

The following is a redacted version of the original report. See inside for details.



Paths to Power

Big Oils and Utilities' diverging strategies for energy convergence

The energy transition may require up to **US\$30 tn investments by 2040 in clean energy infrastructure** to limit global warming. In this report, we look at the **central and different roles of Big Oils and Utilities in enabling this transition**. Big Oils will likely focus on power retail, trading and unregulated generation, alongside biofuels, gas, petrochemicals and carbon capture; Utilities will likely focus on high-growth regulated power generation and power networks, enhancing returns through financial leverage. Big Oils' experience in global gas chains, with their emergence as global LNG market makers, prepares them for their role in the energy transition. **European Oils already spend c.50% of their capex on low carbon activities**, and can enable power supply management in increasingly complex and de-regulated power markets. **Utilities have the opportunity to participate in one of history's largest infrastructure investments**, with material upside to current valuation.

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Note: The following is a redacted version of "Paths to Power: Big Oils and Utilities' diverging strategies for energy convergence" originally published July 10, 2019 [47pgs]. All company references in this note are for illustrative purposes only and should not be interpreted as investment recommendations.

PATHS TO POWER IN NUMBERS



US\$30tn

Investments that may be required by 2040 in clean energy infrastructure to limit global warming.

Utilities



80%

of e-winners' EBITDA from infrastructure activities (vs 40% in 2008).



80%-95%

Greenhouse gas emissions reduction under the EU's long-term strategy.



90%

of power generation would need to come from renewables and flexible storage to meet long-term EU targets.



35%-85%

The increase in power demand from electrification to 2050.



4.5%

Sustainable EBITDA CAGR for the electrification winners.

2X



The number of climate-related shareholder proposals has almost doubled since 2012 and the % of investors voting in favour has increased from 10% to 30%. Climate change investor pressure is biased towards energy producers vs. energy consumers.



53% of proposals target the energy producers, (oil & gas, utilities, coal).



13% target financials (reducing funding for new hydrocarbon developments).



34% target the sectors that account for most of the final energy consumption.

Big Oils



c.50%

The amount of capex European Big Oils are already spending on the low carbon transition (including gas).



50%

How much higher IRRs are for new oil & gas mega-projects (now 15% to 30%) than the returns on projects sanctioned in 2004-14, due to tightening financial conditions on new hydrocarbon projects.

c.10 years



The average length of LNG offtake contracts. That's halved since 2000 as utilities can no longer pass through the volume and basis risk to the final customer. European Big Oils have filled this gap, emerging as market makers, more than doubling their aggregate market share in LNG since 2013.

c.45%



The percentage of all current global energy-related CO2 emissions today attributed to coal from a carbon source perspective. Global coal consumption has returned to growth in 2017 after three years of moderate decline.



Source: Goldman Sachs Global Investment Research

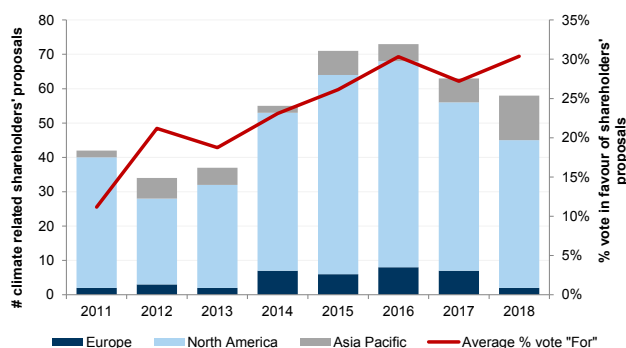
PM Summary: How Big Oils and Big Utilities can profitably enable a US\$16-30 tn clean energy infrastructure investment

The path to De-carbonization:

The energy transition may require up to **US\$30 tn investments by 2040 in clean energy infrastructure** in order to limit global warming. Renewable power and fuels, a structural upgrade of power networks, carbon capture initiatives and electric mobility are set to reshape the energy industry. This ambitious investment programme will require efficient and inexpensive financing, good regulatory frameworks, technological innovation and risk management capabilities with strong balance sheets. In this report, we look at the **central and different roles of European Big Oils and Utilities in enabling this transition**, with the support of financial markets and technological innovators.

Exhibit 1: Shareholders are pushing energy companies to embrace the energy transition...

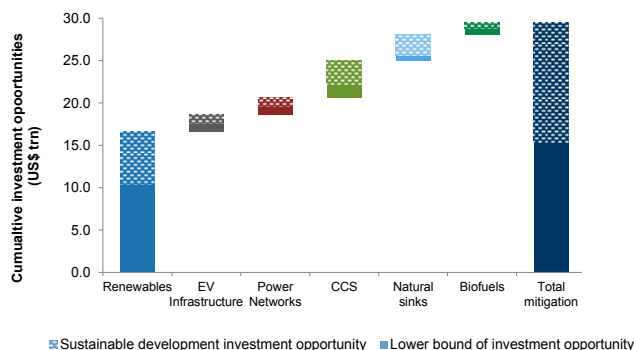
Number of climate-related shareholders' proposals vs % vote in favour



Source: ProxyInsight, Data compiled by Goldman Sachs Global Investment Research

Exhibit 2: ...requiring up to US\$30 trillion in infrastructure investments by 2040

Cumulative investment in clean energy transition to 2040 (US\$ trillion)



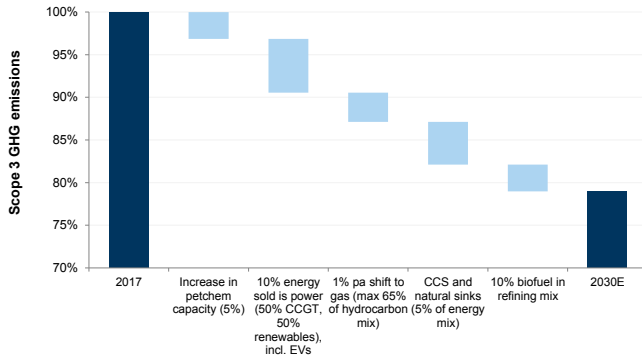
Source: Goldman Sachs Global Investment Research

The path to Big Energy:

We believe that **Big Oils can successfully transform into Big Energy**, leveraging their strong balance sheets and risk-taking capabilities, to play a leading role on the higher risk spectrum of power supply, biofuels, electric mobility, carbon capture and coal substitution. **European Oils are already spending c.50% of their capex in low carbon activities** and can enable power supply management in increasingly complex and de-regulated power markets. **Big Oils' experience in global gas chains, with their emergence as global LNG market makers** over the past decade in a 'de-regulating' market, **prepares them for their role in the energy transition**, while tightening financial conditions and rising barriers to entry in their core oil & gas business provides visibility on improving corporate returns.

Exhibit 3: Big Oils have five key tools that will enable them to de-carbonize in line with society's ambitions...

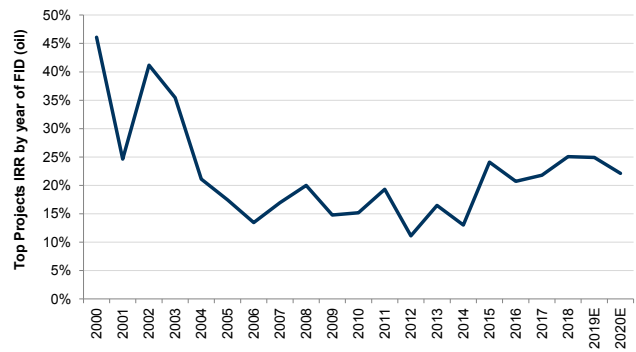
Big Oils scope 3 GHG emissions 2017-30 bridge



Source: Goldman Sachs Global Investment Research

Exhibit 4: ...while their underlying oil & gas business becomes more profitable on the back of reduced competition and higher barriers to entry

Top Projects IRR by year of FID split by winzone



Source: Goldman Sachs Global Investment Research

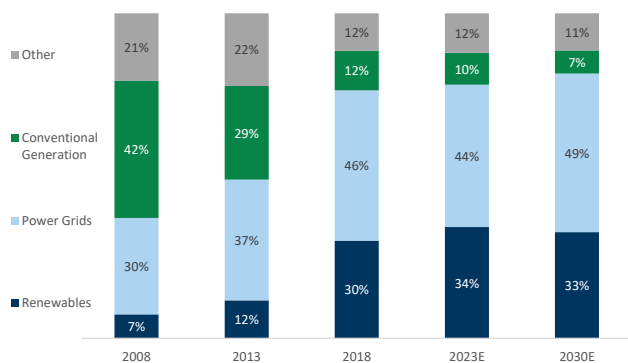
The path to Infrastructure growth:

Utilities have the opportunity to participate in one of history's largest infrastructure investments, with attractive regulated returns and efficient balance sheets. **We believe that the growth in clean power will provide ample opportunities to both set of companies, with a clear business separation across the risk spectrum:** Big Oils will likely focus on power retail, trading and unregulated generation; Utilities will likely focus mostly on regulated power generation and power networks, enhancing returns through financial leverage. We see rising risk of competition for diversified utilities with material gas and power retail and trading arms, as Big Oils enter these businesses with stronger balance sheets. A major digitalisation push by the supply incumbents will be required, under the pressure of compressing margins, while the pure merchant generators will face secular headwinds.

Big Oils will likely focus on power retail, trading and unregulated generation; Utilities will likely focus mostly on regulated power generation and power networks, enhancing returns through financial leverage. We see rising risk of competition for diversified utilities with material gas and power retail and trading arms, as Big Oils enter these businesses with stronger balance sheets. A major digitalisation push by the supply incumbents will be required, under the pressure of compressing margins, while the pure merchant generators will face secular headwinds.

Exhibit 5: Europe's 'utilities e-winners' have undergone a radical shift towards 'infrastructure assets'...

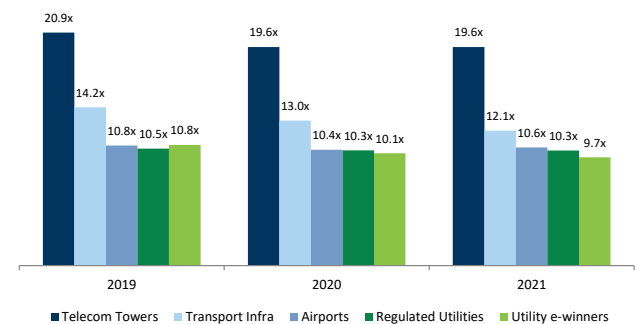
EBITDA split by activity



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 6: ...and yet are not valued in line with other infrastructure assets in the equity market

EV/EBITDA(R) multiples (by European sub-sector)



Source: Goldman Sachs Global Investment Research, FactSet

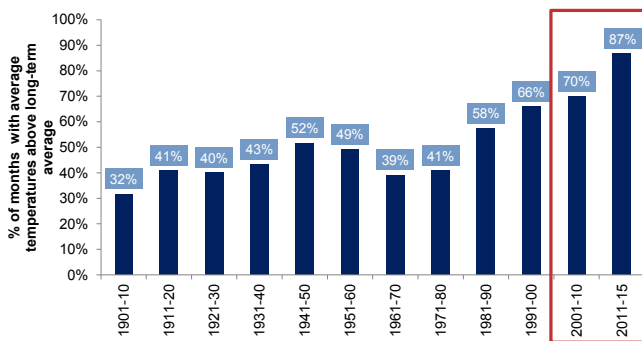
Climate change is shaping the future of the energy sector...

Climate change is re-shaping the energy industry landscape, through financing, regulation, technological innovation and investor activism. While we do not wish to take a stance in the scientific debate associated with the global warming projection scenarios, there appears to be a growing consensus among policy-makers and the scientific community that global mean temperatures are rising, at a pace that has accelerated over the past few years, with emissions of greenhouse gases (GHGs) forming one of the primary contributors to the observed patterns.

Against a backdrop of persistently rising emissions, 195 countries committed in the 2015 Paris Agreement to the ‘ambition’ to limit global warming to well below 2°C above pre-industrial levels. Yet even with increased efforts, the trajectory of emissions does not appear on pace to maintain global warming within the desired range, as shown in Exhibit 7. Energy companies are at the core of the climate debate, as **over two-thirds of global anthropogenic GHG emissions are attributed to the energy sector and over 40% of those are attributed to the power generation industry**. This puts both Big Oil companies and Utilities at the forefront of the climate debate and their critical role in enabling a sustainable transition forms the focus of this report.

Exhibit 7: The frequency of above-average temperatures has risen over the past decade...

