Note: The following is a redacted version of the original report published May 9, 2023 [44 pgs].

GS SUSTAIN: Green Capex

What's on track and spare capacity

Green Capex
The dominant driver of global infrastructure over the next decade

Higher interest rates and lower commodity prices continue to drive debates around the outlook for Green Capex — towards decarbonization, infrastructure and clean water goals — and catalysts for stocks in the Green Capex supply chain. We refresh our analysis of what's on track and continue to see private sector Green Capex per year $0.9 tn higher this decade vs. the 2016-20 annual run rate, though with lower but still substantial spare capacity among publicly-traded companies for additional investment. This still means government, consumer and additional private sector investment will be critical to meet the $2.8 tn increased annual Green Capex run rate needed globally, in our view. Investor feedback continues to focus on corporate rates of return — resilience, momentum and relative strength; we note nine sectors meet at least two of these based our refreshed analysis.

Sectors with favorable corporate returns trends

We highlight nine sectors for returns resilience, strength and/or momentum, meeting at least two of the three. Machinery (all three), Airlines, Diversified Telecom, Energy Equipment & Services, IPPs and Renewables, Transportation Infrastructure, Electrical Equipment, Electronic Equipment and Software.

Brian Singer, CFA
+1(212)902-8259 | brian.singer@gs.com
Goldman Sachs & Co. LLC

Enrico Chinello, Ph.D.
+1(212)357-3398 |
enrico.chinello@gs.com
Goldman Sachs & Co. LLC

Derek R. Bingham
+1(415)249-7435 |
derek.bingham@gs.com
Goldman Sachs & Co. LLC

Evan Tylenda, CFA
+44(20)7774-1153 |
evan.tylenda@gs.com
Goldman Sachs International

Emma Jones
+61(2)9320-1041 | emma.jones@gs.com
Goldman Sachs Australia Pty Ltd

Keebum Kim
+852-2978-6686 | keebum.kim@gs.com
Goldman Sachs (Asia) L.L.C.

Madeline Meyer
+44(20)7774-4593 |
madeline.r.meyer@gs.com
Goldman Sachs International

Brendan Corbett
+1(415)249-7440 |
brendan.corbett@gs.com
Goldman Sachs & Co. LLC

Grace Chen
+44(20)7774-5119 | grace.j.chen@gs.com
Goldman Sachs International

Varsha Venugopal
+1(415)393-7554 |
varsha.venugopal@gs.com
Goldman Sachs & Co. LLC

Xavier Zhang
+852-2978-6681 | xavier.zhang@gs.com
Goldman Sachs (Asia) L.L.C.

Goldman Sachs does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. 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. Analysts employed by nonUS affiliates are not registered/qualified as research analysts with FINRA in the U.S.

Table of Contents

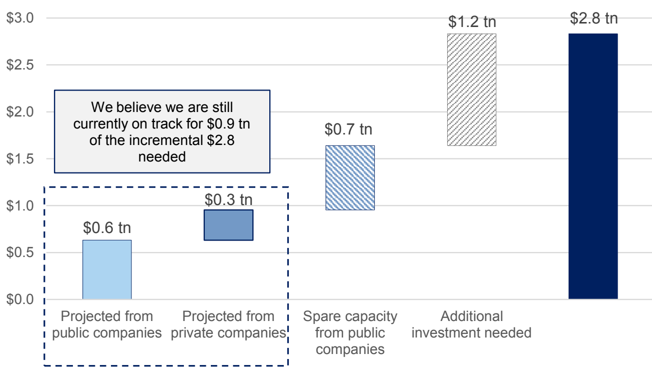
PM Summary

We refresh our estimates for Green Capex — investment this decade towards decarbonization, infrastructure and clean water Sustainable Development goals — for the latest expectations for both public and private companies that we believe can see greater ownership in ESG funds. Our analysis suggests five key takeaways.

1. **We continue to see Green Capex as a secular theme this decade, where we see the need to invest $2.8 trillion more annually in the 2020s (vs. the historical annual average in 2016-2020) to meet Decarbonization, Infrastructure and Clean Water goals.** After refreshing consensus/our estimates for the private sector, we still believe public + private companies are on track for $0.9 tn of the incremental $2.8 tn. Our analysis implies publicly traded companies have the ability to invest $0.7 trillion more (down vs. $0.9 tn previously in our Oct. 2022 report) without stretching balance sheets and while still retaining 30% of operating cash flow as free cash.
2. **Governments are investing more and accommodating greater private sector/consumer investment.** We continue to see positive momentum from government incentives stimulating additional Green Capex. We estimate the Inflation Reduction Act will represent incremental US government effective investment of $0.1 tn annually in 2023-32 vs. a 2022 base.
3. **Investor feedback continues to focus on corporate returns + thematic exposure — we highlight nine sectors for corporate returns strength, resilience and/or momentum.** As Sustainable Investors look for the overlap between favorable financial fundamentals and exposure to key Sustainability themes such as Green Capex, we see rising focus on corporate returns strength, resilience and momentum. We highlight nine sectors for having at least two of these three based on our analyst estimates — **Machinery (all three), Airlines, Diversified Telecom, Energy Equipment & Services, IPPs and Renewables, Transportation Infrastructure, Electrical Equipment, Electronic Equipment and Software.**
4. **Opportunity for discovery value more broadly across the supply chain remains.** We continue to see greater quantification of impact by Sustainable Investors and wider options for Sustainable fund objectives leading to a broadening of the investable universe.
5. **Green Revenue beneficiaries have outperformed Green Reinvestors and Greenablers.** Amid current volatility in markets, we believe this is potentially due to investors looking more closely at earnings tailwinds in deciding which companies to support.

Exhibit 1: We believe the private sector is still on track for $0.9 tn (unchanged vs. prior) of the incremental $2.8 tn Green Capex needed annually in the 2020s. We revise downwards our expectations for Green Capex spare capacity from publicly traded companies to $0.7 tn ($0.9 tn prior), raising the need for additional investments at $1.2 tn annually

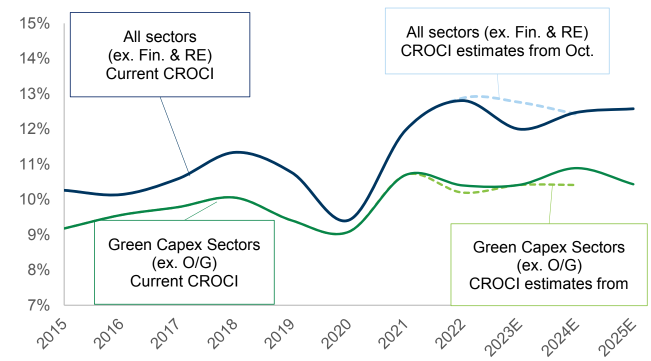
Components of incremental annual investment needed this decade to meet Net Zero, infrastructure and clean bwater goals, $ trillion



Source: IEA, OECD, McKinsey & Company, FactSet, Preqin, Goldman Sachs Global Investment Research

Exhibit 2: Corporate returns for all sectors (ex. Financials and Real Estate) have seen downward revisions for 2023E and are expected to be in-line in 2024E vs. our Oct. 2022 report — Green Capex sectors have seen positive revisions for 2024E

Weighted Average CROCI for all sectors and Green Capex sectors; comparison of current values vs. as published in our Oct. 2022 'Investing in Green Capex' report



All sectors excludes Financials and Real Estate; Green Capex sectors exclude Oil & Gas

Source: Goldman Sachs Global Investment Research

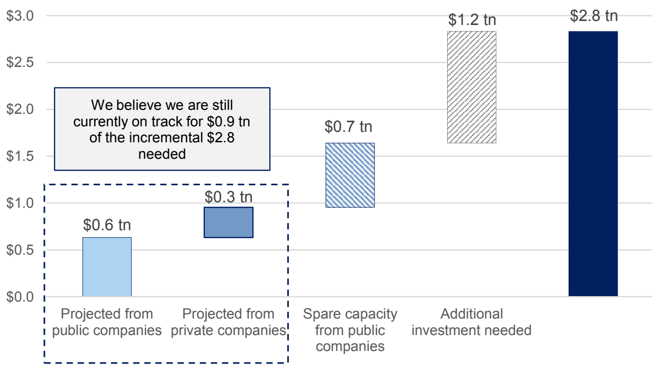
How much Green Capex is on track: Maintain private sector 2020s outlook after refresh

The need: We continue to see $6.0 trillion of annual Green Capex in the 2020s towards decarbonization/infrastructure/clean water, +$2.8 tn from the annual run rate in 2016-20. In our view, Green Capex will be a multi-year secular theme this decade, as focus rises on what's needed to decarbonize the world and meet Clean Water and infrastructure goals. We continue to see the need for annual investments of $6.0 tn this decade, globally. Of the total need, $2.8 tn would be incremental vs. historical annual Green Capex in 2016-2020 (Exhibit 4). We believe an all-in approach across sectors is required, providing opportunities across the Green Capex supply chain to participate in achieving these goals. To stimulate additional investment we believe three **C**'s will be required: **C**ollaboration, **C**omprehensive focus and **C**orporate returns (please see our report on Accelerating the Energy Transition: Stimulating capital and return on capital for more details).

What's on track: After refresh, we continue to see the private sector on track to deploy an incremental $0.9 tn in annual Green Capex — or 34% of the incremental $2.8 tn needed. After considering the latest consensus and analyst capex + R&D outlooks, our analyst estimates for Green Capex mix shifts and Green private equity funds raised, we maintain our outlook that private sector Green Capex is on track for an annual pace this decade $0.9 tn greater than the run rate in 2016-20. This comes $0.6 tn from publicly traded companies and $0.3 tn from private companies. We see potential for publicly traded companies to be investing $0.7 tn more in Green Capex (down from $0.9 tn from our October 2022 report, which as described in greater detail later in the report is largely a function of less expected cash flow from traditional energy companies) while still retaining 30% of operating cash flow as free cash flow and while still maintaining 1.5x net debt/EBITDA balance sheet. Please see Exhibit 3.

Exhibit 3: We believe the private sector remains on track for $0.9 tn (unchanged vs. prior) of the incremental $2.8 tn Green Capex needed annually in the 2020s. We revise downwards our expectations for Green Capex spare capacity from publicly traded companies to $0.7 tn ($0.9 tn prior)

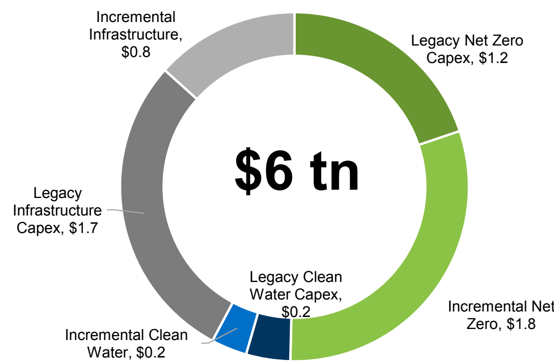
Components of incremental annual investment needed this decade to meet Net Zero, infrastructure and clean water goals, $ trillion



Source: IEA, OECD, McKinsey & Company, FactSet, Preqin, Goldman Sachs Global Investment Research

Exhibit 4: We see the need for an incremental $2.8 trillion of Green Capex per year in the 2020s to $6.0 tn per year on average to support Net Zero, Infrastructure and Clean Water goals

Green Capex in the Net Zero scenario



Source: World Bank, IEA, McKinsey, OECD, Goldman Sachs Global Investment Research

Capex: Greater growth off of higher 2022 base

Consensus expectations for overall capex + R&D growth in 2023E and 2024E are higher than in our October 2022 report off of a higher 2022 base. Consensus estimates currently call for annual growth in capex + R&D in 2023E-24E of 5.3% and 2.6%, respectively, for key sectors relevant for Green Capex. We note consensus expectations for annual capex + R&D growth in 2023E and 2024E are up from 1.0% and 1.5% published in our October 2022 report, with actual 2022 capex + R&D ending the year greater than our expectation in October. Please see Exhibit 5 for more details. Across Green Capex sectors, Capex + R&D growth is driven by Utilities and Clean Energy in 2023E — expected to see ~10% yoy Capex + R&D growth vs. 1% growth for all other Green Capex sectors. Capex + R&D growth in Utilities and Clean Energy is expected to slow down in 2024E and 2025E, but to remain positive. While consensus calls for a modest decline in Capex + R&D for other Green Capex sectors in 2025E, we believe consensus is likely conservative based on past upward revisions. We see potential for upward revisions upon greater corporate disclosure/project designations of capital plans.

