



ENRich 2019

Navigating energy transition

'Voices'



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Message from

Shri Dharmendra Pradhan

Hon'ble Minister of Petroleum & Natural Gas and Minister of Steel

India has made rapid strides by doubling its GDP in the last decade emerging as one of the fastest growing large economies globally. Hon'ble Prime Minister intends to transform India into a \$5 trillion economy in the next five years. We are working relentlessly to achieve his vision—the energy sector will play a critical role in India's journey to achieve its growth aspirations in a sustainable manner.

While enhancing energy efficiency, working on renewable energy and converting waste to wealth we will need all forms of energy to co-exist to achieve energy justice. The oil and gas sector in India has much longer runway than any other large economy in the world – estimates indicate that India's oil demand would double while gas demand would triple by 2040. Even as we make this complex transition to a developed economy, India remains committed to curb the effects of climate change. We have taken a leadership role in the global arena for enhancing access to sustainable energy, including through promoting the International Solar Alliance, which now has membership of over 120 nations.

Our commitment to sustainable global energy future is further evident from the wide range of initiatives that have been introduced such as scaling up renewable capacity to 450 GW by 2030, implementation of

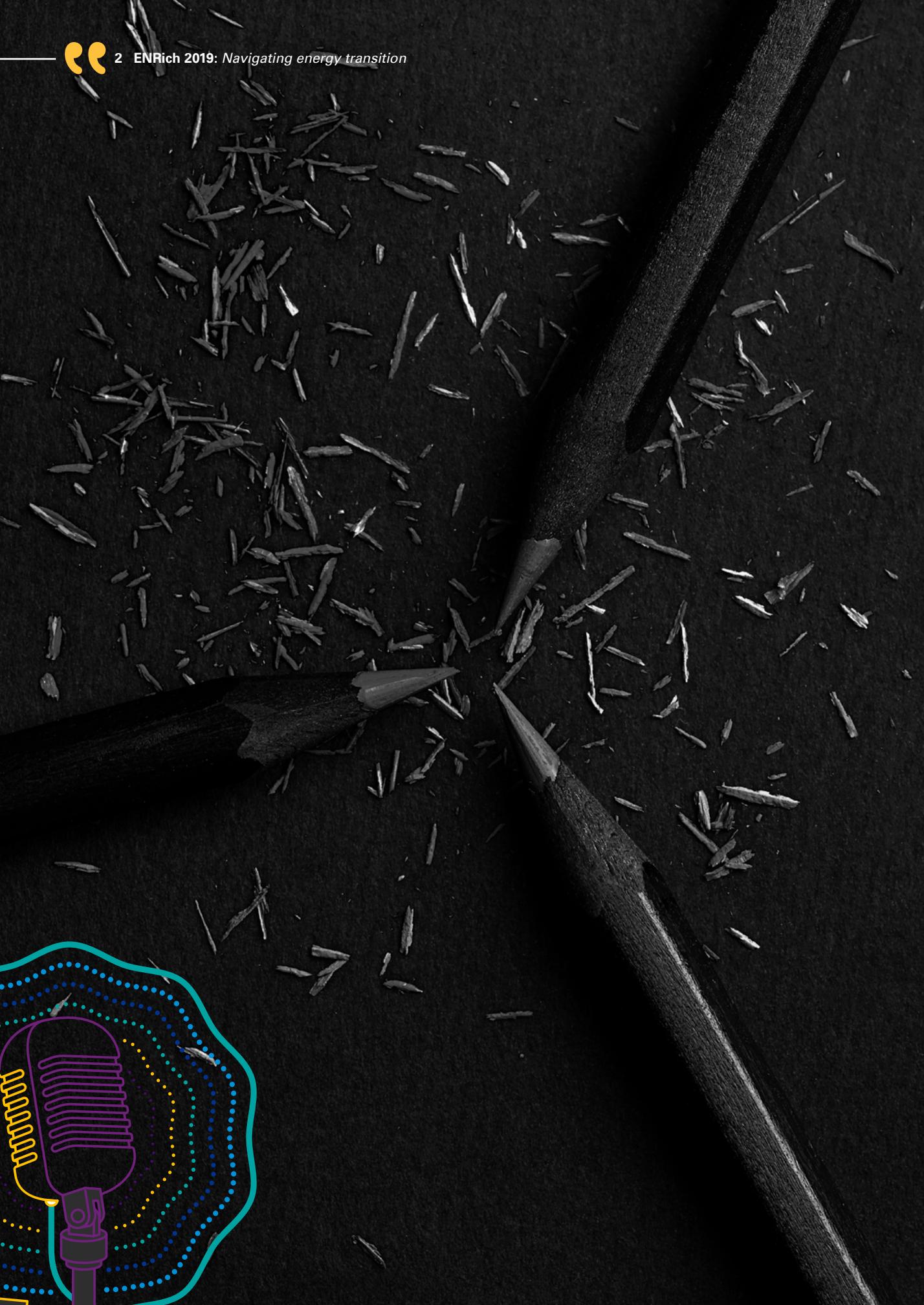
Bharat-VI norms by April 2020, expanding gas infrastructure, liberalization of entry norms for fuel retailing, setting up compressed Biogas (CBG) plants and increasing ethanol blending percentage in petrol to 10% by 2022.

Our oil and gas companies have a proven track record of competence and will leverage their technology and business expertise in evolving and diversifying from oil and gas to emerge as broader energy sector leaders. They support a large number of innovative start-ups on digital transformation.

We continue to 'Reform, Perform and Transform' the sector through proactive and far-reaching policies and market reforms. Our focus remains to attract global investments into the sector as India would need massive investment in expanding oil and gas infrastructure to ensure access of clean and affordable fuel supply to its citizens.

Mahatma Gandhi, father of our great nation, said that earth provides enough to satisfy every man's need but not every man's greed. I believe that if we all work together we can develop a sustainable landscape where citizens and investors in the energy economy can help evolve a benign energy future that leaves the world green and healthy for our future generations.







From Arun Kumar

Chairman and CEO,
KPMG in India

Two broad themes underline the current energy landscape in India: India's increasing energy needs and the need for sustainability.

India's energy needs are clear. With 18% of the world's population, India currently consumes only 6% of the world's energy. And this will grow rapidly. How can these demands be met?

India needs a mix that includes energy from oil and gas, renewables, nuclear, coal, biofuels – and all of this, while addressing pollution. And India needs to deploy technologies that promote energy efficiency and sustainability – from clean coal to smart grids.

Issues related to India's energy use, enabling robust demand-supply balance in synchronicity with growth, ensuring energy security against the shifting sands of geopolitics, managing the transition to less carbon intensive sources – its economics and affordability – are all critical elements of the larger national effort to ensure a sustainable and prosperous future for all.

India's energy planning will also have increasingly significant global climatic implications, as the third largest consumer of energy on the planet after China and the United States, as well as the largest contributor to global energy demand growth over the next few decades.

India's efforts to transition to a greener energy ecosystem is motivated not just by the compelling need to contain environmental and climatic degradation, but also by economic and geopolitical compulsions, since fossil fuel imports account for around half of the country's energy consumption. While the government has announced the ambitious national target of generating 175 GW of renewable energy by 2022, and very significant progress has been made in augmenting solar and wind energy generation in recent years, the fact remains that fossil fuels still account for around 90% of India's primary energy consumption, while renewables account for only around 4%.

India's energy transition efforts have to span a variety of domains, each with its own challenges – ranging from governance structures and regulatory issues, to financing models, behavioural incentives for firms and consumers to migrate to green-energy, ensuring policy stability for investors in the renewable-energy space, apart from technical challenges like the intermittency of solar and wind generation, and the consequential need to build effective and durable storage systems.

The sense of optimism and the commitment to India's green-energy future is evident in the surge in solar and wind capacity investments by the private sector in recent years. Recently, however, concerns have arisen over the need to protect and preserve the sanctity of bid-parameters and contractual obligations between government and private investors.

In order to meet the country's ambitious renewable energy targets, more needs to be done - ranging from adopting a holistic and joined-up approach by the various ministries and agencies of the government at the centre and the states who are mandated to govern the energy space, creating innovative financing instruments to incentivise investment, reducing procedural friction, as well as restructuring the regulatory regime for ensuring an equitable balance of interests between the government, the private sector and the consumers.