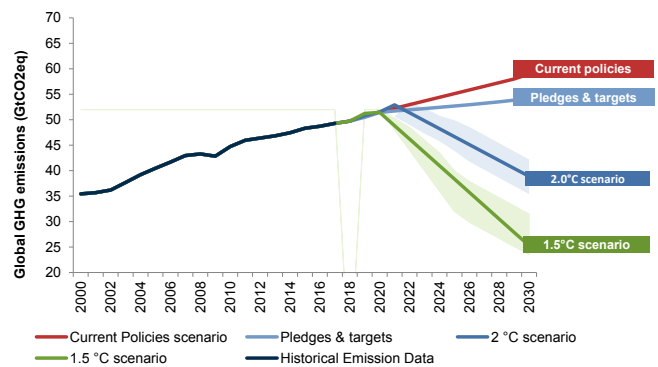
% of months with mean temperatures above the long-term average



Source: World Bank Group, Goldman Sachs Global Investment Research

Exhibit 8: ...leading to a wide range of potential longer-term scenarios depending on the trajectory of greenhouse emission reduction commitments

Historical and projected GHG emissions (GtCO2eq) to 2030



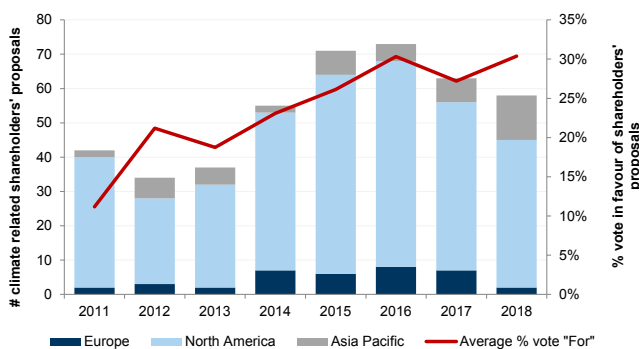
Source: Climate Action Tracker 2018. Climate Action Tracker Emissions Gap (Dec 2018 update). Copyright © 2018 by Climate Analytics, EDGARv4.3.2 of September 2018, Goldman Sachs Global Investment Research

...and investors are taking an increasingly active role in pushing Big Oils and Big Utilities to drive the low carbon transition

Investor activism and shareholder proposals associated with climate change have increased substantially over recent years

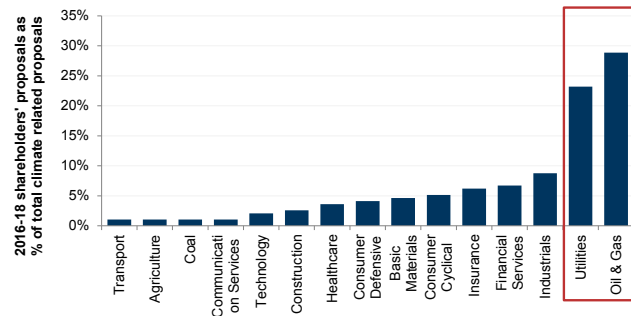
With the current emission trends unlikely to be on track to meet the Paris ambitions, investors are emerging with a leading role in driving the climate change debate. Over the past eight years, investors have taken an increasingly active role in pushing corporate management towards incorporating climate change into their business plans and strategy. The number of climate-related shareholder proposals has almost doubled since 2012 and the % of investors voting in favour has materially increased over the same time period. This investor pressure, however, is not evenly distributed across sectors and has a clear bias towards energy producers vs. energy consumers. 53% of proposals target the energy producers (oil & gas, utilities, coal), 13% target financials and only 34% of the proposals target the sectors that account for most of the final energy consumption. In particular, transport, agriculture and construction account for only 5% of total climate change shareholder proposals, despite being at the very core of the climate change adaptation challenge, while the focus on utility and oil & gas companies has been the highest and substantially increased over the past few years.

Exhibit 9: The number of climate-related shareholder proposals has increased over the past decade, with a doubling in support...
of climate-related shareholder proposals vs % vote in favour



Source: ProxyInsight, Data compiled by Goldman Sachs Global Investment Research

Exhibit 10: ...with a very targeted focus on the energy sector
Split by industry of climate-related shareholder proposals, 2015-18 average



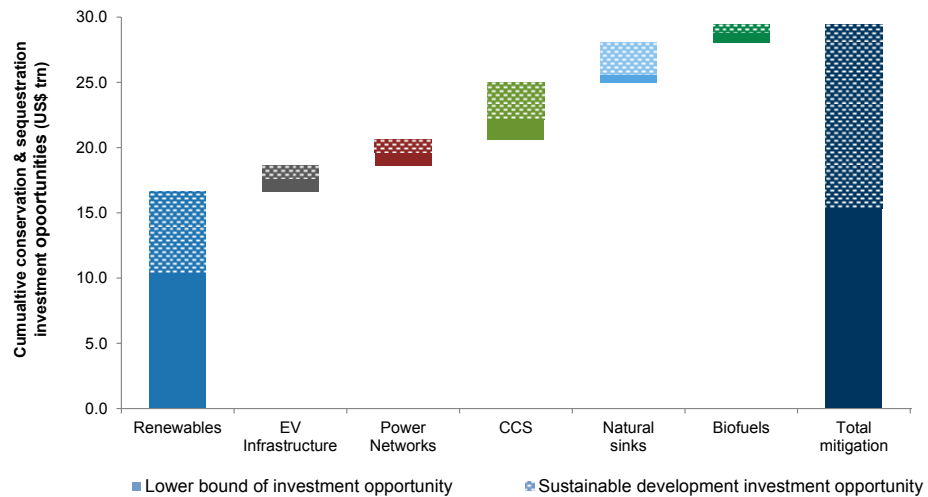
Source: ProxyInsight, Goldman Sachs Global Investment Research

Investing in the time of climate change: A US\$16-30 trillion investment opportunity in clean energy infrastructure

While climate change is a global issue that is likely to impact a very wide range of industries, in this report we focus on the energy sector, the one that has attracted the most interest from the investor community, as outlined in the previous section, and acknowledged to be the primary contributor to the current level of anthropogenic carbon dioxide emissions. Exhibit 11 shows a wide range of investments associated with what we believe are the key investments required to de-carbonize the energy value chain. Those include, among others, the increasing uptake of renewables and biofuels, increasing focus on infrastructure investments that will enable a new era of electrification, and greater focus on natural sinks and carbon sequestration (carbon dioxide capture and storage, CCS). In aggregate, we see a total investment opportunity of up to US\$30 tn by 2040 in a scenario that would be consistent with global warming within 2°C. This is estimated on the basis of the accelerated capacity uptake of renewables that would be required to set an energy mix consistent with a global warming path of 2°C, the electric vehicle and power networks infrastructure required to facilitate an increasingly electrified transport system, and carbon sequestration likely to be required (including increased uptake of carbon capture and storage, natural sinks and biofuels).

Exhibit 11: We estimate there exists a c.US\$16-30 tn investment opportunity for de-carbonization of the energy industry by 2040

Cumulative investment in clean energy transition to 2040 (US\$ trillion)



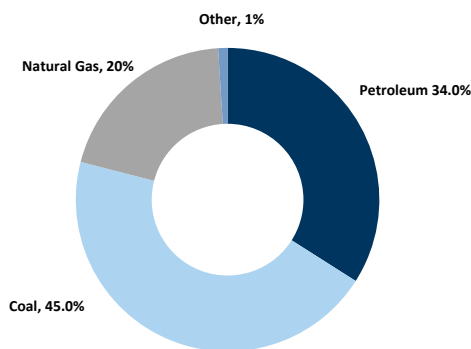
Source: IEA, Goldman Sachs Global Investment Research

A power shift is core to the emission reduction efforts, with a switch away from coal the priority...

The initiatives to reduce carbon emissions can be analysed through the lenses of the carbon source (coal, oil and natural gas), or by the final demand (transportation, residential, industry). From a carbon source perspective, c.45% of all current global energy-related CO2 emissions today are attributed to the most carbon intensive fuel, coal. Global coal consumption has returned to growth in 2017 after three years of moderate decline, despite evidence to suggest that **the transition from coal to natural gas can explain roughly c.80% of the reduction in CO2 emissions** from energy production around different countries in the world since 2000. In the near term, the fuel shift away from coal towards gas is in our view one of the most effective ways to de-carbonize the power generation industry, further supported by low-cost renewable solutions. Depending on the carbon price environment and other incentives available, in addition to the pace of technological innovation and development of current and alternative pathways, more effective solutions are expected to emerge that will enable cost-effective decarbonization of sectors beyond power generation, such as transport (where currently increased uptake of biofuels and LNG bunkers in marine appear to be the most cost-competitive solutions).

Exhibit 12: c.45% of global energy-related CO2 emissions today are attributed to coal...

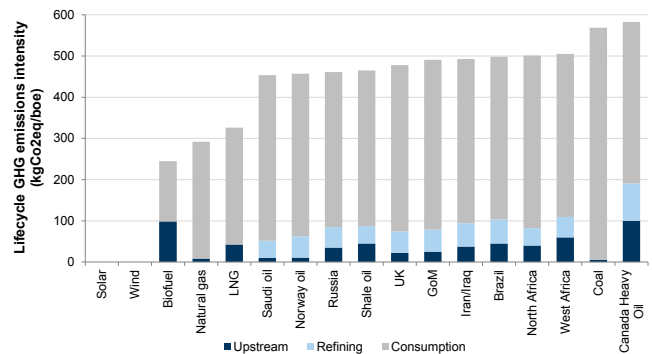
Global CO2 energy emissions by fuel (%)



Source: IEA, Goldman Sachs Global Investment Research

Exhibit 13: ...which is one of the fuels with the highest carbon intensity

Lifecycle GHG emissions intensity (kgCO2eq/boe)

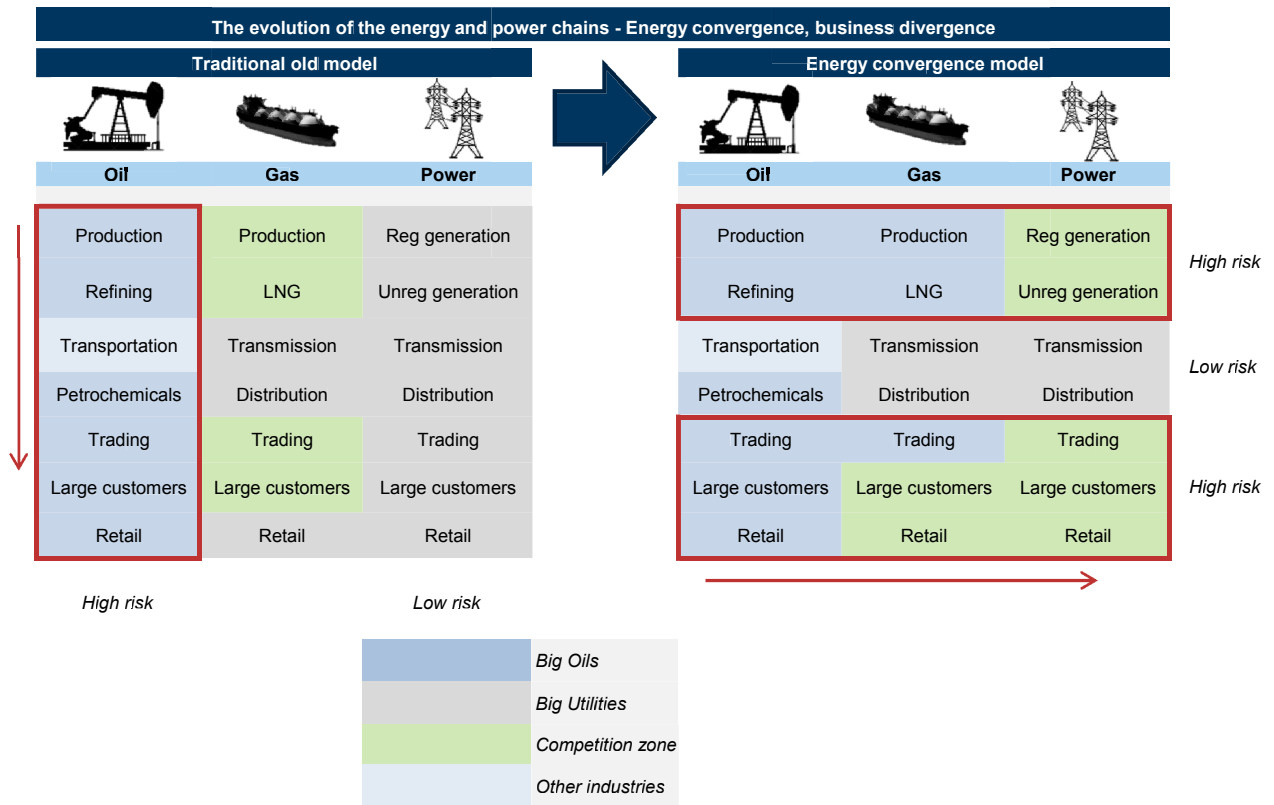


Source: IPCC, Company data, Goldman Sachs Global Investment Research

The new energy and power generation ecosystem; Big Oils and Big Utilities converging towards clean power with diverging business models

The competitive landscape of the energy supply chain is likely to change as a result of the low carbon transition, with the increased uptake of renewables and fuel switching being the most cost competitive solution near term. We believe that this transition will create opportunities for both Big Oils and Big Utilities. **Big Oils** have historically only been fully vertically integrated in the oil value chain and, more recently, in the gas value chain. We believe that their **business will become vertically integrated across oil, gas and power, with a strong presence in businesses with benefits of scale that sit higher on the risk spectrum**. This is where we believe their risk-taking capabilities and strong balance sheets will bring competitive advantages. This will likely result in the **creation of competition zones across areas previously dominated by Utilities**, such as retail, merchant power and power trading. We see rising risk of competition for diversified utilities with material gas and power retail and trading arms, as Big Oils enter these businesses with stronger balance sheets. On the other side, **Utilities have the opportunity to participate in one of the largest infrastructure investment buildouts in history, focusing primarily on regulated power generation and power networks, enhancing returns through financial leverage**.

