



Market Enablers - Facilitating Transformation of Power Utilities in the Changing Paradigm

Knowledge Partner



Founding Partners



18-22 JANUARY 2020
INDIA EXPO MART, GREATER NOIDA, NCR, INDIA

THE THEME

The theme of the World Utility Summit, WUS 2020 is “Utility Next”. The electricity eco system is undergoing an unprecedented transformation with the proliferation of renewables, distributed generation resources and electric vehicles on one side and consumer activism and regulatory pressures on the other. Developing countries are also facing these challenges in addition to their ongoing activities to provide universal 24x7 power supply. Moreover, as many of the consumers of electricity become prosumers, the electricity eco system would change radically and new market entrants would emerge. There is an immediate need for utilities to evaluate how the provision and consumption of energy services would happen in the future.

This summit would bring in thought leaders across the globe to deliberate the preparedness of utilities to deal with the transformational changes. Regulators, technology providers, consultants, government bodies and utility leaders are expected to share their views on the various challenging and exciting scenarios and help shape the roadmap of the future utilities.

SUMMIT TRACKS



MARKET ENABLERS

Knowledge Partner - USAID in association with KPMG

With the emergence of distributed generation resources and availability of multiple electricity providers in today's era, consumers have a variety of options to meet their changing energy demands. At the same time, future of the electricity ecosystem will include higher penetration of next generation technologies like renewables, energy storage, electric vehicles and digitization.

The role of utilities would need to be repurposed to prepare for the future. What will the customer portfolio of utilities look like? What will be future expectations of the consumers from the utility and how will the utilities need to transform themselves to meet them? How will the utility markets evolve? These are some intriguing questions that will be addressed in this track.



REVENUE SECURITY

Knowledge Partner - CRISIL

Utilities get their revenues primarily via billing the customers for their demand and energy usage. New eco systems, with multiple options for consumers to meet their electricity demand, will pose stiff competition to the utilities. How can the investments made by the utilities be safeguarded? How can utilities ensure they are resilient to the transformational changes in the electricity eco system? What are the key learnings from similar experiences? This track will cover the latest developments on the upkeep of the financial health of the utilities, learning across the globe and develop a strategy for a resilient utility.



GRID TRANSFORMATION

Renewable Energy and Electric Vehicles

Knowledge Partner - GIZ

Renewables and electric vehicles are being promoted across the globe for a variety of reasons. These technologies will transform the power grids in an unprecedented way. Renewables introduce high intermittency in generation capacity. High intermittency leads to underutilized transmission infrastructure, increased impact on grid operations and increased need for flexible generation sources. Increasing penetration of electric vehicles will require major upgradation of infrastructure and new business models. New approaches need to be explored to ensure smooth and effective integration of these technologies with the power grids. This track will cover the case studies globally and deliberate the technology considerations and best practices to manage the network.



ENABLING TECHNOLOGIES

Digitalization and Cyber security
Knowledge Partner - Accenture

With the abundance of critical data in power systems coupled with remote access, operating the system securely without compromising system availability and data privacy is a major concern. Cyber security threats are increasing day-by-day and there is a continued need to develop mitigation technologies and solutions to make the power equipment/devices, control systems, communication and operations more secure. Today, many concepts like user and device authentication, data encryption, communication robustness, defense-in-depth, malware protection, whitelisting, system hardening, monitoring and analytics are used by the stakeholders to address cyber security issues effectively. All the stakeholders including equipment/device vendors, system integrators, owners/operators of system, government agencies and technology experts have a role to play in making the power operation and delivery secure. This track will cover the latest development and share best practices in this space.



POLICY & STANDARDS

Knowledge Partner - National Smart Grid Mission

With the changing dynamics of the electricity ecosystem, policies & standards become extremely critical to ensure the technical, financial and business viability for all the stakeholders. There is a need to have a robust policy, especially in the areas of distributed generation, renewables, electric vehicles and energy storage. Consumers should be made aware of the changing scenarios and engage them in the decision process. It is imperative that all the stakeholders in the future utility eco system should support the evolving regulatory standards and ensure seamless transition. Environmental aspects also have to be considered. This track will share the views of various leaders driving policy and standards to ensure that the key interests of all the stakeholders are safeguarded.



ENERGY STORAGE

Knowledge Partner - India Energy Storage Alliance (IESA)

Energy storage has a versatile role to play in operating grids and providing value to all the stakeholders. This includes balancing demand and supply, regulating frequency, managing renewables and providing autonomy for consumers. Energy storage will also play a very important role in achieving full potential of new and upcoming technologies. This track will cover the latest developments in technologies, new business models, grid dynamics, learnings from pilot demonstrations and operational considerations associated with these technologies.

Message from Knowledge Partner



Apurva Chaturvedi
Senior Clean Energy Specialist,
USAID/India



Vikas Gaba
Partner, Power & Utilities, KPMG
Advisory Services Pvt Ltd

On behalf of the USAID's Smart Power for Advancing Reliability and Connectivity (SPARC) programⁱ, we are happy to be a knowledge partner with the World Utility Summit 2020, particularly on the subject of 'Market Enablers - Facilitating Transformation of Power Utilities in the Changing Paradigm'.

The megatrends such as urbanization and demographic shifts, climate change and digitalization are reshaping businesses and societies like never before. From building smart and responsive infrastructure to complying with stringent environment norms, from real time monitoring in a digital network to focusing on customer services, the impacts of these mega trends have penetrated businesses across sectors. The conventional business models, structures and processes that have served well for decades are now being challenged.

In the power sector, the megatrends have led to a seismic shift due to renewable energy becoming competitive with conventional generation sources, heightened consumer awareness that is creating a newer class of more demanding and engaged customers and increasing electrification in various sectors such as mobility. To cater to these changing expectations and market landscape, power utilities are transforming to become behaviorally agile, operationally efficient, technologically advanced and data driven.

For such transformation to be seamless and coherent, utilities will need a unified and strategic approach through the involvement of various stakeholders including policy makers, regulators, private sector, technology providers etc. The utility ecosystem driven by political, sectoral, procedural, institutional and financial enablers (collectively called as market enablers) will be critical to transform utilities into vibrant and agile service providers.

This paper critically analyzes how the market enablers are facilitating the transformation of utilities by leveraging the shifts in the power sector which are in turn driven by the megatrends that are changing the global business landscape. The authors have critically analyzed how the power utility ecosystem is expected to evolve in the future and the role of the respective market enabler in ensuring sustainable value creation.

ⁱ The SPARC Program is a key initiative under USAID's Asia EDGE program. It is a three-year bilateral program with the Ministry of Power, Government of India. The objective of the program is to modernize electricity distribution utilities to improve their operational and financial performance. KPMG is the implementing partner of the SPARC program.

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List of Abbreviations

AI	Artificial Intelligence
BOO	Build-Own-Operate
BOT	Build-Own-Transfer
DBO	Design-Build-Operate
DSM	Demand Side Management
DER	Distributed Energy Resources
DSO	Distribution System Operator
EoDB	Ease of Doing Business
ESG	Environmental, Social and Governance
EU	European Union
EV	Electric Vehicle
FERC	Federal Energy Regulatory Commission
GHG	Green House Gas
IDF	Infrastructure Debt Fund
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
InvIT	Infrastructure Investment Trusts
IPCC	Intergovernmental Panel on Climate Change
IoT	Internet of Things
ISO	Independent System Operators
NISE	National Institute of Solar Energy
NIWE	National Institute of Wind Energy
OEM	Original Equipment Manufacturer
OFGEM	Office of Gas and Electricity Markets
PPA	Power Purchase Agreement

List of Abbreviations

PPF	Project Preparation Facilities
R&D	Research and Development
RE	Renewable Energy
RF	Radio Frequency
RFID	Radio Frequency Identification
SPV	Special purpose vehicles
TSO	Transmission System Operator
UN	United Nations
VAS	Value added services

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1. Executive summary

Macroeconomic and transformative forces are altering the global dynamics, with many countries experiencing structural changes. These changes are driven by the 'mega trends' viz. **urbanization & demographic shift, climate change and technology & digitalization**. These mega trends unfolding at the global, regional and national level are impacting businesses, industries and wider society. From **building smart and responsive infrastructure to complying with stringent environment norms, from real time monitoring in a digital network to focusing on customer services**, the impacts of these mega trends have penetrated businesses across sectors.

The above mega trends are also redefining the business landscape of the power sector. **Renewable energy is getting competitive with fossil fuels, power generation is shifting from centralized mode to decentralized mode, vehicle and building electrification is being pursued actively, utilities are getting more customer centric and new technologies are being deployed/adopted across the value chain**. These changes occurring in the power sector can be broadly classified under 3 phenomena (i) Decarbonization (ii) Decentralization and (iii) Digitalization.

The changing landscape centered around Decarbonization, Decentralization and Digitalization is forcing power utilities around the world to alter the basic premise that has shaped their structure and operations in the past. **Power utilities are evolving to become behaviorally agile, operationally efficient, technologically advanced and data driven**. In this process, they are developing, testing and deploying a range of innovative practices which can potentially transform the structure of power sectors across the world.

For such transformation to be seamless and coherent, power utilities will need a unified and strategic approach through the involvement of various stakeholders including policy makers, regulators, private sector, technology providers etc. **The utility ecosystem driven by political, sectoral, procedural, institutional and financial enablers (collectively called as market enablers)** will lead to positive transformation of utilities into vibrant and agile service providers.

In the above backdrop, this paper intends to highlight the key market enablers and their key attributes, which will enable power utilities to seamlessly transform in the evolving business landscape. In the process, the paper-

- ☐ Analyzes the mega trends and examines its implications on the power sector
- ☐ Analyzes the structure of a future power utility ecosystem and the strategies adopted by utilities to become future ready
- ☐ Identifies the market enablers and details out the key attributes to enable transformation of power utilities

The schematic in Figure 1, shows the overall journey, indicating how mega trends are influencing power utilities and forcing them to undergo transformation in the evolving business landscape. It also shows the market enablers which are facilitating this transformation.

