Goldman Sachs

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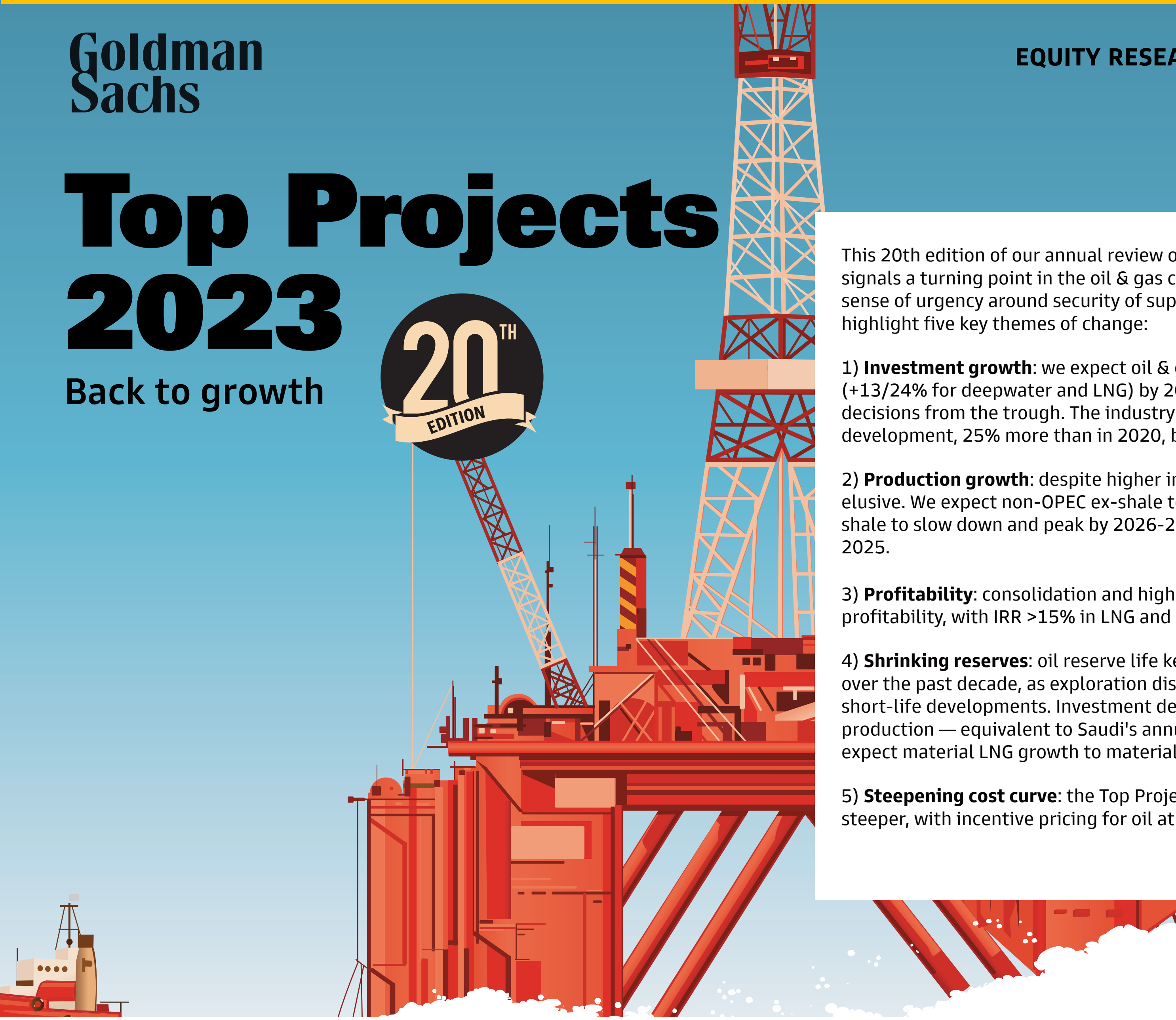
Top Projects 2023



Back to growth

This 20th edition of our annual review of top assets in global oil and gas production signals a turning point in the oil & gas capex cycle, as higher returns and a renewed sense of urgency around security of supply bring the industry back to growth. We highlight five key themes of change:

1) **Investment growth**: we expect oil & gas activity to compound at +9% pa growth (+13/24% for deepwater and LNG) by 2025, with a 2.4x increase of investment decisions from the trough. The industry currently has 70 giant projects under development, 25% more than in 2020, but still 35% below the 2014 level.

2) **Production growth**: despite higher investment, production growth remains elusive. We expect non-OPEC ex-shale to remain broadly flat in the coming years and shale to slow down and peak by 2026-27, leading to a call on OPEC of 1.6 mn blsd by 2025.

3) **Profitability**: consolidation and higher hurdle rates continue to support strong profitability, with IRR >15% in LNG and >20% in oil for this year's new projects.

4) **Shrinking reserves**: oil reserve life keeps shrinking to 23 years, a 56% reduction over the past decade, as exploration disappoints and focus shifts to short-cycle, short-life developments. Investment delays since 2014 will cost 10 mn blsd of oil production — equivalent to Saudi's annual production — by 2024, while we do not expect material LNG growth to materialise until 2026.

