Goldman Sachs | Commodities Research

30 March 2020 | 3:00AM BST

Oil Views: An industry game-changer

Jeffrey Currie
+44(20)7552-7410 |
jeffrey.currie@gs.com
Goldman Sachs International

Damien Courvalin
+1(212)902-3307 |
damien.courvalin@gs.com
Goldman Sachs & Co. LLC

Michele Della Vigna, CFA
+44(20)7552-9383 |
michele.dellavigna@gs.com
Goldman Sachs International

Callum Bruce
+1(212)902-3053 | callum.bruce@gs.com
Goldman Sachs & Co. LLC

Daniel Sharp
+44(20)7774-1875 |
daniel.sharp@gs.com
Goldman Sachs International

1) Twelve days ago we argued the physical end was near, now the physical end is here as the coronacrisis goes global. Last week, the oil surplus generated by an unprecedented demand shock began to hit physical constraints at refineries, pipelines and storage facilities, leading to at least 0.9 million b/d of announced shut-ins at the wellhead, with the true number likely higher and growing by the hour. With social distancing measures now impacting 92% of global GDP, the ultimate magnitude of these shut-ins which is still unknown will likely permanently alter the energy industry and its geopolitics, restrict demand as economic activity normalizes and shift the debate around climate change. Not only is this the largest economic shock of our lifetimes, but carbon-based industries like oil sit in the cross-hairs as they have historically served as the cornerstone of social interactions and globalization, the prevention of which are the main defense against the virus. Accordingly, oil has been disproportionately hit, likely more than 2x economic activity, with demand this week down an estimated 26 million b/d or c.25%.

2) This shock is extremely negative for oil prices and is sending landlocked crude prices into negative territory. Paradoxically, this will ultimately create an inflationary oil supply shock of historic proportions because so much oil production will be forced to be shut-in. The global economy is a complex physical system with physical frictions, and energy sits near the top of that complexity. It is impossible to shut down that much demand without large and persistent ramifications to supply. The one thing that separates energy from other commodities is that it must be contained within its production infrastructure, which for oil includes pipelines, ships, terminals, storage facilities, refineries, and distribution networks. All of which have relatively small and limited spare capacity. We estimate that the world has around a billion barrels of spare storage capacity, but much of that will never be accessed as the velocity of the current shock will breach crude transportation networks first, which we are already seeing evidence of around the world. Indeed, given the cost of shutting down a well, a producer would be willing to *pay* someone to dispose of a barrel, implying negative pricing in landlocked areas.

3) Waterborne crudes like Brent will be far more insulated, staying near cash costs of $20/bbl with temporary spikes below. Brent is priced on an island in the North Sea, 500 meters from the water, where tanker storage is accessible. In contrast, WTI is landlocked and 500 miles from the water. This illustrates an important point. Shut-ins

Investors should consider this report as only a single factor in making their investment decision. For Reg AC certification and other important disclosures, see the Disclosure Appendix, or go to www.gs.com/research/hedge.html.

For the exclusive use of LIZZY.WALKER@GS.COM

will be not be based upon where wells sit on the cost curve but rather on logistics and access. High-cost waterborne crude oil that can reach a ship (storage we have historically never ran out of), are better positioned than landlocked pipeline crude oil sitting behind thousands of miles of pipe, like the crude oils in the US, Russia and Canada. In 1998, when surpluses last breached storage capacity, it was these landlocked crude oils that were the hardest hit. So while markets like WTI, particularly WTI Midland, or Canada's WCS can go negative, Brent is likely to stay near cash costs of $20/bbl. Ultimately, the market never hits nameplate capacity, as other bottlenecks are also at play. During 2008 and also in this crisis, dollar funding and credit constraints that prevent oil owners from accessing storage and transportation capacity also played a role. We believe that the Fed's actions last week alleviate some of this risk, but oil itself creates dollar liquidity given its importance in global trade and setting the price of other traded goods and another sharp drop in oil prices could create additional dollar shortages.