We continue to assume Green mix shift consistent with our forward-looking analyst estimates outline in our Dec. 2022 ESG of the Future report, indicating a 1.5% Green Capex mix shift through 2025E. Solely applying overall capex + R&D growth does not factor in mix shift towards Green Capex, an important driver of Green Capex, in our view. As we detailed in our Dec. 2022 report outlining Green Revenue/Green Capex forecasts, our forward-looking estimates for Green Revenue and Green Capex mix by analysts across 20 sectors implies a 1.5% increase, annually, in weighting in Capex towards sustainable use cases through 2026E. Given potential for further upside, in our scenario analysis we apply the mix shift to capex and R&D across all sectors — not just the sectors surveyed in our analysis of forward-looking estimates.

We maintain our expectation for incremental annual Green Capex on track this decade from publicly traded companies to $0.6 tn. As detailed in Exhibit 6, we incorporate overall capex + R&D YoY growth expectations in 2022-24 and a 3.5% longer term (unchanged vs. our prior report), combined with a 1.5% per year Green mix shift (unchanged vs. our prior report). The 3.5% long-term CAGR is an intermediate data point between consensus estimates for yoy growth in Capeax + R&D in 2023 and 2024. While consensus estimates call for a yoy decline in Capex + R&D in 2025E, we still apply a 3.5% annual growth rate, to reflect our expectation that consensus expectations could potentially see upside via greater clarity on avenues for corporates to reinvest cash flow and given trends we see in opportunities/needs for investment. **Our analysis still implies $0.6 trillion in higher annual Green Capex on track this decade, on average — when applied across the >7,000 companies in our GS SUSTAIN database. We note the trend vs. our October 2022 report is higher before rounding.**

Exhibit 5: FactSet consensus indicates an acceleration in Capex + R&D growth rates in 2022-2025E, now expected to see a 4.4% CAGR (vs. 1.8% CAGR as of 6 months ago)

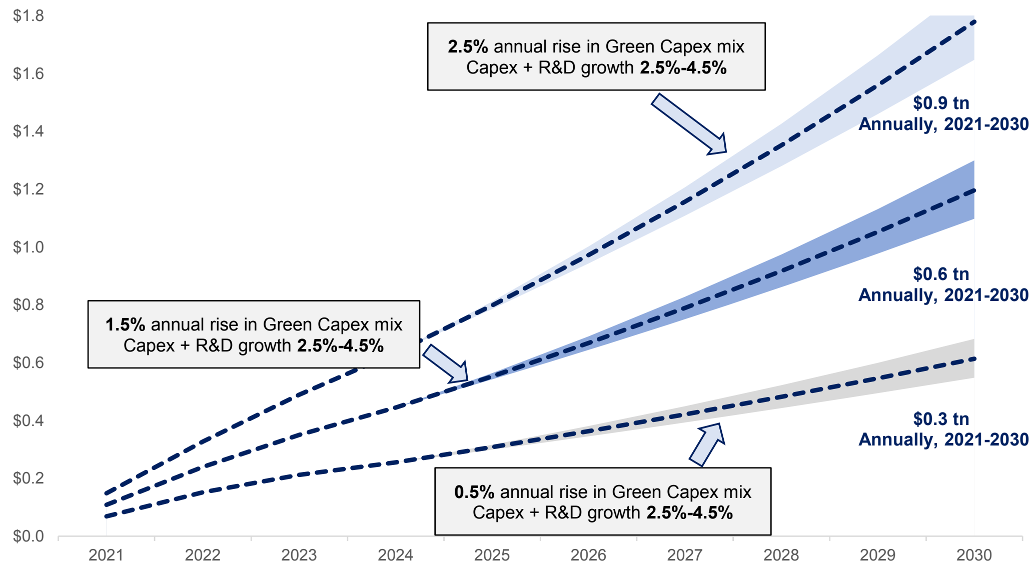
Overview of Capex + R&D YoY growth for Green Capex sectors (excluding Oil & Gas and Energy Equipment and Services), based on FactSet consensus; Total line includes all sectors (not just Green Capex sectors)

	Capex + R&D YoY Growth -- Weighted Average																	
	2022				2023E				2024E				2025E				2022-2025E CAGR	
	Current	vs. - 6-mo	vs. -3-mo	vs. -1-mo	Current	vs. - 6-mo	vs. -3-mo	vs. -1-mo	Current	vs. - 6-mo	vs. -3-mo	vs. -1-mo	Current	vs. - 6-mo	vs. -3-mo	vs. -1-mo	Current	- 6-mo
Airport Services	8.5%	→	↓	↓	9.5%	↑	↑	↑	5.4%	↑	→	↑	1.2%	↑	↑	↑	6.1%	-0.4%
Aluminum	30.9%	↑	→	↑	17.1%	↑	↑	→	-3.2%	↓	↓	↓	-1.7%	↑	↑	↑	9.9%	3.2%
Auto Parts & Equipment	15.0%	↑	↓	→	8.8%	↑	↑	↑	3.0%	↓	↓	→	-1.9%	↑	↑	↑	6.0%	-2.4%
Automobile Manufacturers	20.5%	↑	↑	↑	4.9%	→	→	↓	2.6%	→	↓	→	-3.8%	↑	↑	↑	5.7%	0.9%
Automotive Retail	0.7%	↓	↓	↓	2.0%	↑	↑	↑	-1.5%	→	↓	↓	-1.2%	↓	↓	↑	0.0%	2.2%
Building Products	8.2%	→	↓	→	11.7%	↑	↑	↑	-1.1%	↓	↓	↓	2.4%	↑	↑	↑	5.2%	2.9%
Construction & Engineering	8.8%	↑	↑	↑	-0.8%	↓	↓	↓	4.9%	↑	→	→	3.7%	↓	↓	↓	4.1%	7.2%
Construction Machinery & Heavy Trucks	9.7%	↑	↑	↑	6.1%	↑	↑	↑	1.5%	→	→	→	-5.0%	↓	↓	↓	2.9%	0.8%
Construction Materials	0.5%	↑	↑	↑	-2.0%	↑	↑	→	-4.0%	↓	→	→	0.8%	↓	↓	↓	-1.2%	-2.3%
Copper	33.6%	↓	↓	↑	27.1%	↑	↑	↓	-1.0%	↑	↑	↑	-11.3%	↓	↓	↑	10.5%	6.7%
Diversified Metals & Mining	10.4%	↓	↓	→	15.6%	↑	↑	↓	-2.8%	↑	↑	→	-10.0%	↑	↑	↑	2.8%	-0.1%
Diversified Real Estate Activities	28.2%	↑	↑	↑	-15.9%	↑	↑	↓	-7.5%	↓	↓	↓	3.4%	↓	→	↑	0.8%	-1.3%
Electric Utilities	9.9%	↑	↓	↑	5.7%	↑	↑	↓	0.9%	↓	↓	→	0.8%	↓	↓	→	4.3%	3.3%
Electronic Components	8.7%	↑	↑	↑	-6.2%	↓	↓	↓	4.1%	↑	↑	→	-8.9%	→	↑	↑	-0.8%	-2.9%
Electronic Equipment & Instruments	6.7%	↓	↓	→	6.0%	→	↑	↑	8.6%	↑	↑	↑	-7.3%	↓	↓	↑	3.3%	4.1%
Electronic Manufacturing Services	-14.2%	↓	↓	↓	28.9%	↑	↑	↑	7.3%	↑	↑	→	-30.0%	↑	↑	↑	-4.5%	-8.7%
Heavy Electrical Equipment	13.2%	↑	↑	↑	-0.9%	↓	↓	↓	5.5%	↑	→	→	2.6%	↑	↑	↓	5.0%	-9.8%
Highways & Railtracks	13.3%	↑	↑	↑	32.5%	↑	↓	↑	-24.7%	↓	↓	↓	-10.6%	↓	→	↑	0.2%	-0.2%
Homebuilding	10.2%	→	↓	↓	3.8%	↑	↑	↑	-0.7%	↑	→	→	-8.7%	↑	↑	↑	0.9%	-3.3%
Household Appliances	-5.3%	↑	↑	↑	9.9%	↓	↑	↓	6.1%	↑	→	→	8.1%	↓	↓	↑	4.5%	2.0%
Independent Power Producers & Energy Traders	21.4%	↓	↓	↓	15.1%	↑	↑	↑	1.4%	→	→	↑	8.8%	↑	↑	↑	11.4%	0.4%
Industrial Conglomerates	-9.0%	↓	↑	↑	18.0%	↑	↓	↓	4.5%	↓	↑	→	3.2%	↑	↑	↓	3.7%	-18.1%
Industrial Machinery	17.3%	↑	↓	→	6.8%	↑	↑	↑	0.4%	↑	→	→	-5.3%	↑	↑	↑	4.5%	-2.6%
Integrated Telecommunication Services	-1.2%	↑	↓	↑	-3.1%	↑	→	↑	-0.8%	↑	→	↑	0.0%	↑	↑	↑	-1.3%	-5.3%
Marine Ports & Services	34.9%	↑	↑	↑	-16.6%	↓	↓	↓	-1.8%	↑	↑	↓	-7.0%	↓	↑	↑	0.7%	7.1%
Multi-Utilities	3.4%	→	↑	↓	17.9%	↑	↓	↑	-3.0%	→	→	→	2.1%	↓	↓	↑	4.8%	1.9%
Railroads	27.7%	↑	↑	↑	-0.3%	↓	↓	↓	2.2%	→	→	↑	15.0%	↓	↓	↓	10.6%	9.2%
Real Estate Operating Companies	-47.4%	↓	↓	→	-11.4%	↑	↑	↓	-11.1%	↓	↓	→	7.6%	↓	↓	↓	-18.3%	-15.4%
Renewable Electricity	6.7%	↓	↓	↓	14.5%	↑	↑	↑	10.6%	↑	↑	↑	0.2%	↑	↑	↑	7.9%	5.0%
Semiconductor Equipment	29.0%	↑	↑	↑	11.6%	↑	↑	→	-3.0%	↓	↓	→	-8.4%	→	↓	↑	6.4%	3.8%
Semiconductors	26.0%	↑	↑	↑	-11.2%	↓	↓	→	6.3%	↑	↓	↓	7.6%	↑	↑	→	6.4%	-0.6%
Steel	9.1%	→	↑	↑	8.8%	↑	↑	→	-4.3%	↑	↑	→	-6.1%	↓	↑	↑	1.6%	-0.9%
Systems Software	22.2%	↑	↑	→	8.2%	→	→	→	8.3%	→	↓	→	4.3%	→	↓	→	10.6%	9.5%
Trucking	63.0%	↑	↑	↑	9.0%	↓	↓	↓	4.1%	↓	↓	→	19.5%	↓	↓	↓	21.9%	35.6%
Water Utilities	7.6%	↑	↑	→	10.6%	↑	↑	↑	-0.4%	↓	→	↓	-5.6%	↓	↓	↓	2.8%	3.3%
Wireless Telecommunication Services	4.5%	↑	↑	↑	-7.3%	↓	↓	↓	0.2%	→	→	→	-1.7%	↑	↑	↑	-1.2%	-3.5%
Total	**12.7%**	↑	↑	↑	**5.3%**	↑	→	→	**2.6%**	→	→	→	**-2.5%**	↑	↑	↑	**4.4%**	**1.8%**
Green Capex sectors	**11.1%**	↑	↑	↑	**2.8%**	↑	→	→	**1.7%**	→	→	→	**0.1%**	↑	↑	↑	**3.8%**	**0.3%**
Utilities and Clean Energy	9.7%	→	↓	→	9.8%	↑	↑	↑	0.7%	↓	→	→	1.8%	→	→	↑	5.4%	3.5%
Other Green Capex sectors	11.4%	↑	↑	↑	1.0%	→	→	→	1.9%	→	→	→	-0.3%	↑	↑	↑	3.4%	-0.6%

Arrows refer to revisions in consensus Capex + R&D yoy growth estimates, current estimates vs. 6/3/1-month old estimates. Green arrow: revision >1%. Yellow arrows: revisions between -1% and +1%. Red arrow: revision below -1%.

