 daily spot and forward price assessments, plus market intelligence for world commodities markets
- Coverage includes:
  - Energy
  - Fertilizers
  - Petrochemicals
  - Metals
- Services
  - Price reporting and indexation
  - Consulting
  - Conferences
- Indexation examples
  - US crude oil
  - US and European refined products
  - Europe and Asia LPG
  - US and European environmental markets

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Volatility arises from:

- Changing circumstances
- Uncertainty, exuberance and fear
- Poor information

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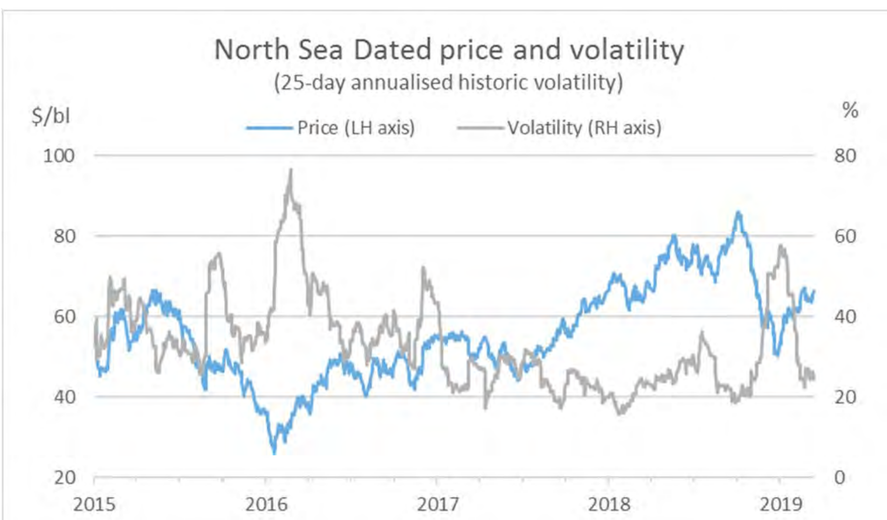
Volatility greatest during periods of large price moves



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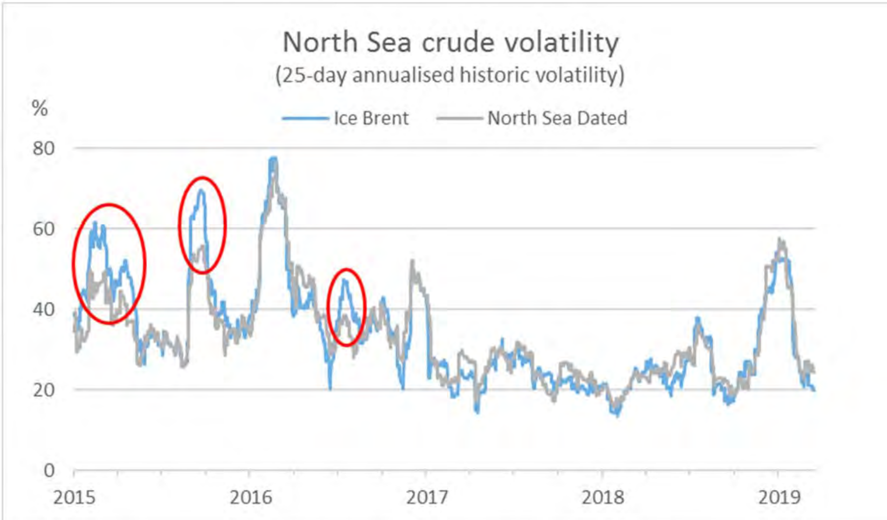
Spot and futures usually follow a similar trend, but…



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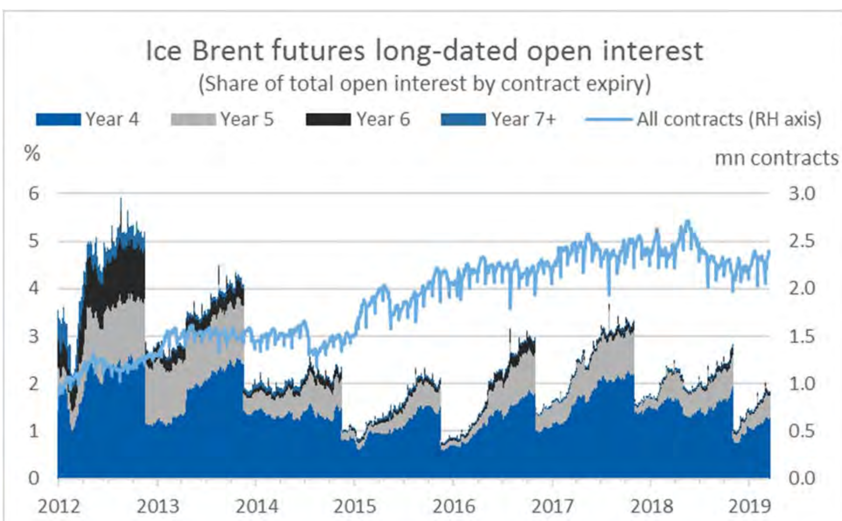
Futures open interest is concentrated in near term



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Oil trade is speculation

- Trade is forward-looking – fundamentals information is backward-looking
- The current policy environment is volatile.
- Hedging instruments are subject to volatility and the same impulses as spot trade.

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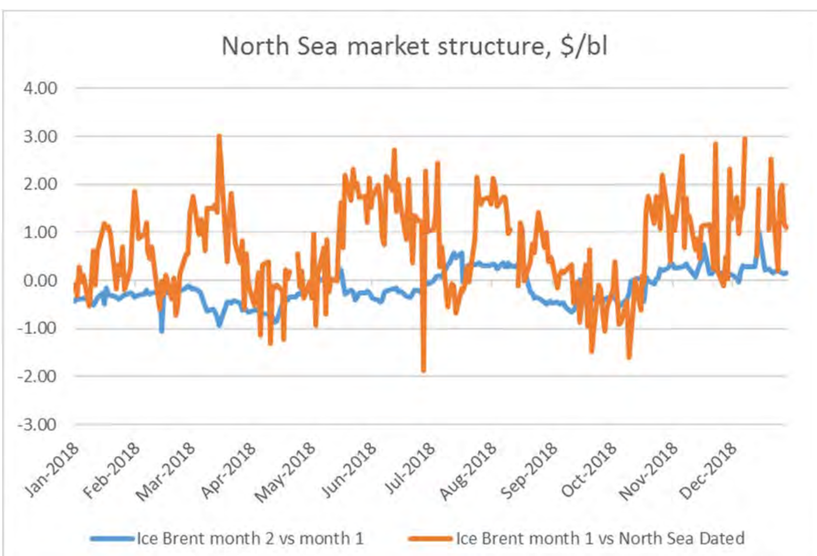
NS Dated and Brent futures - a volatile relationship



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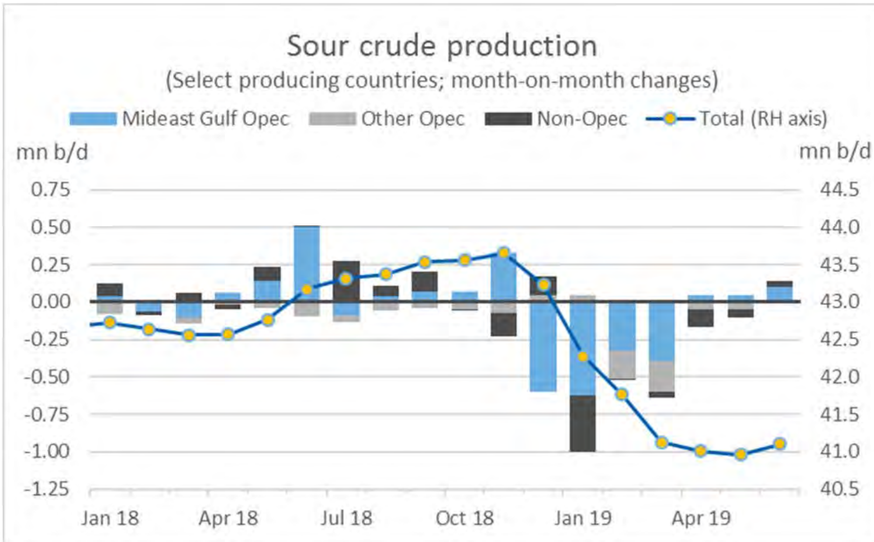
Latest Opec/non-Opec agreement takes effect



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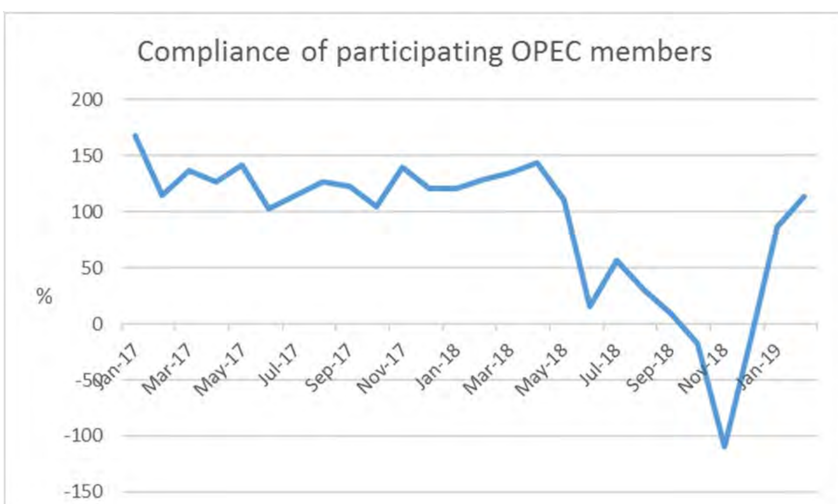
Compliance by Opec members has been high



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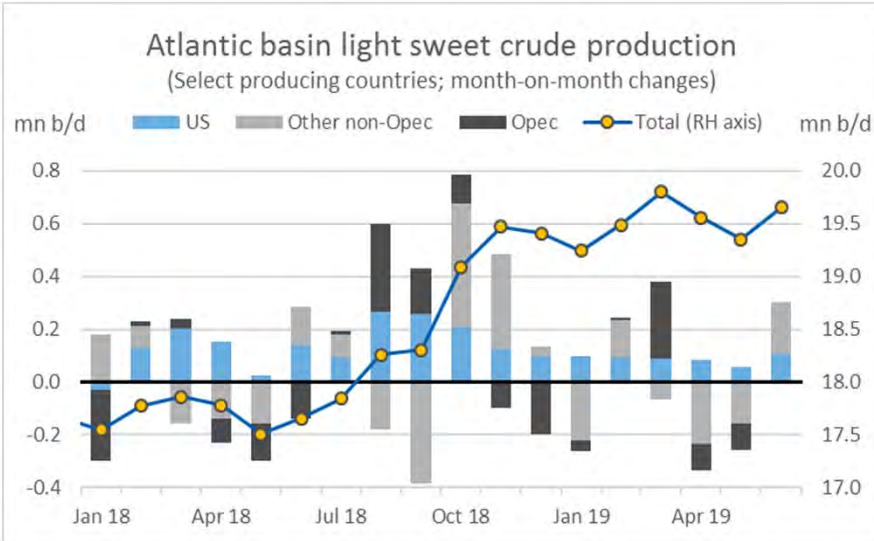
US output continues to grow



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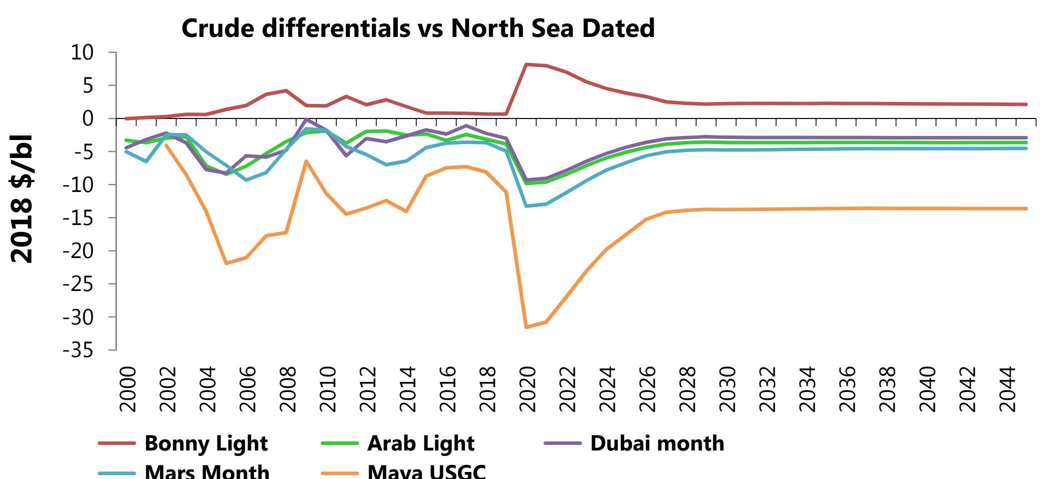
Crude oil spreads – expect a pronounced but temporary IMO effect



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In summary

- Volatility is unavoidable. Currently driven by disruptive and unpredictable policy decisions.
- Physical spot prices help to anchor forward markets in reality.
- The Opec/non-Opec agreements have supported markets but can only go so far.
- They have helped to exacerbate shortages in the supply of heavier sourer crudes.
- US shale production and exports are quicker to react to market signals than conventional oil.

Thanks for listening!

James Gooder
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Interactions of Financial Markets and Oil Prices

3rd Joint IEA-IEF-OPEC Technical Meeting on the interactions between physical and financial energy markets

28 March 2019

David A. Chang, CFA
Senior Managing Director and Commodities Portfolio Manager

Conclusions

Not all financial participants are the same
CTAs, Algos and Risk Premia have different drivers

Massive size and highly **active** in aggregate
They can move 400 million financial barrels in a quarter

Greater volume but **less market depth**

Amplify short-term volatility of oil prices and extremes
Three 40% quarterly declines in 4 years

Maximizing return relative to volatility is their only agenda

Goals

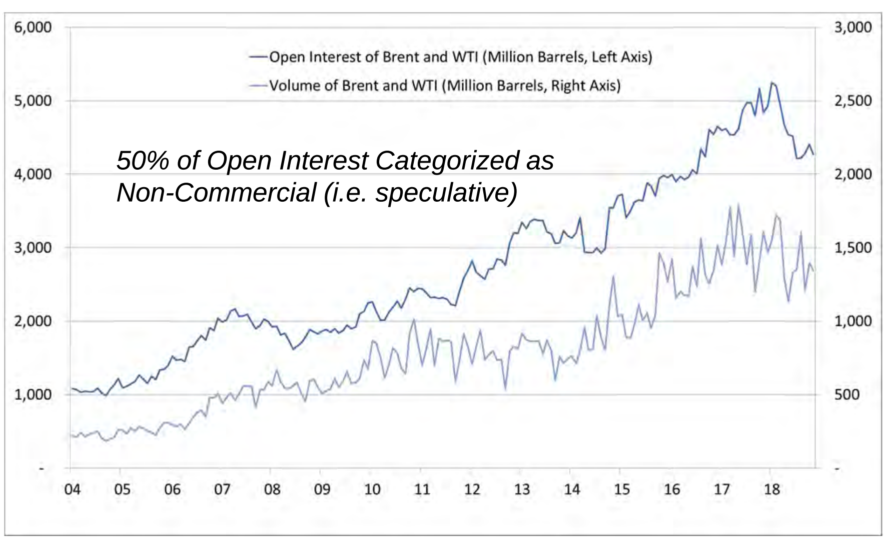
Quantify the size of CTAs, HFTs and Risk Premia

Summarize their behavior and impact

Draw implications for the physical oil community

Financial Oil Markets Are Massive

Open Interest and Volumes Doubled in Last Decade



Source: Bloomberg

Systematic Participants Have Outgrown Fundamental Traders

Algos/HFTs: Top Contributors to Daily Exchange Volume

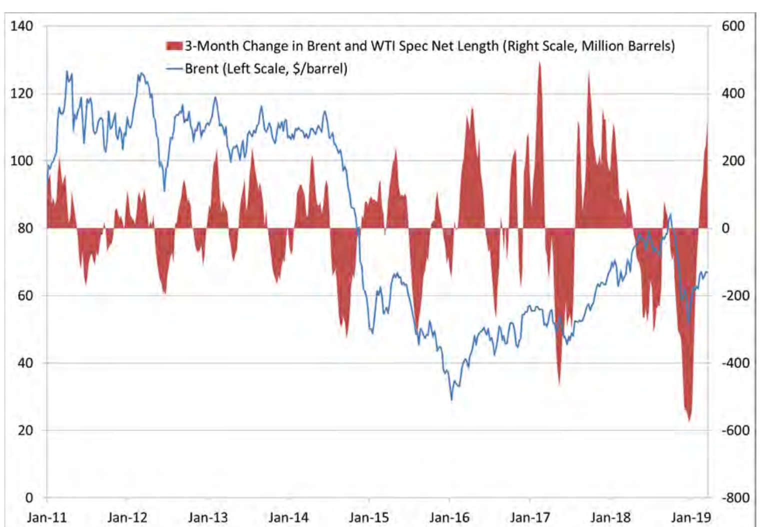
CTAs: $200-300 billion invested across energy

