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RENEWABLES

FUELING THE NEXT ENERGY TRANSITION

HIGHLIGHTS

- At the end of the second decade of the twenty first century, the world seems to be gearing up for yet another transition in energy. This time from hydrocarbons to cleaner and renewable sources amid environmental and sustainability concerns, and global warming.
- The transition away from oil and into renewables has the potential to lead to structural changes in energy markets and global geopolitics. Oil companies will face serious challenges in adapting and transforming their business models, while oil-producing countries will have to adapt and find new sources of revenues to preserve their socio-economic well-being.
- The major trends accelerating the transition to clean energy include regulatory directives issued by governments, economically driven catalysts related to significant declines in costs, growing electrification of energy, and technological advancement that is making energy both smarter and cheaper.
- Of the total electricity generated globally, excluding hydropower, 8.4% was generated from renewable sources in 2017 compared to 2.4% in 2007. This percentage rises to 18.3% for Europe which is at the forefront of the global energy transition.
- China has made tremendous progress in green transformation. It is now generating around 7.3% of its electricity from renewable sources compared to 0.5% 10 years ago.
- The Middle East is still lagging its global peers but this seems to be about to change. GCC countries are planning major investments in the field of renewables which has the potential to drastically change the power generation dynamics in the region.

A HISTORY OF ENERGY TRANSITIONS

History is ripe with transitions into more efficient and cheaper energy sources and human development and prosperity typically went hand-in-hand with such transitions. For most of history, humans have relied on wood and muscle power, first their own and then that of domesticated animals, as their primary source of energy. These sources of energy lasted for millennia, but it wasn't until humans started using coal on a large scale that they were able to take the next big step on the development ladder.

The first major energy transition was wood and muscle to coal. Coal practically fueled the industrial revolution since it was a much more efficient source of energy and had a significantly higher yield than wood. But even as coal occupied a significant space in the global energy mix, another transition was brewing. Oil started to emerge and was being used on a rather small scale. The development of the internal combustion engine and the widespread use of electric power along with the development of advanced refining technology, ushered the advent of the age of oil. Steam engines on ships and locomotives were converted to diesel and steam boilers for the generation of electricity were being replaced by oil boilers. It wasn't long until oil, or black gold, became the main global source of power, both industrial and political. Oil became the major source of fuel that helped propel the world into the twenty first century and largely defined the geopolitics that governed the interests of and the relations among oil producing countries, major world powers, and industrialized nations.

At the end of the second decade of the twenty first century, the world seems to be gearing up for yet another transition in energy. This time from fossil fuels or hydrocarbons, to cleaner and renewable sources amid environmental and sustainability concerns, and global warming. The same way the transition to oil has shaped the twenties century, the transition away from oil and into renewables has the potential to lead to structural changes in energy markets and global geopolitics. Oil companies will face serious challenges in adapting and transforming their business models, while oil-producing countries will have to adapt and find new sources of revenues to preserve their socio-economic well-being.

Having said that, there is a significant amount of uncertainty about the speed and the reach of this transition. Coal has been in use for centuries and the transition to oil and nuclear power haven't displaced it entirely yet. What is certain, however, is that the world will be demanding more energy rather than less, and that the world's dependence on oil as a primary source of energy will have to eventually decline. Even though the speed and the magnitude of this transition are still difficult to determine, the transition may be happening at a much faster rate that many realize. The level of adoption and conversion, and the speed of the technological advancement in the renewables space, especially in energy storage and solar panels, and the rate of decline in associated costs are few of the factors that are accelerating the transition.

TRENDS ACCELERATING THE TRANSITION

According to the BP's annual energy outlook 2019, wind, solar, and other renewables will account for around 30% of the world's electricity supplies by 2040 up from 25% as per last year's estimate. Given the current trends, BP expects this energy transition to be the fastest in history. Oil took 45 years to go from 1% to 10% of global energy in the late 1800/ early 1900. Gas took over 50 years from the beginning of 1900. Renewables, in contrast, are expected to go from 1% to 10% in just 25 years in BP's central scenario, with a possibility of that period going down to 15 years in the event of a faster switch to a low-carbon economy.

The major trends accelerating the transition to clean energy include regulatory directives issued by governments, economically driven catalysts related to significant declines in costs, growing electrification of energy, and technological advancement that is making energy smarter and disrupting the traditional model of central production and distribution of electrical power.

