

Energy investments in an uncertain world



January 2018

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India Energy Congress, an apex congregation of energy professionals from across the sector, is the flagship event of WEC India. Now into its 7th edition, the Congress is a joint event of Ministries of Power, Coal, New & Renewable Energy, Petroleum & Natural Gas, External Affairs and Department of Atomic Energy. The theme of the 7th edition, "ENERGY 4.0: ENERGY TRANSITION TOWARDS 2030", will centre around transition led by disruptions that are fundamentally changing the way we live, work and relate to one another. Energy sector is going through a grand transition and as sector boundaries get blurred in this transition, the Congress seeks to have insights from Industry leaders on the challenges and response of subsectors.

KPMG has been our Knowledge Partner in this endeavour. We thank KPMG team led by Shri Anish De, who anchored the process of writing this background paper. We are also grateful for the valuable advice and support from various organisations and individuals for making this paper possible.

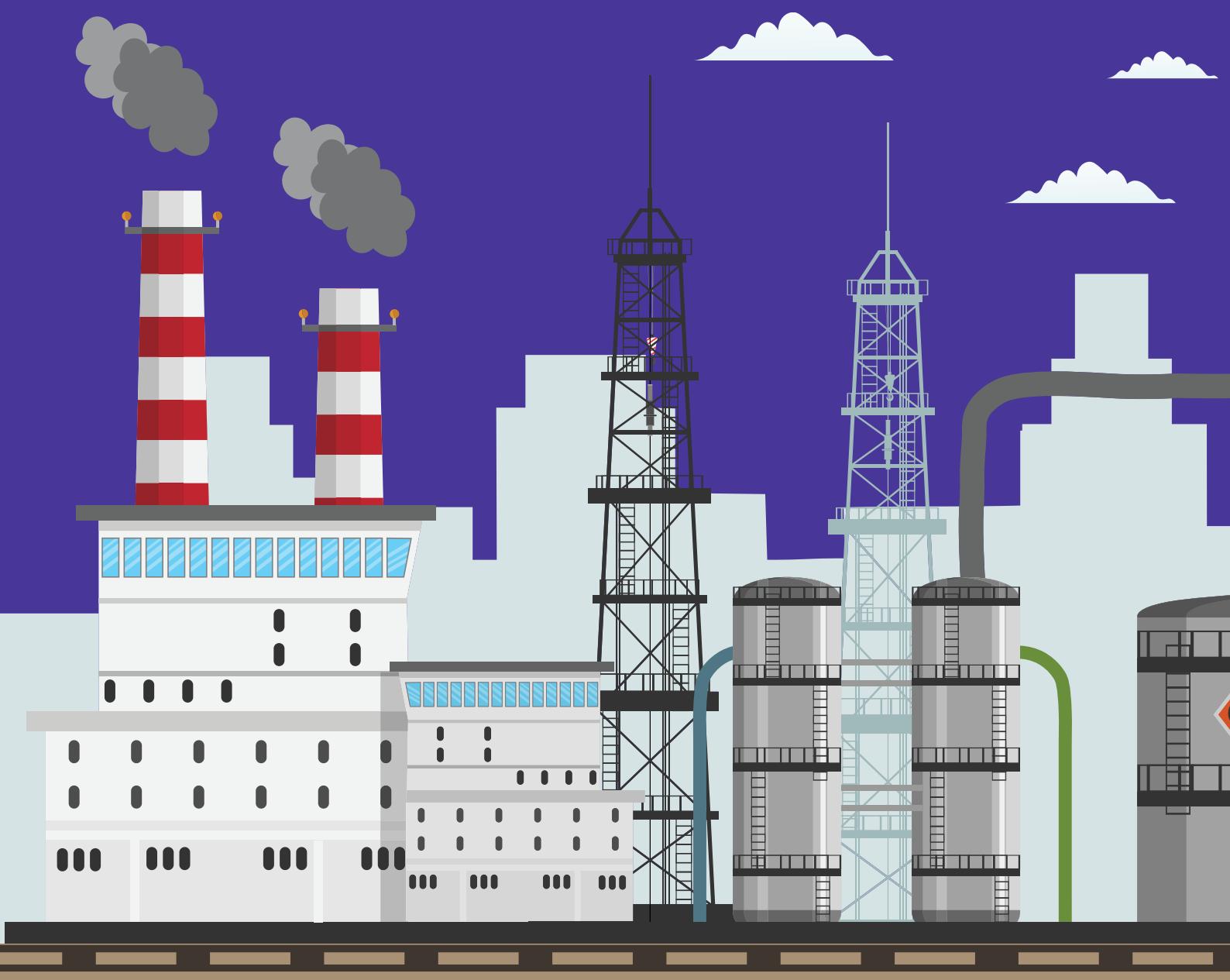
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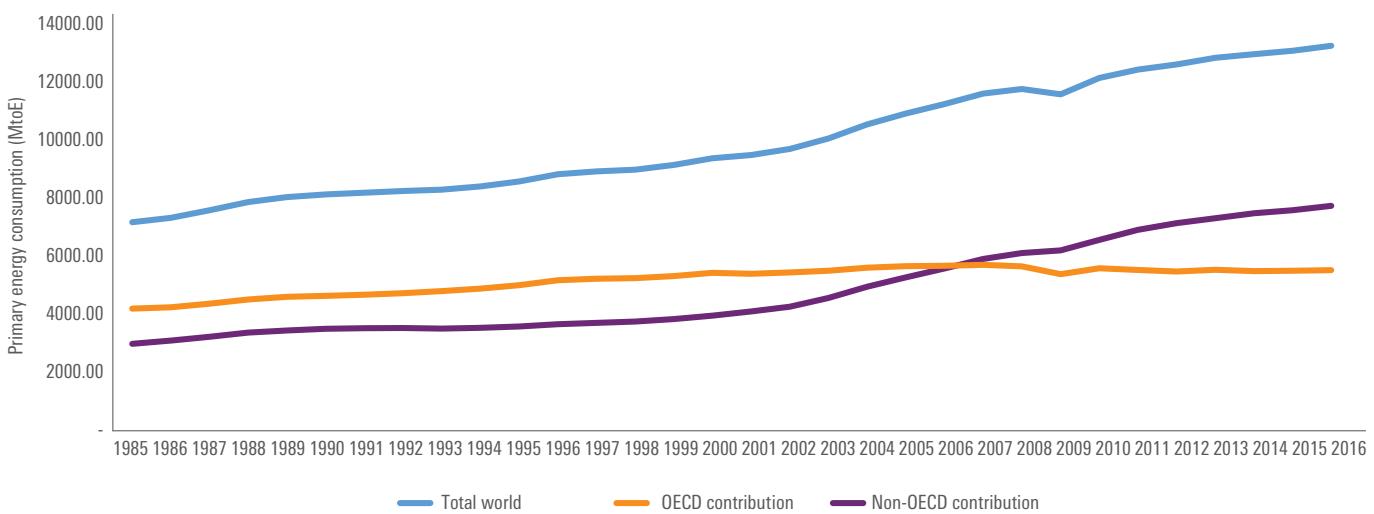


Global mega trends reshaping the energy sector

Over the years, energy has become one of the commodities on which national security hinges. Energy (and much of other core infrastructure) is beyond an economic commodity or service, and has tended to be treated as a public good. As the global economy has grown, energy witnessed concomitant growth in a relatively stable environment barring for the oil shocks of the 1970's or economic disruptions witnessed

in 2008. Though over the last decade, non-member nations of Organisation for Economic Co-operation and Development (OECD) have continued to grow faster and have captured most of the incremental consumption as compared to OECD nations which are witnessing rather plateaued growth. The figure below depicts this trend over the years.

Primary energy consumption over the years



Source: BP Statistical Review of World Energy, British Petroleum, June 2017



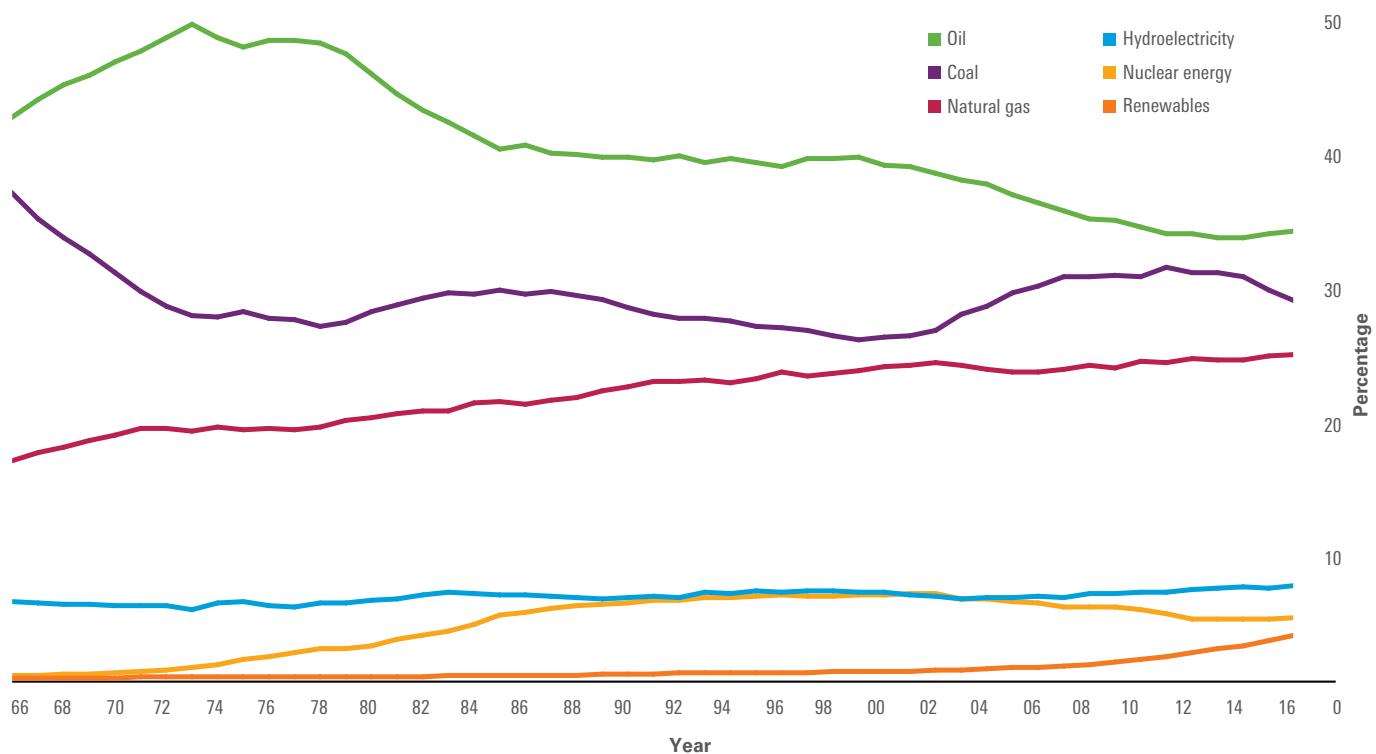
In general, energy has remained a stable investment avenue, especially in the utility sector where the regulatory apparatus in most parts of the world has tended to ensure that the utility risks are kept low and returns are stable.

This established order in the world of energy is now abound with disruptions on demand and supply sides, impacting the consumption trends and energy mix.

Global energy consumption growth remained tepid in 2016, growing at 1 per cent, below its 10 year average of 1.8 per cent. Among fossil fuels, oil and gas grew nominally, while coal consumption was down 1.4 per cent. In sharp contrast, Renewable Energy (RE) consumption registered growth of around 14 per cent.

The global energy consumption trends over the years have been depicted in the figure below:

Shares of global primary energy consumption (Percentage)



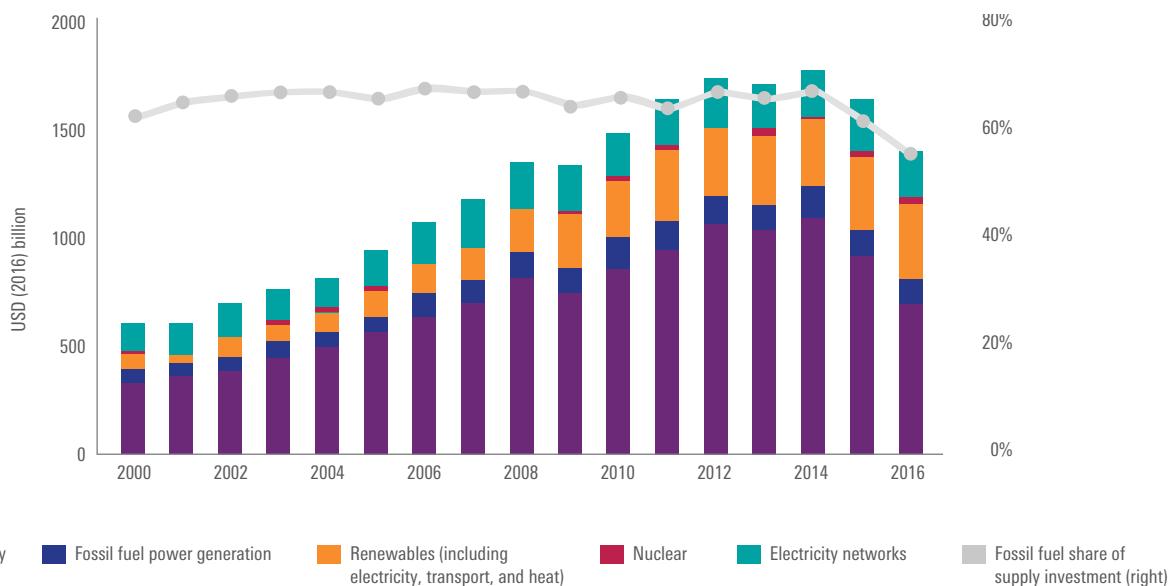
Source: BP Statistical Review of World Energy, British Petroleum, June 2017

Energy investments globally have taken cue from these consumption signals, exhibiting similar trends. As per the International Energy Agency (IEA), total worldwide investments in energy declined by 12 per cent y-o-y in real terms in 2016 led by more than a quarter drop in investments in upstream oil and gas and 5 per cent drop in power generation, offset by 9 per cent increase in spending on energy efficiency and 6 per cent increase in electricity networks.