Risk Premium Strategies: $250-300 billion in commodities

Institutional Investors: $150 billion in commodities

Commodity ETFs: $200 billion across commodities

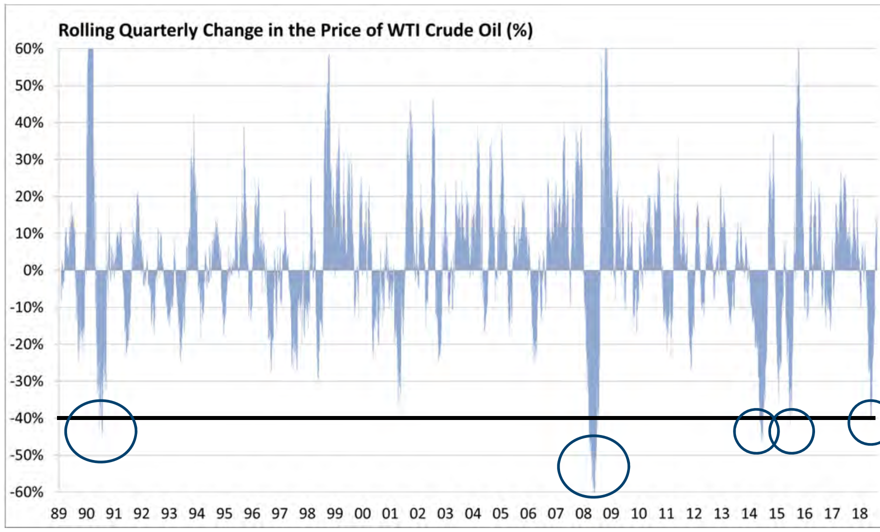
In Aggregate Specs Can Shift over 400 Million Financial Barrels in a Quarter



Source: Bloomberg, CFTC

Greater Short-Term Downside Volatility

Three 40% Corrections in 4 Years



Source: Bloomberg

Algos and High Frequency Traders (HFTs)

Prefer large established markets
  Oil is one of the world's most active financial markets

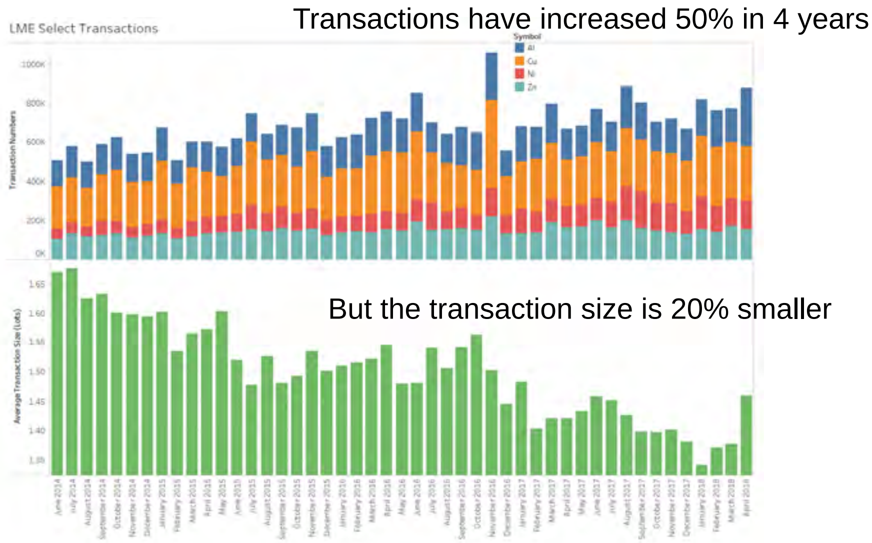
Dominate exchange-traded volume
  Top 10 oil futures market participants

Carry no specific agenda and **indifferent to price**

Liquidity providers turn into liquidity consumers
  More transactions but **less market depth**

Consistently **risk neutral**

HFTs: Good or Bad for Liquidity
It depends on your perspective



Source: Marex Spectron

HFTs: More Trades and Less Liquidity
Social size is a single contract

Source: Marex Spectron

Commodity Trading Advisors (CTAs)

Trend following and driven by price momentum

Trade across liquid derivatives markets

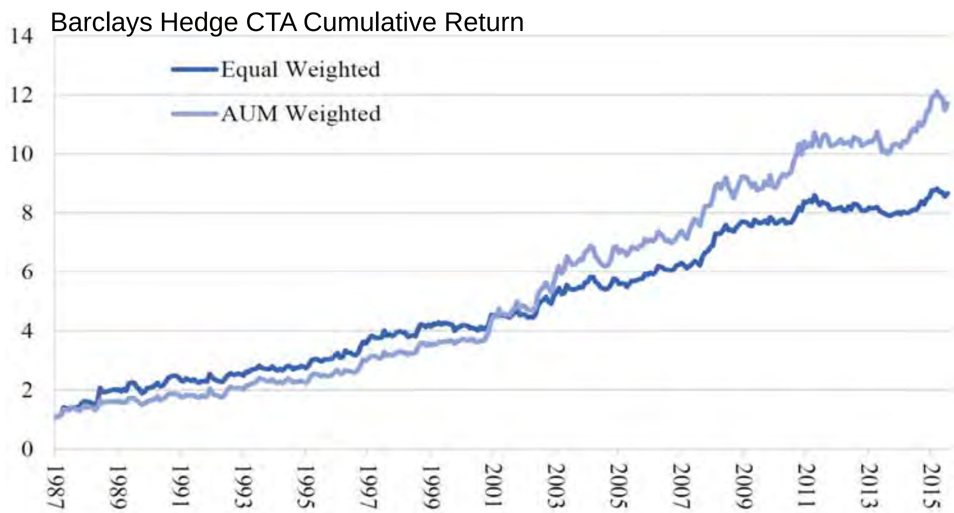
Strict risk controls

Increased sophistication and highly adaptive

Holdings average between 2 and 4 weeks

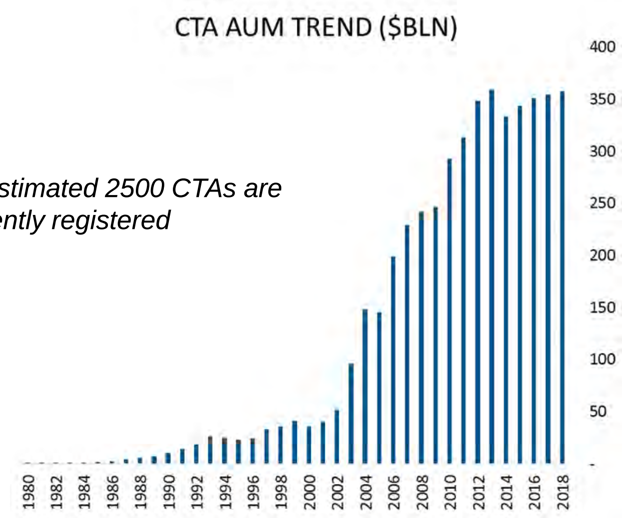
Shorter timeframes increasingly favored

CTA Returns Have Been Strong and Uncorrelated



Source: Barclays

CTAs: Number and size has consistently increased in the last decade



An estimated 2500 CTAs are currently registered

Source: Macquarie Bank

Alternative Risk Premia

Growing pool of assets

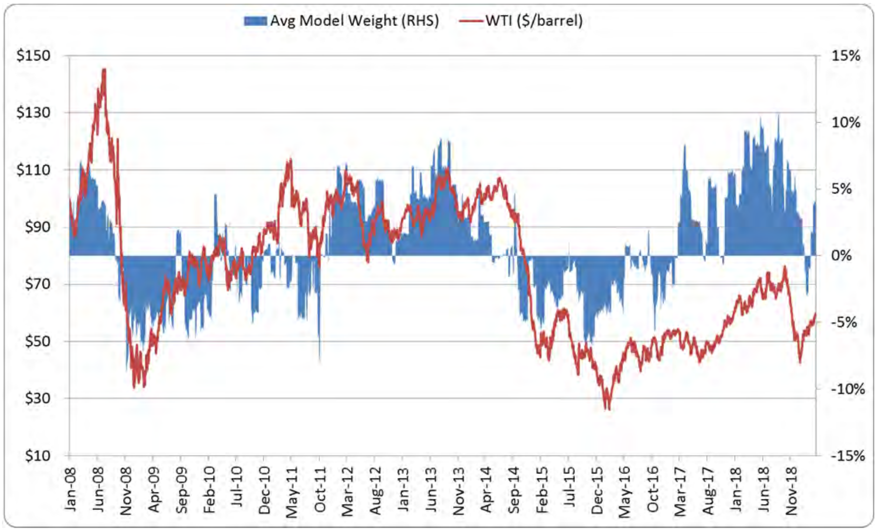
Uncorrelated to traditional assets

Balanced risk approach across asset classes looking to "optimize" Sharp Rations

"Factor" based strategies:
- Carry
- Volatility
- Momentum

Reduce risk when volatility increases

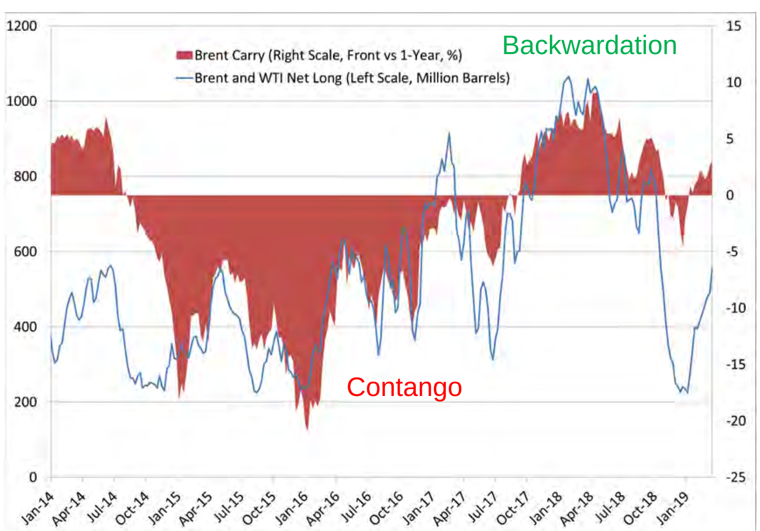
Alternative Risk Premia Strategies Amplify Underlying Moves



Source: Wellington Management

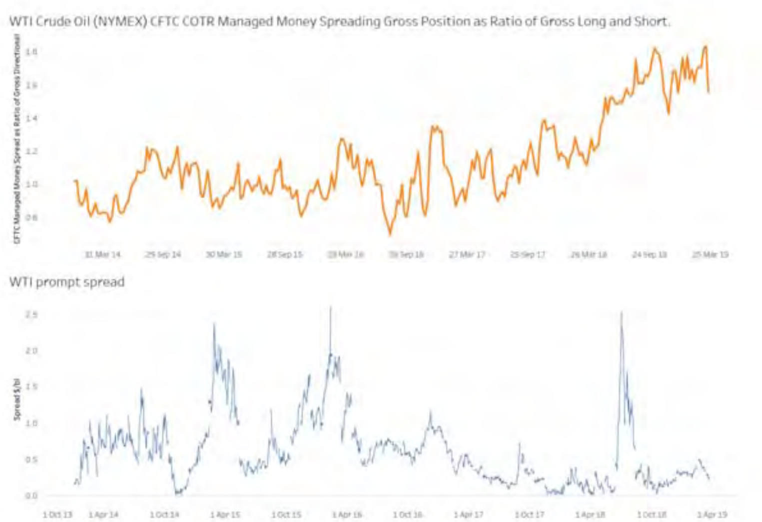
The Carry Influences Money Flows

Backwardation attracts speculative length



Source: Bloomberg

Positioning Increasingly Calendar Spread Based vs Outright Long or Short



Source: Marex Spectron

Implications

Technology has introduced new market conditions

Systematic oil market community can destabilize short-term oil prices

Greater short-term volatility discourages capital investment by elevating the required rate of return

“Price Stability” is an important message that needs to be consistently communicated

The carry is a powerful quantitative signal that OPEC can manage through inventories

The Dynamics & Structure of Modern Crude Markets

The New Paradigm for Physical & Financial Oil: An Exchange Perspective

3rd Joint IEA-IEF-OPEC Meeting

Mike Davis, Head of Market Development, ICE Futures Europe

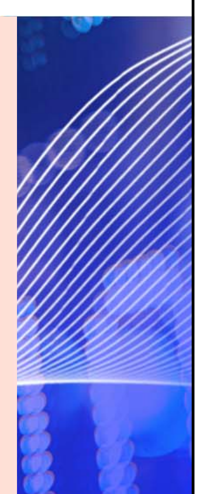
28 March 2019

Introduction to ICE

A Global Exchange Partner and Benchmark Innovator

Intercontinental Exchange (NYSE: ICE) builds, operates and transforms global markets through information, technology and expertise.

We bring transparency, efficiency and market access to participants around the globe.



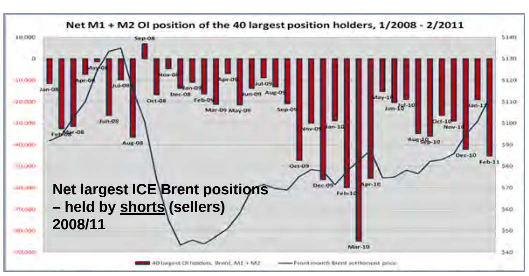
Oil Markets and Benchmarks – Why we should care

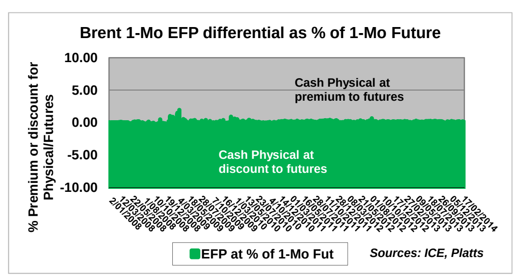
Benchmark is as Benchmark does: Price Discovery Risk & Liquidity

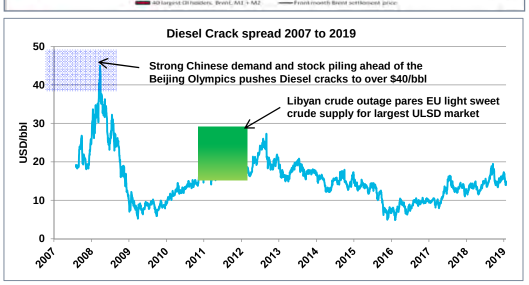
- Price benchmarks do the 'heavy lifting' for oil price discovery, enabling other grades to be traded in reference to the most liquid flat price instruments, providing security and liquidity to the whole market
- Most oil is sold on an unknown forward average flat price, suiting all parties
- Spot physical trade only represents around 5% of the total; the remainder is contract or 'term' pricing (on a monthly average typically)
- Price is a key driver to producers, refiners and end-users. Determines whether fields are explored, developed or closed down; and refineries built/sold
- Price reporting agencies help to re-fix those floating average prices, and risk management tools enable values to be discovered, tested and secured
- Modern risk tools like screen-based futures provide price discovery in flat price terms and potentially exact hedges for all physical types of oil

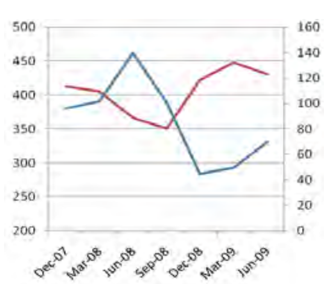
Oil Benchmark evolution a multi-year process, multiple drivers

A decade since the financial crisis, fundamentals and regulatory drivers in motion: a backwards look









Crude Oil Index Fund Activity 2008/9: ***NEGATIVELY*** Correlated Crude Index fund position vs. Price

Index net long position
CrudePrice

Interagency Task Force on Commodity Markets

2008 Forensic Examination of Commodity markets exonerated derivative markets

"The Task Force's preliminary assessment is that current oil prices and the increase in oil prices between January 2003 and June 2008 are largely due to fundamental supply and demand factors….analysis to date does not support the proposition that speculative activity has systematically driven changes in oil prices…. Any upward price pressure exerted by the long positions of future dealers commodity index clients has largely been offset by the short positions of the dealers' other clients."

"The Task Force has found that the activity of market participants often described as "speculators" has not resulted in systematic changes in price over the last five and a half years. On the contrary, most speculative traders typically alter their positions following price changes, suggesting that they are responding to new information – just as one would expect in an efficiently operating market. In particular, the positions of hedge funds appear to have moved inversely with the preceding price changes, suggesting instead that their positions might have provided a buffer against volatility-inducing shocks."

Interagency Task Force participants include the Commodity Futures Trading Commission, staff from the Departments of Agriculture, Energy, and the Treasury, the Board of Governors of the Federal Reserve System, the Federal Trade Commission, and the Securities & Exchange Commission.