We are entering an era when the clear and present dangers of unbridled climate change are revealing themselves to us in terms of catastrophic weather episodes. The need for India to accelerate the energy transition to more sustainable sources has never been more compelling. Renewable energy sources also have the advantage of being unconfined by territorial boundaries and troubled geographies. Given the complexity of the Indian energy ecosystem, all the stakeholders would do well to align around the broad contours of an accelerated energy transition strategy that should be expeditiously executed.





All 'Voices' are arranged in an alphabetical order (as per last names).

The views and opinions expressed herein are those of the persons quoted and do not necessarily represent the views and opinions of KPMG in India.



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Niladri Bhattacharjee

Partner and Lead – Metals & Mining,
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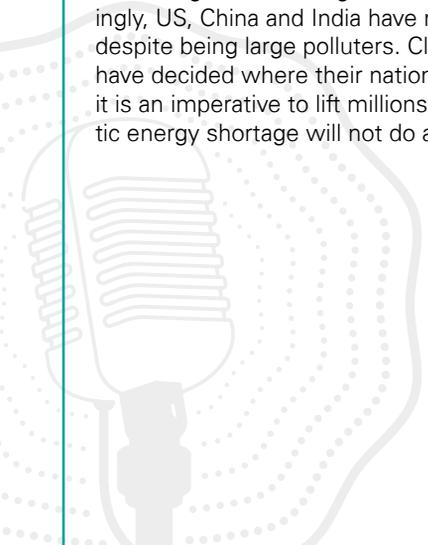
Greta Thunberg: what she means for the Indian coal industry

Before you assume that all this brouhaha will have little impact, just hold your horses. Greta Thunberg needs no introduction. In just one year, she has upped the ante against the fossil fuel club. She has, in the process, rattled various people from the apparently neutral to the clearly opposed end of the spectrum and has therefore attracted vituperative criticism. The reaction of the Australian PM, Scott Morrison summarises the disquiet in the coal producing world over this matter. He said that the climate change debate is creating “needless anxiety” in children and that they also “need an economy to live in”. He stressed on children understanding the context of the climate change debate and that he didn’t want them to “grow into mushrooms”.

There is an optional protocol associated with the UN Convention on the Rights of the Child that allows children to file a complaint to the Committee on the Rights of the Child if they feel their rights have been denied. After the September protests, Greta and a few more child activists filed a complaint at the UN against five countries (not including India) for not doing enough to ward off global warming, under this protocol. Interestingly, US, China and India have not ratified this protocol, despite being large polluters. Clearly, these countries have decided where their national priorities lie. For India it is an imperative to lift millions out of poverty. Domestic energy shortage will not do any good to its ability to

economically address this situation.

However, Greta might have a paradoxical ally against whom no country in the world can hold its own. It is climate change itself. Whether it is the likely disappearance of summer sea ice in the Arctic or the increase in intensity of Atlantic hurricanes, the manifestations of climate change are becoming visible more rapidly than earlier projected. In fact there are studies that show that the long-term trend of frequency of cyclones in the Bay of Bengal is on the increase. Whether Maharashtra contributes \$1 trillion to India’s \$ 5 trillion economy or Mumbai becomes water-world in the next few decades is anyone’s guess. What is more certain is that there is a tipping point out there in the future beyond which the world community will be forced to impose crippling sanctions on fossil fuel. Till then, the cost considerations would continue to deter the world from deploying cleaner technology. The “Kodak moment” for fossil fuels is now and they are all staring at it like deer in headlights. For instance, the Indian coal and power sector have invested very little in terms of R&D in carbon sequestration. They hope, when they can spare a thought from production troubles, somebody on their behalf, will make a breakthrough. Who will they blame when someone moves their cheese? And that someone is more likely to be climate change itself than young Greta Thunberg.





Anish De

Partner, National Head – Energy & Natural Resources, KPMG in India

In India we must find the way to achieve the twin – and sometimes contradictory – objectives of more energy and less carbon

Climate and the world of energy are intricately inter-linked. At the turn of the century global economic growth and the need for energy related resources were growing apace. That relation is now significantly altered. Between now and 2040 global GDP is anticipated to double. Energy demand in contrast is likely to grow only by 30%.

However, this is not good enough. In 1900 the deliberate burning of fossil fuels produced about 2 bn tonnes of CO₂ annually. Today they are close to twenty times that level, altering the balance in the global environment and bringing it on the edge now. Global warming of significant proportion is an accepted reality now, its effects accentuated by frequent climate incidences, changing weather patterns, loss of livelihood. The world is 1°C hotter than it was about a hundred years ago¹. Local impacts are even more accentuated. It is likely to only get worse since even as the rate of addition of greenhouse gasses has abated, we carry far too much of carbon stock from the past century. As Greta Thunberg commented indignantly at the UN General Assembly in September 2019, “you have stolen my dreams”.

A response has indeed been triggered with the world increasing veering towards renewable energy and storage, and in turn setting a virtuous cycle where costs of “alternate energy” have fallen rapidly and energy efficiency has become a part of the design itself. There is unprecedented advancement on both the demand and supply sides of the equation as the world and India seek out more benign methods to advance global growth and welfare.

This is not an easy trajectory, especially for a developing country like India where the population on the average lives only on a fourth of the per capita consumption of

energy that the United Nations believes is necessary for human well-being. Indeed, in India we must find the way to achieve the twin – and sometimes contradictory – objectives of more energy and less carbon.

If there a way? Possibly there is, but certainly isn't an easy one. For a start renewable energy forms only 6% of India's energy basket. Hence, even as growth comes at a fast clip, displacing carbon heavy alternatives with more benign options is a transition and not an event. These are not just technological or resource transitions. Production bases need to be built up for the new forms of energy resources, deployment methods need to evolve. Even as they do, entire industries dependent on traditional energy and resources economies need to transition. It is of course about capital, which in this industry comes with elongated “lock – ins”, but eventually it is about people, about livelihoods and rapid changes in economic patterns, which often carry regional and provincial biases.

There ought to be a method of converting the upside from the adversities and the new opportunities from the new paradigms in energy and natural resources to actuality. This is easier said than done since energy infrastructure comes with long lock-ins, often extending to 25-30 years or even more. Timing of new investments is increasingly becoming tricky as are the efforts in financing the high cost high gestation capital assets. Also, as urbanisation increases rapidly infrastructure build in urban areas to put to effect a rapid transition to new forms of energy becomes extremely difficult. It is often not about the direction any longer, but about the unclear path to get there.

If we can manage the navigation effectively there may be a better future though.

¹ Data in this paragraph abstracted from The Economist, September 20, 2019



Shantanu Dixit

Group Coordinator,
Prayas (Energy Group)

Fixing distribution sector finances need long term solutions

Electricity distribution sector in India is at a cross-road. Average cost of supply for most electricity distribution companies is already in the range of Rs. 7 to 8 per unit, and in some cases, it is close to Rs. 9 per unit! This cost is also increasing at around 5% per year. In addition to this, many DISCOMs are saddled with sustained high-cost, base-load, surplus capacity and continue to face age old challenges of high transmission and distribution losses, poor quality of supply and service, and burgeoning financial losses. Recent years have seen emergence of competitive renewable supply options for many DISCOM consumers. Today, even small, kW scale, solar power is available at around Rs. 4 per unit. As a result, most commercial, industrial and high-end residential consumers, who pay Rs. 5 to 9 per unit, just as energy charges, are looking at ways to reduce drawal (not dis-connecting from the grid) from DISCOMs to reduce cost of electricity. They are aggressively pursuing options such as rooftop solar, net-metering, open access and captive generation. This has resulted in slowing down of hitherto cross-subsidising sales of DISCOMs, putting pressure on DISCOM finances.