In 2016, electricity sector received the largest amount of investment for the first time, edging ahead of oil and gas. Investment in RE based capacities remained the largest area of electricity spending at 41 per cent of total spend. While on a y-o-y basis, in dollar terms RE investments actually declined as compared to 2015, capacity additions were 15 per cent higher¹ over the corresponding period (this was due to a sharp decline in equipment costs).

1. KPMG in India's analysis, IRENA: Global Status Reports 2016 and 2017

Global investments in energy supply



Source: IEA World Energy Investment 2017

The pace and direction of investments in the energy sector going forward will be determined on one hand by expectations on the demand front, and on the other are expected to be deeply impacted by supply side disruptions which are increasingly evident. Slowdown in global industrial growth, widespread adoption of energy efficiency measures, technological advancements in energy generation and distribution are leading to declining energy intensity of growth affecting demand. Further, trends towards electrification of demand (as evident in 2016), are expected to intensify resulting in inter-sectoral shifts in energy investments. On the supply side, continued growth of the U.S. shale, the dominance of RE, adoption of technologies such as distributed RE, battery storage, trends in decentralisation and digitalisation of energy sector are likely to cause deep rooted disruptions in the sector.

Going forward, these factors are expected to intensify, turning business cycles increasingly short. For a business like energy which typically has a longer gestation period, this poses fundamental questions regarding capital allocation, business and operating model and risk mitigation.

Keeping the above in view, the paper delves into the key reasons which are resulting in investment uncertainties in the energy sector, evidences the problems being encountered by energy resource and energy infrastructure providers by studying international and Indian examples and examines how risks have been sought to be mitigated globally to encourage investments. Further, based on the international principles and precedents, the paper provides high level recommendations for key actions that may be taken by developing countries such as India with appropriate rationale.

Key themes giving rise to disruptions and the resultant uncertainties

The key themes that are giving rise to disruptions and uncertainties in the energy industry can be categorised into the following:

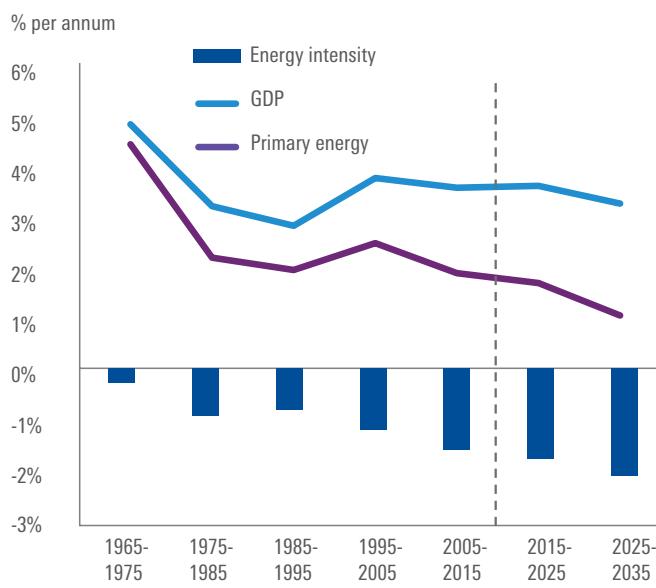
- Demand side changes
- Supply side changes
- Environmental stipulations/mandates and future energy pathways
- Geopolitical and other policy risks
- Rigidity in design of contractual structures
- Other country specific risks

These are further discussed below:

Demand side changes

The 2016 edition of World Energy Outlook by IEA emphasizes that 'the relationship between global economic growth, energy demand, and related carbon dioxide emissions is steadily weakening.'

Growth in GDP and primary energy

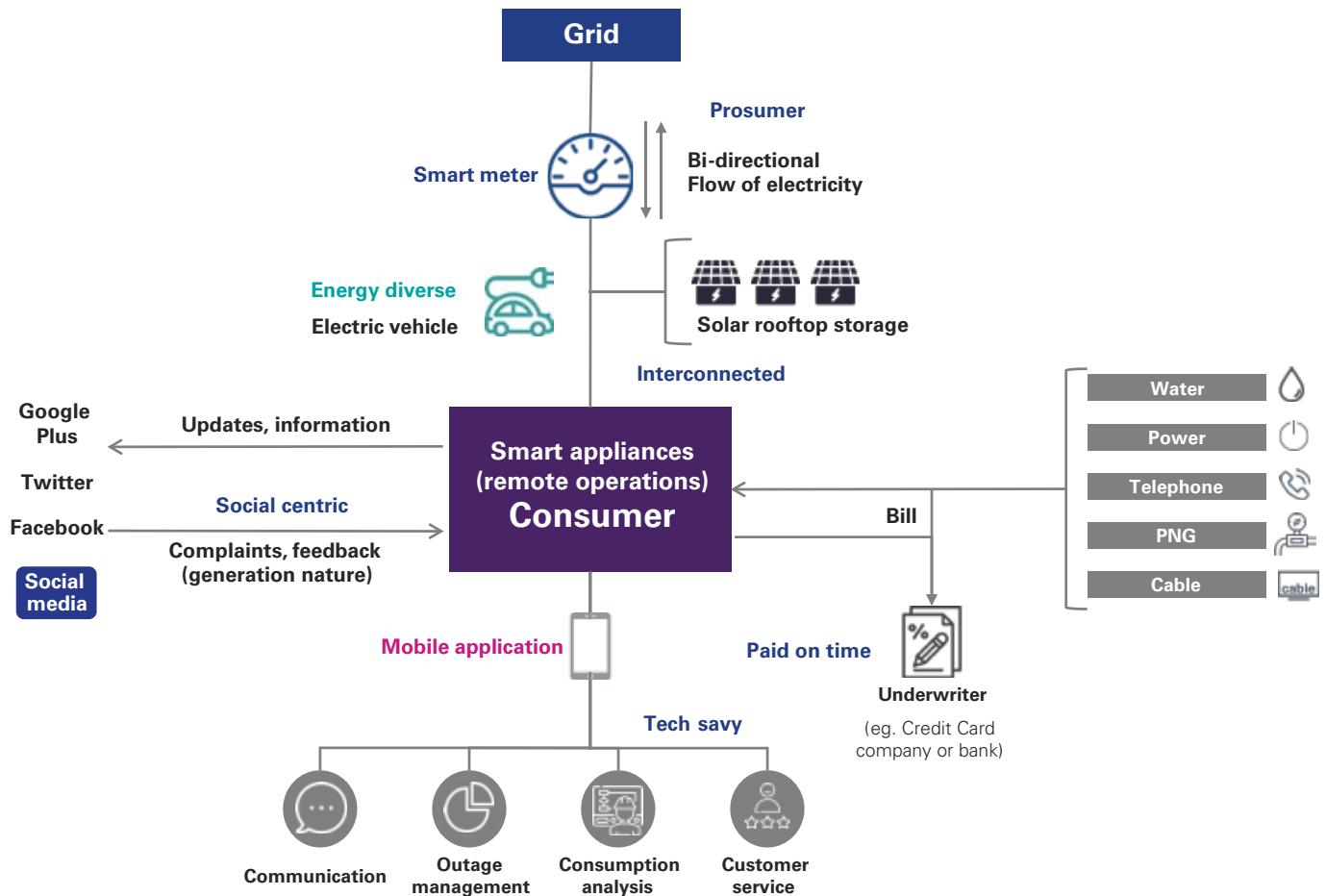


Source: BP Energy Outlook 2017

As per BP Energy Outlook 2017, while global Gross Domestic Product (GDP) is expected to nearly double over the next 20 years, energy demand is expected to grow by only 30 per cent over this period. Technology and productivity improvements globally are resulting in better efficiency and lower energy intensity of demand. More than half of the growth in energy demand is expected to be contributed by China and India driven by rising urbanisation, economic growth and improving per capita incomes. Even within these important demand centers, movement towards energy light and services industry, measures towards energy efficiency, improvement in transport fuel efficiency, have led to varying estimates for long-term growth in demand for energy.

Aside from regional shifts in demand and decline in energy intensity, factors such as greater electricity access, awareness and empowerment of consumers are likely to play a significant role in influencing energy demand. BP Statistical Review anticipates that two thirds of the increase in energy demand may be for power. This is likely to be driven by shifts in consumer preferences towards electricity as a fuel for meeting energy needs as well as greater access to electricity for nearly 1 billion people without access to electricity in Asia and Africa. Further, consumer preferences are likely to play a key role the way electricity is produced and delivered. With greater consumer empowerment enabled through the rise of technologies such as distributed energy generation, advance applications of data sciences, digital technologies including smart homes/smart grids, block chain technology, today's consumer is likely to move towards self-generation, optimal energy management, with better and instant information enabling greater choices in products and services.

Rise of prosumers



Source: KPMG in India's analysis

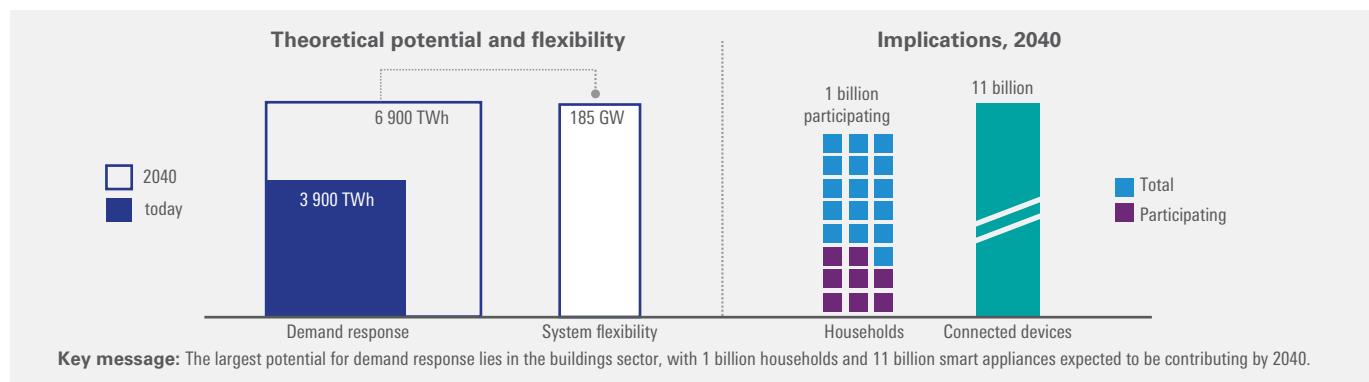
As has been witnessed in countries such as Germany where roof top solar penetration is among the highest in the world, consumers are fast evolving into 'prosumers' who are not only producing and consuming electricity but also through energy efficiency and demand side management, selling electricity to the grid or to each other. With declining solar roof top and battery costs, the participation of the consumer base in demand

response programmes is likely to grow substantially. The IEA² estimates the global technical potential of demand response at about 185 GW in 2040, potentially avoiding cumulative investment of USD 270 billion (in 2016 dollars) going towards new power generation capacity and transmission and distribution.

2. IEA Digitization and Energy 2017

Therefore, as demand is addressed in a more decentralised manner, there is an increasing threat of disintermediation for utilities across the world

Demand response and system flexibility

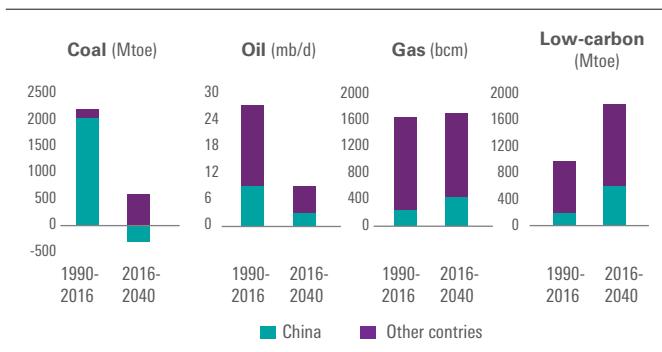


Source: IEA Digitization and Energy 2017

Supply side changes

As per IEA's World Energy Outlook 2017, the future pathways for global energy indicate a dramatic change as compared with the last twenty-five years based on the global policies and intent. Renewables is likely to address 40 per cent of the increase in primary demand by 2040 and along-with natural gas, is likely to take the lead in meeting the future energy needs.