Oil Benchmark evolution a multi-year process, multiple drivers

Oil Instrument Evolution: Fundamental and Price Drivers (Arbitrage)

Time has moved on, but historical echoes in current conditions

1. Major changes in crude going on right now - interesting parallels with 2008 in terms of degree of mismatch between the crude that is available and the ideal slate
2. Hard to recall a time of greater change globally - need our core benchmarks as anchors
3. Product rotation, crude production growth, refinery capacity growth/upgrading, fuel desulphurisation

Benchmark evolution multi-year process:

1. Oil benchmarks evolved into composite 'brands'
2. From local entities to being global assets, though still subject also to their local fundamentals as well as global ones:
3. 3 primary ones- Brent, Dubai and WTI
4. Have effectively become 'brand' names - names not necessarily helpful
5. Composite benchmarks, not a weakness but a strength

Perceptions around Price volatility drove regulatory change

Mismatch between available marginal crude barrel (AG Sour then, LTO now) vs. clean product demand (esp. Diesel, IMO FO components vs. light ends)

Some Parallels with 2018/9 in that respect

Dodd Frank (2010) and other legislation a response to swap regulatory concerns from 2008

- **OTC bilateral went on-exchange and cleared as futures**
- Margin requirements, initial and variation: Intraday margining up to 6 times a day is very reactive to stress conditions
- Multilateral netting in Clearing Houses a more accurate and diversified alignment of risk with trading cost
- Price transparency through daily settlements of OTC instruments
- All contributed to an enhanced safety margin for such valuable commercial instruments alongside the largest futures benchmarks such as Brent and WTI

De-risking Vertical model features include:

- Vertically integrated exchange/clearing
- Model allowed effective warehousing and aggregation of risk
- Cleared instruments and margin to cover off risk rather than allowing bilateral counterparty risk. Intraday margining up to 6 times a day is very reactive to stress conditions
- Inherent diversification of risk within very regulated clearing houses with multiple contingency funds. Exchanges a gold standard for centralised regulation, transparency, data

See: “ICE shifts OTC energy swaps to futures” (FT 31/7/2012)
https://www.ft.com/content/6a915f24-db12-11e1-8074-00144feab49a

Linkages – Benchmarks as ‘Anchor’ points for related prices

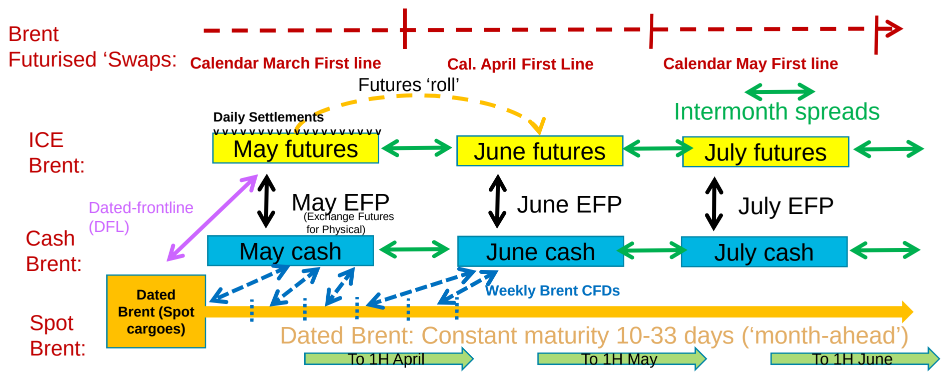
A co-dependency of price through fundamentals

Global oil & refined product inter-relationships in liquidity and price

Region	Global			Asia		US		
Primary Crude (*Future)	(ICE) Brent Crude *			Dubai * Sweet/sour diff		WTI *		Permian LTO *
Ancillary crude			Urals		ESPO	LLS, Mars, ASCI		
Price/liquidity Link				Cracks to..				
Primary product (*Future)	ICE Gasoil* (EU)	Euro-Bob Gasoline Barges	Fuel Oil 3.5% Rdam Barge	Singapore 0.5% Gasoil	Singapore 180CST FO	NYH RBOB*	NYH Heat*	USGC 3% FO
Price/liquidity Linkage			Spreads/diffs	(including some cracks) to...				
Secondary product examples Price/liquidity Linkage up/down and across chains/regions and via cracks to crudes	10ppm Diesel barges Rdam ----------- 0.1% NWE Cargoes Jet CIF NWE ---------- Jet Cargo CIF NWE	Naphtha CIF NWE ----------- Gasoline FOB NWE Cargoes	FO 1% Cargoes NWE ----------- FO 1% CIF MED Cargoes	Jet (Regrade) FOB Sing --------------- Singapore 0.05% Gasoil	Singapore 380CST Fuel Oil	RBOB to Euro Oxy Gasoline	USGC Jet -------- NYH Heat Barge	USGC 1% FO

The ICE Brent Complex

Price Interdependency between physical and financial: ensuring convergence



Crude benchmark landscape evolving by quality and location

1. Brent the Global Standard

Brent has two major benchmarks, each evolving, in physical and derivative forms

- Dated & ICE Brent (+ related instruments)

Physical markets evolution

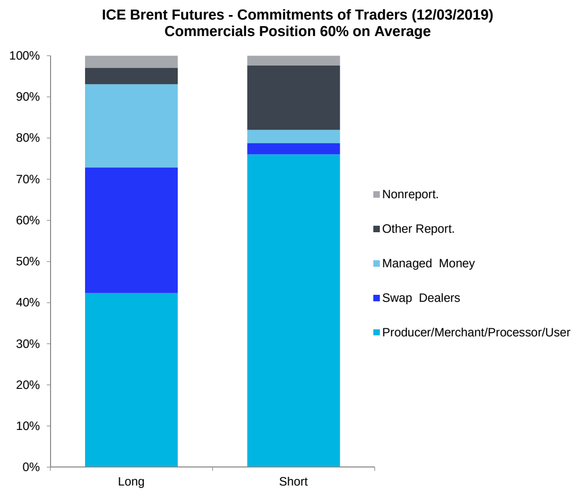
- Dates out to month-ahead
- BFOET and now CIF indications also accepted

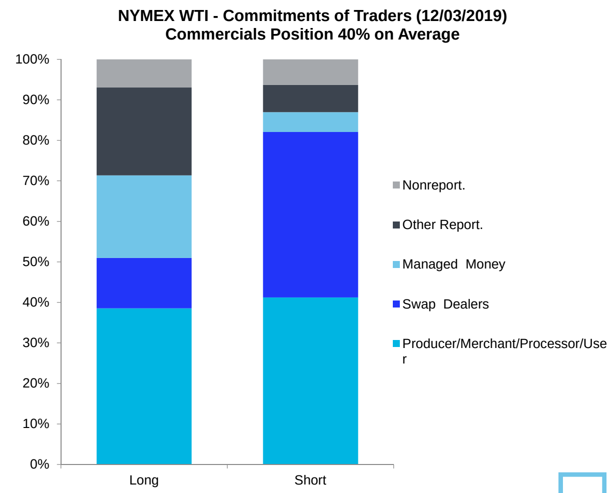
Futures

- ICE Brent Index saw first changes in 30 years late last year:
- capture twice as many relevant indications in the process, easier to hedge
- 5 mini-windows ensure less volatile expiry process
- without moving away from the core M1 full cargo physical cash market for which it solves
- EFP market ensures evergreen convertibility between physical & futures markets
- ICE Futures to 2028, more use of secondary derivatives - supreme confidence in benchmark

ICE Brent futures market

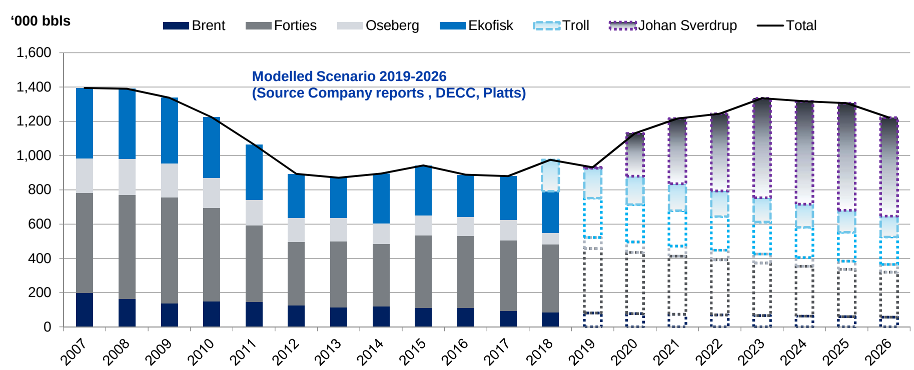
Most closely aligned with global physical crude





Brent: A benchmark scenario 2019-2026

The Anglo-Norwegian option

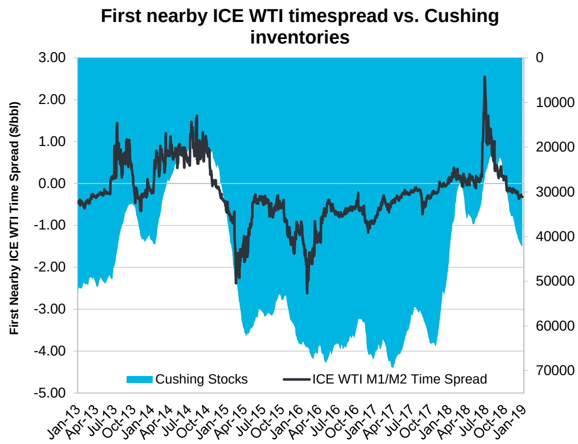


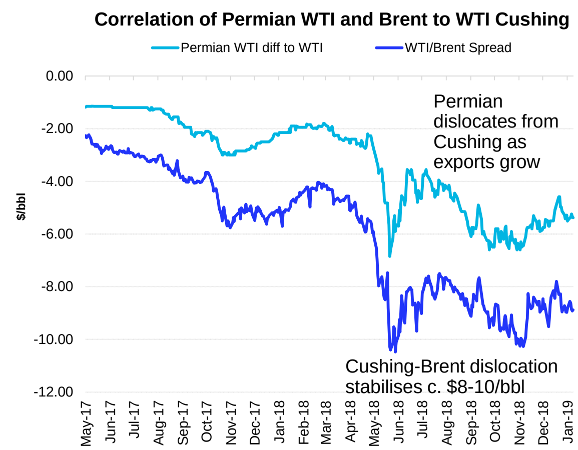
Assumptions:

- Decline rates for legacy BFOE and Troll of 12% p.a. after 2017 (Pre-Buzzard maintenance level)
- Johan Sverdrup added from 2020 (Largest N.Sea candidate for medium-term impact)

2. WTI: Fastest changing benchmark

US production growth, export and infrastructure catch-up (still..)

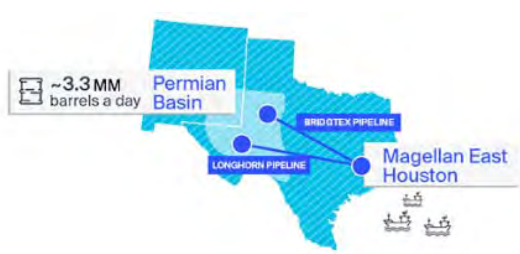




WTI in motion

U.S. Export barrels pricing – the switch from Cushing to Gulf Coast

ICE Permian WTI Futures (HOU)



- A predictable quality specification that reflects Permian WTI crude delivered directly from the Permian Basin.
- Deliverable into the MEH Terminal off the Bridge Tex and Longhorn pipelines and tested at the origin and destination.
- Full quality specifications are published in the Magellan Tariff for the above mentioned pipelines.

WTI in motion

Cushing's era time-bound as takeaway capacity grows?

WTI changing as US infrastructures key pivot moves to USGC from mid continent, more change to come, takeaway capacity for Cushing may bring more volatility there

- For WTI-Brent the 'real' diff is Brent-Permian, expressed through our tradeable diff
- When WTI reaches the water it is competing globally with and contributing to Brent-pricing waterborne liquidity
- WTI Cushing is the darling of US retail futures trade but less and less important for commercial hedgers
- Dynamic change in WTI also - US LTO revolution has added 5 mil b/day and 2 m b/day exports finding their way to Europe and even Asia - lots of 'light sweet', OPEC conserving its heavier grades - IMO influence critical
- LTO crude exports at 2 mil b/day changing the global equation, but can't assume it will be a baseload like other regional FOB stems, rotation in fields and qualities

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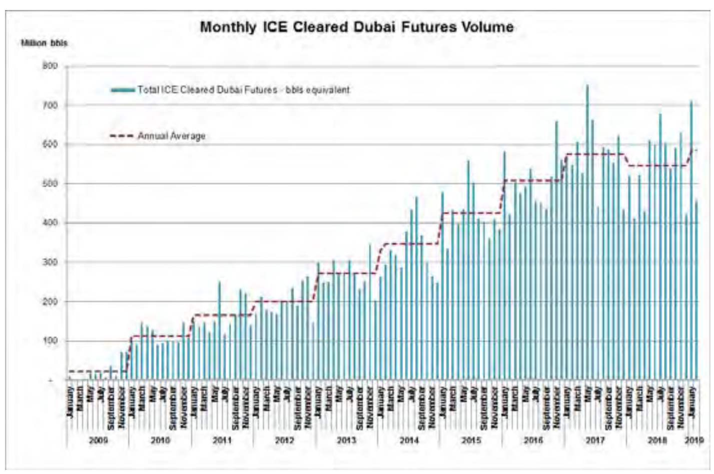
3. Dubai

Taking its place as global benchmark into Asia

- Composite of grades, aligned in our global crude benchmark package
- Dubai futures saw 10-fold growth in volumes over 5 years, and still growing - far and away the most consistently liquid instrument for the ME barrel
- Open interest averages 20+ times its closet Asian competitor, genuine forward curve
- Expect more innovation and growth in ME/AG market places
- NOCs on modernising influences- downstream, more product orientation and trade



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Refined products - Crude linkages

Critical fundamental convergence, where 2008 and 2019 echo - Despite LTO growth, Crude slate/product mismatch

Crude takes its cue from which products we value most highly and where

- All about the refined products
- LTO push to absorb very light ends, gasoline blending, shortage of heavier Naphtha
- Distillate drive essential for positive margin,
- Skew between deep conversion and skimmers reversed for a while
- Still some confusion about how will get to 0.5% requirement

Where next for Transport Fuels - the crude slate mismatch?

Distillate context amongst refined products

- Global crude slate versus clean product demand, different stresses in regions - EU close to 45%, US only 30%, much lower cetane
- Inherent tension between what changes are taking place in the global crude slate and what the product markets are looking for from the refining complex
- **Big changes afoot in US markets, have consequences in Distillates too:**
    - Brent always been a distillate crude, JS will help, but extra LS from US will have a bearing on Distillate and LS equation too, esp. to and beyond IMO
    - Upgrading capacity, distillate margin the only positive part of the barrel in early 2019, although gasoline was oversold and approach of driving season is correcting that imbalance

The Future(s) of Marine Fuel: Products and Crude prices in dynamic linkage

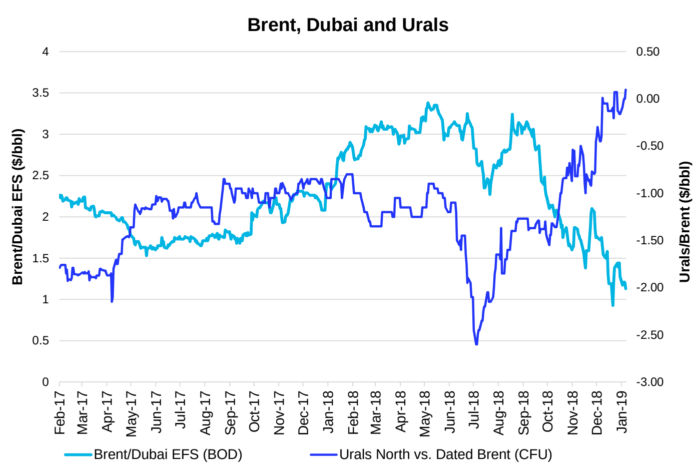
A slice of history to here and now

Available Crude Slate Influence? The 'shale' impact

- US LTO a godsend at this point
- But new refinery conversions a complicating factor
- Destroying fuel oil - drive to extract trapped value in those previously less valuable crudes and products
- FO increasingly a secondary feedstock with secondary units - more and more gasoil, not much FO left

IMO a major influence in narrowing Sweet/Sour Spread

In the face of IMO change and global slate shift to light sweet , Distillate-rich Urals at par to sweet-ish Brent, East-focused Dubai strengthens vs plentiful LTO

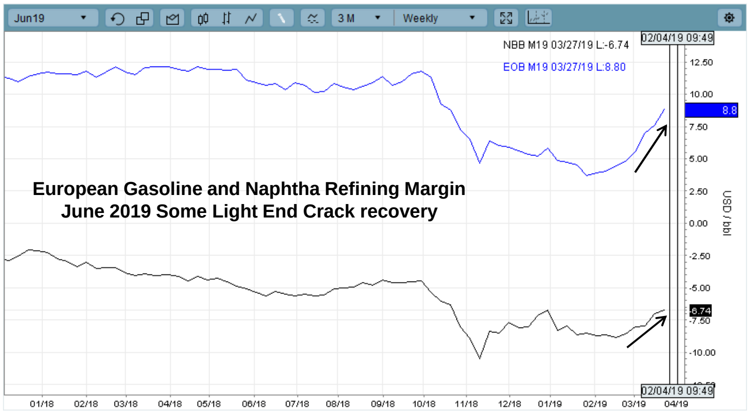


What it means

- Medium sour strengthening: Urals inverted
- Global surplus of light sweet depress Brent's premium to Dubai ; sweet-sour switch would worsen gasoline glut
- 1.1m bpd refining capacity in Q2 2019 to increase tightness of medium sour?
- **So everyone is competing for cheaper, Marine-fuel oriented crudes..**

European Refining Margins

Cross barrels views and yield switching



What it means: crude prices underpinned now?

