INDUSTRY UPDATE: Energy

Introduction

In the maelstrom of daily news readers may be wading through, there are some clear energy trends evolving that will shape 2025 and beyond. Let us begin with an overview of where the world derives its energy in the first place. From the chart below (Chart 1) one can readily recognize that coal, oil and natural gas supply the bulk of the world's energy. In other words, renewables have a long way to go to supplant them. [See source.]

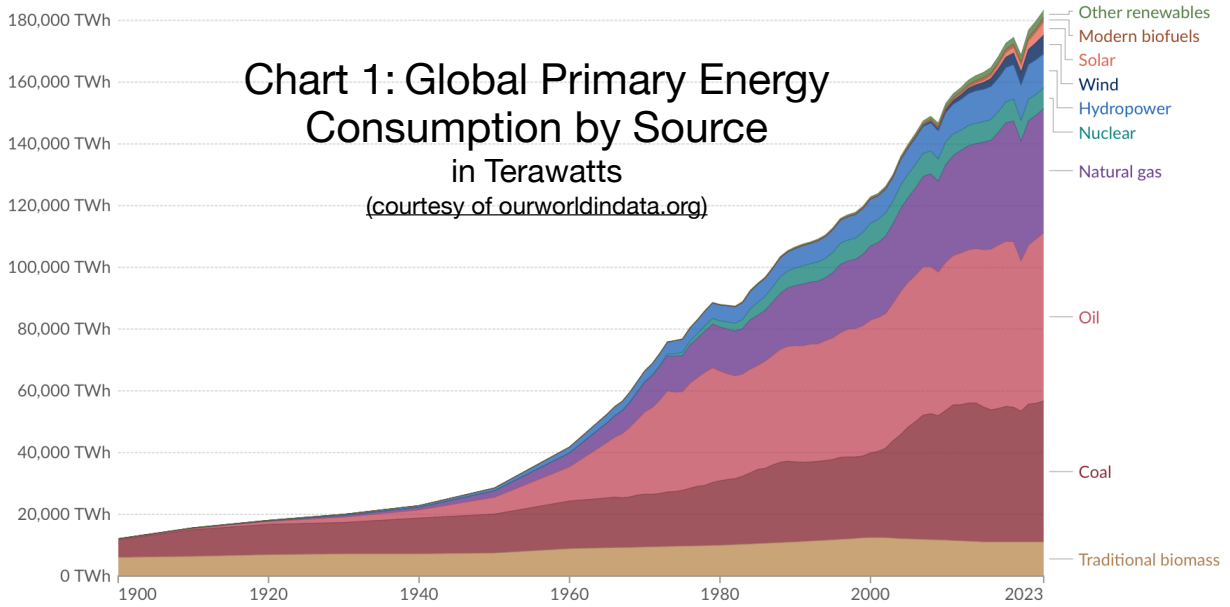
Energy consumption growth, however, seems to be slowing to an estimated 2% p.a. in 2023 as major geographic regions changed their sourcing strategies and/or focused on efficiency. Europe and North America, for example, showed neutral to negative energy consumption growth in 2023. Other regions, notably the developing world, showed higher growth in consumption, largely because their per capita use is still much lower than the developed world's 30,000-100,000 kWh per capita consumption today. [See source.]

Estimates vary as to when peak oil demand will occur, though most point to a period between 2027 and 2034 and demand of 86 [see source] to 110 [see source] million barrels per day. It seems probable that while electric cars will gradually come to dominate passenger traffic, trucks, transportation, and aviation will continue to consume fossil fuels longer because their replacement with electric power is more complicated.

Globally, the International Energy Agency (IEA) expects electricity to grow its share of total consumption. "Electricity is at the heart of modern economies, and its share of final energy consumption is projected to rise from 20% today to over 50% by 2050 in the Net Zero Emissions by 2050 Scenario as electricity demand increases rapidly to decarbonise end-use sectors." [See source.] Many factors are expected to drive this change including cost, efficiency, flexibility, and carbon neutrality.

In fact, the migration toward renewable energy does seem to be happening according to the IEA that now predicts the world will derive about one-third of its electricity from renewables in 2025. But there seems to be a supply constraint in the short term as demand outpaces the supply of clean energy. The IEA underlines this by saying, "Over the next three years the electricity consumption added each year is roughly equivalent to that of the United Kingdom and Germany combined." [See source.]