4) The oil price war is made irrelevant by the large decline in demand and has made a coordinated supply response impossible to achieve in time. A month ago, the logic of the price war made sense when the demand shock was c.5.0 million b/d. It gave OPEC and Russia the first opportunity since 2012 to completely undercut shale, and finally reverse the production cut in 2016 which we believe never made economic sense to begin with. Not only did OPEC producers sacrifice $220 billion in lost revenues (annually at $60/bbl Brent) and market share, but so did the equity and debt shareholders of higher-cost producers. The artificially higher prices distorted incentives for oil investment, leading to inefficient capital spending by these companies that, by our estimates, destroyed roughly $1.0 trillion worth of market cap since 2016. The policy of production cuts was a strategic error, not only to OPEC+ countries, but to all equity and debt owners in the industry. Now the question is: can the US and OPEC save this market? The demand shock has become so large that they can't do it alone, a fact they have acknowledged, stating that a balanced market would require a coordinated global production cut — a policy which appears impossible at this point, too late to stop the current surplus and far below other initiatives on the agenda right now.

5) The key to how quickly prices rebound after this supply shut-in will depend on how much inventory is built. Markets are already hitting transportation bottlenecks without having filled storage capacity. Oil in Canada is now near $5/bbl and WTI Midland $13/bbl with Cushing inventories still only half full. The quicker and harder these capacity constraints are reached, the quicker and more violently the market will rebalance when production shuts in, and the quicker deficits return to the market, putting upward pressure on prices. In the bear market of 2015/16 production shut-ins were based upon a producer position on the supply cost-curve. Unlike then, the logistical nature of the shut-ins suggest they will be completely indiscriminate, inflicting substantial damage on the wells that in some cases will be permanent. Once economic activity begins to normalize, the deficits will likely be substantial as the rebound in demand will be constrained by supply that has been damaged by the shut-ins. This could potentially require continued destruction of commuting and jet fuel demand. Net, if pipelines get clogged up as refineries shutdown, inventories cannot build, reducing the cushion and creating a very quick risk reversal towards oil shortages that could push prices far above

For the exclusive use of LIZZY.WALKER@GS.COM

our $55/bbl target for next year.

6) This will likely be a game-changer for the industry. Once you damage the capital stock in oil it is an expensive and time-consuming process to rebuild, assuming it can be rebuilt at all. This contrasts with the rest of the economy where the capital stock is sitting idle and ready to restart, which is why it is expected to exhibit a V-shaped recovery. In contrast, we believe the upstream sector could lose as much as 5.0 million b/d of oil supply capacity. With that much supply loss the industry will unlikely be able to rebound even close to old demand levels without creating substantial price appreciation, the scale of which will be determined by how much inventory is built in the coming weeks. In addition, the geopolitical landscape is also changing. We note the current political situation in Venezuela, where further US sanctions have been imposed for over half a year and where Rosneft divestitures of oil assets occurred over the weekend. At the same time, Iran has been heavily impacted by the coronavirus, which follows the rise in tensions between the US and Iran in January, during which oil reached its recent peak of $70/bbl. On top of this, there could be further geopolitical instability generated by the extreme economic conditions forced upon the many oil producers in Africa and Latin America.

7) Oil and gas fields are far different from other manufacturing processes. They are organic deposits and as such have decline rates, having shut an older well it may not be economic to bring it back online. Most of these older, more depleted and less productive wells are onshore, not offshore, which makes them the most vulnerable to shut-ins. We believe shut-in economics will be driven by three factors: 1) crude net-backs (driven by local infrastructure constraints and crude quality); 2) variable cash costs (highest in mature fields with low flow rates); 3) decommissioning liabilities (most material for offshore deep-water fields). As such, we believe that shut-ins are most likely at onshore, mature, depleted, heavier and sourer oil reservoirs in countries like Canada, the US, Russia, Latin America and China. Offshore fields are least likely to be affected, due to their generally higher crude quality, lack of infrastructure constraints and high decommissioning liabilities. Mature, heavier oil, high water-cut reservoirs will also suffer the most from a prolonged shut-in and may not return to their pre-shut-in production capacity once oil demand increases.