5) **Steepening cost curve**: the Top Projects cost curve has become smaller and steeper, with incentive pricing for oil at $80/bl and LNG at $11/mcf.

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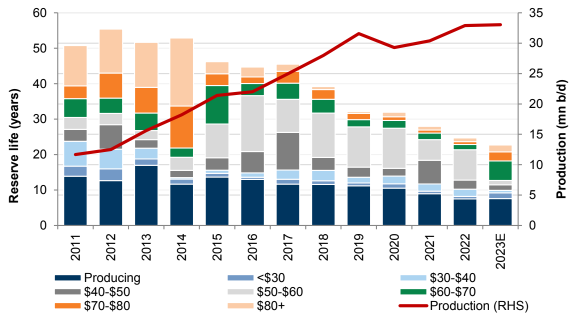
The authors would like to thank Anastasia Shalaeva for her contribution.

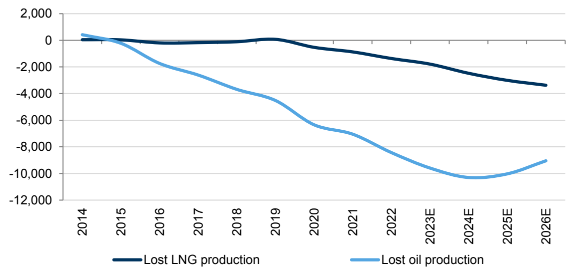
Top Projects in 18 charts

Exhibit 1: Seven years of energy under-investment have pushed the oil industry to more than halve its resource life since 2014...
Top Projects reserve life, by year of report and breakeven



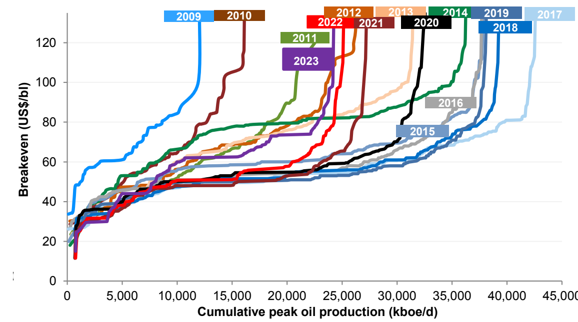
Source: Goldman Sachs Global Investment Research

Exhibit 2: ...as postponements of investment decisions will likely lead to c.10 mn bl/d of lost oil production by 2024-25...
Top Projects lost LNG, offshore and onshore oil production from long-cycle developments in kboe/d; Top Projects 2023 vs Top Projects 2014 expectations



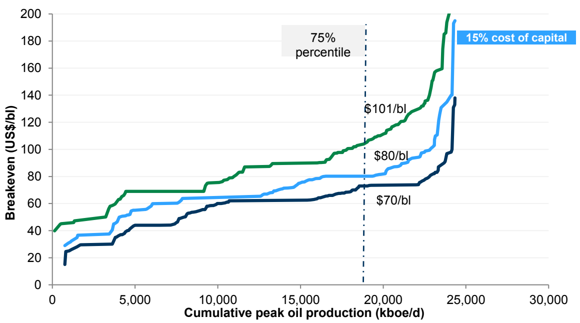
Source: Goldman Sachs Global Investment Research

Exhibit 3: ...leading to a dramatic steepening of the oil cost curve...
Top Projects oil cost curve for pre-plateau projects through the years



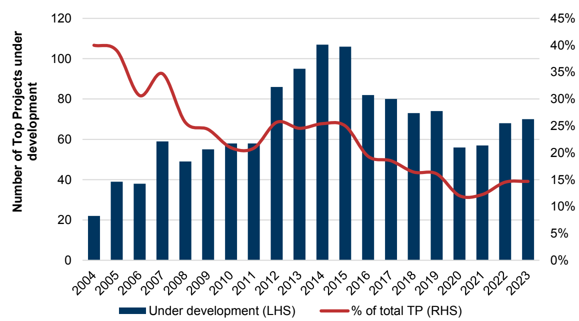
Source: Goldman Sachs Global Investment Research

Exhibit 4: ...as ESG-led higher cost of capital for long-cycle oil developments pushed the incentive price to $80/bl at 15% hurdle rates
Top Projects oil cost curve for pre-plateau projects at different costs of capital



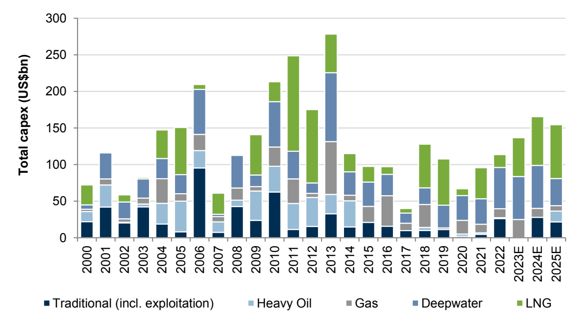
Source: Goldman Sachs Global Investment Research

Exhibit 5: The industry currently has 70 giant projects under development, 25% more than in 2020, but still 35% below the 2014 level
Top Projects number of projects under development