Source: FactSet, Goldman Sachs Global Investment Research

Exhibit 6: We now see incremental Green Capex from publicly traded companies would be $1.2 tn by 2030, with an annual average of $0.6 tn in the 2020s — in a scenario where the percent weighting for publicly traded companies of Green investments across all sectors were to rise at a 1.5% annual pace and overall capex + R&D grows at a 3.5% CAGR (both unchanged vs. our prior report in Oct. 2022)
Incremental Green Capex at different rates of mix shift and post-2024 Capex + R&D growth rates. Values in $ tn

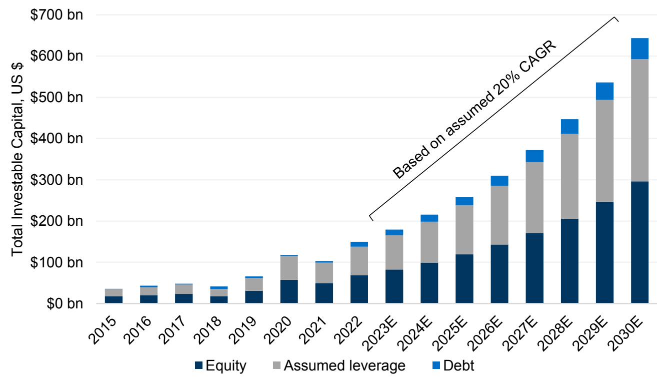


Bands are indicative of 2.5% / 3.5% / 4.5% range in post-2024 Capex + R&D growth rates

Source: Goldman Sachs Global Investment Research

We continue to see $0.3 trillion annually on track from private capital raised for Green Capex-related objectives, on average this decade. We reiterate our expectations for incremental Green Capex on track this decade from privately held companies of $0.3 trillion. Our analysis encompasses private capital raised in Renewable Energy, Clean Tech, Environmental Services, Utilities, Water fund. A scenario where private equity capital raised grows at a 20% CAGR — above the 12% historical CAGR of capital available to invest, and in-line with our Asset Management and Capital Markets teams' view of increasing share of ESG/Infrastructure capital — would imply incremental available capital from privately held companies of $0.3 tn on average within 2021-2030 (unchanged vs. our prior report in Oct. 2022).

Exhibit 7: We estimate Green private equity capital raised plus assumed leverage for 2022 was $150 bn; at a 20% CAGR, annual new available capital would average $0.3 tn this decade
Green private equity capital raised and forecasted, 2015 - 2030E



Assumes 20% CAGR and 50/50 leverage

Source: Preqin, Goldman Sachs Global Investment Research

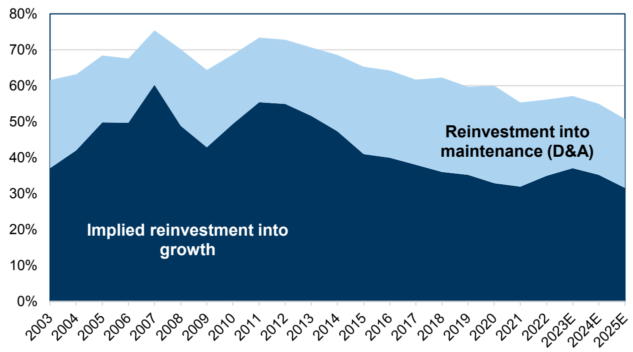
Reinvestment rate now implied to rise in 2023 before resuming decline

We see a pick-up in reinvestment rates of cash flows into capex + R&D in 2023E and 2024E vs. our prior Oct. 2022 Green Capex report, with 2023 expected to be higher vs. 2022 levels before resuming decline. Current estimates indicate reinvestment rates of operating cash flow into capex + R&D revised higher vs. our prior update in Oct. 2022 for 2023E/2024E — about 5 p.p. and 4 p.p. higher. While the trend over much of the past decade has been declining reinvestment rates vs. the 60%-70% seen between 2000 and the mid-2010s, estimates imply 2023 reinvestment rate will be up yoy before resuming declines in 2024-25. Please see Exhibit 8 and Exhibit 9 for more details. While this might be incrementally positive for Green Capex initiatives, we note reinvestment rates into capex + R&D (or aggregate operating cash flow) would still need to move considerably higher in order for publicly traded companies to bridge the gap needed to achieve the full incremental $2.8 tn annual Green Capex needed in the 2020s on path to clean energy/infrastructure and clean water-related Sustainable Development Goals.

Uptick in reinvestment rates vs. our prior report driven by both greater Capex + R&D and lower operating cash flow. As seen in Exhibit 10, the 4-5 p.p. increase in reinvestment rates in 2023E/2024E is driven by a 1%-5% decrease in operating cash flow expectations and a 6%-7% upward revisions in Capex expectations — for all sectors ex. Financials and Real Estate — in 2023E-2024E vs. our prior Green Capex report in Oct. 2022.

Exhibit 8: Reinvestment Rates of cash flows into Capex + R&D are expected to decline to near 50%-55% in 2023E-2025E vs. the historical average of 60%-70% between 2000 and mid-2010s

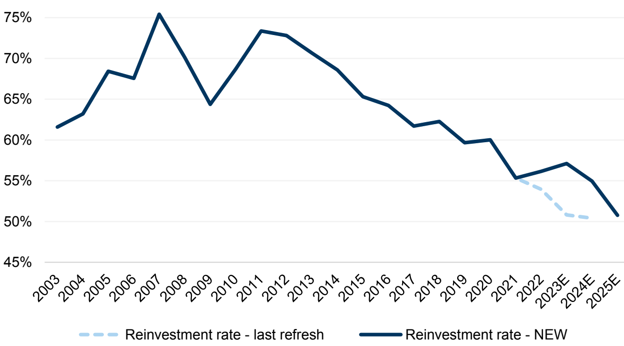
Weighted average reinvestment rate, (capex + R&D) / (operating cash flow + R&D), split by D&A and implied reinvestment into growth; excludes Financials and Real Estate



Source: FactSet, Refinitiv Eikon, Goldman Sachs Global Investment Research

Exhibit 9: Consensus expectations for reinvestment rate of operating cash flow back to Capex + R&D have been revised upwards since our Oct. 2022 report, by about 1-5 percentage points

Consensus estimates for reinvestment rates of cash flows into Capex+R&D, 2003 - 2025E — excludes Financials and Real Estate



Source: FactSet, Refinitiv Eikon, Goldman Sachs Global Investment Research

Exhibit 10: The revisions in expectations for reinvestment rates of cash flows into capex + R&D have been primarily driven by upward revisions to expected capex and downward revisions to expected cash flows

Change in 2023E and 2024E expectations for (1) reinvestment rate of cash flows into capex + R&D, (2) capex and (3) cash flows from operating activities

	Change in Expectations vs. October 2022 report					
	Reinvestment Rate*		Capex		Cash Flow	
	2023E	2024E	2023E	2024E	2023E	2024E
Air Freight & Logistics	8%	5%	-3%	-2%	-10%	-6%
Automobile Components	10%	11%	11%	9%	1%	-2%
Automobiles	5%	1%	9%	10%	4%	8%
Building Products	6%	12%	7%	5%	1%	-6%
Construction & Engineering	0%	22%	5%	4%	6%	-15%
Construction Materials	19%	23%	13%	20%	-5%	-3%
Diversified Telecommunication Services	2%	3%	2%	3%	0%	0%
Electric Utilities	6%	8%	9%	7%	3%	-1%
Electrical Equipment	-2%	-8%	13%	7%	15%	16%
Electronic Equipment Instruments & Components	4%	7%	5%	3%	1%	-5%
Energy Equipment & Services	19%	8%	22%	21%	2%	12%
Ground Transportation	2%	0%	1%	0%	-1%	0%
Independent Power and Renewable Electricity Producers	71%	-10%	112%	9%	24%	21%
Machinery	-6%	0%	5%	7%	12%	6%
Metals & Mining	4%	16%	2%	12%	-1%	-4%
Multi-Utilities	15%	10%	8%	9%	-6%	-1%
Oil Gas & Consumable Fuels	28%	14%	4%	8%	-19%	-6%
Passenger Airlines	0%	11%	4%	18%	4%	6%
Semiconductors & Semiconductor Equipment	16%	6%	-1%	-3%	-15%	-8%
Software	1%	3%	0%	3%	-1%	0%
Transportation Infrastructure	26%	3%	28%	10%	1%	7%
Water Utilities	17%	3%	5%	9%	-10%	6%
Wireless Telecommunication Services	-3%	5%	0%	4%	3%	-1%
Weighted average all sectors (ex-Financials)	**5%**	**4%**	**6%**	**7%**	**-5%**	**-1%**

* refers to the percentage points difference

Source: FactSet, Refinitiv Eikon, Goldman Sachs Global Investment Research

Green Capex spare capacity: Remains robust, but below prior estimate due to lower energy cash flow

We continue to see significant capacity for additional Green Capex from publicly traded companies though below our prior estimate. Based on excess free cash flow and balance sheet capacity, **we see $0.7 tn of annual spare capacity for additional Green Capex from publicly traded companies, down vs. $0.9 tn as of our Oct. 2022 report.** Our spare capacity forecast is based on a reinvestment rate of 70% (i.e., 30% of operating cash flow remains as free cash flow) and net debt/EBITDA of 1.5x. The reduction reflects rolling from 2022 base year to 2023 where capex + R&D is up yoy, upward revisions to capex and downward revisions to operating cash flow. As detailed above, reinvestment rates of cash flows into capex + R&D are expected to increase across Green Capex-critical sectors, due to a combination of expected growth in overall capex and a decline in operating cash flows. The $0.9 tn figure we presented in our Oct. 2022 report was calculated based on expectations for reinvestment rates and net debt/EBITDA for 2022 — the spare capacity referred to estimates for 2023E as of our Oct. 2022 report would have been $1.1 tn annually. Compared to the $0.7 tn described above, we note this implies a ~$0.4 tn decrease in Green Capex spare capacity (referred to 2023E) vs. data as of our Oct. 2022 report.

We highlight that:

- Spare capacity for additional Green Capex has increased modestly for 2 sectors — Metals & Mining and Electrical Equipment.
- Spare capacity is projected flattish for 2 other sectors — Airlines and Software.
- Spare capacity for additional Green Capex has declined in the remaining sectors we consider.

Please see Exhibit 11 and Exhibit 12 for more details on Green Capex spare capacity across sectors.

Spare capacity for additional Green Capex is still concentrated in a handful of sectors: Oil/Gas, Metals/Mining, Software and Autos. Our analysis indicates those 4 sectors hold about 97% of total Green Capex spare capacity. In particular, almost $0.4 tn of the total $0.7 tn (or 55% of overall spare capacity) are held in publicly traded Oil/Gas companies under GS coverage. Metals/Mining, Software and Autos account for 18%, 13% and 12% of total spare capacity, respectively. We note Oil & Gas companies were expected to hold $0.7 tn in additional spare capacity for Green Capex based on 2023E data at the time of Oct. 2022 report, vs. $0.4 tn currently. This is primarily driven by the outlook for oil prices having been revised downward since our prior report — please see our colleagues' note Oil Analyst: A Longer Road to Higher Prices for more details.