Unsurprisingly, China dominates the installation of renewable energy generation and is expected to add another 250 gigawatts (GW) in 2025. Unfortunately, China is also the biggest greenhouse gas emitter because of its extreme reliance on coal. "As China represents nearly 60% of global coal consumption, if coal demand in China indeed grows again, demand in developing nations remains on its upward trajectory, and demand in the US temporarily rebounds, it is highly likely that global coal demand will once again paint a new record higher, even if demand in Europe and other developed economies contracts in 2025." [See source.]



The IEA expects energy prices to increase this year as global electricity demand is forecasted to grow by 4% in 2025 due to economic recovery, artificial intelligence's

INDUSTRY UPDATE: Energy

extreme energy utilization, regional conflicts, supply constraints, and expanding industrial activities. "Current high coal and gas prices are not the result of a single shock event on the demand or supply side," the IEA says. "Rather, they result from a combination of supply and demand factors that gradually tightened markets over the course of several months and even years." [See source.]

One of the reasons for electricity demand growth is certainly the expansion of the electric vehicle (EV) market. In the US as of the third quarter, EVs accounted for almost 9% of unit sales, up 11% year on year (YOY). [See source.] In China, by contrast, sales of "so-called new energy vehicles (NEVs) jumped 37% [in July 2024] from the same period a year earlier, accounting for a record 50.7% of car sales." [See source.] As Chinese manufacturers press their scale advantages in the US and Europe, tariffs are likely to increase, even as established players such as Volkswagen seek to both reduce their conventional manufacturing footprints and pursue partnerships with EV players such as Rivian to access key technology [see source]. *See the Spotlight later in this Update for more information on EVs.*

The conversion of truck and bus fleets, among other factors, is also causing natural gas demand to spike. "The liquefied natural gas (LNG) market is set for significant expansion […] with 27 million metric tons of new supply, nearly 90% coming from North America." [See source.]

"One of the big problems here is wind," said Oliver Metcalfe, head of wind research at BloombergNEF (BNEF). "The slow pace of wind progress is affecting the efficacy of that tripling renewables target." "Though global wind capacity has nearly doubled in the past five years, solar has more than tripled. And the trend is set to continue. Solar installations are forecast to jump 34% in 2024, compared to a 5% increase for wind, according to BNEF. And outside China, by far the world's biggest market, wind farm installations may actually fall slightly this year." [See source.]

Wind projects suffer due to their hefty upfront capital requirements that are also very sensitive to interest rates. Cash shortfalls, bankruptcies, material defects, and other issues have also slowed wind capacity expansion in the short term.

High profile cancellations in New Jersey by wind power operator Ørsted have been banging around in the US courts during 2024, while a new issue has arisen in the form of an at least temporary lack of demand for approved offshore wind generation site leases. In Europe, Markbygden Ett in Sweden faced bankruptcy earlier in the year [see source] and World Marine Offshore already filed for bankruptcy in 2023 [see source]. Wind turbine manufacturer Senivon in Germany and more recently Siemen's Gamsea division have also racked up losses. Nevertheless, in the US, the federal government has approved its 10th scaled offshore wind site, enabling the development of capacity for approximately half of its 30 gigawatt (GW), 2030 goal. [See source.] Beyond this, last year "the EU-27 installed 16.2 GW […,] a record amount but only half of what it should be building to meet its 2030 climate and energy targets." [See source.]

Wind farms are clearly a long-term bet as they require significantly more capital up front than solar power and they have very long regulatory lead times. In spite of this, the IEA still forecasts that wind and solar will each surpass all other major forms of electricity generation by 2035—even coal! [See source.]

Solar photovoltaic cells generated an estimated 2.1 thousand Terawatt hours (TWh) of

INDUSTRY UPDATE: Energy

electricity in 2024 versus coal's 10.8. By 2035 the IEA sees solar and coal trading places, with solar reaching 10.7 TWh, wind 7.5, and coal declining to 7. One issue with this perhaps optimistic scenario is that most of the solar cell manufacturing capacity is and will be in China which, at an expected 1.2 TW output will have four times the annual capacity of the rest of the world combined. [See source.] Nevertheless, power "sector investment in solar photovoltaic (PV) technology is projected to exceed USD 500 billion in 2024, surpassing all other generation sources combined. Though growth may moderate slightly in 2024 due to falling PV module prices, solar remains central to the power sector's transformation." [See source.]