Exhibit 14: The competitive landscape across the energy supply chain is likely to be drawn across the risk spectrum, as Big Oils continue to embrace integration in gas and power



Source: Goldman Sachs Global Investment Research

Electrification: The path to attaining near-full decarbonisation in Europe

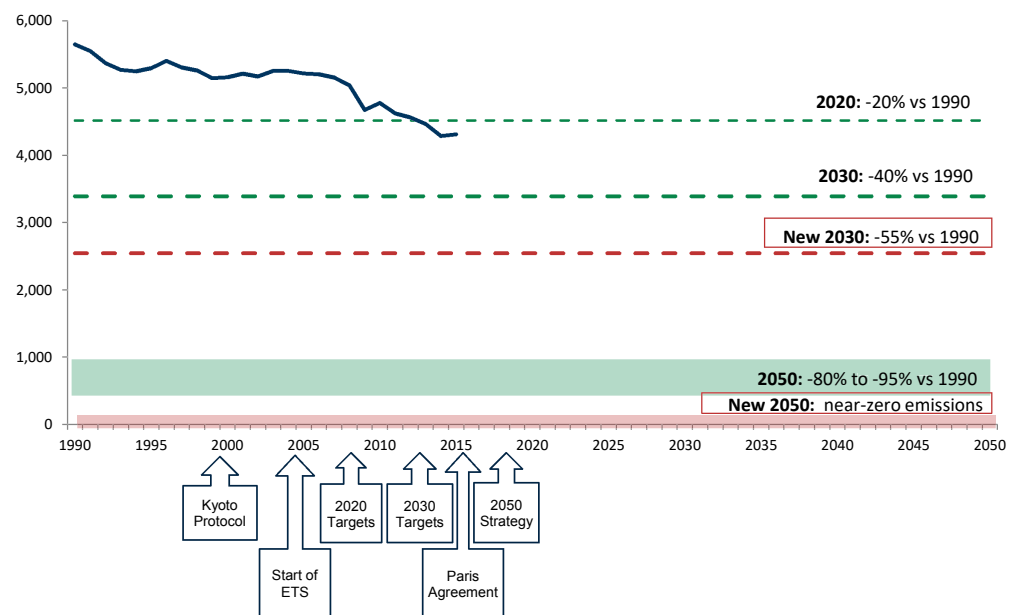
By 2050, the EU targets reducing greenhouse gas emissions (GHG) 80%-95% compared to 1990 levels, implying near-full decarbonisation of the economy. With about three-quarters of this effort still to go (and not insignificant challenges ahead), we see electrification as the most effective route to achieve this objective. The process has already started in power generation – the largest contributor of GHG – where substituting fossil fuel with wind and solar would almost fully “clean up” the power system. At that stage, the generating capacity could be scaled up so that more industries could be electrified (transport, buildings, manufacturing, etc.), offering the potential for the near-complete elimination of fossil fuel power plants, extinction of combustion engines, major upgrades to buildings, a major reduction in oil & gas consumption and overhauls in manufacturing practices. Besides helping the climate, the process could also bring tangible benefits for Europe, which include a potential boost to GDP, more predictable (and lower) energy bills and higher energy self-sufficiency.

EU Climate Policy: The driving force behind decarbonisation

The EU has had climate change at the core of its policy agenda for over 20 years. Now, on the back of steadily improving renewable economics and rising political scrutiny, these efforts are gaining further momentum.

Exhibit 15: The EU has had climate change at the core of its agenda for over 20 years; efforts are now accelerating

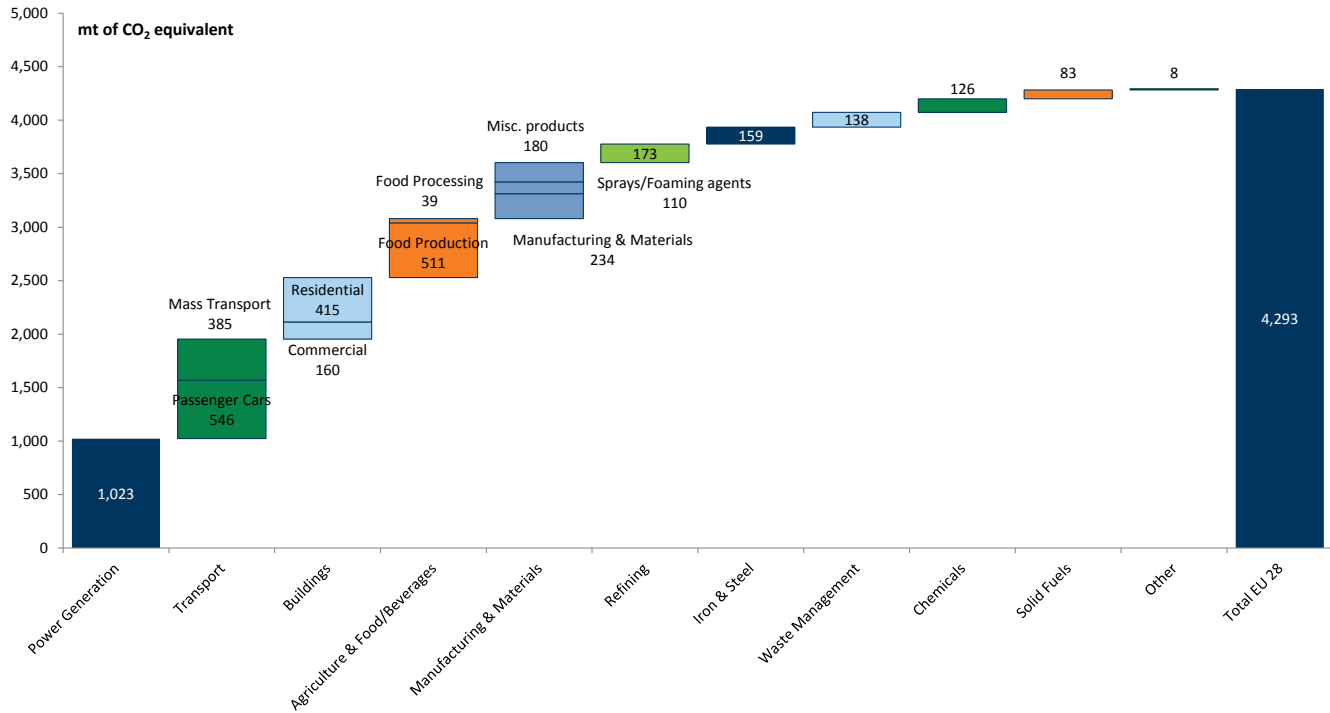
EU GHG emission reduction targets (mtCO_{2e}) and timeline of key policy events



Source: Eurostat, Goldman Sachs Global Investment Research

The main sources of emissions are concentrated in seven industries which jointly account for nearly 95% of EU greenhouse gas emissions. Among these, power generation, transport and buildings are the largest constituents and in aggregate put out nearly two-thirds of total EU emissions.

Exhibit 16: EU GHG emissions: Seven industries are the main sources
EU28 greenhouse gas emissions (2016)



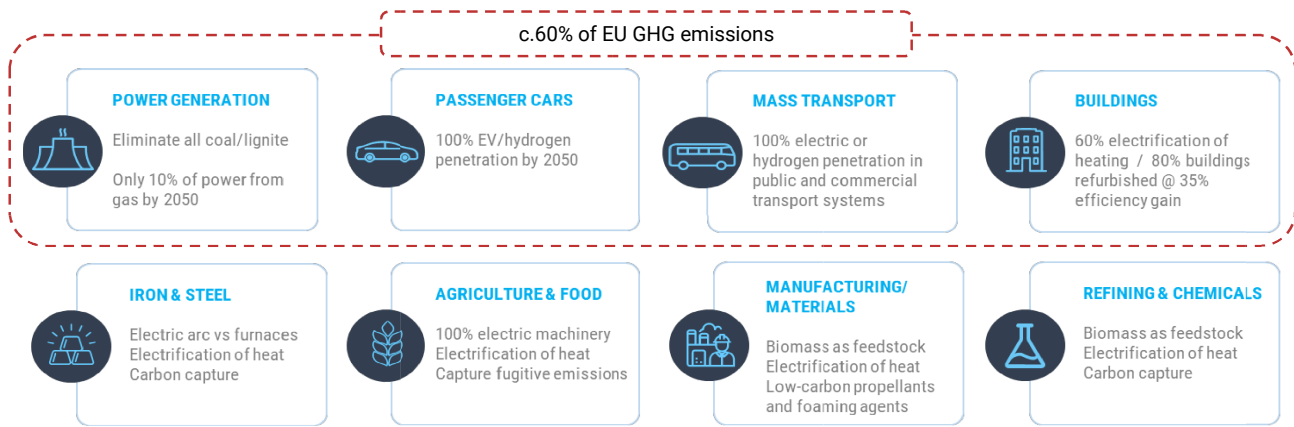
Source: Eurostat, Goldman Sachs Global Investment Research

Decarbonisation: How to....

Sector case studies highlight electrification (of heat, industrial processes, etc.) as a key tenet to achieving Europe’s long-term decarbonisation targets across all sectors. In particular, electrification is set to play a decisive role in (i) fully eliminating emissions from the transport sector, through the adoption of electric vehicles as passenger cars and the use of electrolysis to generate renewable hydrogen for mass transport; and (ii) gradually reducing emissions from buildings, which will progressively switch away from gas boilers (which currently hold a c.85% market share in Europe) in favour of electric heating and heat pumps. Together with the power generation sector, the decarbonisation of transport and buildings could eliminate nearly 60% of all emissions in Europe - enough to satisfy more than two-thirds of the EU’s 2050 target.

Exhibit 17: Only a few industries to tackle to achieve a major decarbonisation

Electricity specific measures we have simulated in our analysis of achieving the 2050 EU LT Energy Strategy (emissions reduction of 80%-95% vs 1990)

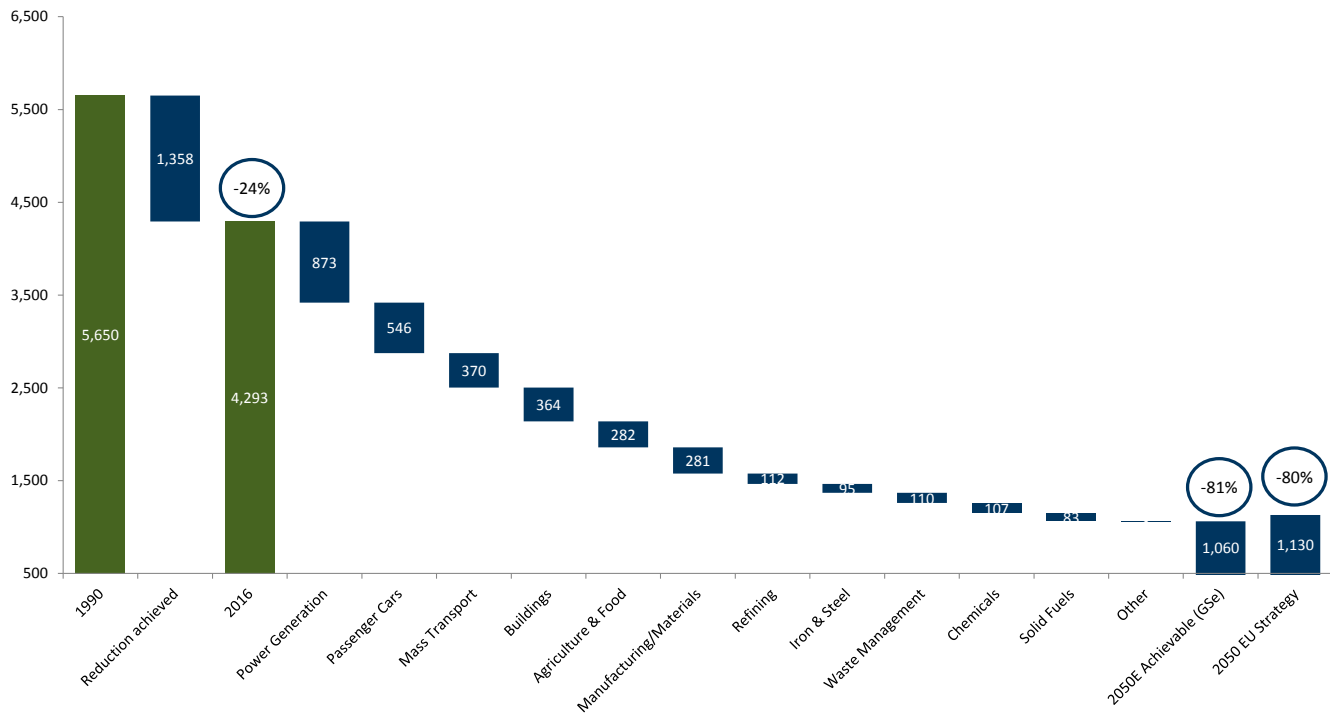


Source: Goldman Sachs Global Investment Research

Our analysis suggests that overall electrification could lower GHG emissions by >80% through 2050E (compared to 1990 levels), thus attaining the lower end of the EU 2050 energy strategy. The largest contribution towards this would come from power generation, transport and buildings, which account for c.60% of total emissions and >65% of the overall emission abatement potential.