8) We believe the current oil crisis will see the energy industry finally achieve the restructuring it so badly needs. We have long argued that it is the supply and demand of capital that matters, not the supply and demand of barrels; as long as there is capital, companies can withstand difficult periods and the barrels always come back. The difference between today and 2015/16 is that shale and high-cost oil producers were already facing sharply higher costs of capital over the past year due to persistently poor shareholder returns. Indeed, these capital restrictions have only been exacerbated by recent events, whereas in 2015/16 capital never dried up – making the likelihood of capitulation by US E&Ps and EM producers much higher today. Further, the rebalancing phase in our New Oil Order framework was cut short in 2016 by Chinese stimulus that boosted demand followed by OPEC+ production cuts that curtailed supply. In the end, we never saw the final regeneration phase of rationalized assets that would have created a more sustainable industry over the longer term.

For the exclusive use of LIZZY.WALKER@GS.COM

For the exclusive use of LIZZY.WALKER@GS.COM

9) Today, we have already seen uneconomic firms shut off from capital. This suggests that the overdue rationalization of the industry is finally set to occur. We believe it will be very selective with a clear focus on upgrading portfolios: Big Oils will consolidate the best assets in the industry and will shed the worst assets. There will be local consolidation amongst E&Ps, and when the industry emerges from this downturn, there will be fewer companies of higher asset quality, but the capital constraints will remain. Capital markets focused on de-carbonisation and lack of visibility over long-term demand will constrain the remaining firms, leading to structural underinvestment and higher corporate returns, bringing an end to energy's lost decade. Only a significant supply shortfall once demand recovers could slow this much-needed industry consolidation and rationalization. A large, sustained deficit would lead to much higher prices until even marginal shale producers respond, as they remain the fastest cycle source of supply.

10) The climate change debate will almost certainly take a different course when the global economy emerges from this and is faced with the prospect of having to make large-scale investments into carbon-based industries. The silver lining of the coronacrisis is that the virtual shutdown of key carbon industries – autos, airlines and cruise ships – is likely to cause carbon emissions to fall this year, with initial data from China pointing to a c.20%+ fall during the peak of the shutdown. It is important to emphasize how the current shock is hurting the unsustainable industries but encouraging sustainable industries. The aircraft and migrant workers that used to bring the world fresh fish, fruit and vegetables have been stopped.

11) Technological hysteresis is already occurring. People are adapting to a more local existence and living off more sustainable activities, consuming less globally-produced fresh food, producing less waste with a more conservative approach to consumption, all of which may have lasting impacts on demand. Further, commuters and airlines account for c.16.0 million b/d of global oil demand and may never return to their prior levels. While oil prices are low today and physical constraints are forcing the behavioral changes, as oil shortages develop once economic activity normalizes, the high oil prices will likely accelerate the energy transition by constraining demand. For example, commuting and jet demand destruction may still be needed to cope with the supply shortage that is likely to occur once significant supply capacity is hampered. Higher oil prices would also greatly improve the relative economics of EVs and hydrogen. But from the supply side, capital markets' push for de-carbonization is likely to prevent the broad investment the industry will need to get out of this crisis and will reinforce a tight physical market beyond 2020.

12) Low returns in energy and commodities have been referred to as a lost decade. Oil has handed investors losses of about 8% per year since 2010. However, we believe that a bottom will be carved out in the coming weeks or months that will serve as the foundation for solid future returns similar to 1999. Combining these potential supply constraints with the large fiscal stimulus in response to the virus, we believe that physical inflationary concerns – with the dollar starting near an all-time high – will finally dominate the financial asset inflation that was a feature of the past decade that acted as a drag on energy and commodity returns. In the very near-term, however, we would play it from the short side. Nonetheless, we must keep in mind the fact that each downturn

has become increasingly shorter in duration as the system has been able to adapt more quickly, and although oil prices are likely to further decline in the coming weeks, it is important to start focusing on the transition.