Longer term, hydrogen may well become a key pillar of both electricity generation and carbon neutrality, though "green" hydrogen derived from emission-free sources may have slowed its growth in the short term. Today hydrogen as a fuel is mainly utilized in industrial applications such as the production of fertilizer and is considered "grey", i.e., not emission-free. The same source suggests that the on-going investment in blue (by-product of industrial processes) and green (emission-neutral) hydrogen will gradually take share as they become more cost competitive. The game changer in this scenario will be "mobility", i.e., the widespread conversion of maritime, truck-fleet, and aviation to hydrogen power, though this will probably only ramp up in the 2040s. [See source.]

By the way, we have not even scratched the surface of innumerable opportunities to further adjust energy consumption. Take the conversion to heat pumps going on across the US and Europe: "The global heat pump market size accounted for USD 112.71 billion in 2024 and is expected to reach around USD 275.93 billion by 2034, expanding at a CAGR of 9.4% from 2024 to 2034." [See source.] Specifically, the "EU plans to increase the number of heat pumps installed from 20 million to up to 60 million in 2030." [See source.]

Transmission grid inefficiency and failure are two other major issues as the transition to electricity rolls out. In the US, 70% of the transmission lines and transformers are at least 25 years old. [See source.] According to one source's forecasts, "speeding up transmission expansion lowers U.S. electric system costs by $270–490 billion through 2050." [See source.]

The same issue of aging transmission infrastructure plagues Europe:

> *Around 40 per cent is over 40 years old, just ten years off its typical lifespan. An aging grid not only loses some electricity transmitted through it, but it cannot be connected to new sources of renewable energy, creating a bottleneck on green electricity generation in some EU member states. For example, in Poland, the grid did not have the capacity to accommodate electricity produced by solar panels, or small photovoltaic (PV) installations, several times this year.*
>
> *[…] The European Commission has itself estimated that €584 billion of investment is needed by 2030, to expand both the transmission and distribution grids.* [See source.]

And let us not forget the need for storage. Today's major workhorse is the Lithium-ion battery. The good news is that manufacturing capacity is increasing rapidly, from about 1.6 TWh in 2022 to 4 TWh in 2025, and a forecasted 6.8 TWh in 2030. Yet this capacity continues to be lopsided with 4.7 TWh—68% of the capacity in 2030—based in China while just 15% and 11% reside in the US and EU respectively. [See source.] Add rising trade tensions and much talk about tariffs to the mix, as well as the bottle necks in the supply of critical rare earth elements and the optimistic scenario offered by the IEA may seem a trifle ambitious. Certainly there are alternative battery technologies under development, [see source], and fuel cells continue to grow their share even if they do not grab many headlines [see source]. These latter technologies will both require significantly more scale, however, before they can really contribute as solutions.

Meanwhile, the insane power demands that lead artificial intelligence (AI) investors to seek energy deals with nuclear power facilities as Microsoft recently did with the operator of the Three Mile Island plant in Pennsylvania [see source] has brought a new urgency to the energy sector.

> …the widening use of AI will still imply an increase in the technology's consumption of power. A single ChatGPT query requires 2.9 watt-hours of electricity, compared with 0.3 watt-

INDUSTRY UPDATE: Energy

> *hours for a Google search, according to the International Energy Agency. Goldman Sachs Research estimates the overall increase in data center power consumption from AI to be on the order of 200 terawatt-hours per year between 2023 and 2030. By 2028, our analysts expect AI to represent about 19% of data center power demand.* [See source.]

Intriguingly, there may also be a way to significantly reduce the consumption of power by computers—including AI—though a major overhaul of computing hardware would be required. It seems that decisions made decades ago on how to manage the process of deleting information on a computer led to an enormous and on-going waste of energy. ""Reversible computing can be so much more energy efficient than conventional computing, and it's potentially the way we should have originally built computers," says Hannah Earley at UK-based reversible computing company Vaire Computing." [See source.]

> *The main reason why AI is so energetically costly is simple: standard computers use energy extraordinarily inefficiently. And they are inefficient because they are constantly erasing information. Though it may seem trivial, this action brings computers right into the crosshairs of the laws of thermodynamics, fundamental principles dealing with energy, heat and entropy, or the measure of disorder that also determines which processes can be reversed.* [See source.]

