



**13th Biennial International Conference and Exhibition
GLOBAL ENERGY & ASSOCIATED DYNAMICS: WHERE. HOW. WHEN.**



CA. Naman Khanna*

Hindustan Petroleum Corporation Ltd., New Delhi

namankhanna@hpcl.in

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Abstract

This piece has been drawn to assess the variables decisive in charting Energy Trends synced with global dynamics. The assessment carried out for charting trends has been used to lend accuracy to way ahead.

How energy is main economic and social driver, is a pertinent question to be answered for evaluation of factors Energy Trends. The paper concentrates on factorizing the contributors. This paper has evaluated the sensitive geopolitical scenarios and ever changing dynamics of economic strengths and growth prospects of countries that have high influence on Energy issues. Dominance of fossil fuels and how they are going to fare in longer run and the extent to which climate change challenges shape up the policy matter have been assessed in consolidating trends. Propensity of Solar energy to register the highest growth and its impact is gauged by associated research of the field and policy centric orientation upgradation favoring alternate energy sources. Polity dynamism and regulatory risk threatening investment in innovation and infrastructure.

The paper maps the way forward on the basis of trends designed considering the dynamism and challenges. Mobilizing necessary capital and ensuring access to energy in the charted way forward is discussed. The paper also investigates into the how trends projects and estimates the enroute corrections and mends which will ensure secure, affordable and environmentally sensitive energy.

Introduction

“Every two minutes, the energy reaching the earth from the sun is equivalent to the whole annual energy use of humanity. All the energy - the cars, lighting, and air conditioning of the world - in one year is equivalent to two minutes of the sun,” said Dr. Lamya N. Fawwaz, vice-president for Institutional Advancement and Public

Affairs at Masdar Institute of Science and Technology (MIST). She was speaking at the 22nd Solar Power and Chemical Energy Systems (Solar PACES) Conference, co-hosted by Masdar Institute and the UAE Ministry of Energy in Abu Dhab.

The message that this remark brings home is essentially the untapped potential of perpetual energy source free from all constraints that sensitivity towards environment may impose. Industrial revolution was fueled by energy dominantly sourced from fossil fuel, but so was political instability and stark disparity in allocation of resources resulting in economic strength over last millennia. Economies of major portion of Middle East has predominantly been dependent upon fossil fuel. Any fluctuation in fossil fuel pricing had corresponding, approximate to proportionality, impact on their economy. The same heat has been measurable in the economies dependent upon Oil imports for fueling their industrial expansion.

Recent dynamics influencer - including and not limited to political scenarios, Shale gas, climate change and policy upgrade - has to large extent forced stakeholders to stop, take stock and mend orientation with greater focus on energy security, its affordability and sensitiveness towards climate.

Design of Study

The paper follows a charted route which encompasses elaborate scheme of assessment of contributors or factors which would prove to be decisive for future estimation, present status of those contributors/factors and the trend in likely scenarios would these contributors/factors will follow and lastly, new contributors/factors that would gain importance and how the changing dynamics would shape future.

Renewable

Renewable energy is at the centre of the transition to a less carbon-intensive and more sustainable energy system. Renewables have grown rapidly in recent years, accompanied by sharp cost reductions for solar photovoltaics and wind power in particular. The



electricity sector remains the brightest spot for renewables with the exponential growth of solar photovoltaics and wind in recent years, and building on the significant contribution of hydropower generation. But, electricity accounts for only a fifth of global energy consumption, and the role of renewables in the transportation and heating sectors remains critical to the energy transition. The share of renewables in meeting global energy demand is expected to grow by one-fifth in the next five years to reach 12.4% in 2023.

Renewables will have the fastest growth in the electricity sector, providing almost 30% of power demand in 2023, up from 24% in 2017. During this period, renewables are forecast to meet more than 70% of global electricity generation growth, led by solar PV and followed by wind, hydropower, and bioenergy. A modest increase in the share of renewable heat is foreseen, as robust growth in total heat demand is expected to result from continuous economic and population growth. Renewables in transport have the lowest contribution of all three sectors, with their share growing only minimally from 3.4% in 2017 to 3.8% in 2023. Although they expand by almost one-fifth over the forecast period, renewables cover only a small portion of all energy demand in transport because of ongoing petroleum product consumption. The world's CO₂ emissions are set to continue rising for decades unless there is greater ambition on climate change, despite the “profound shifts” already underway in the global energy system. Outcome of policies already set out by governments, a surge in wind and solar power would see renewable sources of energy meeting the majority of increases in global energy demand. But a plateau for coal, along with rising demand for oil and gas, would mean global emissions continue to rise throughout the outlook period to 2040. For sustainable development at least 50% chance of limiting warming to 1.65C would be required in line with the Paris Agreement. Investment away from fossil fuels towards efficiency and renewables, as well as the retirement of around half the world's fleet of coal-fired power stations and other changes across the global economy. Warming to no more than 1.5C above pre-industrial temperatures, the aspirational goal of the Paris Agreement.