In many states, open access and captive consumption is already nearly 30% of high paying HT industrial consumption. Some DISCOMs are trying to prevent sales migration by measures such as increasing fixed charges, restrictions on net-metering, and onerous open access provisions. These measures may provide short term respite but are unlikely to help achieve even medium-term financial stability. This is because, on one hand cost of solar power is expected to continue its downward trend, and, on the other hand, battery storage systems are increasingly becoming financially viable. Even conservative estimates indicate that in next 3 to 5 years cost of battery systems would be around 200 – 250 \$/ kWh. For an industrial consumer with predominantly day time demand, this would mean that cost of alternate supply, through solar plus storage, which would be constant for 20 years, will be highly attractive compared to rising DISCOM tariff. It is clear that despite policy, regulatory, tariff (high fixed, grid use charges) and procedural barriers, sales migration is only going to increase in coming years.

Such technology-driven sales migration has two primary

implications. First, DISCOMs must prepare for significant loss of cross-subsidising sales, and hence either increased tariff for subsidised residential and agriculture consumers, or a massive rise in subsidy from state government would be essential. Second, that DISCOMs will face significant demand uncertainty, making power purchase planning more complex and riskier.

To address these challenges, in addition to traditional measures such as reduction in distribution losses, and tariff rationalisation, a three-pronged approach is essential. First, there needs to be rapid solarisation of agricultural consumption, by either solar feeder approach or solar pump approach, wherever appropriate. This will allow reduction in cross-subsidy requirement of DISCOMs and will also provide good quality day time supply to farmers.

Second, DISCOMs should actively facilitate long-term sales migration by even consumers with demand above say, 20 kW, with reasonable cross subsidy surcharge. This will reduce demand uncertainty for DISCOMs. This will also avoid need for new capacity with long term PPAs. Often it is observed that DISCOMs' long-term power procurement is plagued with governance weaknesses, leading to burden of high cost and at times excess capacity. With active encouragement of long-term sales migration, such risks could be avoided.

Third, along with such measures to give freedom to large consumers to choose supply source, DISCOMs need to focus on improving quality of supply and service to small consumers. Willingness to pay and hence increase in tariff for small consumers would be feasible only if there is perceptible improvement in quality of supply and service.

Unless guided by such conscious, long-term policy decisions, situation will unfold chaotically, leaving the distribution companies stranded with excess capacity and huge losses—and the sufferers will be mostly small and rural consumers with serious implications for state-level politics. To avoid such consequences, it is extremely important to intervene at the earliest. The impending changes can be turned into opportunities only if distribution companies, regulators, and policymakers begin acting at the earliest with long-term view, not focus on just short-term solutions.



Anna French Deputy Head,
DFID, India

Huge investments are required to build a climate resilient power sector

Climate change and the degradation of natural resources are the defining issues of our time. The world is getting warmer, sea levels are rising, pollution is costing lives, demand for energy is increasing rapidly and natural habitats are shrinking. There is no doubt that this is an emergency and drastic action is needed to combat future climate change.

There is no path to protecting the climate without dramatically changing the way in which electricity is generated and consumed. Despite the historical public investments that have been made in thermal capacity, the progress in India on this is impressive. The 175 GW renewable energy target has caught the world's attention. In the last five years, the country's renewable energy-based generation capacity has increased from 35

GW (in 2014) to about 82 GW (in 2019).

With greater RE penetration at both centralised and decentralised level, increased uptake of electric vehicles and changing customer expectations - grid management is becoming even more complex. Large scale investments are required to digitise grid operations - to enable measurement and control of electricity flow; enhance efficiency (both at the generation and consumption level); and provide best in class customer services. The nature of investment over the coming decade will determine the future of the power sector in India. Utility leaders, regulators and policy makers need to come together to devise a framework to channel these investments to build a climate responsive and resilient power sector.





Paul Harnick

Global Head of Chemicals &
Performance Technologies, KPMG International

Opportunities abound for Indian chemical companies

The Indian chemical industry is growing fast. Driven by many of the same dynamics which forged the growth of chemicals in China – fast growing population, urbanisation, infrastructure spending, growing middle classes and consumerism – the opportunities in the industry in India are vast. However, the global chemicals landscape is being disrupted by emerging technologies and changing demand patterns. To be successful, Indian chemical companies will need to adapt while they grow. Two of the biggest challenges are in digitisation and changes in the automotive value chain.

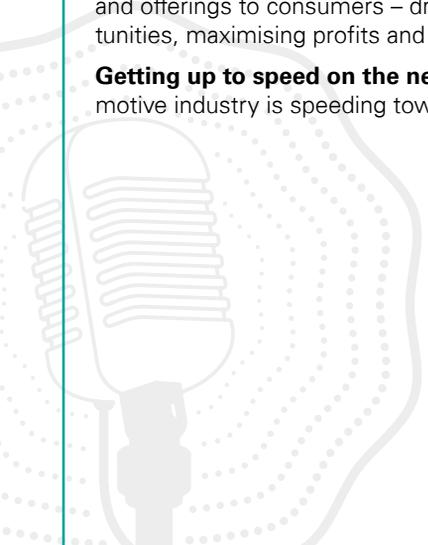
Digitalisation drives global growth - In order to stay competitive in emerging global markets, Indian chemical producers will need to embrace digitalisation. The chemical industry globally is in a nascent stage when it comes to assessing how digitalisation can drive significant business benefit, but companies are investing heavily in exploring ideas and change is likely to come rapidly. Digitalisation offers chemical producers an opportunity to fundamentally improve the way they do business. This is likely to move beyond the traditional focus on efficient plant design, operation, automating and monitoring production. Real-time access to data about customer demand, production capacity and operational performance will enable faster decision-making capacity in pricing, production planning, and supply-chain management. Borrowing best practice from B2C businesses will likely see digitisation of the customer journey and experience enabling chemical companies to provide better services and offerings to consumers – driving cross-selling opportunities, maximising profits and driving down costs.

Getting up to speed on the new mobility - The automotive industry is speeding toward a new era marked

by electric-powered vehicles, autonomous vehicles and shared mobility. Even as global sales tick downward, individual vehicles will be used more intensively, spending less time parked and more time on the road, transporting people and goods in a growing number of ways. For chemical companies supplying the automotive sector in particular, the new mobility will mean a dramatic shift in product portfolios, clients, end users and business models to address an industry ecosystem that's becoming larger, more dynamic and far more interconnected.

In the face of these changes, chemical companies may have to rethink their business models, reconsider key markets and recalculate the value propositions for every product in their portfolio. As with any disruption, there will be winners and losers. Companies that provide engine coolants, general lubricants, fuel additives and multi-gear transmission fluids for ICEs might have to prepare for the possibility of slowing demand. Manufacturers of battery materials and high-performance polymers might plan for increased competition in growing markets. As always, chemical companies will also have to continue their efforts in enhancing regulatory compliance, improving operational efficiencies, identifying new markets and mapping their long-term expansion strategies. These changing demand patterns in the automotive industry are likely to drive fundamental change into the chemicals supply chain over the coming years.

One of the things I love about this industry is how dynamic it is. With these and other changes, there are abundant opportunities for Indian chemical producers to find ways to be successful in the coming years – if they can adapt quickly enough.





Dr. Jennifer Holmgren CEO,
LanzaTech

We live in an amazing time. The future of the planet is in our hands

The climate is changing.

For the past century, human activity has resulted in excessive emissions of carbon in the atmosphere, far more than any planetary process can off-set naturally. Further emissions will increase global temperatures significantly, indiscriminately displacing communities, slowing economies and disrupting agriculture. We need to act now.

The future of our planet rests in our hands: our decisions, our choices and our actions matter. In order to survive and thrive, we must see our current carbon problem as an opportunity to challenge the status quo and create a clean and secure future in a carbon-constrained world.

Breakthrough innovations and new ideas can enable a better future.

Businesses, governments and individuals must reject business as usual, demanding carbon mitigation and sustainability be a part of any success measure. More importantly, we must not benchmark today's innovation against the past; we must, instead, imagine and create a very different future, one where the production of energy, fuels and chemicals is based on distributed, rather than centralised principles. Recent breakthroughs in miniaturisation, automation, AI and 3D printing enable distributed production beyond anything that could have been previously imagined.

The challenge is great, but we have determination and ambition.

Solar has not only increased energy access by creating micro grids in rural areas but has created new economic opportunities by increasing access to electric goods. Getting away from a massive grid and centralised approaches has enabled more than a power revolution; it has also enabled a knowledge, access and communications revolution. The 9B cell phone connections globally are a testament to the value of distributed approaches. If we think differently, if we allow our imaginations to

wander outside our current centralised, bigger is better paradigm, we can achieve more and create economic opportunities in communities that have been left behind by the existing approaches.