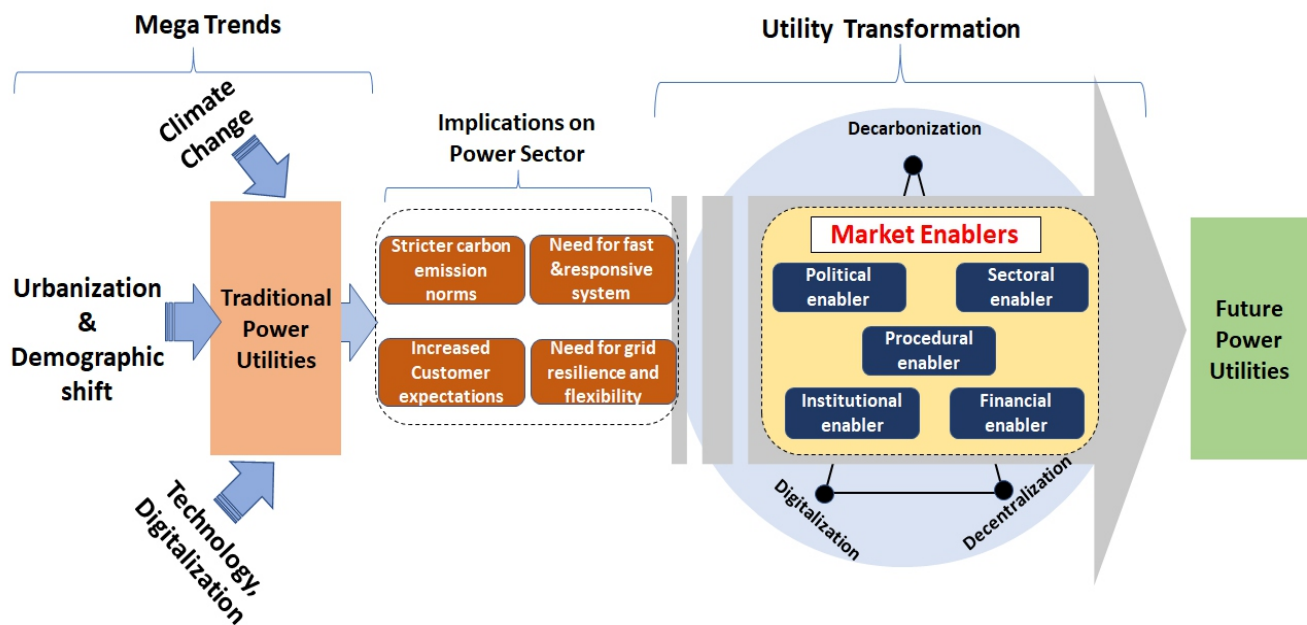


Figure 1: Market enablers facilitating transformation of power utilities

The market enablers and their attributes are summarized in Table 1. These attributes and underlying commitments may already exist in different settings in various countries. However, it is important to structure these under distinct heads viz. political, sectoral, procedural, institutional and financial, to enable decision makers undertake actions in a more planned and meticulous manner.

Table 1: Summary of Market Enablers

Enablers	Attributes	Description (nature and type of commitments)
Political enablers	<ul style="list-style-type: none"> Political commitment and leadership Goals/targets 	<ul style="list-style-type: none"> Country level commitment to move towards low carbon pathways mandated across all sectors/segments Goals and targets – INDC commitments, GHG emission reduction, energy intensity targets, clean transport, clean energy transition, etc.
Sectoral enablers	<ul style="list-style-type: none"> Laws and policies for architecting the future market structures Rules, regulations and guidelines that govern operating conduct of market and its performance Specific goals and targets 	<ul style="list-style-type: none"> Supportive laws and policies at the sector level for areas such as: <ul style="list-style-type: none"> Manufacturing and deployment of RE and battery storage Structural changes in the market to support new market participants like aggregators, demand response providers, ancillary service providers) Modernization of the power systems like deployment of smart meters, grid automation etc. Taxation benefits, other incentives and subsidies Rules, regulations and guidelines in areas such as:

Enablers	Attributes	Description (nature and type of commitments)
		<ul style="list-style-type: none"> Competitive bidding guidelines and standard frameworks for clean energy deployment and modernizing the power system Time bound schemes for deployment and enablement of new business models that help in financing and structural support Wholesale market design that provides transparency and liquidity for increased trading opportunities, financial products for risk mitigation and clear signals for infrastructure investments New regulations like cyber, information and data protection, etc. Clearly spelled out sector level targets e.g. RE target for different countries – solar (large scale and rooftop), wind (incl. offshore wind, EV deployment targets) etc.
Procedural enablers	<ul style="list-style-type: none"> Robust planning mechanisms to meet the new age requirements, and those enshrined in the laws, policy and regulations Supply chain related – equipment specifications 	<ul style="list-style-type: none"> Long term planning for energy system development Short/medium term planning for capacity addition Operating guidelines, new codes and standards, processes and procedures Ease of doing business Tools for better investment and business decisions Supply chain related – equipment specifications and procurement of products and services
Institutional enablers	<ul style="list-style-type: none"> Creating strong institutions, training and capacity building, and knowledge sharing Creating a dynamic and responsive future work force 	<ul style="list-style-type: none"> Institutional capacity creation – new institutions, institutional strengthening, upskilling, staffing, awareness creation, training and education Pilots and demonstration for confidence building, new research and training networks Market readiness – adequacy of vendors, competition in the market, visibility of the pipeline and demand
Financial enablers	<ul style="list-style-type: none"> Financial enablers that support funding, and hence initial implementation, scale up and acceleration 	<ul style="list-style-type: none"> New and innovative financial instrument Platforms to facilitate financing and accessing low cost financing – such as Special Purpose Vehicles (SPVs), aggregators, blended finance, risk capital, grants and incentives Strong ESG framework to comply with international standard to channelize financing Other enablers like payment security mechanism, guarantees, risk allocation mechanism in vendor and contract documentation, climate risk insurance and coverage etc. Pipeline of bankable projects

The market enablers provide a broad perspective on the actions to be taken for smooth transformation of power utilities. They also act as a guiding framework/checklist for power sector stakeholders that on one hand are dealing with the legacy issues, and on the other hand are faced by challenges posted by the new environment.

This paper is structured into following sections-

- ☐ **Section 1- Mega trends are reshaping the global business landscape** - This includes discussion on the mega trends and their impact on businesses, industries and wider society
- ☐ **Section 2 - Implications of mega trends on the power sector and utility operations** -The section focuses on how implications of mega trends are affecting the business environment in the power sector and forcing power utilities to undergo transformation . It also examines the structure of a future power utility
- ☐ **Section 3 - Market enablers are facilitating transformation of power utilities** - The section focuses on the supporting framework across political, sectoral, procedural, institutional and financial aspects that enables transformation of power utilities
- ☐ **Section 4 - Conclusion**

2. Mega trends are reshaping the global business landscape

Mega trends are macroeconomic and strategic forces that are affecting the economies across the world and impacting the infrastructure and energy sectors in profound ways. These trends influence the policy choices as well as the customer behaviour and completely change the way businesses operate. Three mega trends that are currently driving and transforming the global economy are: (i) **urbanization and demographic shifts**; (ii) **climate change**; and (iii) **technology and digitalization**. All these trends are reshaping the global business landscape and will have far reaching impacts on businesses, industries and individuals. Figure 2 presents these mega trends and some of their effects¹ on global ecosystem.

These mega trends have been discussed in detail below.

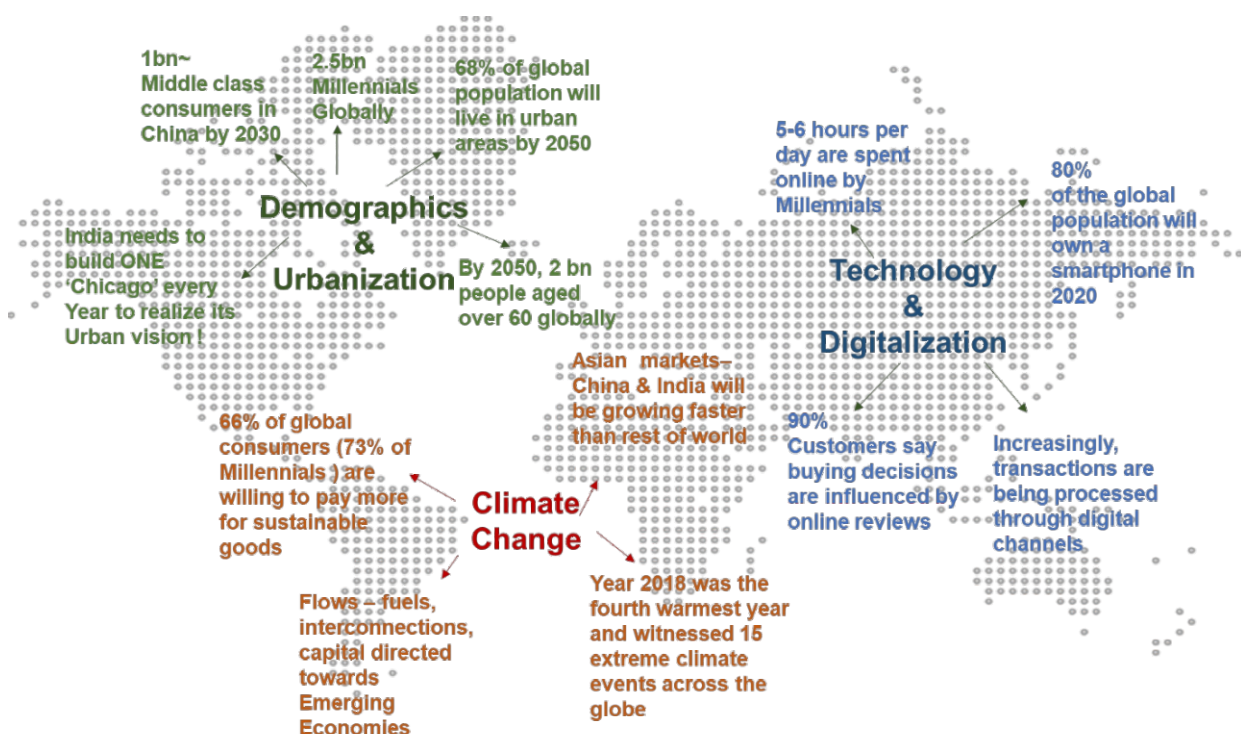


Figure 2: Mega trends and their impacts on global ecosystem

2.1 Rapid Urbanization and Demographic Shift: People across the globe are migrating to cities for various reasons including job opportunities, better living standards, access to services and other facilities like health, education, electricity etc. **It is estimated that by 2050 more than two-thirds² of the world's population will be living in urban areas (refer Figure 3).** Consequently, several country governments have active programs to develop their cities into centers that can accommodate such population explosion. Such large-scale shifts will also call for complete change in the way cities are planned, designed and engineered. Sustainable and climate neutral development will be at the core. Cities will seek to mitigate environmental impact and provide good quality and reliable services to its citizens.