- **Gasoline:** Until March **-** slow demand growth in Asia, US and Europe, complicated by rising gasoline supply from increasing refining capacity in Mid-East and Asia, and lightening crude slate
- **Naphtha**: Was dragged down by both competing petchem feedstock LPG's collapsing price, and weak gasoline blending

So all positive margin had been concentrated in Gasoil/Distillates (Gasoil down, FO up in price)

Questions?

Contacts and Resources

For more information on ICE oil products and data

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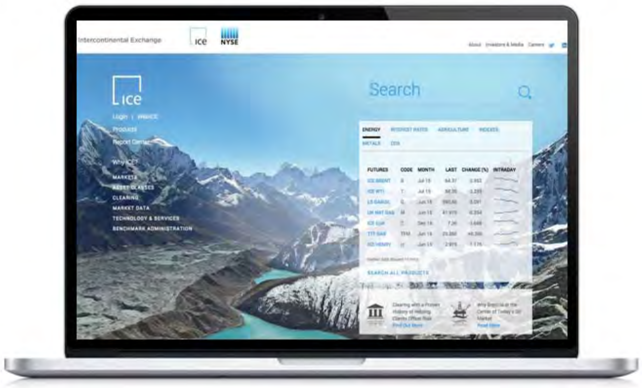
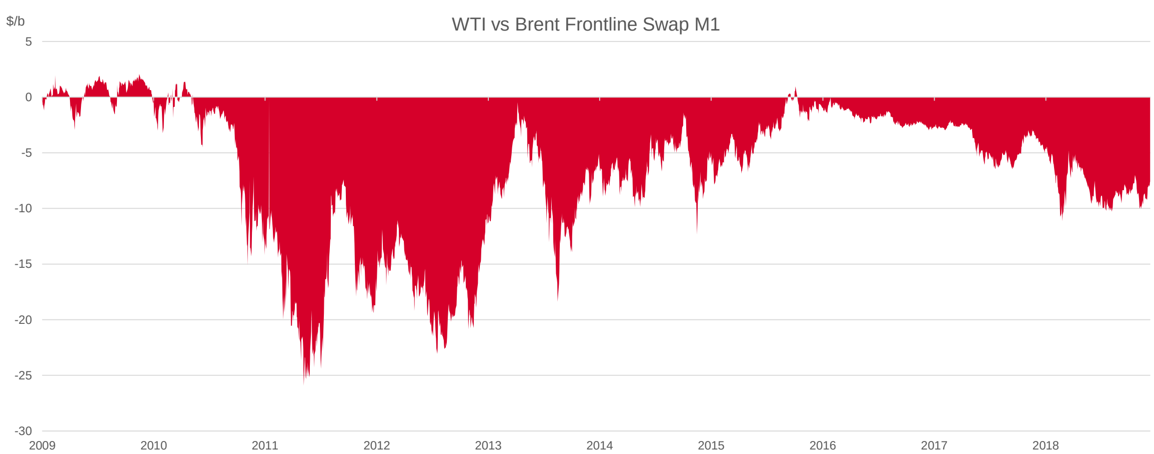


Jonty Rushforth, Senior Director, Price Group

The battle for a Gulf crude contract

S&P Global
Platts

WTI/Brent driven a broader look at US crude pricing



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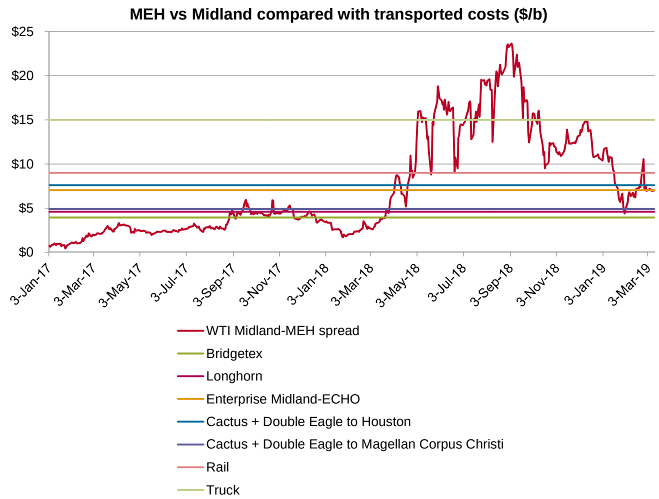
WTI Midland-Houston spread narrows with additional takeaway



Source: S&P Global Platts, Magellan, Enterprise, Plains All American, Kinder Morgan, sources

S&P Global Platts

Exchanges CME, ICE face off for USGC light sweet crude contract

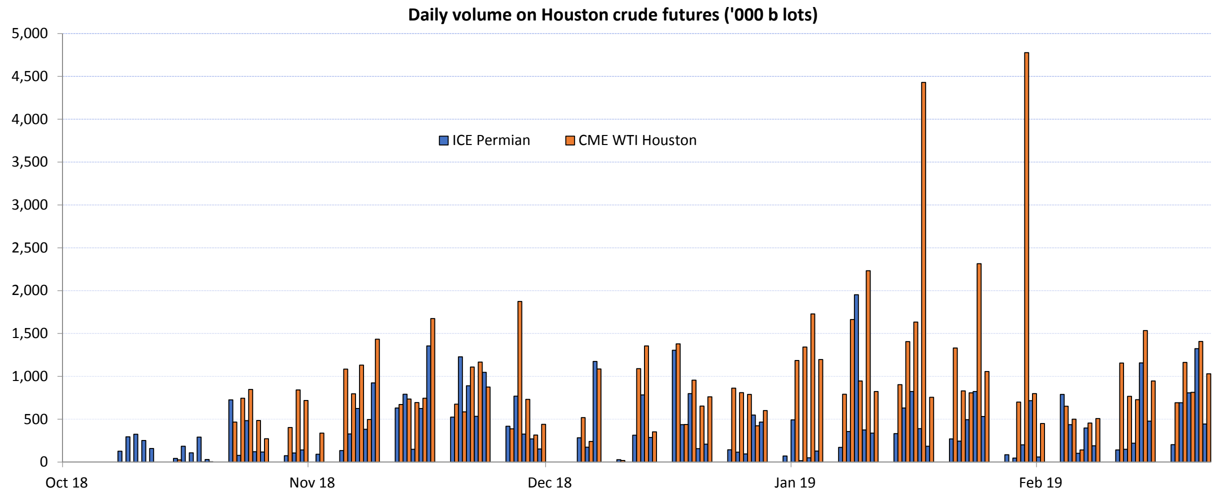
	CME WTI Cushing	CME WTI Houston	ICE Permian WTI
Contract unit	1,000 barrels	1,000 barrels	1,000 barrels
Listed contracts	“All” (9 years)	Months out to 3CY	96 months
API	37-42	40-44	36-44
Sulfur max	0.42%	0.275%	0.45%
Nickel max	8 ppm	4 ppm	-
Vanadium max	15 ppm	4 ppm	-
Delivery point	Enterprise Products Partners and Enbridge Pipeline terminals: Cushing, Oklahoma	Enterprise Crude Houston (ECHO), Enterprise Houston Ship Channel (EHSC) and Genoa Junction terminals: Greater Houston, Texas area	Magellan East Houston terminal: Houston, Texas

Source: CME, ICE

S&P Global Platts

S&P Global Platts

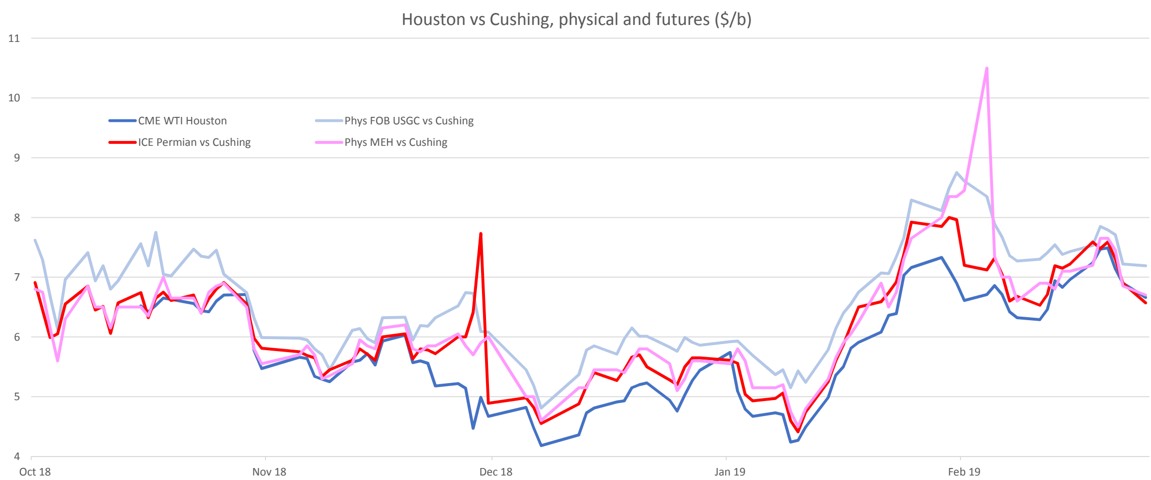
The story so far…



Sources: ICE, CME

S&P Global Platts

Both contracts in line with observed physical markets



Sources: ICE, CME, Platts

S&P Global Platts

S&P Global Platts

Permian pipeline build-out to support increased production

PLANNED PERMIAN PIPELINES

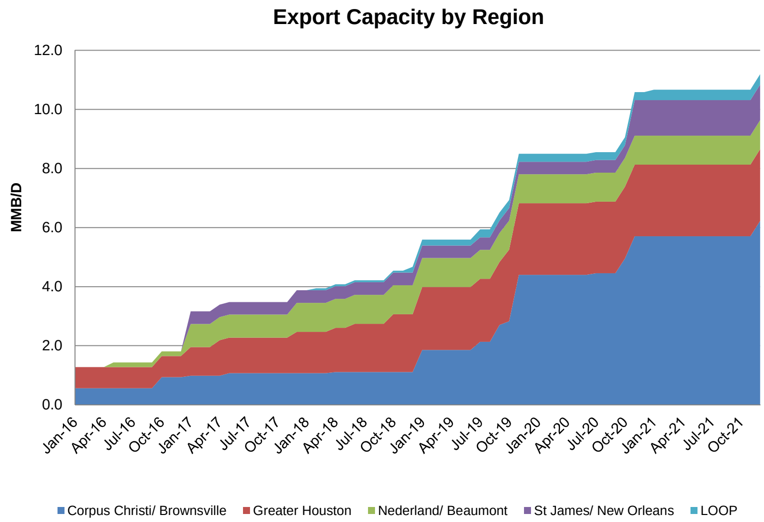
FIRST WAVE

Developer	Name	Capacity (b/d)	Destination	Start up
Phillips 66/Andeavor	Gray Oak	700,000	Corpus Christi, Sweeny/Freeport	Q3-19
EPIC Midstream	EPIC	675,000	Corpus Christi	Q3-19
Plains All American	Cactus II	650,000	Corpus Christi	Q3-19

SECOND WAVE

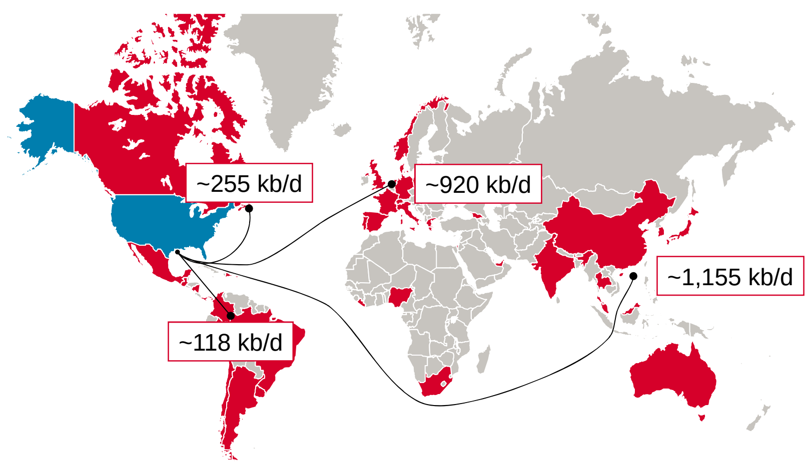
Developer	Name	Capacity (b/d)	Destination	Start up
Energy Transfer	Midland to Nederland	600,000	Nederland	2020
Jupiter Midstream	Jupiter	500,000	Brownsville	2020
ExxonMobil/Plains		1,000,000	US Gulf Coast	2020 (est.)

Source: S&P Global Platts



Source: S&P Global Platts Analytics

US waterborne crude exports average 2.5 million b/d Q1 2019



Source: S&P Global Platts Analytics

Valuing US crude exports

- Platts FOB USGC assessments reflect value of export cargoes from across the Gulf rather than a single location, expecting quality to be defined by spec rather than loadpoint
- Separate assessments for WTI, Bakken and Eagle Ford crude and condensate
- FOB prices reflect loadings from ports along the Gulf Coast, including Corpus Christi, Houston, Beaumont, Nederland, Port Arthur
- Methodology based on typical Aframax-sized cargo, reflecting most common export volume, loading 15-45 days forward
- Spot market notably focused more on European destinations at this size and period
- Asia trade tends to be CFR

Source: S&P Global Platts

FOB USGC values complement CFR North Asia, delivered NWE

CFR North Asia at Singapore close

WTI MEH	PCAQH00
LOOP Sour	PCAQI00

Assessed values include freight and other associated costs.

Launched March 2018.

Northwest Europe Delivered at London close

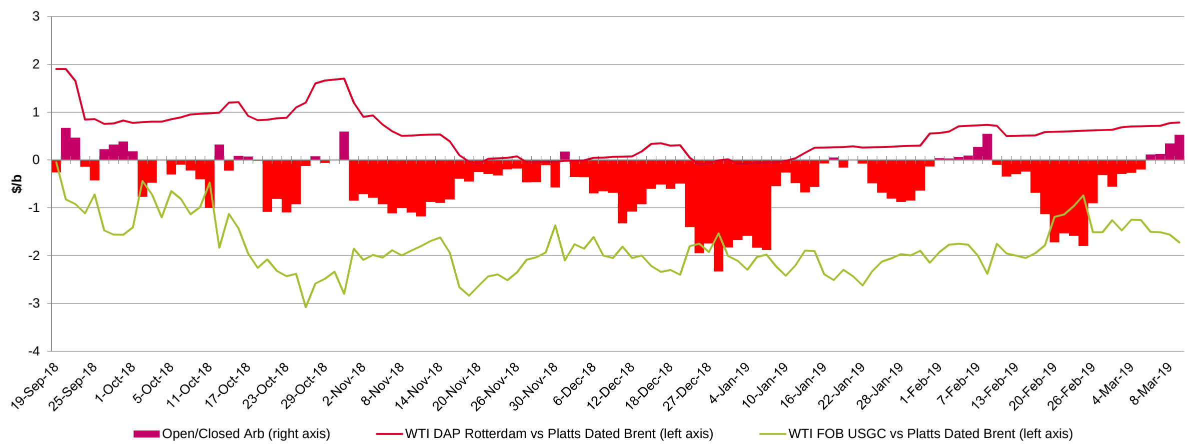
WTI Midland (Basis R'dam)	AWTIC00
WTI Midland (Basis Augusta)	AWTIA00
Eagle Ford 45 (Basis R'dam)	AEFAC00
Eagle Ford 45 (Basis Augusta)	AEFAA00

Priced on DAP basis as differential to 20-60 day forward Dated Brent strip.

Launched September 2018.