As we recently detailed in our Use of cash flow through a Sustainable Investing lens report, when determining whether to afford credit to companies' increased Green Capex, we see investors considering:

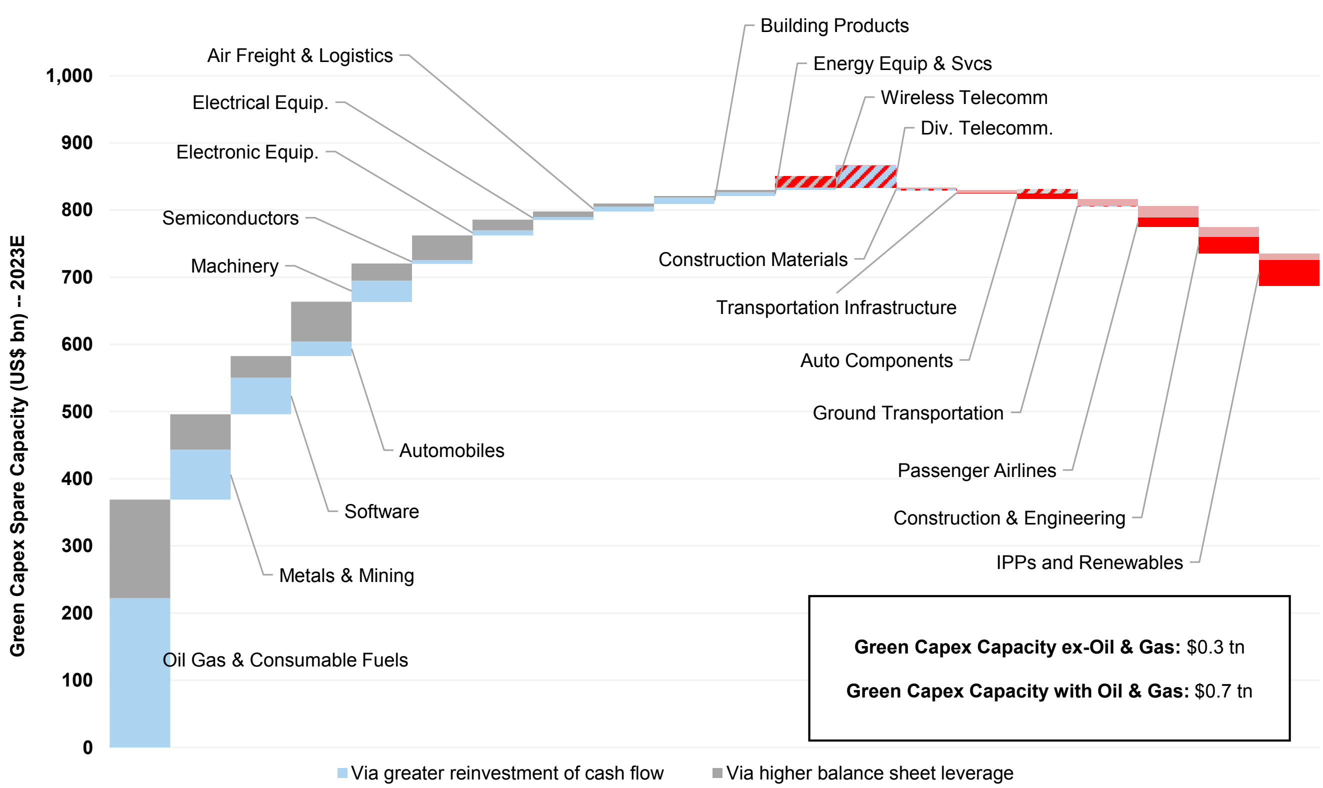
- **C**ore competencies in that area

- **A**vailable capital to deploy
- **R**eturns at the corporate level that are/remain favorable
- **E**xecution to meet goals and raise revenue contribution from Green initiatives that are material.

We believe companies that can demonstrate they are low-cost, low environmental footprint safe operators of a good that serves a sustainable purpose should receive credit for reinvesting in their base business — even if their base business is non-Green. Please see Exhibit 13 for a broad overview of the key questions sustainability investors could consider when determining whether to support capital allocation strategies.

Exhibit 11: Among Green Capex-critical sectors, we see $0.7 tn in annual spare capacity for Green Capex based on 70% reinvestment rate of cash flows and 1.5 Net Debt/EBITDA leverage

Green Capex spare capacity from key relevant sectors needed for Net Zero, Infrastructure and Clean Water goals



Spare Green Capex capacity considers potential for shift in reinvestment and tolerance for leverage. Reinvestment capacity is based on incremental capex/R&D capacity to achieve a 70% 2023E reinvestment rate of cash flow. Leverage capacity is based on incremental spending per year over remainder of decade based on difference between 2023E net debt/EBITDA and 1.5x.

Source: Goldman Sachs Global Investment Research

Exhibit 12: Estimates for 2023E as of our last refresh in Oct. 2022 called for Green Capex space capacity among public companies of ~$1.1 tn annually ($0.9 tn based on FY22E previously); durrent estimates for 2023E indicate a decrease in spare capacity of ~$0.4 tn, primarily driven by Oil & Gas

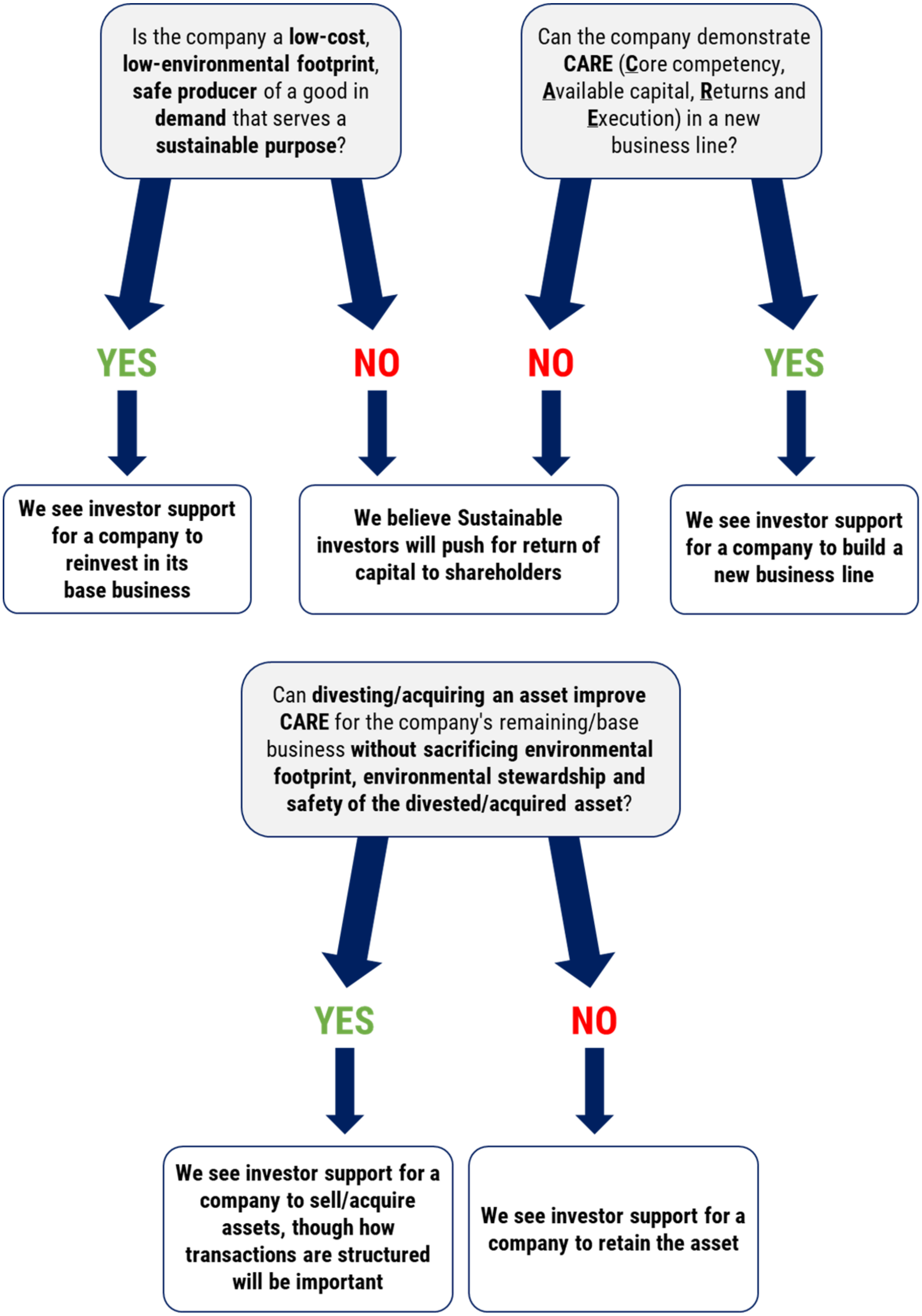
Change in Green Capex spare capacity vs. our Oct. 2022 refresh — via Greter Reinvestment of Cash Flows into Capex + R&D, Higher Leverage and Total. Refers to 2023E.

	Change in Green Capex spare capacity vs. our prior report							
	Driven by Reinvestment Rate				Driven by Leverage		Total	
	Via Δ CF+R&D $ bn	Via Δ Capex+R&D $ bn	Total Δ $ bn		$ bn		$ bn	
Air Freight & Logistics	($4)	$1	($3)	↓	($2)	↓	($6)	↓
Automobile Components	$2	($13)	($10)	↓	($2)	↓	($13)	↓
Automobiles	$17	($29)	($12)	↓	($6)	↓	($18)	↓
Building Products	$0	($1)	($1)	↓	($1)	↓	($2)	↓
Construction & Engineering	$10	($19)	($10)	↓	($4)	↓	($14)	↓
Construction Materials	($1)	($4)	($4)	↓	($1)	↓	($5)	↓
Diversified Telecommunication Services	($3)	($1)	($4)	↓	($3)	↓	($6)	↓
Electrical Equipment	$11	($10)	$1	↑	$1	↑	$1	↑
Electronic Equipment Instruments & Components	$1	($4)	($3)	↓	($3)	↓	($5)	↓
Energy Equipment & Services	$1	($4)	($3)	↓	$0	→	($3)	↓
Ground Transportation	($1)	($0)	($2)	↓	($2)	↓	($4)	↓
Independent Power and Renewable Electricity Producers	$3	($32)	($29)	↓	($5)	↓	($33)	↓
Machinery	$14	($7)	$7	↑	$1	→	$8	↑
Metals & Mining	($6)	($2)	($8)	↓	($4)	↓	($12)	↓
Oil Gas & Consumable Fuels	($167)	($18)	($185)	↓	($84)	↓	($270)	↓
Passenger Airlines	$2	($3)	($1)	↓	$1	→	($0)	→
Semiconductors & Semiconductor Equipment	($36)	($0)	($36)	↓	($15)	↓	($52)	↓
Software	($3)	$1	($2)	↓	($1)	→	($3)	→
Transportation Infrastructure	($1)	($2)	($3)	↓	$2	↑	($1)	↓
Wireless Telecommunication Services	$3	$1	$4	↑	($5)	↓	($1)	↓
Total	**($160)**	**($145)**	**($306)**	↓	**($133)**	↓	**($439)**	↓
Excluding Oil Gas and Energy Services	$7	($124)	($117)	↓	($49)	↓	($166)	↓

Green arrows: increase greater than 5%. Yellow arrows: percent change between +5% and -5%. Red arrows: decrease greater than 5%.