Cities in Africa and Asia are expected to have the fastest urbanization growth rates. Asia's urban population is projected to jump from 48% to 64% by 2050³.

Driven by urbanization, the number of megacitiesⁱⁱ is expected to grow from only 10 megacities (home to 153 million people) in 1990 to 41 megacities (home for 730 million people) by 2050.⁴ It is imperative to ensure that these resource intensive cities and urban areas are developed efficiently and sustainably.

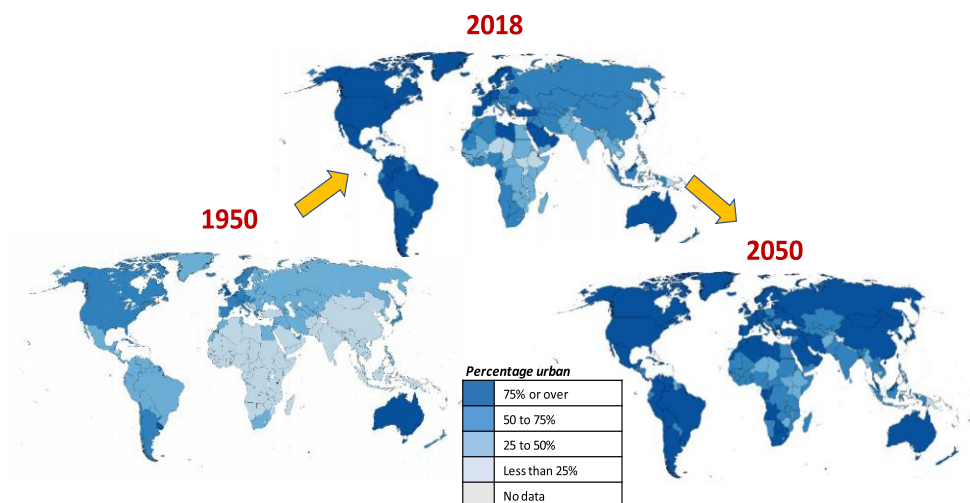
Apart from urbanization, the demographics are also fast changing across countries. As per reports, in India, about

64%⁵ of the population is in the 15-64 years age group indicating that the country is home to one of the youngest populations in the world. Similarly, for other south Asian countries like Sri Lanka and Pakistan, about 65% and 60% of population is in the 15-64 years age group respectively.⁶

Demographically, globally there are about 2.5 billion millennials⁷ (see Figure 4), accounting for more than a third of the world population. Millennials are consumers that are technologically aware, value social causes and at the same time expect personalisation of service.

Some of the key implications of urbanization and demographic shift are:

- ☐ Rapid expansion of cities as demand centers requires infrastructure upgrade (transportation, health, housing, water, sanitation and power etc.) to support the growing population
- ☐ Change in planning paradigm taking into consideration re-allocation of resources (such as fuel, electricity, food and water etc.) and constraints on these, if any
- ☐ Increased pressure on the environment with increased pollution levels (air, water, noise etc.)
- ☐ Millennials as consumers will **require intuitive, digital services across all the spectrum of utility business**



Source: World Urbanization Prospects, 2018, UNDESA

Figure 3: Percentage of population living in urban areas, 1950, 2018 & 2050

ⁱⁱ Mega city are cities with population higher than 10 million

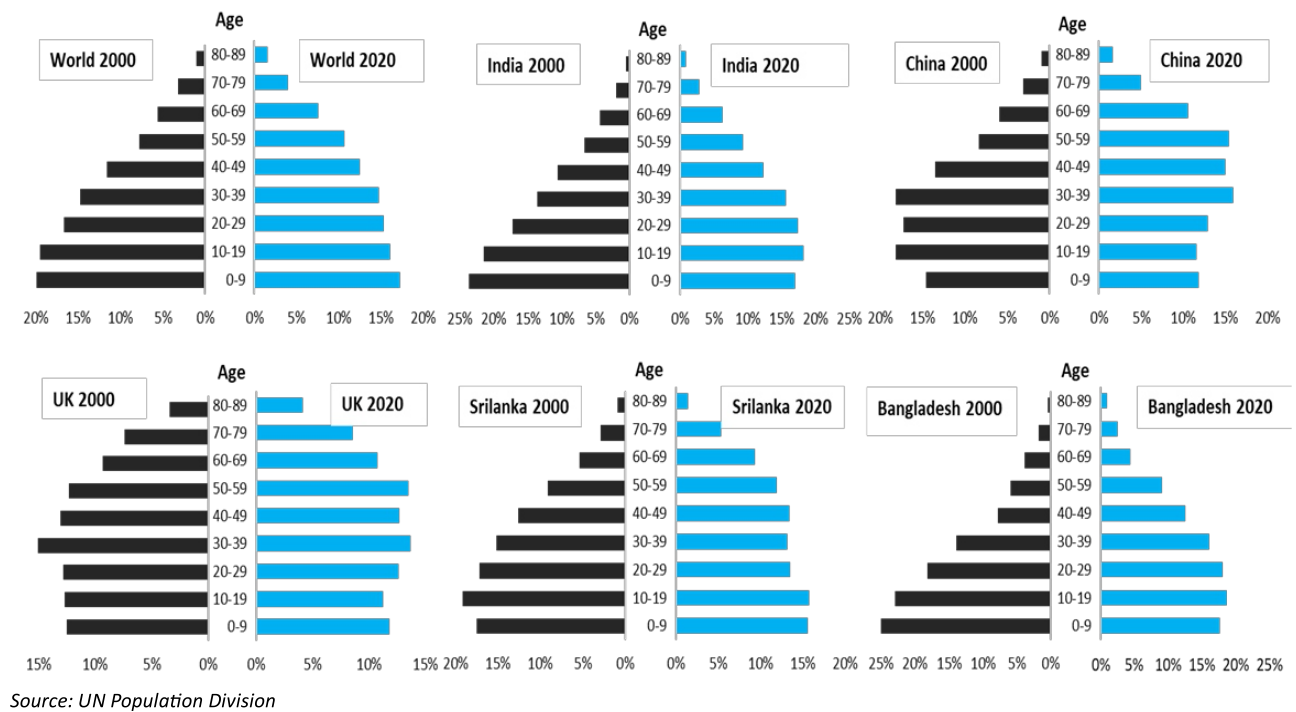
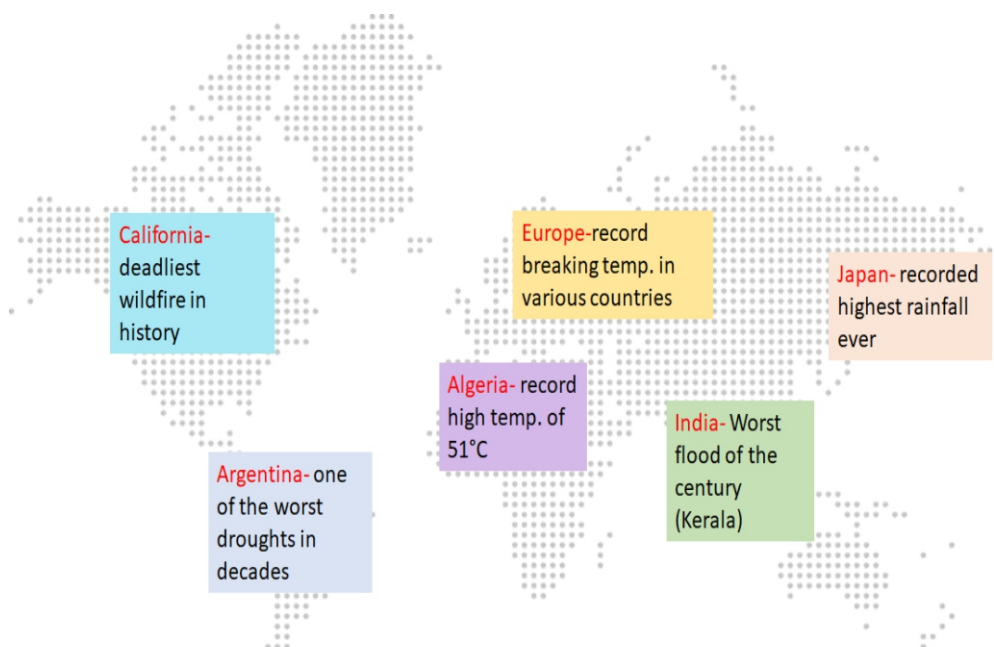


Figure 4: Changes in global demographics

2.2 Climate Change:

Climate change is a defining concern of our times. Increased Green House Gases (GHGs) emissions leading to rise in global temperatures is key contributor to the current climate conundrum. The GHG emission levels have been increasing, and in 2016, GHG emission levels were 31.2% higher than 1990 level. This implies an annual growth of 0.9%.⁸



Source: Word Resource Institute, <https://www.bloomberg.com/news/articles/2018-02-28/worst-drought-in-30-years-adds-to-argentina-s-economic-woes>, Feb 2018

Figure 5: Extreme climate events of 2018

Under the Paris Agreement adopted in 2015, countries had agreed to limit the global warming to well below 2°C and pursue efforts to limit it to 1.5°C. For the countries to meet this target, the global

emission will need to peak at the earliest and then decline. As per UN Climate Change Secretariat, the current efforts will not be sufficient to keep the global warming well below these targets.