Source: S&P Global Platts

Suezmax/day of US crude to Europe despite scarce open spot arb



Source: S&P Global Platts

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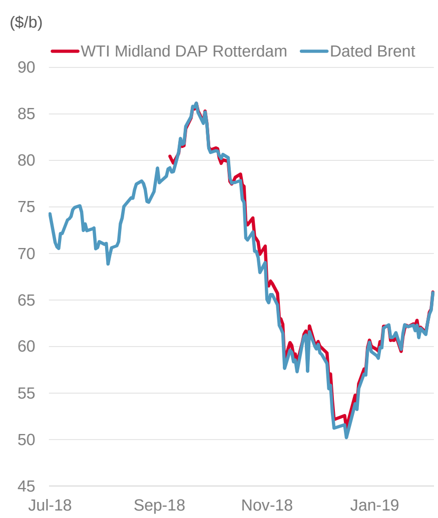
Platts

US Gulf Coast crude DAP Europe



Source: S&P Global Platts

- US crude increasingly coming into Europe and beyond
- Eagle Ford 45 and WTI Midland regularly processed in Europe
- Assessment for 20-60 days forward into Rotterdam and Augusta
- Platts assessment reflecting cargoes of 500kb to 700kb

SUBSCRIBER NOTE: Platts launches assessments for US WTI, Eagle Ford crude for delivery to Europe

Commodity: Oil
Region: EMEA
Subscriber note type: Methodology Change

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Platts

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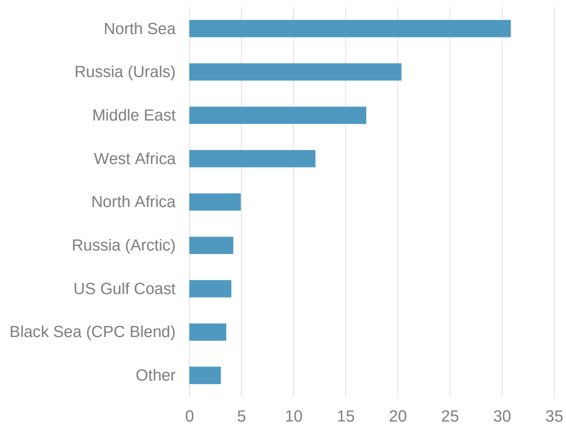
CIF Europe crude values growing in relevance

NWE crude sourcing by region (%)



Source: S&P Global Platts

S&P Global Platts

- Platts CIF methodology gaining more momentum
- US deliveries increasingly part of the European delivered crude market
- Well over half of the Forties loading program moves to the far East each month
- Southwold, Dunbar frequently act as staging grounds for voyages further East
- China is a frequent buyer of Forties and Ekofisk when economics permit

Platts to reflect CIF Rotterdam offers in Dated Brent from November 2019 loadings

- Platts has confirmed that with effect from October 1, 2019, it will reflect competitive offers for Brent, Forties, Oseberg, Ekofisk and Troll crude oil cargoes on a CIF Rotterdam basis in its Dated Brent crude oil benchmark.
- This step will enable the inclusion of a greater amount of market data in the North Sea's light, sweet crude oil benchmark, and ensure that the grades currently reflected in Dated Brent continue to play the fullest possible role in establishing the value of North Sea crude.
- Offers on a CIF Rotterdam basis for Brent, Forties, Oseberg, Ekofisk and Troll will be considered when evaluating the most competitively available light, sweet crude oil grade in the North Sea. Should a firm CIF Rotterdam offer for any of the five grades currently reflected in the Dated Brent assessment, after adjusting for freight, port fees, and sailing time, be more competitive than a comparable bid for those grades on an FOB basis the CIF Rotterdam offer would take precedence in the final assessment of Dated Brent on the loading dates in question.

S&P Global Platts

Methodology

- **TIMING OF APPLICATION:** Platts will reflect competitive CIF offers for cargoes loading from November 2019 onwards, which will start to appear in Dated Brent assessments from October 1.
- **FREIGHT ADJUSTMENT FACTOR:** Platts will phase in the level of freight adjustment over the course of three months until it reaches 80%. From October 1, a factor of 40% will be applied to November-loading CIF equivalent cargoes in the Dated Brent assessment, rising to 60% for December-loading cargoes, and 80% for January-loading cargoes onwards. These percentages would be applied to the cargo's freight rate from its respective terminal to Rotterdam and associated port fees. CIF offers for inclusion in this process should be a full 600,000-barrel cargo on an Aframax-sized ship with a tolerance of 1% in the seller's option.
- **CALCULATION OF FREIGHT ADJUSTMENT FACTOR:** Platts will publish a 10-day rolling freight average the day before each day's Market on Close assessment process, to ensure the freight factor is fully known before the assessment process begins. This will be based on its 10 previous assessments of the Dirty Cross-UK/Continent 80,000 mt freight assessment before the date of publication. Platts will apply a freight adjustment factor of the relevant percentage to this 10-day average to adjust CIF Rotterdam offers of each of the five grades in Dated Brent to determine their value. The derived FOB values would be used in determining value versus an FOB bid in the assessment process for each of the five grades in the Dated Brent basket.

S&P Global
Platts

Addition of further grades in Dated Brent assessment

- Platts has consulted widely on the inclusion in the FOB Dated Brent assessment process of other grades beyond the current five in Dated Brent.
- Platts has noted support for other grades to be included in Dated Brent in the future.
- Reflecting competitive CIF Rotterdam offers of Brent, Forties, Oseberg, Ekofisk and Troll crude in Dated Brent is a critical enabling step for future methodology development and potential inclusion of grades from outside of the North Sea, should that become necessary.
- Platts does not have any immediate plans to bring further grades into the North Sea crude oil basket.

S&P Global
Platts

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argusmedia.com

The evolution of North Sea Dated

Joint IEA-IEF-OPEC Technical Meeting
Vienna

Michael Carolan (Editor, Argus Crude)
28 March 2019

London
Houston
Moscow
Singapore
Dubai
New York
Beijing
Kiev
Tokyo
Astana
Shanghai
Rio de Janeiro
Washington DC
Riga
Calgary
Brussels
Cape Town
Mexico City
Berlin
San Francisco
Sydney

Market Reporting
Consulting
Events

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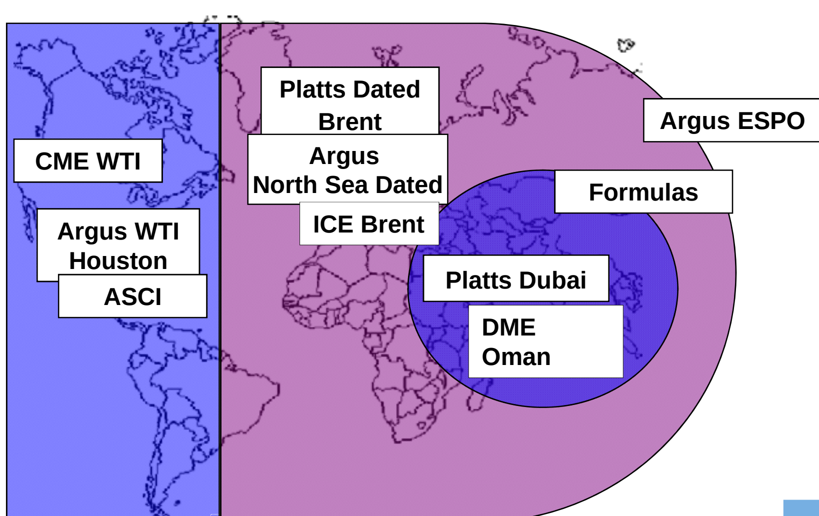
Crude benchmarking around the world



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The European crude market

- North Sea production and trade volumes are in decline.
- Eastern arbitrage has significant effect on fob prices.
- Market calls for a more robust methodology have increased.
- There is a large flow of light sweet crude into the region.
- This can be used for additional price discovery.

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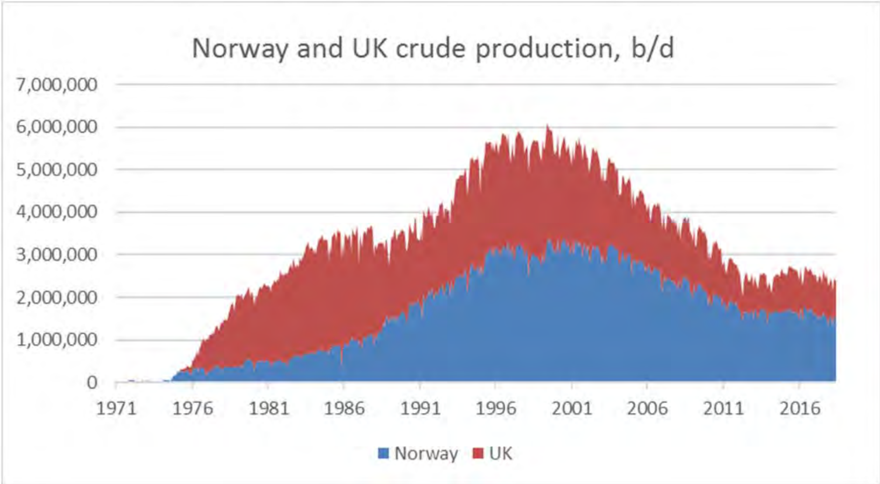
Output decline slows after steep drop



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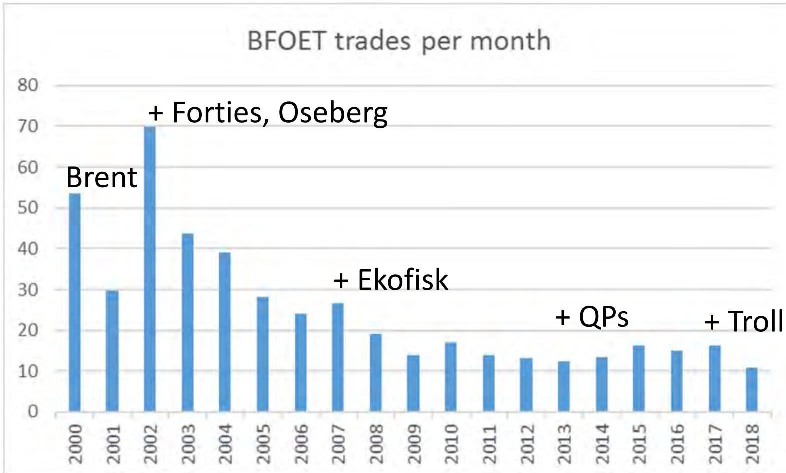
Trade volumes dwindle, despite added benchmark grades



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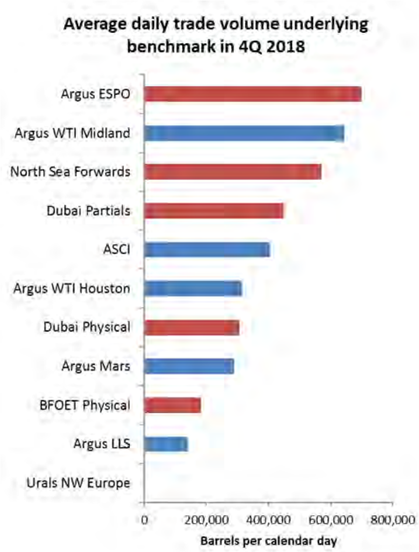
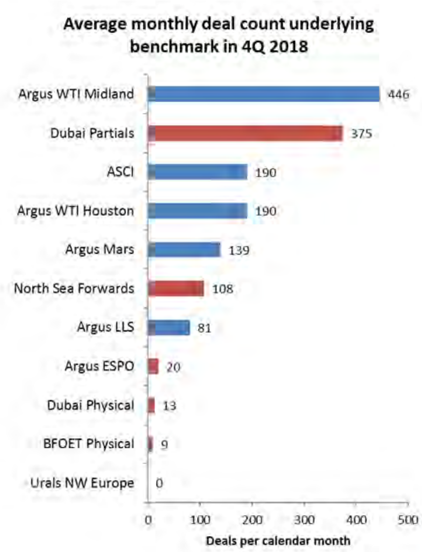
North Sea far less liquid than US markets





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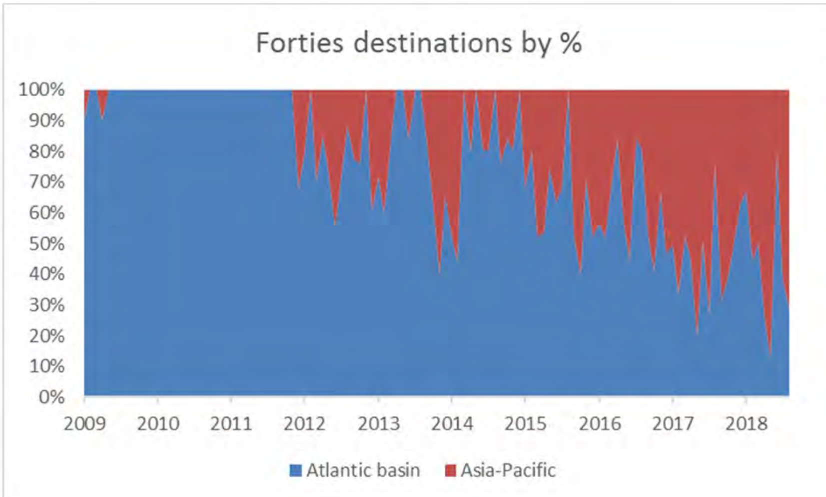
Forties has gone global – creating a two-tier market



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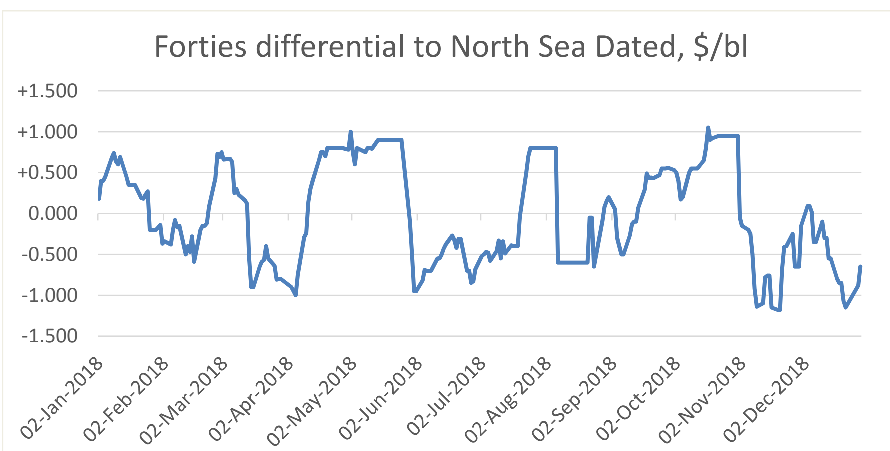
Volatile Forties



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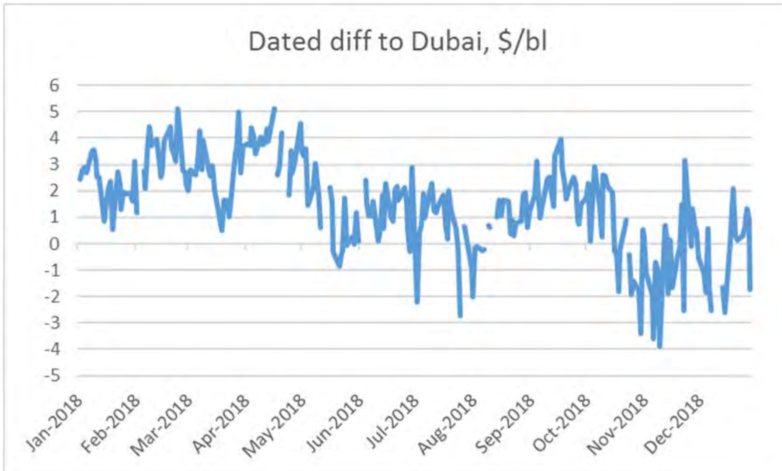
Dated surged against Mideast benchmarks in April…



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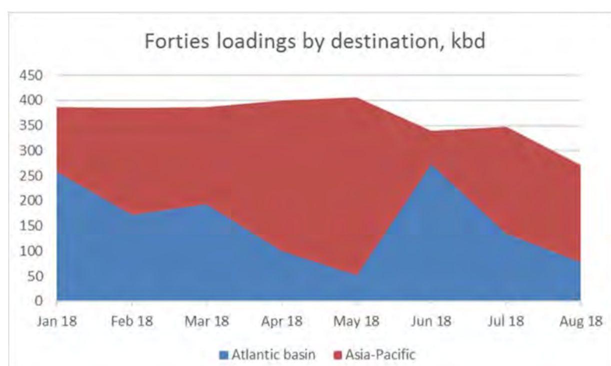
…just as eastbound loadings peaked



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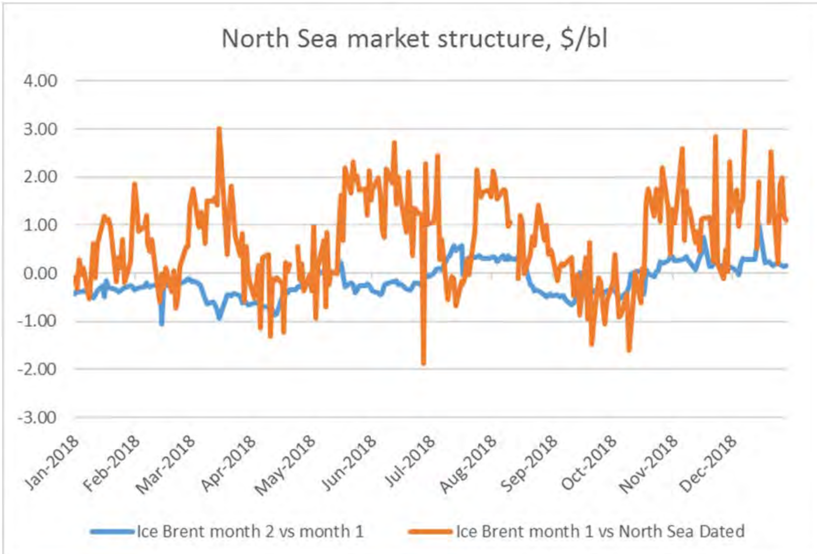
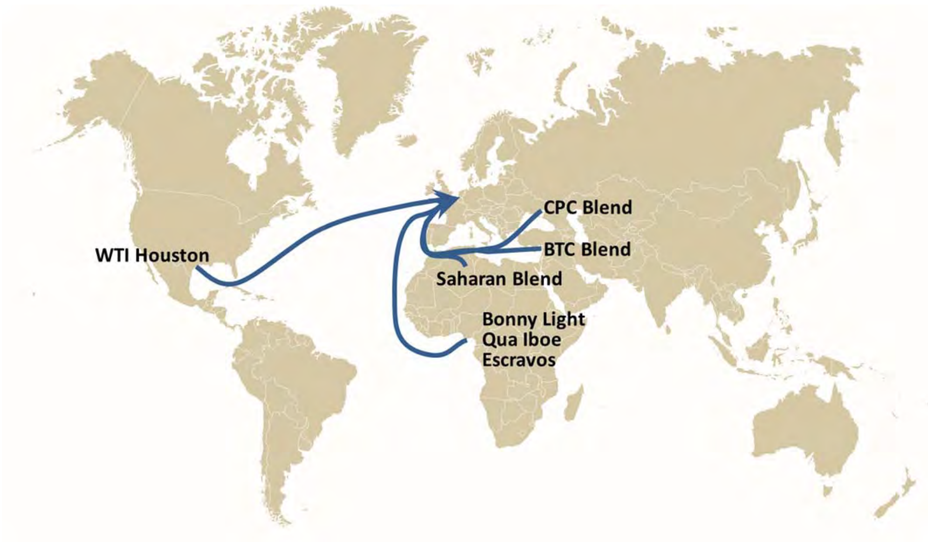
North Sea Dated can send a volatile signal



The North Sea benchmark elements

- Outright price (volume weighted average of forward trade)
- Contracts for Difference curve (aligns timing with physical date-range 10 days to month ahead)
- Physical grade differentials for Brent, Forties, Oseberg, Ekofisk and Troll
- Quality adjustments to bring more expensive grade components (Oseberg, Ekofisk, Troll) closer to others

What is the market price in Europe for light sweet crude?