Deadlines on Sales on Gasoline and Diesel Vehicles

In terms of regulatory catalysts, the list of countries banning the sale of new vehicles running on diesel and gasoline is expanding. The ban is predominately on new vehicle sales with timelines starting as early as 2025 and all the way up to 2040. This could be an important driver for automakers to accelerate the production of Electric Vehicles (EVs) and expand their product lineup. According to Bloomberg New Energy Finance (BNEF), at the start of 2016 the number of EVs models available was just 97. By the end of 2017 this number jumped to 156 and is expected to reach 217 by the end of next year. General Motors announced plans to introduce at 20 EV models by 2023, while Volkswagen promised 20 EV models by 2020 and around 300 by 2030. Starting 2019, Volvo will only be producing fully electrical or hybrid cars.

This trend, however, is not confined to passenger vehicles. It is also extending to larger means of transport such as delivery vehicles, mini-trucks and buses. In December 2017, the Chinese city of Shenzhen completed the transition of its bus fleet to 100% electric. The city has a total of 16,359 buses which, to add some perspective, according a Bloomberg, is greater than the five largest North American bus fleets of New York City, Los Angeles, New Jersey, suburban Chicago and Toronto combined.

Big Oil Is Joining in

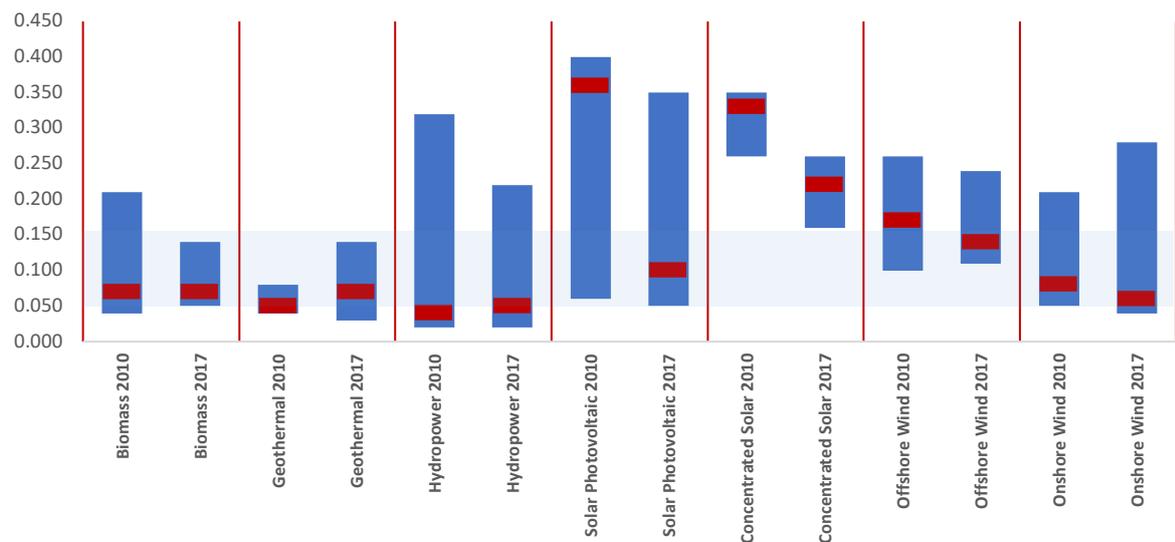
Another important trend is that big oil companies are making significant investments in renewable energy sources. Royal Dutch Shell has recently announced a plan to double the amount it spends on green energy to \$4billion annually up from the originally announced \$2billion. Statoil, Norway's state-owned oil company, is drawing on its expertise in offshore oil drilling to make big investments in offshore wind farms. It has successfully deployed the world's first floating windfarm off the coast of Scotland. Statoil is planning to invest more than \$16 billion in renewables in the coming two decades. Total, the French oil giant, which has become one of the major global players in Solar and battery power, is planning for its low-carbon business to reach 20% of its portfolio by 2035.

Energy Is Getting Smarter ...and Cheaper

Technology is also playing a huge role in accelerating the switch to renewables. Energy is getting smarter and the traditional model of central electricity production and transport over long distances is being disrupted by the virtual power plant. South Australia will be home to the biggest virtual power plant in the world as it embarks on a project to connect up to 50,000 home solar PV and Tesla’s Powerwall battery systems across the south of the country. This technology, although still in the testing phase, has the potential to revolutionize how electricity is produced and delivered. It was developed out of necessity in southern Australia to overcome difficulty and cost constraints related primarily to the transportation of electricity over vast distances, frequent outages, and the high cost of maintenance. If its effectiveness is proven, it could serve as the pilot project for similar undertakings on a global scale.