Countries are experiencing impacts of climate change and have reported changes observed or anticipated in parameters such as temperatures, sea levels, rainfall as well as incidence of extreme climate events, relationship between national, regional and global climate conditions etc.⁹ **Year 2018 was the fourth warmest year recorded globally** and witnessed 15 most extreme climate events (refer Figure 5).

World is not on track to limit temperature rise to 1.5° C.¹⁰

As per the United Nations Intergovernmental Panel on Climate Change (IPCC) **limiting global warming to 1.5°C to pre – industrial levels would require rapid, far-reaching and unprecedented changes in all aspects of society. Emissions in 2030 will need to decrease by at least one third to meet the 1.5°C target (refer Figure 6).**

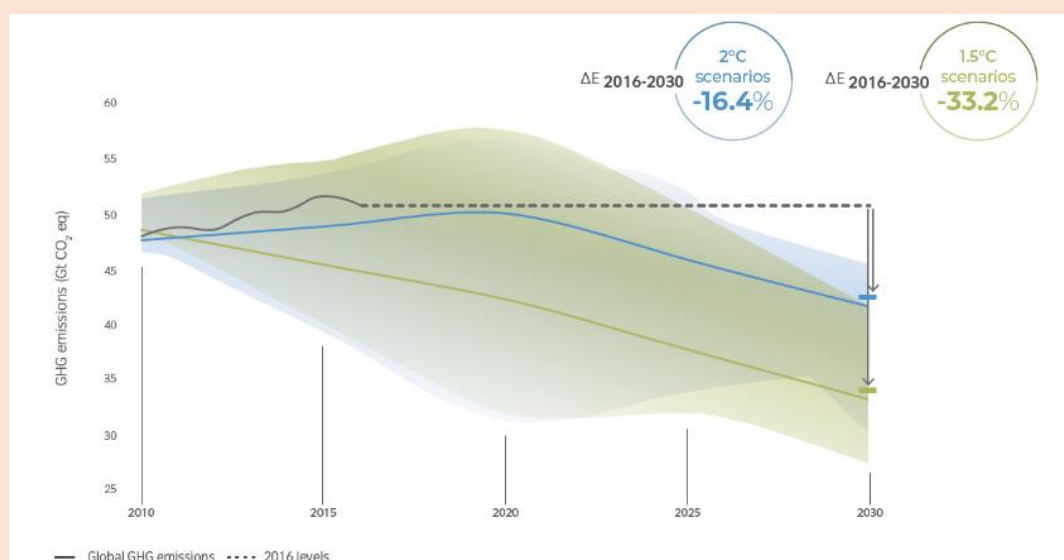


Figure 6: GHG emission trajectory under 20C & 1.50C reduction scenarios

If the above is to be achieved, then global emissions should have already peaked and should have been on a decline. If the emission reduction was to start from soon after 2016, then it would require an annual reduction of 2.8 % in global emissions, to be on the 1.5°C increase by 2030. However, as the emissions continue to grow, they need to peak at the earliest with more substantial annual reduction in emission level.

Source: 'Climate action and support trends' United Nations Climate Change Secretariat. 2019 https://unfccc.int/sites/default/files/resource/Climate_Action_Support_Trends_2019.pdf accessed on 19th December 2019

Extreme climate events impact infrastructure leading to **power outages, roads and bridges damage, destruction of ports and coastal facilities etc.** Such impacts have a cascading effect on other systems. For example, an electric system failure affects other infrastructure services such as water treatment, schools, hospitals etc.

Climate related risks are also impacting businesses including utilities in significant ways. Some of these include **(i) commitment to adopt tighter emission reduction targets, (ii) increased investments in Renewable Energy (RE) and other clean energy options, and (iii) increased adoption of energy efficient products and services** etc.

Increasing viability of RE technologies, in particular wind and solar, is further complementing the efforts/ commitments toward combating climate change around the world. New build RE projects are increasingly becoming competitive with new build coal-based plants, and at times even the operational cost of coal based projects. Thus, for many countries, it makes economical sense to substitute coal with renewables, which has created a virtuous cycle climate change efforts. There are of course grid integration challenges and associated grid balancing costs which puts an opposite pressure on RE uptake, depending on the ambition of the country/ region, the market structures and the potential of their power systems to absorb RE.

2.3 Technology and Digitalization: The past decade has witnessed unparalleled growth in technological innovations and digital transformation. Businesses are investing in automation and innovative technologies to achieve higher operational and resource efficiency, enhance competitive advantage, adopt environmentally sensitive practices and cater to consumer expectations. Utilities are also adopting these technological innovations, and some of these trends are presented below:

- ☐ **Automation of manufacturing**, operations and business processes
- ☐ **Increased focus on data:** Harvesting of data for supporting decision making, monitoring, control, marketing and provision of value-added services. Businesses are offering new services based on aggregation and analytics
- ☐ **Increased deployment of tools and sensors** (IoT, Drones, robotics, smart sensors, RFID etc.) for efficiency improvement and adoption of new business models
- ☐ **Seamless interface** of businesses with consumers - Solutions such as Big Data, predictive analytics and customer behaviour analysis are helping utilities enhance customer engagement
- ☐ New technologies, interconnected network and digitalization is increasing **vulnerability of the power systems**, exposing network elements and devices to cyber attacks

Thus, new trends in technology and digitalization are pushing the productive potential and assisting in new business opportunities across sectors.

As seen in the above sections, the mega trends have significant impact across businesses, industries and utility operations. **The implications of the megatrends are further manifested in the form of policies, new programs, and initiatives.**

The mega trends have an equally significant impact on the power sector. The following section provides a detailed understanding of the implications of the mega trends on the power sector.

3. Implications of mega trends on the power sector and utility operation

Mega trends are inherently disruptive, and they are **altering the established order, affecting business as usual across the global economy**. These trends are also redefining the business landscape across the value chain for the power sector.

3.1 Impact of Urbanization and Demographic shift on the Power Sector

Power sector around the world is evolving to meet the power requirements due to increased **urbanization and changing demographics**. Some of the key impacts are as follows:

- Urbanization will drive growth of **cities as concentrated load centers** and power utilities will need to plan their infrastructure and service delivery models accordingly
- Utilities will need to meet energy demand through clean and sustainable interventions. This will be important from environment and climate change imperative
- Services provided to the consumers will need to be responsive, technology enabled, reliable and convenient
- Increased consumer awareness with localization of demand will lead to adoption of decentralized clean energy options such as solar rooftop
- Catering to increased consumer engagement, especially with **millennials, is forcing power sector to become responsive, smarter and focused on digital services across all the spectrum of its facilities**

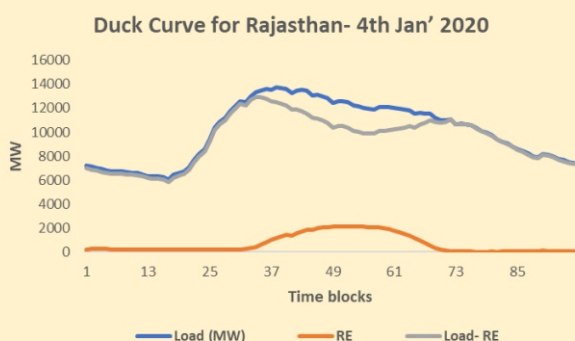
3.2 Impact of Climate Change on the Power sector

Climate policies are increasingly subsuming energy/power sector policies. Some of the key implications in this regard are as follows:

- As one of the largest contributors to GHG emissions and as one of the most vulnerable sectors to climate change, the implications for the power sector are both on mitigation and adaptation.¹¹ **Improve system resilience & strengthen grid** to minimize and better manage impact of climate events on assets, infrastructure and to maintain service quality and reliability. Grid stability will also need to be ensured despite changes in the demand-supply patterns.
- **Adopt low-carbon energy resources and technologies:** To comply with stricter environmental norms and mitigating climate change impacts, utilities are adopting renewable energy (solar, wind etc.), energy efficient products and technologies (electric vehicles, battery storage etc.). Renewable energy (such as solar rooftop) and storage technology combined will decentralize energy supply, with consumers moving to self-generation to become prosumers.
- **Invest in grid balancing technologies and frameworks** to manage the intermittent nature of renewable energy. Regardless of the objective for RE investment (climate change mitigation or economy), absorption of high share of RE necessitates investment in grid modernization and mechanisms/ frameworks to allow participation of innovative and fast response technologies for grid balancing, such as battery storage and Demand Response. Figure 7 below highlights the impact of solar variability on the load curve.

High RE penetration resulting in Duck Curve

A Duck Curve is characterized by very high ramping requirements on a net load basis. The system is required to ramp downwards in the morning when solar generation increases and ramp upwards in the evening when solar generation decreases and demand increases.