"In reversible computing, instead of running a calculation in only one direction (inputs followed by outputs) and then feeding the output to a new calculation and running it again, the computing can be done in both directions (known as "time-reversible" computing). Effectively, energy is retained inside the chip instead of being released as heat." [See source.] Unfortunately, this would require redesigning and replacing most computer chips and that, even if it ever gets off the ground, will take time. Think about the wholesale replacement of incandescent light bulbs with diodes, though, and you may begin to feel more optimistic. In any case, Vaire Computing did raise some initial seed funding, so, stay tuned. [See source.]

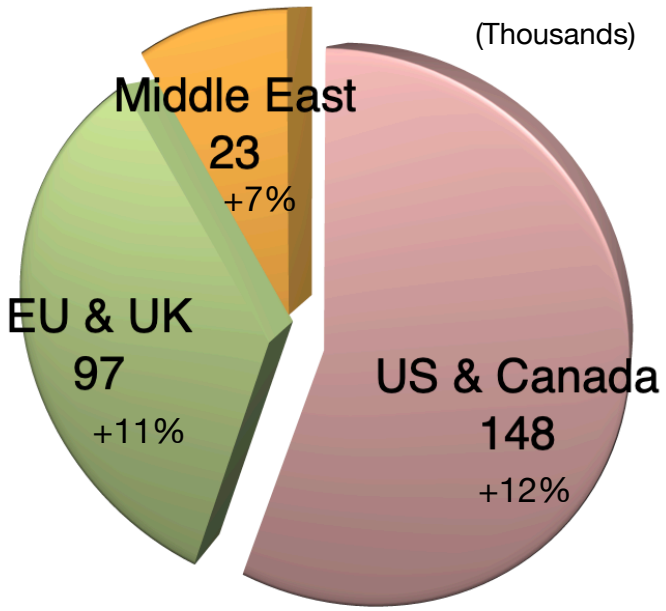
Clearly the energy sector is diversifying rapidly. New skills are called for. New horizons beckon. This means that talent drawn from other sectors is again in demand and the opportunities for executives to move between sectors are multiplying, so now let us examine the women and men who make all of those megawatts move.

The Market for Executives

LinkedIn tells us that more than 268,000 executives participate in the related fields of Oil and Gas, Renewable Energy, Environmental Services, and Electric Power Transmission, Control and Distribution—a cohort that has grown by 11% in the past year while almost 10,000 changed jobs. This means there were approximately 36,000 executive opportunities in the sector over the last twelve months, comparatively a very high fluctuation of 13%. *See the Editor's Note for a more detailed explanation of who constitutes an "executive."*

Chart 2 examines where this population works, its relative size, and growth rates. While overall LinkedIn rates the hiring demand as high,