Source: FactSet, Goldman Sachs Global Investment Research

Exhibit 13: We believe Sustainable Investor support for corporate cash allocation strategies will depend on 3 key questions
How we see more Impact-focused Sustainable Investors weighing corporate use of cash options



Source: Goldman Sachs Global Investment Research

Governments incentivizing more Green Capex: IRA case study

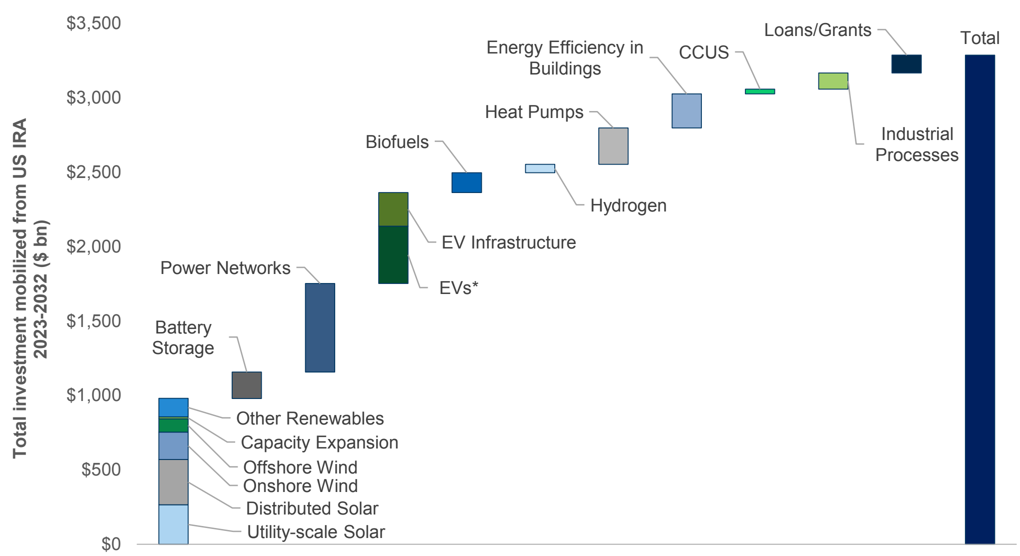
We see policy initiatives such as the Inflation Reduction Act as supportive of rising Green Capex deployments... We noted in our most recent report on the US Inflation Reduction Act we see the provisions in the bill stimulating meaningful investments across the Green Capex supply chain in the US, totaling $2.9 tn in 2023-2032. When considering consumer spending on EVs — via the premium pricing for EVs vs. equivalent ICEs — the total investment mobilized increases to $3.3 tn in the same period (Exhibit 14). **In our view, about 50% of the $3.3 tn of total cumulative investments mobilized by the US IRA will be incremental vs. the pre-IRA baseline.** Please see Exhibit 15 for more details.

- Total investments in the verticals impacted by the US IRA amounted to ~$160 bn in 2022 (including consumer spending for EVs), prior to the bill going into effect.
- Extending the same run-rate to the decade 2023-2032 in which the IRA is meant to stimulate investments, we derive total baseline investments of $1.6 tn. Compared to the total investments of $3.3 tn stimulated by the bill in 2023-2032, this implies **incremental capital mobilized of about c.$1.7 bn in the same period ($165 bn annually)**, or c.50% of the total.
- We expect the government contribution to be $1.2 tn in 2023-32, up ~$110 bn annually vs. the run rate in 2022 for energy and climate-related incentives.

We note that this will not fully bridge the gap towards what's needed globally based on our analysis what's on track and what's needed. From an emissions perspective, we see US carbon dioxide emissions down 39% in 2030 vs. 2005 levels (below rate targeted by the Biden Administration for total greenhouse gas emissions of 50%-52%).

For more details, please see our US Inflation Reduction Act: Latest views on capital mobility, timing, US budget-related risks report from May 3 or Carbonomics: The third American energy revolution from March 22.

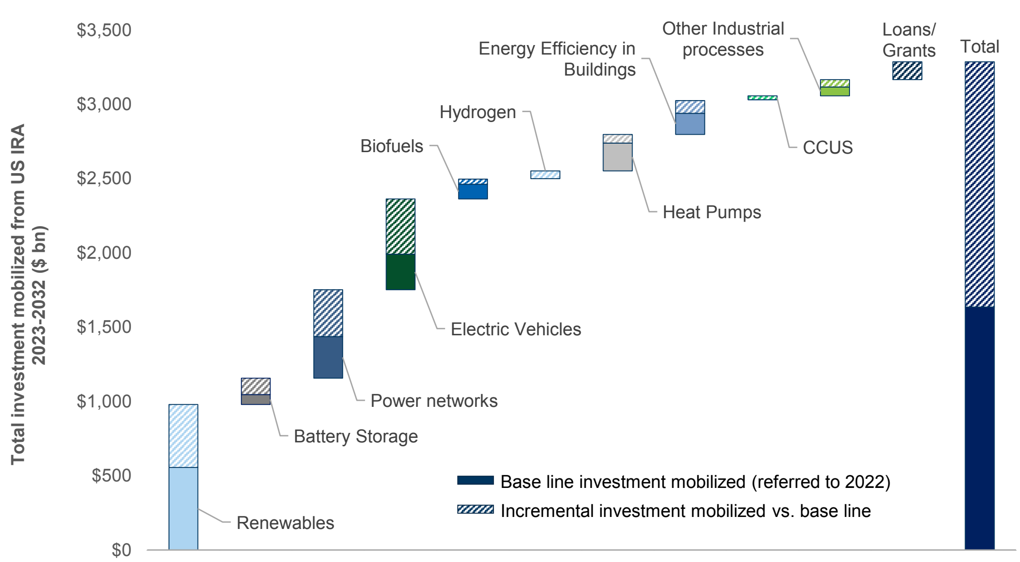
Exhibit 14: Total investment mobilized: Our bottom-up analysis indicates the US IRA will mobilize $2.9 tn in 2023-2032, $3.3 tn when considering the incremental spending for EV purchases
Cumulative investment mobilized on the back of the US Inflation Reduction Act, 2023-2032; $ bn



* Investment in EVs calculated using the expected ASP premia for EV vs. corresponding internal combustion engine vehicle

Source: Goldman Sachs Global Investment Research

Exhibit 15: Incremental investment mobilized: Our base case forecasts imply the IRA will lead to an average annual run rate of investment in 2023-32 that is double 2022 levels
Cumulative investment mobilized from US IRA, 2023-2032, divided in baseline (referred to 2022) and incremental vs. baseline; $ bn



Source: Goldman Sachs Global Investment Research

Profitability: Focus on sectors with resilient, favorable and/or rising corporate returns

Feedback from investors on Green Capex and broader Sustainable Investing themes suggests continued focus on profitability/corporate returns, which we believe will remain front and center. For Green Capex, we believe investors will view more favorably sectors critical for Green Capex goals where corporate returns are expected to be a combination of resilient, above-average and/or having favorable momentum in coming years. In particular, sectors where corporate returns are considered favorable that also have spare capacity for increased Green Capex could also see greater Sustainable Investing interest in engagement.

Among Green Capex-critical sectors, 9 are expected to see at least two of key corporate returns indicators: (1) resilient in 2023E/2024E vs. our prior Oct. 2022 report; (2) greater than industry average in 2023E/2024E; or (3) rising in 2023E/2024E vs. 2022. As detailed in Exhibit 16, current estimates call for corporate returns:

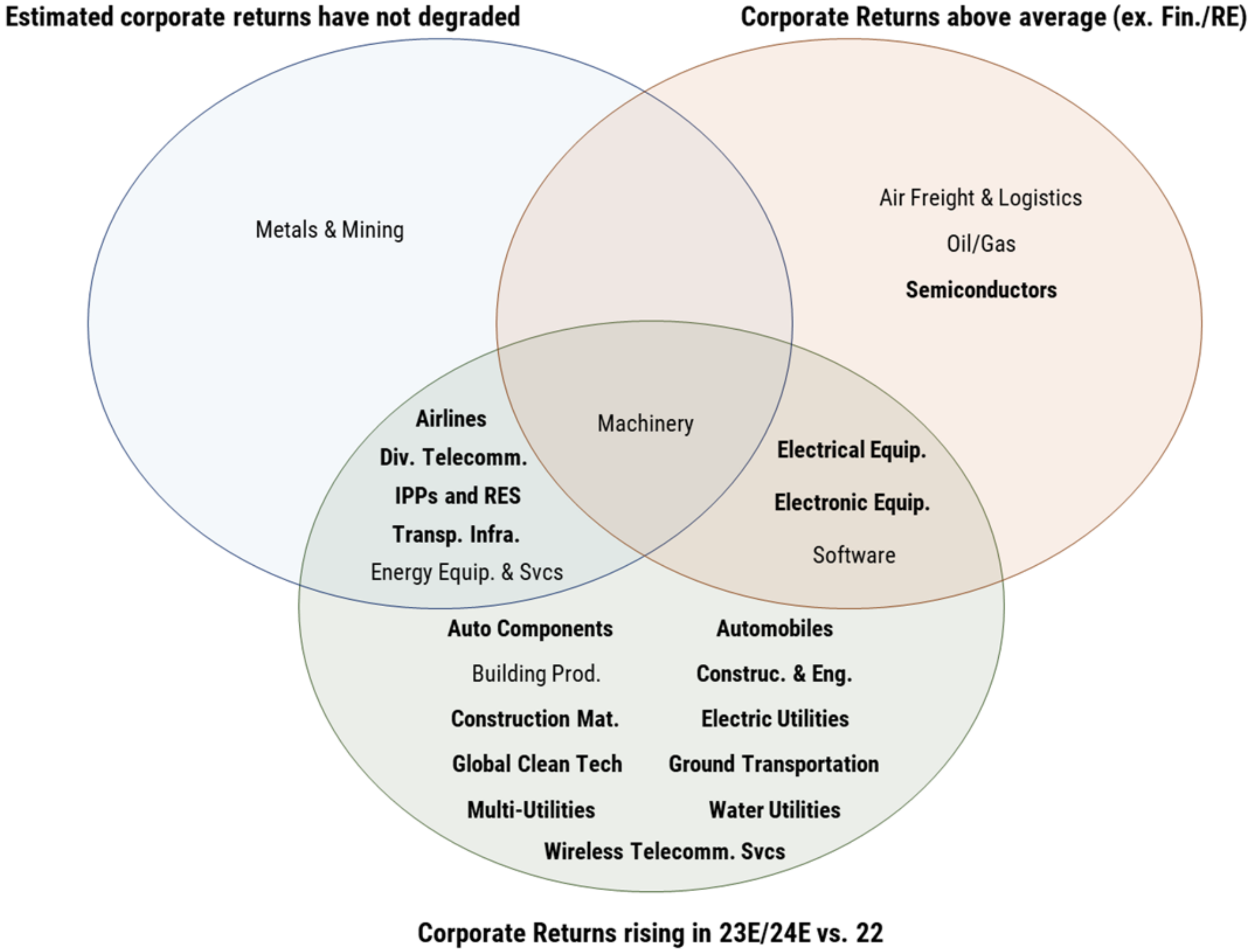
- To be resilient vs. our Oct. 2022 report, above industry average and rising in 2023E/2024E vs. 2022 in 1 sector: **Machinery**.
- To be resilient vs. our Oct. 2022 report and rising in 2023E/2024E vs. 2022 in 5 sectors: **Airlines**, **Diversified Telecomm.**, **Energy Equipment & Services**, **IPPs and Renewables** and **Transportation Infrastructure**.
- To be above industry average and rising in 2023E/2024E vs. 2022 in 3 sectors: **Electrical Equipment**, **Electronic Equipment** and **Software.**

Among Green Capex-critical sectors, reinvestment rates of operating cash flow into Capex + R&D are expected above-average in 2023E/2024E for 16 sectors. The remaining 7 — Air Freight & Logistics, Building Products, Energy Equipment, Machinery, Metals & Mining, Oil/Gas and Software — are forecast to have reinvestment rates below average. We note that Global Clean Tech companies are expected to see reinvestment rates above average.

Expectations for industry corporate returns — Green Capex + other sectors ex. Financials and Real Estate — in 2023E have been revised downwards vs. our Oct. 2022 report. However, current estimates for 2024E industry-wide corporate returns are in-line with our prior estimates from Oct. 2022. Please see Exhibit 17 for more details. Returns expectations for 2023E — measured as cash return on cash invested (CROCI) and ex. Financials and Real Estate — have seen ~80 bps of downward revisions vs. prior estimates in our Oct. 2022 report. Our analyst estimates now call for corporate returns across all sectors of 12.0% and 12.5% in 2023E and 2024E, respectively. This compares with pre-pandemic corporate returns of 10.8% in 2019 and 11.0% on average in 2010-2019 average for all sectors.

Exhibit 16: Machinery is the only sector where returns have not degraded since our October 22 report, are expected to be above average and are expected to rise; 8 other sectors meet at least 2 of the 3 criteria

Overview of sectors for which (1) corporate returns analyst estimates have not degraded vs. our Oct. 2022 report, (2) estimated corporate returns in 2023E-24E are above average (ex. Financials and Real Estate) and (3) corporate returns are forecast to rise in 2023E or 2024E vs. 2022. Bolded sectors have above-average — ex. Financials & Real Estate — reinvestment rate (refers to 2023E-24E average)



Corporate returns are considered not degraded if current estimates are higher than or within 0.1% of prior estimates. Calculations refer to the sector 23E/24E average cash return on cash invested (CROCI).