3.3 Impact of Technology and Digitalization on the Power sector

Power utilities across the world are **adopting new age technologies and transforming digitally** in response to the mega trends. Some of the key impacts are as follows:

- ❑ **Improved planning with better data and computing services**: Digital technologies and analytics being used across all spectrum of power utility services for cost optimization, customer experience enhancement and efficiency improvement
- ❑ **Improved process and operations efficiency** by adoption of technologies such as robotics, Drones, blockchains, analytical tools and other automation interventions
- ❑ **Better consumer service delivery** with improved infrastructure mapping, fault detention and correction, outage management etc. Smart meters in combination with home energy management systems, data analytics and cloud computing can help enhance consumer engagement through better visibility of consumption
- ❑ **Support consumer empowerment** – Smart meters supporting bidirectional energy flows, data analytics, block chain and peer-to-peer exchanges will empower consumer to adopt self-generation, energy trading and demand response etc. to better manage its demand
- ❑ **Focus on Cybersecurity** – Utilities will need to ensure that the data (about consumer, its consumption trends, energy infrastructure, grid etc.) available with them is protected from any breach or misuse. Cybersecurity will be core to the utility business and suitable investments will need to be made

Critical events affecting power utility operations

The mega trends discussed above have already started to impact utilities. Following are some of the events that have occurred and can be considered case in point.

- ❑ **Southwest blackout of California (2011)** lasted for 12 hrs, affecting 2.7 million Americans. Food worth \$12 to \$18 million¹² was spoilt, there were massive traffic jams with non-operational signals, several sewage pumping stations failed, resulting in contamination of water in many areas. While there were other reasons for the blackout, the extreme heat experienced by users and the resultant increase in demand for energy was one of the contributing factors for the event.

- ❑ **Blackout in USA (2017)** - Hurricane Maria devastated Dominica, the U.S. Virgin Islands and Puerto Rico, knocking out 80%¹³ of Puerto Rico's electrical grid and plummeted the island into darkness. It took 11 months for Puerto Rico to restore power. This is often said to be the largest blackout in US ever.
- ❑ **Ukraine power grid cyberattacks (2015/2016)**- Black Energy Malware infected the Power grid, leaving more than 2,25,000¹⁴ customers without power. Ukraine had a second and significant cyber-attack in December 2016, where test run of a malware through which attackers could view, block, control or destroy grid control equipment, including circuit breakers.¹⁵
- ❑ **Cyber-attack on Kudankulam Nuclear power plant¹⁶, India**- A malware attacked the administrative network of the plant. However, there were no serious consequences¹⁷.

As seen above, the implications of the mega trends are quite significant. There are instances in the past, where these **implications have resulted into critical events impairing power utility operations and affecting larger interests**. In such a scenario, it is imperative for power utilities to adapt and respond to the changing environment. **Many power utilities are already feeling the impact of these mega trends and have started building a new business landscape of the power sector.**

3.4 Utility of the future – Evolving ecosystem and structure

Influenced by above trends, **various utilities have started to respond in different ways to become behaviorally agile, operationally efficient, technologically advanced, customer centric and data driven**. In this process, they are developing, testing and deploying a range of technologies and innovative practices, transforming themselves into utilities of the future.

The schematic in Figure 8 shows the ecosystem of a future power utility, that entails an interconnected system of multiple assets synched together working to meet the dynamic customer and grid requirements. It includes host of new functions, systems and players to suit the transformed ecosystem.

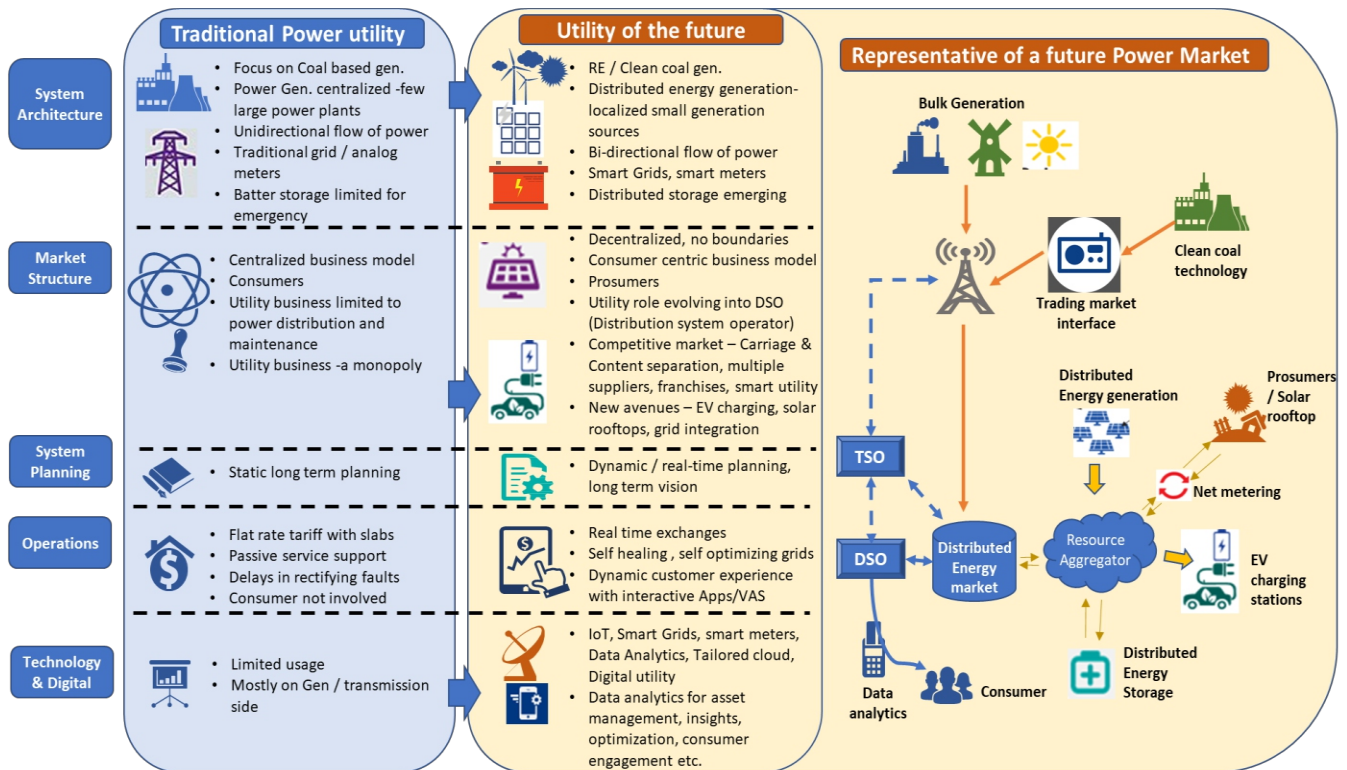


Figure 8: Future power utility ecosystem

Key characteristics of the transformed system includes:

- ✓ Bi-direction flows
- ✓ Advanced controls & visibility
- ✓ Diverse energy sources operating in integrated & optimized manner
- ✓ Customer end actions to help smoothen load curve
- ✓ Thermal generation providing base support
- ✓ Storage supporting diurnal variations
- ✓ Blurring sector boundaries with integration of electric & gas networks, EVs, etc.
- ✓ Markets assuming a significant role
- ✓ Emergence of value-added services and new business and customer services model

Utilities around the world have already started facing the above changes to varying degrees and extent. While some have already started working towards a sound response strategy, others, particularly the ones in developing countries, will need to plan and adapt to the changing operating dynamics. Following are some of the response strategies adopted by utilities to respond to the changing dynamics and to equip themselves to be agile, responsive and future ready.

- ✦ **Change planning paradigm** – The environment in which utilities operate is transitioning, and the traditional planning philosophy and tools need to be re-looked. Ensuring grid stability and resilience while serving the customer requirements in a technology-driven environment is now core to utility

service delivery. **Utilities are moving from being ‘energy supply utilities’ to ‘energy service utilities’.** Utility planning needs to be flexible to take into account the changing environment. Strategies to manage intermittent renewable energy power, including flexibilization of conventional power, innovations in contracts including shorter term Power Purchase Agreements (PPAs), incorporating cyber-security in planning, systems and protocols etc. are some such interventions. Need for quick response solutions has driven investments in smart infrastructure. Through data analytics, utilities can have the ability to plan for shorter terms, complex systems and optimize across different drivers. Proactive measures are required to adopt this changing planning paradigm focusing on infrastructure, resources, human capital and investments.

- ✦ **Develop new business models** – Developing new business models in this transitioning environment is imperative. **Move from consumers to prosumers, increased use of DR/ DSM interventions (increased role of consumer), improved metering technology, amalgamating decentralized solution with grid etc. all require new business models.** Utilities need to assess risk-return matrix of each of the model and the risks need to be suitably allocated across market participants. Here utilities will also need to actively engage with policymakers and regulators to develop a conducive environment supporting new business models.
- ✦ **Move towards customer centricity** – Driven by changing demographics and economic shift, coupled with technological advancements that are reshaping market dynamics, **customers are becoming centers of service of delivery demanding high quality service.** Utilities need to be prepared to service these demands. As the power markets moves towards competitive markets, the utilities need to accept this changing trend and move towards more customer centric business operations. Services such as Omni channel interface; 24/7 customer care services; personalized services, etc. need to be recognized and infrastructure, systems, processes and capabilities of the utilities need to be suitably adapted.

The response strategies will help transform traditional power utilities and deal effectively with the evolving state. However, for such transformation to be seamless and coherent, power utilities will need a unified and strategic approach through the involvement of various stakeholders including policymakers, regulators, private sector, technology providers etc. **The utility ecosystem driven by political, sectoral, procedural, institutional and financial enablers (collectively called as market enablers)** will lead to positive transformation of utilities into vibrant and agile service providers. The next section focuses on the **market enablers** that will facilitate the transformation of power utilities.

4. Market enablers- facilitating transformation of power utilities

As discussed in the previous sections, the implications of the mega trends are influencing transformation of power utilities. This transformation is being facilitated by market enablers. The market enablers provide supporting framework around political, sectoral, procedural, institutional and financial aspects.

