Goldman Sachs

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GCC Capex Wave Series

Saudi Arabia Capex Super-Cycle: Diversifying, Decarbonizing, Digitalizing

The GCC countries have embarked on an economic diversification and growth journey underpinned by ambitious government targets across sectors. Our recent conversations with investors have centered around key themes including O&G production efforts, downstream expansion, renewable energy/clean hydrogen, mining plans, digital transformation, and transportation & logistics. With this report, we introduce our **GCC Capex Wave Series**, where we intend to map out the region's investments across sectors.

In this note, we focus on **Saudi Arabia**, the GCC's largest economy. Led by ambitious targets and extensive investment plans, the country is undertaking economic diversification with a holistic transformation approach, underpinned by digital transformation, various development plans across sectors, exploration efforts, and decarbonization/net zero targets. In 2021, Saudi launched the National Investment Strategy (NIS), a US$3.3tn (SAR12.4tn) strategy and a key enabler of Vision 2030 . The strategy aims to boost the size of investments, enhance innovation, raise the private sector's contribution to the economy, and support the development of strategic sectors.

Within six strategic sectors, we see scope for nearly US$1 trillion in preliminary investments through the end of the decade across investment programs, with more projects likely to be announced in tandem with technological progress and as Saudi accelerates the execution of mega-projects and smart cities.

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The following is a redacted version of Goldman Sachs Research's report "GCC Capex Wave Series: Saudi Arabia Capex Super-Cycle: Diversifying, Decarbonizing, Digitalizing" originally published Sept. 24 2023 (84pgs). All company references in this note are for illustrative purposes only and should not be interpreted as investment recommendations.

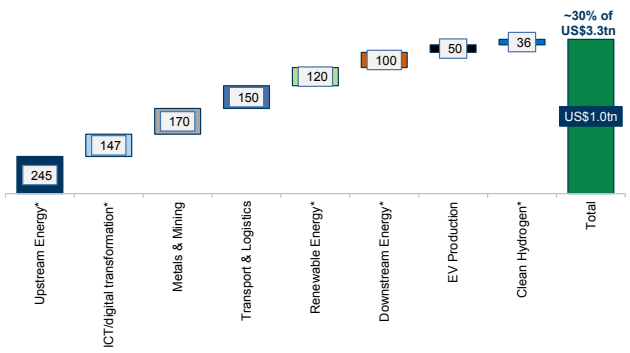
Capex super-cycle in the making, benefiting from a constructive macro backdrop

Since the launch of Vision 2030 in 2016, Saudi Arabia has made meaningful strides in growing the non-oil economy through various developments and investments across strategic economic sectors. In 2021, the country launched the NIS, a massive US$3.3tn (SAR12.4tn) investment plan and a key enabler of Vision 2030. We see scope for c.US$1.0tn (SAR3.8tn) in total investments through the end of the decade across six strategic sectors, namely upstream/downstream energy, clean technology (renewable energy/low-carbon hydrogen/EV), metals and mining, digitalization and transport & logistics, and note that the investment plans are likely to develop further in tandem with technological progress/availability over time and as sector strategies are finalized.

US$1.0tn (SAR3.8tn) in investments likely across six strategic sectors

In this report, we focus on mapping out announcements, investment plans, and development projects across six strategic sectors in Saudi: upstream energy, downstream energy, clean technology, metals & mining, digital transformation and transportation & logistics. Overall, we estimate that there is scope for US$1.0tn (SAR3.8tn) in investments through the end of the decade (using details from announced projects and sector targets), with four sectors accounting for the lion's share. This goes beyond the announced mega-projects, which account for a cumulative >US$870bn in investments by 2030.

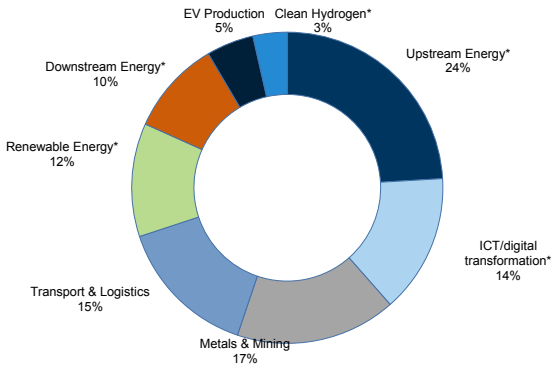
Exhibit 1: We see scope for a total of c.US$1.0tn in investments across six strategic sectors by 2030
US$bn, unless otherwise stated



*Mid-point of estimated investments shown above; targeted investments used for metals & mining and transport & logistics

Source: Goldman Sachs Global Investment Research

Exhibit 2: Upstream energy, ICT, metals and mining and transportation account for 70% of the estimated investments
% of total investments



*Mid-point of estimated investments shown above; targeted investments used for metals & mining and transport & logistics

Source: Goldman Sachs Global Investment Research

Exhibit 3: We see substantial investment opportunities across six strategic sectors that are likely to drive a capex upcycle in Saudi through the end of the decade

US$1.0TN INVESTMENTS LIKELY ACROSS SIX STRATEGIC SECTORS

Upstream Energy: Embarking on sizable O&G production plans
- Aramco plans to increase maximum sustainable capacity (MSC) from 12 to 13 mboe/d by 2027;
- Abundant and cheap natural gas has become a crucial contributor for long-term energy security and economic security in Saudi;
- Aramco started the development of the Jafurah unconventional gas field, estimated to hold around 200tn cubic feet of gas;
- **Total investment estimate: US$245bn**

Downstream Energy: Next leg of downstream capex underway
- Significant exploration efforts and expansionary projects in the upstream space potentially unlocking incremental feedstock allocations;
- Growing demand for petchem products, outpacing demand for oil derivatives (gasoline/diesel);
- Crude oil to chemicals technology (COTC) a promising area within the space, driving further investments;
- **Total investment estimate: US$100bn**

Clean Tech: Ambitious renewable energy and clean hydrogen targets
- Saudi plans to add 58.7GW in renewable energy capacity and 2-3GW in nuclear capacity by 2030;
- On the clean hydrogen side, Saudi targets production of 2.9mtpa by 2030, of which we estimate c.1.9mtpa to come in blue hydrogen; NEOM Green Hydrogen to be the world's largest green hydrogen production site;
- Increasing focus on EV production could drive c.US$50bn in investments by 2030 (source: Ministry of Investment)
- **Total investment estimate: US$206bn**

Metals & Mining: Leveraging US$1.3tn worth of vastly under explored metals and minerals
- Introduction of a new mining investment law in 2021 to facilitate the issuance of exploration licenses;
- Leveraging an estimated US$1.3tn worth of vastly under explored metals and minerals, deadlines for bidding rounds for 5 new exploration licenses announced;
- Transforming the sector into the third pillar of Saudi's national industry and further diversifying the economy away from oil;
- **Total investment identified: US$170bn**

Digital Transformation: At the core of Saudi's economic transformation plans
- Digital transformation is a key pillar and enabler of Vision 2030, supporting industries and the private/ public sector entities;
- Telecoms capex focused on network capacity, 5G and FTTH expansions;
- IT sector focused on smart solutions, system integration, managed and digital services; massive investments expected within the cloud/data/AI space;
- **Total investment estimate: US$147bn**

Transport & Logistics: Becoming a leading travel and logistics hub
- Saudi launched an updated National Transport and Logistics Strategy (NTLS) and a Saudi Aviation Strategy (AVS);
- The country recently launched a new PIF-owned national airline, Riyadh Air;
- PIF announced the masterplan for the King Salman International Airport, expected to accommodate up to 185mn passengers and process 3.5mn tons of cargo by 2050;
- **Total investment identified: US$150bn**

Where we estimate total investments, we use a combination of project announcements and our estimates based on country targets for sectors. Mid-point of estimated investments shown above; targeted investments used for metals & mining and transport & logistics

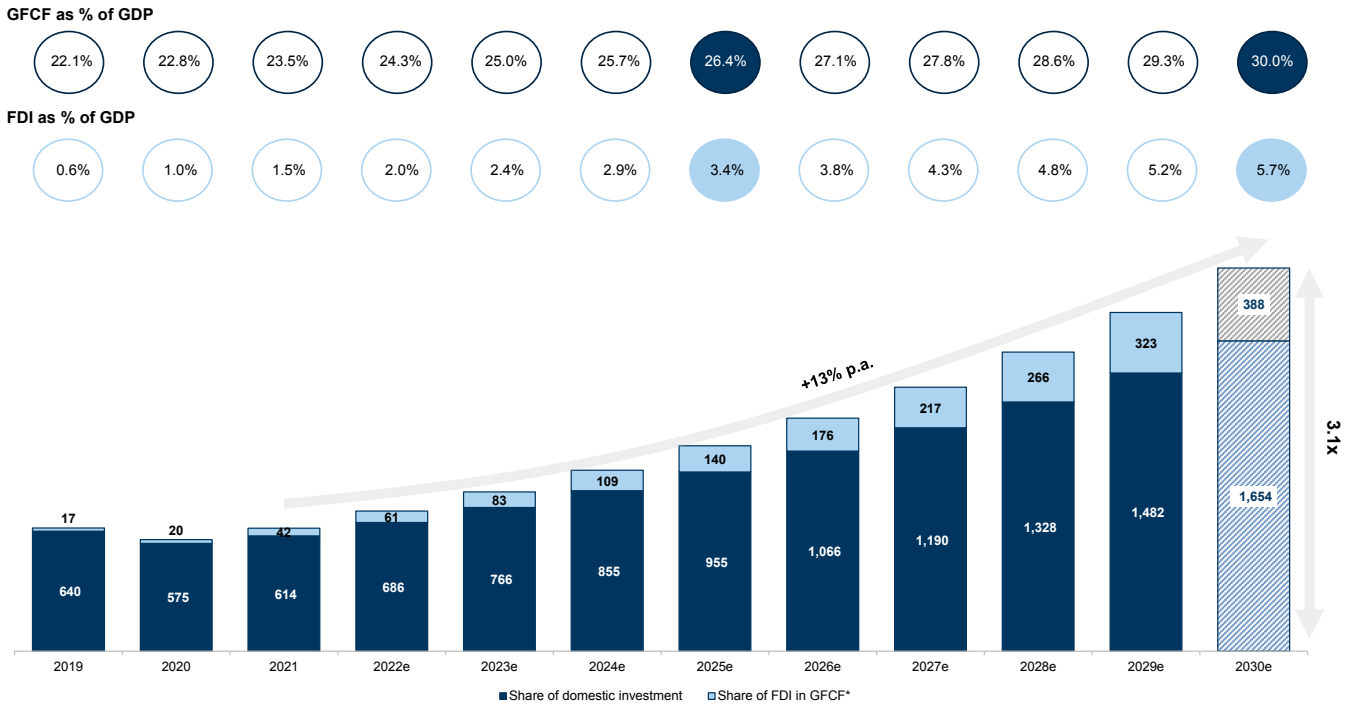
Source: Goldman Sachs Global Investment Research, National Transport and Logistics Strategy, Invest Saudi, State News Agency , Ministry of Industry and Mineral Resources, Ministry of Energy, Ministry of Investment

Spending on mega-projects is set to rise

The NIS aims to facilitate the government's investment across sectors, attract higher Foreign Direct Investments (FDI) and grow the private sector's contribution to the economy through the Shareek Program, which is expected to account for 40% of total investments, followed by the PIF's program at 24%. As highlighted in Exhibit 4, FDI as a % of GDP is expected to grow to 3.4% by 2025 and 5.7% by 2030, vs. 26.4%/30% for GFCF (gross fixed capital formation, i.e. investments), with total investments recording a 13% CAGR in 2021-30E.

We highlight that while the NIS covers the country's overall investment plans by 2030, Saudi has introduced different strategies across sectors, facilitating the path to achieve Vision 2030 goals. These include National Transformation Program, ICT Sector Strategy, National Renewable Energy Program (NREP), Saudi Aviation Strategy and National Transport & Logistics Strategy among others, alongside a list of ambitious targets to be achieved over the coming years. We also expect more strategies and announcements as initial targets are met, supported by further technological breakthrough across sectors.

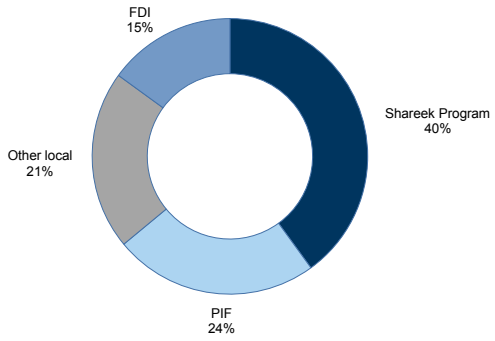
Exhibit 4: Expected evolution of targets over the decade leading to 2030...



*GFCF = Gross fixed capital formation (investments)

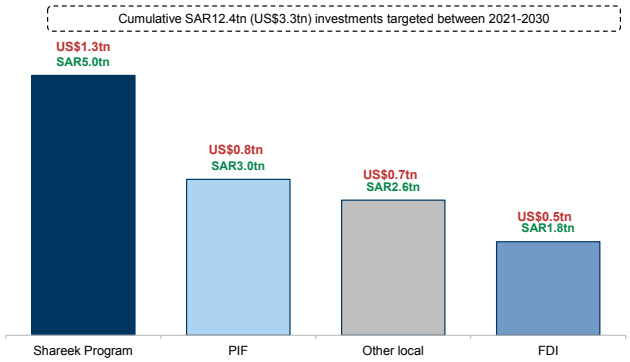
Source: National Investment Strategy (NIS)

Exhibit 5: …with c.40%/24% driven by the Shareek program and PIF…
Contribution by investment program (%)



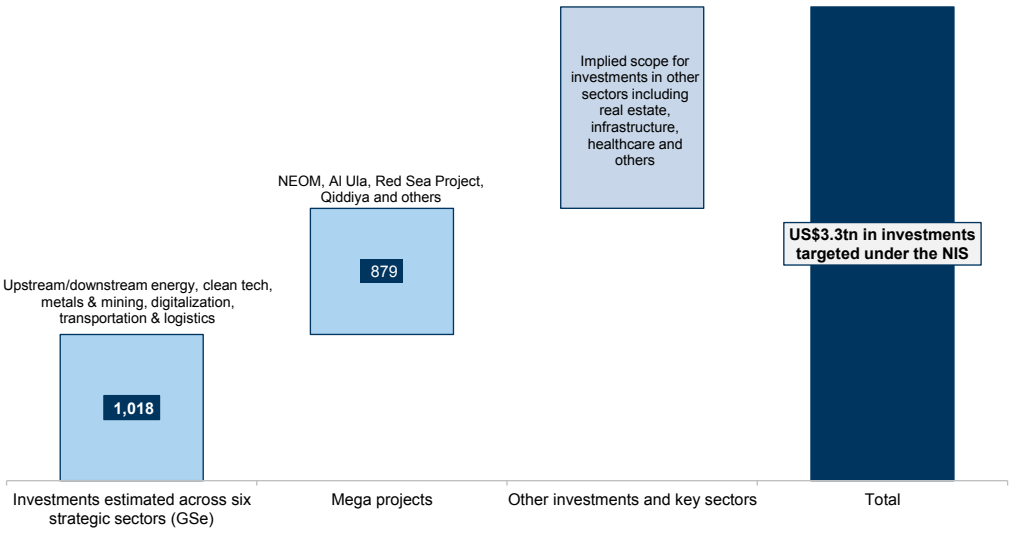
Source: Saudi Arabia Vision 2030, National Investment Strategy (NIS)

Exhibit 6: …in Saudi's massive US$3.3tn (SAR12.4tn) investment plan under its Vision 2030 across different investment vehicles
Saudi Arabia's investment plan under Vision 2030



Source: Saudi Arabia Vision 2030, National Investment Strategy (NIS)

Exhibit 7: Across these investment programs, we estimate c.US$1tn in investments in six strategic sectors and note that there are targets for mega projects within other sectors too (including real estate, healthcare and others)
Total investments (US$mn)



Source: Goldman Sachs Global Investment Research, National Investment Strategy, Middle East Economic Digest (MEED)

As highlighted by GS MENA economist Farouk Soussa, there are tangible investments afoot that, while falling short of the grand targets stated under Vision 2030 and related strategies, would nonetheless be transformational in their magnitude. Exhibit 8 outlines the main mega-projects currently underway in Saudi, amounting to a total expected investment of >US$870bn by the end of the decade. While execution on the projects has been relatively slow (c.6% of total as of June 2023), we note that some of them such as the Red Sea Project, Amaala, Qiddiya and Diryah Gate are among those that are at a more developed stage (>15% completion rate). The largest and most well-known project is the US$500bn NEOM project, a futuristic city on the Saudi side of the Gulf of Aqaba. While the construction of the mega-city is still in its early stages, the project has seen the highest level of investments in the past couple of years, at over US$18.2bn (c.4% of total cost).

Exhibit 8: Saudi Arabia has over US$870bn in mega-projects set for completion by 2030
As of June 2023

Sector	Project	Amount (US$bn)	Amount Executed (US$bn)	Execution Rate
Mixed	NEOM	500	18.2	4%
	New Murabba	100	0	0%
	Jeddah Cultural Urban Revival	20	0.3	2%
Tourism	Red Sea Project	16	7.2	45%
	Al Ula	15	1.7	11%
	Rua Al Madina	10	1.4	14%
	Amaala	5.1	2.4	47%
	Asir Project	3	0.3	10%
	Boutique Group Hotels	1.5	0	0%
Entertainment	Entertainment Ventures	5	0.2	4%
	King Salman International Park	23	0	0%
	Qiddiya	8.8	2.3	26%
Real Estate	Diryah Gate	20	2.9	15%
Housing	Roshn	90	2.8	3%
Infrastructure	King Salman International Airport	30-50	0	0%
Total as per MEED		**879**	**50**	**6%**

Source: Middle East Economic Digest (MEED), compiled by Goldman Sachs Global Investment Research

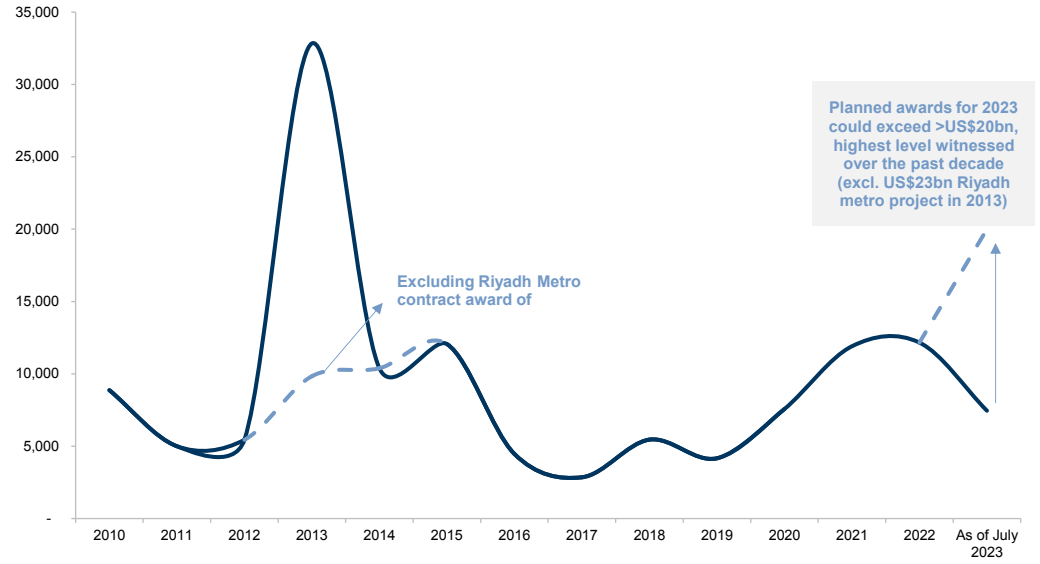
Saudi Arabia's capital Riyadh to see an uptick in investments

As part of the US$3.3tn investment plan targeted by the end of the decade, at least 30% is set to be allocated to the capital city Riyadh, as per the Ministry of Investment. Saudi aims to grow Riyadh into one of the world's top 10 cities (vs. currently among the top 40 largest city economies globally), and targets to increase its population from 7.5mn to c.15-20mn in 2030. Additionally, Riyadh's development is a strategic move for Saudi's economic diversification plan, as the city represents c.50% of the national non-oil economy.