Exhibit 18: Our analysis identifies emission reductions to 2050 that could lead to >80% reductions in emissions vs 1990

EU emissions evolution (mtCO2e) under our electrification analysis



Source: Eurostat, Goldman Sachs Global Investment Research

Renewables & Networks: The Growth Engine

As discussed in the previous section, decarbonising the power mix will be the necessary condition to enable an emission-free electrification of all other sectors in the economy. As policy moves (globally) to accelerate efforts in this direction, supported by the ongoing decline in the costs of renewable installations, we anticipate a significant acceleration in renewable additions over the coming decade. On the back of this, the addressable market for European developers could double in size by 2030, leaving significant room for incremental growth (the combined organic market share of Utilities and Big Oils will likely be below 30% in 2030).

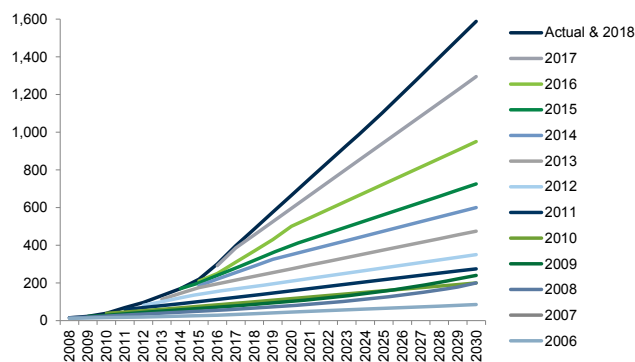
To make this growth possible, material upgrades to network capacity - both through physical investments and digitalisation - will be required, we estimate to the tune of €280bn in Europe alone. Supported by these material investment needs, we estimate that distribution networks could sustain a 3.5% long-term RAB CAGR to 2050.

Renewable development consistently underestimated

Renewable growth has been surprising to the upside for the past 10 years. The charts below show that the International Energy Agency (IEA) has consistently revised upwards its solar and wind capacity forecasts. It is interesting to observe that just over 10 years ago, for 2030 the IEA was expecting less than 100 GW of solar PV, globally. In its latest update, the IEA is forecasting c.1,500 GW.

Exhibit 19: Solar installations have far outpaced IEA forecasts...

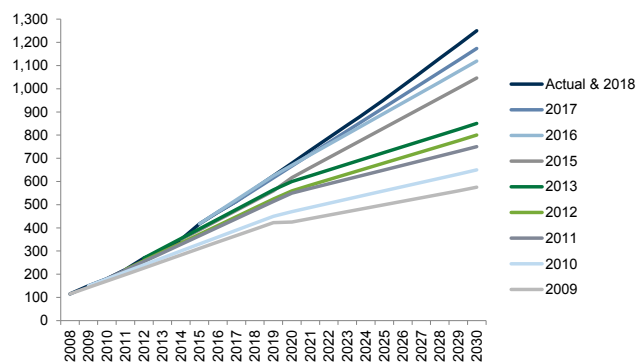
IEA solar PV forecasts to 2030 by year of publication, data in GW



Source: IEA

Exhibit 20: ...as have wind installations since 2008

IEA wind forecasts to 2030 by year of publication, GW



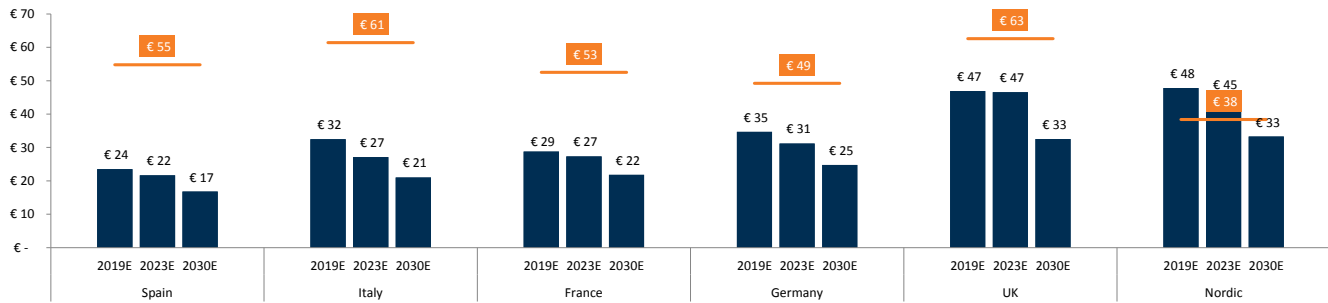
Source: IEA

Renewables deeply in the money

The consistent underestimation of growth can be traced back to a material decrease in renewable costs over the past decade. Solar levelised costs of energy (LCOEs) are now at a discount to wholesale power prices in most EU countries. Particularly in Southern Europe solar energy is c.50% cheaper than forward curves. We factor into our analysis a gradual decrease in capex/MW and estimate that a widespread switch to bifacial trackers could lower costs further by up to 30%.

Exhibit 21: Solar PV costs are already significantly below forwards in most European countries

Solar PV LCOEs in blue, 2020 forwards in orange, €/MWh

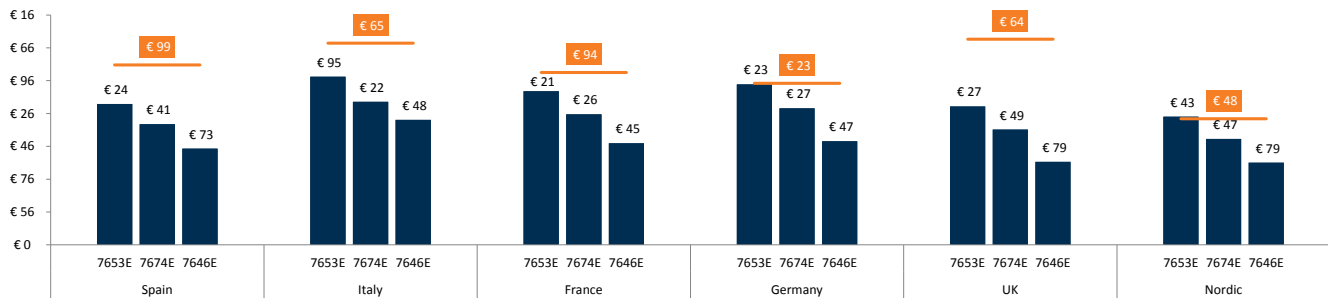


Source: Bloomberg, Goldman Sachs Global Investment Research

Similarly, onshore wind LCOE has recently reached or dipped below forward power prices across Europe. This implies that all new onshore wind installations would be deflationary for electricity bills. Looking forward, we continue to expect LCOE to fall, driven by turbine efficiency and size.

Exhibit 22: Onshore wind is at or below grid parity in all major regions

Onshore LCOEs in blue, 2020 forwards in orange, €/MWh



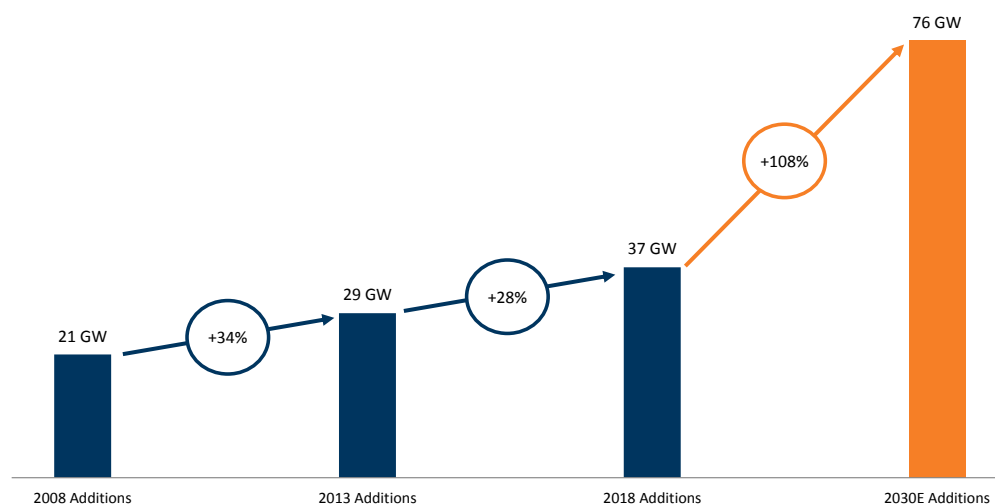
Source: Goldman Sachs Global Investment Research

Addressable market to double by 2030

Driven by increasingly ambitious policy targets and constantly improving economics, the addressable market for renewables (Europe, the US, Latam and the South East Asian offshore markets) could double by 2030, in our view. In the long term, we expect continued growth, driven by three secular trends: (1) better economics *vis-a-vis* conventional technologies; (2) the need to meet climate targets (in Europe above all); and (3) the need to satisfy future growth in electricity demand.

Exhibit 23: The global addressable market for renewables has been growing at an accelerating pace, and could double by 2030E

Annual renewable additions in the addressable market for European renewable developers (GW pa)



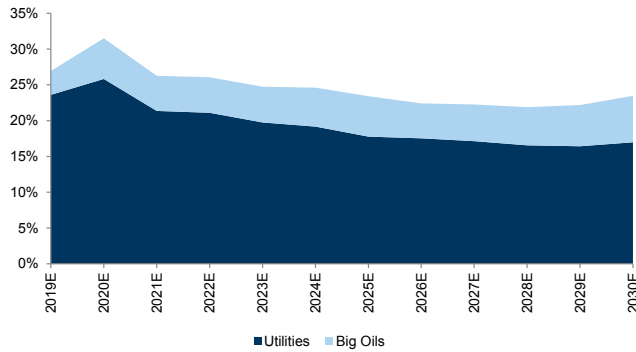
Source: Goldman Sachs Global Investment Research, IRENA.

Big Oils entering the space: Is there room for everyone?

Given the need to decarbonise their portfolios, Big Oils have been redirecting an increasing (albeit still modest) share of their capex towards “clean activities”. This has led the market to worry about rising competition and compressing returns on new renewables projects. Although competitive pressures are on the rise, our analysis shows the impact on returns is unlikely to be significant. The significant acceleration in addressable market growth could in fact imply a decline in the market share of Utilities and Big Oils from the early 2020s; maintaining the currently targeted pace of installations will mean that their market share could fall below 30% by 2030. In our view, this suggests significant room to accommodate new entrants - which beyond Big Oils include IPPs and financial investors - while still retaining a sizeable buffer for both Utilities and Big Oils to upgrade their growth ambitions in the space over the coming years. Looking at the cumulative evolution of the addressable market (US, Europe, Latam and non-EM Asia), it is evident that the majority of cumulative additions will continue to come from independent players (c.70% of the market).

Exhibit 24: As the addressable market expands, Utilities and Oil Majors will only take up a c.30% share...

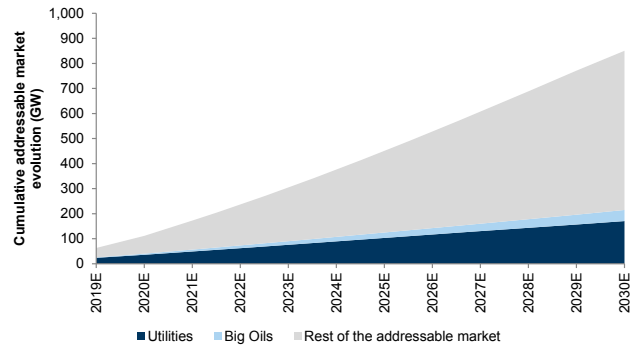
Market shares at current run rate of installations (% of addressable market)



Source: Goldman Sachs Global Investment Research, Company data

Exhibit 25: ...suggesting significant room for both groups to upgrade their targets without harming returns

Cumulative evolution of addressable market (GW)

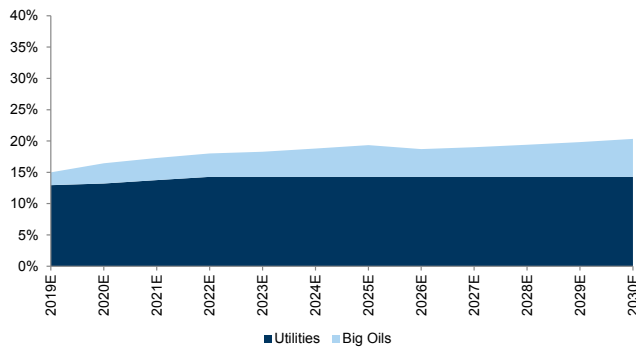


Source: Company data, Goldman Sachs Global Investment Research

Looking at market shares on a global level - including “frontier” regions like Africa and EM-Asia, where European Utilities do not have an established presence - shows an even lower level of concentration. While in this case the market share of Big Oils would be more significant - around 6% by 2030 - Utilities would see their market share stable at around 18%, implying a combined concentration of <25%. Similarly, on the capex side, we estimate that Utilities and Big Oils combined will capture only about one-third of the overall investment opportunity in the renewables addressable market.