Success will require considerable investment, into the hundreds of billions of dollars per year, to achieve the full level of circular carbon technology deployment required. We should not think of these as isolated investments as these dollars will help grow economies, creating jobs and improving standards of living. India's Council on Energy, Environment and Water estimate more than 300,000 are expected to be employed achieving the country's goal to install 160 GW of solar and wind power. New ideas and new technologies are job creators and when these technologies can aggregate from a distributed base, then jobs can grow throughout the country and not just benefit one geographic location.

We must unlearn what we have learned. We must change how we operate.

How we procure, utilise and dispose off carbon will define the planet we leave for our children. Emerging technologies and continued innovation hold the promise of real solutions to transition to a flourishing low carbon economy by 2030. But this is not enough. We must also learn to take risks so we can move quickly to the low carbon future we must have. The time to talk, compromise, sign agreements and rethink is long past. There is only time for action now. A course of action can be adjusted after the act, trying to get it perfectly right before setting it in motion which only favors the status quo.

We must now commit ourselves completely.

Mohandas Karamchand Gandhi once said, "You may never know what results come of your action, but if you do nothing there will be no result."

I urge you to embrace this challenge. This is our time. The future is in our hands.



Santhosh Jayaram

Partner and Head, Climate Change & Sustainability, KPMG in India

India's sustainable energy journey will be greatly aided by circular economy concepts being ingrained into project conception

The rapid growth in world population in recent times has been putting a strain on the limited availability of raw materials as well as having a major impact on the environment. The circular economy model of production and consumption is a design process for a regenerative economy that converts waste to wealth and creates enormous possibilities in its wake. It allows the life cycle of products to be extended through a wide range of practices that involve utilisation of waste, raising efficiency and continual use of natural resources. Thus, it is redefining economic growth by placing an increased value on natural and societal capital.

The growth story of any country is strongly connected with energy demand. India had a per capita energy consumption of 24 Gigajoules and Human Development Index (HDI) of 0.64 in 2017 i.e., medium human development. Growth of the economy and improvement in quality of life for citizens would require India to increase its energy consumption. The Economic Survey 2018-19 projects a requirement of quadrupling of per capita energy consumption in India to reach an HDI of 0.8 and enter the group of countries with high human development. Further, to align with the global move towards decarbonising economies, India has also been taking significant steps to increase adoption of renewable energy sources. This move towards decarbonisation has a virtuous connect with circular economy.

India has a substantial potential for energy generation from Urban, Industrial and Agricultural Waste/Residues in the country. BioCNG, biogas and energy from different wastes, such as cattle dung in rural areas or vegetable/food and municipal solid waste in urban areas can be used for various energy related end uses such as cooking, electricity generation and transportation. Based on the availability of cattle dung alone from about 304 million cattle, there exists an estimated potential of about

18,240 million cubic meter of biogas generation annually. With increase in urbanisation, municipal corporations are also facing challenges in MSW management and are planning waste to energy systems.

Being a tropical country, solar energy has tremendous potential in India and is already witnessing a strong growth. As the solar energy market increases, the volume of discarded products would also increase and without circularity for the materials used by solar industry, it will cease to be a sustainable source of energy. A 100 GW of solar capacity entails an estimated demand of about 7 million tonnes of materials including glass, aluminum, silicon, silver, etc. which can be retrieved and recycled reducing the stress on resources. With the advent of EVs and batteries, India also needs to plan for issues around conserving natural resources and addressing end of life issues for batteries. Countries such as US and UK have taken the lead in research by establishing battery recycling R&D centres/programmes.

Circularity can give a fresh new lease to conventional energy sources as well. Industry symbiosis has the potential of utilising heat and material leakages from one industry process in another process. There are also possibilities in pre-production, production and customer interfaces where circularity can be a value enhancer. On the energy supply-side, pre-combustion interventions, renewable energy, waste-to-energy, fuel conversion, recycling materials from energy production plants are ways of circularity while energy efficiency, demand response and energy as a service are possibilities at the user side.

With immense possibilities and substantial room for growth, India's sustainable energy journey will be greatly aided by circular economy concepts being ingrained into project conception and will aid the resource efficiency journey.



Santosh Kamath Partner and Lead, Alternate Energies, KPMG in India

Energy (sector) transition is going to be uncomfortable for many players, the best strategy is to accept the reality and move forward to adapt to this change

The energy industry is seeing the most dramatic shifts it has seen in the last hundred years. Driven by global climate change pressures, three fundamental drivers are bringing this change: first, a shift to renewables; second, a movement to electric mobility and electrification of demand in general; and third a rising trend of energy efficiency enabled by technology.

While this transition is going to be uncomfortable for many players, the best strategy is to accept the reality and move forward to adapt to this change. Players who

will adapt early will do well and may create competitive advantages. We will see a bunch of new entrants also entering the fray enabled by falling entry barriers. I do see new age companies rising in the areas of electric mobility, energy efficiency and renewable energy. It is an opportunity for various stakeholders to ride on this change.

This year's ENRich focusses on this very interesting theme of energy transition and will debate on the various issues leading to and arising out of this transition.





Saurabh Kumar

Managing Director,
Energy Efficiency Services Limited

Convergence of clean energy transitions

The energy sector, in particular, power sector, is moving towards a transition not witnessed in over a century. The time honoured standard wires and transformers business centralised power units through large country level grids, is giving way to a decentralised, intermittent and dispersed systems. It is estimated that the energy demand will rise (in 2040) by almost one quarter, largely due to population growth and urbanisation. Further, more than 40% of the energy supplied will be from Renewables as countries pursue decarbonisation as compared to a global average of around 20-25% as on date.

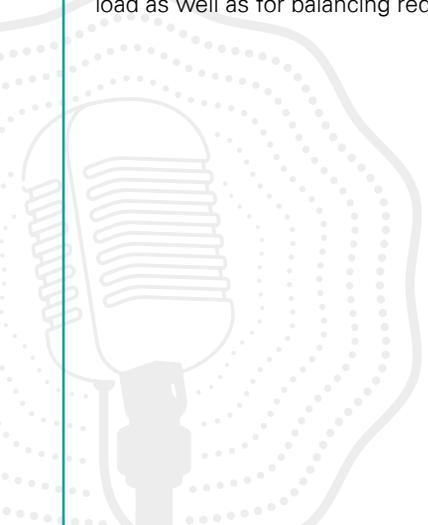
The concerns of climate change will make coal a less likely option for base load power and issues related to proliferation and safety would not allow nuclear power to fill in the base load gap. In this backdrop, the energy sector transitions that will take place are as under:

- a) Electric mobility will become attractive, particularly to a developing country like India, from the stand part of operational affordability, energy security and savings of foreign exchange due to import substitutions.
- b) Solar power will dominate the new installations.
- c) Digitisation of the grid will become pervasive and will allow real time response to demand and supply.
- d) Cooling demand, particularly in tropical countries like India, will perhaps be the single biggest driver for demand and in turn will make grid peakier as has been the case globally.
- e) Natural gas will be a candidate to replace coal for base load as well as for balancing requirements. The impact

on affordability, due to higher cost, will be an issue for policy makers to deal with particularly when more than 20 GW of gas based capacity is stranded in India.

f) Battery storage, both at supply (bulk) and demand side is a technically viable solution for most of the above challenges.

The drivers of new energy sector are fundamentally different from the ones that have shaped the way the sector has evolved over time. The challenges indicated above will necessitate innovations in off-grid solar and wind generation, electric vehicles (EVs), battery storage, etc., more accessible and affordable. Digitisation of the sector through smart meters and smart grids, Artificial Intelligence, big data analytics, blockchain and the Internet of Things, will enable real time to optimise supply and demand disruptions to traditional business models. The energy system will therefore be fundamentally different to that of today requiring new innovative policies and regulations, financing and business models. Traditional ways of managing utilities and grids, systems and controls will be disrupted, with risks and opportunities mounting. Managing such significant, interdependent changes will demand flexibility from energy companies as they adjust to the new normal. Convergence of Policies and Regulations are the key drivers for this transition to be sustainable, scalable and affordable in our quest for a decarbonised world. This will also stimulate private investment in the sector. Digitisation will help in real time operations and flexibility that is the new normal for the new energy.