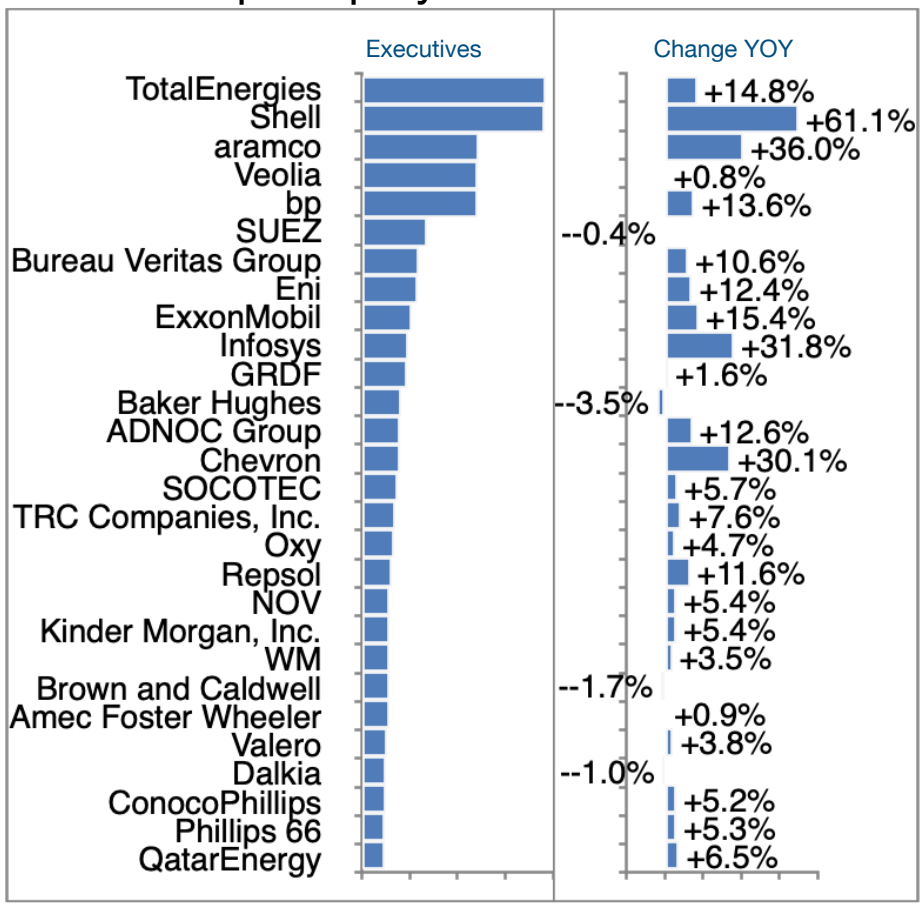
Chart 2: Executives per Region



INDUSTRY UPDATE: Energy

the US and Canada rank as very high, the EU and UK as high, and the Middle East as moderate in terms of hiring demand. This cohort has a strong male bias. Only 18% of executives are female.

Chart 3: Top Employers of Executives



Much of the exceptional growth in executive head counts (Chart 3) is related to M&A activity. "The oil and gas industry is on track for another record year of mergers and acquisitions (M&A) deals. In contrast to the global slowdown in M&A activity over the last couple of years, the energy sector experienced an M&A uptick with several major US deal announcements in late 2023. […] In the US, there were 84 M&A deals announced in Q1 2024 for the sector, worth a total value of $53 billion." [See source.] By and large these projects reflected a desire for diversification, though fracking in the Permian Basin area of Texas also played an out-sided role.

Total Energies engaged in a number of M&A projects in 2024 including acquiring hydroelectricity capacity in Norway. [See source.] Aramco grew by acquiring talent largely from regional players (including Sabic, the King Fahd University of Petroleum & Minerals, and Texas-based SLB). Consulting group Infosys grew very significantly through a net talent flow of more than 1,200 employees (not only executives) from Tata Consulting.

The only sizable decline (Baker Hughes) most likely reflects the on-going impacts of the firm's restructuring announced in 2022. [See source.]

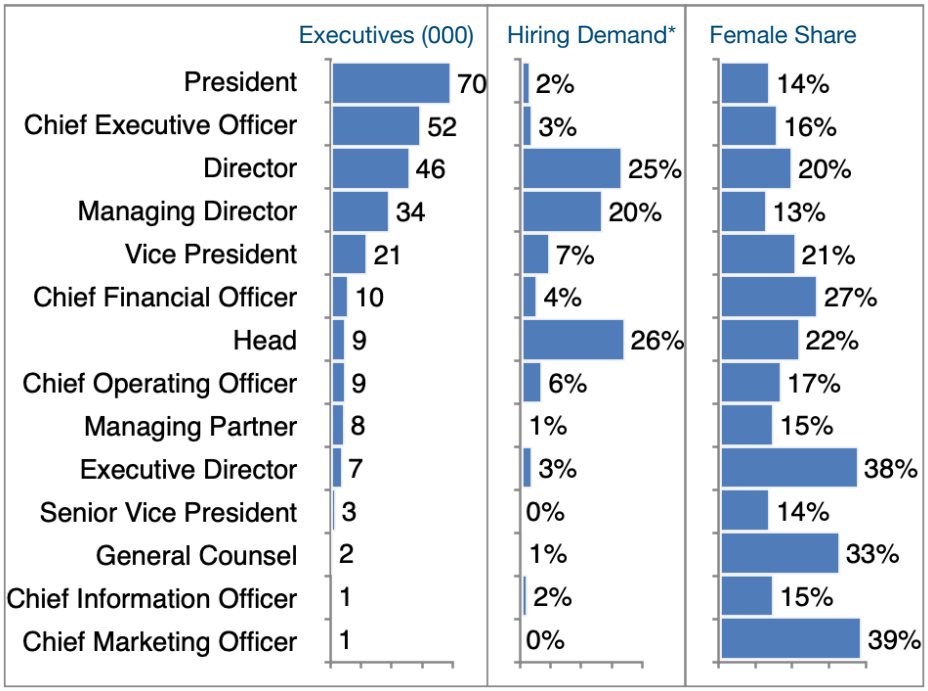
As is visible from the Top Employers chart, these firms include many rather large companies, but the overall composition of this executive cohort reflects many smaller firms as well. This is more readily visible in Chart 4: Executive Titles, as evidenced by the relatively lower proportion of VP titles and the high share of President and CEO roles.