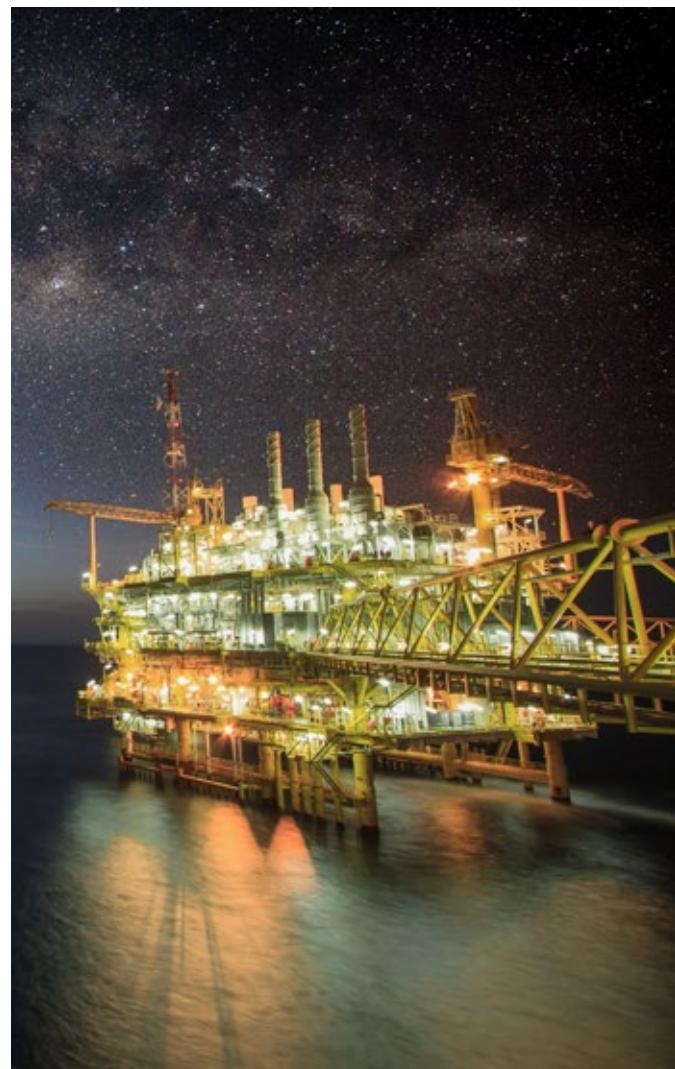
Change in world energy demand by fuel



Source: IEA World Energy Outlook 2017

A new energy landscape is clearly emerging giving rise to supply side dynamics which are evident across fuels/resources as well as the energy sector's value chain.

whose business dynamics have been centered around utilisation of own networks.



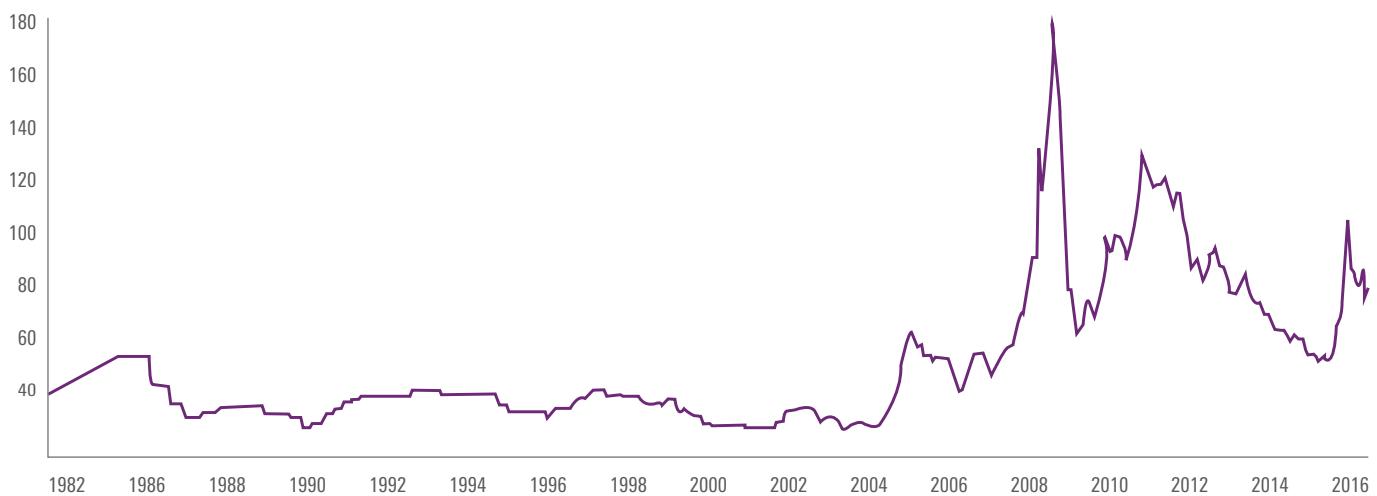
Coal

Among fossil fuels, coal has been the fastest growing resource over the last quarter-century. In fact, global coal consumption increased by 64 per cent between 2000 and 2014.³ Going forward, coal consumption is expected to fall sharply to ~0.2 per cent with consumption peaking by mid-2020s.⁴ Demand uncertainties from global policy shifts including in key demand centres such

as China and India are creating price fluctuations in this commodity impacting margins of coal players. Tumbling coal prices since the beginning of this decade have led to widespread bankruptcies in this sector with some of the world's largest coal producers filing for bankruptcy protection. With the prospects of the sector uncertain, interest of investors in this sector could weaken.

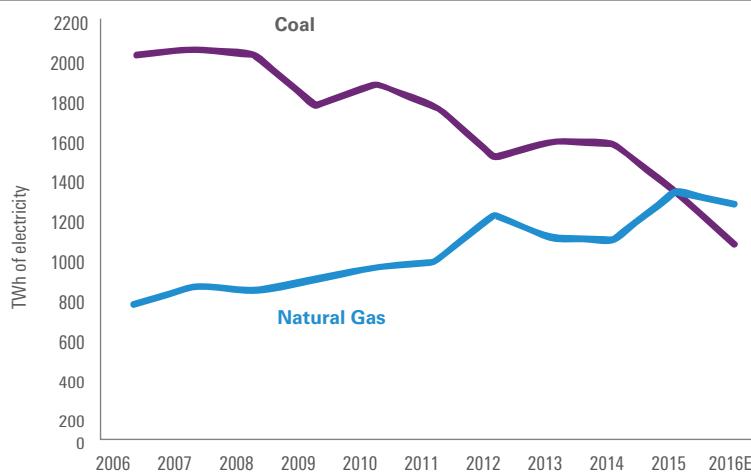
Coal price trend

Australian thermal coal (USD per metric ton)



Source: Quandl, quandl.com, as accessed on 12 January, 2018

U.S. gas power vs coal power



Gas this year will supply 35% of U.S. electricity, compared to 30% for coal.

This is dramatic reversal, considering that in the mid-2000s coal accounted for over 50% of U.S. electricity and gas was under 20%.

Source: Quandl, quandl.com, as accessed on 12 January, 2018

3. World Energy Council: World Energy Resources Coal 2016
4. BP energy outlook 2017

Coal is currently the largest contributor to global electricity generation at ~41 per cent share.⁵ While nearly 900 GW coal based power generating capacity was built in the last 15 years, only about 400 GW is expected to be constructed till 2040.⁶ Further, analysts expect that the growth anticipated in coal based generating capacities, will be largely limited to the existing assets under construction. In India, CEA anticipates no addition to coal plants post 2022.⁷

Given the move away from coal globally, the ecosystem associated with coal sector, such as mining companies, thermal capital equipment providers, EPC companies face uncertain times. Their assessment of the emerging scenarios and the decisions they take will impact the future of these companies in critical ways.

Oil

Low oil prices over the last couple of years have favourably impacted the demand of oil, especially from the transport sector. The oil sector despite facing glut, does not appear to be have found disfavour with financiers (as per IEA, major oil companies issued new debt of over USD100 billion between late 2014 and early 2017). It is also interesting to note the increasing role national oil companies are playing in upstream investments with their share of outlay in this segment rising from below 40 per cent to 44 per cent in 2016.⁸

As per IEA, oil demand will continue to grow till 2040. However, pace of growth in this sector is expected to be tepid at 0.7 per cent. While factors such as higher efficiency and fuel switching will create a downward pressure on oil demand for transport, the industry believes that the overall oil demand is likely to continue to go up bolstered by the demand from petrochemicals, trucks, shipping, aviation, etc. The U.S. shale is expected to cater to almost 80 per cent of the growth in oil till 2025 after which analysts expect the U.S. shale oil growth to plateau. Production discipline has been agreed to be extended throughout 2018 and oil prices are expected to remain firm. The reaction of shale companies and their production strategy could definitely impact the markets.

In China and India, the key demand centres for oil, oil demand continues to be strong. In India, where there is heavy reliance on oil imports and refineries are operating at full capacity, the planned investments in exploration, refineries etc. continue to be on course. India's continued economic growth and low per capita consumption, coupled with the move to cleaner fuel standard creates the case for such investments.

Further, most new refineries are being conceived with integrated petrochemical complexes, which affords significant product slate flexibility.

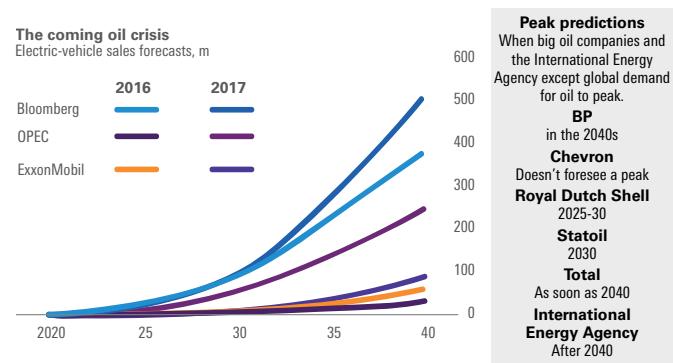
5. Worldcoal.org

6. IEA: World Energy Outlook 2017

7. National Electricity Policy 2016

8. IEA: World Energy Investment 2017

Electric Vehicles (EVs) sales forecasts & oil peak predictions



Source: Economist.com August 2017 edition; Bloomberg New Energy Finance (BNEF) IEA and the companies, The Wall Street Journal

In the longer-term, EVs are expected to emerge as significant disruptor to oil demand in the automotive sector as these become a viable alternative to petrol and diesel-fuelled vehicles. However, industry and analysts widely differ in their estimates of their 'peak predictions'. Given this, the pace and impact of EV adoption is one of the key uncertainties faced by investment decision makers today.

Investors are likely to be further concerned by far-reaching implications of the recent announcement by World Bank to cease financing of new upstream oil and gas projects after 2019 in order to align its support to climate goals.

Natural gas

Natural gas is likely to continue to find investment interest as the prospects remain bright for both power and industry use. As per BP Energy Outlook 2017, natural gas is expected to grow at the fastest rate (among fossil fuels) of around 1.6 per cent between 2015-2035 led by US shale which is expected to account for more than 60 per cent of the increase in gas supplies. Industrial use of gas is expected to be a major growth driver.