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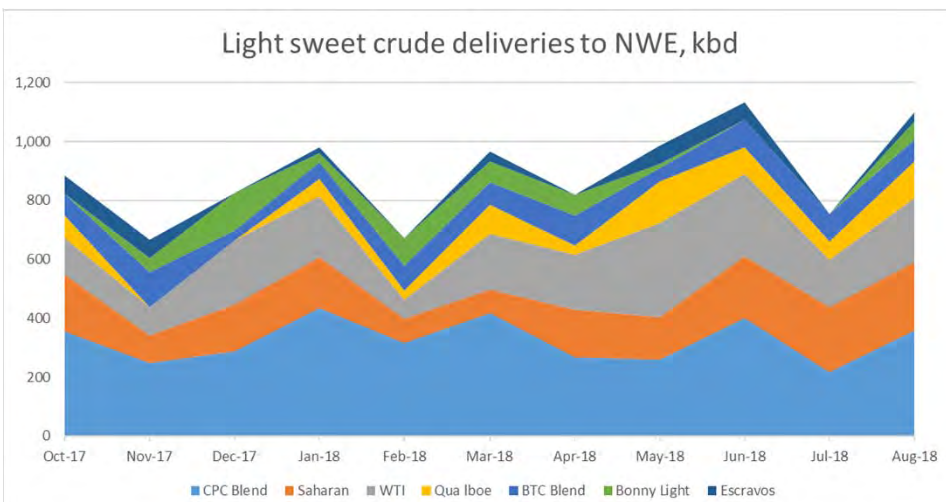
Potential pool of trade – needs transparency



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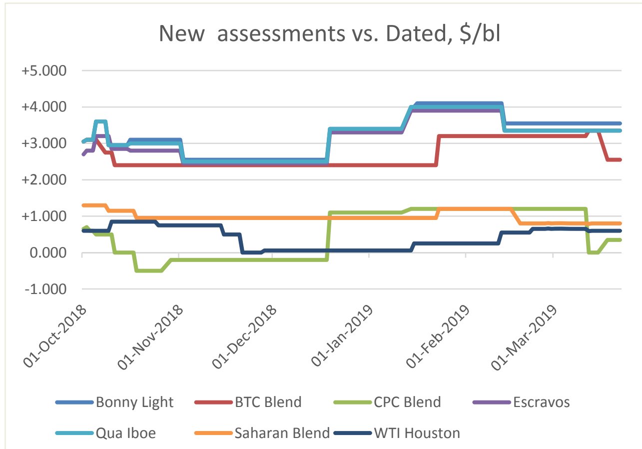
Argus launched cif Rotterdam assessments in Oct 2018

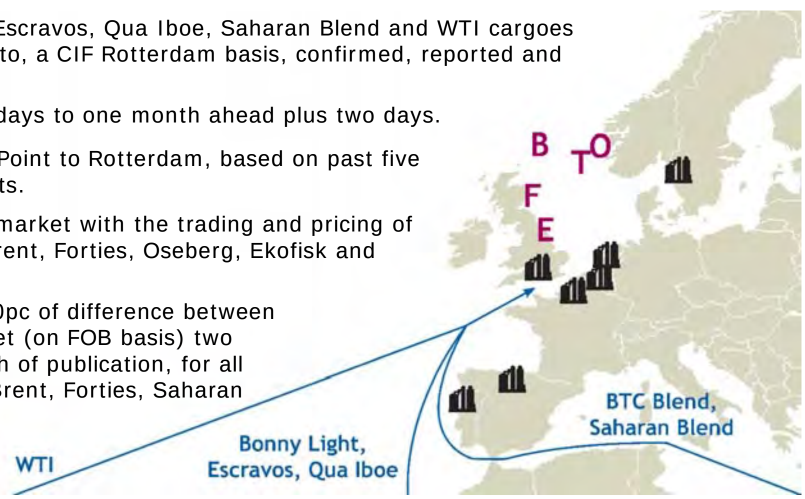
Delivered northwest Europe assessments	Basis	Diff	Bid	Ask	±
CPC Blend cif Rotterdam	Dated	+1.10	60.45	60.51	-1.11
BTC Blend cif Rotterdam	Dated	+2.40	61.75	61.81	-1.11
Saharan Blend cif Rotterdam	Dated	+0.95	60.30	60.36	-1.11
Bonny Light cif Rotterdam	Dated	+3.40	62.75	62.81	-1.11
Qua Iboe cif Rotterdam	Dated	+3.40	62.75	62.81	-1.11
Escravos cif Rotterdam	Dated	+3.30	62.65	62.71	-1.11
WTI cif Rotterdam	Dated	+0.06	59.41	59.47	-1.11

- Observations and feedback – CPC Blend, while liquid, is discounted to other light crudes and there are quality concerns. We have therefore excluded it from the benchmarking process.
- Several grades, not all, require quality premium adjustments in order to be relevant to the benchmark setting process. Exceptions: Saharan Blend and WTI.

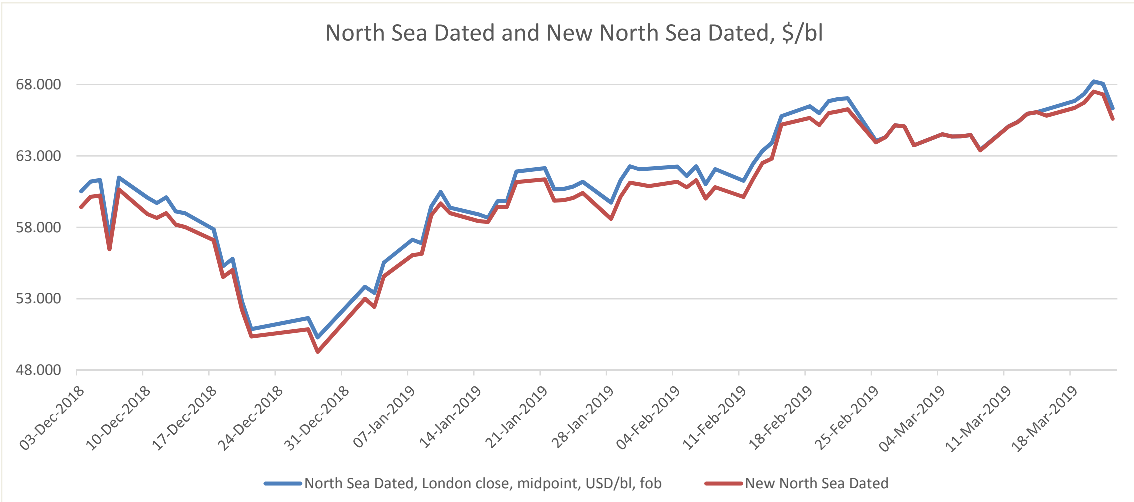


New North Sea Dated

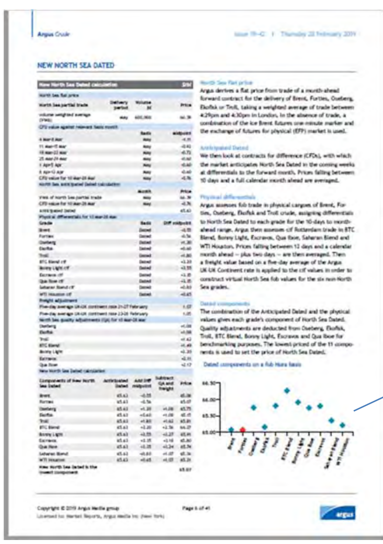
- Bonny Light, BTC Blend, Escravos, Qua Iboe, Saharan Blend and WTI cargoes traded on, or normalised to, a CIF Rotterdam basis, confirmed, reported and assessed.
- Assessed for delivery 12 days to one month ahead plus two days.
- Freight deduction Hound Point to Rotterdam, based on past five working days' assessments.
- This aligns the delivered market with the trading and pricing of FOB North Sea grades, Brent, Forties, Oseberg, Ekofisk and Troll.
- Quality adjustments at 60pc of difference between grade and lowest in basket (on FOB basis) two months previous to month of publication, for all grades in basket except Brent, Forties, Saharan Blend and WTI.

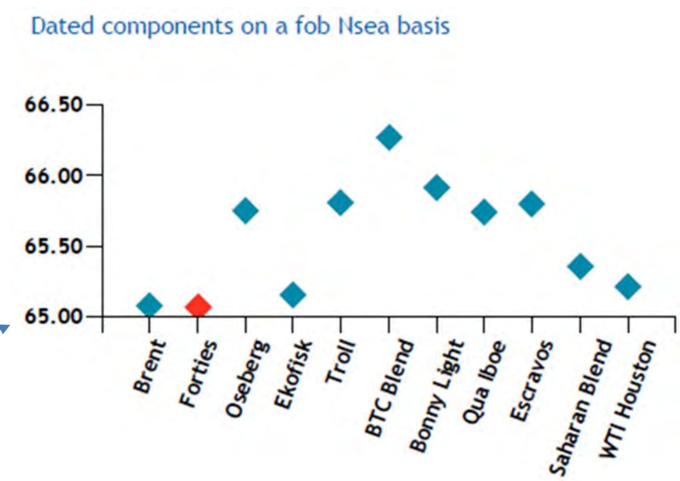


The new benchmark’s performance



The new benchmark’s elements





See p.6 of Argus Crude and crude methodology documents at argusmedia.com/methodology

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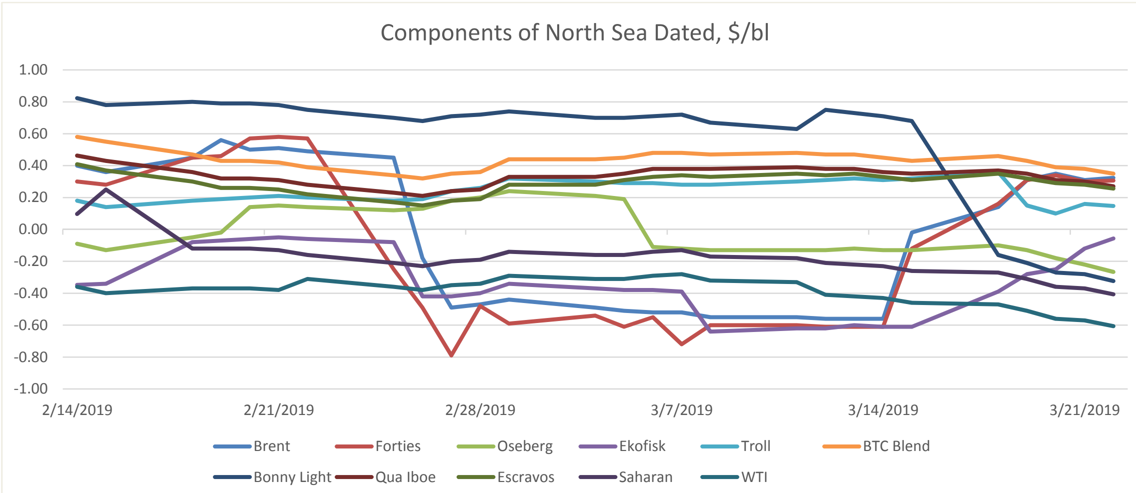
The new benchmark's elements



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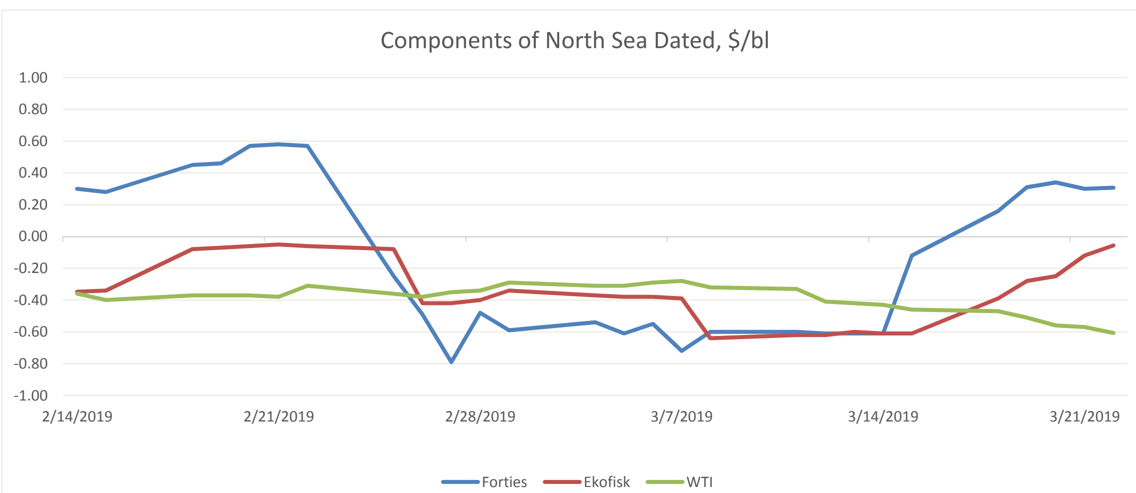
The new benchmark's elements



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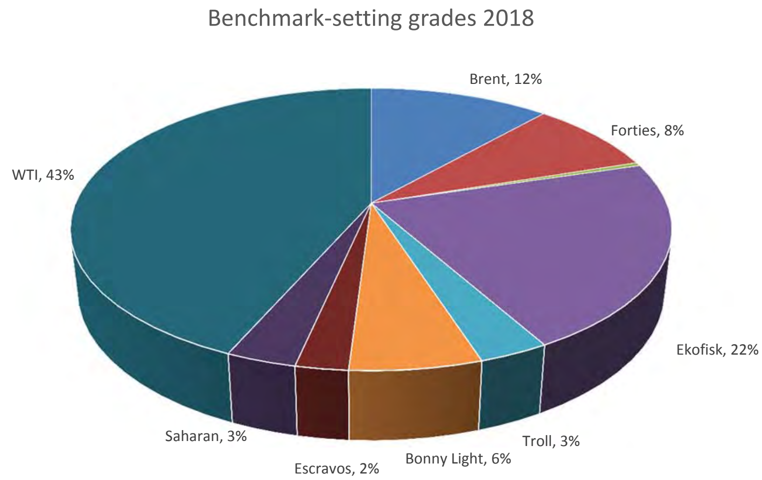
What sets New North Sea Dated



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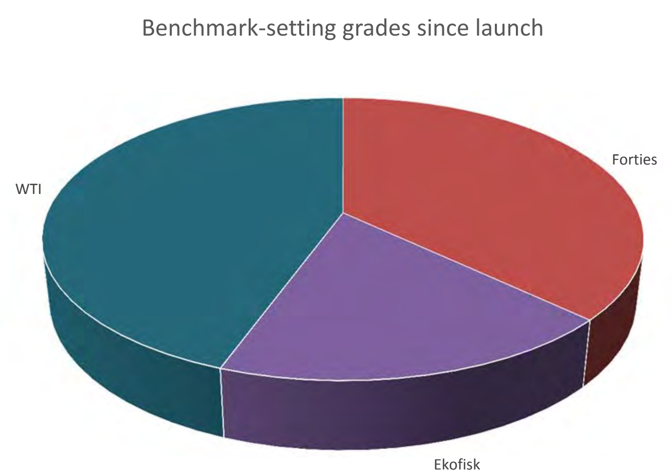
What sets New North Sea Dated



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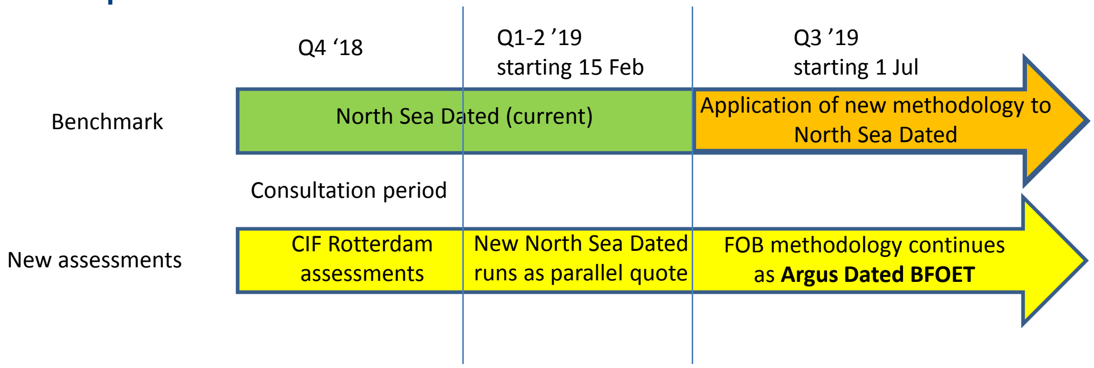
Implementation timetable



- Argus conducted a consultation process throughout quarter 4 2018.
- Argus will continue to publish the full range of current assessments. CIF Rotterdam does not replace FOB Ceyhan, FOB Bonny terminal, etc.
- The Argus North Sea crude benchmark will continue to be called **North Sea Dated** and published in the Argus Crude report. We will continue to publish a price without CIF elements, which will be called **Argus Dated BFOET**.