The schematic in Figure 9 shows the overall journey, indicating how mega trends are influencing power utilities and forcing them undergo transformation in the evolving business landscape. It also shows the market enablers which are facilitating utilities in this transformation .

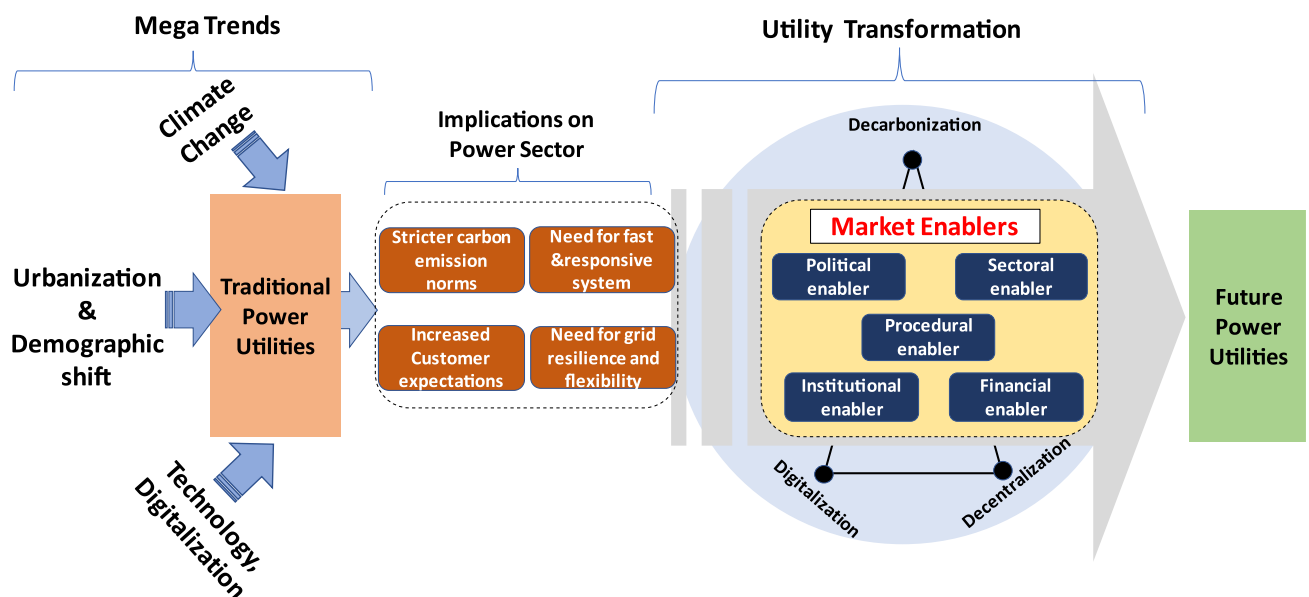


Figure 93: Market enablers facilitating transformation of power utilities

The market enablers are broadly classified under the following heads (i) **political enablers**; (ii) **sectoral enablers**; (iii) **procedural enablers**; (iv) **institutional enablers**; and (v) **financial enablers**. Each one of these is discussed in detail below.

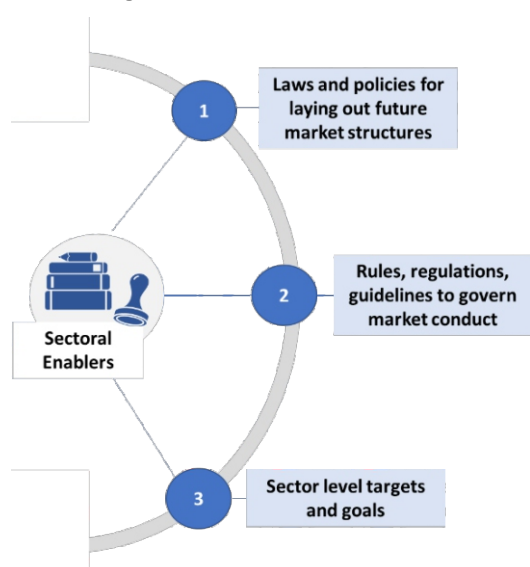
4.1 Political enablers- Political commitment and leadership are vital to brace the disruptive and transformative trends and prepare for transition. Commitment in the form of binding and ambitious goals is necessary to send clear signals to the market and pave the way for potential market reforms and restructuring. Targets and milestones need to be quantified against the set goals. The commitments must further devolve on various contributing sectors of the economy, such as energy, infrastructure, manufacturing, agriculture etc.

For instance, in case of the climate challenge, 196 nations¹⁸, party to the Paris climate accord have submitted



their pledges for emission reductionⁱⁱⁱ. However, some nations have taken a lead, recognized the 'Climate Emergency' and committed to becoming "carbon neutral" or even "carbon sink" by mid-century. They have further set milestone commitments (say, for year 2020 and 2030) and carbon budgets to monitor and measure the progress. Some examples of strong commitment and leadership are highlighted as below:

- ✦ The United Kingdom (UK) had set a target for reduction of all GHG^{iv} emissions by 80% till 2050¹⁹. Taking cognizance of the 'Climate Emergency', the target was further revised to "*achieving at least 100% emission reduction by 2050*", i.e. to become a GHG sink till mid-century.
- ✦ Reeling under the impact of record-breaking temperature (in 2016 and 2018), intense droughts (2013), cyclones (Fehi, 2019), and other climate extremes, the New Zealand has also recently enacted the "Climate Change Response (Zero Carbon) Amendment Act in November 2019". The act has set a target to become net-zero²⁰ by 2050.
- ✦ Bhutan's commitment has been recognized as most praiseworthy. The Himalayan kingdom is already a carbon sink due to ~70%²¹ forest cover reliance on hydroelectricity to meet its electricity needs. However, Bhutan is taking additional measures to cut down carbon emissions through further afforestation. Among other measures, they are planning to cut down fossil fuel use by de-incentivizing use of private vehicles, building pedestrian zones and public transport.
- ✦ The European Union (EU) has set a target to cut the vehicular carbon emissions from about 130 g CO₂ / km in 2015 to 95 g CO₂ / km by 2020²². The United States (US) has set a similar target to reduce emissions from 152 g CO₂ / km in 2016 to 93 g CO₂ / km by 2025.
- ✦ India has set INDC targets such as achieving 40% share of non-fossil fuels in generation mix by 2030, reducing emissions intensity of its GDP by 33-35% by 2030 (compared to 2005 levels) and creating a carbon sink of 2-3 billion tonnes CO₂ equivalent through afforestation. This is being enabled through supporting policies, regulations, schemes, incentives and state/ sector level targets.



4.2 Sectoral enablers: The energy transition is likely to require significant shift in market structure, governing principles, business/operating models, procedures and economics. The market requires an evidence-based framework that lays out viable pathways and approach and pace of transformation. The framework must be consistent with the country specific needs and potential impact. The goal should be to create a more sustainable, robust and reliable energy system, capture economic value and protect consumer interests.

A research backed strategic plan which considers the views of wider stakeholders could be a good starting

ⁱⁱⁱ Intended Nationally Determined Contributions (INDC)

^{iv} Greenhouse Gases - Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons and Sulphur Hexafluoride.

point for creating such a framework. The national level targets should cascade into sector, technology and region-specific targets for deployment of respective technologies/initiatives.

Enactment of laws is important to create binding commitments, improve market confidence and reduce investors' perception of risks. Comprehensive laws cascading into specific policies and regulations are vital to mobilize the market in the right direction by redefining existing structure and setting boundary conditions for conduct of market players (such as competition, in teractions, issue resolution etc.). It is important to build-in flexibility in the frameworks (such as control periods) to allow maneuverability in future.

For instance, Mexico has set its priorities as climate change mitigation, generation cost reduction and reducing social inequalities. **Mexico's "Energy Transition Law 2015"**²³ **defines the clean energy targets, mandates preparation of clean energy roadmap and fosters distributed generation. The law has led to creation of various policy instruments including trading of Clean Energy Certificate and competitive procurement of clean energy.** Depending on the country specific needs and impact, some of the indicative areas requiring enabling legislation, policies and regulations are indicated as follows:

✦ Enabling laws and policies

- **Uptake of emerging RE technologies** such as solar, wind, offshore wind, geothermal etc.
- **Strengthening of existing manufacturing and supply chain** ecosystem and development of new manufacturing capabilities/facilities
- **Deployment of grid balancing mechanisms** and technologies, such as battery storage to support in RE integration
- **Structural changes in the market** to support new market participants like aggregators, demand response providers, ancillary service providers
- **Modernization of the power systems**, including deployment of smart meters, grid automation etc.
- **Fiscal incentives** such as subsidies, grants and exemption of taxes and duties for uptake of any specific technology

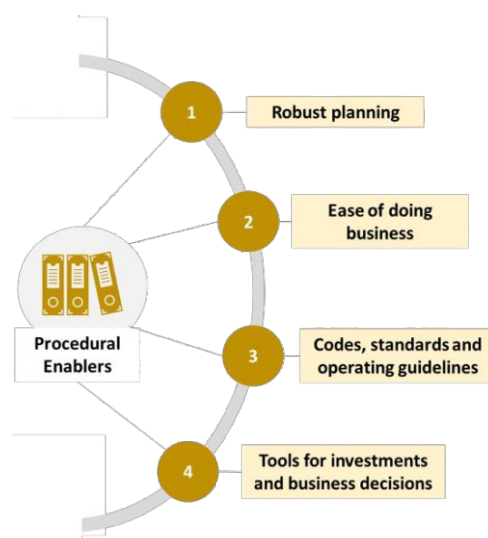
✦ Enabling rules, regulations and guidelines

- **Competitive bidding guidelines and standard frameworks** for clean energy deployment and modernizing the power system
- **Time bound schemes** for deployment of specific technologies
- **Enablement of new business models** that help in financing and deployment
- **Wholesale market design** that provides transparency and liquidity for increased trading opportunities, financial products for risk mitigation and clear signals for infrastructure investments
- **New market segments** such as capacity and ancillary service markets
- **New regulations like cyber, information and data protection**, etc.