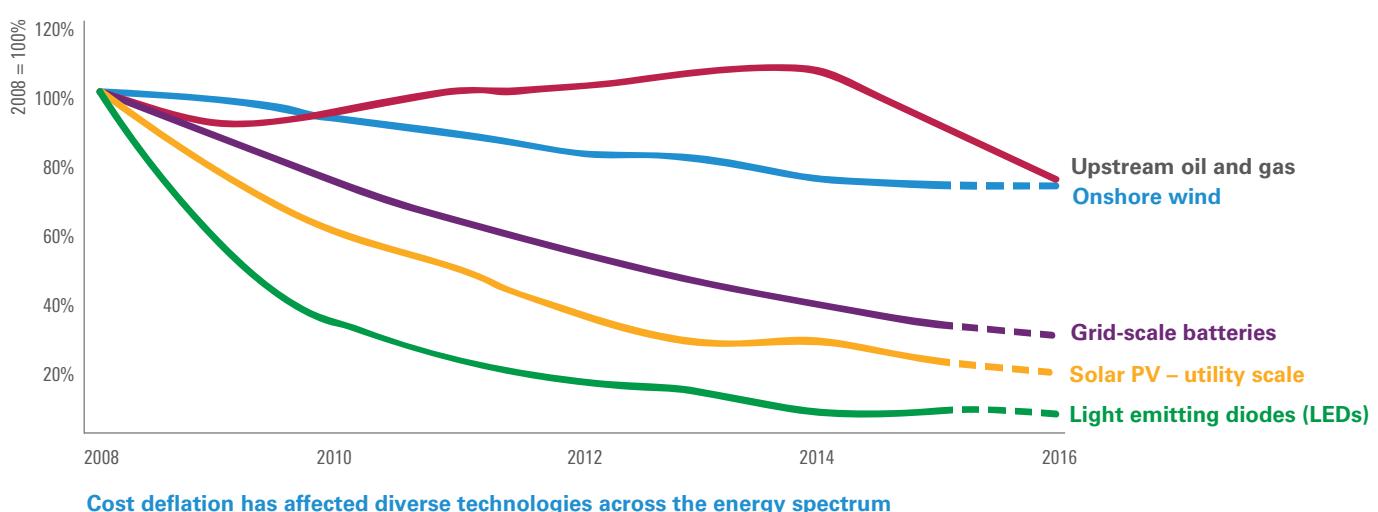
With increasing supplies (largely from the U.S. and Australia), gas prices are likely to remain soft. In fact, in the U.S., natural gas is expected to influence the power mix in both North and South America with low gas prices allowing gas plants to replace retiring coal and nuclear plants. Further, gas is likely to continue to gain share in many markets globally for generating power owing to increasing environmental restrictions governing coal and its role in flexible generation.

Renewable energy

Driven initially by concerns on climate change and with subsidies or supportive Feed in Tariff (FiT) regimes, RE growth has now gained substantial momentum with technological advancements and declining cost curves. As per BNEF⁹ going forward RE will capture 72 per cent of the estimated USD10.2 trillion to be invested in new power generation capacity worldwide by 2040.

As the penetration of RE increases, lack of sufficient flexibility within the power system could increase the risk of curtailment. Various RE markets have had instances pertaining to curtailment due to increasing ingress of RE impacting the grid stability.

Recent cost trends



Source: World Energy Investment, IEA 2016

As a result, despite increasing cost competitiveness of RE, investors face uncertainty with respect to curtailment which directly impact returns. Aside from mechanisms such as forecasting and scheduling, addressing such issues would need market transformations to provide the right signals for inter-play of solutions such as demand response, ancillary services, flexibility of coal plants, capacity remuneration mechanisms etc. for enhancing grid flexibility while ensuring resource adequacy.

One of the biggest disruption on the supply side is expected to be caused by battery storage technologies. As lithium ion battery costs become competitive, storage solutions have the potential to address the flexibility required in the grid competitively, thus facilitating a higher ingress of RE.

Environmental stipulations/mandates and future energy pathways

Following the Paris Agreement on climate change, 193 countries with share of nearly 88 per cent in global carbon emissions,¹⁰ have stipulated carbon emission reduction commitments by 2030. The goals set by

various governments have been backed by clear policy thrusts in most countries paving way for strong investments signals in clean energy. At the same time, this has wrought considerable uncertainty in investments in fossil fuel based technologies. Various global organisations including those associated with conventional fuels have firmed up their commitment towards climate change goals and are redrawing their business strategies to invest in clean energy and technologies. For instance, global mining major BHP Billiton Limited (BHP) recently stated that it would leave the World Coal Association and review its membership of the U.S. Chamber of Commerce to evaluate if their stances align with BHP's support for action against climate change.

One of the biggest contributors to carbon emissions is electricity production. Countries such as India and China which together are expected to add a majority of incremental power capacity, have taken purposeful strides towards RE capacity additions. As per IEA, low carbon sources and natural gas are expected to meet 85 per cent of increase in global energy demand from 2016 till 2040.

9. New Energy Outlook-2017, Bloomberg New Energy Finance, 2017

10. www.carbonbrief.org. The statistics would change with US's withdrawal from the Paris agreement

With cost economics for RE improving rapidly coupled with medium-term uncertainties in demand owing to surplus capacities, existing conventional value chain players face uncertainties with respect to the prospects of the conventional power segment. Further, India has also tightened emission norms for coal based plants with stricter standards on carbon dioxide, sulphur dioxide and nitrogen oxide production in coal plants which imply an increase in fixed costs, affecting plant economics adversely vis-a-vis RE deployment.

The transport sector is another important contributor to emissions contributing around 14 per cent¹¹ to emissions globally. In order to control emissions, governments are increasingly looking at providing appropriate fiscal and policy stimulus to drive a faster adoption of EVs. The EV30@30 campaign, announced at the Eighth Clean Energy Ministerial in 2017, has set up a collective aspirational goal for all Electric Vehicles Initiative (EVI)¹² members of a 30 per cent market share for EVs by 2030 with ambitious EV adoption targets being announced by most member countries over this period.

While directional changes in future energy pathways are evident, there is considerable uncertainty around the speed of the transition. A full-fledged drive towards clean energy could drive a much faster transition in future energy pathways. On the other hand, policy reversals such as the U.S.A.'s decision to withdraw from the Paris Agreement and pursue revival of coal industry have the potential to slow down the pace of the transition.

11. <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>

12. The Electric Vehicles Initiative (EVI) is a multi-government policy forum established in 2009 under the Clean Energy Ministerial (CEM). The initiative seeks to facilitate the global deployment of 20 million EVs, including plug-in hybrid electric vehicles and fuel cell vehicles, by 2020 (Source: CEM)

While it is expected that the industry would chart its own path of low carbon footprint and not depend on governments, the intensity of change could be impacted affecting investment decisions.

Geopolitical and other policy risks

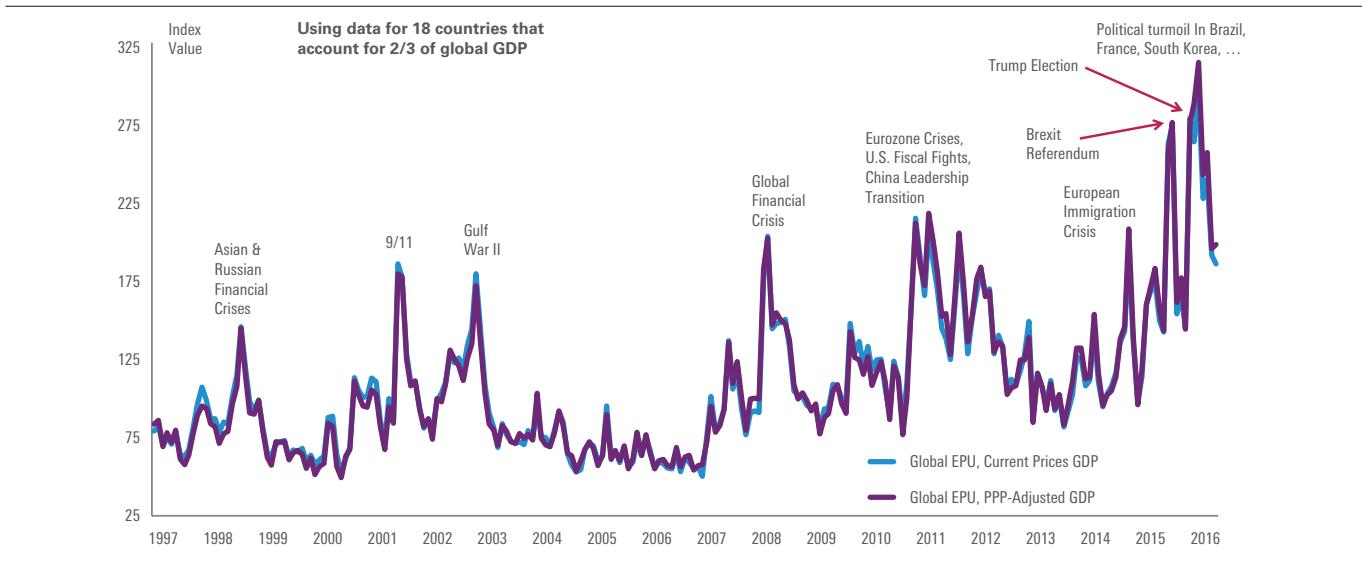
Energy is inherently a highly capital intensive sector and pay-back periods for investors are long. Government's policy and regulatory actions can create an uncertain environment for investors, especially in a scenario where governments are seen to be making retrospective amendments. In fact, energy investors face uncertainties not only due to policy shifts within the country where investments are made but also due to geopolitical events/policy changes in other countries since energy resources (especially fossil fuels) are unevenly distributed and under strategic control of a few regions/countries.

Shifts in political priorities with elections, fiscal constraints, technological progress, etc are some of the common drivers for directional policy amendments globally. In 2013 in Spain, there was a retrospective and sudden reduction of feed-in tariffs for photovoltaic systems by almost 25 per cent for rooftop and 45 per cent for ground-mounted systems by the government in a bid to reduce the tariff deficits.¹³ The U.S.A.'s decision to withdraw from the Paris Agreement is a stark example of policy risks driven by electoral changes. In the past, industries in the U.S.A. have also been dogged by Production Tax Credit (PTC) uncertainties.

13. Determinants of Policy Risks of Renewable Energy Investments, Nadine Gatzert, Thomas Kosub- Department of Insurance Economics and Risk Management Friedrich-Alexander University Erlangen-Nürnberg (FAU)



Global Economic Policy Uncertainty Index, January 1997 to May 2007¹⁴



In the oil sector, after around two years of unrestrained output to gain market share, OPEC decided to resort to production cuts. Even certain non-OPEC countries (including Russia) went ahead with production cuts. These actions have resulted in firm oil prices during 2017 after record lows over last two years favourably impacting investment flows. Since June 2017, Brent prices have further strengthened owing to drop in the U.S. crude inventories, stronger than expected demand growth, geopolitical tensions between OPEC countries and cyclonic activity in the U.S. disrupting production. In October 2017, OPEC reaffirmation of production discipline to manage supply glut, and rising tension between the Iraq government and Kurdistan Regional government have led to prices firming up further. As discussed before, the production discipline has been extended for 2018. However, learnings from the past indicate that formal commodity agreements have a limited ability to influence market conditions over extended periods of time (Baffes et al. 2015; World Bank 2016b). Also, an extended rally in oil price is likely to result in a strong supply side response from the U.S. shale producers as well. Therefore, investment flow towards oil sector could be extremely sensitive to any change in policy stance in respective countries.

Globally, policy stability and adequate risk balancing have been the key factors leading to increase in equity and debt flow for the energy sector. As the energy sector is going through transition led by disruptive technologies and emission reduction targets, various geopolitical developments and uncertainties too have a direct bearing on investment decisions. The Global Economic Policy Uncertainty Index¹⁵ at the end of 2016 was the highest since 1996. This was triggered by global events such as the U.K. referendum on EU

membership, the U.S. elections, slow-down in China, Brazil, etc. While the index is falling in 2017, political and economic uncertainties are unlikely to abate significantly in the near term owing to rising nationalism, unpredictable electoral outcomes and other geopolitical developments globally.

Rigidity in design of contractual structures

Uncertainties are getting exacerbated especially in emerging countries owing to badly designed contracts which have rigid structures over Power Purchase Agreement (PPA) period (which can be as long as nearly 20-25 years) and have lopsided risk allocations. Faced with emergent disruptions, the rigid contract structures are discouraging investments in energy sector as developers fear that unfavourable changes in law and other externalities could put assets under stress and create investment risks. There is typically lack of adequate provisions for renegotiation even when the situation clearly warrants the same.

A case in point is of an Indian company which in 2006 won the bid for a large coal-fired power plant based on competitive tariff offered. The rates had been offered at the back of planned procurement of coal from its coal mines in Indonesia at competitive transfer prices. In 2010, the Indonesia's energy regulator issued regulations stipulating that the price for coal exports from Indonesia need to be linked to international rates with the aim to create better frameworks for transfer pricing. This led to a significant increase in the price of the coal sourced for the project, making the plant unviable at the quoted rates and resulting in significant financial stress.

14. Policyuncertainty.com, as accessed on 12 January 2018

15. Created by a group of top 10 economists, this Economic Policy Uncertainty Index for 17 countries which account for 2/3rds of world GDP, using media reporting and economic forecasts to show how much uncertainty there is economic policy

A principal challenge clearly at this time is that the changes and disruptions are threatening to be rapid and co-incidental with massive net impact. Investment frameworks and financing instruments developed to address these situations along with the underlying commercial contracting framework need to be sufficiently robust and/or flexible to cope with these changes.

Country specific risks

Other than the above global uncertainties, country specific investment risks are also perceived. For instance in India, where power is mostly sold by generators to utilities (discoms), one of the key risks perceived by investors is the counter party risks owing to poor financial health of the utilities/offtakers which have often delayed payments. Further, utilities have also attempted to renege on the PPAs, especially

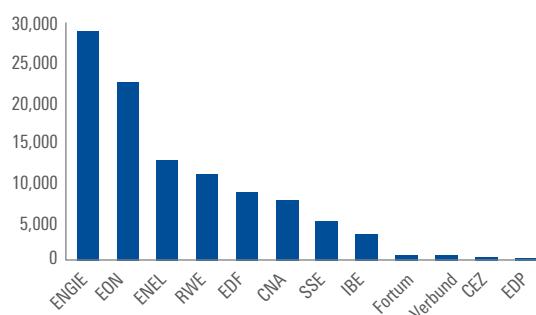
higher cost renewable energy PPAs, given the sharply declining tariffs.