Indeed, the city is already experiencing an uptick in construction activity, with US$12.2bn in contracts awarded in 2022, the highest level since 2013. The latter stood at US$32bn, of which US$23bn was related to the development of Riyadh metro. As per MEED, more awards are expected, and there are c.US$9bn worth of contracts currently in bidding evaluation stage, which, if awarded this year, could bring the total contracts to >US$20bn. In total, MEED identified US$110bn and US$60bn in design and under-study awards, respectively.

The future pipeline of projects includes (1) New Murabba Development Company, which was launched in February 2023 to develop the world's largest modern downtown, and (2) King Salman International Airport launched in November 2022, which, if completed on time in 2030, will become the world's largest airport in terms of passenger capacity.

Exhibit 9: >US$120bn in contracts have been awarded for the development of Riyadh between 2010-22
Contract awards (US$mn)



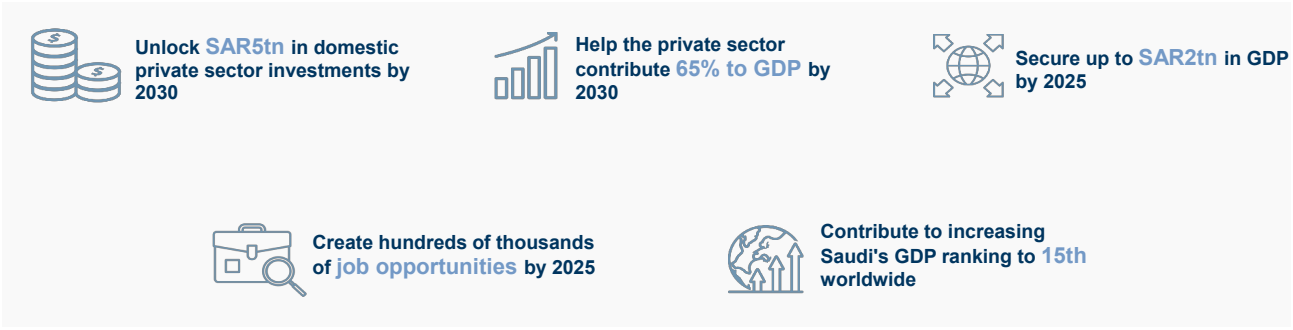
Source: Middle East Economic Digest (MEED)

Saudi introduced supportive programs to enable investments under the NIS

Shareek program: Incentivizing domestic investments of the private sector

Shareek, announced in 2021 and led by the Council of Economic and Development Affairs (CEDA), is a dynamic program that aims to increase domestic investments of listed and non-listed private sector companies to **SAR5tn (US$1.3tn)** by 2030. The program is underpinned by several projects offered by the government to incentivize investments by the private sector. The program currently includes 28 private firms, and targets an increase in private sector GDP contribution to 65% and non-oil exports to 50% (from 16% initially).

Exhibit 10: Key objectives under the Shareek program



Source: Shareek

On March 1, 2023, the government announced the first wave of supported projects for large companies joining Shareek (Private Sector Partnership Reinforcement Center). Frameworks were signed for a total of 12 projects across eight companies in a number of strategic sectors, with a total value of c.SAR192bn (US$51.2bn), of which the share of large companies is c.SAR120bn (US$32bn). These projects are expected to contribute up to SAR466bn (US$124.3bn) to GDP over the next two decades with an economic multiplier of 2.43, and are intended to result in the creation of more than 64k jobs.

National Development Fund broadens the scope of investments; PIF, the sovereign wealth fund, and the Saudi banks to play a pivotal role in the economic transformation story

Between 1Q21-1Q23, Saudi Arabia generated significant oil gains, and, during this period, the international investment position of the country improved by >US$150bn, as per Saudi Central Bank monthly data. Going forward, our MENA Financials team's view is that the SWFs are likely to play a pivotal role in regional economic diversification through both local project spend and international investments. The Public Investment Fund (PIF), which is among the largest SWFs globally with c.US$700bn in AUM (up from c.US$250bn in 2018), is expected to play a key role in terms of local investment and development (c.SAR3tn in investments targeted under the NIS by 2030).

Saudi has also launched several institutional initiatives, namely the National Development Fund (NDF), to broaden the scope of development and encourage investments across the various economic sectors targeted under Vision 2030. Through its various funds and development banks, the NDF aims to facilitate investments by the private sector. Some key funds include the Saudi Industrial Development Fund (SIDF) and the National Infrastructure Fund (NIF).

Furthermore, Saudi banks are also likely to be key facilitators of this capex wave. Indeed, our MENA Financials team expects Saudi Vision 2030 projects to be the core engine for credit growth.

Exhibit 12: Saudi has launched several institutional initiatives to broaden the scope of development and encourage investments from the private sector

National Development Fund (NDF) to facilitate investments by the private sector

Public Investment Fund Program	Saudi Industrial Dev. Fund	National Infrastructure Fund
Launched in 2017, the PIF Program plans to support the private sector and launch promising industries, committing to invest no less than **US$40bn (SAR150bn)** p.a. into the local economy through 2021-25. It also aims to raise the share of local content in PIF and its affiliates to 60%, and to contribute US$320bn (SAR1.2tn) to non-oil GDP, cumulatively, by 2025.	Established initially in 1974, SIDF was one of the primary financial enablers of Saudi's industrial transformation. The fund aligned its objectives with those of Vision 2030, and continues to **play a vital role in promoting industrial investment opportunities**, expanding its support to cover a number of promising sectors in industrials, energy, mining and logistics.	Launched in 2021, the NIF plans to support up to **US$53bn (SAR200bn)** in projects related to the water, transportation, energy, digital infrastructure, education and health sectors through 2030.

Source: PIF, Saudi Industrial Development Fund, Vision 2030

Economic outlook looks favorable; solid progress on market reforms supports Saudi's equity capital market transformation

The GS commodities team remains bullish on the oil price outlook and forecasts an average 2023 Brent Crude Oil price of US$82/bbl (and US$91/bbl in 2024). This is largely in line with the IMF's forecast budget break-even oil price of c.US$81/bbl for Saudi Arabia (as of May 2023).

Our CEEMEA economist Farouk Soussa highlights that Saudi Arabia's oil policy is supportive of its fiscal outlook. He expects the impact of higher oil prices to outweigh the drag to revenue from lower production post the recent cuts. Farouk estimates that the budget deficit would widen to 2.4% of GDP if oil prices were to remain at around $75/bbl for the remainder of the year. As it is, with his assumption of oil prices in the mid-$80s range for the remainder of the year (based on forward pricing), he is forecasting a budget deficit of 1.4% of GDP.

Our Financials team believes the Vision 2030 projects are likely to be funded through a combination of both local and foreign funding in the form of equity and debt. The cumulation of oil gains together with plans to leverage diversified funding sources (local/foreign as well as debt/equity) should limit project outlay risk related to oil price volatility.

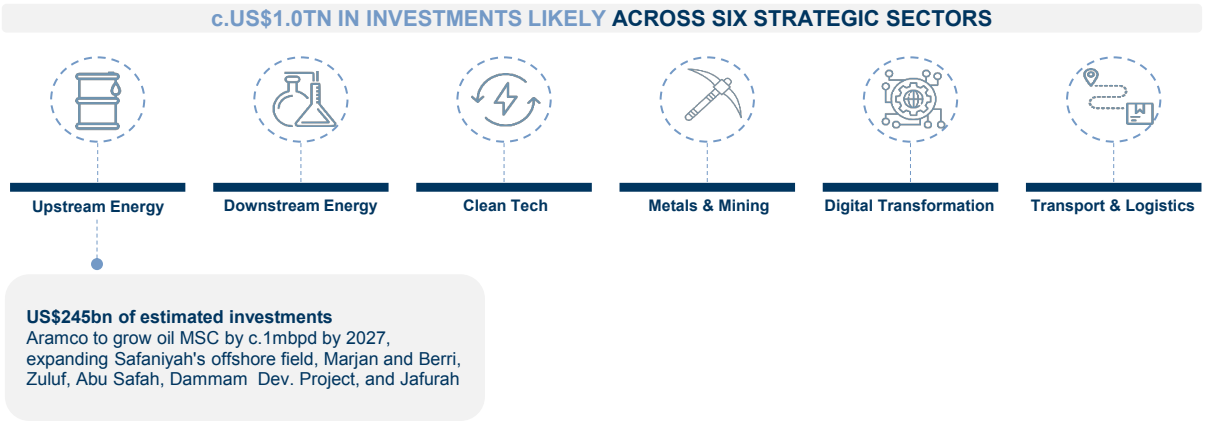
Furthermore, GS economists estimate that external assets could reach $5.5trn by end-2026, an increase of $1.3trn over the next four years. In an upside scenario, where Brent oil prices rise steadily to US$120/bbl over that period, they estimate that GCC external assets could reach US$6 trillion. Conversely, in a downside scenario, where oil prices decline to US$40/bbl, they believe GCC external assets could plateau at just under US$5 trillion.

Additionally, as highlighted by our MENA Financials team, Saudi Arabia, the largest market in MENA and one of the largest in EM, is at the forefront of the equity capital market transformation being seen in the region. Initiatives include significant market reforms, such as new listings, relaxation of foreign ownership limits (attracting foreign capital), and broadening of the product suite.

Upstream Energy: Embarking on a large O&G capex program in Saudi

While Saudi continues to undertake significant clean energy investments on its path to net zero, the country has made several announcements over the past 24 months related to the expansion of oil and natural gas capacities to cater to growing demand both domestically and internationally.

Exhibit 13: We see a capex upcycle driven by O&G exploration and development projects



Mid-point of estimated investments shown above

Source: Goldman Sachs Global Investment Research

Upstream expansion is mainly focused on (1) **catering to structurally tight supply** post a multi-year period of under-investment globally; (2) **utilizing hydrocarbon resources in more value-add products** such as petrochemicals; (3) **lowering carbon emitted from power generation** by switching to gas; and (4) **providing the base** for the build-up of blue hydrogen exports. Overall, we see multiple factors driving upstream growth over the medium to long term, including the country's focus on increasing gas production (from both conventional and unconventional sources), expanding its existing oil maximum sustainable capacity (MSC) and enhancing exploration efforts with meaningful potential volumes across natural gas liquids (NGLs) and condensates.

Exhibit 14: Overview of key upstream growth projects in Saudi Arabia

Decription	Location	Completion
Marjan Field development One of the oldest and biggest offshore oil and gas fields in the Arabian Gulf. Through this project, Aramco aims to add 300kbpd of oil, 2.5 bscfd of gas, and 350kpd of ethane and	Arabian Gulf, Saudi Arabia	2025
Berri Field development In order to sustain crude production capacity at 12mbpd in the short term, Aramco aims to double the field's capacity to 500kbpd mainly through enhanced oil recovery	Arabian Gulf, Saudi Arabia	2025
Zuluf Field development The initiative involves building a new onshore central processing facility that is expected to process an incremental 600kpd and includes associated pipelines and other infrastructure	Arabian Gulf, Saudi Arabia	2026
Dammam Field development Construction activities are underway and the project is expected to add 25kbpd and 50kpd of crude oil by 2024 and 2027, respectively	Arabian Gulf, Saudi Arabia	Phase 1: 2024 Phase 2: 2027
Abu Safah Field development Managed by Aramco, the offshore oil field is a joint reservoir between Saudi/Bahrain. The field's capacity is expected to grow by 100kboepd by 2027.	Arabian Gulf, Saudi Arabia	2027
Safaniya Field development One of the world's largest conventional offshore oil fields by reserves and production capacity. Post the expansionary initiatives, production is set to increase by around 350kbpd in 2027, and another 350kbpd post 2027	Arabian Gulf, Saudi Arabia	Post 2027
Jafurah Field development Center to Saudi's energy transition strategy, Jafurah is a sizable unconventional gas field estimated to hold 200trn cubic feet of rich raw gas. Production is expected to ramp up from 200mscfd in 2025 to a sustainable 2bscfd of gas by	Arabian Gulf, Saudi Arabia	Phase 1: 2025 Phase 2: 2030

Source: Compiled by Goldman Sachs Global Investment Research, Company data, Regional news outlets

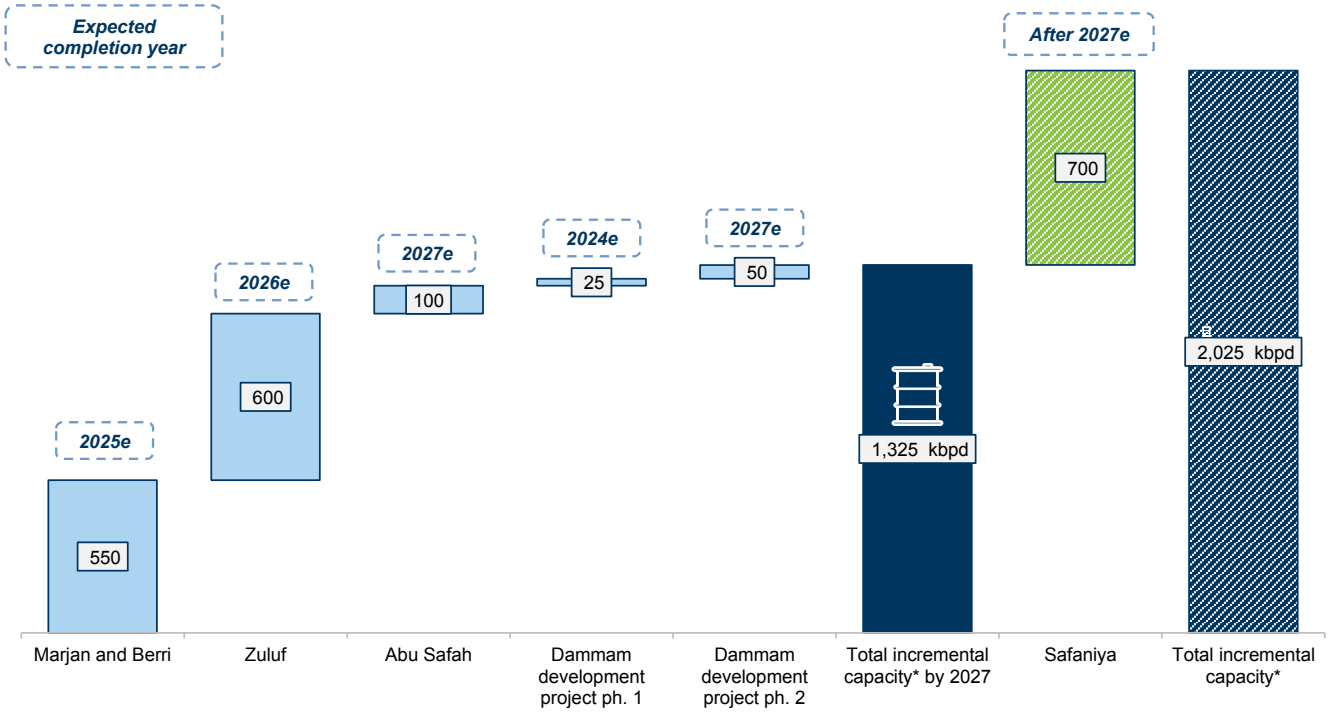
Crude oil expansion: Another multi-year period of growth investments on the horizon

In line with the rest of the industry, OPEC has made minimal commitments to incremental capacity growth over the past seven years, as evident in the limited pipeline of growth developments. This is while non-OPEC capacity growth was dampened owing to the increase in decline rates, driven by aging assets and a lack of brownfield activity during the COVID (2020-21) period. We believe these factors have shaped a tight oil (and broader energy) market, also reflected in Aramco's plans to scale oil production over the next few years.

With regard to announced expansionary projects, Saudi aims to grow its oil MSC by c.1mbpd to 13mbpd by 2027, largely through field expansion projects highlighted in Exhibit 15 including Marjan and Berri, Zuluf, Abu Safah, and the Dammam Development Project. Beyond 2027, Aramco plans to expand Safaniya's offshore field by 700kbpd, raising Saudi's oil production capacity to 13.7mbpd. Using available data on investment

costs and project targets, we estimate these oil-related expansion projects requiring **c.US$73-82bn (c.SAR274-308bn)** in capex spending through 2030.

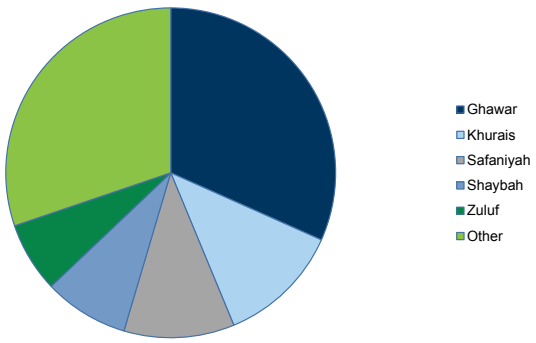
Exhibit 15: Saudi aims to increase oil MSC from 12mbpd to c.13mbpd by 2027
Key announced expansionary oil projects



*Excluding decline rate effects

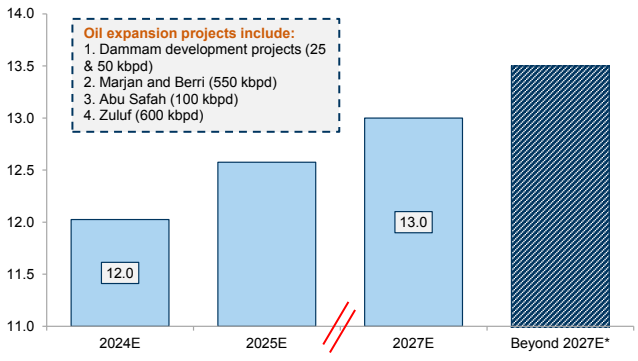
Source: Company data, data compiled by Goldman Sachs Global Investment Research

Exhibit 16: The lion share of Saudi's MSC of 12mbpd comes from Ghawar, Khurais, and Safaniyah oil fields (combined capacity of 6.6mmbpd)
Saudi's oil field contribution to total maximum sustainable capacity, %



Source: Company data, data compiled by Goldman Sachs Global Investment Research

Exhibit 17: Saudi aims to increase its crude oil MSC to c.13mmbpd by 2027 with further upside coming from Safaniyah's expansion thereafter
Saudi's maximum sustainable capacity, mmbpd

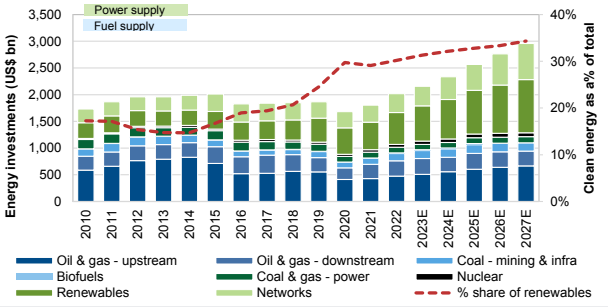


*Includes 700kpbd upside to the MSC target from the Safaniya expansion project, excluding decline rate effects