Exhibit 26: Globally, Utilities and Big Oils will occupy less than 25% of the market...

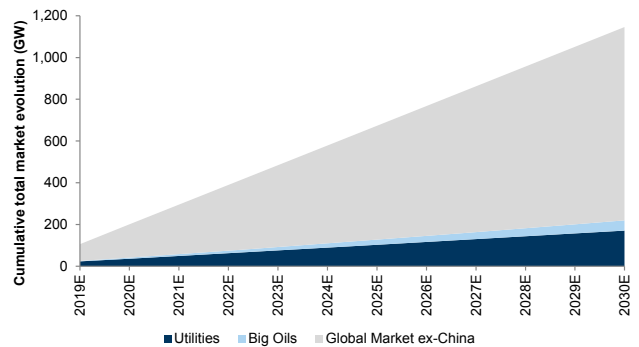
Market shares at current run rate of installations (% of total market)



Source: Goldman Sachs Global Investment Research, Company data

Exhibit 27: ...with relatively higher investments by Big Oils in “frontier” markets where they already have an established presence

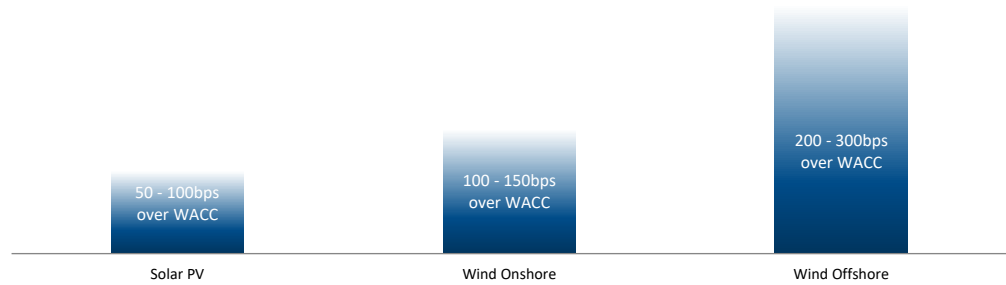
Cumulative evolution of total market ex-China (GW)



Source: Company data, Goldman Sachs Global Investment Research

As yet, it remains unclear what the evolution of returns will be: we believe IRRs are already near the trough for solar PV, while in onshore we could see some incremental reduction (25-50bp). The major threat remains in wind offshore, where most (new) projects still earn 200-300bp over WACC, suggesting that returns could compress 100-150bp (although some premium vs onshore remains justified by the higher complexity and correspondingly higher operational risk of the projects).

Exhibit 28: IRR vs. WACC spreads could still see some downside in wind onshore/offshore
 Project IRR vs. WACC for typical projects (post tax)

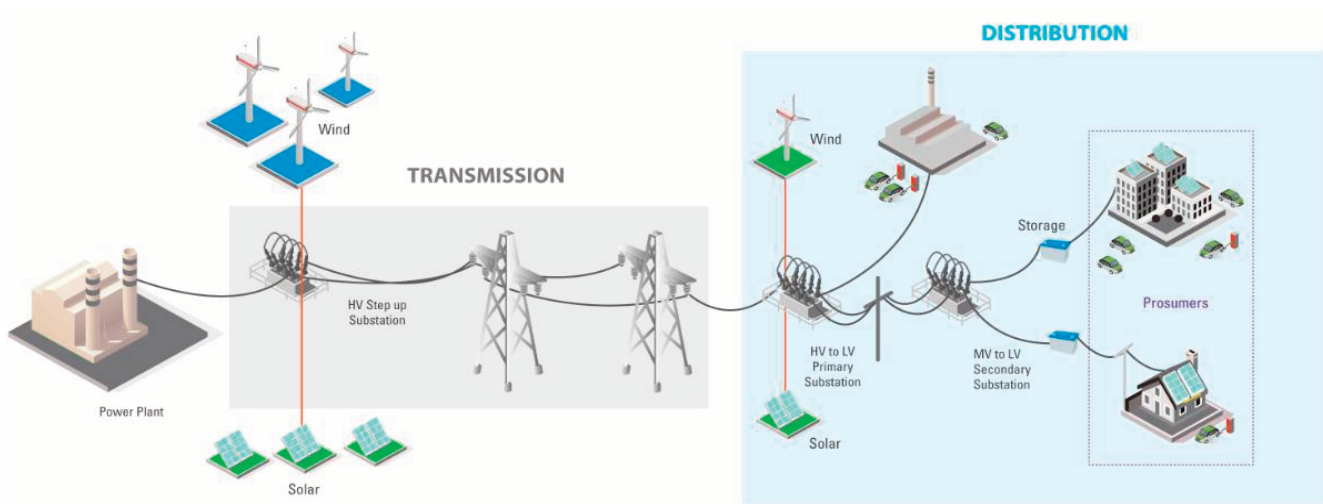


Source: Goldman Sachs Global Investment Research.

Networks: Untangling complexity brings growth

Evolving technology and digitalisation should change the way companies operate, especially in terms of asset productivity and labour intensity. To fully embrace renewables, storage, demand-side management, remote controlling and real-time demand forecasting, power grids will have to be digitalised. We estimate this capex opportunity at nearly €300 bn. European utilities currently employ (nearly) one million people (at an annual cost of c.€70 bn, equivalent to about two-thirds of sector EBITDA), 20% of whom will retire over the next ten years. Digitalisation could allow for a 15% reduction in controllable costs (c.€10 bn savings) by 2050, on our estimates.

Exhibit 29: How the power complex is evolving (newer elements in colour)

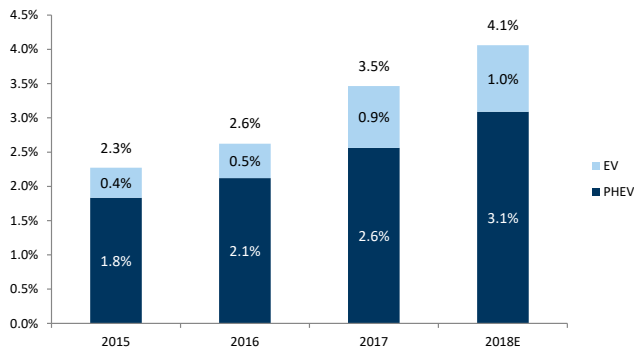


Source: Goldman Sachs Global Investment Research

We see material upside to current run-rate grid capex levels, driven by continued renewable deployment and the increasing penetration of electric vehicles. We estimate that an extra €280 bn needs to be spent in Europe by 2050, which should accelerate European RAB growth from 2% pa (on run-rate capex) to 3.5%. New IT systems in supply, fully digitalised networks and the utilisation of predictive algorithms to manage grids and power stations could allow for a 15% reduction in controllable costs (c.€10 bn of net savings), we estimate. Our cost savings analysis is underpinned by in-depth discussions with a sample of European utilities.

Exhibit 30: Plug-in vehicle penetration is rising in Europe

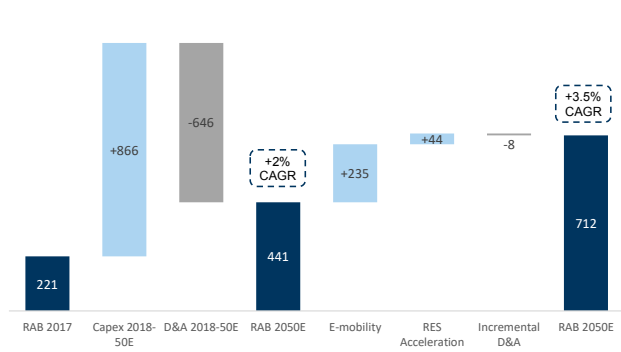
Share of plug in vehicles in European fleet, full electric (EV) and plug-in hybrids (PHEV)



Source: IHS, Goldman Sachs Global Investment Research

Exhibit 31: We expect 3.5% annual RAB growth through 2017-50

European electricity distribution RAB bridge, € bn



Source: Goldman Sachs Global Investment Research

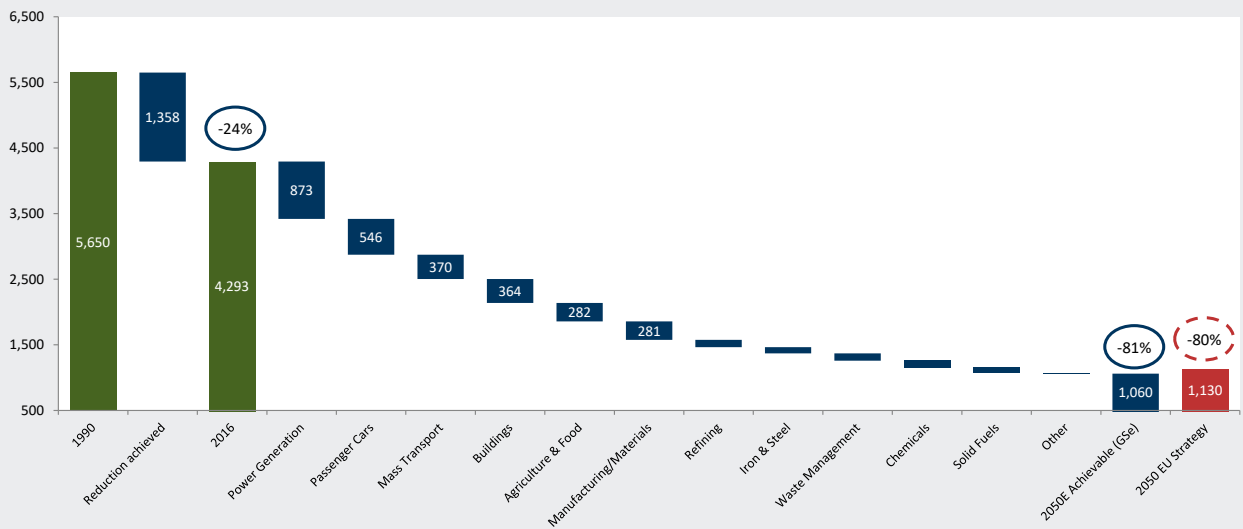
Electrify Everything: Europe leading by example

The EU is one of the regions with the greatest de-carbonization transformation to date globally, incorporating climate change at the core of its agenda for nearly 20 years after the introduction of the EU Climate Change Programme (2000). Since then, GHG emissions have fallen by c.20%, renewables now account for c.30% of power production and the output from coal plants has shrunk by c.35%. The region is currently targeting a reduction in greenhouse emissions of 80%-95% from 1990 levels by 2050, that, if met, would imply an almost full de-carbonisation of the European economy. With about three-quarters of this effort still to go, our view is that electrification will be one of the most effective routes in achieving this objective.

As we highlighted previously, electrification, both in power generation as well as transport sectors, is one of the most substantial contributors to mitigation efforts. In power generation, the primary source of global emissions accounting for nearly one quarter, electrification is already well underway with wind and solar replacing fossil fuels in the energy mix. Meanwhile, there exists a very large potential for further emission reductions and electrification potential in the industry, making electrification a pervasive process across all sectors of the economy including transport (through the elimination of combustion engines as we already outlined with electric vehicle penetration accelerating), buildings (with major upgrades in heating and insulation), and manufacturing (through major process redesign). Electrification can bring several tangible positives, in addition to setting the example for a cleaner, less carbon-intense world, including a potential c.1% boost to GDP for Europe, more predictable energy bills and an incremental positive benefit to the EU's balance of payments, all else equal, through greater energy independence. Europe is, in our view, leading by example and setting the framework for other regions to follow on the path to de-carbonisation through its mitigation initiatives.