Some examples of forward looking and enabling frameworks are highlighted as below:

- ✦ **UK** - Taking forward the UK example, the RIIO^v price control framework rolled out by the energy regulator Ofgem incentivizes energy utilities (electricity transmission, distribution and gas) to innovate and develop smarter and low carbon networks. The second phase of RIIO will be implemented in 2021, focusing on more stringent targets to deliver innovation, reliability and least cost to consumers. Ofgem reports that existing RIIO regime has led to investments of £100 billion and cost of transmitting a unit of electricity has dropped 17% since mid-1990s.²⁴ One approach to allow flexibility is to roll out such frameworks (including RIIO) for a designated period, allow intermittent review and finally going for a policy overhaul at the end of control period.
- ✦ **India** - Another noteworthy example is of India, which has set ambitious goals to add 175GW RE capacity by 2022²⁵. To support the targets, the government has rolled out generation based and fiscal incentives for utility scale as well as distributed RE technologies, developed competitive bidding frameworks and designated nodal agencies for running the auction and enabling financial and implementation support. The share of RE (excluding large hydropower) in India's energy mix currently stands at 22% and growing.
- ✦ **US** - In 2016, the Federal Energy Regulatory Commission (FERC) issued a final rule²⁶ to allow the sale of primary frequency response service at market-based rates by sellers with market-based rate authority for sales of energy and capacity. The rule is intended to promote competition in anticipation of growing demand for primary frequency response service as a result of increasing ingress of RE and consequent need for stringent balancing norms.
- ✦ **Brazil** has enacted law No. 10.295/20111 for establishing the national policy²⁷ on conservation and rational use of energy. It supports establishment of maximum levels of energy consumption and industrial energy efficiency, among other related things.

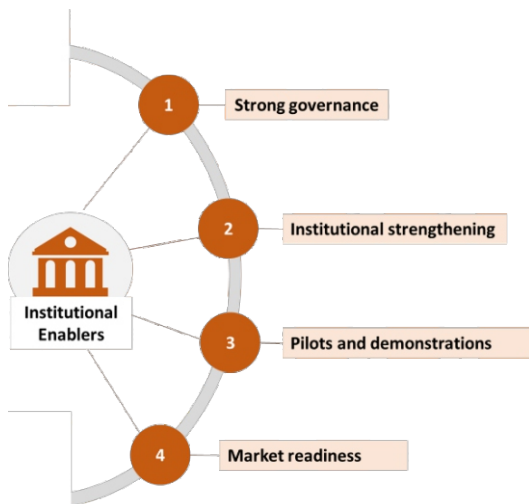
4.3 Procedural enablers: The operational contours of power sector are bound to change as we move to a more decentralized energy system with bi-directional energy flow, behind the meter and smart technologies connected to the grid, and consumers playing a more active role in energy market. It will affect market operations due to increased real time actions (e.g. energy trading, balancing), interactions with new players in the energy and balancing markets (e.g. consumers, aggregators, distributed energy generators.). From system operation perspective, the conventional energy generators will need to be more flexible (cycle) and redesign operating procedures to give way to intermittent RE, and system operators will need better situational awareness, robust grid monitoring and control.



Such paradigmatic changes will necessitate changes in planning approaches, increased coordination definition of existing operating mechanisms, as indicated below:

^v RIIO stands for Revenue =Incentives + Innovation + Outputs. RIIO2 is restructured version of earlier RIIO framework

- ✦ **Long term planning** - Globally utilities and countries are moving towards integrated planning or whole system planning which considers the impact of emerging technologies energy system (demand, supply, network constraints etc.) as well as other socio-economic priorities such as energy access, reliability and affordability. The planning indicates the general direction and least cost approaches to develop the energy system. Such comprehensive planning, incorporating scientific approaches, will be required at national, regional level (in purview of concerned utilities).
- ✦ **Medium to short term planning and coordination**- Traditionally central/designated agencies are responsible for planning for infrastructure development, network strengthening and modernization. However, more active planning requires firm indications, preferably from the wholesale markets (energy, capacity etc.) to indicate capacity addition and augmentation. Increased interaction among market players and information dissemination is required for coordinated system development to avoid over/under investment.
- ✦ **New/modified operating guidelines** are required for demand estimation, scheduling, generation forecasting, dispatch, system reserve deployment, grid balancing etc. in view of interplay of emerging technologies and business models with exiting system. This may include establishment of new agencies such as Independent System Operators (ISO) or Distribution System Operators (DSO) for more granular control on system operations.
- ✦ **Codes and standards** for interconnection of distributed generation resources, behind the meter technologies, smart meters etc. with the grid; communication technologies, standards and protocols;
- ✦ **Ease of Doing Business (EoDB) mechanisms** for new businesses and project developers for easing the processes and reducing the “time to market”. EoDB factors may include single window clearance procedures for investments and business registrations, tax breaks, support (of government and relevant agencies) in land acquisition and permits, access to low cost finance, grants and subsidies, counterparty risk mitigation mechanisms etc. Similarly, on the customer side this may include quick electricity connections, rapid resolution of outages, quick query resolution etc.
- ✦ **Tools and frameworks** for resource assessment (such as solar and wind atlas), smart grid maturity assessment, standard contracts and bids for procurement, cost-benefit evaluation (e.g. for solar rooftop deployment) etc.
- ✦ **Supply chain related** standards and specifications for equipment manufacturing and procurement (such as solar modules, wind turbines, inverters, batteries), landed cost estimates etc.
- ✦ **Customer-centric norms, targets and orientation** - policies, regulations, guidelines and performance targets must be customer centric to support enhanced services and protection of consumer interests. At utility end, the customer-centricity must go beyond electrification and provision of reliable supply. Increased competition from other suppliers and self-generation technologies will require focus on value added services around energy management, energy efficiency, supply sourced from clean energy, demand response etc. to reduce the energy cost for consumers and improve their satisfaction levels. Capturing of new business opportunities (such as utility driven solar rooftop installation) will also aid utilities remain economically viable.

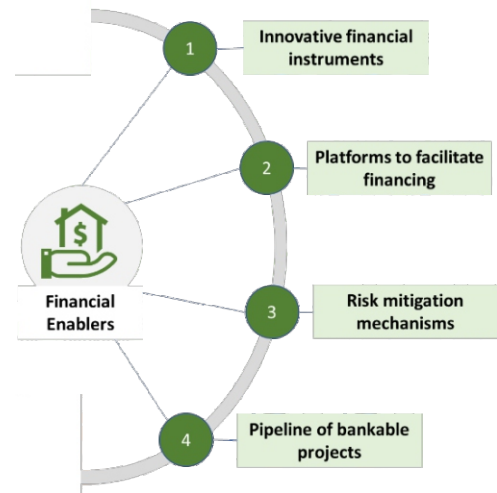


4.4 Institutional enablers: Transformative trends and emerging technologies necessitate development of organizational and individual capabilities to adapt to the change. The institutional capacity of overall market ecosystem needs to be improved, including utilities, regulators, policymakers, industry and communities. Some of the key institutional enablers relevant for government level as well as industry level adoption are:

✦ **Strong governance** for implementation of government schemes, monitoring and enforcing industry compliance with mandated commitment/targets, planning, evaluation and inter-agency coordination.

- ✦ **Creation of new institutions** for transition planning, undertaking research and development, facilitating techno-commercial collaboration, incubating and accelerating of start-ups, advising government and markets, enabling knowledge exchange and capacity building. For instance, UK has created Committee on Climate Change (advisory, planning and monitoring body), India has institutions such as National Institute of Solar Energy (NISE) and National Institute of Wind Energy (NIWE) for capacity creation, R&D, coordination and collaboration.
- ✦ **Strengthening of existing institutions** by assessing the imminent training and skilling needs, rolling out large scale and targeted programs. This is relevant for institutions across the board such as regulators, system operators, utilities, project developers, OEMs etc. Furthermore, the capacity building is necessary across the organizational hierarchy.
- ✦ **Education** of future workforce must be aligned with market needs. Graduate, under-graduate and vocational courses and certifications must include subjects focused on building technical, commercial and management skills in emerging areas.
- ✦ **Market readiness** is required in form of an efficient supply chain and established vendor base (for provision of goods and services). This requires reducing entry barriers (through conducive regulations, policies, procurement guidelines), promoting transparency and competition, improving visibility of demand for products and services, promoting innovation and collaboration.

4.5 Financial enablers: Financial investments are imperative for traversing the energy transition - for investing in clean energy generation and integration, network upgrade and modernization, automation and operational modifications (e.g. environmental compliance, cycling) and launching new products and services. As a first step it is critical to estimate the investment need and gap in view of market transformation. More ambitious the commitments, higher will be the investment gap. Public resources being limited, it is vital to unlock institutional and private investment to bridge the expected investment gaps. Some of the key enablers to channelize investments are:



- ✦ **National climate/green funds** - This is a comparatively new mechanism wherein domestic and international capital (various forms of debt and equity) is blended and channelized into green projects. Development capital (from international development organizations) is often pooled with national funds earmarked by respective governments. These funds provide low cost financing to targeted projects and technologies, which help in accelerating the commercialization and attract private capital.
- ✦ **Innovative financial instruments and investment vehicles**, that help channelize offshore/institutional/private capital into domestic sectors. Innovation is necessary to mitigate investor risks and improve their confidence due to higher perceived risks associated with emerging sectors, technologies and new business ventures. Innovation is also required to create market liquidity and capital churning for existing investors to support new projects. Some example of such investment vehicles launched in India are Infrastructure Debt Fund (IDF) and Infrastructure Investment Trusts (InvIT)²⁸. Climate bonds and green bonds are fixed income instruments launched in many countries.
- ✦ **Platforms for providing low cost finance**, for instance the Global Innovation Lab²⁹ for Climate Finance, which is a public-private platform that develops and pilots innovative instruments. In 2016, the Lab, in partnership with various countries (Germany, Netherlands, UK, US, Denmark etc.) launched four financial instruments³⁰ to catalyze investments in Asia, Africa and Latin America. The Central Bank of Lebanon has created a national financing mechanism³¹ wherein it provides interest free long-term loans for energy-efficiency and renewable energy projects, The Chilean Economic Development Authority provides credit line³² to Chilean banks for lending in RE sector.
- ✦ **Pipeline of bankable projects**- A number of capital-intensive projects are unable to attract sufficient funding and/or low-cost funding due to long gestation periods, counterparty risks, market uncertainties and perceived risks of investors. This is particularly true for emerging technologies which are not much matured and commercialized. Bankability improvement is an approach for making such risky projects more bankable (for investments) by various means, such as infusion of risk capital during for project development, strong contracting frameworks for risk mitigation, hedging and risk sharing mechanisms, support during project lifecycle (from inception to commissioning) etc.