Source: Company data, data compiled by Goldman Sachs Global Investment Research

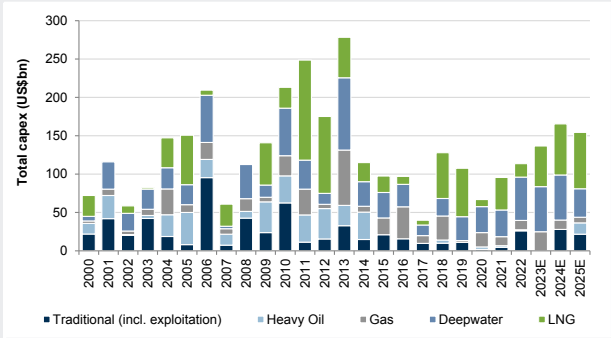
As highlighted in the Top Projects report, the energy industry has been under-investing since the peak of 2014, with investments in traditional energy (oil, gas upstream) falling 50% in 2020 from the peak and driving an 18% reduction in global primary energy investments, from $1.3trn in 2014 to $1trn 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 that of Qatar, as per our energy team's 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; our energy colleagues estimate the need for an incremental $1.5trn pa capex by 2032. They 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 18: Primary energy capex fell over the past decade, but our energy team expects it to grow 48% by 2027...
Primary energy supply capex split by source (US$bn) and renewables share as a % of total (%)



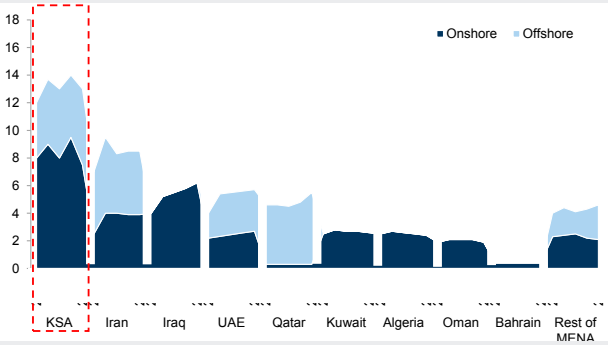
Source: IEA WEI (historicals), Goldman Sachs Global Investment Research

Exhibit 19: ...with the renewed focus on energy security re-igniting oil & gas commitments
Top Projects capex sanctioned by year, split by winzone (excl. Russia)



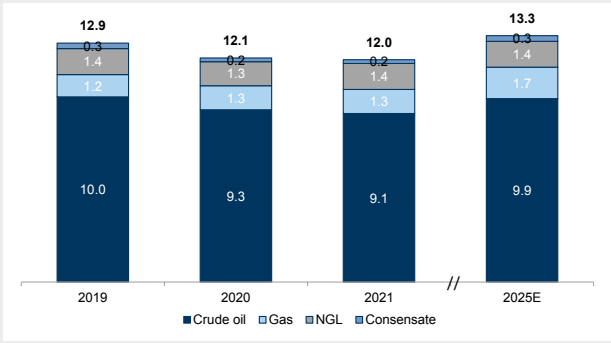
Source: Goldman Sachs Global Investment Research

Exhibit 20: Saudi Arabia is expected to lead in terms of both onshore and offshore hydrocarbon production in MENA
Hydrocarbon production volumes from 2021 to 2030 by MENA country (mnboe/d)



Source: Rystad market report

Exhibit 21: Hydrocarbon production in Saudi Arabia is set to grow at a 3% CAGR through 2025
Production by hydrocarbon type in Saudi (mnboe/d)



Source: Rystad market report

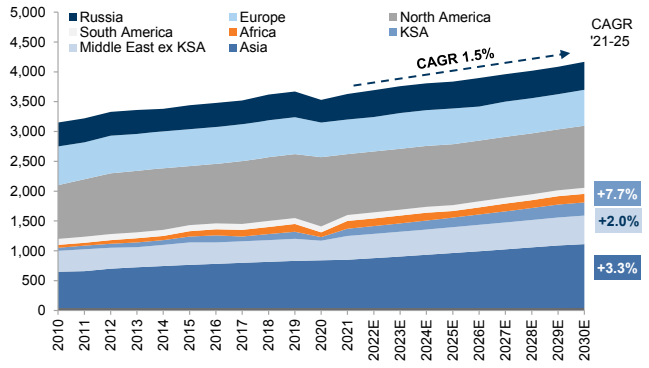
Natural Gas expansion: A key area of focus within the upstream space

Abundant and cheap natural gas has become a crucial contributor for long-term energy security as well as economic development and diversification of the GCC economies. In Saudi, the government has placed gas at the center of its energy transition strategy as it aims to reduce its carbon footprint meaningfully by 2030 and reach net zero by 2060. Demand for natural gas in the country is expected to grow at a 5% CAGR through 2030 (source: Rystad), meaningfully outpacing the global average of 1.5% over the same period. Additionally, Saudi aims to increase its gas production by more than 50% to c.15bsfd by 2030, with incremental volumes expected from natural gas and ethane.

With regard to expansionary projects, Jafurah's unconventional field development stands out as one of the largest in terms of incremental capacity addition and investment size (expected to require over US$68bn in capex over the first 10 years of development, as per Aramco). Jafurah is forecast to add 200msfd by 2025, scaling up to a sustainable 2.0bsfd by 2030, and 2.2bsfd by 2036, in addition to 420msfd of ethane and 630kbpd of NGLs and condensate. Besides Jafurah, Aramco expects to add 2.5bsfd of incremental gas production capacity by 2025 from the Marjan field. Towards the end of the decade, we see scope for Saudi to become a net exporter of natural gas mainly via blue hydrogen and blue ammonia (with natural gas a key input for both products). Overall, we currently estimate **c.US$83-91bn (c.SAR311-341bn)** in gas-related investments through 2030, based on available data on investment costs and project targets.

Exhibit 22: Rystad sees growing demand globally for hydrocarbons through 2030, in particular gas

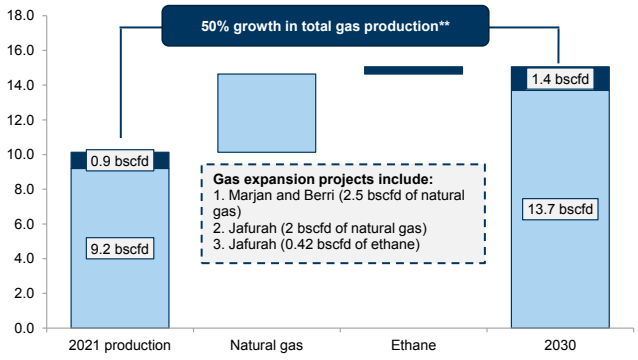
Global natural gas demand by continent, in bcm per year



Source: Rystad market report

Exhibit 23: Saudi Aramco aims to grow its gas production by 50% by 2030

Saudi Aramco's gas production (both natural gas and ethane), bscfd

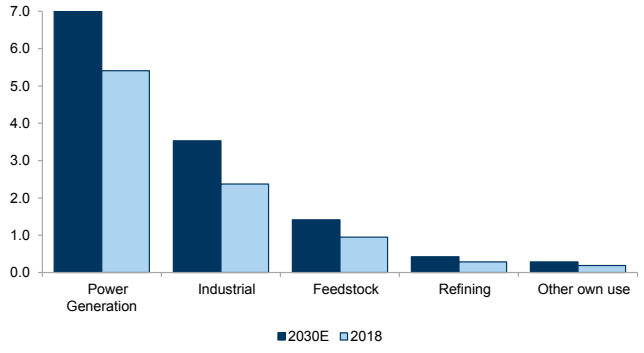


**Includes both natural gas and ethane production

Source: Regional news outlets, Company data, compiled by Goldman Sachs Global Investment Research

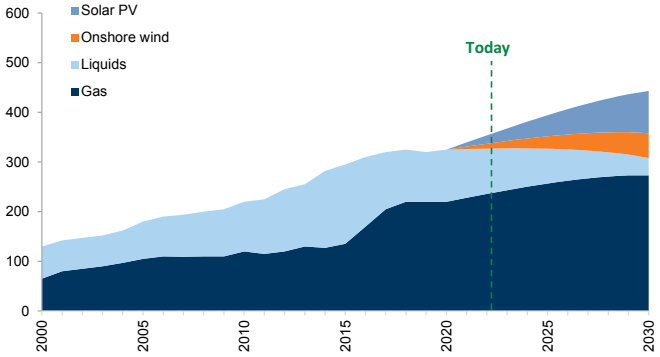
We highlight that a sizable part of the incremental gas from the aforementioned growth projects is likely to be allocated to power generation as well as refining and industrial sectors. Saudi's Ministry of Energy (MoE) has plans to steer away from generating electricity using oil liquids (including fuel oil); as such, it aims to primarily use natural gas, which has relatively lower carbon emissions vs oil liquids, as well as renewables, to achieve a cleaner power generation mix by the end of the decade. In addition, the gas and gas liquids produced are likely to be directed towards building Saudi's capabilities in the clean hydrogen/ammonia space and expanding downstream petrochemicals production.

Exhibit 24: We see Saudi's shift towards clean energy by 2030 driving meaningful demand for gas in power generation
Saudi gas demand by end use, bscfd



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 25: Saudi aims to increase the contribution from gas in the energy mix towards 2030 given its lower carbon emissions relative to other hydrocarbon liquids
Saudi's energy mix, in TWh



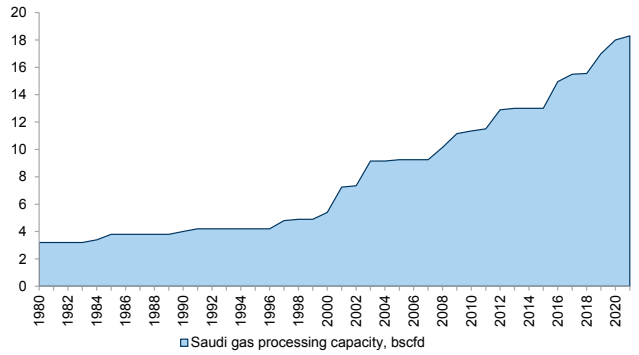
Source: Arabian Drilling , Rystad, Reuters, Saudi Aramco

On the infrastructure side, Aramco significantly expanded its natural gas processing capacity for both conventional and unconventional raw gas over the last few years to 18.3bscfpd (as of FY2021). The company recently announced that both Hawiyah and Haradh compression projects became commercially operational towards the end of 2022, with full capacity ramp-up expected in 2023; Aramco expects these to add 1.3bscfd of raw gas processing capacity once fully operational.

Looking ahead, Aramco aims to pursue various infrastructure expansion projects, including (1) the first development phase for the Jafurah gas plant (expected raw gas processing capacity of 3.1bscfd), which is likely to come online by 2025; and (2) the Tanajib gas plant, which is expected to add an incremental 2.5bscfd of additional processing capacity and come on stream by 2025.

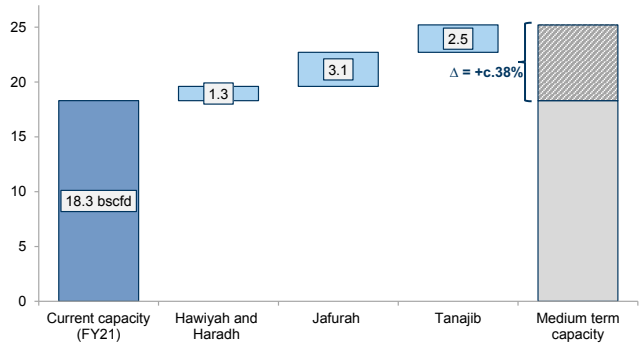
We expect another **US$74-88bn (SAR278-330bn)** of capex to be spent on sustenance and other infrastructure-related spend. We forecast this portion of capex to grow annually between US$200-400mn as Saudi embarks on its upstream capacity growth plans.

Exhibit 26: Aramco's gas infrastructure has been growing significantly over the last decade given the growth in supply/ associated and non-associated gas production
Saudi gas processing capacity since 1980, bscfd



Source: Company data

Exhibit 27: We see gas processing capacity and related infrastructure ramping up meaningfully over the medium term to cater to the gas production growth targets
Saudi's gas processing capacity, bscfd



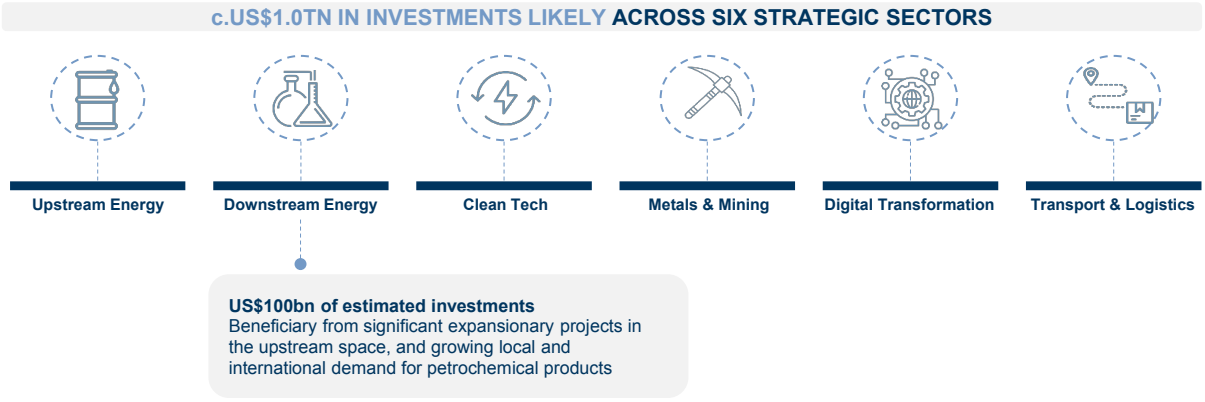
Haradh and Hawiyah fields already commenced commissioning activities and full capacity is expected to be reached in 2023

Source: Company data, data compiled by Goldman Sachs Global Investment Research

Downstream Energy: Looking at the next phase of capex growth

Saudi has ambitious plans to grow its downstream hydrocarbon production. Indeed, Aramco aims to place one million barrels of oil in petrochemical production and increase natural gas liquids allocation to the petrochemicals space. Saudi today is one of the world's largest petrochemicals hubs and its sizable upstream energy expansionary projects should pave the way for the sector to meaningfully grow its production over the next decade.

Exhibit 28: We see a capex upcycle driven partially by the need for higher capacity to cater to growing local and international demand



Mid-point of estimated investments shown above

Source: Goldman Sachs Global Investment Research

We expect the next leg of growth in the downstream space, mainly driven by (1) significant upstream exploration efforts and expansionary projects underway, which could potentially unlock incremental feedstock allocations, and (2) growing demand for petrochemical products both locally and internationally, with demand outpacing that for oil derivatives such as gasoline and diesel.

We estimate that **c.US$93-107bn (c.SAR349-401bn)** of total capex could be spent by the sector through 2030, on the back of recent announcements and project plans from multiple industry players, as well as potential unlocking of additional feedstock allocations following significant upstream gas expansion efforts (namely from Jafurah). For instance, Aramco recently expressed its intention to grow its oil to liquids chemicals capacity to 4mbpd with one million barrels to be allocated in Saudi via the thermal oil to chemicals route.

Overall, we see scope for (1) c.US$32bn (c.SAR122bn) of capex from integrated refining/chemical plant expansion projects, (2) c.US$57-71bn (SAR214-266bn) from potential crackers that could be added in the market, and (3) c.US$4bn (c.SAR15bn) from newly announced PDH plants.

To estimate the required capex for integrated refining/chemical plants, we use the average total investment cost/incremental chemical production for global COTC projects which we then multiply by the estimated production capacity of announced projects (computed assuming a 43% crude oil to chemicals conversion ratio, in line with industry players' levels). While we do not factor in Aramco's expectations for future conversion rates as the base case in our analysis, we note that it sees conversion rates as likely to reach above 70% underpinned by its key focus on innovation coupled with potential technological breakthroughs in catalyst and separation devices. Key announced growth projects within the Saudi integrated refining/chemicals space include SABIC's COTC partnership with Aramco/Sinopec and SABIC's liquid to chemicals plant project announced in November 2022.

To estimate the required capex for potential crackers, we take into account plans that have already been discussed by key industry players. These include APPC's new mixed feed cracker which is expected to come online by 4Q25, as well as Sipchem's potential cracker addition which management has highlighted on previous earnings calls. Beyond these, we assume a potential addition of 6-8 other crackers in Saudi in line with the country's aim to diversify its economy partly via utilizing more hydrocarbon volumes to produce more value-add downstream products. We apply the average capex per ton for similar growth projects to the expected incremental capacity from the aforementioned growth projects and arrive at c.US$57-71bn (SAR214-266bn) of required investments for other potential crackers.

In terms of planned PDH expansion projects, we note that both APPC and Alujain have two sizable projects underway which are expected to require combined investment costs of around c.US$4bn, as per respective company announcements.

We note that out of the c.US$93-107bn total capex we estimate by 2030, **US$15bn (c.SAR56bn) worth of projects have already been announced at specified budgets**. This expansion could result in Saudi's chemical capacity growing meaningfully by 2030.

Exhibit 29: Average estimated investment potential in the downstream energy space

Source: Goldman Sachs Global Investment Research, Regional news outlets, Company data

Integrating refining with chemicals, a growing focus for Saudi

Saudi Aramco sees crude oil to chemicals technology (COTC) as among the most promising areas within the downstream space given its ability to realize higher output yields vs traditional steam cracking. The company highlighted its recent achievement in increasing the yields via the thermal oil-to-chemicals route from a historical range of 8%-12% to around 50%; longer term, the company expects it to reach 70%-80% as the technology improves further. Integrating the downstream business with upstream/refining production phases is one key area that could result in realizing incrementally higher margins along the hydrocarbon value chain. We see this as a key theme in Saudi's next phase of chemicals expansion with potential room for improved cost efficiencies and value creation opportunities across the industry.

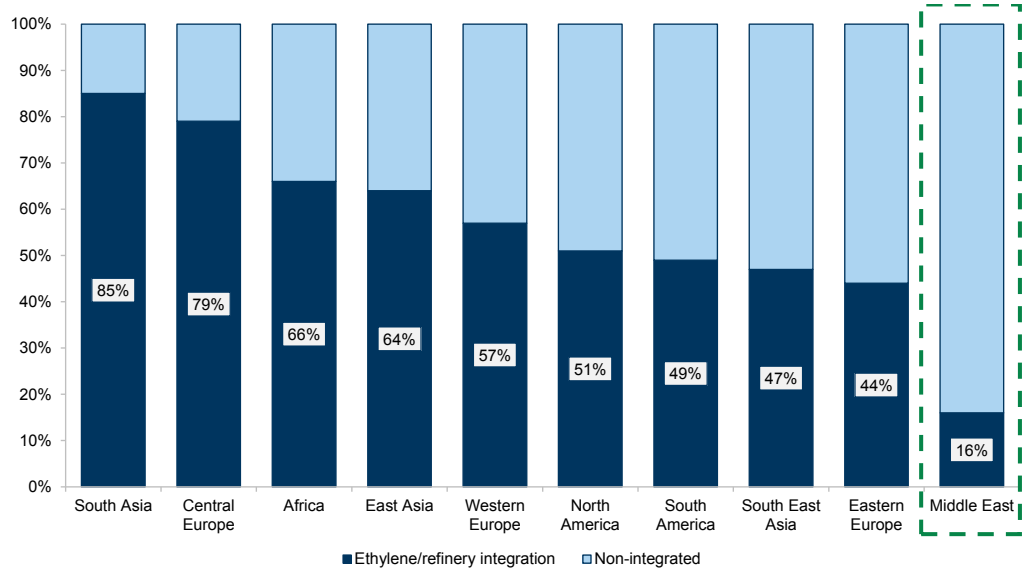
By 2030, Saudi aims to allocate 4mbpd of crude oil for chemicals production, with 1 million placed locally. This is in line with the country's vision to support the creation of a world-leading downstream sector as it seeks to maximize value from Saudi's crude oil production by integrating across the hydrocarbon chains and support conversion industries to produce semi-finished/finished products to diversify the economy. The Middle East currently has only c.16% of its ethylene/propylene capacity integrated (with refineries), meaningfully below the 60% average across other regions globally, as per GPCA; we see this share growing over time as more integrated production facilities, including crude oil/liquids to chemical units, begin to come on stream (largely from Saudi) over the medium term.