Arvind Mahajan

Former Head, Infrastructure,
Government & Healthcare, KPMG in India

As the companies and societies make a concerted effort to turn green, it is apparent that transportation is a critical part of the overall puzzle

Energy landscape is transforming globally driven by multiple considerations, the key being economic prosperity (in hitherto disadvantaged countries) and climate considerations. Even when some nations are hesitating, societies, consumers and companies are largely unanimous on the way forward – efficiency and greener energy consumption.

One of the central themes of the global energy transition is electrification. As a proportion of Total Final Consumption (TFC), share of electricity is estimated to increase from 19% in 2017 to ~24% in 2040². Electricity is the fastest growing energy source (towards meeting final demand) globally and is attracting more investment, outpacing other sources including oil and gas.

Transportation is one area which is likely to see significant development along electrification. Transportation sector globally consumes one fifth of the total primary energy consumption³. Within transportation sector, road mode consumes more than 70% of total energy consumption. As the companies and societies make a concerted effort to turn green, it is apparent that transportation is a critical part of the overall puzzle.

Personal mobility has already seen significant innovation. As I see it, there are two primary axes of the transformation. First is shared mobility, with companies like Uber, Lyft, Ola and many others enabling sharing of cars between disparate group of consumers thereby reducing the fuel (and emission) intensity of the travel. Second is electrification of the automobiles as global auto companies race to convert their internal combustion engine (ICE) vehicles to electric vehicles (EVs). And of course, there are many other exciting things happening in the adjacencies-cases in point being autonomous and connected vehicles, flying cars and what not! The two trends will increasingly make our transportation efficient and greener. The next milestone is development and marketing of compact car which shall enable electrification of transportation en-masse. The building blocks are already there and from here onwards, it will be a function of innovation in business models, perfection in manufacturing and battery technology and enabling of the overall ecosystem.

Within road transportation, the next frontier shall be goods transportation. In India logistics industry is worth more than USD 160 billion, of which the lion's share is

made by road transportation. However, this segment is ridden with many issues, the key being lack of transparency and trust, fragmentation, unreliable service quality and limited use of technology. In India, before electric trucks and the like are brought in, the industry will have to mature more. There are some interesting developments happening in this segment and it is now getting attention from multiple start-ups.

The need is for policy makers to come out with a comprehensive and long term EV policy rather than coming out with pronouncements from time to time and sometimes going back on them. This policy should ideally be formulated keeping in view India's commitments on climate change, policies of other countries, especially China, and consultation with all key stakeholders to ensure balancing of interests. FAME is a good step forward but is not sufficient. Since India does not have official targets for EV penetration at present, there is a delay in investments and hesitancy in developing full-fledged supply chains. Policy interventions are needed that improve the attractiveness of electric cars vis-a-vis ICE cars, targeting both supply and demand.

I expect the shift in electrification to move beyond automobiles and touch all other aspects of transportation including air travel and maritime transportation. The two combined account for roughly 21%⁴ of the total energy consumption in the transportation sector. More importantly, air mode is one of the fastest growing segments and hence, accounting for a significant growth in energy consumption as well. It is here that we are likely to see continued investment and some very exciting innovation in technology and business models.

India with its burgeoning transportation sector has the potential to lead in some of these areas. There is a need for concerted effort between all stakeholders – government, academia, companies, research and technology firms, etc. However, the transition will not come without its share of challenges – key being the geo-political implications (Lithium battery storage technology being the new Oil and re-alignment of global supply chains and associated risks), re-skilling (particularly at the bottom of pyramid, capital investment, etc. Navigating transitions are never easy and this will be no different. We as a nation need to get our act together and aim higher. It is time to make step changes and move beyond the incremental changes.

² Source: IEA (<https://www.iea.org/weo2018/electricity/>)

³ Source: BP (<https://www.bp.com/en/global/corporate/energy-economics/energy-outlook/demand-by-sector.html>)

⁴ http://www.iiasa.ac.at/web/home/research/Flagship-Projects/Global-Energy-Assessment/GEA_Chapter9_transport_hires.pdf



Manas Majumdar

Partner and Lead,
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The plastic circular economy – problem, necessity or opportunity?

Nearly 400 million tonnes of plastic is produced every year globally, and close to half of that is typically meant for single use purpose. While not all that goes as waste (and some single-use plastic is reused/retained) – a whopping ~90% of plastic waste is not recycled and is primarily buried in landfills or dumped into rivers and oceans leading to environmental issues.

However, the plastic that is recycled is part of a growing recycling industry, currently valued at USD ~35 Bn. Plastic recycling is of four major plastic resin types – PET dominates with 55% share, HDPE- 33%, PP- 4% and LDPE- 3%. And going forward recycling industry is expected to grow @ ~5% CAGR over the next decade but the current margins are relatively thin and need to be bolstered for sustainable growth.

There are global dynamics at play though: in Dec 2017, China, which imported around bulk of (> 80%) of plastic waste collected for recycling in EU and in US, abruptly introduced the “National Sword Policy”. As per this policy, China realising the costs and harm to the groundwater and air by processing plastic waste, shut its doors to imports of recycled material - reducing imports to less than 10%. This has impacted the recycling industry and many countries are now facing issues to find a new destination for their waste, not having adequate domestic waste infrastructure of their own. This clearly highlights the gaps in plastic recycling infrastructure, policies and enablers, even in the developed world and the scope for corporate and government action.

In recycling, PET is the most organised and technologically advanced segment among plastics. China dominates the recycled PET capacity with ~70% of global

capacity followed by Europe and North America (8% each) while India contributes only 5% of recycled PET capacity. This is a great opportunity for Indian players to create PET recycling infrastructure as PET consumption in India is expected to continue growing at rates much higher than GDP over the next 5-10 years.

However, there are challenges beyond infrastructure for recycling. While the markets for recycled PET (or r-PET) and virgin PET are somewhat distinct, the pricing of recycled PET trends directionally with virgin PET. Recycled PET, therefore, is facing near-term issues due to overcapacity of virgin PET in India and hence pressure on prices which is further accentuated by inadequate policy enabling plastics recycling (whether it is in plastic collection & segregation, logistics or incentives for recycling plants).

While India has taken up a great initiative of banning single use plastics in many states and is targeting a complete ban by 2022, there is need to follow-up with measures to handle plastic waste better. Key focus must be on looking beyond the traditional and inefficient channels of waste collection and processing and enabling the scale-up of recycling facilities.

To end, I will just highlight the simple impact of plastics recycling - one metric tonne of recycled PET chips is equivalent to 1.5 metric tonnes of CO2 emissions avoided. Hence, it is imperative for Indian government bodies to look at the cumulative cost-benefits of PET recycling and formulate policies accordingly; equally petrochemical players and corporate citizens need to take up the mantle and structure and scale-up the nascent and fragmented recycling industry.



Dr. R.K. Malhotra

Director General, Federation
of Indian Petroleum Industry

Energy transition to cleaner and sustainable sources for mobility in India would need to consider multiple options

India's Prime Minister Shri Narendra Modi has laid down a vision of \$ 5 trillion economy by 2025, which would require sustained GDP growth of around 8% leading to corresponding increase in energy demand. The demand for oil in India is projected to increase more than any other country in the world during the next two decades. The natural gas will have a much higher growth as the Government has a vision to increase the gas share in total energy mix from current around 6% to 15%. Large growth in renewables will see their share going up from 3% to 16% in the total energy mix of the country by 2040.

The significant growth expected in the oil & gas sector will require multifaceted approach to reduce import dependence by increasing domestic production of oil & gas and improving efficiencies while creating appropriate infrastructure for imports, supply and distribution of petroleum products, CNG and LNG etc. We will have to simultaneously work towards developing innovative technologies for increased supply of affordable and clean alternatives like Bio-fuels, Bio-CNG etc.