A pipeline of bankable projects helps attract long term capital and accelerates project development. Sector level participants need to consider mechanisms to enable creation of such bankable projects – such as through Project Preparation Facilities (PPFs), which may offer financial or technical assistance. Bankability improvement may cover utility modernization, advanced energy systems, smart meter projects, energy storage deployment, solar/wind parks, customer centric investments, new business models etc.

- ✦ **Innovative business models** - Development and testing of innovative business models is important to test ideas and concepts for giving a push to adoption of any technology or solution. For instance, deployment of solar rooftop, EV charging infrastructure, battery storage applications, Demand Response, Demand Aggregation, Smart Metering etc. Demonstration and pilots help establish the business case and incorporate learnings to further refine the model and scale up. Incubators and accelerators are required to support such models. Apart from nodal ministries and government agencies, utilities need to take lead on this.
- ✦ **ESG framework** - Various international funds, development organizations, international financial institutions and investors, require the investee projects to showcase sustainability through Environmental, Social and Governance (ESG) safeguards. A comprehensive ESG framework prepared for adoption by new projects can be extremely helpful in attracting such capital at attractive rates.
- ✦ **Risk mitigation** plays a large role in catalyzing investments. Often, for fledgling markets and technologies, this push needs to come from governments. To support deployment of RE and other technologies, government agencies can become counterparty to mitigate payment security and offtake risks inherent in a particular contract. Guarantees backed by financially strong organizations (market leaders, large utilities etc.) can also help mitigate risks and attract investors.
- ✦ **Public-private Participation (PPP)** has been regarded as an important mechanism for bridging infrastructure investment gaps, particularly in emerging economies. PPP leverages the enabling and governance capabilities of public sector and the financial and operational capabilities of private sector. Different models such as Build-Own-Operate (BOO), Build-Own-Transfer (BOT), Design-Build-Operate (DBO) etc. can be deployed, depending on the project and sector needs.

The Market Enablers, their key attributes and underlying commitments are also summarized in Table 2.

Table 2: Summary of Market Enablers

Enablers	Attributes	Description (nature and type of commitments)
Political enablers	<ul style="list-style-type: none"> ○ Political commitment and leadership ○ Goals/targets 	<ul style="list-style-type: none"> ○ Country level commitment to move towards low carbon pathways mandated across all sectors/segments ○ Goals and targets – INDC commitments, GHG emission reduction, energy intensity targets, clean transport, clean energy transition, etc.
Sectoral enablers	<ul style="list-style-type: none"> ○ Laws and policies for architecting the future market structures ○ Rules, regulations and guidelines that govern operating conduct of market and its performance ○ Specific goals and targets 	<ul style="list-style-type: none"> ○ Supportive laws and policies at the sector level for areas such as <ul style="list-style-type: none"> ○ Manufacturing and deployment of RE and battery storage ○ Structural changes in the market to support new market participants like aggregators, demand response providers, ancillary service providers) ○ Modernization of the power systems like deployment of smart meters, grid automation etc. ○ Taxation benefits, other incentives and subsidies ○ Rules, regulations and guidelines in areas such as <ul style="list-style-type: none"> ○ Competitive bidding guidelines and standard frameworks for clean energy deployment and modernizing the power system ○ Time bound schemes for deployment and enablement of new business models that help in financing and structural support ○ Wholesale market design that provides transparency and liquidity for increased trading opportunities, financial products for risk mitigation and clear signals for infrastructure investments, ○ New regulations like cyber, information and data protection, etc. ○ Clearly spelled out sector level targets e.g. RE target for different countries – solar (large scale and rooftop), wind (incl. offshore wind, EV deployment targets) etc.
Procedural enablers	<ul style="list-style-type: none"> ○ Robust Planning Mechanisms to meet the new age requirements, and those enshrined in the laws, policy and regulations ○ Supply chain related – equipment specifications 	<ul style="list-style-type: none"> ○ Long term planning for energy system development ○ Short/Medium term planning for capacity addition ○ Operating guidelines, new codes and standards ○ Ease of doing business ○ Tools for better investment and business decisions; ○ Operating procedure and processes ○ Supply chain related – equipment specifications and procurement of products and services

Institutional Enablers	<ul style="list-style-type: none"> ○ Creating strong institutions, training and capacity building, and knowledge sharing ○ Creating a dynamic and responsive future work force 	<ul style="list-style-type: none"> ○ Institutional capacity creation – new institutions, institutional strengthening, upskilling, staffing, awareness creation, training and education, ○ Pilots and demonstration for confidence building, new research and training networks ○ Market readiness – adequacy of vendors, competition in the market, visibility of the pipeline and demand
Financial Enablers	<ul style="list-style-type: none"> ○ Financial enablers that support funding, and hence initial implementation, scale up and acceleration 	<ul style="list-style-type: none"> ○ New and innovative financial instrument ○ Platforms to facilitate financing and accessing low cost financing – such as Special Purpose Vehicles (SPVs), aggregators, blended finance, risk capital, grants and incentives ○ Strong ESG framework to comply with international standard to channelize financing ○ Other enablers like payment security mechanism, guarantees, risk allocation mechanism in vendor and contract documentation, climate risk insurance and coverage etc. ○ Pipeline of bankable projects

The market enablers provide a broad perspective on the actions to be taken for smooth transformation of power utilities. They also act as a guiding framework for power utilities which are in transition or inception stage, and as a checklist for those which have already transformed.

5. Conclusion

The mega trends viz. urbanization & demographic shift, climate change and technology & digitalization are reshaping the world we live in, through implications on economies, businesses, industries, societies and individuals. The power sector is highly exposed to the implications of the mega trends and is witnessing fundamental changes in its business landscape. Influenced by above trends, various utilities have started to respond in different ways to become - behaviorally agile, operationally efficient, technologically advanced, customer centric and data driven. In this process, they are developing, testing and deploying a range of technologies and innovative practices, transforming themselves into utilities of the future.

Power utilities around the World are at various stages of this transformation. While, few have reached advanced stages, several utilities particularly in the developing countries, are either in early stages or contemplating actions to start their transition journeys.

Irrespective of the transition stage the utilities are in, for a seamless transformation, need for enabling environment across political, sectoral, procedural, institutional and financial aspects remains inevitable. The World Energy Forum's latest global *Energy Transition Index*³³ for year the 2019 shows that countries with weak regulatory frameworks, lack of policy certainty and resistance towards switching to alternative sources of fuel are facing challenges in their energy transition journeys. On the contrary, countries with strong enabling environment are amongst the top in terms of their readiness to transform.

The 'market enablers' identified and discussed in this paper are critical support elements which fulfils the requirement of enabling frameworks for transformation. They enable decision makers to undertake actions in a more planned and meticulous manner. It is upon the key players in the power sector including policy makers, regulators, utilities, private sector, academia and research organizations to come together and lead the way.

Glossary

Aggregators: Market player that can optimize the use of distributed energy resources. They bundle DERs to engage as a single entity

Artificial Intelligence (AI): An umbrella term for technologies that enable a computer to perform tasks that usually require human intelligence

Blockchain: A time-stamped series of immutable records of data that is managed by a cluster of computers not owned by any single entity. Each of these blocks of data (i.e. block) is secured and bound to each other using cryptographic principles

Decarbonization refers to the reduction or elimination of carbon dioxide from energy sources

Decentralization: Process when energy is produced closer to where it will be used, rather than at a large plant elsewhere and sent through the national grid

Distributed energy resources (DER): Small and medium-sized power resources connected to the distribution network

Net Metering: A billing mechanism wherein consumers are compensated for the surplus power generated they add to the grid at a predetermined price

Prosumers: A consumer who generates electricity as well by various means e.g. solar rooftop.

Endnotes

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This paper has been prepared under USAID bilateral program with the Ministry of Power, titled Smart Power for Advancing Reliability and Connectivity (SPARC). KPMG is the implementing partner of the SPARC program. The contents in this paper do not necessarily reflect the views of USAID or the United States Government.

About SPARC

The United States Agency for International Development (USAID) launched the “Smart Power for Advancing Reliability and Connectivity (SPARC)” program in partnership with the Ministry of Power, Government of India in 2018. SPARC is a three-year initiative with the objective of supporting the transformation of operational and financial performance of electricity distribution utilities. KPMG is the implementing partner of the SPARC program.

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Authors

Vikas Gaba
Ruchika Chawla
Manas Tiwari
Mohd Sarim Siddiqui
Amit Agarwal

Reviewed by:

Apurva Chaturvedi, Senior Clean Energy Specialist USAID/India

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Contact Details

The Secretariat, The World Utility Summit, 26/1, 5th Floor,
WTC-brigade Gateway Campus, Dr. Rajkumar Road, Malleswaram West, Bengaluru-560 055, India
Phone: +91 77220 86088
Email: Secretariat@worldutilitysummit.org | Website: www.worldutilitysummit.org