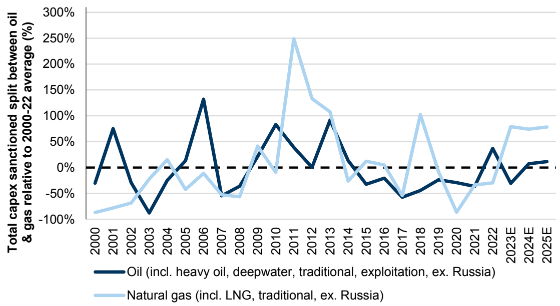
Source: Goldman Sachs Global Investment Research

Exhibit 6: Renewed focus on energy security is re-igniting oil & gas capex commitments...
Top Projects capex sanctioned by year, split by winzone (excl. Russia)



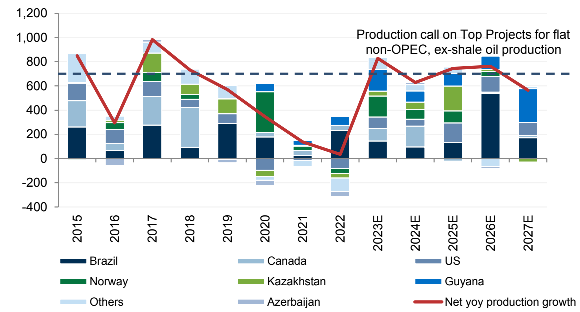
Source: Goldman Sachs Global Investment Research

Exhibit 7: ...with oil capex normalizing, while LNG goes back to peak spending
Capex sanctioned (by date of sanction) split between oil & gas relative to the 2000-22 average (%), excl. Russia



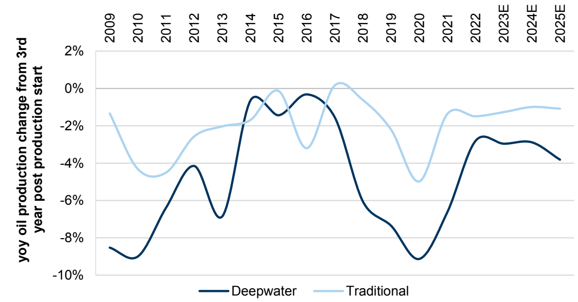
Source: Goldman Sachs Global Investment Research

Exhibit 8: The pipeline of mega-project delivery recovers in 2025-26 but leaves non-OPEC ex-shale production broadly flat over the coming years
YoY oil production growth (kbl/d) from non-OPEC and ex-Russia, ex-shale, shown excluding and including impact of production shut-ins



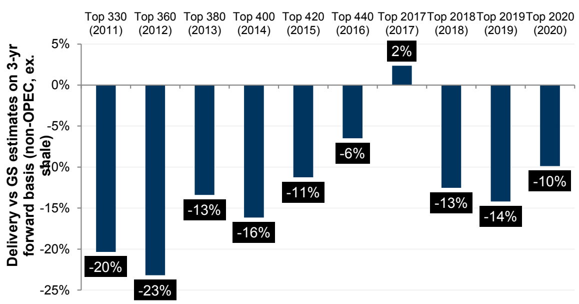
Source: Goldman Sachs Global Investment Research

Exhibit 9: The focus on brownfield developments brings decline rates back from the 2018-20 peak...
YoY oil production change from 3rd year post production start of Top Projects fields



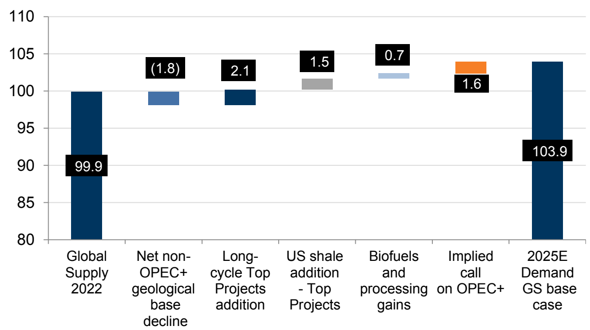
Source: Goldman Sachs Global Investment Research

Exhibit 10: ...while project delivery remains disappointing
Delivery vs GS estimates on 3yr forward non-OPEC, ex-shale production



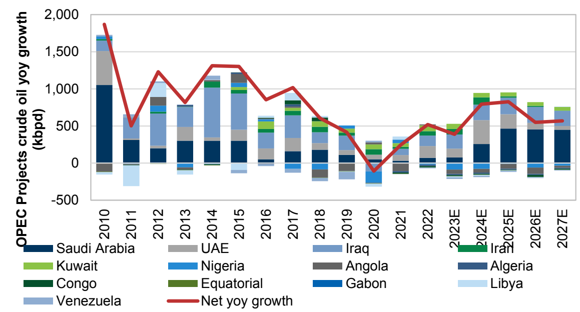
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 11: We expect a tightening oil market, with a c.1.6 mn bl/d incremental call on OPEC by 2025...
Key drivers of supply growth from 2022 to 2025E