Another example is the gas sector in India which suffers from various challenges. There is lack of flexibility in commercial contracts, pancaking of tariffs, volume risks (extant selection mechanisms), taxation anomalies, lack of pricing reforms in end-user segments amongst others. Uncertainties around the taxation regime are a significant cause for concern in the sector. In particular in India, the partial application of the Goods and Service Tax (GST) regime to the energy sector has caused consternation. In general, investors continue to seek a reasonable, predictable and stable fiscal regime for their investments, especially in these uncertain times where the ability to absorb fiscal shocks is often limited.

Examples of some such challenges faced from across the globe are provided in the box below:

Europe – Policy shifts and global commodity price movements

Utilities impairment since 2010 by co. (EURO mn)



Source: Jefferies estimates, Company Data

In Europe, utilities have witnessed widespread losses in asset valuation with falling wholesale electricity prices. At the peak in 2008, as per MSCI European Utilities Index, the top 20 European utilities were worth EURO1 trillions. By 2013, half of investors' value was eroded.

The downslide began with global commodity price dynamics which made coal cheaper and affected prospects of gas plants. Governments' shift away from nuclear energy further affected asset valuation. The downwards spiral has been exacerbated by increasing penetration of RE which has contributed to an over supply and further dive in electricity prices.

Source: The Economist – "How to lose a trillion Euros"

Indonesia – Risk sharing mechanisms in PPAs



Indonesia energy regulator some months back issued regulations, viz. MEMR Reg.10 which outlines inter-alia new risk sharing mechanisms under PPAs. The regulations require IPPs to also share force majeure risks by removing deemed dispatch provisions for events such as natural disasters impacting the grid.

Although the regulations do allow for the extension of the PPA term in such event, this is unlikely to fully address the lender's concern pertaining to loss of revenue and cash flow thereby impacting project bankability. Also, insurance contracts typically factor the developer asset and performance, and since the developer has no role wrt the utility assets, this heightens investor concerns.

Source: Media articles

Tanzania- Off take risks



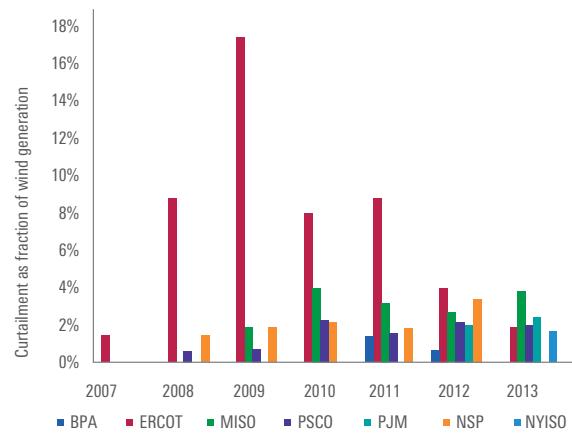
The Tanzania Electric Supply Company (TANESCO) is wholly owned by the government of Tanzania and is a bundled utility. Son Gas (majority owned by Globeleq) is an independent power company that runs a gas-powered plant in Dar es Salaam and contributes nearly 20 per cent of Tanzania's grid power.

TANESCO, has been in arrears in a significant portion of its payments to SonGas Limited from 2012. SonGas owing to arrears has found it difficult to honour its commitment for natural gas. In 2016, SonGas threatened to suspend its operations due to long-standing arrears by TANESCO.

Source: KPMG in India's analysis, 2018

U.S.- RE curtailment risks

Levels of curtailment in the U.S.



Source: NREL

As per the NREL study, levels of wind curtailment experienced differed significantly by region and utility service areas

Generally, curtailment in the range of 1 to 4 per cent of wind generation was observed. Higher levels were reported for Electric Reliability Council of Texas (ERCOT) where curtailment in 2009 even jumped to 17 per cent.

Based on utility interviews, issues such as transmission congestion, high wind ramps or over supply have been identified as key reasons.

Source: NREL 2014 study "Wind and Solar Energy Curtailment: Experience and Practices in the United States "

Key risks and challenges across the energy value chain

The key disruptions and uncertainties discussed above are giving rise to projects risks across the energy sector value chain. Some such challenges faced are summarised below:

Table 1: Key risks and challenges in the energy sector

Energy generation fuels		Energy infrastructure
Coal	<ul style="list-style-type: none"> Policy actions deterring coal use Declining share in energy generation, crowded out by RE and natural gas Reduced funding avenues 	<p>Coal power plants</p> <ul style="list-style-type: none"> Low PLFs Increased investment requirement for emission control norms Balancing and flexibilisation requirements in view of rising RE share Rigidity of contracts
Oil	<ul style="list-style-type: none"> Supply glut Price volatility OPEC production-cut back agreements Non-OPEC supply increase Faster U.S. shale oil drilling activity Increasing EV deployment commitments 	<p>Refineries</p> <ul style="list-style-type: none"> High product inventories Weak demand and low prices Reduction in reserve development projects High U.S. shale gas production Newer business models Increasing technological developments, operating cost discipline crucial
Natural gas	<ul style="list-style-type: none"> Abundant supply led by shale leading to soft prices Slower LNG supply growth 	<p>Renewable energy projects</p> <ul style="list-style-type: none"> Dispatch risks Counterparty risks (for high tariff projects) Policy reversals with respect to concessions/ exemptions Lower than anticipated technological advancements in RE and battery storage Technology/performance risks <p>Nuclear plants</p> <ul style="list-style-type: none"> Safety concerns Geopolitical situations <p>Gas power plants</p> <ul style="list-style-type: none"> Storage and demand response Maintaining reliability, resource adequacy and fuel diversity Regulatory challenges in some markets Rising share of RE for power demand Regional pipeline availability <p>Network assets</p> <ul style="list-style-type: none"> Right of way concerns Geographical disputes Asset integrity issues Asset utilisation risks with distributed generation Harsh weather externalities

Global uncertainties deeply influence capital allocation and investment decisions. In an uncertain environment, the decisions tend to sway not only between regions, but also to sectors where investment horizons are shorter and thus are considered low risk-low return.

With the energy sector facing uncertainties in face of emerging disruptions, it becomes important to understand the specific challenges being faced by the resource and infrastructure players and seek ways to address them.

Addressing uncertainties from an energy financing standpoint

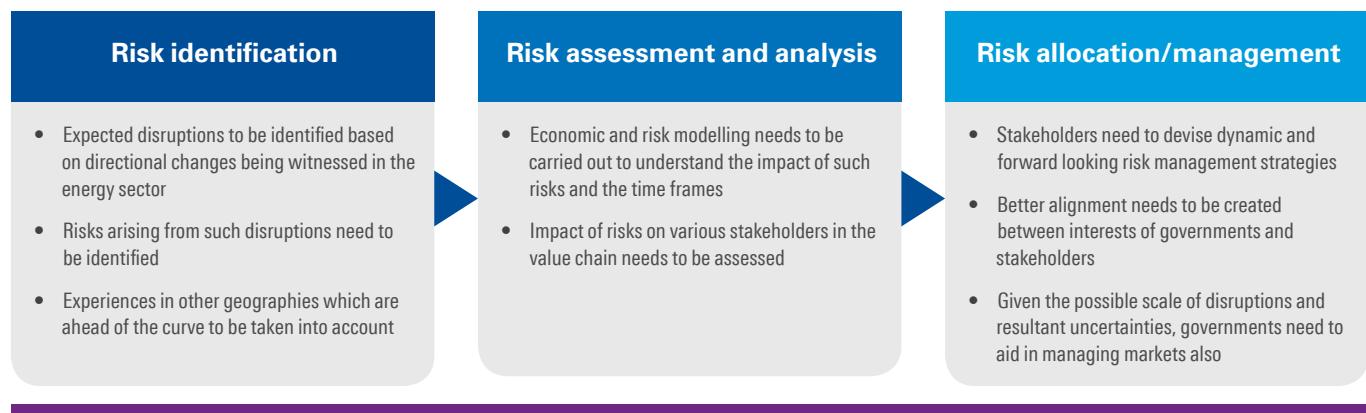
The investment decisions which were pretty straightforward around 5-10 years back, such as setting up energy generating stations to cater to growth in demand (largely under regulated tariffs or with strong visibility on market prices) are by fair means not so easy in today's changing times. The sector is today deeply influenced by disruptive factors such as customer preference, smart applications and technologies as well as environmental concerns. At the same time, structures and contractual arrangements are weakening and policy shifts are increasingly putting returns at risk.

With uncertainties rife across the energy spectrum, investment decisions need to move beyond evaluating

the immediate market opportunities and the evident risks. Stakeholders in the energy space need to increasingly take into account the possible disruptions which could critically influence the pathways that energy sector can adopt, identify opportunities as well as new risks and assess the impact. Further, the sector needs to devise dynamic and forward looking risk management strategies that would allow them to keep pace with new developments.

Nevertheless, the pace of disruptions may still have the ability to beat management expectations. Here, analysing and monitoring critical influences would be the key to spotting both opportunities and risks early.

The process of managing risks in the wake of possible disruptions



As per conventional risk allocation principles, market and asset performance risks typically need to be borne by investors, while risks arising out of policy shifts and other externalities could be allocated to governments. However, if infrastructure is indeed of the nature of public good (or essential for delivery of a human right), then to an extent even the market risks on account of the energy sector disruptions needs to shift back to the governments and be spread across rate payers and tax payers. If too much risk is put on investors then private capital could move away from the sector, as financiers seek safer areas for capital allocation. In the Indian power sector context, the risk allocation framework for

the Rewa Ultra Mega Solar Power Project in Madhya Pradesh is a good example wherein the contractual documents were well-designed covering the roles and responsibilities of the stakeholders and risks were not lopsided. One such risk mitigation measure introduced was an innovative three-tiered payment security mechanism developed within the contractual framework to address counterparty risks. The tiered mechanism also included a guarantee from the state (which was consuming maximum electricity being generated from the project). This allayed investor concerns on payment delays and resulted in steep fall in tariffs and huge investor interest.

Governments need to ensure that to the extent possible, necessary support for management of emerging risks is provided to the sector through 1) strengthened contractual structures and flexible contracts 2) development of enabling market structures 3) conducive and stable policy frameworks and 4) innovation in financial de-risking instruments.

Strengthened contractual structures and flexible contracts

The investment decisions by debt and equity providers and pricing is largely guided by the provisions of contractual terms and the credit profile of the off-taker both in regulated as well as non-regulated markets. However, contractual structures in many emerging countries suffer from unimaginative design and improper risk allocation framework. There is a tendency to load all residual risks on the project sponsors and lack of adequate provisions for renegotiation even when the situation clearly warrants (rigid contracts).

It is imperative that contractual frameworks with utilities/authorities, as well as financing agreements are revisited to ensure robustness. There should be a clear definition of risks and an optimal allocation which allows clarity in understanding, assessing and pricing these risks. The Kelkar Committee¹⁶ report on 'Revisiting and revitalizing PPP model of Infrastructure' (November 2015) also proposes re-balancing of the risk sharing in infrastructure projects in India. While this may need to be evolved with changing times and country specific requirements, it does lay down specific framework which can be adopted suitably in energy infrastructure financing.

Some specific recommendations put forth by the Kelkar Committee for allocating and managing risks under PPAs are:

- An entity should bear the risk that is in its normal course of business
- An assessment needs to be carried out regarding the relative ease and efficiency of managing the risk by the entity concerned
- Cost effectiveness of managing the risk needs to be evaluated
- Any overriding considerations/stipulations of a particular entity need to be factored in prior to implementation of the risk management structure
- Sophisticated modelling techniques are prevalent to assess probabilities of risks and the need to provision them. The Department of Economic Affairs (DEA) may hone its skills in this and provide guidance to project authorities

- There should be ex-ante provisioning of renegotiation framework of in the bid.

The issue of renegotiation is at the core of contract administration. Empirical and theoretical research over the past two decades clearly has moved from a preference for rigid contracts towards the fact that uncertain economic environment and limited rationality make long duration infrastructure contracts necessarily incomplete.

There is a broad body of research and knowledge that have been led by Oliver Hart (1995, 2003) and Jean Tirole (1999) that characterise infrastructure contracts as 'incomplete contracts'. Infrastructure contracts, in such research and analysis have been broadly covered under two basic typologies by Athias and Saussier (2010) :

- Rigid contracts, in which the contracting parties attempt to specify the means of coordination according to future states of nature. In other words, in such a contract, parties try to prevent renegotiation, essentially by deciding the price to be charged by the private operator for the whole duration of the contract.
- 'Flexible contracts', in which the parties do not try to avoid renegotiation and plan to renegotiate price once any uncertainty unfolds.