Another key driver for integrated refinery/chemical plants is higher olefins and aromatics demand growth vs key oil derivative products such as diesel and gasoline. We see global demand for the latter growing at less than 1% CAGR through 2030 (from 2021) partially due to a combination of (1) growing interest in cleaner burning fuels such as natural gas, hydrogen, and renewables and (2) higher penetration of electric vehicles within the transportation space. These growth projections are dwarfed by those for ethylene/propylene which are expected to grow at CAGRs of c.3.7%/4.0% over the same period (per Argus).

Saudi Aramco and SABIC have recently announced multiple initiatives within the space, including its plan to convert 400kbpd of crude oil to chemicals in Ras Al-Khair, as well as another similar project in partnership with Sinopec.

Given SABIC's industrial scale and size, as well as its strategic relationship with Aramco (parent), the company is able to leverage advanced technological capabilities in both upstream/downstream.

Exhibit 30: The Middle East holds one of the lowest shares of integrated refineries globally, but this is likely to grow over time as more COTC projects potentially come on stream over the medium term
Share of ethylene/refinery integrated capacities by region

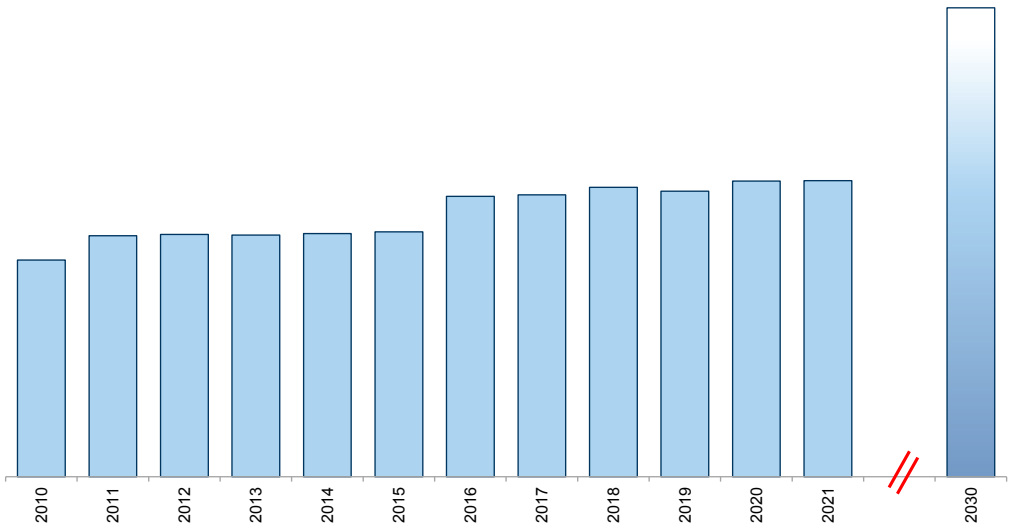


Source: GPCA

Room for more mixed crackers

To enable higher returns for COTC projects, Saudi Aramco is likely to utilize the growing production of natural gas liquids, which, if combined with heavier feed, could drive returns higher for mixed crackers. Several listed companies have expressed interest in building mixed crackers (e.g, Sipchem and APPC) and we see potential for around c.US$57-71bn (SAR214-266bn) in additional capex by 2030. While limited information has been shared around most projects, we believe the market is likely to see an increase in the number of crackers, particularly in light of sizable gas field expansion projects such as Jafurah.

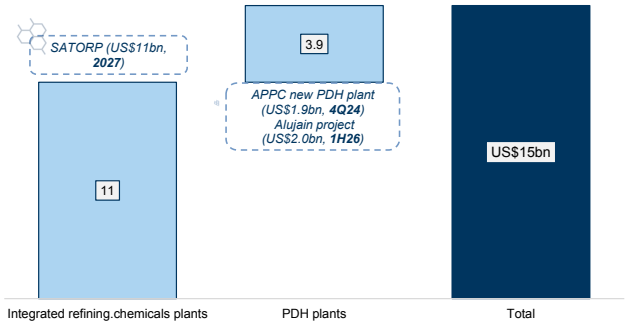
Exhibit 31: Total capacity for key petrochemical products have potential for meaningful expansion ahead
Key petrochemical products by capacity in Saudi, ktpa (for illustrative purposes)



Key petrochemical product capacities from listed companies in Saudi

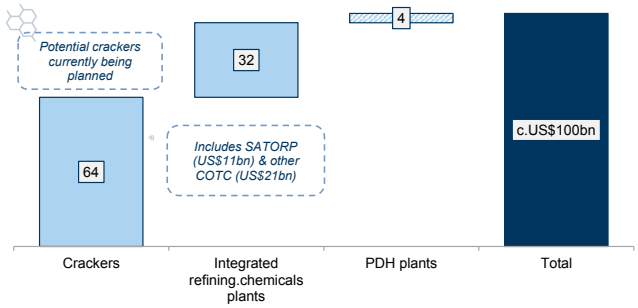
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 32: We see c.US$15bn in announced downstream capex plans so far...
Total capex (US$bn)



Source: Compiled by Goldman Sachs Global Investment Research

Exhibit 33: ...and estimate average additional potential spending of US$85bn by 2030, bringing the average total investment to US$100bn (on GSe)

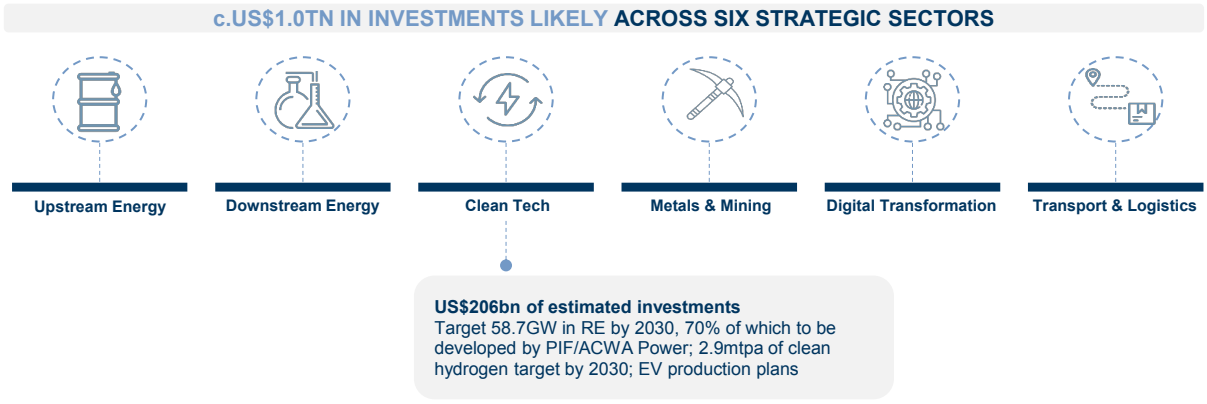


Source: Goldman Sachs Global Investment Research

Clean Tech: Future-proofing through decarbonization

Despite expected spending in the upstream energy space, Saudi remains committed to achieving its net zero target by 2060 by accelerating investments in clean energy technologies. Under Vision 2030, Saudi aims to (1) generate 50% of its electricity requirements through renewable energy sources (RES) by 2030 through the installation of 58.7GW of solar and wind capacities; and (2) produce 11mtpa of clean ammonia and 2.9mtpa of 'clean' hydrogen by 2030 (and 4mtpa by 2035). We estimate a total of c.US$193-218bn (SAR724-818bn) in investments would be required to achieve the targets set for renewable energy, clean hydrogen and EVs by 2030. Additionally, Saudi aims to have 30% of cars in its capital city Riyadh as EVs by 2030.

Exhibit 34: Despite expansionary projects in the upstream energy space, Saudi remains committed to achieving diversification and decarbonization targets



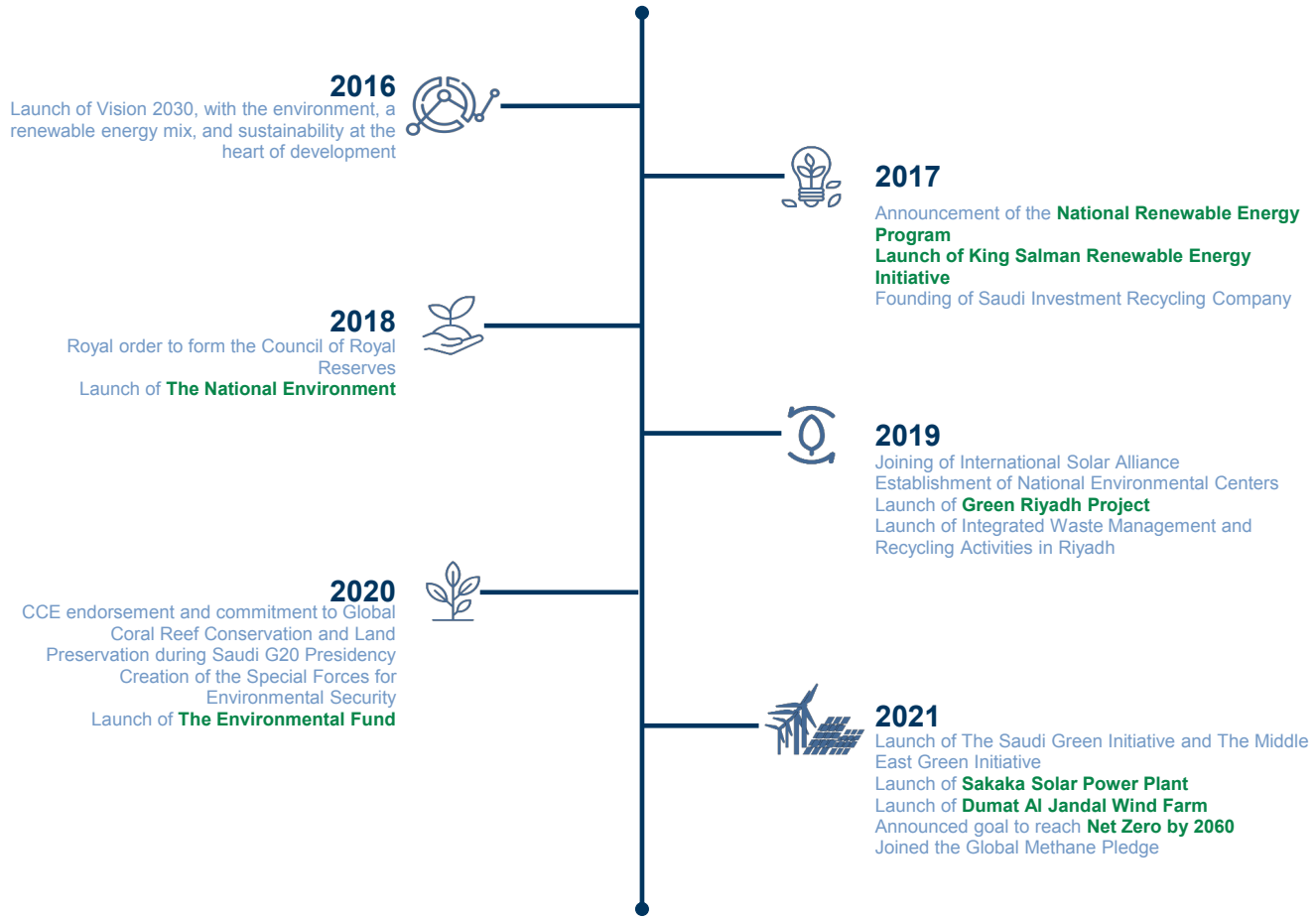
Mid-point of estimated investments shown above

Source: Goldman Sachs Global Investment Research

Renewable Energy: ambitious targets; tenders have been accelerated

Over the past few years, Saudi Arabia launched several green initiatives as part of its Vision 2030, most notably the National Renewable Energy Program (NREP) and Renewable Energy Initiative in 2017. Within four years of launching these programs, Saudi inaugurated the Sakaka solar PV plant (300MW) and Dumat Al Jandal onshore wind farm (400MW) in 2021, bringing the total operational capacity to 700MW connected to the grid by year-end.

Exhibit 35: Saudi Arabia has made meaningful progress on renewable energy strategies, policies and targets over the past few years



Source: Saudi Arabia Vision 2030

Over the past 12-24 months, the country has engaged in accelerated tendering processes to achieve its renewable energy targets of 27.3GW in installed capacity by 2024, and 58.7GW by 2030, with the latter broken down into: (1) c.40GW in solar PV (photovoltaic, 68%), (2) c.16GW in wind (27%) and (3) c.2.7GW in solar CSP (concentrated solar power, 5%). Additionally, Saudi plans to ramp up its nuclear generation capabilities with an aim to reach 2-3GW of installed capacity by 2030.

REPDO (Saudi's Renewable Energy Project Development Office) was tasked by the Saudi government to procure 30% of the 58.7GW renewable power target through public tenders, while the remaining 70% will be developed by the PIF via a Strategic Framework Agreement (SFA) signed with ACWA Power. The company and the PIF have already identified 11.5GW to be developed by 2025. Sudair solar PV (1.5GW) is the first project to be developed under the SFA pipeline; it achieved financial close in mid-2021 and moved to the construction phase, with an expected commercial operational date in 4Q2024.

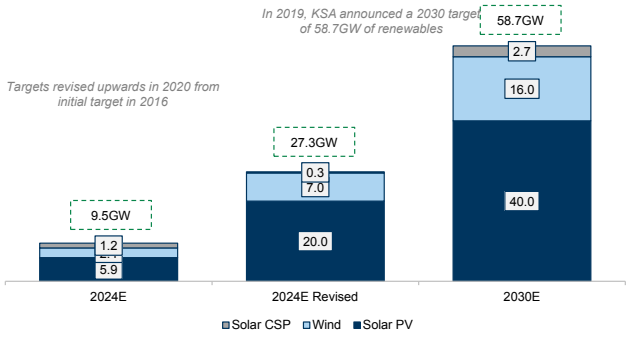
The renewable energy IPP market is increasingly attracting the interest of international investors and developers/EPC contractors alongside established and new local stakeholders. In tandem with the privatization program undertaken by the country, we

believe that the proportion of private schemes is likely to increase as the government encourages the participation of the private sector in various economic sectors including the development of RE.

We note that to date there are 19.85GW in RE projects in Saudi, split between completed (c.7%), in execution phase (c.16%) and announced (c.78% or 15.5GW, of which most projects have been tendered so far - see Exhibit 40 below for details). In terms of technology split, we see 85% of the c.19.9GW in solar PV form vs. 15% in onshore wind, with Saudi planning to launch tenders for several wind farms including Yanbu (700MW), Al-Ghat (600MW) and Waad Al Shamal (500MW). With the pipeline of announced projects in mind, we believe that an acceleration in implementation is required for the country to achieve both its shorter and longer-term targets (in line with historical and currently announced project timelines, we highlight that an estimated 2-3 years is needed on average for a project to reach the commercial operational stage). We note that Saudi announced in December 2022 the approval on the execution of 10 RE projects with a total capacity of 7GW, showcasing the country's commitment to accelerating deployment.

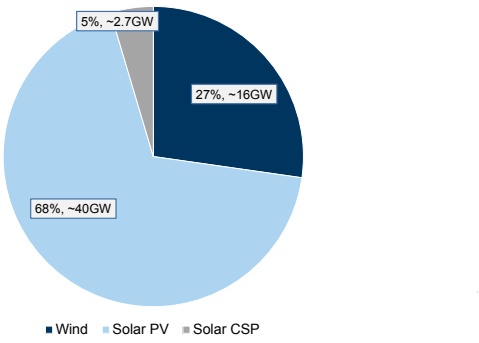
Furthermore, we note that NEOM itself could require initially up to 20GW in solar energy capacity, with room for more capacity requirements as the mega-project progresses. In fact, NEOM's utility subsidiary Enowa appointed a France-based company (Assystem) to conduct pre-development and preliminary design and planning studies for seven planned solar PV projects in the Tabuk and Duba regions in Saudi. This is in line with NEOM's strategy to be 100% powered by RE by 2030; it is also expected to contribute to Saudi's target to reduce its emissions by 278mt of carbon dioxide equivalent annually from 2020 to 2030.

Exhibit 36: Saudi's 2024 renewables targets were revised upward in 2020 from the initial targets set in 2016
Renewable energy targets (GW)



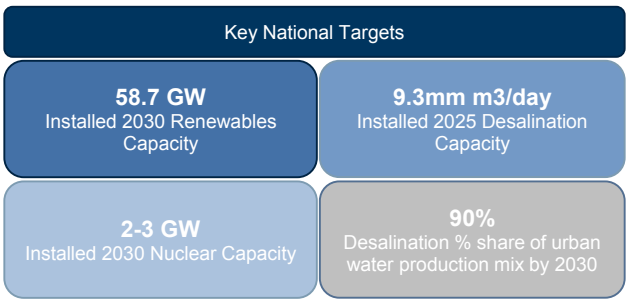
Source: ACWA Power

Exhibit 37: Saudi Arabia's 2030 RE target by source



Source: Vision 2030, National Renewable Energy Program (NREP)

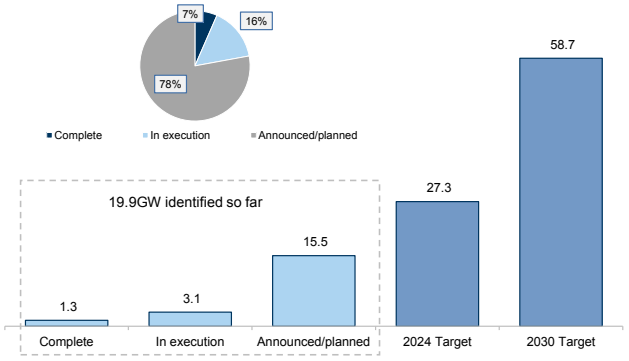
Exhibit 38: Key national targets as specified under the Saudi Vision 2030/NREP



Source: Vision 2030, National Renewable Energy Program (NREP), ACWA Power

Exhibit 39: We note that 19.9GW in RE capacity is so far either operational, under construction or announced (tendered or pre-tender)

Capacity (GW), to date



Source: ACWA Power, Masdar, PIF, Ministry of Energy, EDF Renewables, REDPO, compiled by Goldman Sachs Global Investment Research

Exhibit 40: List of projects

As of July 2023

Project	Type	Size	Status	Com	Partners
Sakaka	Solar PV	300	Complete	2020	ACWA Power & Others
Dumat Al Jandal	Wind	400	Complete	2021	Masdar & EDF Renewables
Jeddah	Solar PV	300	Complete	2022	Masdar & EDF Renewables, NESA Holding
Rabigh	Solar PV	300	Complete	2023	China Energy Engineering Group (CEEG)
Complete		**1,300**			
Qurayyat	Solar PV	200	Execution	2024	ACWA Power, Al Babtain, Gulf Investment Corp.
Al Faisaliyah (Shuaibah)	Solar PV	600	Execution	2023	ACWA Power, Al Babtain, Gulf Investment Corp.
Rafha	Solar PV	20	Execution	2024	Tamasuk Holding Company, Alfanar Group, Desert Technologies
Madinah	Solar PV	50	Execution	2024	Al-Balagha, Alfanar Group, Desert Technologies
Ar-Rass	Solar PV	700	Execution	2024	ACWA Power & others
Yanbu 4 iwp	Solar PV	20	Execution	2023	Engie SA, Nesma, Mowah
Sudair	Solar PV	1,500	Execution	2024	ACWA Power, PIF
In execution		**3,090**			
Saad	Solar PV	300	Announced	2023	Jinko Power Technology Co
Shuaibah 2	Solar PV	2,060	Announced	2025	ACWA Power, The Water and Electricity Holding Company (Badeel)
Rabigh 2	Solar PV	300	Announced	TBD	ACWA Power
Layla	Solar PV	80	Announced	2024	ACWA Power, Ministry of Energy
Wadi Al Dawaser	Solar PV	120	Announced	TBD	REPDO
Ar Rass 2	Solar PV	2,000	Announced	TBD	ACWA Power, Badeel (PIF owned)
Saad 2	Solar PV	1,125	Announced	TBD	ACWA Power, Badeel (PIF owned)
Al Kahfah	Solar PV	1,425	Announced	TBD	ACWA Power, Badeel (PIF owned)
NEOM	**Solar PV**	**3,900**	**Announced**	**2026**	**ACWA Power, NEOM, Air Products**
Yanbu	Wind	700	Announced	2026	Saudi Power Procurement
Al-Ghat	Wind	600	Announced	2026	Saudi Power Procurement
Waad Al Shamal	Wind	500	Announced	2026	Saudi Power Procurement
Yanbu Wind Power Plant	Wind	850	Announced	TBD	REDPO
Al Hanaka	Solar PV	1,100	Announced	TBD	TBD
Tabarjal	Solar PV	400	Announced	TBD	TBD
Announced/planned		**15,460**			
of which tendered %		*90%*			

Total capacity identified (MW)	**19,850**

	% of total	GW
Solar PV (MW)	85%	16.8
Wind (MW)	15%	3.1

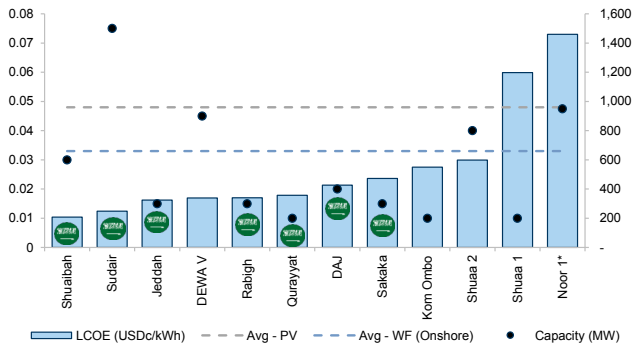
	Government Targets
2024 target (GW)	27.3
2030 target (GW)	58.7
2024 target - % identified so far	73%
2030 target - % identified so far	**34%**

Source: ACWA Power, Masdar, EDF Renewables, PIF, Ministry of Energy, REPDO, Middle East Economic Digest (MEED), compiled by Goldman Sachs Global Investment Research

In terms of economics, we believe the country screens attractively within both the MENA and global context. Based on our benchmarking analysis on an LCOE (levelized cost of energy) basis, Saudi offers some of the lowest bids seen within the RE space; for instance, the average LCOE of PV projects in Saudi stands at a >60% discount to the global weighted LCOE (as of 2021).