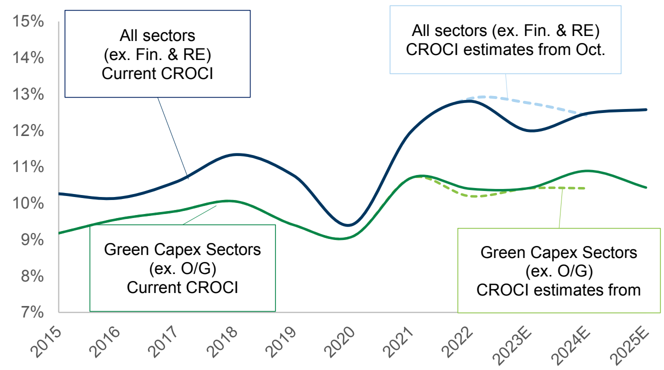
Source: Goldman Sachs Global Investment Research

Corporate returns in Green Capex sectors specifically are projected in-line with prior expectations in 2023E — we note a ~50 bps upward revision in 2024E vs. prior estimates. As reported in Exhibit 17, on a weighted average basis for Green Capex-critical sectors excluding Oil/Gas — current estimates imply corporate 2023E CROCI in-line with those in our Oct. 2022 report. However, we note returns across Green Capex sectors are now expected to rise in 2024E (a ~50 bps upward revision vs. prior estimates).

Returns are expected to have positive momentum in 2022 through 2025E for 10 sectors: Auto Components, Automobiles, Building Products, Construction Materials, Electrical Equipment, Energy Equipment, Ground Transportation, Machinery, Passenger Airlines, Transportation Infrastructure. The majority of Green Capex sectors are expected to see rising returns in 2023E, 2024E and 2025E vs. the prior year — 16 sectors in 2023E, 17 sectors in 2024E and 14 sectors in 2025E, out of 23 total. Please see Exhibit 19 for more details.

Exhibit 17: Corporate returns for all sectors (ex. Financials and Real Estate) have seen downward revisions for 2023E and are expected to be in-line in 2024E vs. our Oct. 2022 report — Green Capex sectors have seen positive revisions for 2024E

Weighted Average CROCI for all sectors and Green Capex sectors; comparison of current values vs. as published in our Oct. 2022 'Investing in Green Capex' report

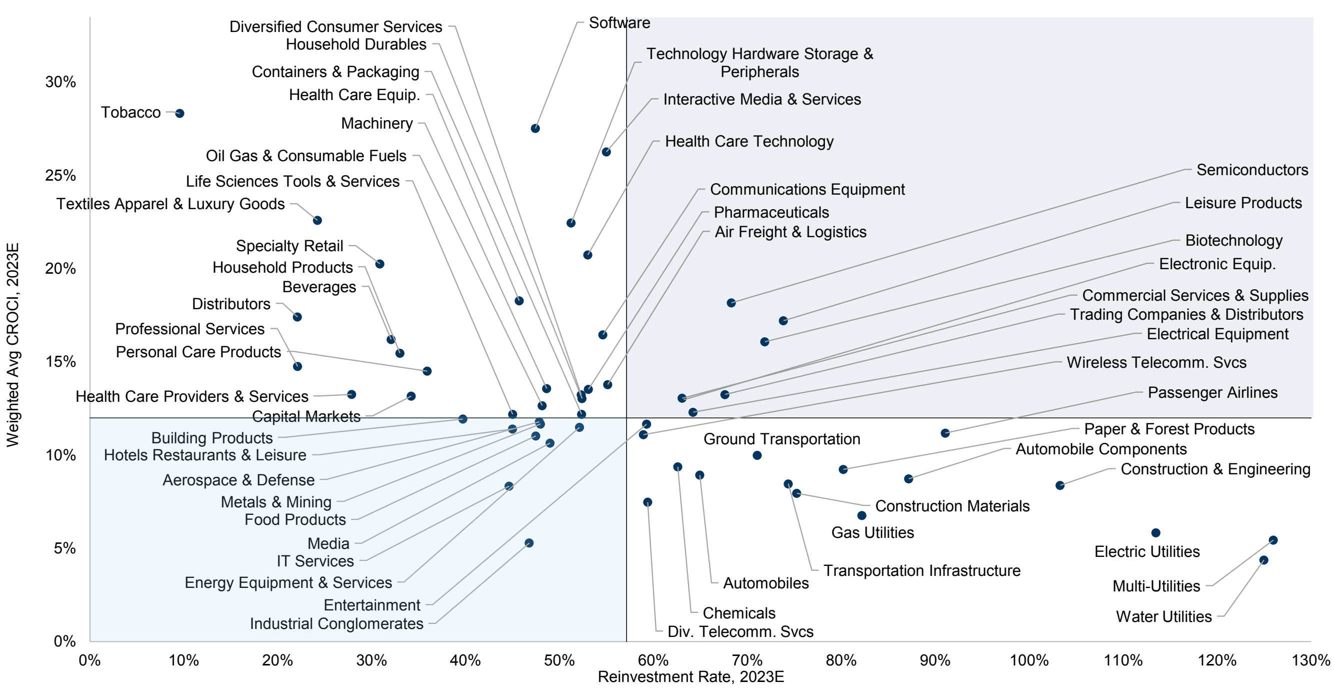


All sectors excludes Financials and Real Estate; Green Capex sectors exclude Oil & Gas

Source: Goldman Sachs Global Investment Research

Exhibit 18: There are still relatively few sectors with expected above-average corporate returns that are expected to invest more than 60% of adjusted cash flow in R&D and capex — suggesting capacity for further investment

Reinvestment rate vs. cash return on cash invested weighted average by sector for companies covered by GS Research, 2023E



* We view Real Estate cash return on cash invested as less comparable than other sectors

Source: FactSet, Goldman Sachs Global Investment Research

Exhibit 19: Among sectors critical for Green Capex, 16 are expected to see corporate returns rising YoY in 2023E, while 17 are expected to see corporate returns rise in 2024E

Overview of sector-level weighted average CROCI in 2022-2025E. Highlighted sectors are forecast to have rising corporate returns throughout the considered period.

Green Capex-critical sectors		CROCI (2022)	CROCI (2023E)		CROCI (2024E)		CROCI (2025E)	
Air Freight & Logistics	↓	16.4%	13.8%	↓	14.6%	↑	16.1%	↑
Automobile Components	↑	7.8%	8.7%	↑	9.3%	↑	9.7%	↑
Automobiles	↑	8.2%	8.9%	↑	9.1%	↑	10.0%	↑
Building Products	↑	11.6%	11.9%	↑	12.5%	↑	13.0%	↑
Construction & Engineering	↑	8.2%	8.4%	↑	8.4%	→	9.7%	↑
Construction Materials	↑	7.5%	8.0%	↑	8.1%	↑	8.4%	↑
Diversified Telecommunication Services	→	7.3%	7.5%	↑	7.4%	↓	7.4%	→
Electric Utilities	↑	5.6%	5.8%	↑	5.8%	→	5.8%	→
Electrical Equipment	↑	9.8%	12.3%	↑	13.3%	↑	14.9%	↑
Electronic Equipment Instruments & Components	↑	13.4%	13.0%	↓	13.9%	↑	13.9%	→
Energy Equipment & Services	↑	9.5%	11.5%	↑	12.7%	↑	13.2%	↑
Ground Transportation	↑	9.1%	10.0%	↑	10.9%	↑	11.6%	↑
Independent Power and Renewable Electricity Producers	↑	5.3%	6.0%	↑	5.9%	↓	5.8%	→
Machinery	↑	12.1%	13.6%	↑	13.9%	↑	14.8%	↑
Metals & Mining	↓	13.3%	11.7%	↓	11.5%	↓	12.1%	↑
Multi-Utilities	↑	4.1%	5.4%	↑	5.6%	↑	5.5%	→
Oil Gas & Consumable Fuels	↓	16.4%	12.7%	↓	12.4%	↓	12.2%	↓
Passenger Airlines	↑	6.9%	11.2%	↑	12.2%	↑	12.7%	↑
Semiconductors & Semiconductor Equipment	↓	18.9%	15.0%	↓	18.0%	↑	17.9%	↓
Software	↓	27.8%	27.5%	↓	29.2%	↑	19.1%	↓
Transportation Infrastructure	↑	7.3%	8.5%	↑	9.0%	↑	9.2%	↑
Water Utilities	↑	4.5%	4.4%	↓	4.6%	↑	4.7%	↑
Wireless Telecommunication Services	↑	9.5%	11.1%	↑	11.3%	↑	10.5%	↓
Green Capex sectors -- ex. Oil/Gas	→	**10.4%**	**10.4%**	→	**10.9%**	↑	**10.3%**	↓
All Sectors, Weighted Average **(ex. Financials and Real Estate)**	↓	**12.7%**	**12.0%**	↓	**12.4%**	↑	**12.5%**	↑

Green arrows indicate an increase greater than 0.1%, red arrows indicate a decrease greater than 0.1%, yellow arrows represent changes between +/- 0.1%. Arrows beside sector names refer to the percentage point difference in 2025E CROCI vs. 2022 CROCI. Arrows in 2023E/2024E/2025E columns refer to the percentage point difference vs. the prior year.

Source: Goldman Sachs Global Investment Research

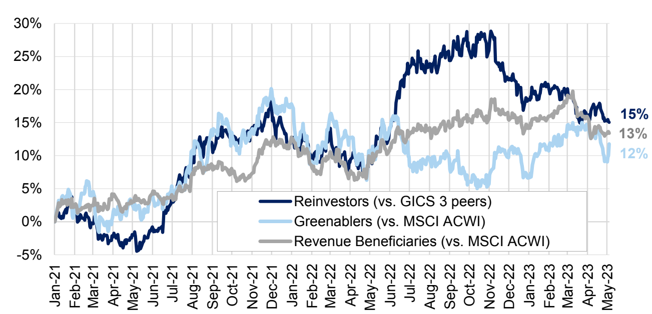
Green Capex stock performance: Mixed since the beginning of 2022

Stocks screening under our Green Capex investment themes have broadly outperformed market benchmarks since the beginning of 2021, but performance has been mixed since the beginning of 2022. For both universes, stocks meeting the criteria of our Green Capex investment themes have outperformed market benchmarks — sector peers based on GICS 3 classification for Reinvestors, MSCI ACWI for Revenue Beneficiaries and Greenablers — since the beginning of 2021. On the contrary, when we consider stock performance starting in 2022, performance of Green Capex stocks — based on current and prior selection criteria — has been mixed. We continue to see scope for greater appreciation of Green Capex stocks potentially driving greater ESG weightings across these themes on the back of:

- Exposure to secular growth themes through global investments in climate transition and UN SDGs.
- Attractive profile corporate returns, which we believe could receive greater focus in the wake of recent market volatility.
- Further discovery value as more than 60% of Green Capex stocks in GS coverage (inclusive of all ratings) are underweight in ESG funds relative to their respective weights in the benchmark.

We note the differences in relative performance across Reinvestors based on stocks that currently meet our selection criteria vs. those in October 2022 is primarily due to a change in universe composition. In particular, we note higher outperformance vs. GICS 3 peers — on average — across Metals & Mining, Machinery, Construction Materials and Chemicals, for stocks that currently meet our criteria vs. the selections outlined in our Oct. 2022 report.

Exhibit 20: Based on our latest refresh, stocks that screen for our three Green Capex investment themes have broadly outperformed respective benchmarks since the beginning of 2021...
Average relative stock performance of Green Revenue Beneficiaries, Green Re-investors and Greenablers since Jan. 1, 2021. Based on current stock selection tools

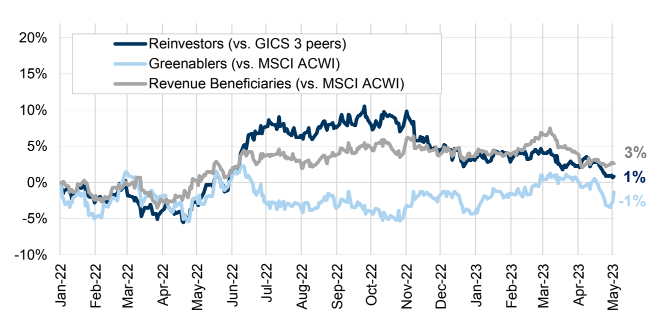


Note: Equal weighted indices. Includes stocks with corporate returns above average -- referred to global or regional sector average, ex. Greenablers. Stock selection based on criteria discussed in the report, but includes Neutral and Sell-rated stocks as opposed to just Buy-rated stocks.