Since no probability can be assigned to unknown events, contracts cannot provide provisions for all possible future contingencies. As they are confronted with risks to which they cannot assign any probabilities, agents find it impossible to write complete contracts. Hence long term contracts need to reflect an element of flexibility to address their inherent incompleteness. Such flexibility can be accorded to the contracts through explicit renegotiation clauses. International literature indicates that such provisions for tariff renegotiation are not only essential, but must be explicitly provided for in the contract framework to render them sufficiently flexible to address emergent situations over the contract life. There have been various instances where mutual re-negotiations between contracting parties have benefited both the parties and the larger good for the nation. Some examples pertain to Phnom Penh Airport Concession Renegotiation (Cambodia, 1997), Thailand financial crisis and re-negotiation of PPAs, re-negotiation of gas PPAs in Andhra Pradesh (1999-2007) among others. Of course, due regulatory process adopted for renegotiation and benefits have to be established to initiate re-negotiations.

16. Kelkar committee to evaluate PPP in India was a committee set up to study and evaluate the extant public-private partnership (PPP) model in India. The committee was set up by India's central government and headed by Vijay Kelkar

Role of markets in promoting risk management

Energy markets need to be designed with adequate flexibility and adequacy of products to manage the dynamic environment and address the consequent risks of market players. In particular, market design needs to focus on the following aspects

Enabling market structures

Development of short-term markets

- Long-term and short-term markets markets are complements
- Short-term markets enhance competition, improve economic efficiency, provide investment signals

Balancing high ingress of RE

- Variability cause by RE has implications on system balancing.
- Need for development of ancillary and balancing markets for frequency response

Risk management tools

- Price volatility in short-term markets increases risks for buyers and sellers.
- Instruments such as energy futures and contracts for differences need to be developed to enable firm lock-in of prices

Providing resource adequacy

- Capabilities in load forecasting, generation portfolio optimisation and generation flexibility in conventional plants.
- Capacity markets need to be evaluated to complement wholesale markets.
- Separation of content and carriage

• **Improving market efficiency through development of short-term market:** Long-term and short-term markets have emerged as complements. Global experiences including lessons from India have demonstrated that both long-term contract driven structures and short-term market driven structures must coexist to enhance competition, bring economic efficiency. Further, the scale has to be sufficiently deep to provide the right investment signals and improve market efficiency. Presence of enabling short-term markets is especially critical for natural gas sector wherein the market has been largely driven by long to medium-term supplies (domestic and re-gasified LNG), resulting in supply chain inflexibility/rigidity.

• **Balancing high ingress of RE:** Variability caused by the large ingress of renewables in the grid has implications on other generation sources from system balancing point of view. Using spinning and supplemental reserves becomes critical. Therefore, there is a need to focus on development of frequency response and operating reserves through creation of well-structured ancillary and balancing markets. There is a need to evaluate and encourage solutions such as battery storage ecosystem where cost curves are sharply declining, in order to achieve scale and further bring down integration costs. With growing ingress of RE, role of hydro and gas based secondary and tertiary response is critical in grid balancing.

- **Providing resource adequacy:** Further, the right signals need to be provided for encouraging conventional generation to provide resource adequacy. A scientific approach needs to be adopted towards modelling the future demand and portfolio optimization/balancing, etc. Apart from these, there is also need to have more flexibility built into the design of the conventional generation plants to maintain base load. Further, at the right stage, capacity market statements need to be introduced and eventually capacity markets need to be developed to complement wholesale energy markets.

- **Developing risk management tools like energy futures and Contracts For Difference ('CFDs'):**

Wholesale market participants can face significant risks owing to spot price volatility in electricity markets. Generators could face a risk of low prices which can impact their margins. On the other hand, discoms/consumers can face the risk of price surges. While long-term contracts are available to manage pricing risks, such contracts come with inherent inefficiencies and improperly allocated risks, as discussed before. In such a scenario, markets need to offer financial risk management tools like energy futures and Contracts For Difference which allow market participants to lock in firm prices for the electricity they generate or purchase in future.



17. CfDs are contractual arrangements for low carbon generation technologies such as renewables, nuclear and carbon capture & storage (CCS). CfD essentially provide protection against volatility in wholesale electricity prices. Depending on the nature of the generation technology, generators will receive a CfD contract through auctions to be held for the same. The contractual arrangement offers to maintain a fixed 'strike price' such that if the market prices exceed the strike price, the generators will be liable to pay the difference, thereby avoiding over payment by the consumers. On the other hand, if market prices are lower than the strike price, generators will be provided a top up, thereby eliminating price volatility risk for generators.

Financing instruments/options to address risks

For the last few years, more than 90 per cent of investment in energy is being financed through balance sheet financing globally. While the availability of project finance to the overall energy sector has remained small, the past five years have seen a growth of 50 per cent in project finance for power generation, especially renewables based capacities which reflects lower perceived risks by lenders for this segment.¹⁸

It is imperative that innovative new mechanisms are evolved to address risks considered as significant and alternative means of financing are widened.

One of the critical aspects to also consider here is the access to a desirable investor base. Long-term patient capital from international institutional investors such as pension funds and insurance funds need to be attracted to the sector. However, although the return

expectations of such investors are more aligned to the returns typically generated by infrastructure projects, the investors have limited appetite for risks. Further, with the new energies landscape increasingly led by innovations in technologies such as battery storage, digitalisation, etc., new business models are likely to drive the future. It is imperative to attract various categories of investors such as angel funds, start-up funds, accelerator and innovation funds, to scale up such business opportunities.

Deployment of financial de-risking instruments backed by enabling policy measures can improve risk return profile of projects and help scale up investments attracting different categories of investors to energy projects.

Financial risk mitigation tools to address investment risks

Financial instruments

Investment risks	Government guarantee	Political risk insurance	Partial risk/credit guarantee	Export credit guarantee	Currency risk hedging	Currency risk guarantee fund	Local currency lending	Internal/external liquidity facility	Liquidity guarantee	Put option	Grant and convertible grant	Resource guarantee fund	Geothermal exploration insurance	Portfolio guarantee
Political risk	✓	✓	✓	✓										
Policy and regulatory risk	✓	✓	✓	✓										
Counterparty risk	✓	✓	✓	✓				✓						
Grid interconnection and transmission risk		✓	✓	✓										
Technology risk			✓	✓										
Currency risk		✓			✓	✓	✓							
Liquidity and refinancing risk									✓	✓	✓			
Resource risk											✓	✓	✓	✓

Source: IRENA

18. IEA: World Investment Outlook 2017

Financial risk mitigation techniques have commonly involved the use of credit enhancement techniques such as guarantees. These are typically issued by public entities, i.e. governments and multilateral finance institutions to address general credit risks or specific risks, for instance technology risks. Credit enhancements may also be done by issuers of instruments through tranching of securities into superior, sub-ordinate securities etc. where credit profile of the securities are structured based on the risk and return expectations of investors.

For emerging companies where financing costs are high, international capital provides an attractive avenue for attracting long term capital and low costs. However, a particular pain point in raising international debt by emerging countries is the risk of foreign exchange fluctuations. With hedging costs eating away the interest rate arbitrage, innovations in currency risk mitigation instruments such as masala bonds in India¹⁹ which allow developers to raise local currency denominated loans from international investors, need to be explored. However, the associated regulatory framework should ensure holistic involvement of players and not just a few top rated ones, with access to various classes of capital.

Other risk mitigation instruments can involve liquidity facilities to address payment delays by utilities, resource risk mitigation tools, etc.

Through regulatory and policy support, financing instruments can be structured with apt risk mitigation and allocation to facilitate sustained financing flow towards the energy sector.

Of course, robustness of the contracts has to go hand in hand for financing to be effective. Therefore, a combination of financial and non-financial measures are required for creating a more favourable investment environment or supporting financing through risk mitigation measures. Examples of financial innovations across the globe are mentioned in the subsequent section of the report.

Conducive and stable policy frameworks

Long term policy and visibility is critical to creating a conducive environment for sustained investments in energy. In sectors such as RE, while there is directional certainty in terms of government's intent to promote RE, there is considerable uncertainty caused by policy amendments impacting the sustainability

of the envisaged returns. For e.g., in an Indian state, wind assets were developed under Average Pooled Procurement Cost (APPC) along with Renewable Energy Certificate (REC) route a few years back which provided compensation to the project at the pooled power purchase cost. Further, RECs were issued to the project, which could be traded on the power exchange. However, subsequently, the state regulator issued an amendment to the definition of APPC capping the APPC to a certain percentage of the applicable preferential tariff for wind determined from time to time for the state. The said amendment applied to all existing projects. At the same time, a significant inventory of RECs remained unsold with projects, owing to the glut in the REC market. As per the developer/investor community, the combined occurrences significantly impacted the project and equity returns for the investors.

Further, in the natural gas sector in India, lack of an integrated policy for pipeline development has led to pancaking of tariffs for end consumers as well as lack of access to natural gas. As per global best practices, gas transmission and distribution is either planned collectively by different network owners or there is a centralised Transmission System Operator (TSO). Therefore, there is a need for a long-term integrated policy for streamlining gas distribution in India and improving investor interest.

The policy must consider state support for infrastructure development where overall government policy goals alignment and societal benefits are strong, but the financial goals of the project may not be fully addressed for conventional financing or Public Private Partnership (PPP). Viability Gap Funding (VGF) or innovations like the Hybrid Annuity Model (HAM) as adopted in the case of Indian highway development provide interesting case references for this.

While it is paramount for investors and investee companies to review their risk management strategies, clearly governments have an important role to play in helping the sector address uncertainties arising from the potential disruptions. The investment decision makers have to be incentivised to prioritize investments which deliver greater social and environmental benefits, not at the cost of sacrificing financial returns, but measuring and assessing wider basket of benefits that an investment delivers to arrive at its true value.

In the ensuing section, the report examines some international examples of measures to encourage energy financing in uncertain business environment.

19. Masala bonds are rupee denominated bonds issued outside India thereby giving access to international capital markets, while addressing challenges such as high cost of hedging by issuer since the lending is Indian Rupee denominated. Here the currency risk is borne by the investor. Issuance through masala bonds stood at around INR 30,600 crore till March 2017.

International examples of measures to encourage energy financing in uncertain business environment

Innovative business and financing strategies have been adopted both in developed countries as well as the emerging economies to address uncertainties arising from the business environment. These include measures such as business restructuring, or use of instruments such as guarantees, credit enhancements, derivatives, special purpose vehicles, etc. Efficacy of different structures and instruments is highly dependent on project and country specific peculiarities and requirements, including the robustness of contracts and the enforcement mechanism.

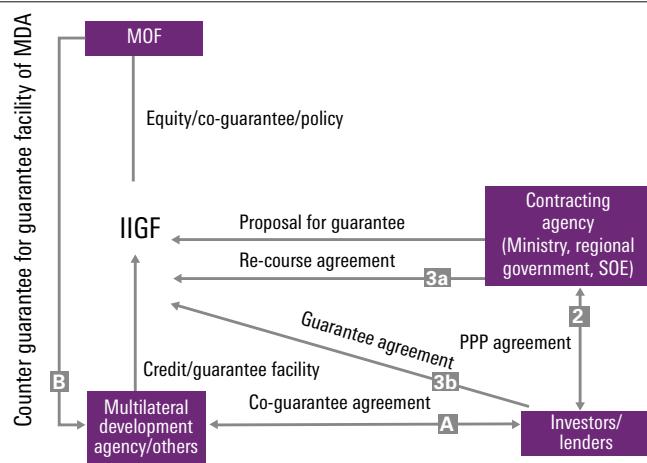
This section provides examples of following strategies adopted across the world to address uncertainties:

1. Managing financing and investment risks in uncertain times through risk mitigation tools
2. Re-orientation of businesses to adapt to sector transformations
3. Improving flexibility, sustainability and profitability of conventional segments to promote investments

Managing financing and investment risks in uncertain times through risk mitigation tools

Indonesia: Indonesia Infrastructure Guarantee Fund (IIGF):²⁰

IIGF structure



Background: Indonesia Infrastructure Guarantee Fund (IIGF) was formed in 2009 to provide contingent support to PPP projects in the form of government guarantee. The IIGF engaged with the World Bank and other international Financial Institutions (FIs) and institutions to strengthen its risk management framework and processes and developing right guarantee structures. The IIGF acts as the guarantee provider to the private sector for various infrastructure risks that may occur on part of government, such as delays in the processing of approvals and licenses, change in rules and regulations, tariff adjustment issues, non-integration of network/facilities and other risks allocated to the government as per the PPP contract. This facility reduces the risks and enhances the credit rating of projects making them more bankable and accessible to wide range of investor class.