Rising demand

On the basis of stated plans and policies around the world, global energy needs will continue to rise by 1% per year until 2040, adding demand equivalent to China's current total. This growth is driven by a rising population – based on the UN's “medium” projections to reach 9 billion people by 2040 – and an expanding economy, with global GDP increasing by 3.4% a year, per International Monetary Fund projection. The rate of energy demand growth is around half the average rate of 2% seen since 2000, due to shifts towards less energy-intensive industries, energy efficiency gains and “saturation effects” – for example, where demand for cars reaches a peak. Gas use is also expected to rise rapidly, overtaking coal to become the second-largest source of energy after oil and meeting a third of the rise in overall demand.

Global primary energy demand by fuel, millions of tonnes of oil equivalent, between 1990 and 2040. Other renewables includes solar, wind, geothermal and marine. In contrast to the rapid gains for gas and renewables, coal use plateau and then decline slightly from today's levels. Oil demand will start to level off by the 2030s as a result of vehicle fuel-efficiency gains and the rise of electric vehicles (EVs), which see passenger car oil demand peak in the late 2020s. There are profound questions over the future of conventional cars, given falling costs for EVs. Oil demand for freight, shipping, aviation and chemicals continues to grow, with the growing popularity of SUVs another potential factor propping up demand. (Notably, documentation for the Saudi Aramco share sale also has global oil demand levelling off from around 2035.

Some two-thirds of the increase in global energy demand to 2040 comes from the Asia Pacific region. India becomes the world's most populous country and its energy demand doubles, making it the single largest contributor to global growth and accounting for more than a quarter of the total increase. Within this total, rising coal demand from Asian countries offset large declines in the US and Europe. Infrastructure have slowed sharply, but the large stock of existing coal-using power plants and factories.

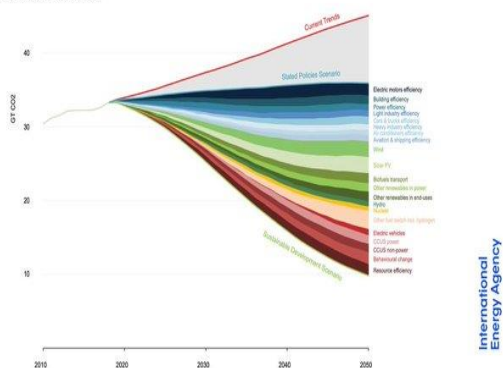
Shifting shares



The rise of renewables as anticipated is demonstrative of the profound shifts yet it also points to the slow moving nature of the global energy system, as exemplified by the long, high plateau in demand for coal. a future where renewables meet half of the increase in demand to 2040, and the pace of growth slows due to shifting economic factors and energy efficiency, it remains well short of putting a cap on global CO2 emissions. If increases in global temperatures are to be stopped, then even more decisive changes will be required.

Average annual change in global energy demand, by fuel, million tonnes of oil equivalent. The rising portion of demand growth met by renewables sees the fossil fuel share of global energy use decline from 81% in 2018 to 74% in 2040. By the 2030s, investment in fossil fuels without carbon capture would halve, relative to the average during 2014-2018. At the same time, investment in renewables, electricity networks and nuclear would roughly double and spending on energy efficiency would nearly quadruple. This reflects the fact that energy efficiency is the single most important factor in tackling emissions.

Energy-related CO2 emissions & reductions in the Sustainable Development Scenario by source
 World Energy Outlook 2019



Lower demand has knock-on consequences, particularly when combined with more rapid growth from renewables. Within this total, coal use in the power sector would be hardest hit. More than half of current coal-fired power stations would retire by 2040, representing a fleet larger than China’s current capacity. With half of retirements coming before the end of their useful lives, some of the \$1tn of capital invested in the world’s existing coal fleet would be put at risk, if warming is kept below 2C. Some 98% of the

222 gigawatts (GW) of coal in Europe and 88% of the 276GW in the US would close. The remaining coal plants would mostly need to be repurposed or retrofitted. This means they would either operate limited hours, during peaks in demand and troughs in renewable output, or would face substantial investments to fit carbon capture and storage (CCS) technology to prevent their CO2 emissions. This year’s outlook contains new analysis on the methane released during coal mining, which it suggests has a greater warming impact than aviation and shipping combined.