Exhibit 32: Over 80% of EU emission reductions can be achieved, in our estimates, through electrification spread across a number of industries

EU emissions evolution (MtCO2eq) under the electrification analysis



Source: Eurostat, Goldman Sachs Global Investment Research

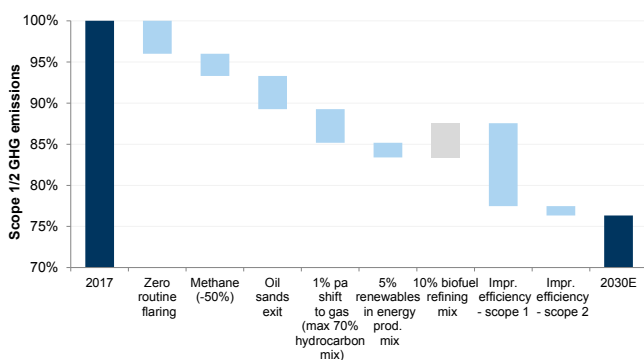
Big Oils have many tools to achieve the transition towards Big Energy, with clean power being the single most important lever

Big Oils have many tools to become broader, cleaner energy providers: clean power, biofuels, petrochemicals, gas value chains, sequestration and reforestation

Big Oils have shown a significant ability to adapt to technological change in their 100+ years of history. We believe it is now a strategic focus to drive a low-carbon transition consistent with the global ambition to contain global warming within 2°C of pre-industrial levels. Big Oils are key to this low-carbon transition as they produce and market energy products that account for c.10% of the energy sector’s carbon emissions. We believe that **Big Oils have many tools at their disposal that would enable them to achieve this transition towards Big Energy and become broader, cleaner energy providers**, the single most important one being a **deeper presence in the global gas and power chains**, including retail, but also through EV charging and renewables, biofuels, petrochemicals, improved upstream and industrial operations, re-forestation and carbon capture.

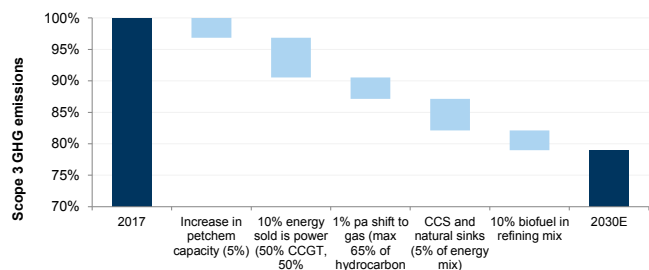
We estimate that this transition, if fully embraced and executed, **has the potential to lead to a 20%+ reduction in greenhouse gas emissions (GHG) by 2030 in Big Oils’ direct operations but also on a ‘well to wheel’ basis**, consistent with a 2°C scenario. We estimate that **Big Oils can see improving returns in their path to becoming Big Energy**, as the improved market structure that now characterises the oil & gas industry (increased consolidation and higher barriers to entry) will likely foster **improved returns in the traditional oil & gas business**. These higher returns from the traditional oil & gas business should in turn provide Big Oils with further funding to re-imagine their business, **showing renewed value for scale and integration**.

Exhibit 33: We estimate that Big Oils can deliver an equivalent 20%+ reduction in GHG by 2030 in their direct operations...
Big Oils scope 1/2 GHG emissions intensity 2017-30 bridge



Source: Goldman Sachs Global Investment Research

Exhibit 34: ...and on a ‘well to wheel’ basis, transforming themselves into ‘Big Energy’
Big Oils scope 3 GHG emissions 2017-30 bridge



Source: Goldman Sachs Global Investment Research

All European Big Oils have set ambitious targets on the path to becoming 'Big Energy'

The theme of de-carbonization and climate change has already been incorporated into the EU Big Oils' strategies, leveraging on the wide range of the tools outlined above:

- **Equinor** is currently targeting an annual reduction of 3 million tonnes of CO₂ by 2030 (compared to 2017) with CO₂ emissions per boe reduced by 10% (from 2016 base) and with new energy having the potential to constitute around 15%-20% of annual capex (from <1% in 2017).
- **ENI's** ambition is to achieve zero net upstream carbon emissions by 2030 (Scope 1) while guiding towards €1.4 bn spending in energy solutions in 2019-22E, further expanding its installed renewable capacity to >1.6GW and 5GW by 2022E and 2025E, respectively.
- **RDSHELL** has linked emission targets to management remuneration and has reiterated its long-term ambition of a 20% reduction in 'Net Carbon Footprint' of its energy products by 2035 and around 50% by 2050E.
- **BP** is targeting zero net growth in operation emissions out to 2025 and 3.5 Mte of sustainable GHG reductions by 2025 (and methane intensity of 0.2%) while committing US\$500mn pa on expanding the low carbon and renewable energy business.
- **TOTAL** has set its targets to reduce carbon intensity by 15% by 2030 (2015 base) and by 25%-35% by 2035 as the company increases exposure to natural gas, biofuels, efficiency, carbon sinks and low carbon electricity through the commitment of US\$1-2 bn capex pa to 2020.
- **OMV** aims to increase petrochemicals production volume by 12% by 2025 in addition to a targeted reduction of carbon intensity of business activities by 19% by 2025 (from 2010 base).
- **Repsol's** 2020 objective is to reduce carbon intensity by 3% and 40% by 2040 (2016 base) while the Viesgo acquisition should open the door to accelerated gas and power integration.
- **Galp** aims to achieve zero routine flaring by 2030 in addition to growing its gas business, and increasing low carbon investments (by 2020 invest €45.2mn in eco-efficiency projects and €66mn by 2023). The company's investment in low-carbon energy and new business models aim to account for c. 5% of total capital by 2020, and 5% to 15% from 2020 onwards.

Vertical integration in gas and power a key ingredient to Big Oil's decarbonization drive

Big Oils have been vertically integrated in oil, from production to retail, for over a century. We believe the coming decade will see them **integrating vertically in gas and power, leveraging their brand/customer relationships, technical expertise and trading capabilities to acquire power customers**. For renewables, we estimate the capacity build-up potential for the majors on the basis of company guidance and estimate the capex requirement on the basis of the total renewables capacity guidance (wind split assumed at 80%/20% onshore/offshore and split between wind and solar assumed at 50%/50%). While Big Oils are likely to play a key contributing role in the

growth of renewable energy moving forward, a small % of their clean energy budget will likely be attributed to this pillar of the low carbon transition as the companies utilize and embrace a wide variety of levers on their path to decarbonization, including but not limited to retail, power, gas, biofuels exposure and natural sinks (reforestation, carbon capture and storage). Overall we see **European Big Oils already spending c.50% of their capex on the low carbon transition and path to Big Energy**, when accounting for total gas, power & retail, petrochemicals, biofuels, renewables and natural sinks.

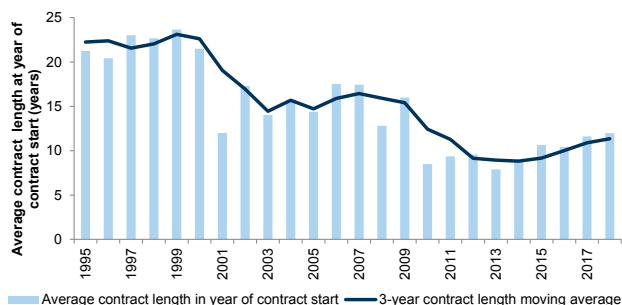
LNG: The first step of Big Oils towards Big Energy

LNG has ‘de-regulated’ as buyers move away from long-term contracts, and Big Oils have stepped in as ‘market makers’

LNG has been a cornerstone of Big Oils’ businesses for decades. However, the market has structurally changed over the past decade. Historically, Big Oils would take the project and commodity price (oil price) risk of the projects, but the volume risk and the basis risk (gas prices vs. oil prices) would be incurred by the utilities customers. Since 2000, the average length of LNG offtake contracts signed has almost halved to c.10 years and so has the average contract volume, with a larger share of the volumes sold on the spot market, as utilities can no longer pass through the volume and basis risk to the final customer. This ‘de-regulation’ of the LNG market is changing the industry dynamics, with the emergence of large portfolio players (Big Oils) with global scale and the ability to act as ‘market makers’ in an illiquid market with volume and basis risk. This is creating clear economies of scale and higher barriers to entry. As Asian utilities continue to de-risk through signing shorter and smaller contracts, only a handful of companies including Big Oils and a few NOCs, in our view, will be in a position to undertake major new LNG developments.

Exhibit 35: The average contract length for signed LNG contracts commencing each year has almost halved since 2000

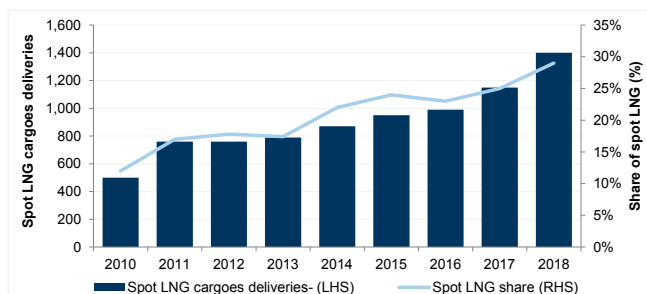
Average contract length at year of contract start and 3-year moving average



Source: Kepler, Goldman Sachs Global Investment Research

Exhibit 36: Spot LNG cargo deliveries have started to gain momentum at the expense of contracted LNG volumes over the past five years

Spot LNG cargo delivery (LHS) vs spot LNG market share (RHS)



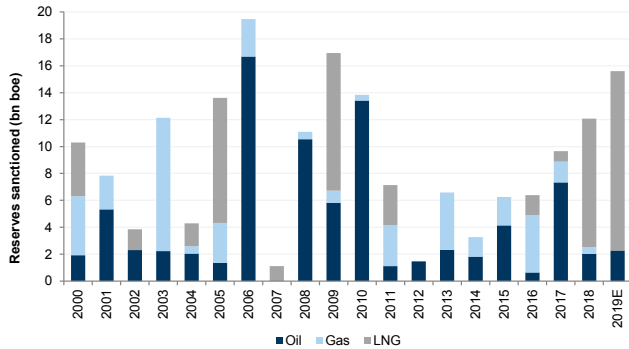
Source: Royal Dutch Shell, Data compiled by Goldman Sachs Global Investment Research

A number of new developments are moving ahead...

We believe that we are currently entering the **next wave of LNG projects**, dominated by Big Oils, with LNG sanctions likely to continue to accelerate in 2019-20E. LNG is the hydrocarbon with the most constructive long-term demand outlook, primarily driven by the ongoing policy shift in China and its blue sky policy. Exhibit 37 shows the reserves sanctioned by the ‘Seven Sisters’, according to our Top Projects analysis, split by type of product (oil, gas and LNG), with LNG dominating project sanctions by the majors in 2018 and expected to continue to lead to a healthy pace of FIDs in 2019-20E, further cementing Big Oils’ shift towards Big Energy.

Exhibit 37: We are entering the next wave of LNG projects sanctions...

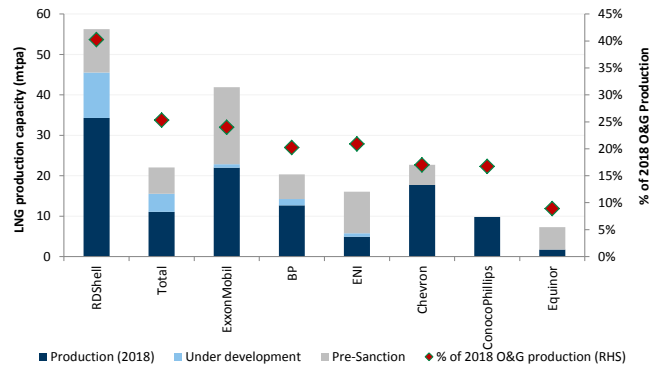
Top Projects reserves sanctioned by the 'Seven Sisters' (RDSHELL, TOTAL, BP, ENI, Equinor, ExxonMobil, Chevron)



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 38: ...driven by Big Oils, as they transition to Big Energy

LNG production capacity (split by producing, pre-sanctioned and under development) and as a % of total 2018 oil & gas production for Big Oils



Source: Company data, Goldman Sachs Global Investment Research

...and generating profitable business opportunities with clear economies of scale

The integrated gas divisions of the majors are already one of the most profitable parts of Big Oils' portfolios, thanks to their global scale, advantaged cost positioning and high barriers to entry.

Utilities: *e-winners* leading the energy transition as business models diverge

The decarbonisation effort and the electrification process are likely to imply rising infrastructure investments for the leading companies in renewables and power grids. Still, some companies in Europe - companies we call “e-winners” - could sustain annual growth rates of 4%-5% at EBITDA on the back of the transition from fossil fuels to wind/solar, the investments in the grids and the digitalisation-led cost savings across all the businesses. We continue to stress the importance of scale as a way to safeguard returns for renewable developers, providing protection against the increasing competition from Big Oils in the renewables space.