Government of India, in last few years, has taken several initiatives to promote exploration and production activities in the country. Policy reforms like Hydrocarbon Exploration and Licensing Policy (HELP), Open Acreage Licensing Policy (OALP) and incentives for Enhanced Recovery (ER) and Improved Recovery (IR) etc. will bring foreign investments and enable increased domestic production of oil & gas.

National Bio-fuel Policy has been put in place to increase the supply of bio-fuels by allowing use of variety of raw materials for ethanol production. The Policy also encourages production of bio-diesel from non-edible oilseeds, used cooking oil, short gestation crops etc. The policy also provides for viability gap funding, tax incentives and higher purchase price for 2G ethanol.

At present there are 1424 CNG Stations in the country with over 31 lakh vehicles. PNGRB's completion of 10th bidding round will cover 70% of country's population and 53% of the geographical area with expansion of CNG network to 10,000+ stations. Projects like gas grid of 30,000 Kms and gas infrastructure for import of LNG

and supply of gas will see an investment of around USD 60 billion in next few years. SATAT initiative to promote compressed bio-gas (CBG) with purchase price guarantee and assured returns will help in increasing supply of green transport fuel.

CNG has limitation of range in case of heavy-duty vehicles moving long distances. The electric vehicle option is also not a viable option for trucks. As per the study conducted by FIPI, LNG appears to be a viable option for such heavy-duty vehicles moving long distances.

Use of CNG and LNG besides the Bio-fuels in transportation could emerge as a key driver towards achieving India's CoP 21 commitments.

Although the shift to electric vehicles (EVs) does reduce the vehicle emissions and local pollution, the other alternatives like BS VI petrol and diesel as well as Bio-fuels, CNG, LNG, CBG will also reduce the vehicle emissions substantially. The CO₂ emissions will not reduce with EVs as we will continue to produce electricity from coal to cater to India's energy needs. Further, unless there is some disruptive innovation for new battery materials, the dependence on lithium and cobalt will have long term implications for importing these materials from limited supply sources as compared to diversified sources of supply for oil & gas.

Hybrid vehicle technology (IC engine +battery) offers a better solution than the EVs. The Hybrid vehicles are fuel efficient which would mean lower carbon emissions.

Another alternative in future would be hydrogen fuel cell hybrids in which IC engine will be replaced by a fuel cell. The fuel cells are much more efficient as compared to IC engines. They have advantages over EVs as the fuelling time is less than one tenth as compared to fast charging systems for EVs. The countries like Japan and Korea are reviewing their EV policy viz-a-viz hydrogen fuel cell vehicles.

Energy transition to cleaner and sustainable sources for mobility in India would therefore need to consider various options which ensure energy security and supplies besides being market competitive and energy efficient with lower life cycle carbon emissions.



Karan Marwah

Partner, CFO Advisory Services,
KPMG in India

Finance is changing. Is your organisation ready?

Finance has always been the life blood of a business and the finance function has been the steward of directing and managing the flow of capital and measuring the outcomes. However, the world of business has seen unprecedented change in the last few years. The drivers for this are varied and include various macro and micro economic factors including geopolitical and regulatory volatility, digital disruption, evolving demographics which are changing the way we consume and hence the way businesses serve these needs to name a few. This is especially true for the ENR sector where we have seen a steady evolution of technology, extreme volatility in input factors and a lot of uncertainty in the regulatory environment coupled with financial stress and high scrutiny on the impact these businesses have on the environment and society.

Given the evolving business landscape, finance functions need to keep pace with these changes and even drive some of them to ensure optimal outcomes. The reality, however, is that most finance teams are not prepared to meet these wider demands. "The finance function is, by nature, very conservative, detail-oriented, rule-oriented, and structured," says Jim Carroll, a futurist and trends and innovation expert. "To make the transition to a more forward-looking model requires a lot of innovative thinking. Unfortunately, many finance functions are not structured to support that."

There is an urgent need for finance functions to disrupt and reinvent in order to meet the demands of its customers, including investors, shareholders, boards, suppliers, regulators, internal and external auditors and even society at large. These stakeholders increasingly expect finance to serve the role of a true business partner.

Given the changes mentioned above, the role of the CFO has to evolve. Leading finance organisations have developed an agenda to deal with disruption and the CFO must lead this change to turn disruptors into opportunities for competitive advantage and growth and improve the delivery of insights and analysis to stakeholders.

While there is no single path for the next-generation CFO, the position's increasing importance to the organisation will be universal. CFOs will need the right tools, structure, and workforce to support growing responsibilities.

Experience shows that CFOs are deriving specific benefits for their companies by focusing on these key areas:

I. Innovation and investment - CFOs need to think like venture capitalists and maintain a firm grip on the numbers while preserving a focus on market opportunities, threats, sector disruptions, and customer retention.

II. Extreme automation - Finance professionals must embrace technology disruptors to transform their operating models and unlock the benefits of extreme automation. The "extreme" in extreme automation refers to the integration of multiple disruptive technologies— all at once—across all processes.

III. Insights and analysis - As the only person in the enterprise with both the permission and the duty to integrate strategy, finance, and analytics, the CFO is uniquely positioned to define the analytics agenda.

IV. Risks and controls - An estimated 60% to 70% of manual controls performed today will be automated over the next five to ten years. Extreme automation promises to improve controls while reducing internal and external compliance costs.

V. Organisation and talent - There is an urgent need to reskill existing resources to derive maximum benefits from emerging technologies and also be able to shape their future roles moving away from being book keepers to business partners.

It is no longer business as usual for finance. The scale and speed of transformation required to stay ahead of the curve is unprecedented. The key to success is proactively taking the first step by developing a blueprint for how your finance organisation can turn disruptors into opportunities for competitive advantage and growth.

73% CEOs in India agree that the growth of the organisation depends on the company's ability to challenge and disrupt any business norm. *

74% CEOs disregard data driven insights because they found these to be contrary to their own experience or intuition. *

88% CEOs in India have taken it upon themselves to lead the technology strategy of their companies. *

*Source: KPMG in India CEO Outlook 2019 report is based on a survey of 125 CEOs in India, who participated in a global CEO survey conducted by KPMG International.



Regina Mayor

Global Sector Head of Energy &
Natural Resources, KPMG International

76% of the CEOs surveyed indicated that their organisation's growth will depend on how they navigate the shift to a low-carbon, clean-technology economy

The energy industry is at the crux of significant change. New technologies, geopolitics, and a volatile oil market have been top of mind for executives for years. This year, a new concern topped the charts: climate change. In our 2019 Global CEO Outlook, climate change was cited as the biggest risk to organisational growth across all industries – not just energy.

The long-standing debate has taken centre stage, as the effects of climate change have become more palpable and businesses see the financial impact of climate change – in addition to the environmental impact. Over three-quarters of CEOs (76 percent) say that their organization's growth will depend on their ability to navigate the shift to a low-carbon, clean-technology economy. It is clear that CEOs are feeling investor and stakeholder pressure to move away from a sole reliance on fossil fuels and adapt additional alternative approaches to energy solutions.

As the discussion evolves, the industry continues to debate what a sustainable future looks like. We can't

rely on only one renewable source to power our growing population and the changing demand in global markets for energy. Thus, incorporating a range of fuels – including hydrocarbons, renewables, and others – may be the building blocks to a sustainable energy future.

This approach can bridge the gap where renewable sources cannot provide enough power. It can also help growing economies like India gain more reliable and affordable access to electricity, where there are still 200 million people who lack access, according to World Bank data. Around the world, more than 1 billion people – roughly 16% of the world's population – are still in the dark. This is where we can truly make a change.

The world is at a tipping point and at KPMG, we are in the centre of it all as we help some of the largest companies in the world identify ways they can contribute to a low-carbon economy. It is exciting to see where we are headed as we all work together to power our future for many more generations to come.





Nitin Prasad

Country Chair,
Shell India

Navigating the pathways in the energy transition

To address climate change, the world needs to make the transition to a lower-carbon energy future. As the global population grows and living standards rise, society will need to meet increasing energy demand. At the same time, it needs to ensure that everyone enjoys the economic and social benefits of energy, including those who currently have no or insufficient access to it. This requires changes in the way energy is produced, used and distributed. From now until 2040, says the International Energy Agency, the world's greatest energy demand is likely to come from India. The country is experiencing huge growth. Today, it has 1.4 billion people but, by 2025, it could surpass China as the world's most populous nation. Therefore, how India addresses its energy transition in the next 30 years could inform how other countries address this monumental global challenge.