Perhaps one the most significant development that is materially accelerating the transition is the generally declining cost of renewables. Clean energy is becoming increasingly affordable, and in many instances comparable to hydrocarbon alternatives.

Chart 1. Global levelized cost of electricity from utility-scale renewable power generation technologies 2010-2017



Source: IRENA Renewable Energy Cost Database, blue band represents the fossil fuel-fired power generation cost range.

The chart above from the International Renewable Energy Agency (IRENA) depicts the evolution of the cost range and the average of major green energy alternatives over the past 10 years. It also shows the fossil fuel power cost range as the light blue shaded area. The average cost is shown as the red marker on the vertical bars.

The most meaningful observation is in the field of Solar photovoltaic (PV) and Concentrated Solar (CS). The average cost for Solar PV is now within the range of fossil fuel cost and stood at \$0.100/ kWh during 2017 down from \$0.360/ kWh. That’s a 72% decline for the most popular source of decentralized renewable electricity generation for homes. Other sources have also seen significant cost declines; the average cost for the more centralized Concentrated Solar is down 33% to \$0.220/ kWh, while that of onshore and offshore wind declined by 25% and 18% respectively over the same period.

Green is the New Black

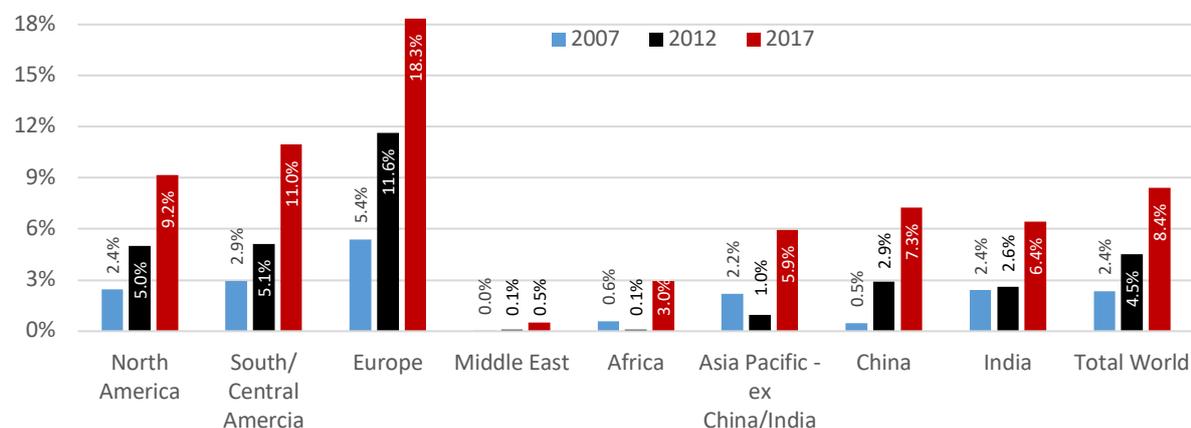
Corporates are also embracing green energy and low emissions initiatives as part of their social responsibility undertaking. The RE100, an acronym for Renewable 100 percent, is a “collaborative, global initiative uniting more than 100 influential businesses committed to 100% renewable electricity, working to massively increase demand for - and delivery of - renewable energy”. As of March 2019, RE100 has in fact secured commitments from 166 companies to go 100% renewable. The list comprises some of the most influential multinationals in financial services, insurance, industrial, and retail including the likes of Apple, Facebook, Bank of America, Microsoft, Google, Coca-Cola, Nike, Walmart, Visa, 3M, and Unilever to name just a few.

This trend has become like a competition among multinational companies and renewable energy commitments have become the new norm. To participate in the RE100, members must set a public goal of sourcing 100% of their energy needs from renewable sources by a specific year. They would disclose their electricity data annually and RE100 will report on their progress. Although some of the target years for many members stretch as far as 2050, the RE100 Progress and Insights Annual Report 2018 showed that 75% of the member companies are aiming to reach their targets by 2030. Moreover, six members have already reached their 100% goal while 37 are already over 95% renewable. According to RE100, if the member companies were a country, it would have the 23rd largest electricity consumption in the world at more than 188 TWh per year. The member companies have a total combined revenue of around \$4.5 trillion or 5% of global GDP which represents an important source of finance to clean energy infrastructure.