Data as of May 5

Source: Refinitiv Eikon, Goldman Sachs Global Investment Research

Exhibit 21: ... While performance since Jan. 2022 has been mixed: Reinvestors and Green Revenue Beneficiaries have modestly outperformed benchmarks, Greenablers have modestly lagged.
Average relative stock performance of Green Revenue Beneficiaries, Green Re-investors and Greenablers since the beginning of 2022. Based on current stock selection tools



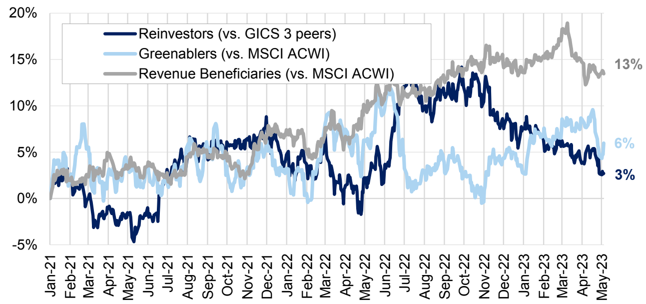
Note: Equal weighted indices. Includes stocks with corporate returns above average -- referred to global or regional sector average, ex. Greenablers. Stock selection based on criteria discussed in the report, but includes Neutral and Sell-rated stocks as opposed to just Buy-rated stocks.

Data as of May 5

Source: Refinitiv Eikon, Goldman Sachs Global Investment Research

Exhibit 22: Stocks exposed to the Green Capex investment themes based on our Oct. 2022 report screen have broadly outperformed market benchmarks since beginning of 2021 — Revenue Beneficiaries have generated the greatest outperformance

Average relative stock performance of Green Revenue Beneficiaries, Green Re-investors and Greenablers since Jan. 1, 2021. Based on stock selection tools as of Oct. 2022



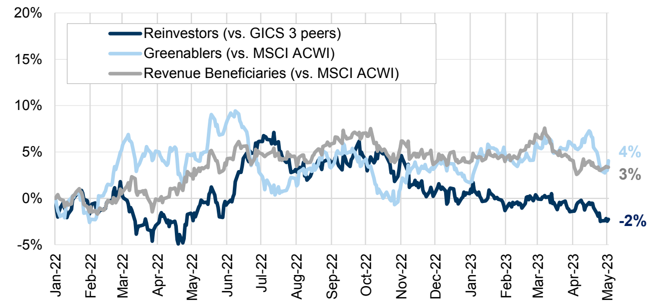
Note: Equal weighted indices. Includes stocks with corporate returns above average -- referred to global or regional sector average, ex. Greenablers. Stock selection based on criteria discussed in the report, but includes Neutral and Sell-rated stocks as opposed to just Buy-rated stocks.

Data as of May 5

Source: Refinitiv Eikon, Goldman Sachs Global Investment Research

Exhibit 23: Stocks exposed to the Green Capex investment themes based on our Oct. 2022 report have generated mixed performance: Greenablers and Revenue Beneficiaries have modestly outperformed, Reinvestors have modestly lagged

Average relative stock performance of Green Revenue Beneficiaries, Green Re-investors and Greenablers since the beginning of 2022. Based on stock selection tools as of Oct. 2022



Note: Equal weighted indices. Includes stocks with corporate returns above average -- referred to global or regional sector average, ex. Greenablers. Stock selection based on criteria discussed in the report, but includes Neutral and Sell-rated stocks as opposed to just Buy-rated stocks.

Data as of May 5

Source: Refinitiv Eikon, Goldman Sachs Global Investment Research

Green Revenue Beneficiaries

We continue to believe investors could potentially reward companies that stand to be revenue beneficiaries of Green Capex spending across the supply chain. We see rising investors' interest to seek broader exposure to Net Zero, Clean Water and Infrastructure goals, particularly for those companies which stand to potentially be revenue beneficiaries of Green Capex spending upstream in the supply chain. Revenue beneficiaries not expected to reinvest a high and/or rising share of cash flows into capex could also attract greater investor support in the current market more focused on profitability vs. long-term net asset value, in our view.

Electrical Equipment and Machinery are the most represented sectors among Green Revenue Beneficiaries — we see favorable profitability tailwinds nearer term for Industrials. The two sectors are significantly overweight in ESG funds, being owned at 195%-282% of the weight of their sector benchmark — based on GICS 3 classification. However, the range of ownership in ESG funds for companies in those sectors is significantly wide, and thus we still see opportunities for greater recognition in ESG funds of Machinery and Electrical Equipment companies — we note these companies have broad exposure to almost all verticals in the Green Capex mosaic. In addition to potential earnings tailwinds, we believe many of the revenue beneficiaries in the Industrials space could receive greater Sustainability investor support for those looking to move earlier in the supply chain but may have "FOME" (Fear of Misaligned Exposure) that limits interest in more historically higher emitting sectors early in the supply chain.

High and/or Rising Reinvestors

We continue to focus on High and/or Rising Reinvestors with favorable corporate returns — i.e., those companies that are reinvesting capital on path to Net Zero, Clean Water and Infrastructure goals — potentially warranting greater recognition among ESG funds. In our view, greater focus on Green Capex initiatives and the need to step up investments vs. historical average could catalyze greater recognition from investors for those companies that are investing incremental capital towards Green projects, while generating attractive corporate returns over the medium term. As disclosure improves, we believe companies levered to the Green Capex mosaic that are shifting weightings in their capex/revenue mix towards sustainable use cases will become clearer, potentially opening room for greater appreciation in ESG funds (see our ESG of the Future report for more details). At the same time, we believe there could be greater willingness by investors to reward companies able to generate attractive corporate returns while increasing their overall reinvestment rate of cash flow to capex and R&D for projects aligned with Net Zero, Clean Water and/or Infrastructure goals — particularly in the wake of market volatility and more focus on profitability.

Methodology. Our **Rising Re-investors** screen reflects four criteria:

- Revenue alignment/eligibility of at least 25%/30% with Sustainable Development Goals related to Net Zero, Clean Water and Infrastructure (Clean Water & Sanitation, Affordable & Clean Energy, Infrastructure & Sustainable Industrialization, and Sustainable Cities & Communities) based on our UN SDG Alignment tool.
- Reinvestment rate of operating cash flow into capex + R&D rising by at least 5 p.p. in 2023E/2024E vs. 2019.
- CROCI above global sector or regional sector average in 2023E/2024E.
- The company is not rated in the bottom quintile of our GS SUSTAIN Operational E&S Headline percentile score.

Our **High Re-investors** screen reflects four criteria:

- Revenue alignment/eligibility of at least 25%/30% with Sustainable Development Goals related to Net Zero, Clean Water and Infrastructure (Clean Water & Sanitation, Affordable & Clean Energy, Infrastructure & Sustainable Industrialization, and Sustainable Cities & Communities) based on our UN SDG Alignment tool;
- Reinvestment rate of cash flow into capex + R&D that is at least 1.4x sector average or 1.4x global corporate average and above sector average in 2023E/2024E.
- CROCI that exceeds global sector or regional sector average in 2023E/2024E.
- The company is not rated in the bottom quintile of our GS SUSTAIn Operational E&S Headline percentile score.

Greenablers in 4 sectors: Copper/Aluminum, Electricity Transmission, Semiconductors and Cybersecurity

We believe Sustainable Investor support can rise for Greenablers — i.e., companies in those sectors where near-term investments are needed to help drive customer execution towards Decarbonization/Clean Water/Infrastructure goals and help alleviate future supply-chain bottlenecks. We note these sectors are generally less appreciated in ESG funds, based on our fund ownership analysis. We continue to believe that Sustainable investor focus could rise beyond Solar/Wind/Water as attention broadens across the Green Capex supply chain. In this framework, we believe Greenablers sectors could receive higher priority, on the back of the need for more urgent and timely investments to avoid supply chain bottlenecks downstream due to longer project lead-times. As noted above, in the wake of profitability, we believe Sustainable Investor focus could gravitate more meaningfully towards those companies expected to generate attractive corporate returns. As outlined in our October 2021 Green Capex report, while not exclusive, we identify four key Greenablers sectors: Copper/Aluminum, Electricity Transmission, Semiconductors and Cybersecurity. These sectors are critical or — at a minimum — strongly needed for the vast majority of the Green Capex mosaic's verticals.

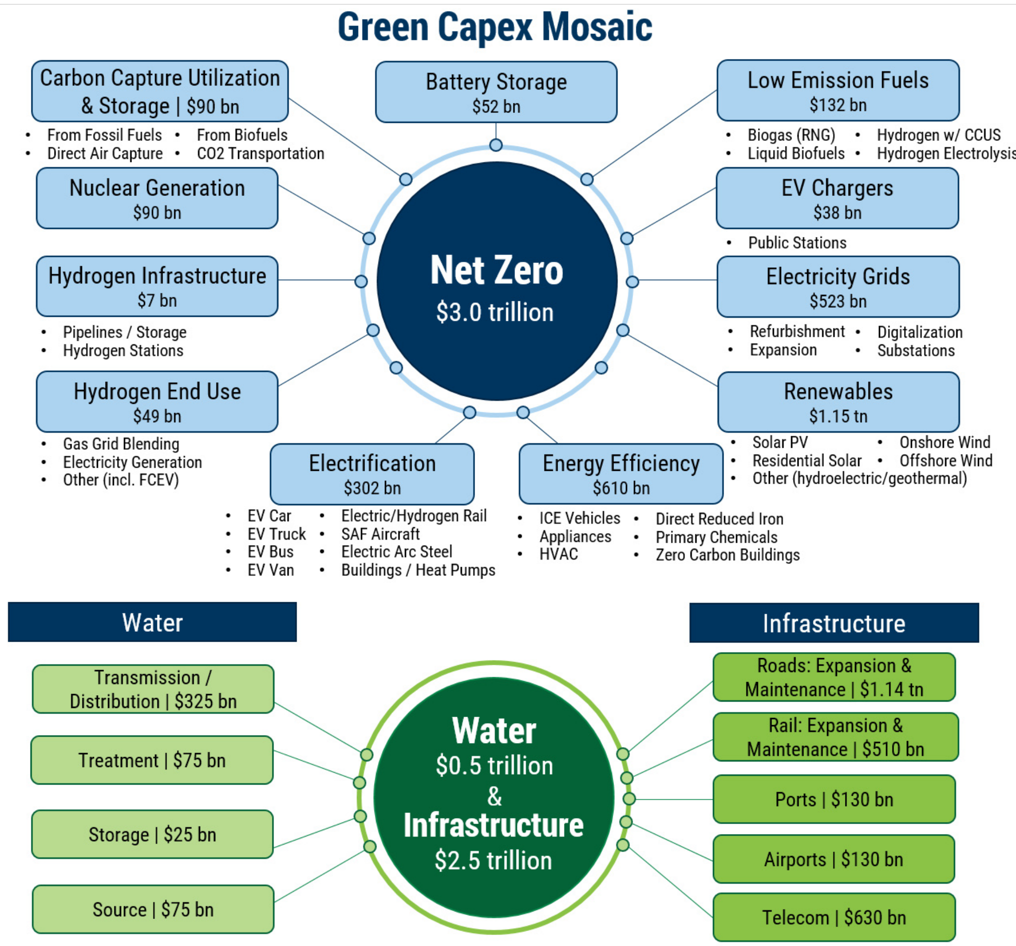
Methodology. Our Greenablers screen reflects three criteria:

- Revenue alignment with the specific Greenabler sector (we focus on the four Greenablers we initially identify: Copper/Aluminum, Electricity Transmission, Semiconductors and Cybersecurity).
- CROCI in 2023E/2024E higher than 5% (a lower corporate returns threshold vs. our other themes to reflect the potential for upward earnings revisions from Green demand going forward) — ex. Utilities for which CROCI needs to be above sector average.
- The company is not rated in the bottom quintile of our GS SUSTAIN Operational E&S Headline percentile score.