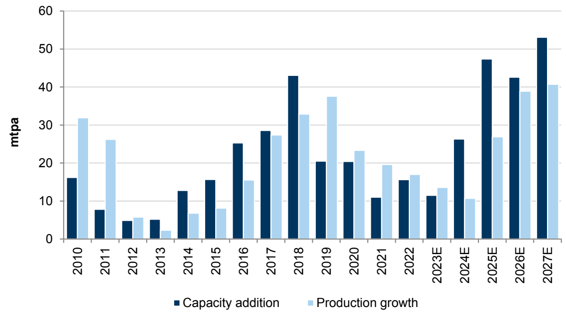
Source: IEA Oil Market Report, Goldman Sachs Global Investment Research

Exhibit 12: ...which can be served by OPEC capacity growth, mostly in Saudi and UAE
OPEC projects yoy oil production growth (kbl/d)



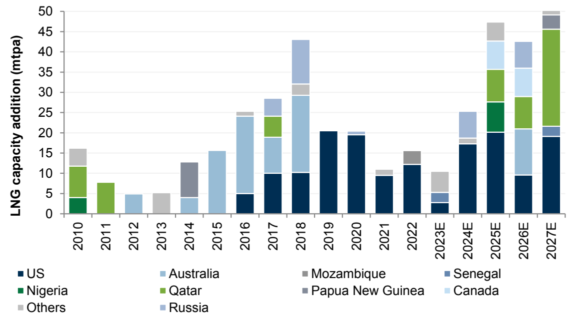
Source: Goldman Sachs Global Investment Research

Exhibit 13: The LNG market will not add material new capacity until 2025E at the earliest...
Annual increase in LNG production and capacity in mtpa



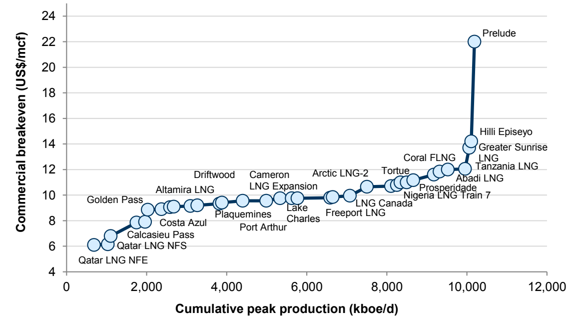
Source: Goldman Sachs Global Investment Research

Exhibit 14: ...driven by Qatar and the North America...
LNG volume additions in mtpa by region



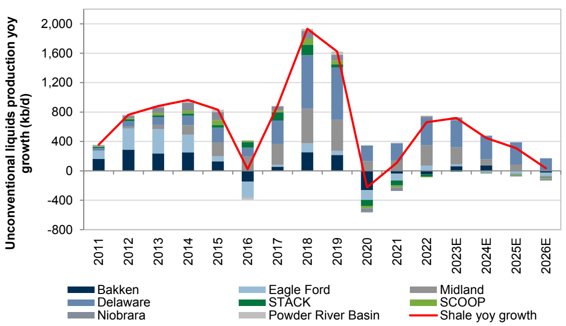
Source: Goldman Sachs Global Investment Research

Exhibit 15: ...and attractive economics for new-build with incentive pricing at $c.11/mcf
Top Projects 2023 LNG cost curve (pre-plateau)



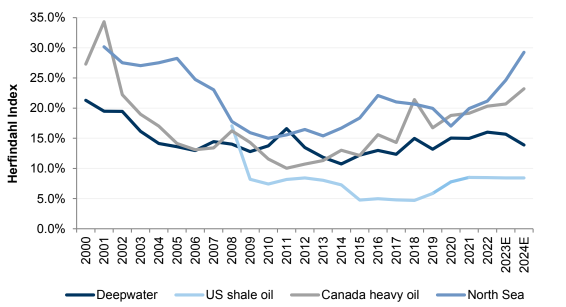
Source: Goldman Sachs Global Investment Research

Exhibit 16: We saw strong recovery in shale production in 2022 which we expect to continue in 2023, before moderating in 2024-26...
Unconventional liquids production change yoy (kbl/d)



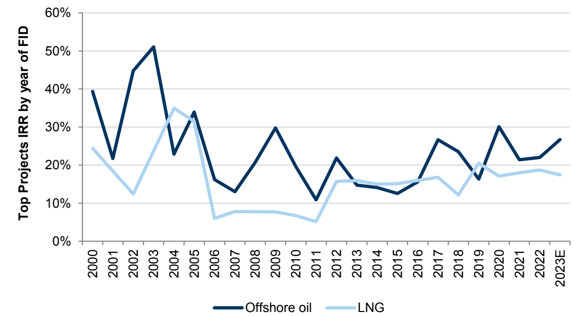
Source: Goldman Sachs Global Investment Research

Exhibit 17: ...with US shale oil joining the consolidation trends of the rest of the industry
Herfindahl index for key oil producing winzones over time (%)



Source: Goldman Sachs Global Investment Research

Exhibit 18: Oil profitability has returned to mid-2000 levels, with offshore oil projects and LNG profitability >15%
Top Projects IRR by year of FID split by winzone