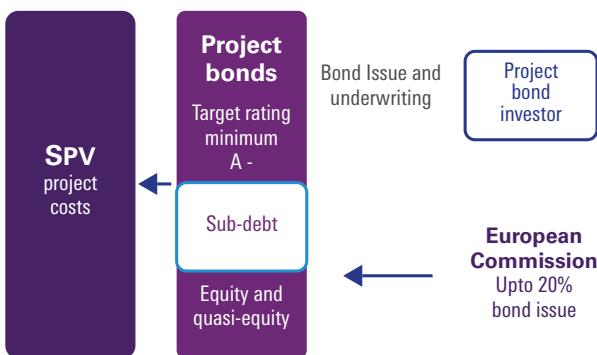
Experience: Notable big deal in energy sector involving IIGF pertained to Japan Bank for International Cooperation (JBIC)-led consortium funding of 2 GW ultra-supercritical coal-fired power generation plant, Central Java Power Plant, being developed by PT Bhimasena Power Indonesia (BPI). The BPI will sell the generated electricity to PT PLN (Indonesian utility) for 25 years. Japanese companies such as the Electric Power Development Co Ltd, ITOCHU Corporation have stake in BPI. The loan provided on project finance basis is being co-financed by multiple lenders, including various Japanese Banks. The JBIC has provided political risk guarantee for the portion financed by private financial institutions. The IIGF has provided a guarantee concerning PLN's obligation stipulated by the power purchase agreement, together with the Indonesian government.

EU: Europe Project Bond Initiative:²²

Background: The Europe 2020 Project Bond Initiative is a joint initiative of the European commission and European Investment Bank (EIB). The initiative is designed to enable eligible infrastructure projects, usually PPP projects, attract additional private finance from institutional investors such as insurance companies and pension funds by providing credit enhancement via subordination.

This subordination can be in the form of a contingent credit line or in the form of a subordinate loan for the project, thereby increasing the debt coverage and reducing risks for the senior lenders. The EIB seeks to cover up to 20 per cent of the project debt on a first loss basis.

Euro Project Bond 's structure



Experiences: One of the first issues supported is a GBP305.1 million bond issue for the Greater Gabbard offshore transmission link which are electricity transmission assets connecting the 140 wind turbines of the 504 MW Greater Gabbard offshore wind farm to the U.K. onshore grid. The EIB provided credit enhancement of GBP 45.8 million (amortising with bond) which resulted in an upgrade in the bond rating from Baa1 to A3. As per Office of Gas and Electricity Markets (Ofgem), the PBCE reduces the investment risk, enabling the project to attract cheaper finance, which ultimately reduces costs for consumers.

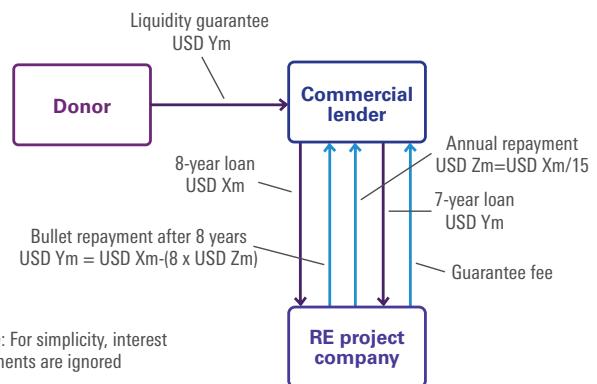
Developing countries: Liquidity guarantees:²³

Background: Liquidity guarantees have been deployed to provide short term cash flows to projects, for example, in case of delays under PPA or to extend tenors to improve a project's liquidity profile.

Experience: In the West Nile Rural Electrification Project in Uganda, one of the challenges to increase the rural electrification was the replacement of the conventional government-led rural electrification, with a private sector-led, commercially oriented program. A significant limitation to attracting finance was that project pay back was long, however, regulations limited maximum loan tenor to eight years. To allow for a longer-term loan, the World Bank structured two separate senior loans for local banks to lend to the project. The first loan expires after eight years when a bullet repayment of the outstanding principal is to be made. This repayment was funded from a new seven-year loan, making the total period loan repayment period 15 years.

A liquidity facility guarantee was used to ensure that local banks would have sufficient funds to make the second loan after eight years, thereby removing repayment risk for the project developer. The fees and margin payable to each local bank were designed to incentivize it to continue financing for the full 15 years (Wang et al., 2013).

Liquidity guarantee structure



22. The EU-EIB 2020 Project Bond Initiative and Developments in Infrastructure Financing, Project & Infrastructure Finance Conference S&P Capital IQ, London

23. IRENA: Risk mitigation and structured finance 2016 and World Bank case study UGANDA - West Nile Rural Electrification Project

The U.S.: Credit enhancement through pooling in assets/ cash flows.²⁴

Background: Apart from credit enhancement through guarantees or liquidity lines, aggregation of the assets/ pooling of cash flows of various assets mitigates the geographical, offtake and technology concentration risks through portfolio diversification. Globally, especially in the U.S.A., pooling of assets has also been quite developed. This instrument has been extensively used across the segments where risks associated with individual assets creates challenges in access to and cost of capital.

Experience: In 2012, the U.S. Department of Energy and the National Renewable Energy Laboratory (NREL) created the Solar Access to Public Capital (SAPC) project to analyse securitization. Via the SAPC for solar roof top assets, standardised residential lease and commercial PPA contracts have been developed to streamline investments through aggregation of assets and securitisation.

24. NREL, KPMG in India's analysis.



Re-orientation of businesses and financing models to adapt to sector transformations:

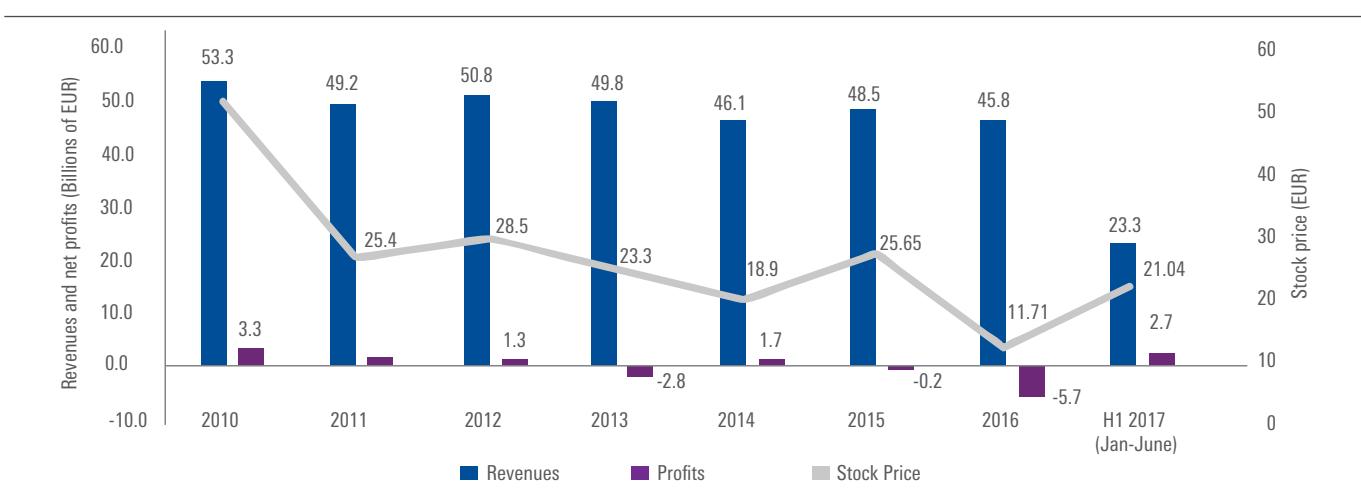
Germany: Restructuring by utilities, in wake of losses, into companies with different assets classes which unlocked shareholder value (E.g., RWE Group):²⁵

The RWE Group (RWE) is the largest supplier of electricity in Germany and the third largest supplier of gas. It has a total global generation capacity of 49 GW with ~7 per cent coming from RE. RWE saw a 90 per cent decline in its stock price since its peak reached in 2008, largely attributable to the decline in wholesale prices due to increase in RE and falling utilisation of

fossil plants. It posted a loss of EUR2.8 billion in 2013 for the first time in 60 years. It was due to EUR4.8 billion in impairment losses over its fossil fuel plants.

Witnessing these trends and erosion in their market capitalization, RWE restructured their business to allow a division into a 'clean' and a 'fossil based' utility providing investors the option to invest in two different risk classes, and ultimately favourably impacted the parent utility companies with overall higher value and market capitalisation.

Financial and stock performance of RWE Group



Source: KPMG in India analysis, 2018

In fact, the renewables focused arm created by RWE, Innogy, which was listed on the Frankfurt Stock Exchange, was valued at more than twice the market capitalization of RWE at that time. Further, Innogy's listing raised about EUR5 billion, of which EUR3 billion went to RWE and provided it a useful infusion of cash. As can be seen in the financial and stock performance figure for RWE presented above, post restructuring in Q4 2016, RWE saw strong revenue and profitability growth as well as recovering stock prices in the first half of 2017.²⁶

Brazil: Re-orientation of focus by Brazil's National Development Bank (BNDES) to suit investment trends:²⁷

The Brazilian Development Bank (BNDES) is the main financing agent for development in Brazil and is fully owned by the Brazilian government. It is in the process of redefining its priorities and its role going forward. In 2014, it revised its Operational Policy (OP) aligning it to suit investment trends in the country, the national

financial industry's experience and the need to serve companies more efficiently and provide higher quality services.

The BNDES conducted a review of its energy strategy and in October 2016, announced a new funding policy under which it ruled out investments in new coal and oil fired power plants and a focus towards RE and energy efficiency project with favourable terms offered for such projects, to aid Brazil's goals for clean power.

The BNDES has obtained significant financial and technical support from various development banks to meet its objectives including funding from Inter-American Development Bank (IDB), New Development Bank (NDB), etc. The World Bank recently conducted a study to contribute to the improvement of BNDES OP. The paper provides recommendations to establish BNDES as a more effective and focused development bank, less dependent on the government for funding, and less subject to interference by improving its governance.

25. RWE Group annual reports, KPMG in India analysis

26. This strong financial turnaround has been attributed to multiple factors including refund of nuclear tax worth EUR 1.7 billion after a German High Court ruling declaring the tax as illegal and void, increased revenue through dividend payments from Innogy, reports of France based Engie showing interest in acquiring Innogy and better performance of RWE's power trading operations as well as gas based power plants.

27. World Bank media articles and www.bnDES.gov.br

Increased focus on emerging technologies such as data analytics, Artificial Intelligence (AI) globally:

Various traditional energy players and utilities are re-orienting their strategy and looking for entry/expansion into data analytics and AI areas for 1) operational improvement 2) management of distributed generation assets 3) identifying new business models.

For example²⁸, Eneco, a major Dutch utility, has sought to provide new services to the customers, in order to re-orient itself to the changing energy landscape. It's venture Jedlix (in partnership with Tesla and BMW), is engaged in electric vehicles charging business wherein it allows EV owners to smart charge their vehicles at nominal rates when there is large supply of RE in the grid. Eneco has also supplied its consumers a wall-mounted energy monitor, Toon, which allowed its customers to control their domestic heating settings through a phone-based application showing in detail the electricity and natural gas consumption and other information such as weather forecast etc.

As per a BDO study, energy investments in big data and AI have increased approximately 10 times in 2017, as energy business players including as utilities adapt their strategy in these uncertain times to look at areas for improving decision making such as energy forecasts etc. As per the study, Mergers and Acquisitions (M&A) activity involving energy companies and AI start-ups increased from an average USD500 million in Q12017 to USD3.5 billion in Q22017. There is ever increasing number of startups which are looking to commercialise blockchain-based energy trading concepts, and therefore blockchain players might become the imminent focus for investments and M&A activity.

Oil majors diversifying into RE business²⁹:

Global oil major BP, which adopted a sunburst logo around two decades back to express its solar energy ambitions, has recently announced a USD 200 million investment in UK based solar generator Lightsource, which has ambitious plans to increase its solar generation capacity to 8 GW through large scale projects in countries such as India, US, Middle

East and Europe. Though this investment is a small amount as compared to BP's size and as compared to what BP has spent in the past, this investment marks BP's second entry and renewed focus on the solar segment. In around 2011, BP wrote down billions of its investments it made into solar panel manufacturing business on account of inability to face competition from China. As per statements made to Reuters by BP's senior management, they see attractive long-term value proposition and growth in terms of return, cash delivery and profitability in the solar generation business. Other oil majors, such as Royal Dutch Shell, Total have also invested into the RE segment in order to diversify and prepare for the new energies landscape.

Global gas contract renegotiations³⁰:

Globally, the historical contracts are being reworked to reflect the current and future expected market dynamics. If one looks at natural gas, given the supply situation, various countries/companies have undergone contract restructuring by either reducing the prices to the present trends (delinking from oil) and/or reducing contract durations from 25 years to 10-15 years in order to protect their market shares. For example, recently India renegotiated its deal with ExxonMobil for a price cut on its 20-year LNG contract. Globally, French utility major Engie and Statoil agreed for renegotiation of their long-term gas supply contracts by modernizing them to adapt to the evolution of the European natural gas markets, by adjusting the prices to be fully reflective of the market conditions.