India's energy decisions - its energy pathways - must consider its specific challenges, including its business and socio-political frameworks, as well as its access to technology, capital and resources.

For almost 50 years, Shell has been developing energy-focused scenarios, helping generations of Shell leaders, academics, governments and business leaders to consider possible pathways when making decisions. Our latest scenario, called Sky, illustrates a technically possible, but challenging, pathway for society to achieve the goals of the Paris Agreement. In Sky, we illustrate the following possibilities for India:

- Aided by government policies and NDC commitments, overall emissions could plateau in the 2030s. A sectoral based approach, with an emphasis on Transport and Industry, as a part of the NDC can help to guide the transition.

- By 2030, additional solar and wind could meet all incremental electricity demand, phasing out new-built coal. Round the clock solutions i.e. as baseload equivalent will need to emerge from combinations of gas and renewables, demand management, grid efficiency and storage.

- By 2030, India could join the second wave of entrants to international carbon markets. Afforestation already features strongly as a part of the NDC; allowing industry and corporate participation, perhaps through incremental steps, will accelerate the development of nature-based solutions backed by a strong carbon market.

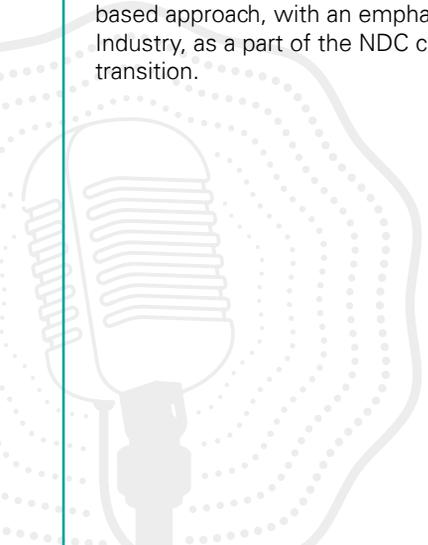
- By 2040, India could lead the world in distributed solar PV deployment and also distributed biofuel solutions.

- By 2050, India could be the first country to capture, utilise or store one Gt CO₂ per year through CCS and CCUS technologies.

While these potential and possible milestones may sound encouraging, success will require unprecedented collaboration between policy-makers, business leaders, non-governmental organisations and consumers.

It will require collective action across the energy system, from lifestyle choices made by consumers to strong government policies to decarbonise economies by government.

Shell Scenarios are not policy proposals or predictions. They do not argue for what should be done, nor forecast what will be done. But with our extensive experience in the energy business, we believe we can play a part in India's future, working together with its people, industry partners and other institutions to create new innovations for a sustainable and cleaner energy future.





Saptarshi Roy

Director (HR),
NTPC Limited

Urgent need for the energy companies to put in place a robust mechanism to groom their talent for future leadership roles

In today's wired-together world, change is happening at a much faster pace than ever before. To get ahead of the competition and for sustainable growth companies need a workforce who has agile, flexible and strategic thinking. The degree of responsiveness and speed required today is much higher than the gone-by times. Companies that could not prepare themselves for the changes that were taking place became extinct from the business horizon.

India's energy landscape is getting transformed with the accelerated growth of the 'Renewable Energy'. The hitherto untapped solar energy is increasingly getting its rightful place in the energy basket. However, being of intermittent nature it comes with inherent challenge of grid connectivity and grid stability. Tapping the full potential of renewable energy alongside the conventional sources of energy opens up new vistas of potential innovations. The traditional boundaries between the two distinct entities of energy producers and consumers are gradually getting merged and a new breed of "Prosumers" is emerging -

these are energy consumers who also produce energy. The technological developments are going to contribute immensely in the way we produce and consume energy. Also, the advent of digitalisation, artificial intelligence, augmented/virtual reality (AR/VR), smart grid, e-mobility, energy storage etc. will further open new opportunities.

There would be many more challenges and risks in future as a result of the fast-evolving energy sector. In order to meet the emerging challenges, so as to mitigate the concomitant risks and constantly innovate, energy companies need to develop future energy leaders. These future energy leaders need to have strategic perspective on the electricity/energy business, in-depth understanding of the industry and its policies and regulatory framework and have knowledge about the latest analytical tools for decision making. There is an urgent need for the energy companies to put in place a robust mechanism to groom their talent for future leadership roles to successfully steer the organisations in uncertain times.





Michael Satin

Director, Clean Energy and Environment Office, USAID/India

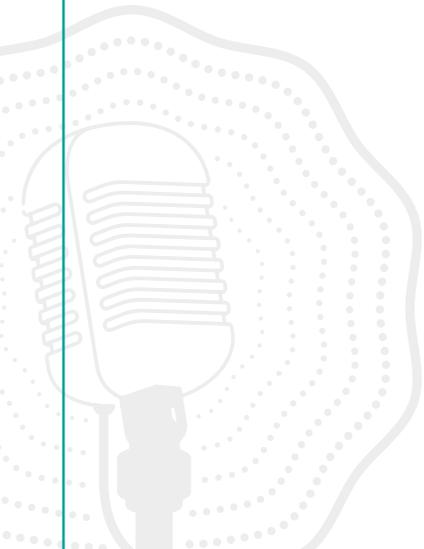
Customer-centricity will drive the future of power sector

The Indian power sector is going through a transitional phase, which is primarily driven by emerging mega trends that are redefining the sector landscape. This includes trends like rising number of 'prosumers', technological advancements, changing customer expectations, growing climate change concerns, among others. In such a changing paradigm, the distribution utilities, which are at the last mile delivery of power, need to gear up to adopt new and holistic approaches to manage the electricity grid of the future. The conventional view of electricity being treated as a commodity needs to be changed to its provision as a service.

The utilities are responding to this changing trend through deployment of advanced energy systems, digitisation of key processes, increased focus on network strengthening, improving efficiencies, adapting new strategies to provide seamless customer experience,

among others. However, the pace of evolution needs to be accelerated. This would require concerted efforts from all stakeholders to induct new policy and regulatory frameworks, create strong institutions, build capabilities and encourage innovation.

It is imperative to consider a long-term view of possible disruptions which could critically influence the pathways of power sector landscape. The new frameworks and institutions would also need access to global know how, learnings from countries and utilities which are ahead of the curve, best in class technologies, data driven tools and approaches, etc. More importantly it is imperative to build an ecosystem in which customer-centricity and satisfaction is at the core of utility's business operations. Utilities of the future need to be prepared to help customers identify and select their preferences and make informed choices.





Sugata Sircar

CFO & Country Finance Partner,
Greater India, Schneider Electric

Digital Rol - deliberation and experience sharing among organisations and service providers is critical as we all go on the digital journey

Investment in digital technology is a necessity which is increasingly acknowledged. However, the ways of doing it is not always clear. Should there be an overall strategy and several areas taken up together? Should there be prioritisation? Should a fund be kept aside for this, as returns would be unclear? Is there a good way of assessing the returns on digital investment? While areas like manufacturing and supply chain offer more use cases and clearer visibility of returns, investment in digital technology for processes, for customer acquisition and stickiness, pricing, and other areas, seem like investment in intangibles.

Methodologies are emerging for measuring returns in the above areas. The benefits can be in increasing revenue and its predictability, market opportunities from analysis, pricing opportunities, efficiency of resources and reliability.