Source: Goldman Sachs Global Investment Research

Top Projects 2023: PM Summary

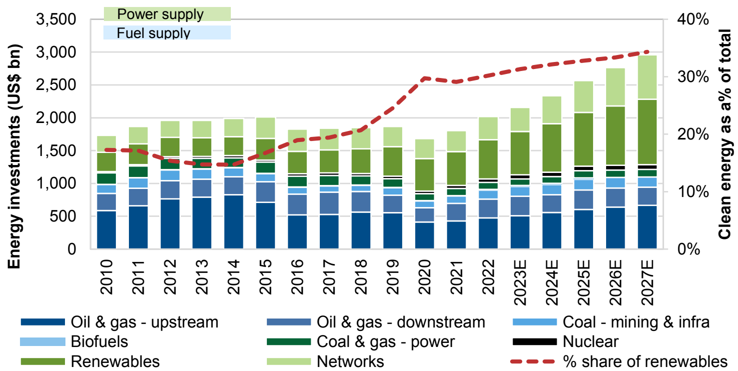
This 20th edition of our annual review of top assets in global oil and gas production signals a turning point in the oil & gas capex cycle, as higher returns and a renewed sense of urgency around security of supply bring the industry back to growth. **Oil & gas activity has declined at a compounded 7% from 2014 to 2021, and we now expect it to return to 9% pa growth**, with LNG and deepwater compounding at +24/13% pa respectively over the next three years. We highlight five key themes of change, that we analyse in detail in this report: 1) Investment growth; 2) Production growth; 3) Profitability; 4) Shrinking reserves; 5) Steepening cost curve.

We expect primary energy capex to grow 48% by 2027 to $1.9 trn (from $1.3 trn in 2022)

We believe that the energy industry has been under-investing since the peak of 2014, with investments in traditional energy (oil, gas upstream) falling 50% in 2020 from the peak and driving an 18% reduction in global primary energy investments, from $1.3trn in 2014 to $1trn in 2020. A number of oil and gas project investment decisions have been delayed since 2014, translating into 10 mn bl/d of lost oil production by 2024-25 – equivalent to Saudi Arabia's annual production – and 3 mn boe/d of lost LNG production – more than Qatar, on our estimates. The focus has shifted in recent years to energy sustainability, but the overall growth of the investments in renewables has not been sufficient to compensate for the abrupt drop in investments in the traditional energy space, given the smaller scale and higher capital intensity per unit of energy output. The average capex intensity of low carbon energy developments is c.2x that of hydrocarbons, further enhancing the need for energy capex; we estimate the need for an incremental $1.5trn pa capex by 2032. We expect the annual pace of investment decisions in long-cycle oil & gas mega-projects to exceed $150 bn pa by 2024, almost 3.0x the level of the trough in 2020, driven by a strong recovery in LNG and deepwater, driving a return of double-digit oil & gas capex growth for the first time in a decade.

Exhibit 19: Primary energy capex fell over the past decade, but we expect it to grow 48% by 2027...

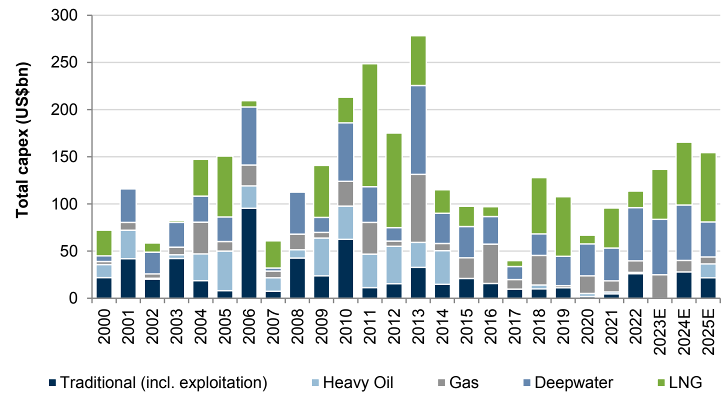
Primary energy supply capex split by source (US$bn) and renewables share as a % of total (%)



Source: IEA WEI (historicals), Goldman Sachs Global Investment Research

Exhibit 20: ...with the renewed focus on energy security re-igniting oil & gas commitments

Top Projects capex sanctioned by year, split by winzone (excl. Russia)



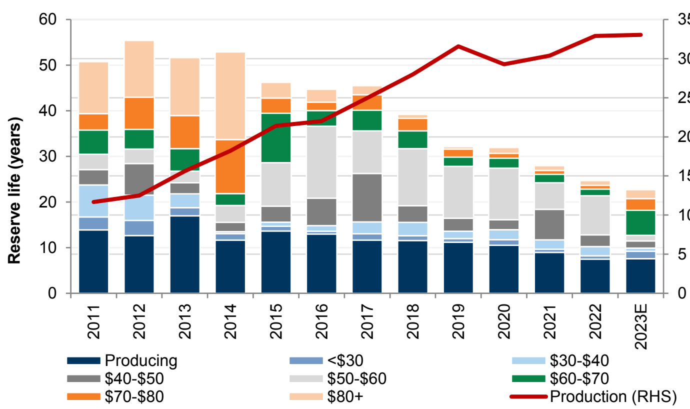
Source: Goldman Sachs Global Investment Research

Shrinking reserves: Concerns over stranded assets push oil resource life to more than halve since 2014

The strong focus on de-carbonization and concerns around stranded assets have led to a curtailment of oil & gas capex and an increase in the hurdle rate for oil mega-projects from 10% to 15-20% over the past five years. According to our analysis, the resource life of Top Projects (recoverable resources/production) fell to 23 years from >50 years in 2014, a halving since the end of the 2004-14 'super-cycle'. Yet the economics are much healthier, with c.70% of the undeveloped resources profitable at a Brent price <US$70/bl vs. only 25% in 2014 on our estimates. In our view, this provides the industry with a strong incentive to bring back projects and activity, with improving returns and lower Scope 1&2 emissions than the current production base.