Focus on cost and efficiency improvements:

There are many examples of how efficient operations and reduced cost of technologies are leading to lower breakeven price of oil for a lot of fields. Many U.S. shale producers today operate at below USD30 per barrel breakeven prices, as compared to their initial cost of USD80 per barrel. The focus on cost reduction led by technology advancement is what is helping the oil and gas industry sustain business profitability in the current market scenario. In the North Sea area of Europe, efficiency improvement initiatives have reduced the cost of oil extraction from USD30 per bbl to USD15 per bbl.³¹

28. NYTIMES article "Dutch utility bets its future on an unusual strategy: Selling less power" dated August 18, 2017

29. KPMG in India analysis, 2018

30. KPMG in India analysis, 2018

31. <http://www.offshore-mag.com/articles/print/volume-77/issue-8/european-update/lower-operating-costs-keep-north-sea-viable-in-low-price-environment.html>

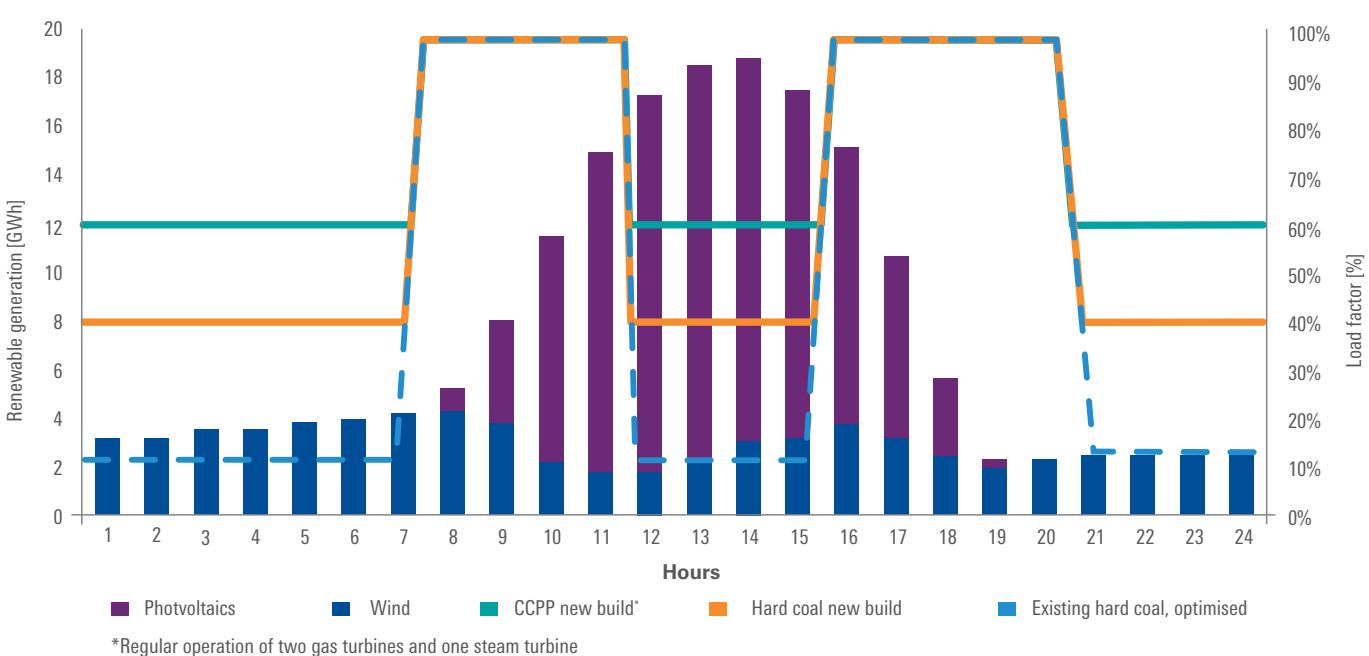
Improving flexibility sustainability and profitability of conventional segments to promote investments

Germany: Flexibilisation of coal plant

Background: The fundamental stochasticity, variability and geographic concentration inherent in renewables is perceived as a challenge given the dominance of coal in electricity mix for most countries. More so, in emerging countries such as India where the grid is operated far from optimally and where ancillary mechanisms are still in infancy. However, the role played by coal in balancing the grid can be far more than is visualised by the policy makers and grid operators.³²

Experience from Germany has demonstrated that necessary flexibilisation can be built into coal plants so that they can play an important role in balancing RE and remain relevant in future energy scenario. Germany's solar PV capacity is almost half of its peak demand, with a higher solar penetration than any other country in the world. Despite the RE dominance, Germany ensured the continued relevance of fossil fuel based plants for the power sector. Germany ensured that coal and gas plants were made increasingly flexible to allow these to play an important role in Germany's electricity markets.

Germany experience



Source: www.transparency.eex.com

Experience: Germany on March 16, 2012 encountered intense solar radiation where the generation from solar ramped up by 16 GW in a matter of five hours and decreased thereafter.

Germany was able to manage the fluctuations well by operating both coal and gas plants intermittently between partial and full-load operation as these had short-term flexible operating capability.

The German example demonstrated how with a well prepared and planned system, a high penetration of intermittent energy resources can be accommodated.

A combination of resources with flexible generation capabilities and a strong transmission network can help manage the variability in an effective manner and also provide a case for conventional plants to remain relevant.

Globally, several strategies have been adopted by industry and governments alike for mitigating financing risks and addressing transformations which are likely to impact businesses significantly. Greater awareness, capacity building, demonstration of early successes is crucial for the energy sector to understand, anticipate and address risks arising from disruptions.

Summary conclusion and next steps

The energy sector is in the midst of a deep transformation, globally as well as in India, giving rise to increasing uncertainties around energy investments. A complex interplay of factors such as policy thrust on low carbon pathways, technological advancements, changing consumer preferences, shifting balance of power in oil and gas industry and government policies and actions are causing disruptions to conventional business models and investment flows. These shifts are impacting the entire value chain of the energy sector. The energy sector is responding through reduced investments in carbon heavy technologies such as coal based generation, re-alignment of incumbent business models to the evolving trends, larger investment allocation to renewables, increased focus on grid integration, greater focus on cost rationalization and productivity improvements in oil and gas sector, etc.

As per the World Energy Outlook (IEA), while fossil based fuels and infrastructure, especially natural gas and oil, are expected to remain as the key backbone of the global energy systems, a sharp transition in energy pathways driven by global policies, could have consequences for fossil fuel segments and the associated value chain players (although the impact is likely to vary from resource to resource). Therefore, financing decisions in capital intensive energy assets where pay-back period is typically long, is fraught with uncertainties over recovery of costs and availability of financial returns.

Globally, a basket of options have been employed by the sector to mitigate risks associated with such uncertainties through innovative financing arrangements accompanied by re-orientation of business models to align with policy and technological shifts. Given that energy is often considered a public good and one of the key social responsibilities of governments, in order to meet the requirements of this capital intensive sector, it is paramount for governments to encourage private investments to supplement strained public resources. Hence, it is important for governments to step up risk mitigation measures and look to strengthen policy and regulatory environment, develop efficient market

structures and improve contractual design to make these less rigid and ensure a fair risk allocation.

Based on the discussions in the paper, the following key themes of action emerge for developing countries such as India, to deal with the uncertainties that disruptive forces are bringing in its wake:

- **Increasing role of governments:** Governments, especially for developing markets, should step-up their role in infrastructure creation, and take on more considered approach, if not more risks. Government needs to focus more on delivering longer-term economic and social goals for its citizens and lesser on the short-term measures of risk mitigation, inaction and cost avoidance. The support can take evolution in any shapes, viz. standardisation of contracts and agreements, building flexibility into contracts to allow renegotiations to withstand adverse externalities, tax credits, long-term visibility on policy and regulations, etc. which could enable a more widespread access to a diverse pool of investors for the developer community. Further, with initial handholding by government through financial risk mitigation measures in underdeveloped though essential energy segments, the energy infrastructure market once developed would find their own takers ultimately reducing the pressure on public finance. Further, newer models and learnings from other sectors such as the HAM for asset financing and the Toll-operate-Transfer (TOT) model in road sector for assets recycling can be considered to be implemented for monetization of stable revenue earning assets in the energy sector.
- **Improving market designs:** The structure of power markets need to evolve as energy sector transforms, to provide the right investment signals and improve market efficiency. In most developing countries, electricity supply has been largely regulated and competitive market structures are slowly evolving. Developed countries with power exchanges have significantly more liquid exchange trading volumes as compared to India:

Global power exchange trading

S. No	Country	Power exchange trading as per cent of total energy consumption
1	India	3%
2	France	23%
3	Belgium	29%
4	U.K.	53%
5	Germany	53%
6	Austria	53%
7	Nordic Countries	91%

Long-term bilateral contracts in most nations with highly liquid exchange trades is limited (typically five-seven years). Apart from bilateral contracts, many exchanges also trade in futures – duration usually limited to three years beyond which liquidity decreases significantly. Most of the above nations also have well segregated products (futures/forwards) catering to base load, peak load, seasonal variations etc. Some are looking at capacity markets as a solution, some are also advocating long term bilateral contracts (more than 15 years) to reduce price uncertainty.

It is imperative that experiences from developed economies are studied and market reforms are implemented while bearing in mind that the pace and extent of transformations required may significantly vary from past experiences. Measures such as development of short term markets, introduction of new products such as weather derivatives, day ahead/ intra-day products, development of ancillary and capacity markets need to be evaluated to improve market efficiency, improve grid security and provide resource adequacy.

Source: IEX investor presentation, September 2017



- **Institutional strengthening:** Measures such as tariff reforms, separation of carriage and content need to be taken to strengthen the utilities in emerging countries so that utilities are empowered and adapt well to change and continue to play an important role in managing consumer requirements nimbly and efficiently.

Tariff distortions have been perennially present in emerging economies with large users being subjected to high tariffs, often rendering grid supply uneconomical for large consumers. Utilities, on the other end, continue to face losses on account of under-recovery of power purchase costs due to subsidised retail tariffs coupled with high aggregate technical and commercial losses (AT&C). It is important to strengthen utilities by measures to optimize costs, modernize networks through deployment of technologies to improve information flows, and rationalise tariff structures to increase the competitiveness of utilities.

Further, with deep disruptive influences on the demand side such as evolution of smart technologies, distributed generation and storage solutions (with rapidly declining battery costs), there will be newer challenges for the utilities to adapt to serve the much empowered customer. As power systems in emerging economies becoming amenable to competition, especially in the supply function that involves procurement and sale of energy, measures to separate carriage and content need to be explored not only from the perspective of competition or consumer choice, but also to de-risk the utilities from financial stress.

- **Supporting financing innovations:** Regulations and policies aiming at development of structured financial de-risking instruments such as credit guarantees, aggregation models, Infrastructure Investment Trusts (InvIT), masala/green bonds, security tranching and liquidity facilities to address various risks should be developed. The enabling regulations should consider deepening the corporate bond market, by enabling low-investment grade or non-investment grade entities to tap requisite investor community.

Government needs to support such financial innovations through information exchange between countries, capacity building, greater stakeholder awareness, policy, regulatory and fiscal measures and exploring support of developmental funds.

- **Improving investment climate:** The investment climate especially in emerging countries needs to be considerably improved to provide ease of doing business for energy players. Governments need to make a significant effort to improve governance by increasing transparency, laying down well defined procedures, improving controls, stringent monitoring and accountability to provide a better investment climate to investors which allow them to be nimble and quickly adapt to the challenges emerging in the energy space.

An important measure here is also setting up quasi-judicial expert adjudicatory bodies with deep understanding of energy sector issues, who can speedily and efficiently address arbitration and bring relief to stakeholders thereby reducing investment certainties.

- **Encouraging new investment avenues:** The adoption of new disruptive technologies such as smart grid technologies, battery storage, EVs, AI based automation etc. needs to be facilitated by creation of awareness, capacity building of critical stakeholders such as utilities and creating a conducive ecosystem for attracting investors such as angel funds, venture capitalists, development institutions, which can assist in start-up funding towards these newer areas in energy technology going forward.

While the role of the government in identifying and addressing critical risks and uncertainties in an increasingly complex energy landscape is paramount, finally, industry players need to revitalize their risk management strategies and processes. There is a need to move beyond assessing immediate market opportunities and the evident risks. A longer-term view needs to be taken of possible disruptions which could critically influence the pathways that energy sector can adopt. Both opportunities as well as new risks need to be identified, their impact assessed and strategies adopted. To reduce the element of surprise, critical influences to change need to be monitored closely. Strategies that may be adopted by players could range from business re-organisations to allow for flexibility and nimbleness, evaluating the need to refocus business strategies and gain first mover advantage in new areas, exploring innovations in financing avenues, examining learnings from countries and companies ahead of the curve and greater policy advocacy to represent the risks from policy, market and contractual environment to governments.

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