Appendix 1: Green Capex mosaic; how GS SUSTAIN can help

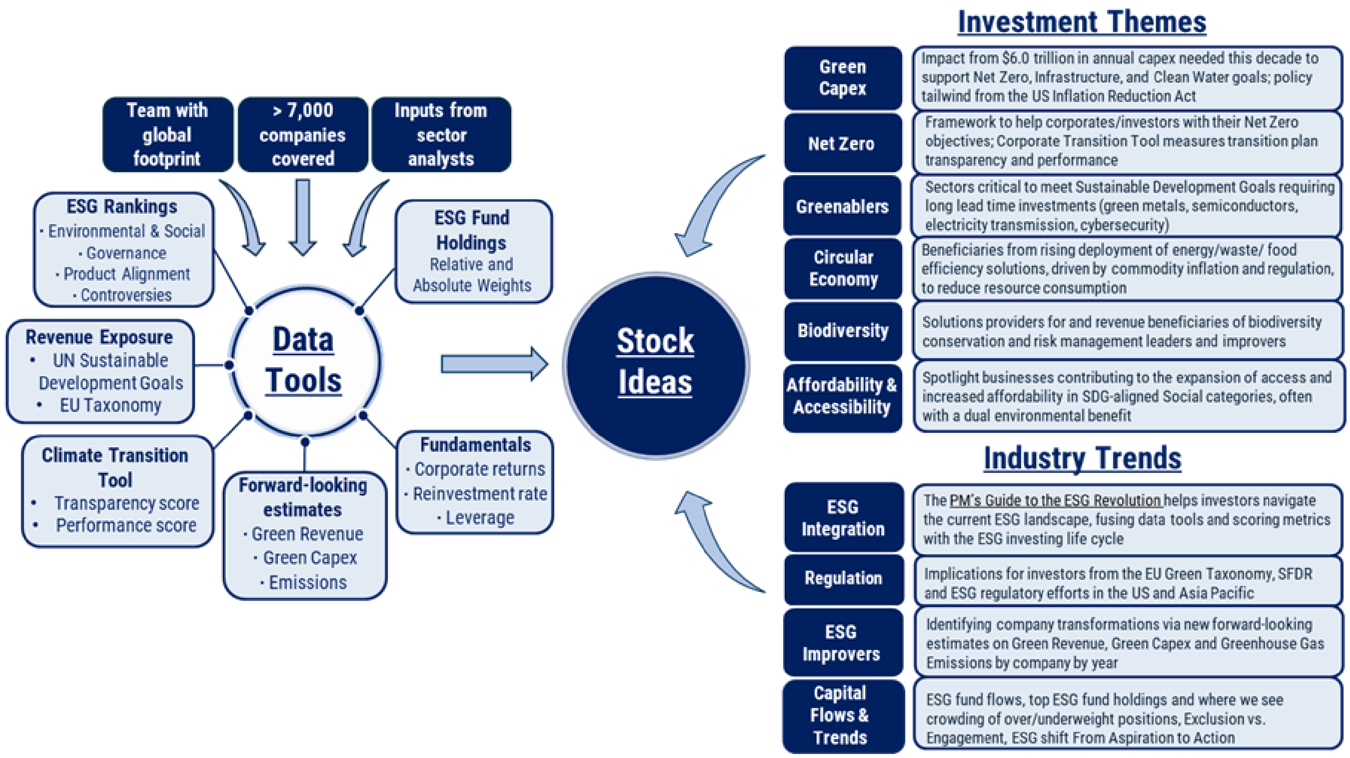
Exhibit 24: The Net Zero, Infrastructure and Clean Water mosaic

Critical technologies/focus areas and annual investment in the 2020s to achieve Net Zero, Infrastructure and Clean Water needs



Source: IEA, McKinsey, OECD, Company data, Goldman Sachs Global Investment Research

Exhibit 25: How GS SUSTAIN can help: Data tools, themes, trends and ideas



Source: Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Brian Singer, CFA, Enrico Chinello, Ph.D., Derek R. Bingham, Evan Tylenda, CFA, Emma Jones, Keebum Kim, Madeline Meyer, Brendan Corbett, Grace Chen, Varsha Venugopal and Xavier Zhang, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

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

GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a stock by comparing key attributes to the market (i.e. our coverage universe) and its sector peers. The four key attributes depicted are: Growth, Financial Returns, Multiple (e.g. valuation) and Integrated (a composite of Growth, Financial Returns and Multiple). Growth, Financial Returns and Multiple are calculated by using normalized ranks for specific metrics for each stock. The normalized ranks for the metrics are then averaged and converted into percentiles for the relevant attribute. The precise calculation of each metric may vary depending on the fiscal year, industry and region, but the standard approach is as follows:

Growth is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher growth company. **Financial Returns** is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns. **Multiple** is based on a stock's forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only P/E, P/B and P/D), with a higher percentile indicating a stock trading at a higher multiple. The **Integrated** percentile is calculated as the average of the Growth percentile, Financial Returns percentile and (100% - Multiple percentile).

Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

For a more detailed description of how we calculate the GS Factor Profile, please contact your GS representative.

M&A Rank

Across our global coverage, we examine stocks using an M&A framework, considering both qualitative factors and quantitative factors (which may vary across sectors and regions) to incorporate the potential that certain companies could be acquired. We then assign a M&A rank as a means of scoring companies under our rated coverage from 1 to 3, with 1 representing high (30%-50%) probability of the company becoming an acquisition target, 2 representing medium (15%-30%) probability and 3 representing low (0%-15%) probability. For companies ranked 1 or 2, in line with our standard departmental guidelines we incorporate an M&A component into our target price. M&A rank of 3 is considered immaterial and therefore does not factor into our price target, and may or may not be discussed in research.

Quantum

Quantum is Goldman Sachs' proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

Disclosures

Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	48%	36%	16%	63%	56%	47%

As of April 1, 2023, Goldman Sachs Global Investment Research had investment ratings on 3,026 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See 'Ratings, Coverage universe and related definitions' below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

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.

Distribution of ratings: See the distribution of ratings disclosure above. **Price chart:** See the price chart, with changes of ratings and price targets in prior periods, above, or, if electronic format or if with respect to multiple companies which are the subject of this report, on the Goldman Sachs website at https://www.gs.com/research/hedge.html.

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 Global Investment Research 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 Resolution n. 20 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 Resolution n. 20, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** This information is being provided to you for information purposes only and is not, and under no circumstances should be construed as, an advertisement, offering or solicitation by Goldman Sachs & Co. LLC for purchasers of securities in Canada to trade in any Canadian security. Goldman Sachs & Co. LLC is not registered as a dealer in any jurisdiction in Canada under applicable Canadian securities laws and generally is not permitted to trade in Canadian securities and may be prohibited from selling certain securities and products in certain jurisdictions in Canada. If you wish to trade in any Canadian securities or other products in Canada please contact Goldman Sachs Canada Inc., an affiliate of The Goldman Sachs Group Inc., or another registered Canadian dealer. **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:** Goldman Sachs (Singapore) Pte. (Company Number: 198602165W), which is regulated by the Monetary Authority of Singapore, accepts legal responsibility for this research, and should be contacted with respect to any matters arising from, or in connection with, this research. **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 and United Kingdom: 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 (including as that Delegated Regulation is implemented into United Kingdom domestic law and regulation following the United Kingdom's departure from the European Union and the European Economic Area) 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.

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 Type II Financial Instruments Firms Association, The Investment Trusts Association, Japan, and Japan Investment Advisers 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.

Ratings, coverage universe and related definitions

Buy (B), Neutral (N), Sell (S) Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock's total return potential relative to its coverage universe. Any stock not assigned as a Buy or a Sell on an Investment List with an active rating (i.e., a stock that is not Rating Suspended, Not Rated, Coverage Suspended or Not Covered), is deemed Neutral. Each region manages Regional Conviction lists, which are selected from Buy rated stocks on the respective region's Investment lists and represent investment recommendations focused on the size of the total return potential and/or the likelihood of the realization of the return across their respective areas of coverage. The addition or removal of stocks from such Conviction lists are managed by the Investment Review Committee or other designated committee in each respective region and do not represent a change in the analysts' investment rating for such stocks.

Total return potential represents the upside or downside differential between the current share price and the price target, including all paid or anticipated dividends, expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The total return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

Coverage Universe: A list of all stocks in each coverage universe is available by primary analyst, stock and coverage universe at https://www.gs.com/research/hedge.html.

Not Rated (NR). The investment rating, target price and earnings estimates (where relevant) have been suspended pursuant to Goldman Sachs policy when Goldman Sachs is acting in an advisory capacity in a merger or in a strategic transaction involving this company, when there are legal, regulatory or policy constraints due to Goldman Sachs' involvement in a transaction, and in certain other circumstances. **Rating Suspended (RS).** Goldman Sachs Research has suspended the investment rating and price target for this stock, because there is not a sufficient fundamental basis for determining an investment rating or target price. The previous investment rating and target price, if any, are no longer in effect for this stock and should not be relied upon. **Coverage Suspended (CS).** Goldman Sachs has suspended coverage of this company. **Not Covered (NC).** Goldman Sachs does not cover this company. **Not Available or Not Applicable (NA).** The information is not available for display or is not applicable. **Not Meaningful (NM).** The information is not meaningful and is therefore excluded.

Global product; distributing entities

Goldman Sachs Global Investment Research 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.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or contatogoldmanbrasil@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicação com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou contatogoldmanbrasil@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by 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.

Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

European Economic Area: GSI, authorised by the PRA and regulated by the FCA and the PRA, disseminates research in the following jurisdictions within the European Economic Area: the Grand Duchy of Luxembourg, Italy, the Kingdom of Belgium, the Kingdom of Denmark, the Kingdom of Norway, the Republic of Finland and the Republic of Ireland; GSI - Succursale de Paris (Paris branch) which is authorised by the French Autorité de contrôle prudentiel et de resolution ("ACPR") and regulated by the Autorité de contrôle prudentiel et de resolution and the Autorité des marches financiers ("AMF") disseminates research in France; GSI - Sucursal en España (Madrid branch) authorized in Spain by the Comisión Nacional del Mercado de Valores disseminates research in the Kingdom of Spain; GSI - Sweden Bankfilial (Stockholm branch) is authorized by the SFSA as a "third country branch" in accordance with Chapter 4, Section 4 of the Swedish Securities and Market Act (Sw. lag (2007:528) om värdepappersmarknaden) disseminates research in the Kingdom of Sweden; Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research in the Federal Republic of Germany and those jurisdictions within the European Economic Area where GSI is not authorised to disseminate research and additionally, GSBE, Copenhagen Branch filial af GSBE, Tyskland, supervised by the Danish Financial Authority disseminates research in the Kingdom of Denmark; GSBE - Sucursal en España (Madrid branch) subject (to a limited extent) to local supervision by the Bank of Spain disseminates research in the Kingdom of Spain; GSBE - Succursale Italia (Milan branch) to the relevant applicable extent, subject to local supervision by the Bank of Italy (Banca d'Italia) and the Italian Companies and Exchange Commission (Commissione Nazionale per le Società e la Borsa "Consob") disseminates research in Italy; GSBE - Succursale de Paris (Paris branch), supervised by the AMF and by the ACPR disseminates research in France; and GSBE - Sweden Bankfilial (Stockholm branch), to a limited extent, subject to local supervision by the Swedish Financial Supervisory Authority (Finansinpektionen) disseminates research in the Kingdom of Sweden.

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 Global Investment Research. 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.

The analysts named in this report may have from time to time discussed with our clients, including Goldman Sachs salespersons and traders, or may discuss in this report, trading strategies that reference catalysts or events that may have a near-term impact on the market price of the equity securities discussed in this report, which impact may be directionally counter to the analyst's published price target expectations for such stocks. Any such trading strategies are distinct from and do not affect the analyst's fundamental equity rating for such stocks, which rating reflects a stock's return potential relative to its coverage universe as described herein.

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 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 Goldman Sachs Global Investment Research 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.

© 2023 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.