Exhibit 21: Almost a decade of energy under-investment has pushed the oil industry to halve its resource life since 2014...

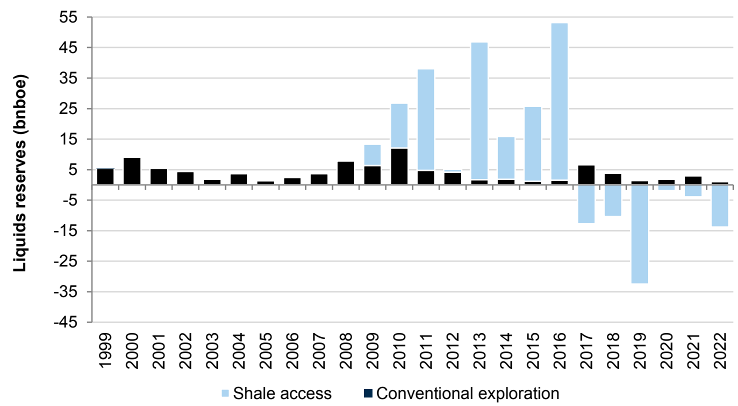
Top Projects reserve life, by year of report and breakeven



Source: Goldman Sachs Global Investment Research

Exhibit 22: ...with the last five years seeing negative resource revisions which marks the end of the great resource expansion of 2009-16

Total liquids reserves discovered/accessed by year, based on Top Projects

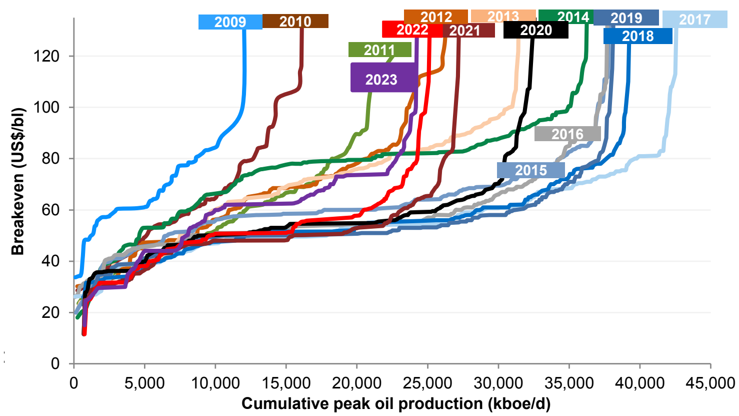


Source: Goldman Sachs Global Investment Research

Steepening cost curve: The Top Projects oil cost curve is steepening for the sixth consecutive year

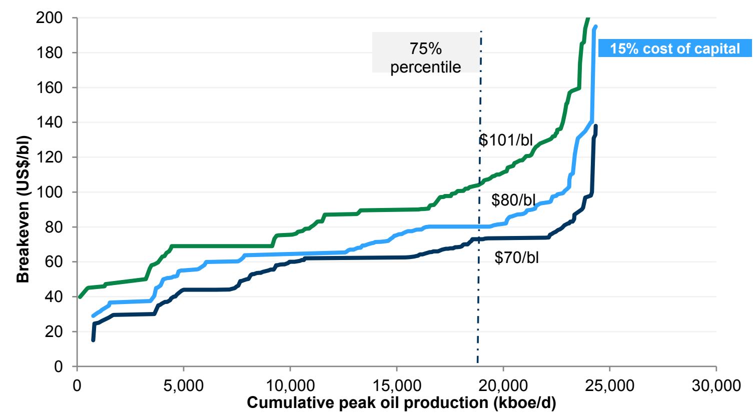
Following a decade of resource expansion that ended in 2017, this year's Top Projects edition shows an ongoing steepening of the cost curve. This is driven by project delays, capex and opex inflation and higher taxes. Another driver of capital efficiency in the past 5 years has been the increasing cost of capital for hydrocarbon projects. We estimate that the hurdle rate for giant long-cycle oil developments has risen from 10% in the 2004-14 cycle, to 15-20% in recent years. If we apply this higher cost of capital across the Top projects cost curve, the marginal incentive price (the 75th percentile of the cost curve) is no longer $70/bl, but $80/bl (at 15% hurdle rates) and up to $100/bl (at 20% hurdle rates).