Editor's Note:

In this Update "executives" will generally refer to the Vice President, Senior Vice President, Chief Operating Officer, Chief Financial Officer, Managing Director, Chief Executive Officer, Chief Marketing Officer, Chief Information Officer, Managing Partner, General Counsel, Head, President and Director titles principally located in the US, Canada, Europe, the UK, and/or the Middle East. Unless otherwise noted, the data in this Update will largely come from LinkedIn and represents a snapshot of the market as it was at the time of the research. Is LinkedIn truly representative? Here's a little data: LinkedIn has more than 1 billion users. (See Source.) It is by far the largest and most robust business database in the world, now in its 20th year. LinkedIn Talent Insights data is derived by aggregating profile data voluntarily submitted by LinkedIn members. As such, LinkedIn cannot guarantee the accuracy of LinkedIn Talent Insights data.

INDUSTRY UPDATE: Energy

Chart 4: Executive Titles

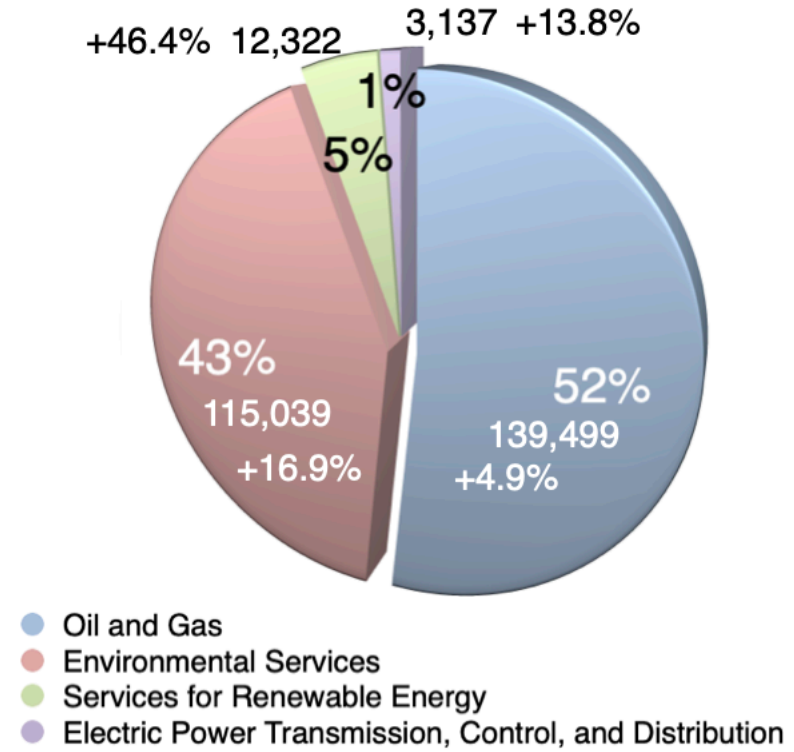


*The share of help-wanted ads posted for these positions on LinkedIn in the past year.

In the context of Chart 4, hiring demand refers only to what The Barrett Group (TBG) calls the published market, i.e., help-wanted ads. In general we find this to be about 15% of the overall demand. In our experience, the most senior roles are often filled by other means. [Read more about the unpublished market.] Nevertheless, this hiring demand data point does provide an indication of the relative demand for various roles whereby Head (of function) was hotly in demand, followed by Director and Managing Director. Though generally sparse, female executives predominate in the CMO (39%), Executive Director (38%), and General Counsel (33%) roles.

As alluded to earlier, one reason for the high fluctuation rate in this industry is the relative diversity of the executive opportunities as companies explore new segments, expand into new fields, develop and deploy new technologies, and generally evince a highly experimental approach. The growing imperative of taking carbon footprints into account is visible in Chart 5 as the growth in Environmental Services (+16.9%) far exceeds the other sectors. Not surprisingly, LinkedIn rates Environmental Services as well as the Electric Power sector both as evincing very high hiring demand.