Excluding transmission and distribution costs, we estimate that the installation of the remaining portion of 38.9GW in RE would require **c.US$38-57bn (SAR143-214bn)** in investments by 2030, and **US$54-73bn (SAR203-274bn)** including the nuclear energy target, based on current investment costs of existing projects in Saudi and the UAE. Beyond adding GWs, investments would also be required for transmission and distribution, as well as modernizing the grid to allow for the export of energy, which could entail **c.US$38bn (SAR143bn)** in investments, as per the MoE, bringing the total average investment to **US$120bn (SAR450bn), including US$17.4bn of announced investments.** We flag that these calculations are based on projects that have achieved financial close and announced GWs and therefore could be subject to change as more projects are announced.

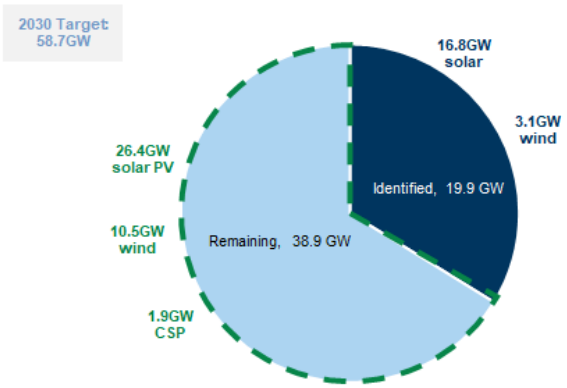
Exhibit 41: Solar and onshore wind projects in Saudi Arabia rank competitively on cost vs. other projects in the region, and when compared to the global weighted average LCOEs
Capacity (MW, RHS), levelized cost of energy (LCOE in USDc/kWh, LHS), and global average weighted LCOE for PV and onshore wind (USDc/kWh, as of 2021)



*Noor 1 capacity includes 700MW in CSP, and 250MW in Solar PV

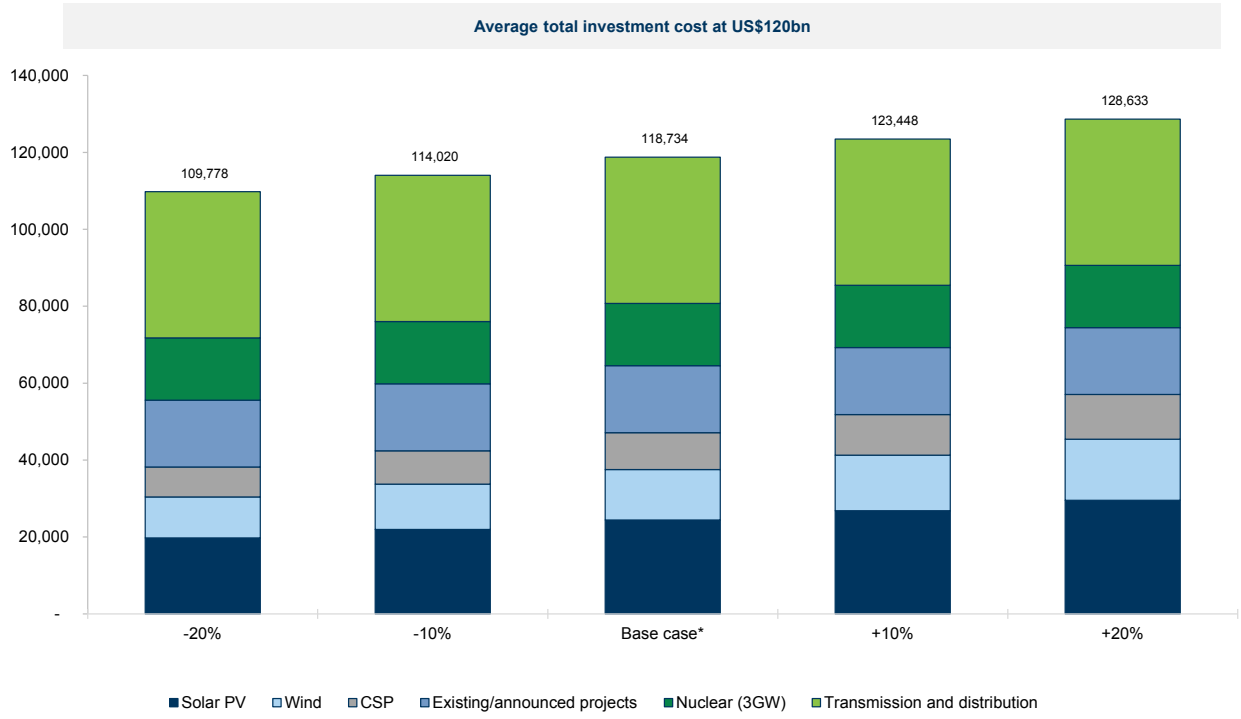
Source: IRENA, ACWA Power, DEWA, Masdar, data compiled by Goldman Sachs Global Investment Research

Exhibit 42: The projects announced so far account for 34% of Saudi's 2030 RE target; we expect the remaining capacity to come mainly in solar PV
Identified capacity additions vs those remaining to reach Saudi's 2030 RE target (GWs)



Source: Vision 2030, Goldman Sachs Global Investment Research

Exhibit 43: We estimate a potential total investment of c.US$110-130bn as likely in renewable and nuclear energy by 2030
Total investments (US$mn); scenarios based on different capex levels for solar PV, wind, and CSP



*Base case based on the capex/GW of existing projects that have achieved financial close

Source: Goldman Sachs Global Investment Research

Clean Hydrogen: Strategically positioned to capture growing hydrogen demand

We believe Saudi is strategically positioned to capitalize on a growing clean hydrogen economy given its attractive cost positioning in both renewable energy and natural gas, as well as infrastructure readiness benefiting from leading CCUS capabilities (via Aramco). We see several themes shaping the industry by 2030, establishing Saudi as a major hub for clean hydrogen and ammonia exports. We estimate that a total of c.US$33bn-c.US$39bn in investments would be required to achieve the target of 2.9mtpa of clean hydrogen by 2030.

As highlighted in The Rise of Clean Hydrogen, hydrogen has the potential to decarbonize the most challenging parts of the Carbonomics cost curve, including long-haul transport, steel, chemicals, heating and long-term power storage. Furthermore, hydrogen also screens attractively as a fuel when compared to other conventionally used fuels owing to its low weight (lightest element) and high energy content per unit mass (>2.5x the energy content per unit mass of both natural gas and gasoline). Over the past few years, the intensified focus on decarbonization and climate change solutions has begun to translate into renewed policy action aimed at the wider adoption of clean hydrogen. Our global energy team expects 'green' hydrogen to become the ultimate decarbonization tool with significant longer-term potential.

While 'blue' and 'green' hydrogen are the lowest carbon intensity hydrogen production pathways, both technologies are more costly when compared to traditional hydrocarbon-based 'grey' hydrogen production, based on our energy colleagues' hydrogen cost of production analysis. Our global team estimates the cost of production of green hydrogen can be 1.3-5.5x that of blue hydrogen depending on the price of natural gas and LCOE. Opex improvements driven by improved utilization levels from integrated design optimization, centralization of production, and economies of scale will be key for higher adoption in the future. This leads us to conclude that both 'blue' and 'green' hydrogen will form key pillars of the low carbon transition, but with 'blue' facilitating the near- and medium-term transition until 'green' reaches cost parity longer term.

Exhibit 44: Hydrogen end uses and ongoing related projects

Chemicals	Steelmaking	Shipping	Transportation	Heating
Hydrogen is key to the production of ammonia and methanol	This industry is responsible for producing betwen 7-10% of global CO2 emissions. Hydrogen has the potential to decarbonize the industry by enabling the production of "green steel"	Hydrogen is likely to have an important role in shipping via conversion to ammonia or in the form of fuel cell electric vehicles (FCEV) trucks	Road Transport: Fuel cell electric vehicles (FCEVs) enjoy short refueling time and lower weight making them particularly useful in long-haul and heavy transportation	Hydrogen can be blended with the current pipeline infrastructure and could effectively be a lower-cost alternative

Source: Compiled by Goldman Sachs Global Investment Research, MHI Group

Understanding green, blue and grey hydrogen

Hydrogen fuel contains the highest energy content per unit mass vs other fuel types (2.5x more than conventional fossil fuels). In addition, it has short refueling time, low weight, and zero direct emissions when sourced from renewable energy sources. The energy source that is used in the production process determines the 'color' of hydrogen. The major ones are as follows:

Grey hydrogen is the carbon-emitting hydrogen which has been produced for numerous decades. It involves splitting natural gas using fossil fuel energy.

Green hydrogen is produced via water electrolysis, an electrochemical process in which water is split into hydrogen and oxygen using only renewable energy sources throughout the production process. As highlighted by our utilities team in Green Hydrogen: The next transformational driver of the Utilities industry, c.65% of the total cost related to green hydrogen production is electricity input cost. This creates an opportunity for the future as economies of scale further reduce the cost of electrolysis (as already seen in the past ten years when costs have fallen by c.60%).

Blue hydrogen is produced when natural gas is split through steam methane reforming (SMR) or auto thermal reforming (ATR) with the resulting CO_2 getting captured and stored through a process called Carbon Capture Usage and Storage (CCUS).

Exhibit 45: Comparison between the production of green vs. blue hydrogen

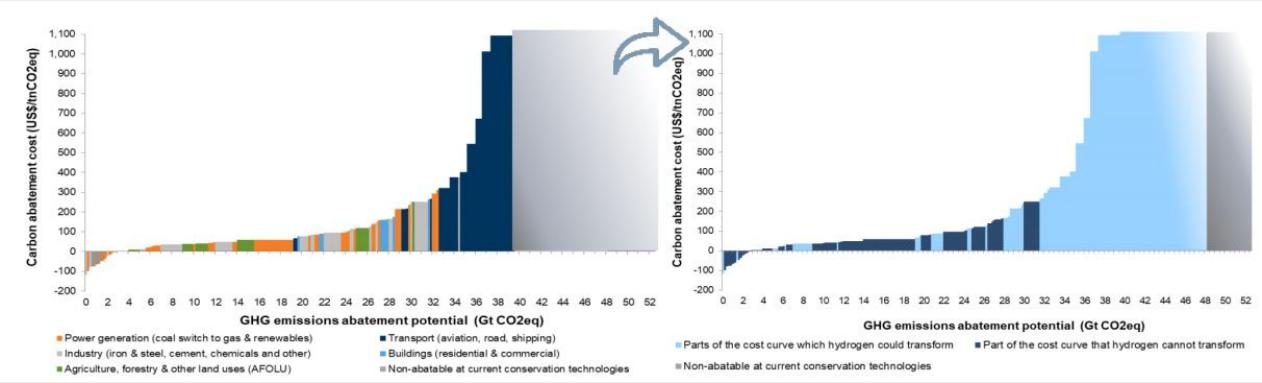
Electrolyser-based "green"	CCUS-based "blue"
• High capex	• Low-to-moderate capex
• Low-to-moderate cash costs	• Moderate-to-high cash costs
• Low/no variable cost	• High variable cost
• High price risk	• Low price risk
• Low cost risk	• Moderate-to-high cost risk
• Deflationary cost outlook	• Inflationary cost outlook

Source: Argus

Hydrogen: potential to transform the carbon abatement cost curve

Based on current technologies to reduce GHG emissions, our energy team estimates that c.25% of current global anthropogenic GHG emissions are not abatable under current, commercially available, large-scale technologies at prices <US$1,000/tnCO2eq, calling for more technological innovation and breakthroughs to unlock the net zero carbon potential. Examining the emerging technologies, it appears that hydrogen is currently at the forefront of this technological challenge: based on our energy team's analysis, it has the potential to transform 45% of the cost curve (including non-abatable emissions <$1,000/tnCO2) and can be attractively positioned in transportation, building, power generation and industrial applications.

Potential to address non-abatable GHG emissions under current, large-scale, commercially available technologies



Source: Goldman Sachs Global Investment Research

In Saudi, we see several trends shaping the future hydrogen economy: (1) an increasing focus on decarbonization (278mtpa of CO2 emissions reduction target by 2030, net zero by 2060) is a driving force behind clean tech investments; (2) the rise of renewable energy sources would facilitate the production of green hydrogen (e.g. NEOM Green Hydrogen); and (3) we believe Saudi is strategically positioned to export blue/green ammonia (as ammonia offers an alternative for hydrogen storage, allowing transportation over longer distances) given the existing infrastructure (e.g. Aramco's CCUS capabilities) and the competitive production cost positioning.

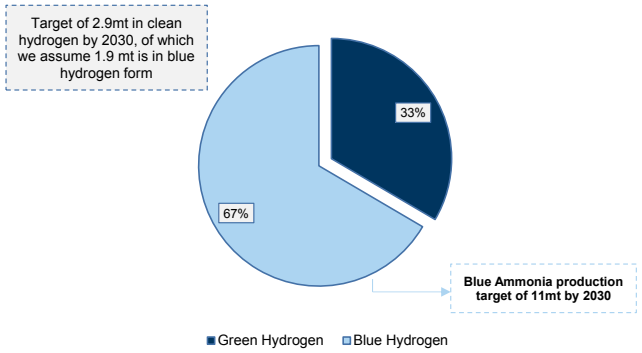
Exhibit 47: Key hydrogen projects in Saudi Arabia

Source: ACWA Power, Marafiq, Saudi Basic Industries Co (SABIC), Saudi Aramco, compiled by Goldman Sachs Global Investment Research

In terms of government targets, Saudi has announced its aim to produce 2.9mtpa of 'clean' hydrogen by 2030 (scaling it up to 4.0mtpa by 2035), and 11mt of blue ammonia. Based on the latter, we assume c.1.9mtpa of blue hydrogen production and the remaining c.1mtpa by 2030 to come in green form.

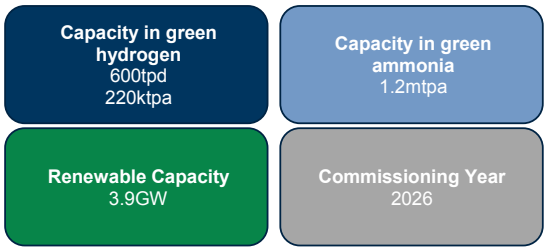
The country is currently developing the world's first large-scale green hydrogen plant in the smart city NEOM in an equal JV between NEOM, Air Products and ACWA Power, with a capacity of 600tpd (c.220ktpa) and a project cost of US$8.4bn. The plant will be powered by 3.9GW of renewable power, and when commissioned in 2026, would produce up to 1.2mtpa of green ammonia, mitigating the impact of 5mn metric tonnes of CO2 emissions per year.

Exhibit 48: Saudi is targeting 2.9mt of clean hydrogen by 2030, of which we assume c.1.9mt would come in blue hydrogen form
% of total



Source: Argus Media

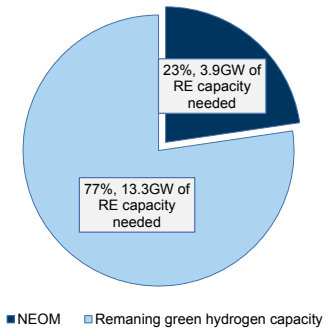
Exhibit 49: NEOM Green Hydrogen key details



Source: ACWA Power

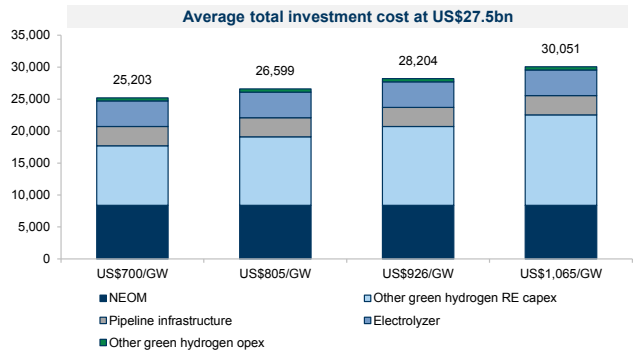
For **green hydrogen**, our analysis suggests that some of the most important investment areas needed to produce green hydrogen are renewable energy, electrolyzers and gas pipeline/terminal infrastructure. We use NEOM's project as a benchmark for RE capacity, and estimate that an additional 13.3GW would need to be used to produce 0.75mt of green hydrogen. We would expect this capacity to come mainly in solar PV given the relatively cheaper costs and faster implementation process when compared to CSP/wind. Including NEOM, we estimate between **c.US$25.2-30.1bn (c.SAR94.5bn-112.7bn)** in overall investments would be needed to produce c.1mt of green hydrogen by 2030, broadly in line with capex/GW figures of announced renewable energy projects.

Exhibit 50: Saudi would need to install an additional 13.3GW in RE capacity to reach c.1mt in green hydrogen production by 2030
Renewable energy capacity, % of total



Source: ACWA Power, Goldman Sachs Global Investment Research

Exhibit 51: We estimate investments needed for green hydrogen by 2030 between US$25.2-30.1bn
Total investments (US$mn), scenarios based on different capex/GW for solar PV projects



Estimated electrolyser capacity assumed at 5.0GW

Source: Goldman Sachs Global Investment Research

NEOM Green Hydrogen Company (NGHC) execution update

NEOM Green Hydrogen Company (NGHC) announced in May 2023 that it has **reached financial close** following the signing of financial agreements with 23 local, regional and international banks and investment firms, covering the project cost for the integrated green hydrogen project to be established in NEOM, Saudi Arabia.