GREEN ENERGY GENERATION IS GROWING FAST

According to the BP Statistical Review of World Energy (June 2018), the share of electricity generated from renewable sources, excluding hydropower, has almost quadrupled in the past 10 years on a global level.

Chart 2. Percent of Electricity Generated from Non-Hydro Renewable Sources



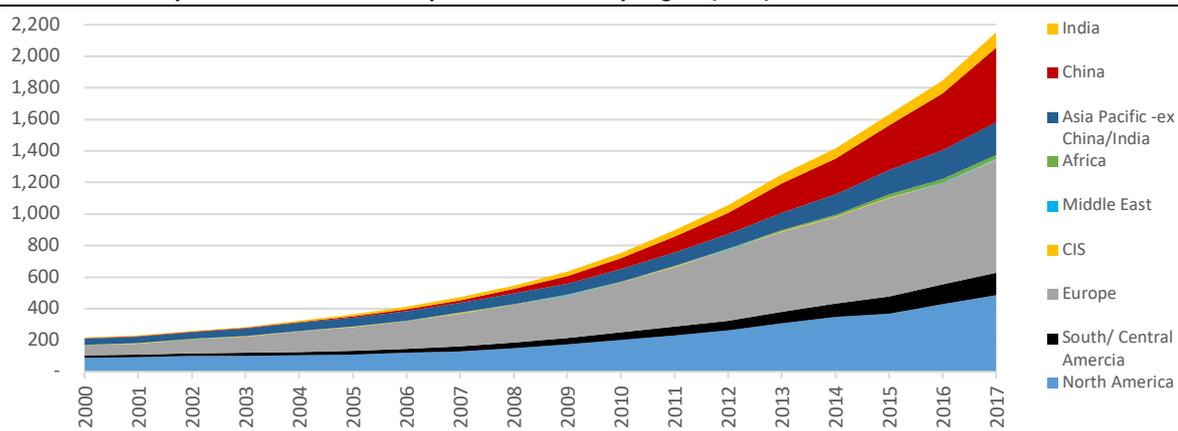
Source: BP Statistical Review of World Energy (June 2018), NBK Capital

Of the total electricity generated worldwide, excluding hydropower, 8.4% was generated from renewable sources in 2017 compared to 2.4% in 2007. Europe and the Americas are still the world leaders in terms of share of renewable electricity generation. Europe advanced from 5.4% to 18.3% over the past decade, while South and Central America grew from 2.9% to 11.0% over the same period. The United States and Canada rank 3rd as a region with 9.2% compared 2.4% in 2007.

Europe has been at the forefront of adopters in renewable energy with a share of around one third of worldwide electricity generated from green sources or the equivalent of 715 TWh in 2017.

The most impressive progress, however, was in China. It used to generate 0.5% of its total electricity from renewable sources as recently as 2007. Now, 10 years later, this percentage is up to 7.3%, or the equivalent of 471 TWh out of the total electricity generated in 2017 of 6,495 TWh. That's the equivalent of 22% of the total electricity generated from green sources worldwide and compares to 22.5% for North America and 33.2% for Europe.

Chart 3. Electricity Generation from Non-Hydro Renewables by Region (TWh)



Source: BP Statistical Review of World Energy (June 2018), NBK Capital

In the Middle East, of the total electricity generated during 2017 of 1,211 TWh, only 5.97 TWh or 0.5% was generated from renewable sources according to the BP Statistical Review of World Energy. The region is still far behind in terms of renewable energy adoption and is mainly reliant on hydrocarbon for electricity generation. This, however, seems to be changing.