CO2 emissions

Global CO2 emissions from energy would continue to rise from the record level they reached in 2018, putting the world on track for upwards of 2.7C of warming this century. In contrast, CO2 declines quickly to 17% below 2010 levels by 2030, 48% by 2040 and 68% by 2050. This is on course for net-zero emissions by 2070 and corresponds to a 50% likelihood of limiting warming to 1.65C, or a 66% chance of 1.8C. This trajectory is less ambitious than most pathways to 1.5C with no or limited overshoot. In its special report on 1.5C, the Intergovernmental Panel on Climate Change (IPCC) said this would need CO2 to fall 45% below 2010 levels by 2030 and to net-zero by 2050.

Global CO2 emissions from energy and industrial processes in the past and under a range of different scenarios for the future.

Coal changes

Despite the near-term increase in expected demand, coal use would remain below the global peak reached in 2014. Rising demand in India is one of the key factors holding global coal use steady, despite rapid falls in developed economies, such as the US and EU. Part of the reason for this increase in India is a large expected buildout of new coal-fired power stations, with 232GW of capacity built by 2040, roughly doubling its installed capacity and accounting for a third of global additions. India’s coal capacity growth could be cut sharply, if declines in the cost of battery storage are faster than expected. Solar and cheap storage could reshape the evolution of India’s power mix offering a very compelling economic and environmental proposition.



It is also worth comparing the 232GW of new coal capacity expected, with India's current pipeline of just 85GW, of which a quarter has been frozen in construction for years. Another 510GW of new coal has been cancelled since 2010 due to competition from cheaper renewables, financial distress at utility firms and public opposition. In addition, India has repeatedly overestimated electricity demand growth, meaning existing coal capacity is running less than two-thirds of the time. Moreover, data for 2019 to date suggests India's electricity generation from coal could be declining. India recently has announced a highly ambitious target for solar, wind and biomass capacity to reach 450GW, potentially as soon as 2030. If this target is met, then wind, solar and other low-carbon sources could largely meet rising demand without new coal, according to recent Carbon Brief analysis.

Supersized solar

In the electricity sector, renewables surging and overtaking coal as the largest source of power by the mid-2020s. By 2040, low-carbon sources would be supplying more than half of the world's electricity needs – rising to 85%. It is worth highlighting, however, that electricity accounts for only a fifth of final energy consumption today, a figure that rises to 24% by 2040. This is one of the many reasons why renewables alone cannot solve the climate challenge. The increase in expected renewable output is mostly absorbed by higher demand, meaning that generation from other sources is relatively unaffected. Carbon Brief analysis suggests the increase in 2040.

Solar saga

Despite the large upwards revision in solar output in 2040 the technology remains relatively conservative relative to some others. Annual net additions of solar capacity around the world, gigawatts. Following weaker solar growth in 2018, a renewed acceleration in annual solar PV deployment, alongside enhanced efforts to ensure smooth integration of the resulting solar generation into power systems, is essential to reach climate targets and other sustainable development goals. Cost reductions do not guarantee continued competitiveness because the system value of solar PV tends to decline relative to the system average as its share of generation rises. This is because solar output is concentrated in the middle of the day, with additional

capacity adding to supply and so partially eroding the price commanded by already-built solar panels. Despite these issues, some other outlooks are much more bullish on solar capacity growth. In the first eight months of 2019, growth in India's CO₂ emissions slowed down sharply, putting the country on track to its lowest annual increase in nearly 20 years. Analysis based on data from various ministries responsible for electricity, coal, oil, gas and foreign trade, shows that emissions increased by 2% in the first eight months of the year, a lower rate than any annual increase since 2001. The main reason was a slowdown in the expansion of coal-fired electricity generation, the analysis shows, with renewable output surging and demand growth slowing. Oil demand growth has also slowed this year, helping keep the increase in India's emissions to just 2%, against an average of 5% per year over the past decade. The trend in India's CO₂ emissions is of global importance. Since 2013, the country has accounted for more than half of the increase in global CO₂ output. Slower growth in coal-based power generation will also benefit the country's air quality efforts, as essentially all coal-fired power plants in India lack pollution controls commonly required in, say, the EU and China.

Slowest growth

India's CO₂ emissions have doubled since 2005, driven by a rapid expansion in coal use. The growth is poised to slow down in 2019. Electricity generation from coal slowed markedly in the first eight months of 2019, putting the country on track to its slowest power-sector emissions increase in three decades. This was due to a surge in renewable power generation and a slowdown in demand growth, which means the share of fossil fuels in meeting power demand growth will be the lowest the past 30 years

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References

Lauri Myllyvirta is an energy and air pollution analyst covering air pollution and fossil-fuel trends globally. Sunil Dahiya is an analyst with Greenpeace East Asia



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targets. IEA Outlook 2019.*
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