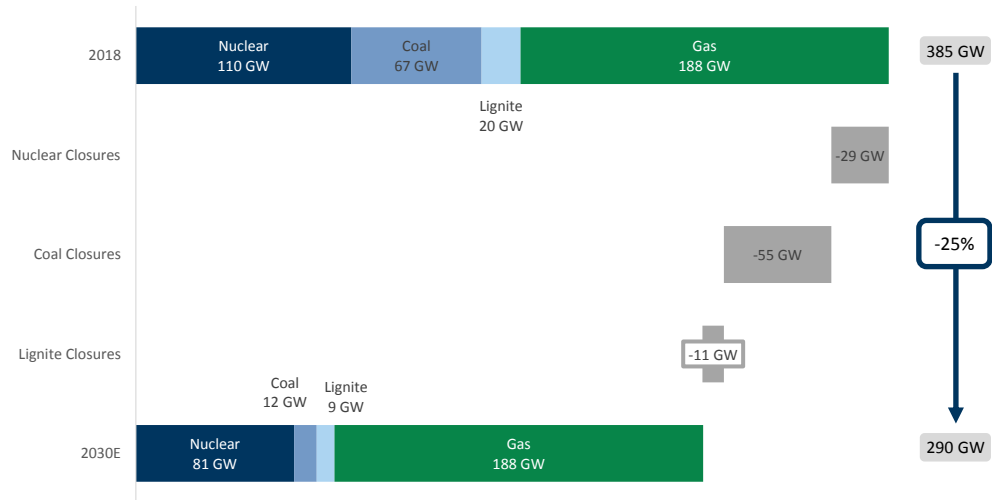
At the other end of the spectrum, companies exposed to gas activities might struggle - we estimate an electrification-led decline in gas demand of c.50% by 2050. Legacy power generation will continue to come under pressure owing to lower power prices (as an increasing number of “in the money” renewable installations gain market share in the power mix), and as conventional capacity retires (nuclear, lignite and coal across most countries in Europe). Lastly, we see supply activities coming under intense competitive pressure from new entrants (online retailers and Big Oils); in light of this threat, we see an exception only for those companies capable of extensive cost-cutting (through digitalisation) while at the same time protecting their scale and customer base.

We estimate that - as a result of the energy transition - the *e-winners* will be able to sustain EBITDA growth of 4.5% over the long term. This steady expansion will be underpinned by renewable additions, network investments and digitalisation savings, which will more than offset lower generation profits (as thermal power plants are phased out) and rising competitive pressures on supply margins.

Legacy generation: Entering a slow (but steady) decline

As part of Europe’s push towards decarbonisation, nearly 100GW of thermal generation capacity will be decommissioned over the coming decade. While in many cases this will be driven by phaseout policies imposed by governments, many of these closures would be justified by the extent of the recent improvement in renewable economics and the ensuing acceleration in installations that we forecast.

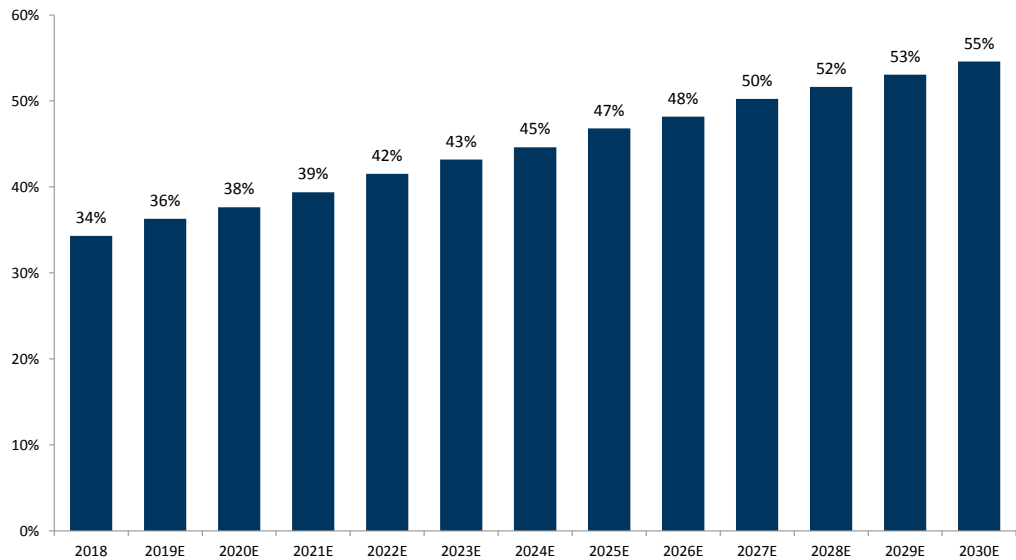
Exhibit 39: Europe will decommission nearly 100GW of thermal capacity over the coming decade
 Thermal capacity evolution in Central Europe (GW)



Source: Goldman Sachs Global Investment Research, ENTSOE

At the same time, these closures will be replaced by “in-the-money” renewables, which are set to rise from 34% to c.55% as a share of the generation mix.

Exhibit 40: Renewables are set to account for more than half of all power generation in Europe by 2030
 Renewables (including hydro) as % of power European power generation

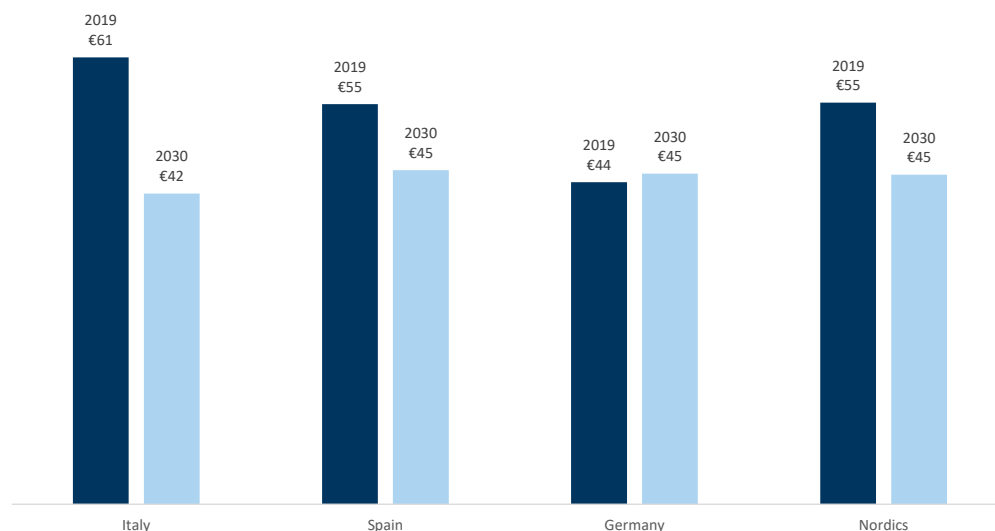


Source: Goldman Sachs Global Investment Research, ENTSOE

Over the long term, we expect the increasing renewable penetration in the generation mix to be deflationary to power prices, which by 2030 could decline by c.25% in most countries in Europe. The exception to that could be Germany, which in our view will remain significantly tighter than other regions owing to the ongoing decommissioning of coal and lignite (c.2GW pa to 2038) and the grid constraints that are preventing an acceleration in renewable additions in the near term.

Exhibit 41: Power prices could slide c.25% as renewables rise - except in Germany

Power price forecasts (€/MWh)



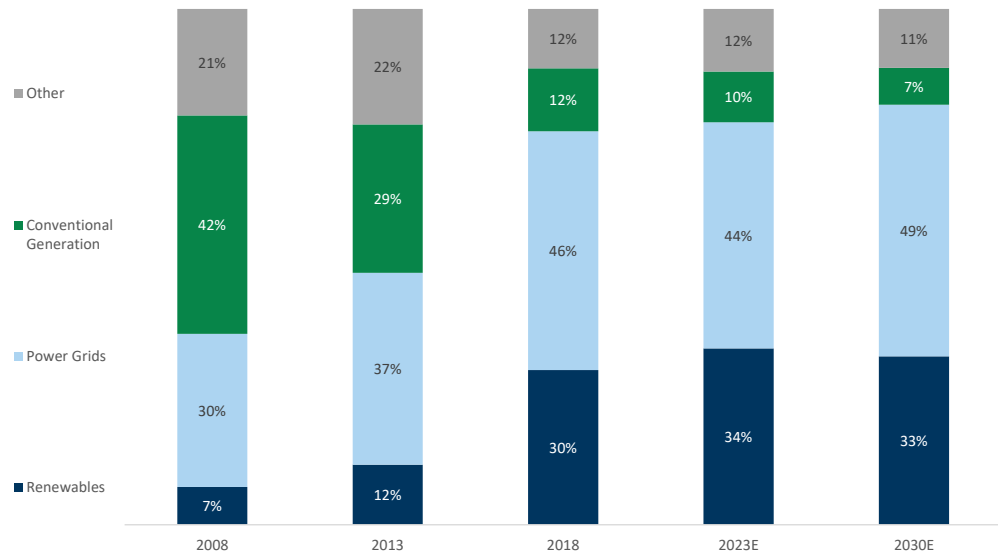
Source: Company data, Goldman Sachs Global Investment Research

European Utilities: A re-rating opportunity

As we have discussed above, over the past decade infrastructure activities (networks and renewables) have turned from a mere auxiliary business with little upside to the sector's new "growth engine"; merchant activities, on the other hand, which were buoyed by the commodity upcycle ahead of the financial crisis, entered a slow but steady decline. As a result, utilities have significantly and consistently redirected capital towards the former and away from the latter, to the extent that 80% of capex for the companies that we identify as the *e-winners* is now directed at infrastructure activities - vs. just 40% in 2008. Similarly, by 2023 we expect nearly 80% of EBITDA to come from networks and renewables, vs <40% in 2008.

Exhibit 42: Europe e-winners have undergone a radical shift towards an infrastructure-driven business model

EBITDA split by activity

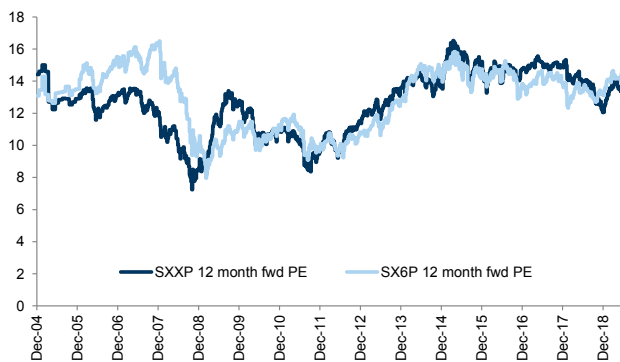


Source: Company data, Goldman Sachs Global Investment Research

However, the sector’s relative valuation to the market remained broadly unchanged over the past ten years, trading in line on P/E and at a 100-150bp discount on dividend yield. This suggests that the sector has seen little-to-no re-rating relative to the market, despite the radical shift towards infrastructure activities combining a safe, visible and often inflation-protected earnings profile with a prospect of significant future growth, thanks to the ongoing decarbonisation and electrification of the economy.

Exhibit 43: The sector’s relative valuation is largely unchanged since the financial crisis...

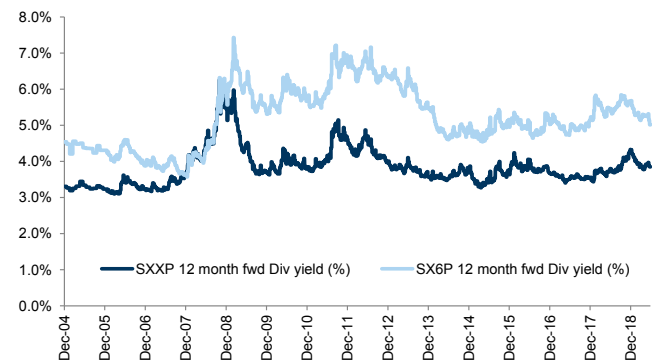
12-month forward P/E evolution - sector vs market



Source: Datastream

Exhibit 44: ...both on P/E (where they trade in-line) and dividend yield (where they exhibit a 100-150bps discount)

12-month forward dividend yield evolution - sector vs market



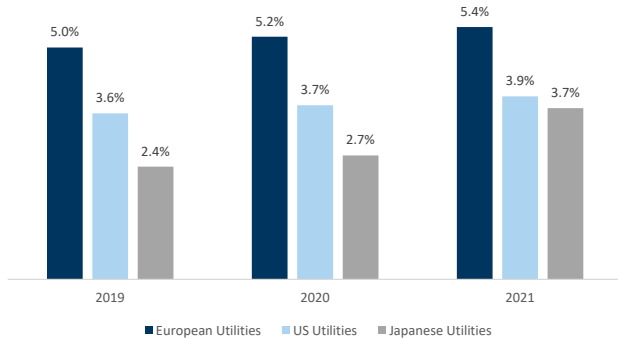
Source: Datastream

This valuation gap is further corroborated by a global comparison. Compared to other major developed market such as the US and Japan, Utilities trade at a significant discount. This discount is observable both in absolute terms - European utilities yield >5%, vs 3%-4% for US utilities and 2.5%-3.5% for Japanese utilities - and in relative

terms - European utilities offer yields 450-500bp above the average sovereign bond yield, while the same spread is significantly lower at 260-380bp in Japan and 155-190bp in the US.

Exhibit 45: European utilities trade at a discount to US and Japanese peers in absolute terms...