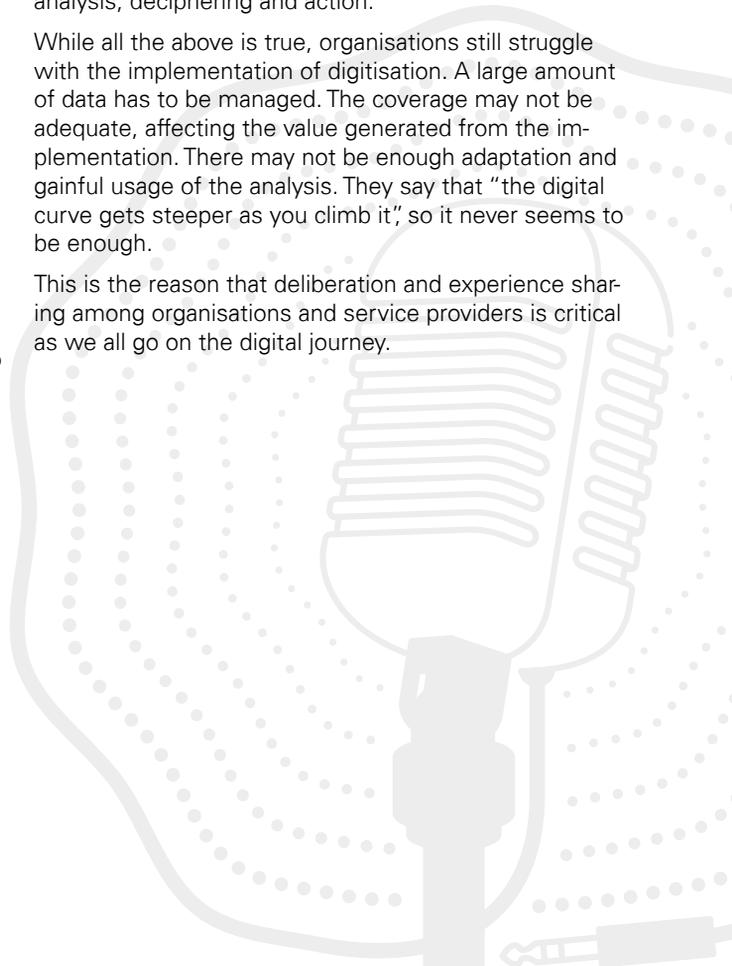
While it is good to have a digital strategy, it is possible to take up these investments in parts. Prioritised areas can be taken up first. Processes which have the maximum potential for gain and scalability become the first choices. An iterative approach can be used, making changes as the deployment progresses. This is a clear advantage over traditional systems and applications which needed large commitments and often created major disruption to

implement.

We are individually so tuned to adopt digital technology today that it becomes more easily acceptable when it is deployed in the work place. Change management is required, of course, as processes would change, and resources would be re-deployed. On implementation, data and analytics start throwing up insights, which may not have been seen before. It needs a change in approach to deal with this new set of data and analysis. So, people have to spend more time on the information coming out and on acting on the findings. Certain roles would therefore evolve from preparation or mechanical monitoring to analysis, deciphering and action.

While all the above is true, organisations still struggle with the implementation of digitisation. A large amount of data has to be managed. The coverage may not be adequate, affecting the value generated from the implementation. There may not be enough adaptation and gainful usage of the analysis. They say that "the digital curve gets steeper as you climb it", so it never seems to be enough.

This is the reason that deliberation and experience sharing among organisations and service providers is critical as we all go on the digital journey.





Manu Srivastava

Principal Secretary, New & Renewable Energy Department, Madhya Pradesh

Madhya Pradesh has constantly endeavoured to mitigate the risks in its projects through robust project structuring

Madhya Pradesh has worked on renewable energy projects with two goals in mind: (1) to reduce the rate of renewable energy so as to make its use economically viable, and (2) to facilitate use of renewable energy by a wider section of customers.

To achieve these goals, Madhya Pradesh has constantly endeavoured to mitigate the risks in its projects through robust project structuring. It has also aimed at appropriate allocation of risk between the stakeholders, so that the party that is best placed to handle the risk bears the same.

These attempts have led to Madhya Pradesh consistently achieving low rates. Rewa Ultra Mega Project was the first project in the country to break the grid parity barrier with a first-year tariff of Rs. 2.97. In MP's rooftop RESCO tender, we achieved a first-year tariff of Rs. 1.58, which further reduced to Rs. 1.38 in the second round.

As regards the second goal of facilitating using of renewable energy by new categories of customers, Rewa is supplying power to Delhi Metro, the first and only case in the country of inter-state supply of power to an institutional customer. The rooftop RESCO project covers 291 Government colleges, 124 engineering colleges, 156 police stations, etc., which would never have got green power had they been required to make a capital investment.

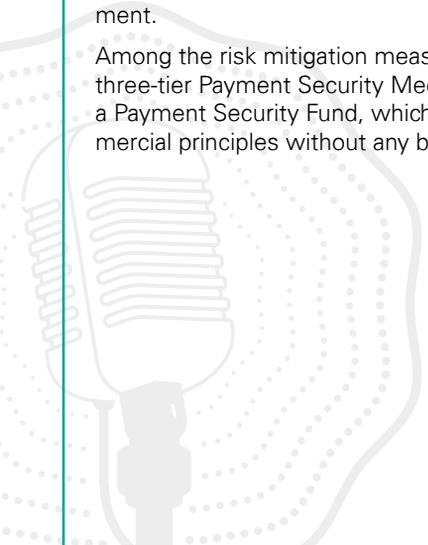
Among the risk mitigation measures was setting up a three-tier Payment Security Mechanism. This included a Payment Security Fund, which was set up on commercial principles without any budgetary support from

Government of India, on the simple logic that market rate of interest is lower than the rate of penalty in the PPA for delayed payment. Payment Security Mechanism also included guarantee by the State Government.

Another prominent risk mitigation measure was a clear "Change in Law" provision. This became especially important since Rewa bid came at time when GST was around the corner. In MP's RESCO tender, safeguard duty was imposed very close to the tender closing. To calculate the impact of additional taxation during commissioning or O&M phase on the tariff is a challenge and so its principles were clearly enunciated in the tender documents itself, thus limiting any discretion in the matter.

An interesting example of risk allocation was that the delivery point of Rewa project was kept at Rewa, rather than Delhi as initially requested by Delhi Metro. At the time of the decision, policy laid down that ISTS transmission for RE would have no charges and losses. However, the notification issued subsequently gave the benefit only to DISCOMs, thus leaving Delhi Metro outside the ambit of free ISTS transmission. Had the delivery point been kept at Delhi, the project would never have materialised, or the bidders would have built the uncertainty into their cost and quoted a much higher price.

Madhya Pradesh's attempts at risk mitigation and appropriate allocation of risks have been possible only on account of extensive interactions with the bidders as also their lenders. This has led to improvement of project structuring, apart from it being a deeply satisfying learning experience at a personal level.





Ted Surette

Global Head Power & Utilities and National Industry Leader, Energy & Natural Resources, KPMG in Australia

Hydrogen: global enthusiasm continues to grow

Global interest in hydrogen has significantly increased in 2018 and 2019. There are several reasons explaining this attention. The pursuit of decarbonisation pathways is the most significant driver.

Hydrogen is found in water (H₂O), bio-waste, wood, as well as fossil fuels like coal, natural gas and oil. Today, 95% of the hydrogen used for industry globally is extracted from fossil fuels. The cost of extracting hydrogen from water, using electrolysis with zero carbon emissions, is declining. Electrolysis is a method of splitting water molecules into hydrogen and oxygen using electricity. When that electricity is generated from renewables, we get carbon emissions-free green hydrogen.

Several countries have developed hydrogen roadmaps and are now detailing their strategies. Many have started pursuing hydrogen trials. Hydrogen has an array of potential applications, including power generation, zero-emission fuel cell transport (cars, buses, trucks, trains, ships, forklifts, aerospace), energy storage and industrial uses.

Countries like Australia are looking at using its abun-

dant renewable sources to produce hydrogen in large quantities in order to export to overseas markets i.e. Japan. Simultaneously, both public and private sectors are looking at the potential for solutions for today and into the future. The International Energy Agency has also identified hydrogen as instrumental in diversifying the global energy mix and reducing emissions.

There are challenges to solve over years ahead. Production costs need to come down; safe storage and transport costs need to be developed and increasing the general public's understanding of the role and benefits of hydrogen is required.

The Government of India Ministry of New and Renewable Energy is also involved in activities involving hydrogen. Ongoing global collaboration with the efforts of other countries will be vital to leverage learnings as technologies mature. Hydrogen may be a long game in some countries depending on their individual energy, resource and policy circumstances. Nonetheless, global momentum across many governments and corporates points to hydrogen playing a role in contributing to a pathway towards a decarbonised world.



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