The company also **concluded the EPC** (engineering, procurement and construction) **agreement** with Air Products, valued at US$6.7bn. The total financing was constructed on a non-recourse project finance basis, with US$1.5bn provided by the National Development Fund (on behalf of the National Infrastructure Fund), US$1.25bn by the Saudi Industrial Development Fund, and the rest from a consortium of financiers.

As a reference, the project's total cost was revised to US$8.4bn (vs. US$5.0bn initially), with the increase accounting for inflation.

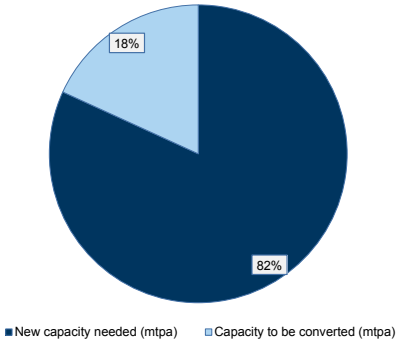
As per Air Products, land preparation for the project has been completed, along with 30% of the engineering phase with all major sub-contracts awarded. Additionally, the contract covers the construction of a 2.93GW solar power generation plant, a 1.37GW wind power farm, and a 400MW battery energy storage system, with a power transmission network extending 190km. Furthermore, the project comprises 2GW of electrolysers (to be supplied by German-based Thyssenkrupp) to produce 650t of H2/day, and air separation units to produce nitrogen for the conversion of hydrogen into 1.2mn tons of ammonia/year.

With regard to **blue hydrogen**, Saudi is currently developing its blue ammonia business with an aim to produce up to 11mtpa by 2030, requiring 1.93mt of blue hydrogen.

We see c.9mnt of incremental blue ammonia sellable capacity potentially coming online by 2030 (translating into 1.58mt of blue hydrogen), in addition to the current ammonia capacity that can be converted (SANCO/Maaden). Aramco and SABIC (through SANCO) have already shipped small quantities to Japan and South Korea where they were primarily used for the purpose of low carbon power generation. Maaden also announced in November 2022 that it will export its first blue ammonia shipment of 25kt to South Korea and it also shipped 25kt of blue ammonia to China in May 2023 (see here for more details). For the existing ammonia capacity, we expect additional reconfiguration capex (around c.US$0.5bn) mainly linked to carbon capture infrastructure.

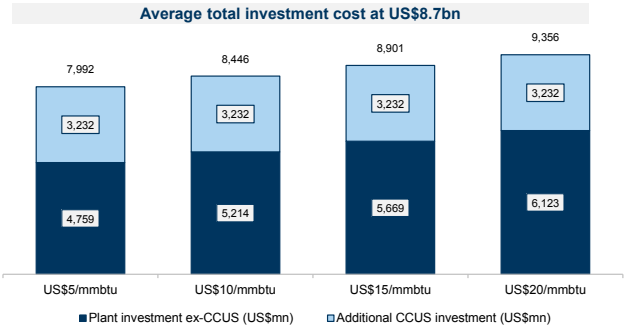
Using our energy team's in-house GS blue hydrogen cash cost model, we estimate that the production of an additional 1.58mt of blue hydrogen alongside applying CCUS to the total capacity of 1.93mt would cost potentially between **US$8.0bn-9.4bn (c.SAR30bn-35bn) looking at four different gas price scenarios (we use US$5/mmBtu at the lower end and US$20/mmBtu at the upper end)**. This brings the total investments to **US$33.2bn-39.4bn (SAR124.5bn-SAR147.8bn)**, in line with the country's anticipated investments **(c.US$36bn, or SAR135bn announced)** in clean hydrogen by 2030.

Exhibit 52: To meet the blue ammonia production target of 11mtpa by 2030, Saudi will need to add 1.93mtpa of blue hydrogen, of which we expect >80% to come in capacity additions
% of target capacity



Source: Ministry of Energy (MoE), Goldman Sachs Global Investment Research

Exhibit 53: We estimate US$8.0-9.4bn in potential investments needed to achieve the country's blue hydrogen target
Total investments (US$mn), scenarios based on different natural gas prices (US$/mmbtu), all else equal



Source: Goldman Sachs Global Investment Research

Electrification: Growing focus on EV rollout in Saudi

While EV adoption in the Middle East is still nascent, its growing penetration globally, coupled with government-led energy transition initiatives, has been accelerating its adoption regionally. In COP27 last year, several countries pledged to transition to EVs by 2040 as a way to accelerate their decarbonization plans. Saudi has similarly announced multiple initiatives around the future of cars in the region given the meaningful contribution of cars to the country's total energy consumption (21%, per Saudi Energy Efficiency Center). In terms of expected capex, Saudi could see around **US$50bn (SAR188bn)** being spent on EV production over the next decade (Ministry of Investment). This is while total installed capacity in the country is expected to reach over 300k vehicles per year over the same period (source: SIDF (Saudi Industrial Development Fund)).

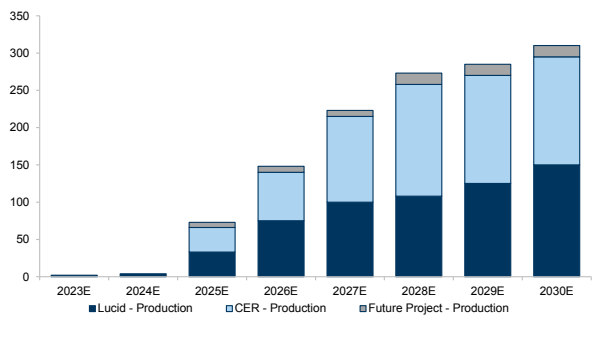
By 2030, Saudi aims to have 30% of cars in Riyadh (and c.10% of cars in Saudi) powered by electricity. In May 2022, Saudi announced plans to invest around c.US$2bn (or c.SAR.8bn) in an EV battery plant, in line with the country's broader plans to diversify its economy away from hydrocarbons and develop the industrial sector as part of the Saudi Vision 2030 and National Industrial Development and Logistics Program (NIDLP); the project is currently underway.

Saudi also recently launched Ceer, the country's first EV maker; according to the Saudi government, the company is expected to produce around 150k cars per annum and contribute around US$8bn to the country's GDP by 2034. In addition, vehicles produced by Ceer are expected to be available by 2025. The company is expected to design, manufacture, and sell vehicles in Saudi as well as the broader MENA region.

Lucid also signed an agreement with the Saudi government to build its first overseas production factory in Saudi where it could potentially manufacture up to 150k vehicles per year. Furthermore, Saudi Arabia agreed to purchase between 50-100k EVs over a ten-year period; delivery of the vehicles is expected to start this year with an initial order ranging between 1-2k vehicles annually, scaling to 4-7k beginning in 2025.

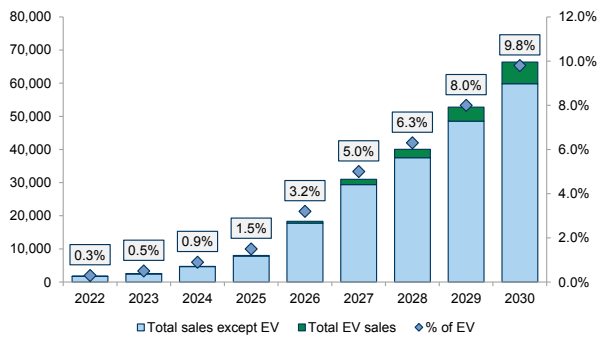
We believe Saudi could potentially be a key player within the EV space partly driven by its diversification efforts, economic resources, and proximity to input-exporting countries (Saudi's position at the intersection of Africa, Asia, and Europe positions it competitively to import minerals from mines in Africa, produce vehicles domestically, and finally export to international markets).

Exhibit 54: The supply of battery EVs locally built in Saudi is expected to grow...
Number of vehicles (thousands)



Source: SIDF

Exhibit 55: ...with EV penetration expected to reach around c.10% by 2030
Car sales (excluding EV) and EVs in Saudi



Source: SIDF

Metals & Mining: Seeking economic diversification

Saudi Arabia's mineral resources are estimated to be worth SAR5tn (US$1.3tn), including over 15 commercially viable minerals (out of the 48 identified in total) and 20mn ounces of unexplored gold reserves, as per Invest Saudi. The expansion of the mining sector is an important part of Vision 2030, as the country aims to increase its contribution to GDP to US$64bn by 2030 (vs. US$17bn in 2021) and reduce the reliance on imports by US$7.5bn by 2035. Overall, Saudi is targeting cumulative investments of US$170bn (SAR638bn) by 2030, of which nine projects worth US$32bn (SAR120bn) have been already announced.

Exhibit 56: Saudi aims to invest US$170bn in the metals & mining sector by 2030

Source: Goldman Sachs Global Investment Research

Saudi is the world's 13th largest country by land mass (2.1mn km2), of which c.30% is a major source of base and precious metals (source: Invest Saudi), in what is known as the Arabian Shield region. The country's largest mineral and metal resources include phosphate, gold and copper, followed by zinc, iron ore, uranium, niobium, silver and others; Saudi is targeting 50% completion of the geological survey program for the Arabian Shield (600k km2) by 2025. The expansion of the metals & mining sector is an important part of Vision 2030 as the country seeks economic diversification and aims to grow the non-oil economy.

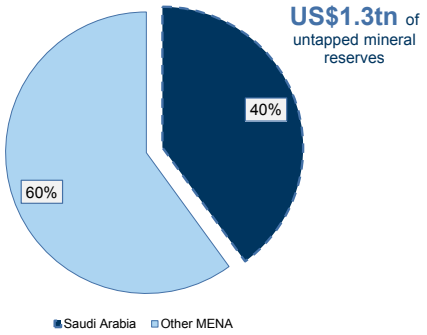
Exhibit 57: Saudi Arabia's metals and mining industry snapshot (as of 2022)

*as of 2019

Source: Ministry of Industry and Mineral Resources, Invest Saudi

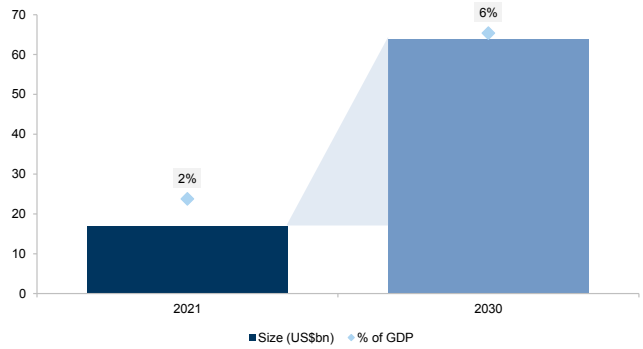
With the mining sector being the third pillar of Saudi's economic diversification agenda, its development is a main area of focus over the coming few years. The government has undertaken several steps to support growth of the metals and mining industry, including the introduction of a new Mining Investment Law, and the construction of railways to facilitate logistics. As of 2021, Saudi has invested >US$40bn in fully integrated mining value chains, in partnership with the private sector (as per the National Industrial Development and Logistics Program (NILDP)). Additionally, the country has attracted US$8bn in FDI to the sector, and issued 145 licenses in 2021. Saudi is currently targeting new investments worth >**US$30bn** in mining and metals production across different projects, and cumulative investments of **US$170bn by 2030**.

Exhibit 58: Saudi Arabia accounts for 40% of the MENA region's mining reserves, with untapped mineral reserves valued at US$1.3tn
Saudi Arabia mining sector reserves as a % of MENA region



Source: Saudi Arabia Vision 2030

Exhibit 59: Saudi aims to increase the mining sector's contribution to annual GDP to US$64bn by 2030E
Mining sector size (US$bn) and % contribution to GDP



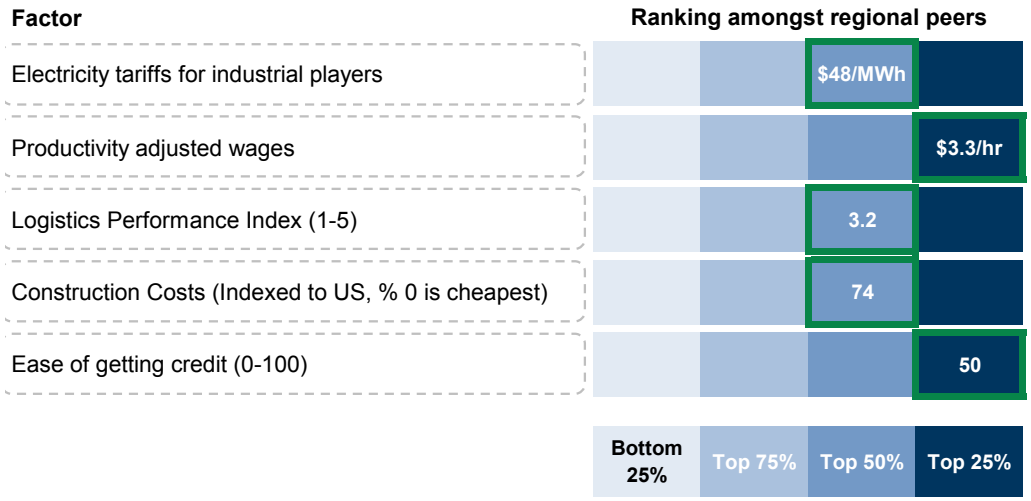
Source: Saudi Arabia Vision 2030, IMF, compiled by Goldman Sachs Global Investment Research

A new Mining Investment Law to facilitate investments in the sector

To attract both local and foreign investments and facilitate licensing, Saudi passed a new Mining Investment Law which came into effect on January 1, 2021. It aims to enhance governance in the sector, improve transparency and lift investor confidence, as stated by the Ministry of Industry and Mineral Resources (MIMR). The law (1) clarifies the roles and responsibilities of new investors in Saudi mining projects, (2) digitalizes the process for issuing new mining licenses, hence enhancing the ease of doing business, (3) streamlines license approvals and (4) requires transparent publication of records related to mining licensing activities. As per the MIMR, a new mining exploration license can now be issued in 90-180 days under the new investment law vs. a number of years globally.

We highlight that on taxation, post April 2021, Saudi Arabia introduced a royalty/severance fee of 4% on phosphate extraction and 1.5% on gold, accounted for as part of COGS. In addition, a 20% income tax is applied to the hypothetical income on the first sellable product, which falls below the EBITDA income line.

Exhibit 60: Saudi Arabia ranks favorably vs. other countries in the region in terms of the cost of doing business



Source: Invest Saudi

In terms of financing, the SIDF plays a leading role in implementing development policies and programs, and promoting industrial investment opportunities. In 2017, the Council of Ministers approved the amendment of SIDF's Basic Law, broadening its reach to support a number of new sectors under Vision 2030 focus, i.e. mining, industry, energy and logistics. Through the National Industrial Development and Logistics Program (NILDP), SIDF introduced new packages of financial products and services. For the mining sector, SIDF aims to raise the latter's contribution to GDP, as well as increase job opportunities and the flow of domestic/foreign investments into Saudi; to achieve this, SIDF offers financing for (1) mining projects for all minerals up to 75% of the cost of eligible projects, and (2) the final stage of the exploration process, including drilling and mine preparations, among other services.

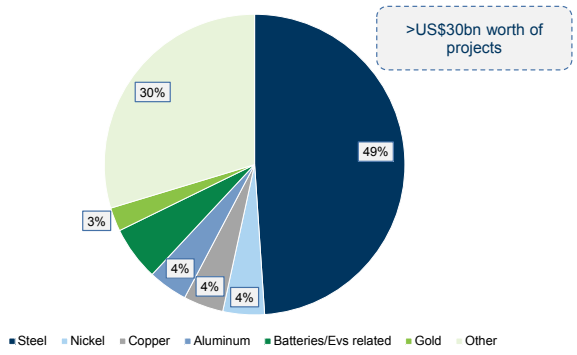
On recent developments in the space, Saudi awarded the mining license of the Khnaighuiyah area (26mt in zinc and copper, both critical minerals contributing to the global energy transition) recently to a consortium comprising Moxico Resources Plc and Ajlan & Bros. Additionally, Maaden is rapidly expanding new mines like Mansourah Massarah (250k ounces of gold), which is currently in execution phase, while a consortium of Maaden and Barrick Gold T7 Ltd won the Umm Al-Damar exploration license (40 km2; includes copper, zinc, gold and lead) and Al Masane Al Kobra Mining (AMAK) was awarded four exploration licenses (expiring in July 2027) for copper and gold in Al-Dawadmi (396km2) near Riyadh. Saudi also announced that new gold and copper ore deposits exist within the Madinah region that could be explored. Overall, the total of number of active licenses for reconnaissance, exploration, and exploitation stood at 1,967 (as of 2022), with 48 minerals identified in the Kingdom.

Looking into 2023, the country has announced bidding timelines for five new mining licenses across (1) Ar Ridaniyah site (zinc deposits), (2) Umm Hadid site (silver, lead, zinc and copper deposits), (3) Bir Umq in Madinah (copper and zinc deposits), (4) Jabal Sahabiyah (zinc, lead and copper deposits) and (5) Muhadad (copper, zinc, lead and gold deposits). As per the Ministry, pre-qualified bidders and bid winners for the projects are

expected to be announced over the coming few months, with exploration licenses to be issued within three months of the end of the rounds.

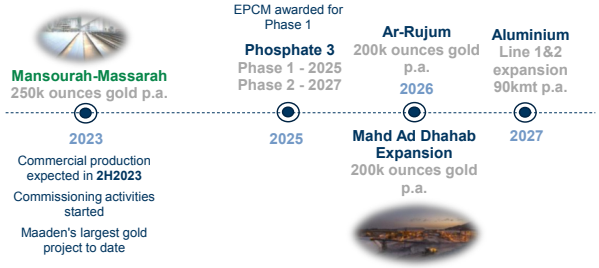
Furthermore, we highlight that progress on new plants and ventures has also been moving in the right direction; Baoshan Iron and Steel Co., one of China's largest listed steelmakers (and a subsidiary of China Baowu Steel Group, the world's largest steelmaker), announced in May that it has signed agreements with Aramco and the PIF to build a steel plate manufacturing JV (with Baosteel owning 50% and Aramco/PIF each owning a 25% stake). The JV will be designed with an annual capacity of 2.5mn tons of direct reduced iron and 1.5mn tons of steel plate, and is expected by Baosteel to come online by the end of 2025. The project will also be equipped with a direct reduced iron furnace and an electric arc furnace fueled by natural gas, which is also forecast to reduce carbon dioxide emissions by >60% vs. the traditional blast-furnace based steelmaking process (as per Baoshan).