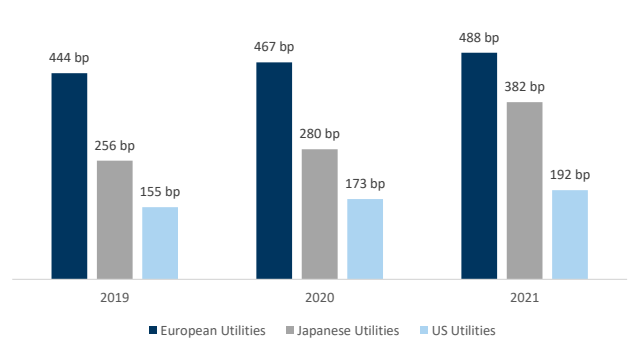
Dividend yields - global comparison



Source: Goldman Sachs Global Investment Research

Exhibit 46: ...and offer significantly higher yields relative to their respective bond yields

Dividend yield - bond yield spread - global comparison

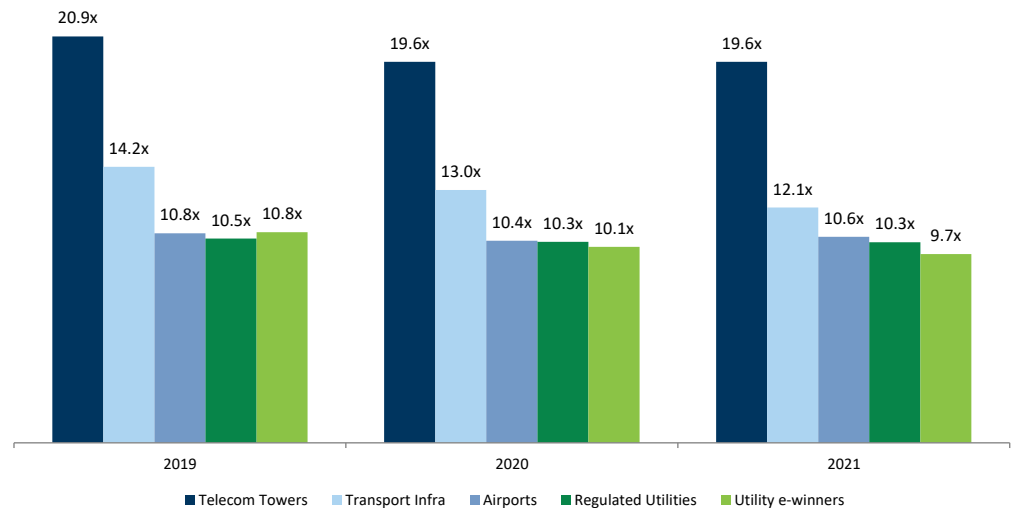


Source: Goldman Sachs Global Investment Research, Bloomberg

Compared to other sectors with similar earnings visibility and risk profile, such as regulated/contracted infrastructure and concession businesses, the *e-winners* trade at a discount valuation starting in 2020/21, suggesting that their long-term growth outlook remains underappreciated relative to other sectors.

Exhibit 47: Despite accelerating secular growth, the e-winners trade at a discount to comparable infrastructure assets

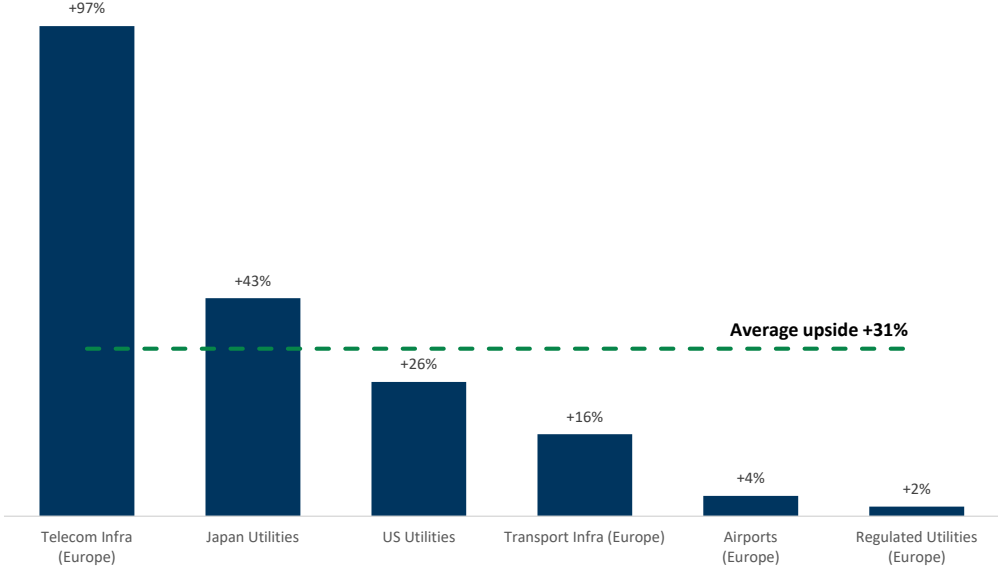
EV/EBITDA(R) multiples (by European sub-sector)



Source: Goldman Sachs Global Investment Research, FactSet

Overall, combining the geographical and cross-sectoral dimension shows that the *e-winners* have scope to re-rate by c.30% from simply starting to trade in line with peers in other geography and similarly regulated/contracted sectors in Europe.

Exhibit 48: The e-winners could re-rate c.30% by matching the valuation of infrastructure peers in Europe, the US and Japan
Re-rating potential from reaching peer group valuation



Note: Japan/US utilities calculated on dividend yield, all other baskets based on EV/EBITDA(R)

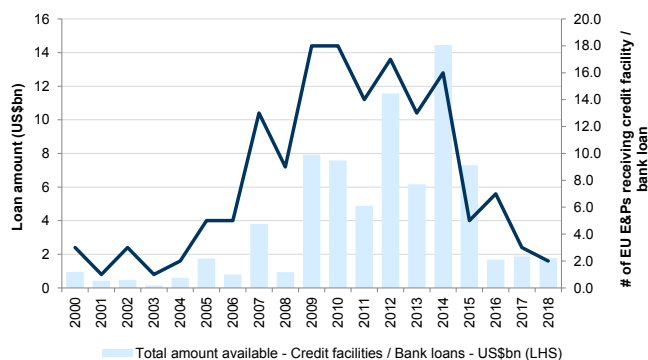
Source: Goldman Sachs Global Investment Research, Bloomberg

Big Oils become more profitable on the back of higher barriers to entry and consolidated market structure

The current focus of Big Oils on de-carbonization does not come at the expense of lower corporate returns, as the **improved market structure that now characterises the industry** will likely foster improved returns in the traditional oil & gas business.

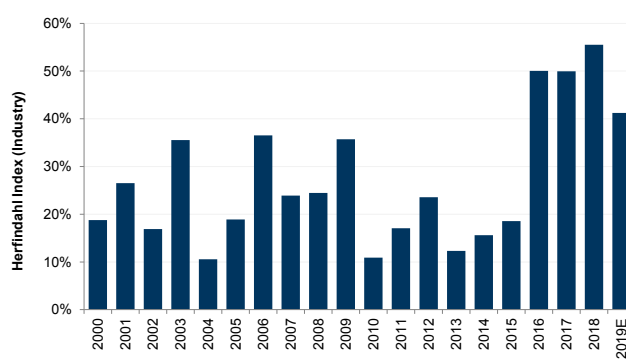
Our analysis shows tangible evidence that the ongoing drive for de-carbonisation is **transforming the competitive landscape and structure of the industry in this 'Age of Restraint'** into a **more consolidated market with higher barriers to entry** through tightening funding and a rising risk premium. Over the last five years, capital availability for new oil developments has significantly decreased as the market focuses on de-carbonization with: (1) Reserve-based lending to E&Ps being down 90% from the peak as financial institutions redirect financing towards renewable developments. Reserve-based lending was the financing of choice for E&Ps and some NOCs as international operators of mega-projects in the 2000s. The banks that were most active in reserve-based lending are mostly looking to discontinue hydrocarbon financing over the long term; (2) NOCs moving away from aggressive international expansion as they focus on higher-return domestic investments, gas and downstream value chains. Between 2003 and 2014, oil prices rose well above the budget breakevens of OPEC countries, creating a US\$1.6 tn surplus that was partially re-invested in oil & gas capex, financing the international expansion of NOCs. Since 2014, the substantial fall in oil prices has pushed NOCs to retrench to their home basins, making them net sellers of resources and incentivising stronger collaboration with Big Oils; and (3) Big Oils' carbon reduction ambitions reducing their ability to accelerate oil field developments.

Exhibit 49: With financing for independent long-cycle oil & gas developers having dried up...
EU E&Ps amount raised through credit facilities/bank loans (US\$ bn)



Source: Bloomberg, Goldman Sachs Global Investment Research

Exhibit 50: ...the market structure for the industry is the most favourable in 20 years
Herfindahl Index, Top Projects capex by operator at time of FID



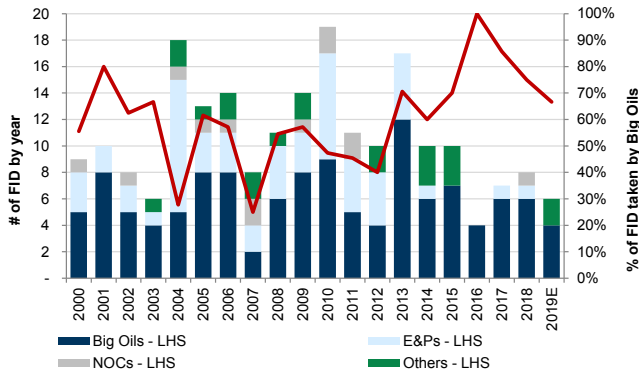
Source: Company data, Goldman Sachs Global Investment Research

The three drivers of tighter financial conditions for new oil fields are leading to the **'Restoration' of the industry's oligopolistic structure**. Over the last five years, **Big Oils have doubled their market share in long-cycle developments and US shale oil**, re-establishing the attractive returns that were lost during the oil & gas revolutions of the 2000s spawned by National Oil Companies and shale. **IRRs for new oil & gas**

mega-projects of 15%-30% are 50% higher than the returns on projects sanctioned in 2004-14. This restoration of profitability through scale, concentration and standardisation is leading to shorter time-to-market and a more dynamic cost curve, with Big Oils in a position to leverage the higher returns from their traditional oil & gas business to foster innovation and investment in their ongoing low carbon transition efforts.

Exhibit 51: Big Oils have regained their Top Projects leadership in a newly consolidated market...

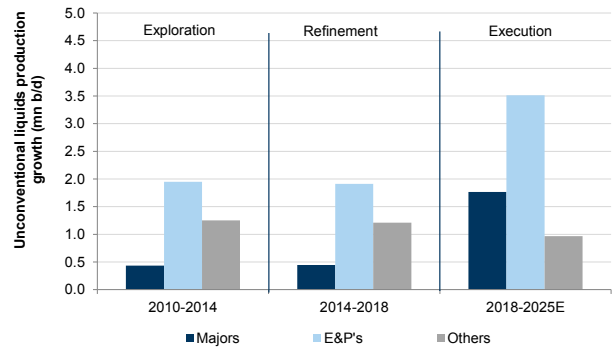
FIDs taken by year (Top Projects); Big Oils refers to ExxonMobil, Chevron, RDSHELL, TOTAL, ENI, BP, Equinor



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 52: ...with early signs of Big Oils' dominance more prominent in shale oil as well

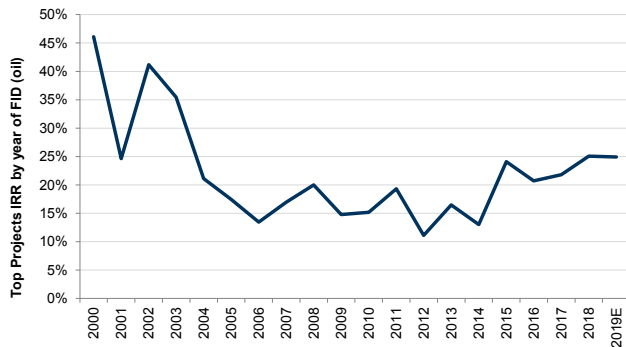
Shale oil growth by company category



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 53: The repaired market structure allows returns to recover to levels last seen in the early 2000s...

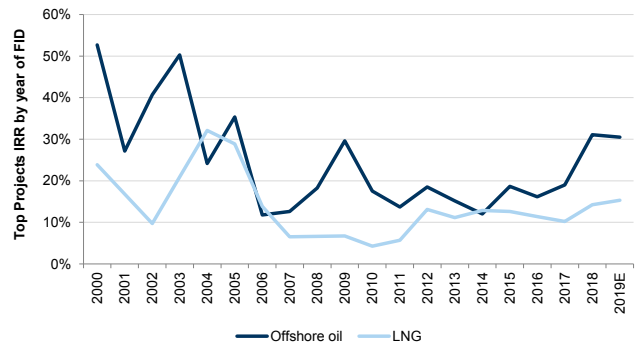
Top Projects IRR by year of FID split by winzone



Source: Goldman Sachs Global Investment Research

Exhibit 54: ...led by a profitability recovery in Deepwater and LNG

Top Projects IRR by year of FID split by winzone



Source: Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Michele Della Vigna, CFA, Alberto Gandolfi, Matteo Rodolfo, Zoe Stavrinou and Derek R. Bingham, 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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