Exhibit 23: The oil cost curve is steepening for the sixth consecutive year...
Top Projects oil cost curve for pre-plateau projects through the years



Source: Goldman Sachs Global Investment Research

Exhibit 24: ...as ESG-led higher cost of capital for long-cycle oil developments pushes the incentive price to $80/bl+
Top Projects oil cost curve for pre-plateau projects at different costs of capital

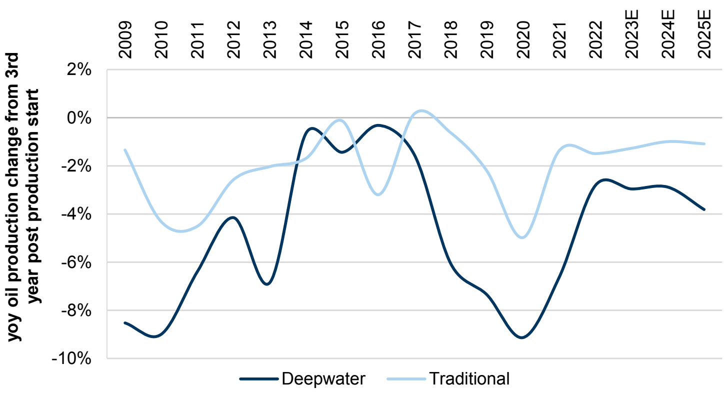


Source: Goldman Sachs Global Investment Research

The end of non-OPEC growth: Investment revival is not sufficient to push non-OPEC back into production growth

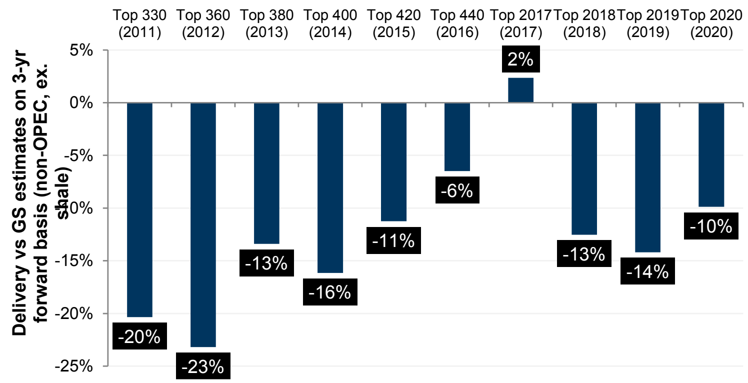
Our Top Projects bottom-up analysis suggests that we have entered a structural phase of anaemic non-OPEC growth, driven both by a thinner pipeline of mega-project deliveries and slower US shale growth. Mega-projects delivery has substantially slowed from 2021, seven years after peak oil prices, as it did in 1987 (seven years after the 1980 oil price peak), as the industry exhausts the development pipeline to which it committed in the 'supercycle' years. We estimate that the long-cycle developments will only add an average of c700 kbl/d pa over the next five years, which is barely sufficient to counter decline rates, but not to deliver net production growth, on our estimates. The downcycle has also accelerated the transformation of shale into a more concentrated (through consolidation), cash generative (through better logistics, infrastructure, data usage, efficiency, contiguous acreage and scale) and lower growth industry (fewer players targeting growth, while mature basins plateau or decline). In 2022 US shale reached its local peak with the production growth recovered from the shale deceleration observed in previous years. We saw strong recovery in shale production in 2022 which we expect to continue in 2023, before moderating in 2024-26.

Exhibit 25: The industry re-focus towards brownfield developments is leading to a normalization of decline rates from the elevated levels of 2018-21...
YoY oil production change from 3rd year post production start of Top Projects fields



Source: Goldman Sachs Global Investment Research

Exhibit 26: ...while project delivery remains challenging
Delivery vs GS estimates on 3yr forward non-OPEC, ex-shale production

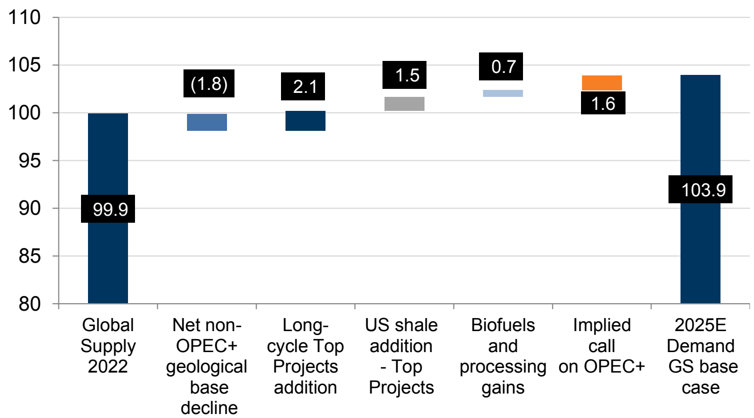


Source: Goldman Sachs Global Investment Research

We expect a call on incremental OPEC production as large as 1.6 mn bl/d by 2025, reducing OPEC spare capacity despite the Saudi and UAE capacity expansions