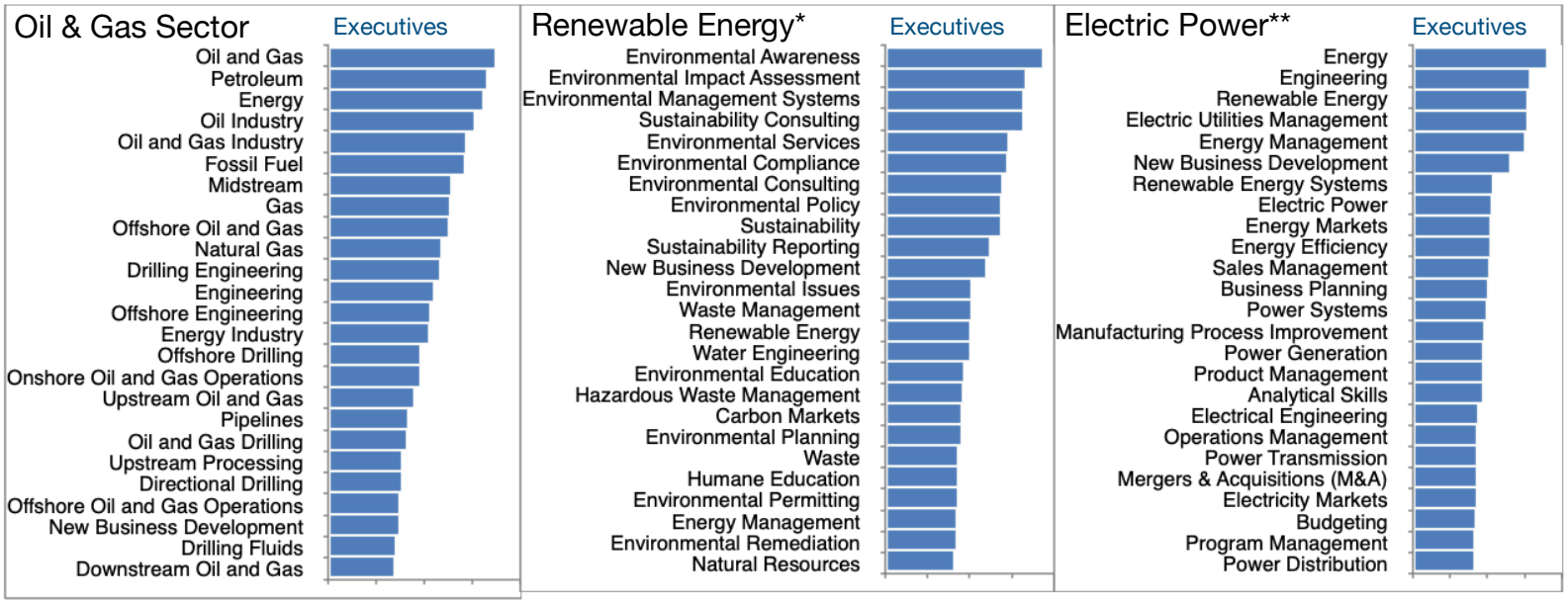
Chart 5: Executives per Sector



The relative growth rates of the various sectors in Chart 5's data juxtaposes curiously with the preponderance of executives highlighting various Oil and Gas specializations in Chart 6. Presumably many of these individuals will want to add Renewable credentials in the coming years given the pace and direction of developments in the industry.

INDUSTRY UPDATE: Energy

Chart 6: Executive Specializations



*Renewable Energy and Environmental Services; **Electric Power Transmission, Control and Distribution

This list looks quite dissimilar if we switch the lens to the Renewable Energy sector where Veolia, Suez, Bureau Veritas Group Infosys, Socotec, TRC Companies, and WM rank at the top of the cohort's employers—four of them based in France.

Of course, the Oil & Gas sector offers a list of well-known players with significant scale already supporting larger organizations. In this grouping Shell, TotalEnergies, Aramco, BP, ENI, ExxonMobil represent the top employers.

As explained earlier, there is and will be significant movement between the various sectors covered in this Industry Update, however, when one looks at the specializations or skills that executives have entered in their LinkedIn profiles, there remain significant differences. One variable is the size of the populations. While Oil & Gas executives in Chart 6 range between 13,000-35,000 per specialization, or Renewable Energy executives number from 11,000-24,000, the Electric Power segment counts just 250-540 executives per skill area.