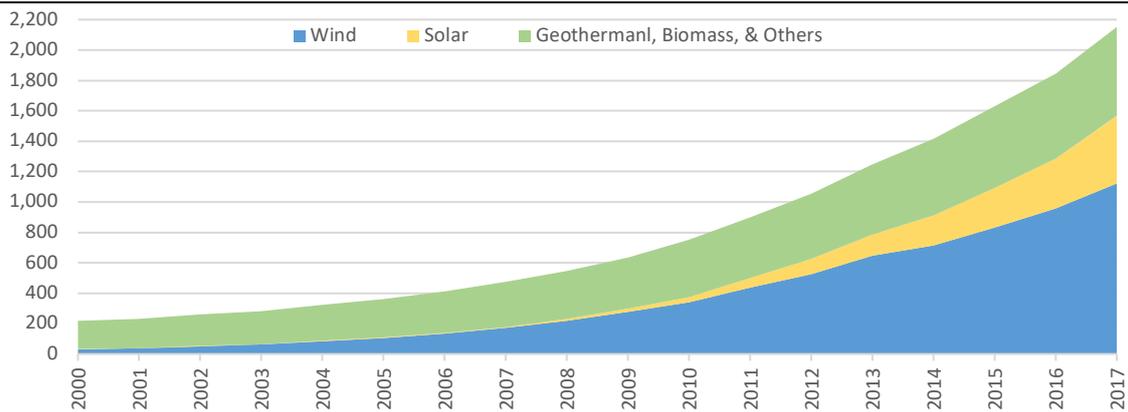
As part of its Vision 2030, Saudi Arabia is intent on integrating renewable sources, especially solar power, in its electricity generation power mix. The ground breaking for the SAR 1.2 billion 300 MW Sakaka solar power project in Al Jouf started in late 2018 with an estimated completion date of October 2019. This and other similar projects are part of the plan to shift the country's reliance on fossil fuel into more sustainable sources in addition to job creation across the solar value chain. Other projects are in the pipeline and, according to a statement by minister Khalid Al-Falih in the Abu Dhabi Sustainability Forum in 2018, the Kingdom is planning around 60GW of power generation from renewable sources by 2030.

In a new report published by the International Renewable Energy Agency (IRENA), renewable energy has become the most competitive form of power generation in the countries of the

Gulf Cooperation Council (GCC). IRENA said that achieving the stated 2030 targets on a regional basis could bring significant economic benefits to the region such as creating hundreds of thousands of jobs and saving some 354 million barrels of oil equivalent (MBOE) in the region’s power sector.

DRAMATIC DECLINES IN COST DRIVING GROWTH

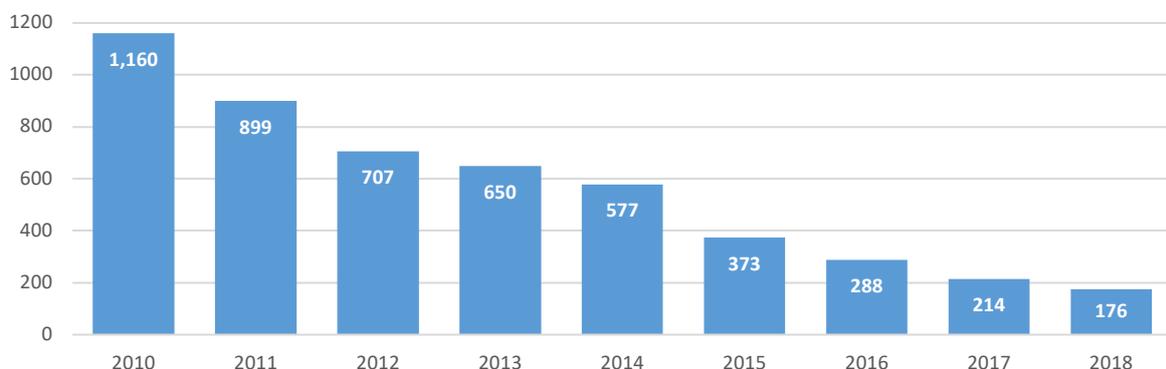
Chart 4. Electricity Generation from Non-Hydro Renewables by Source (TWh)



Source: BP Statistical Review of World Energy (June 2018), NBK Capital

Biomass, geothermal and other sources as a group have been the main component of the renewable energy sources mix until 2010. Since then there has been a phenomenal growth in wind power which grew from around 14% at the beginning of the century to a little over 50% since 2012 with an annual growth rate of 21% over the past ten years. Solar power, on the other hand, has been growing at a whopping 50% annually since 2007 and reached a share of 21% in the energy mix at the end of 2017.

Chart 5. Cost of Lithium-ion Battery Packs (USD/ KWh)



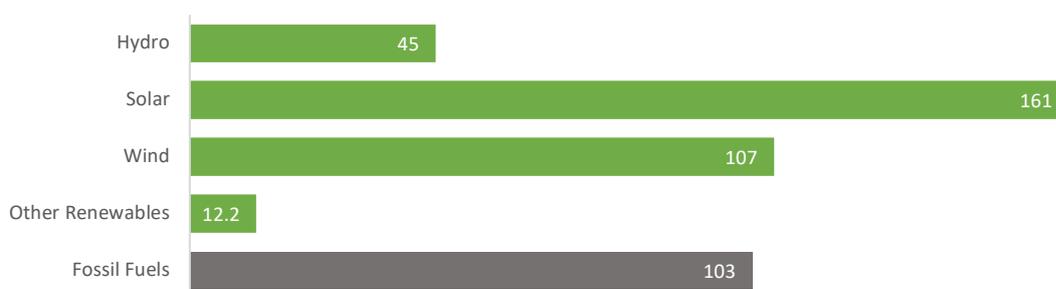
Source: Bloomberg New Energy Finance (NEF) – data adjusted to real 2018 dollars