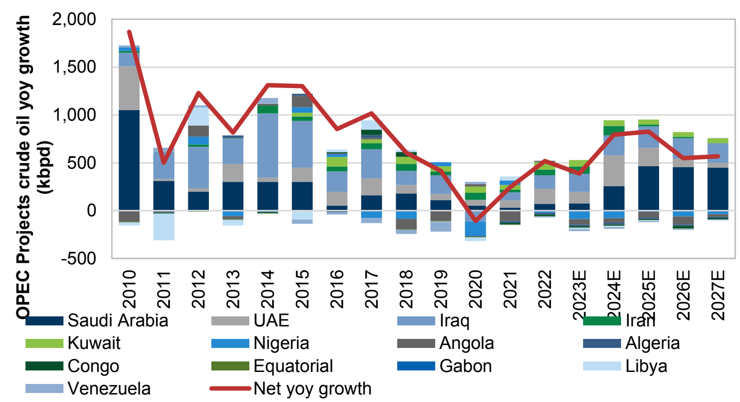
Based on the GS demand base case, we estimate a call on incremental OPEC production as large as 1.6 mn bl/d by 2025, from 2022. OPEC, in line with the rest of the industry, has made minimal commitments to incremental capacity growth over the past seven years and this shows in a small pipeline of growth developments. We believe this will start to change in 2024, with Saudi's planned capacity expansion and the acceleration of UAE growth plans.

Exhibit 27: We expect a tightening oil market, with a c.1.6 mn bl/d incremental call on OPEC by 2025...
Key drivers of supply growth from 2022 to 2025E



Source: IEA Oil Market Report, Goldman Sachs Global Investment Research

Exhibit 28: ... reducing OPEC spare capacity despite the Saudi and UAE capacity expansions
OPEC projects yoy oil production growth (kbl/d)

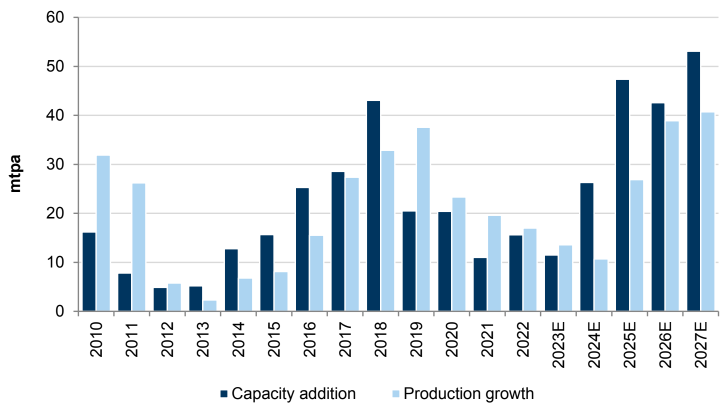


Source: Goldman Sachs Global Investment Research

The LNG market should see material volume growth only starting in 2025, mostly from Qatar and North America

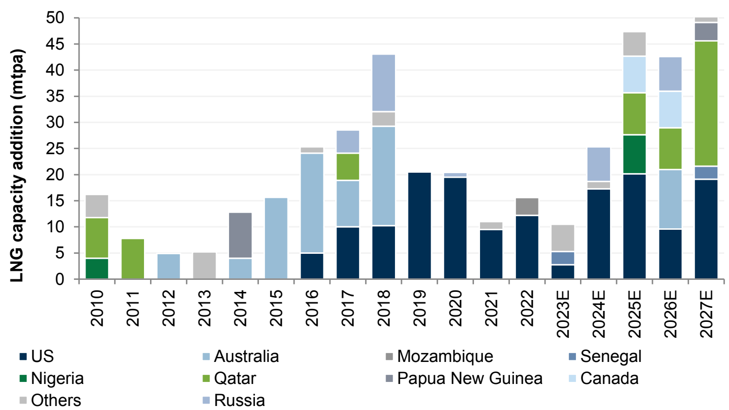
2022-23 were record years for the number of announced LNG projects and LNG FIDs taken, with several new projects in our Top Projects database: Sabine Pass LNG expansion (20 mtpa capacity), Corpus Christi Trains 8&9 expansion (3 mtpa), Altamira LNG (4.2 mtpa). Our analysis suggests that the lack of LNG investments in 2014-17 and the persistent delays in project sanctions will keep the LNG market tight until 2025-26 with LNG production growth of only c.15 Mtpa in 2023-24E, vs. 20-40 Mtpa in 2017-22, leaving a potential LNG supply gap before the next wave of LNG projects comes onstream from 2025E, with a major role for Qatar and North America LNG exports. The tightness in the gas market that was observed in 2022 dissipated in 2023 driven by warm winter, ample inventories and lagging China and European industrial demand, and while taking longer-than-expected, our economists expect sequential recovery in China activity and gas demand throughout the year driving balances tightly going into next winter.

Exhibit 29: The LNG market has a tightening window in 2023-24E, before new supply comes in 2025-26E...
Annual increase in LNG production and capacity in mtpa



Source: Goldman Sachs Global Investment Research

Exhibit 30: ...driven by Qatar and the North America
LNG volume additions in mtpa by development status



Source: Goldman Sachs Global Investment Research

The authors of this report would like to thank Anastasia Shalaeva for her significant contribution to this report.

Disclosure Appendix

Reg AC

We, Michele Della Vigna, CFA, Yulia Bocharnikova, Neil Mehta, Umang Choudhary, Nikhil Bhandari, Ati Modak, Henry Meyer and Bruno Amorim, CFA, 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

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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%

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