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A representative benchmark helps all

- Liquidity and transparency aids the price discovery process.
- Refiners benefit from a market in which regional and imported grades are competitive with one another.
- Producers can set differentials with confidence.
- Traders can judge the arbitrage between regions.

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In summary

- The North Sea Dated benchmark has become volatile and is regularly driven by factors outside the region.
- Asian demand, particularly for Forties and Ekofisk, can reduce the number of cargoes available for price identification.
- There is a steady flow of competing light sweet crude being delivered into the European market.
- If this trade is reported and assessed, it can be integrated into a more representative incarnation of the benchmark.

Thanks for listening!

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3rd Joint IEA-IEF-OPEC Technical Conference
Vienna
March 28, 2019

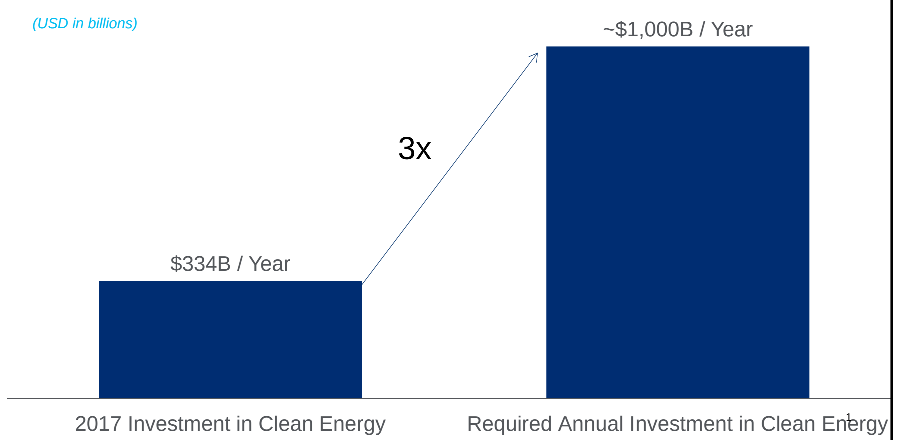
Michael Eckhart
Managing Director
Global Head of Environmental Finance
Citigroup, Inc.
michael.eckhart@citi.com

citi

Topics

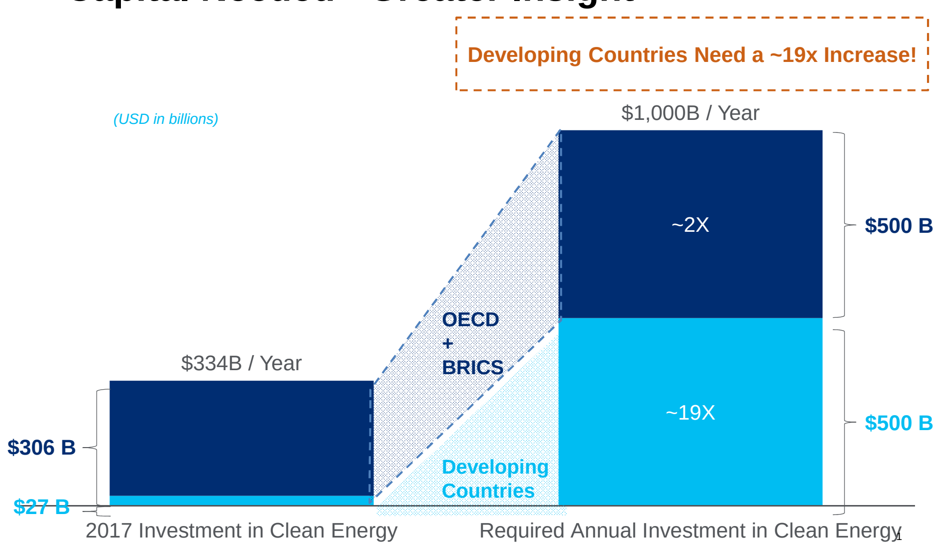
1. Climate Risk and Capital Requirements
2. Bank Perspective: Citi as an example
3. Investor Perspective: ESG and Green Bonds

Capital Needed to Finance Climate Solutions



Source: International Energy Agency (IEA); Coalition for Environmentally Responsible Economics (CERES), Bloomberg New Energy Finance (BNEF)
1. Annual investments required to limit the increase in global temperature to 2 degrees Celsius above pre-industrial levels

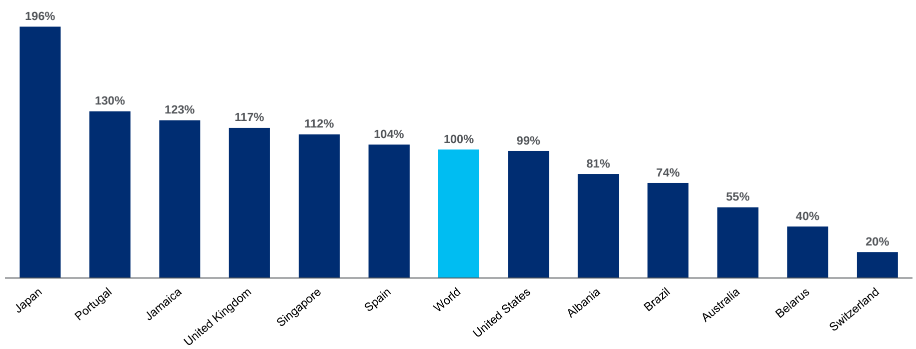
Capital Needed - Greater Insight



Source: International Energy Agency (IEA); Coalition for Environmentally Responsible Economics (CERES), Bloomberg New Energy Finance (BNEF)
1. Annual investments required to limit the increase in global temperature to 2 degrees Celsius above pre-industrial levels

High Public Sector Indebtedness

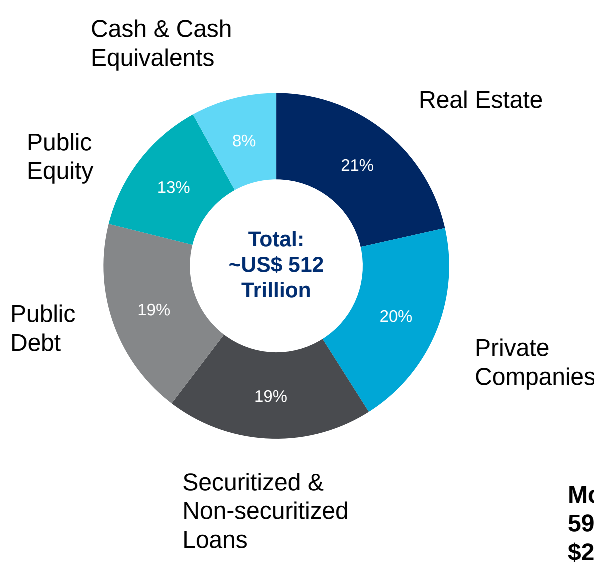
2016 Central Government Debt (as a % of GDP)



In 2015, the world figure reached 100%, with $73T of GDP and $73T of debt

Source: World Bank Data

Global Capital Stock

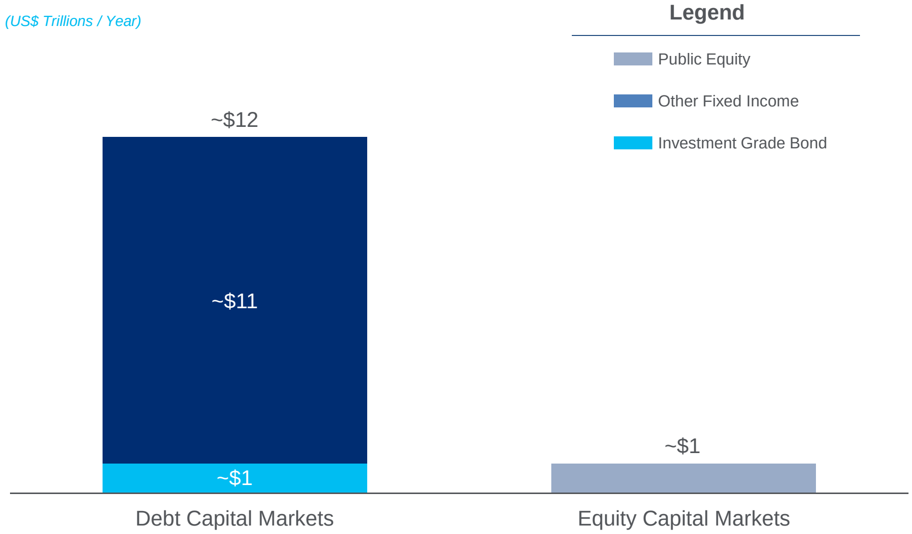


Money = 59% $297 Trillion

Sources: Gadzinski et. al..*The Global Capital Stock: A proxy for the Unobservable Global Market Portfolio* (2016) UNEP, *The Value of Everything* (2015)

New Issuances: Debt and Equity Capital Markets

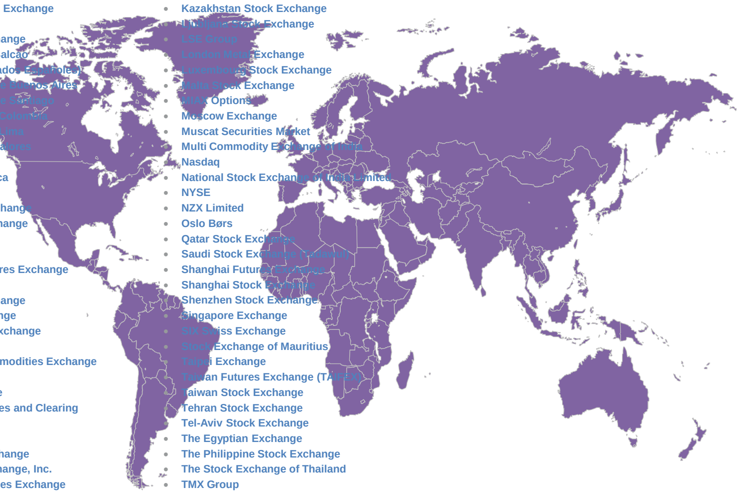
(2006 – 2016 Average)



Source: Dealogic

Major World Exchanges

- Amman Stock Exchange
- Athens Stock Exchange (ATHEX)
- Australian Securities Exchange
- Cboe Global Markets
- Bermuda Stock Exchange
- B3 SA Brasil Bolsa Balcao
- BME (Bolsas y Mercados Españoles)
- Bolsa de Comercio de Buenos Aires
- Bolsa de Comercio de Santiago
- Bolsa de Valores de Colombia
- Bolsa de Valores de Lima
- Bolsa Mexicana de Valores
- Borsa Istanbul
- Bourse de Casablanca
- BSE Limited
- Bucharest Stock Exchange
- Budapest Stock Exchange
- Bursa Malaysia
- Cboe Holdings
- China Financial Futures Exchange
- CME Group
- Colombo Stock Exchange
- Cyprus Stock Exchange
- Dalian Commodity Exchange
- Deutsche Börse
- Dubai Gold and Commodities Exchange
- Euronext
- Hochiminh Exchange
- Hong Kong Exchanges and Clearing
- ICE Futures USA
- ICE Futures Canada
- Indonesia Stock Exchange
- Intercontinental Exchange, Inc.
- International Securities Exchange
- Irish Stock Exchange
- Japan Exchange Group
- Johannesburg Stock Exchange
- Korea Exchange
- Kazakhstan Stock Exchange
- Ljubljana Stock Exchange
- LSE Group
- London Metal Exchange
- Luxembourg Stock Exchange
- Malta Stock Exchange
- MIAX Options
- Moscow Exchange
- Muscat Securities Market
- Multi Commodity Exchange of India
- Nasdaq
- National Stock Exchange of India Limited
- NYSE
- NZX Limited
- Oslo Børs
- Qatar Stock Exchange
- Saudi Stock Exchange (Tadawul)
- Shanghai Futures Exchange
- Shanghai Stock Exchange
- Shenzhen Stock Exchange
- Singapore Exchange
- SIX Swiss Exchange
- Stock Exchange of Mauritius
- Taipei Exchange
- Taiwan Futures Exchange (TAIFEX)
- Taiwan Stock Exchange
- Tehran Stock Exchange
- Tel-Aviv Stock Exchange
- The Egyptian Exchange
- The Philippine Stock Exchange
- The Stock Exchange of Thailand
- TMX Group
- Warsaw Stock Exchange
- Wiener Borse
- Zhengzhou Commodity Exchange



Sources: World Federation of Exchanges

Bank Perspective: Citi as an Example

Our Approach to Citizenship at Citi

Citizenship is a responsibility shared across our businesses

"The ways we help make our communities stronger, provide opportunities to those who need support, protect our environment and celebrate diversity are the truest reflection of our values and the progress we enable around the world."
– Michael Corbat, 2017 Global Citizenship Report

- **A Business Model that Adds Value to Society**
- **A Focus on Ethical Decision-Making and Responsible Business Practices**
- **Taking a Stand on Issues that Matter and Driving Solutions**
- **An Enhanced Focus on Transparency and Knowledge Building**

Specialized Citizenship functions – Sustainability, Citi Volunteers and Citi Foundation – are an enhancer for our business-led efforts and catalyze innovation and the direct engagement of our colleagues

Environmental and Social Leadership

International Climate Commitment

- Citi signed on to the "We Are Still In" declaration in support of climate action to meet the Paris Climate Agreement.

WE ARE STILL IN

- Mike Corbat signed a letter to U.S. President Trump from 30 CEOs that appeared in the Wall Street Journal.

THE WALL STREET JOURNAL.

U.S. CEOs' Letter Urges Trump to Commit to the Paris Agreement
May 12, 2017

Mr. President:

We are writing to express our strong support for the United States remaining in the Paris Climate Agreement.

As CEOs of large American companies, or with significant operations in the United States…The Paris Agreement gives us that flexible framework to manage climate change while providing a smooth transition for business. We believe that American companies … and our suppliers, customers, and communities…will benefit from U.S. participation in the Paris Agreement…

… Let's work together to maintain the United States' status as the world's biggest champion of economic growth and innovation...

Sincerely,

DAVID W. MacLENNAN *Cargill Inc.*	WILLIAM BROWN *Harris Corporation*	JEAN-PIERRE CLAMADIEU *Solvay*
MICHAEL L. CORBAT *Citigroup Inc.*	ALEX GORSKY *Johnson & Johnson*	ELON MUSK *Tesla Inc.*
JAMES QUINCEY *The Coca Cola Company*	JAMIE DIMON *JP Morgan Chase*	PAUL POLMAN *Unilever*
WENDELL WEEKS *Corning Incorporated*	FRANCOIS-HENRI PINAULT *Kering*	RICHARD BRANSON *Virgin Group*

Corporate Leadership on Societal Issues

"I'm proud of the actions we've taken to define who we are and what we stand for as a company…a firm of our size and scale achieves great and big things when we put our mind to it."
Michael Corbat, CEO

- In March 2018, Citi announced a U.S. Commercial Firearms Policy that requires firearms retailers and manufacturers who sell through U.S. retail channels to conform to best practices.
- Citi joined other companies in signing an amicus brief in support of the LGBT community, which related to the case of *Masterpiece Cakeshop, Ltd. v. The Colorado Civil Rights Commission.*
- In 2018, Citi signed the UN Women's Empowerment Principles (WEP), which promotes the equal and full inclusion of women in society, the economy and in the workplace.