Exhibit 61: c.49% of the investment opportunities in Saudi are related to steel manufacturing plants
Contribution to total investment (%)



Source: Saudi Vision 2030

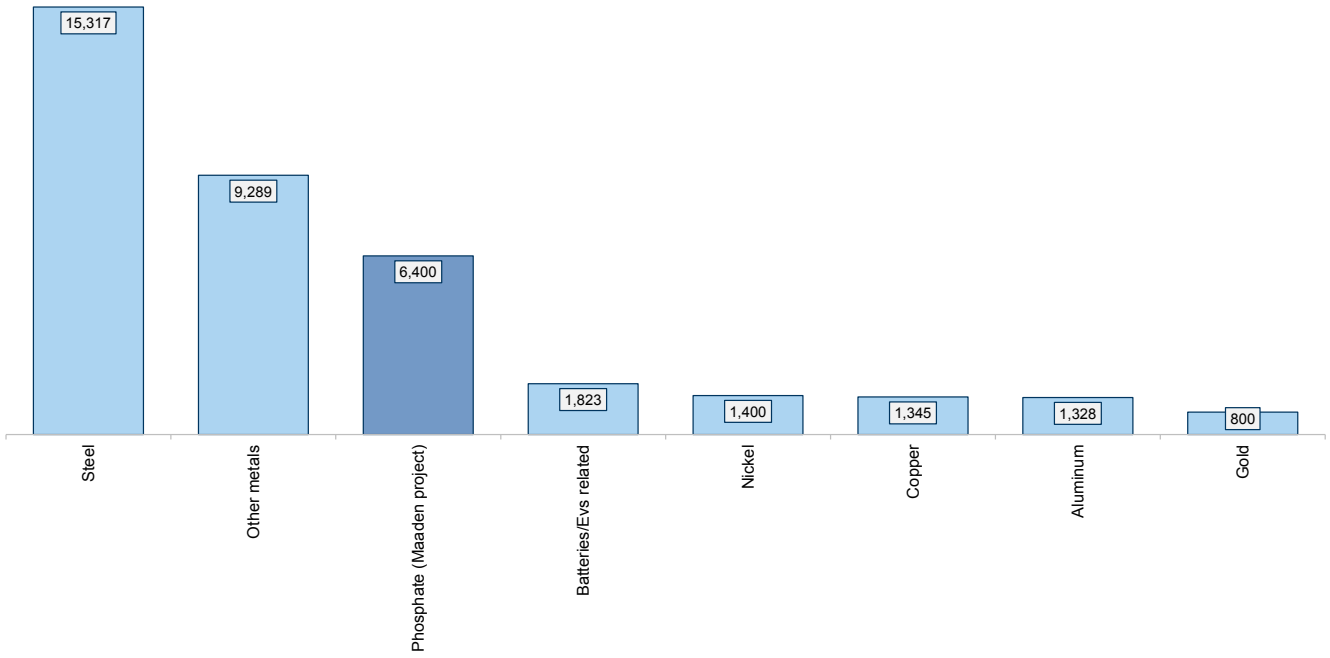
Exhibit 62: Maaden's near-term projects: (1) commercial production at Mansourah-Massarah and (2) exploration efforts in Mahd Ad Dahab and Ar-Rujum gold mines
Maaden's near-term growth projects in metals and mining, as of 2Q23



Green = in execution, Blue = under study

Source: Maaden

Exhibit 63: Saudi announced several projects within the metals & mining space that are available for investments
Investment required, US$mn



Source: Invest Saudi

Exhibit 64: A sample of projects identified by Saudi Arabia available for investments (US$mn)
As of August 2023

			Investment cost range (US$mn)	
Sizable >US$110mn projects	Unit	Size	Low	High
Green hydrogen based Steel slabs production	mtpa	4	4,700	5,000
Steelmaking facility for specialty products	ktpa	7500	4,000	4,000
Automotive flat steel plant	ktpa	500	2,500	2,500
Integrated Steel plate production plant	mtpa	1.2	2,300	2,300
Engineered Metals Complex	ktpa	380	1,630	1,630
Polysilicon plant	ktpa	10	1,100	1,100
Copper cathode manufacturing plant	ktpa	300	1,000	1,000
Nickel plant	ktpa	10	950	950
Pelletization plant	mtpa	7	950	950
Hot rolled coil plant	mtpa	3	900	900
Gold refinery	tpa	30	800	800
Heavy profiles, marine profiles and rails	mtpa	1.6	800	800
Steel round billet production plant	ktpa	600	680	680
Thin gauge steel sheets	ktpa	375	660	660
Technical ammonium nitrate plant	ktpa	200	500	500
Titanium plant	ktpa	6	500	500
Aluminum engine block caster	ktpa	50	492	492
Nickel iron plant	ktpa	15	450	450
Automotive brake casting	ktpa	75	450	450
Rare earth elements	ktpa	10	400	400
Tinplate production plant	ktpa	400	400	400
Calcium Ammonium Nitrate manufacturing plant	ktpa	500	350	350
Tantalum and Niobium complex	ktpa	883	300	300
Ferrochrome manufacturing plant	ktpa	200	250	250
Stainless steel grade seamless pipes plant	ktpa	40	227	227
Alloyed seamless pipes manufacturing plant	mtpa	50	220	220
Specialty glass plant	ktpa	180	220	220
Graphite Electrode Production	ktpa	70	200	200
Graphite anode active material plant (EVs)	ktpa	10	200	200
Ferrosilicon smelter	ktpa	80	180	180
Manganese (EV metals materials)	ktpa	40	180	180
Aluminum rolling foil	ktpa	35	167	167
Aluminum Alloy Wheels casting plant	ktpa	40	152	152
Silicon smelter	ktpa	45	140	140
Manganese metal manufacturing plant	ktpa	30	120	120
Brass and copper plant	ktpa	45	120	120
Develop a cathode block plant	ktpa	250	110	135
Total investment cost US$mn			29,298	29,623

			Investment cost range (US$mn)	
Smaller <US$110mn projects	Unit	Size	Low	High
Magnesium metal plant	ktpa	30	108	108
Aluminum fluoride plant	ktpa	34	105	105
Integrated re-melt and extrusion plant	ktpa	65	100	100
Stainless steel casted/forged parts	ktpa	50	100	100
Copper foil manufacturing plant	ktpa	10	95	95
Titanium Fabrication Facility	ktpa	3	80	100
Aluminum plate plant	ktpa	50	80	80
Refractory materials	ktpa	70	80	80
Aluminum scrap recycling plant	ktpa	120	70	70
Fiberglass	ktpa	25	70	70
Copper smelting plant	ktpa	50	65	65
Exploit Granite resources	ktpa	450	60	60
Container glass plant	ktpa	60	60	60
Aluminum circles and slug	ktpa	20	60	60
Ductile Iron Pipe (DIP) production plant	ktpa	200	59	59
Metallurgical powder	ktpa	30	50	50
Processing glass plant	mtpa	42	50	50
Vanadium refinery	ktpa	10	50	60
Aluminum Primary Foundry Alloys plant	ktpa	100	47	47
Aluminum Conductor Manufacutirng Facility	ktpa	50	40	50
Frac sand and resin coated sand	ktpa	250	40	40
Brass foundry plant	ktpa	10	35	35
Develop copper section products	ktpa	10	35	35
Develop copper tube manufacturing plant	ktpa	10	35	35
Magnesium die casting	ktpa	10	31	31
Metal Injection Moulding Plant		TBD	30	50
Aluminum LiB foils production facility	ktpa	10	30	40
Copper rod plant	ktpa	115	30	30
Aluminum Extrusion plant	ktpa	10	25	25
Aluminum Composite Panel plant	ktpa	25	25	25
Aluminum Rod plant	ktpa	30	20	20
Reactive Silica plant	ktpa	50	20	20
Aluminium Master Alloys Facility	mtpa	7500	15	20
Aluminum casting plant	ktpa	25	15	15
Low Relaxation Pre-stressed Steel assembly line	ktpa	10	10	20
High carbon wire rods	ktpa	100	10	10
High purity Silica sand production	ktpa	144	6	6
Total investment cost US$mn			1,841	1,926

Source: Invest Saudi

Digitalization: At the core of Saudi's economic transformation

Digitalization stands at the heart of Saudi's economic transformation journey, with demand for smart solutions driven by both public and private sectors as entities strive to grow and scale efficiently. While telecommunications infrastructure is mature and services are well-developed with overall internet penetration at 97.8% (vs. the global average at 63%), digitalization remains relatively less mature when Saudi is benchmarked against more digitally advanced countries in Europe, East Asia and North America. The Saudi government has introduced plans and strategies to accelerate and incentivize digital implementation across sectors. Between capex spent by telecom players and investments announced, we estimate a cumulative c.US$143-150bn (c.SAR536-563bn) in total investments as likely by 2030 and see upside to this number as execution on smart cities accelerates.

Exhibit 65: We see scope for a total c.US$147bn in average investments in digital transformation initiatives

Mid-point of estimated investments shown above

Source: Goldman Sachs Global Investment Research

National Transformation Program 2020

The government established the National Transformation Program 2020 under Vision 2030, with an aim to provide a roadmap to develop the necessary infrastructure that enables the public, private and non-profit sectors to achieve the goals of Vision 2030. On the digital transformation side, Saudi aims to develop the digital economy (reaching 19.2% of GDP by 2025) and e-government (achieving a 92% maturity level for major e-services by 2025).

According to the UN's EGDI (E-Government Development Index) study published in September 2022, Saudi Arabia is one of the most advanced countries in terms of e-Government development and the second most advanced in the region after the UAE, with its score improving by 7% in 2022 with respect to 2020. In terms of regional rankings, Saudi ranked ahead of other GCC markets including Oman, Bahrain, Kuwait and Qatar.

Saudi's market has room for growth

Saudi Arabia enjoys a relatively mature IT/Tech regulatory ecosystem; however, emerging technologies raise data privacy/security issues, on which regulatory focus remains. Additionally, the existing cloud infrastructure in Saudi is largely under-utilized, leaving scope for improved offerings to customers across sectors. In terms of market readiness, the country screens attractively vs. regional peers on ICT access/use indices, ease of doing business, business model creation and the global entrepreneurship index, among other metrics (as per Saudi Invest).

Additionally, Saudi has increased its focus on developing the ICT sector over the past decade, making it one of the pillars of its Vision 2030. Through a series of strategies, initiatives and investments, the government aims to grow the sector's contribution to GDP boosting the non-oil economy, accelerate digital transformation across different industries and enhance the entrepreneurial tech environment in the country. Enabling ICT growth in the country is expected to create more than 25 thousand jobs in the sector, increase the size of the IT and emerging technologies market by 50%, and raise the industry's contribution to GDP by SAR50bn by end 2023, as per ICT Sector Strategy 2023 set by the Ministry of Communication and Information Technology (MCIT).

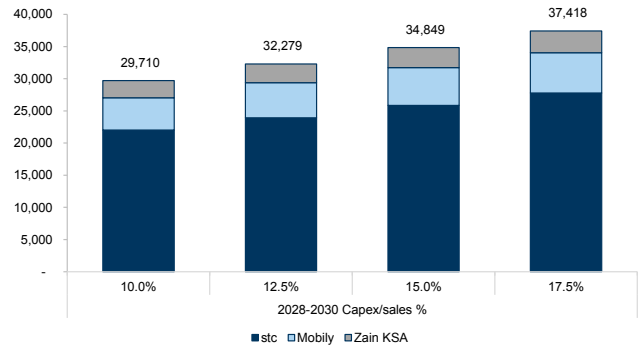
Furthermore, the government's plan as stated in its vision is likely to act as a catalyst for the development of new mega-projects (smart cities like NEOM, King Abdullah Financial District and others) as well as provide support for SME growth. The latter's contribution to GDP is expected to increase to 35% by 2030 (source: Vision 2030), supported by initiatives through *Monshaat*, the Saudi General Authority for SMEs. Moreover, the government is pushing for the adoption of cutting-edge technologies in Artificial Intelligence (AI), robotics, virtual/augmented reality, cloud, IoT and E-commerce.

Exhibit 66: Key market trends across the ICT sector

Source: MIS, stc Solutions, Goldman Sachs Global Investment Research

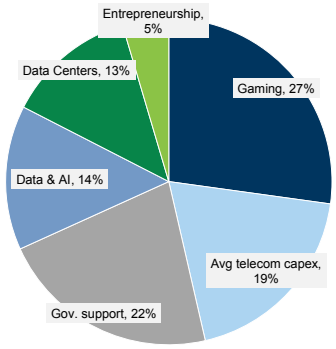
On the **telecommunications** front, we see spending focused on continued 5G rollout, FTTH expansion and investments in new growth verticals within the IT space. Indeed, both stc and Mobily raised their capex guidance over the next 2-3 years to >14% of revenues, showcasing the growing need for investment in both telecom and digital infrastructure. As such, we see potential for all three telecom operators in Saudi to spend a cumulative **c.US$30-37bn (c.SAR111-140bn)** in capex over 2023-2030E, focused on network enhancements and capacity growth, 5G, FTTH rollout, and other non-traditional investments including enterprise solutions, data centers/cloud, wholesale/submarine cables, cybersecurity and emerging tech (AI) (see Exhibit 67).

Exhibit 67: We expect total capex spending by telecom operators to remain relatively elevated through 2030...
Total capex over 2023-2030E (US$mn) based on scenarios from 2028-30E reflecting different capex/sales assumptions that are broadly in line with historical levels



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 68: ...contributing 19% of total average spending expected within the ICT/tech space by 2030
% of total average investments



Telecom spending - GSe; other investments are targets

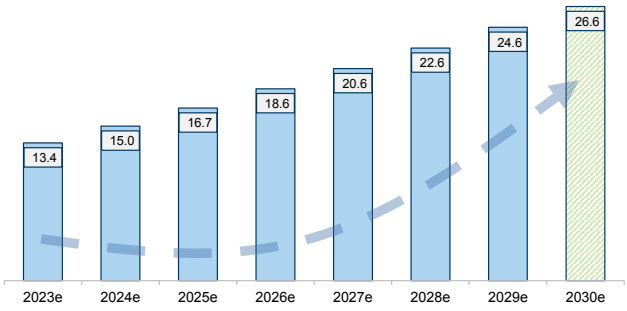
Source: Goldman Sachs Global Investment Research, Invest Saudi, State News Agency

Beyond telecoms, total spending by the public and private sector on IT, professional services and digital solutions in Saudi is expected to grow by a 12.7% CAGR through 2027 (based on IDC forecasts), contributing 2.0% to GDP, on our estimates (vs. 0.9% as of 2022). Taking the IT spending growth rate into account, we expect the gap in spending between Saudi and more digitally mature markets as a % of GDP to narrow through the end of the decade. We note that stc Solutions, Elm, MIS and other local and international IT/digital services providers have key exposure to growing demand from public and private sectors. Additionally, we see more demand upside driven by the ongoing execution of smart mega-projects and cities, resulting in a higher number of project awards.

In terms of investments, the Saudi government announced a couple of strategies totaling US$38bn (SAR142.5bn), focused on (1) data & AI as part of its **National Data & AI Strategy (US$20bn, SAR75bn**), and (2) its **data center strategy (US$18bn, SAR68bn)** which was launched in early 2022 with an aim to build a network of large-scale data centers across the country, with a capacity exceeding 1.3GW by 2030. On this, the Saudi MCIT highlighted that it is working closely with the private sector, including local and international investors, to achieve this goal; indeed, Microsoft, SAP, Oracle and other international players have signed agreements to invest and establish public cloud regions in the country.

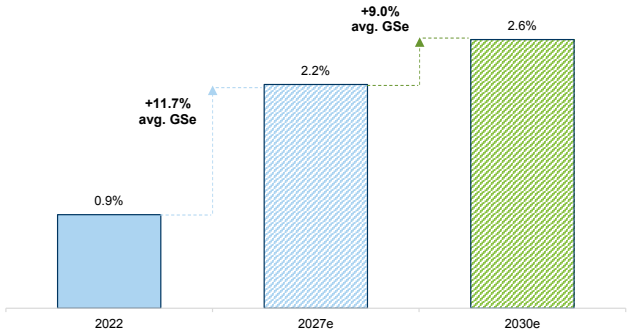
We highlight that AI has gained additional focus in the past few years, with the country establishing the Saudi Data & AI Authority (SDAIA) to drive the national agenda for Data & AI, with the key focus until 2030 set on addressing the country's needs to enable AI development, as well as build the foundations needed to gain competitive advantages in key niche domains. Under the National Data & AI Strategy launched by SDAIA, Saudi aims to rank among the top 15 countries in AI technologies and among top 20 countries in scientific contribution, empower 20k+ data and AI experts, and stimulate the ecosystem by enabling the creation of 300+ startups in the field.

Exhibit 69: We expect spending on IT services in Saudi to grow to >US$26bn p.a. by 2030...
Spending on IT services in Saudi (US$bn)



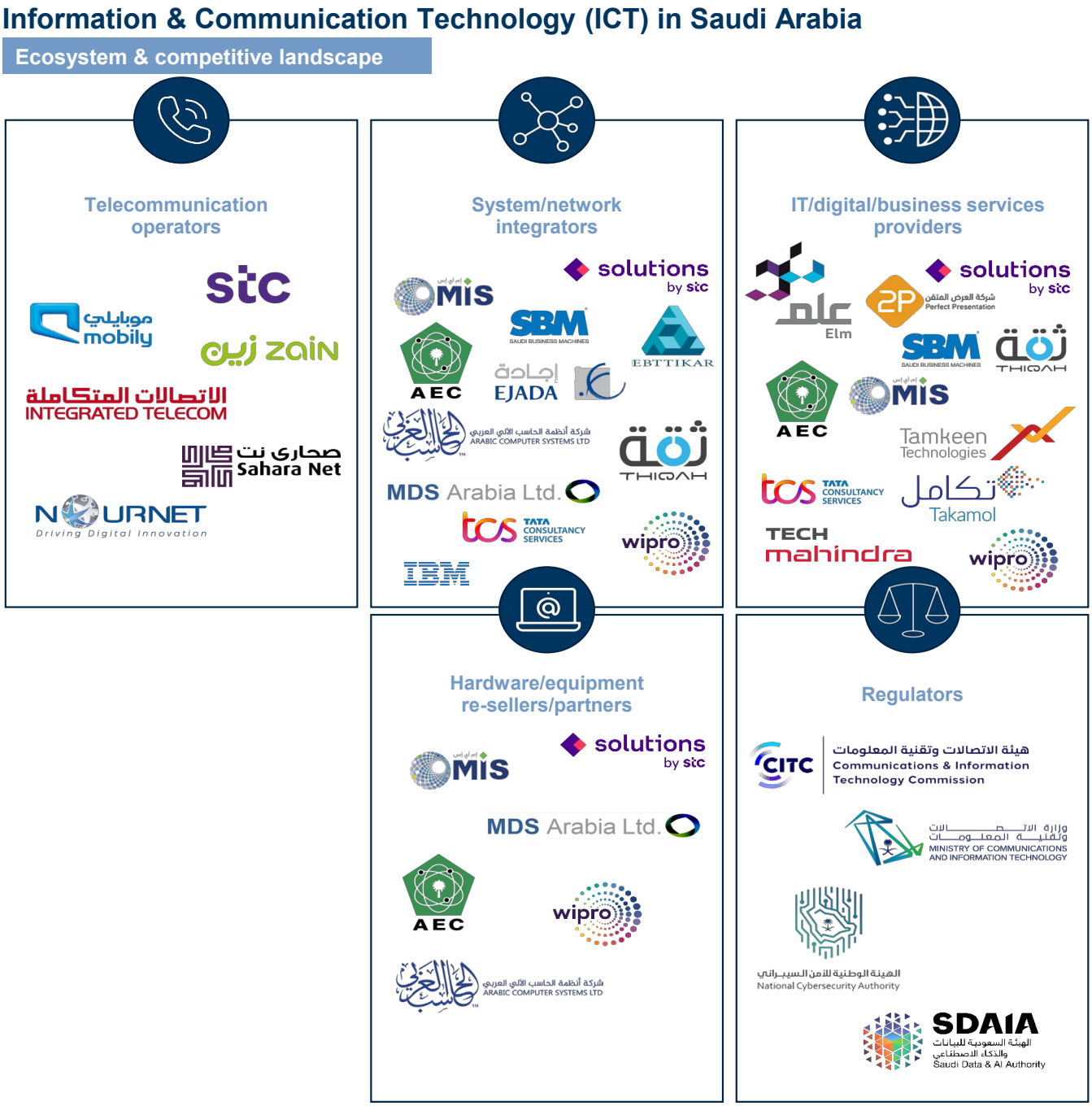
Source: stc Solutions, IMF, Goldman Sachs Global Investment Research

Exhibit 70: ...contributing 2.6% to GDP, on our estimates, vs. 0.9% in 2022
IT spending in Saudi as a % of GDP



Source: stc Solutions, Goldman Sachs Global Investment Research

Exhibit 71: An overview of Saudi Arabia's ICT ecosystem



We note that the list of companies we present in this exhibit is not exhaustive

Source: stc Solutions, Elm Co., MIS, compiled by Goldman Sachs Global Investment Research

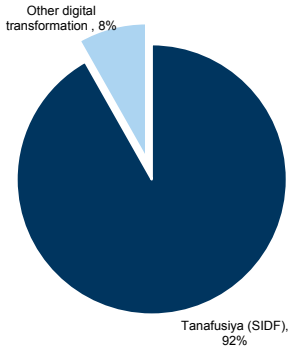
Additionally, the government has announced **US$2.5bn (SAR9.4bn)** in support to build the digital infrastructure in Saudi, with further support from the SIDF which dedicated a **US$28bn (SAR105bn)** fund and delivers programs such as Tanafusiya - the latter provides consulting and financing services to companies to pave the way for digital transformation. Under Industry 4.0 developments, Saudi also aims to (1) increase the readiness of technical infrastructure in industrial cities from 50% to 100% by 2025, (2) raise the number of facilities benefiting from the fourth industrial revolution to 43 by

2025 (vs. 10 in 2021), (3) set up five centers to develop industry 4.0 use cases and applications, and (4) develop a financing program of US$800mn to digitally transform 100 factories.