Solar PV is becoming more affordable thanks to the declining cost of solar cells and batteries. The cost of lithium-ion batteries dropped down from around USD10,000 in the early 1990s to less than USD 200 currently and is projected to drop below the USD 100 mark within the next

two years. According to data compiled by Bloomberg New Energy Finance (BNEF), the average cost has dropped from USD1,160/ KWh in 2010 to USD 176/KWh as of 2018, or the equivalent to 85%.

The rapid decline in the cost of energy storage, in addition to technological advances in wind and solar are allowing renewable alternative to effectively compete with coal and gas power plants. This is making investments in renewable energy for power generation more economically feasible and more socially acceptable. According to BNEF, total investments in renewable electricity generation amounted to around USD 326 billion in 2017 globally compared to USD 103 billion for fossil fuel-based plants. This is very telling about current trends and the future direction of the global energy mix. The International Energy Agency projects that by 2050, renewables will account for 64% of the world’s total electricity generation mix, with wind and solar accounting for 48%. Fossil fuels (Oil, Gas, and Coal) will have a share of less than 30% of which gas will represent the majority.

Chart 6. Investments in Electricity Generation in 2017 – Renewable vs. Fossil Fuel (USD Billion)



Source: Bloomberg New Energy Finance/ U.N. Environmental Program, Stratfor

CHINA IS LEADING ON MULTIPLE FRONTS

Over the past few years China has made tremendous progress in the renewable space and has become the world leader in many ways. Around 40% of global clean energy investments in 2017 was in China, accounting for more than USD 130 billion. Data released by China’s National Energy Administration revealed that the country has installed 52.8 gigawatts of new solar capacity in 2017 up from 34.2 gigawatts a year before. This is on top of 12.8 gigawatts of hydropower and 45.78 gigawatts of thermal.

China dominates the global supply chain for solar energy as it produces around 60% of the solar cells produced globally and 71% of solar modules. This trend is expected to continue as 70% of planned supply chain expansions in solar are in China. It is also the world’s leader in Electric Vehicles (EVs) manufacturing and sales. Global EVs sales reached 2.1 million units in 2018 (according to data published by ev-volumes.com), out of which 1.2 million were sold in China or the equivalent of 57% of global sales volume.

China has become the world's biggest miner and supplier of rare earth materials used in the production of batteries. It has also acquired substantial cobalt and lithium mining rights in Africa, South America, and Europe, where it also invested in electric utilities. It has enough battery production planned to triple the rest of the world's. Contemporary Amperex Technology Ltd. (CATL), a lithium battery manufacturer in southeast China raised USD 850 million in a hugely oversubscribed IPO in June last year. It will use the proceeds to become the largest battery producer globally displacing both Tesla and Chinese giant BYD.

FINAL THOUGHTS

The energy transition that the world is undergoing is real and it could be happening at a much faster pace than many have imagined. A combination of factors are working together to accelerate this transition including efforts by governments to honor their environmental commitments related to climate targets, and by the private sector that is starting to make economic sense from renewable energy solutions.

Advancements in renewable technologies such as wind and solar, in addition to storage, which has been a major industry bottleneck, are now opening the way for large scale adoption of green power generation. Steep reductions in costs have made some renewable solutions very competitive compared to traditional gas or coal powered electricity generation. The growing electrification of energy is displacing coal and gas in power generation and oil in transportation through a growing demand for and availability of EVs. The disrupting power of renewables is changing transportation, power generation, and transmission, and could, in a sense, be democratizing the power industry by changing the traditional centralized model of power generation and distribution into a smart decentralized virtual power plant.

This does not mean that oil, even in the longer term, will cease to be used. Just as coal is still used today, oil will most likely stick around but its importance will most definitely wane. If this scenario were to happen, it will cause structural changes in the global economy and have profound effects on international relations and geopolitics. This is will be highly dependent, however, on the speed and the depth of transition and the who will be the major winners and losers that would emerge from it.

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