Another dimension that may be glossed over on Chart 3 is the top employers per segment. For example, the smaller Electric Power cohort boasts a very specific employer ranking with Southern California Edison at the top, followed by Center Point Energy, Centrica, NiSource, Regal Rexnord, British Gas, and GE Grid Solutions in its top tier.

Turning to the actual specializations in Chart 6, while there are a few more generic areas of focus such as New Business Development or Sales Management, by and large, the disciplines are highly specific to the energy industry. Executives contemplating entering this field would do well to remember the relative growth rates, too, of the three sectors as laid out in Chart 5.

Of course, clients of The Barrett Group have access to far more granular data than we can provide in a general industry update whether at the outset of their program or in preparation for a specific interview.

The following Spotlight takes a slightly deeper look at the obstacles and opportunities electric vehicles (EVs) may offer the world.

INDUSTRY UPDATE: Energy

Spotlight on Electric Vehicles

"Globally, private cars and vans were responsible for more than 25% of the world's oil consumption in 2022. However, the rise of heavier and less efficient vehicles, such as SUVs, has slowed progress on improving vehicle efficiency." The sector accounts for something on the order of 10% of global CO_2 emissions. [See source.]

This is why many car companies have announced strong investment amid significant public relations hype for their EV-based emissions-reduction strategies. However, recently several manufacturers have backed off their earlier ambitious EV plans. GM, for example, lowered its forecast 2024 EV output projections by 50,000 units. Toyota has postponed its plans to build EVs in the US by at least one year to 2026. Volvo announced that it is dropping its plan to go 100% EV, and Ford seems to be changing course from all-electric to hybrid technology on a number of models. [See source.]

Nevertheless, including hybrids (PHEV) and EVs, globally unit sales in 2023 reached 14.2 million, up 35% vs. internal combustion vehicles' 10.5% increase. EVs and PHEVs reached 1.4 million units in the US, 3.2 million in Europe and 8.4 million in China. [See source.] "We're predicted to see 17 million in sales by the end of 2024. Electric cars could account for 20% of total car sales by then." [See source.]

Of course charging an EV is rather critical to its scaled adoption. What is the prognosis on this front?

The IEA has this to say on the subject: "[…] by 2030 there will be 33 million EVs on the road and 28 million EV charging ports will be needed to support them. The majority of charging will be at home and work, with the public network for opportunity charging and less common long trips." [See source.]

Clearly, the world has a long way to go. Here are a few actual and/or planned updates on the roll out of charging opportunities:

- *China accounted for 70% of global public LDV [light duty vehicle] charging in 2023 and is expected to remain a leader with a similar share in 2035. [See source.]*
- *In Europe, the [forecasted] stock of public LDV chargers increases to around 2.7 million in 2035 […], up from about 730 000 in 2023. [See source.]*
- *In Q2 2024, the number of EV charging ports in the [US] Station Locator grew by 6.3%, or 12,485 EV charging ports, bringing the total number of ports to 211,382." Most of the progress remains in the northeastern US and California.* [See source.]
- *In the United States, the government has announced nearly USD 50 million to subsidise projects that aim to expand access to convenient charging, in line with its objective of building a national network of 500 000 public EV charging ports by 2030. In the APS [a planning scenario], the number of public chargers reaches 900 000 in 2030 and 1.7 million in 2035, many of which will likely be funded by private investment and go beyond highway corridors. This translates to about 55 electric LDVs per charging point in 2035.* [See source.]

So although the future may be bright for EVs, the next few years may be difficult as the Economist recently reported:

> *Carmakers had a testing year, as they contended with growing trade tensions between China and the West. The eu and America imposed tariffs on Chinese electric vehicles, accusing Beijing of handing out unfair subsidies to local firms. The move caused concern among European manufacturers such as Volkswagen and bmw, which feared Chinese retaliation and disruptions to their operations in the country.*
>
> *Meanwhile, China's export restrictions on critical minerals like gallium and germanium squeezed carmakers' profit margins. byd, a Chinese firm, overtook Tesla as the world's largest manufacturer of evs. For startups, the landscape was even bleaker. Investor fatigue and missed production targets slashed the combined valuations of three American challengers, Rivian, Lucid, and Fisker, from $250bn in 2021 to $19bn. Many now face extinction, unable to compete with established automakers or the rapid global expansion of Chinese firms.* [Source: https://www.economist.com/the-world-in-brief, "Trade tensions shake the EV industry", December 2024]

In short, hold on. It may be a bumpy ride.