Citi at a Glance

Our Mission

To serve as a trusted partner to our clients by responsibly providing financial services that enable growth and economic progress

Institutional Clients Group

- **Largest** proprietary global network with a physical presence in **98 countries**
- Facilitate **~$4 trillion** of transaction flows daily
- Serve approximately **90%** of global **Fortune 500** companies

Global Consumer Banking

- **Growing** Commercial Bank that serves midsized clients with cross-border needs
- A lean, urban retail bank footprint across **19 markets** in the U.S., Mexico and Asia
- **#1** credit card issuer **globally**[1]

Approximately **13,000 INSTITUTIONAL** client relationships

Conduct business in more than **160 COUNTRIES** and jurisdictions

Nearly **210,000 EMPLOYEES** globally

More than **100 MILLION** customer accounts

[1] Source: Based on loans outstanding as of 3Q18

20 Years of Sustainability Progress

Citi has been helping to drive sustainability within the financial sector for over 20 years

1995

Joined the UN Environment Programme Finance Initiative

2000

Published first Global Citizenship Report

Co-created Equator Principles for project finance (currently 93 members)

2005

Launched 10-year $50B Climate Initiative

2010

Joined UN Global Compact

2015

Launched Sustainable Progress Strategy and $100B Environmental Finance Goal

Co-drafted and established the Green Bond Principles

2016

Commenced 2020 (3rd generation) environmental footprint goals

2017

Announced 100% renewable energy by 2020 goal

2018

Signed onto "We Are Still In" commitment in support of the Paris Agreement

Founding member of the U.S. Alliance for Sustainable Finance

"Incorporating the principles of sustainability into everything we do improves our own operations, enhances our clients' work, and contributes to a better world." - Mike Corbat, CEO

What Sets Citi Apart?

As the leading **GLOBAL** bank doing business in more than 160 countries and jurisdictions, we help our clients solve climate challenges around the world

PARTNERSHIPS with companies, governments and non-profits afford unique opportunities to make positive impacts

We draw on the deep **EXPERTISE** of our global teams to provide innovative sustainable finance solutions

Sustainable Progress Strategy

Priority issues: Climate Change, Sustainable Cities, and People and Communities

Environmental Finance

$100 Billion Environmental Finance Goal
to lend, invest and facilitate $100B over
10 years to activities focused on environmental and climate solutions

Environmental and Social Risk Management

Work with our clients to manage environmental and social risks and impacts associated with our products and services

Operations and Supply Chain

Manage our global facilities and supply chain to minimize direct impact, reduce costs and reflect best practices

Engagement and Transparency

Engage with stakeholders and our employees to achieve sustainable progress, and report on the results of our strategy and goals

\

Finance for a Climate-Resilient Future – Citi's TCFD Report

- We launched our TCFD Report, *Finance for a Climate-Resilient Future*, on November 13, making us the first North American bank to release a TCFD report
- In this report, we shared the results of our climate scenario analyses to understand the impacts of transition and physical risks for a portion of Citi's oil & gas and utilities portfolios using three different warming scenarios: 1.5˚C, 2˚C and 4˚C
- Report link: https://www.citigroup.com/citi/sustainability/data/finance-for-a-climate-resilient-future.pdf

Sustainability Recognition

Citi has been recognized for its sustainability performance and innovative financing solutions

2018 The Banker Most Innovative Investment Bank for Corporate Social Responsibility American Banker Magazine	2013-2018 Civic 50 Honoree- Highest Score: Impact Measurement Points of Light	2018 Euromoney World's Best Bank for Corporate Responsibility Euromoney	2017 Climate Leadership Awards Corporate Leadership Award Climate Leadership Awards
2017 Newsweek Best in Industry for U.S. Banks Newsweek Green Rankings	2017 FT IFC Excellence in Climate Solutions for Block Island Wind Farm FT/IFC Transformational Business Awards	2017 Risk Electricity House of the Year Risk Magazine	2013-2017 100 Listed on UN Global Compact 100 UN Global Compact
2002-2017 FTSE4Good Listed on FTSE4Good Index FTSE	2001-2017 Dow Jones Sustainability Indexes Listed on World and North America Sustainability Indexes Dow Jones Sustainability Index	2017 CDP 2016: A- Carbon Disclosure Project	2016 Environmental Finance Energy Efficiency Deal of the Year Environmental Finance Magazine

Contacts

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Commodities / Citigroup Energy Inc.
Roxana Popovici
Managing Director
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Resources

Citi's 2017 Global Citizenship Report – http://www.citigroup.com/citi/about/citizenship/download/2017/2017_citi_global_citizenship_report.pdf

Banking on 2030: Citi & the Sustainable Development Goals – http://www.citigroup.com/citi/about/citizenship/download/Banking-on-2030-Citi-and-the-SDGs-Report.pdf?ieNocache=68

Sustainable Growth at Citi: Progress and Impacts of Citi's $100 Billion Environmental Finance Goal – https://www.citigroup.com/citi/sustainability/data/Sustainable-Growth-at-Citi.pdf?ieNocache=72

Citi's 2018 Proxy Statement – http://www.citigroup.com/citi/investor/annual-reports.html

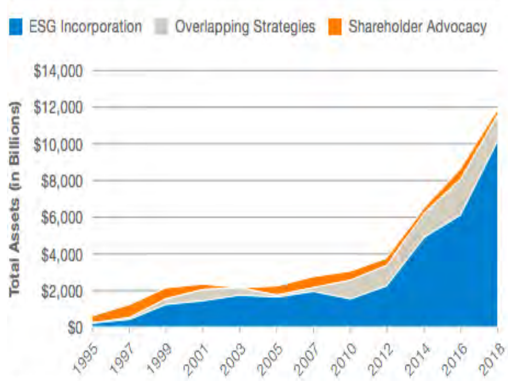
Investor Relations, Corporate Governance: Environmental and Social Information section – http://www.citigroup.com/citi/investor/corporate_governance.html#Environmental-and-Social-Information

Investor Perspective

ESG Investing is on the rise in the U.S. (and beyond)

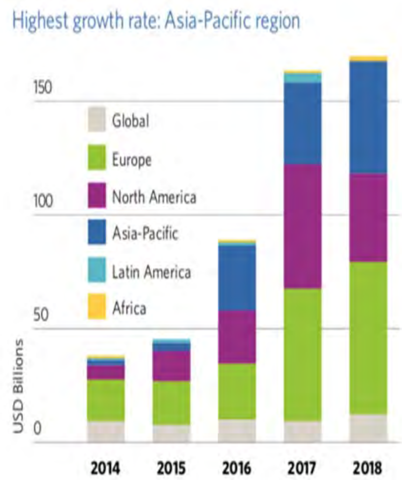
FIGURE A

Sustainable and Responsible Investing in the United States 1995–2018



SOURCE: US SIF Foundation.

Global green bond issuances totaled US$167bn globally in 2018



Source: Climate Bonds Initiative

What are Green, Social & Sustainability Bonds?

Green Bonds

The use of proceeds for Green bonds are exclusively targeted towards ***climate and / or environm... ...ility purposes***

Social Bonds

The use of proceeds for Social Bonds are used exclusively for ***social projects, e.g. SME Lending, Social Housing,***

Themed Bonds

Sustainability bonds

The use of proceeds for Sustainability bonds can target both ***climate / environmental projects*** *as well as specific* ***social projects***

Energy Transition Bond

Blue Bonds

Water Bonds

Education, Youth, Employment ("EYE") Bond

Sustainable Development Goals Linked Bonds

Examples of Citi's Green Bond Clients

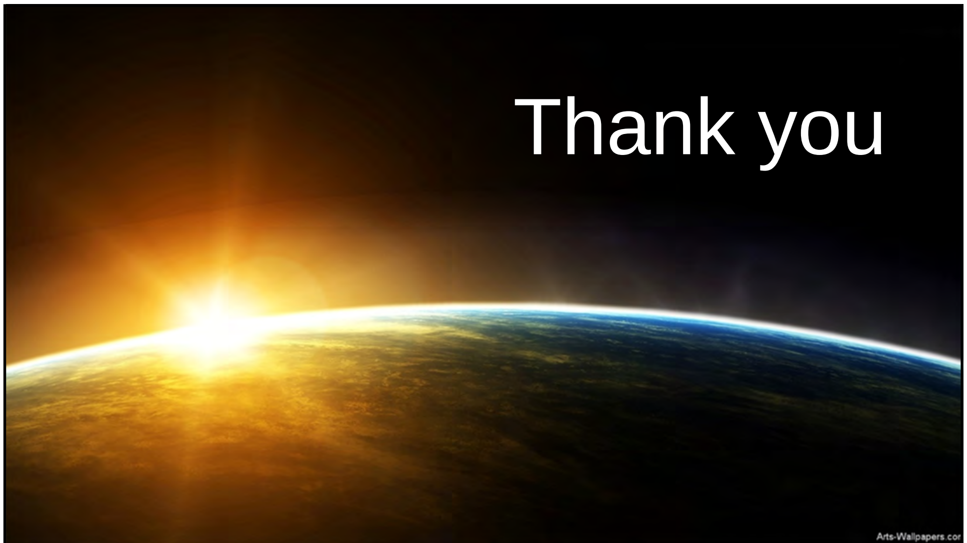
Sovereigns

Corporates

Banks and Financial

Summary and Conclusions

1. Climate change presents a tremendous challenge to society
2. While it seems a great challenge, and it is, the world has the capital to address this, but the public sector is having difficulty understanding how to mobilize the capital – this is our task today.
3. Citi is one of many examples of financial institutions that are well into this already – both as to our own account and in serving clients
4. Investors are starting to shift funds towards sustainability, and will continue to do so.



Thank you

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Citi believes that sustainability is good business practice. We work closely with our clients, peer financial institutions, NGOs and other partners to finance solutions to climate change, develop industry standards, reduce our own environmental footprint, and engage with stakeholders to advance shared learning and solutions. Citi's Sustainable Progress strategy focuses on sustainability performance across three pillars: Environmental Finance; Environmental and Social Risk Management; and Operations and Supply Chain. Our cornerstone initiative is our $100 Billion Environmental Finance Goal – to lend, invest and facilitate $100 billion over 10 years to activities focused on environmental and climate solutions.

Integrating Climate into our Strategy

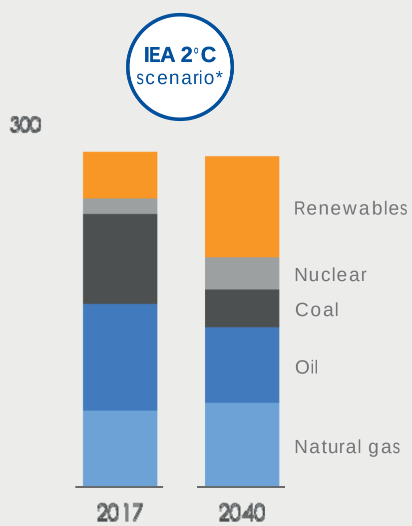
Etienne Anglès d'Auriac - VP Climate - Strategy & Climate division

IEA-IEF-OPEC Technical Meeting - 28th March 2019

Integrating climate into strategy

Taking into account anticipated market trends

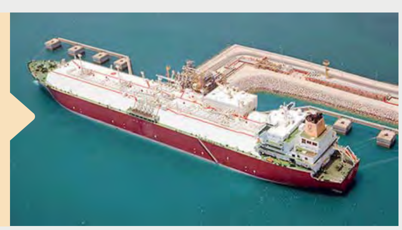
Global energy demand
Mboe/d



* IEA Sustainable Development Scenario

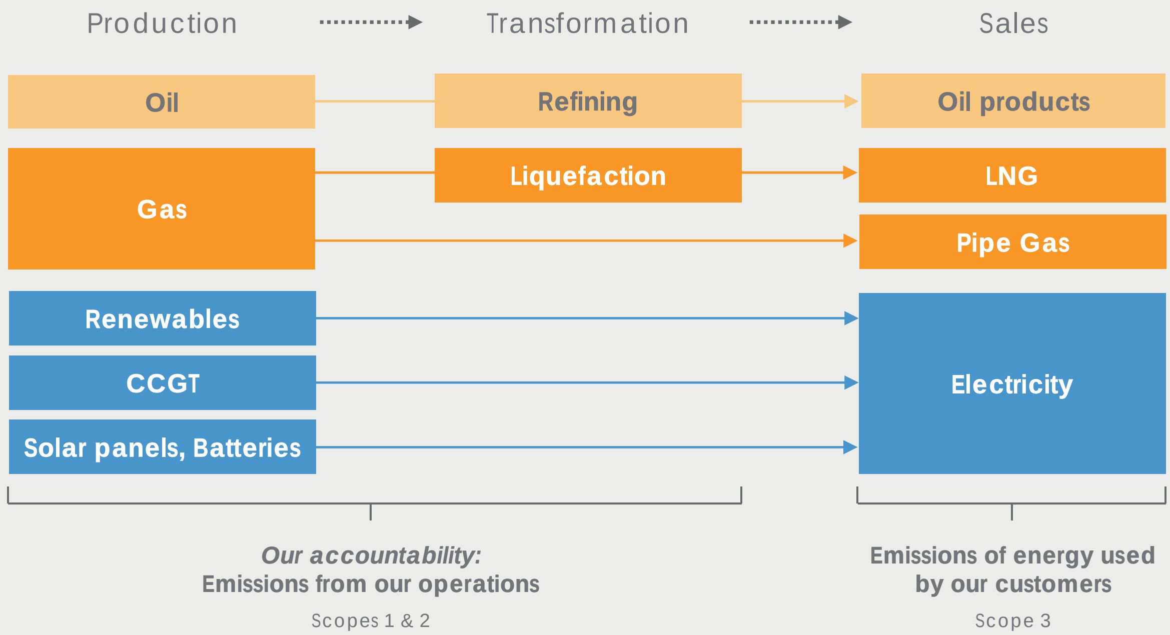
Focusing on **oil** projects with **low breakeven**

Expanding along the **gas value chain**



Developing profitable & sizeable **low carbon electricity** business

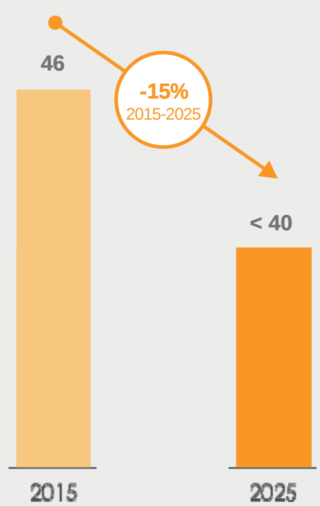
GHG emissions: from our operations to our sales



Our accountability: reducing emissions from our operations

15% reduction of our GHG emissions (scope 1+2) between 2015 and 2025

2015-25 Scope 1 & 2 emissions from operated facilities by oil & gas activities*
Mt/y



* E&P, RC & M&S

Flaring reduction

CH4 Methane Control

Energy Efficiency

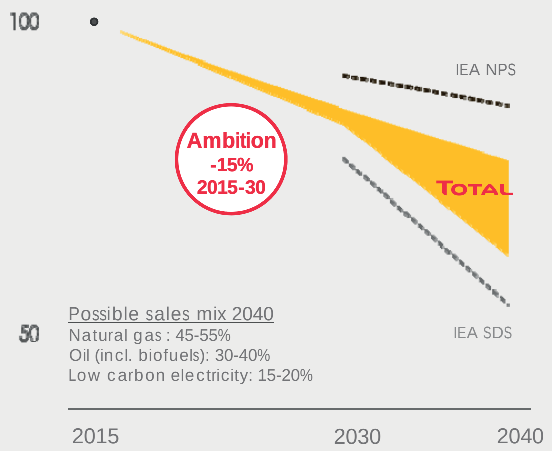
Process electrification

Scope 1 & 2 emission reduction targets to be included in **Total executives** compensation

Our ambition: strategy contributing to tackle climate change

Reducing the carbon intensity of energy products used by our customers

Carbon intensity: weighted average of lifecycle* emissions of energy products
Base 100 in 2015 (75 gCO_2/kbtu)



NPS: New Policy Scenario ~2.7°C by 2100
SDS: Sustainable Development Scenario ~2°C by 2100
* Scopes 1, 2 & 3

Further improving **efficiency** of our **operations**

Growing in **natural gas**

Developing a profitable **low carbon electricity** business

Promoting sustainable **biofuels**

Investing in **carbon sink businesses** (natural sinks & CCUS)

Total, the Responsible Energy Major

International Leadership on ESG & climate actions

Integrating Climate Into Our Strategy

Annually reporting since 2016 **Integrating climate into our strategy**

TCFD

Supports **TCFD** and **recommendations** implemented in our reporting

Climate Leadership Council

Founding Member. Advocating a **Carbon Dividends** plan

OGCI — Oil and Gas Climate Initiative

Oil & Gas Climate Initiative and Climate Investments fund

UN Global Compact

Total recognized as **Global compact Lead Company** on Sept 2018

Founding member of **Alliance to end plastic waste** in the environment, especially in the ocean