Electronic entertainment/gaming also remains a key focus area within the digital transformation journey of Saudi; Savvy Games Group (SGG), a company wholly owned by the PIF, aims to invest **US$38bn (SAR143bn)** in the gaming industry by 2030, of which US$19bn will be dedicated to the acquisition of minority stakes in relevant companies, US$13.3bn will be used to acquire a leading game publisher, US$5.3bn will be targeted towards investments in mature industry partners, and lastly US$0.5bn will be used to enable growth for early-stage games and e-sports ventures.

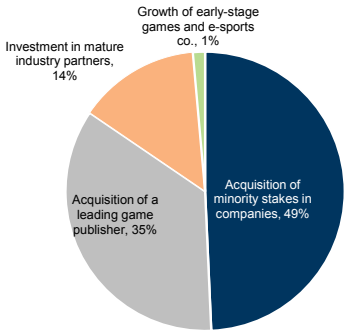
Lastly, Saudi announced **>US$6.4bn (SAR24bn)** in future technologies and entrepreneurship investments as it aims to secure its position as the region's largest digital market. Investments include (1) the launch of Aramco Venture's Prosperity7's US$1bn fund, and (2) NEOM Tech & Digital Company's US$1bn fund.

Exhibit 72: The government has established c.US$30.5bn in funds to enable digital transformation across sectors in a push towards the adaptation of Industry 4.0
US$bn, % of total



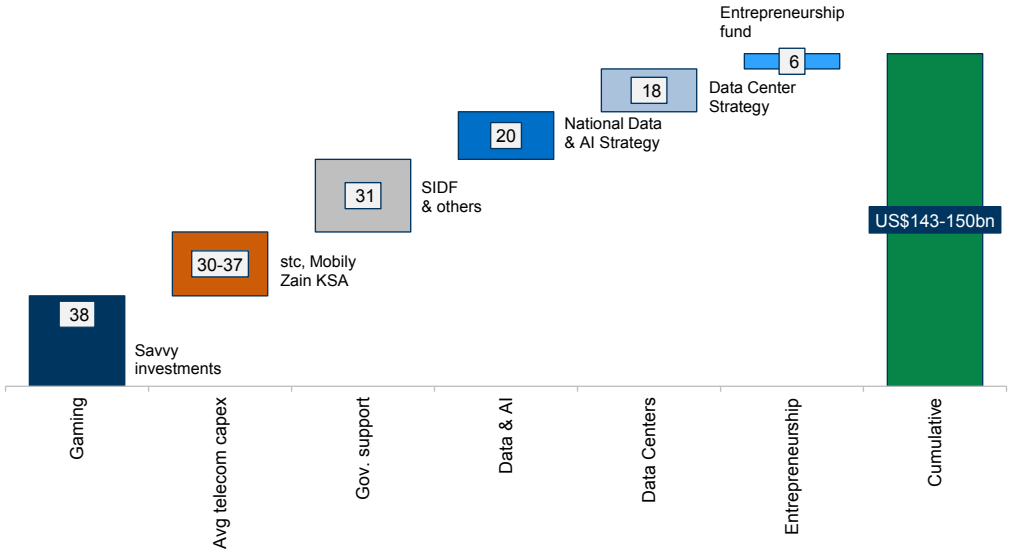
Source: Invest Saudi

Exhibit 73: Within the gaming sector, Savvy Games Group plans to invest US$38bn by 2030
% of total



Source: State News Agency (SPA)

Exhibit 74: In total, we see potential for US$143-150bn in investment within the ICT space by 2030
US$mn



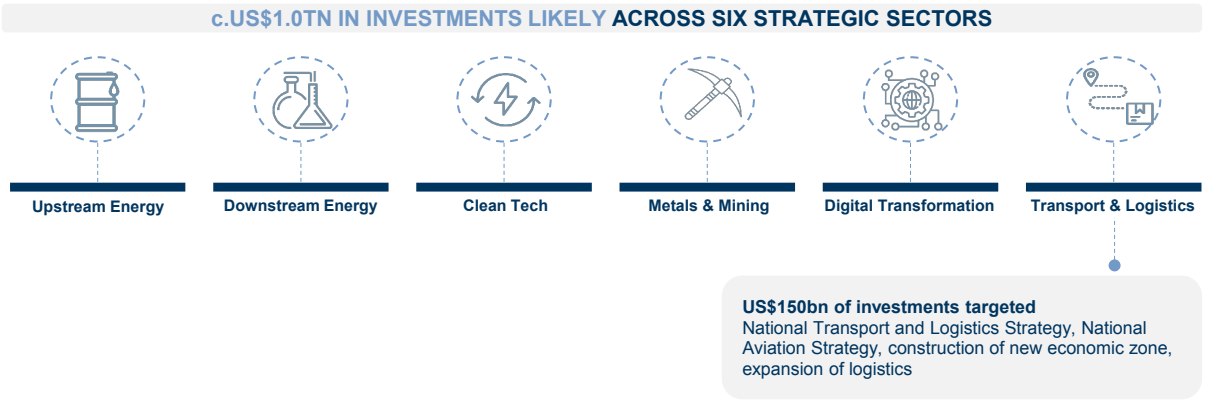
Source: Invest Saudi, State News Agency, Goldman Sachs Global Investment Research

In terms of key participants, local ICT/telecom players are in a position to accelerate the country's digital transformation through both in-house initiatives and partnerships with global companies such as Wipro, IBM, Tata, Oracle, Microsoft, Accenture, and Cisco. We believe telecom players play a key role in modernizing the infrastructure and implementing the latest network technologies (e.g. 5G), aiding the role of IT solutions (including cloud, IoT, cybsersecurity etc.) providers in digitalizing the public and private sectors. We see players like stc Solutions well-positioned given its relationship with the government, paving the way for further partnerships with global hyperscalers. Below, we list publicly listed Saudi and global ICT players that have a noticeable presence in the country, albeit we note that this is not an exhaustive list.

Transportation & Logistics: Aiming to become a leading travel and logistics hub

Beyond digital connectivity, Saudi also aims to become a leading logistics hub and an international travel destination. The country launched an updated transport and logistics strategy in 2021, with targets around expanding airports' capacities, boosting the sector's contribution to GDP to 10%, launching a new national air carrier and improving the capabilities of the air cargo sector, among others. In terms of investments, Saudi targets US$150bn (SAR563bn) through the end of the decade, of which US$100bn (SAR375bn) is focused on the aviation sector.

Exhibit 75: Saudi is targeting US$150bn in investments in the transportation & logistics sector



Source: Goldman Sachs Global Investment Research

The National Transport Strategy (NTS)

In 2017, Saudi launched the National Transport Strategy (NTS) 2030 under which the Ministry of Transport and its affiliates (including the Department of Roads, the General Authority of Civil Aviation or GACA and the Public Transport Authority, among other government entities) aimed to (1) enhance the transport sector's performance and ensure its position as a key enabler of Vision 2030, (2) increase integration across different modes of transportation, (3) implement new logistics hubs, and (4) enhance fiscal sustainability and livability across the country. The strategy initially suggested an investment of c.US$31bn (c.SAR115bn) by 2030, in addition to US$12bn (SAR44.5bn) allocated by GACA for the expansion of Jeddah, Riyadh, Abha and Jizan airports.

The National Transport and Logistics Strategy (NTLS)

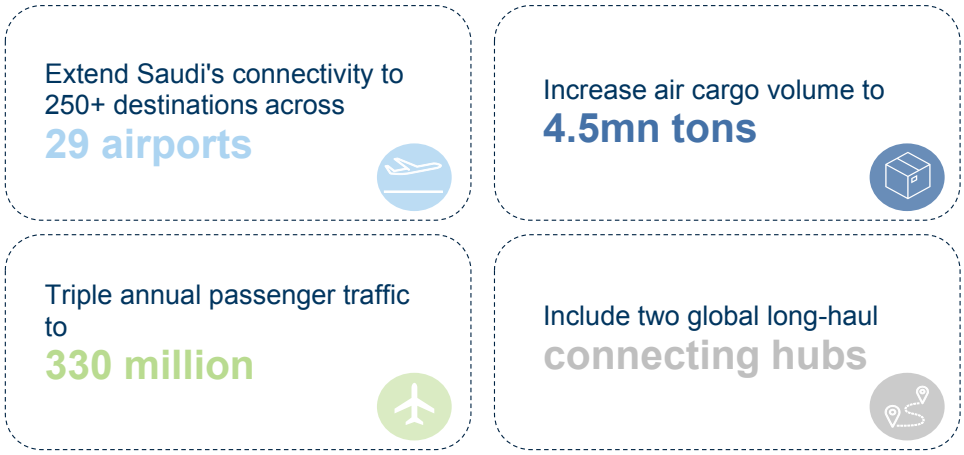
In June 2021, the country revised the initial strategy and announced the National Transport and Logistics Strategy (NTLS), a comprehensive program that aims to position Saudi as a global logistical hub and improve all transport services in support of Vision 2030. Some key targets covered by the strategy include (1) increasing the number of international destinations served to more than 250, (2) launching a new national air carrier, (3) transforming the country into a logistics hub, raising its global ranking in the Logistics Performance Index from 49 to 10, (4) boosting the sector's GDP contribution to 10%, (5) improving the capabilities of the air cargo sector by doubling its capacity to

>4.5mn tons, (6) boosting railway capacity to 25mn passengers and 36mn tonnes of freight by 2025 and (7) increasing capacity to accommodate 30mn Umrah visitors per year (vs. c.7mn in 2022, according to the Ministry of Hajj and Umrah). In total, the NTLS targets **US$150bn** in investments by 2030.

The Saudi Aviation Strategy 2030 (AVS)

As part of the NTLS, the Saudi Aviation Strategy 2030 was launched in 2022, backed by **US$100bn** in investments from both the government and private sectors, with an aim to triple the aviation sector's contribution to the economy to US$74.6bn by 2030. Key targets include (1) extending connectivity to 250+ destinations across 29 airports; (2) tripling annual passenger traffic to 330mn (vs. c.100mn carried in 2019 pre-COVID pandemic); (3) increasing air cargo volume to 4.5mn tons (from 0.8mn tons currently, where Saudi captures 33% and 7% of the Middle East's total demand for air cargo goods and air cargo transit markets, respectively); and (4) adding two global long haul connecting hubs. The strategy also aims to develop the country's airfreight system, improving flexibility in the logistics sector to allow for increased capacity, targeting a 17% CAGR in air freight handling by 2030.

Exhibit 76: Main targets as stated under the Saudi Aviation Strategy



Source: Saudi Aviation Strategy

Additionally, the strategy redefined GACA's role as a pure regulator, transferring 25 of the country's airports to GACA-owned Matarat Holding Company, a private operator. Through GACA's regulatory measures, Saudi aims to enhance aviation competitiveness and the operating environment, as well as transforming airlines and their support services by reducing their cost base through a pricing reform program. The new operating environment is expected to attract more FDI into the sector, eventually boosting the country's air transport efficiency ranking to among the top 5 globally by 2030, according to the strategy.

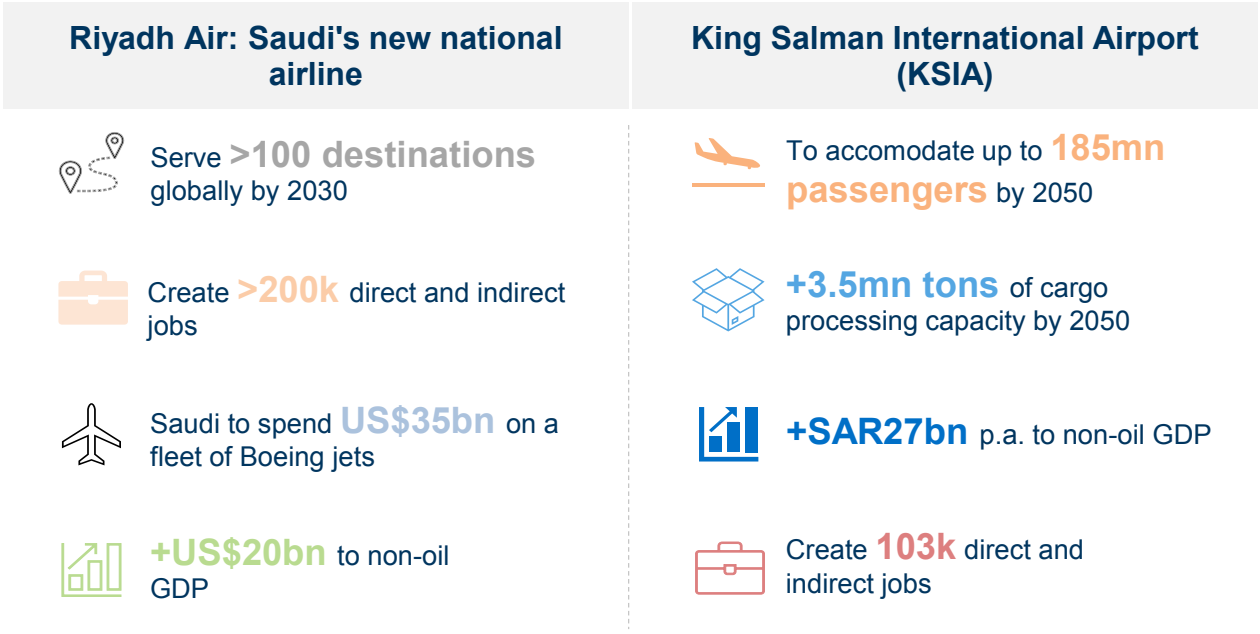
Riyadh Air: Saudi Arabia's new national airline

Saudi announced on March 12, 2023 the creation of Riyadh Air, a PIF-owned new national airline, as the country moves to compete with regional transport and travel hubs. The airline is expected to serve more than 100 destinations globally by 2030, add US$20bn to the country's non-oil GDP and create >200k jobs both directly and indirectly. Additionally, Saudi is set to spend c.US$35bn on a fleet of 72 Boeing jets as it prepares to commercially launch Riyadh Air (source: PIF).

King Salman International Airport (KSIA)

In addition to the national aviation strategy, the PIF announced in November 2022 the master plan for King Salman International Airport, which is expected to position Riyadh as a global logistics hub and stimulate transport, trade and tourism. The airport project is in line with the country's vision to transform Riyadh to be among the top ten city economies in the world and support the city's population growth to 15-20mn people by 2030. Additionally, the airport is forecast to accommodate up to 185mn passengers, and process 3.5mn tons of cargo by 2050, covering an area of c.57km2 allowing for 6 parallel runways, and 12km2 of airport support facilities, residential areas, retail outlets and other logistics real estate. KSIA is expected to contribute SAR27bn p.a. to non-oil GDP, and create 103k direct and indirect jobs, aligning with Vision 2030, although no details around investment cost/funding have been announced yet (source: PIF).

Exhibit 77: Summary of Saudi's new national airline and KSIA targets



Source: PIF, compiled by Goldman Sachs Global Investment Research

Logistics

In 4Q2022, the Saudi government announced moving ahead with the construction of 19 logistics services zones across Riyadh, Jeddah, KAEC (King Abdullah Economic City) and other areas out of the 59 targeted as per the Ministry of Transport and Logistics Services. The total investment value of the 19 zones is estimated at **US$7.7bn (c.SAR30bn), as per Saudi's Transport and Logistics Services**, to be undertaken in partnership with the private sector.

Additionally, the government launched the Global Supply Chain Resilience Initiative (GSCRI), which is aimed at attracting **c.US$10.6bn (c.SAR40bn)** for supply chain enhancements. The GSCRI is part of the NIS, and is aiming to grow Saudi's market share in sectors where it has competitive and strategic advantages, and strengthen its regional and global supply chain activities, alongside supporting domestic development. To achieve this purpose, the initiative allocated US$2.7bn (SAR10bn) in financial and non-financial incentives for global investors.

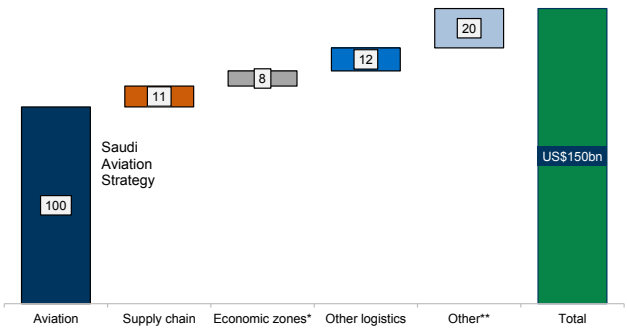
In total, Saudi has identified a **US$30bn** investment opportunity in its logistics sector by 2030.

Other investments

Aside from aviation and logistics, Saudi also announced its plans to increase the railway network to 8,080km from 5,330km, as well as raise its port occupancy rate by 70% by 2030. Saudi reported in February 2023 that its share of transshipment operations in the region tripled over the past three years, reaching 32% by the end of 2022 (vs. 12% in 2020), and it is targeting a 50% regional share by 2030. Additionally, the country intends to have the largest share of transit maritime trade in the Red Sea, attracting global transshipment operations to Saudi ports.

Additionally, we see fuel distribution companies providing the infrastructure needed to (1) support the development of the overall transportation sector in the country and (2) enable the planned urban developments in major cities like Riyadh or across the announced mega projects.

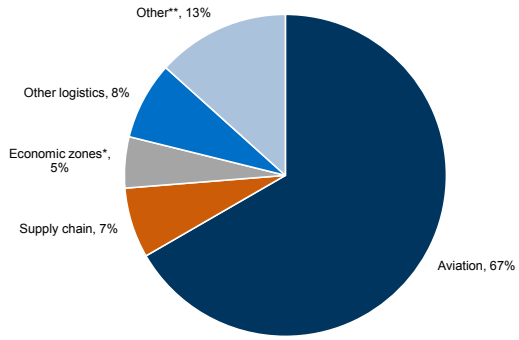
Exhibit 78: Saudi is targeting US$150bn in investments across the transportation and logistics space...
US$bn



*19 economic zones under development, 59 targeted in total; **Other includes railways, sea port and other supply chain related investments

Source: Saudi Aviation Strategy, Reuters, Zawya, National Transportation and Logistics Strategy, compiled by Goldman Sachs Global Investment Research

Exhibit 79: ...of which we calculate 67% is in the aviation sector
% of total investment by sub-sector



*19 economic zones under development, 59 targeted in total; **other includes railways, sea port and other supply chain related investments

Source: Saudi Aviation Strategy, Reuters, Zawya, National Transportation and Logistics Strategy, compiled by Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Faisal AlAzmeh, CFA, Dalal Darwich, Waleed Jimma, Michele Della Vigna, CFA, Waleed Mohsin, Neil Mehta, Daniela Costa, Harsh Mehta, Ati Modak, Christian Hinderaker, CFA and Marcio Farid, 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.

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