For the exclusive use of LIZZY.WALKER@GS.COM

Disclosure Appendix

Reg AC

I, Michele Della Vigna, CFA, hereby certify that all of the views expressed in this report accurately reflect my personal views about the subject company or companies and its or their securities. I also certify that no part of my compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

We, Jeffrey Currie, Damien Courvalin, Callum Bruce and Daniel Sharp, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

Disclosures

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. **Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of the Global Investment Research Division of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client's objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client's own objectives, financial situation and needs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests and a copy of Goldman Sachs' Australian Sell-Side Research Independence Policy Statement are available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Brazil:** Disclosure information in relation to CVM Instruction 598 is available at https://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 20 of CVM Instruction 598, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** Goldman Sachs Canada Inc. is an affiliate of The Goldman Sachs Group Inc. and therefore is included in the company specific disclosures relating to Goldman Sachs (as defined above). Goldman Sachs Canada Inc. has approved of, and agreed to take responsibility for, this research report in Canada if and to the extent that Goldman Sachs Canada Inc. disseminates this research report to its clients. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 951-A, Rational House, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. **Japan:** See below. **Korea:** This research, and any access to it, is intended only for "professional investors" within the meaning of the Financial Services and Capital Markets Act, unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests is available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Research reports do not constitute a personalized investment recommendation as defined in Russian laws and regulations, are not addressed to a specific client, and are prepared without analyzing the financial circumstances, investment profiles or risk profiles of clients. Goldman Sachs assumes no responsibility for any investment decisions that may be taken by a client or any other person based on this research report. **Singapore:** Further information on the covered companies referred to in this research may be obtained from Goldman Sachs (Singapore) Pte. (Company Number: 198602165W). **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union: Disclosure information in relation to Article 6 (2) of the European Commission Delegated Regulation (EU) (2016/958) supplementing Regulation (EU) No 596/2014 of the European Parliament and of the Council with regard to regulatory technical standards for the technical arrangements for objective presentation of investment recommendations or other information recommending or suggesting an investment strategy and for disclosure of particular interests or indications of conflicts of interest is available at https://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

For the exclusive use of LIZZY.WALKER@GS.COM

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan and Type II Financial Instruments Firms Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Ombudsman Goldman Sachs Brazil: 0800 727 5764 and / or ouvidoriagoldmansachs@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Ouvidoria Goldman Sachs Brasil: 0800 727 5764 e/ou ouvidoriagoldmansachs@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by either Goldman Sachs Canada Inc. or Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom and European Union.

European Union: Goldman Sachs International authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority, has approved this research in connection with its distribution in the European Union and United Kingdom.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by our Global Investment Research Division. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (https://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

We and our affiliates, officers, directors, and employees, will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research, unless otherwise prohibited by regulation or Goldman Sachs policy.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is focused on investment themes across markets, industries and sectors. It does not attempt to distinguish between the prospects or performance of, or provide analysis of, individual companies within any industry or sector we describe.

Any trading recommendation in this research relating to an equity or credit security or securities within an industry or sector is reflective of the investment theme being discussed and is not a recommendation of any such security in isolation.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options and futures disclosure documents which are available from Goldman Sachs sales representatives or at https://www.theocc.com/about/publications/character-risks.jsp and https://www.fiadocumentation.org/fia/regulatory-disclosures_1/fia-uniform-futures-and-options-on-futures-risk-disclosures-booklet-pdf-version-2018. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

Differing Levels of Service provided by Global Investment Research: The level and types of services provided to you by the Global Investment Research division of GS may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to https://research.gs.com.

Disclosure information is also available at https://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.

For the exclusive use of LIZZY.WALKER@GS.COM

© 2020 Goldman Sachs.

No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.

For the exclusive use of LIZZY.WALKER@GS.COM