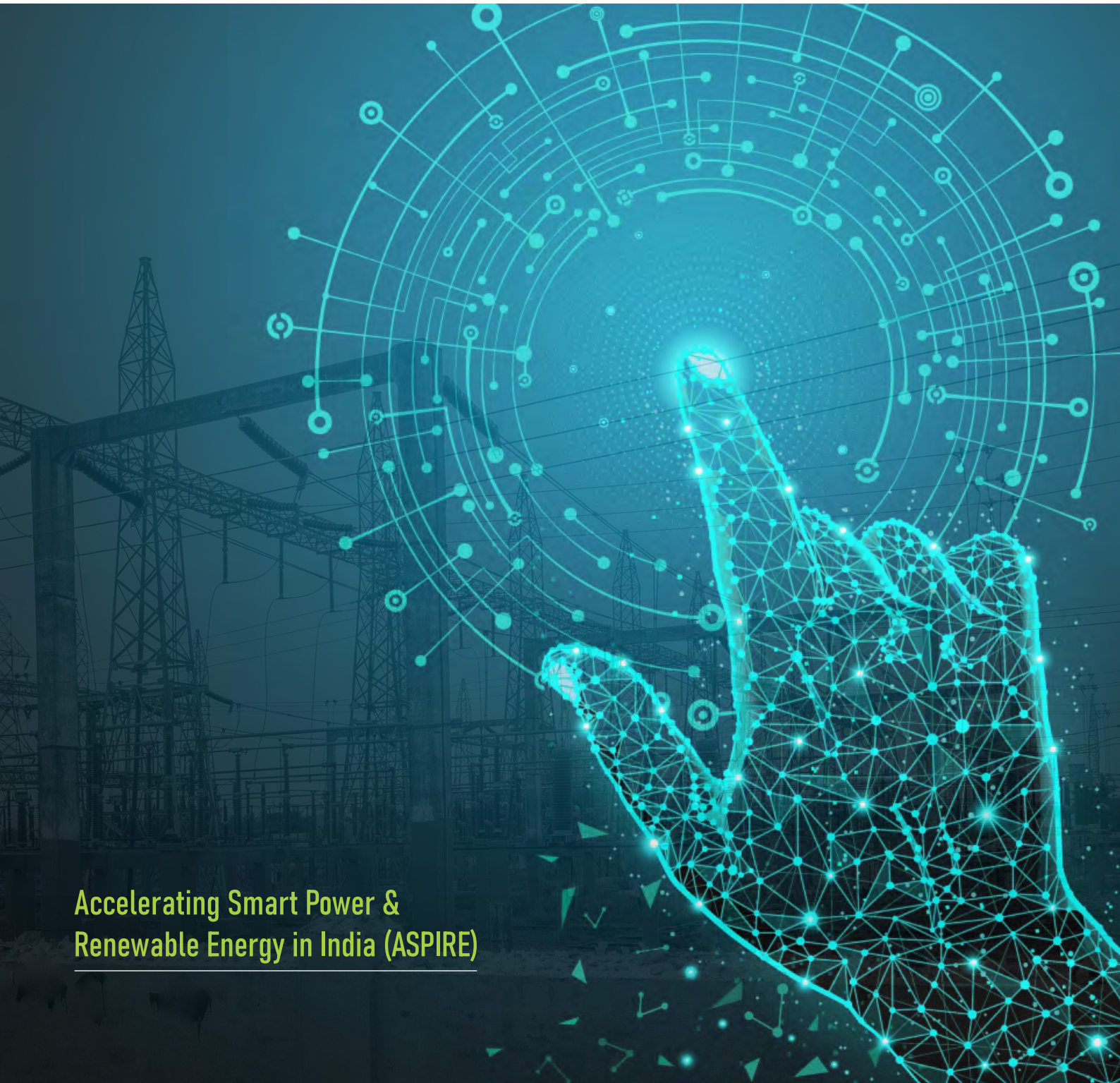
UK Government

INSTITUTIONALIZING
INDIA-UK CERTIFIED COURSE
DIGITAL UTILITY MANAGER



Accelerating Smart Power &
Renewable Energy in India (ASPIRE)

INTRODUCTION

The electric utilities are on the threshold of a rapid transformation with the advent of distributed renewable generation, electric vehicle and energy storage systems etc. – a move towards a new era of decentralised systems. Considering the complexity of operations with decentralisation of the grid, and increasing role of customers, the utilities need to adapt advanced technologies and undergo digital transformation to improve their business processes and operational efficiency and thereby requires competent digital utility workforce to support the implementation and operational process.

Emerging technologies like Artificial Intelligence, Machine Learning, Data Science and Advanced Analytics, Blockchain, Virtual Reality, Augmented Reality and Robotics are changing the way the utilities used to operate and also creating new revenue opportunities for the utilities. Many utilities as part of their digital transformation journey, have started focusing on implementation of different IT and OT applications, their integration to the existing systems and deployment of analytics solutions to explore the option of data driven decision making to ensure operational efficiency, grid reliability, customer satisfaction.

NEED FOR CAPACITY BUILDING

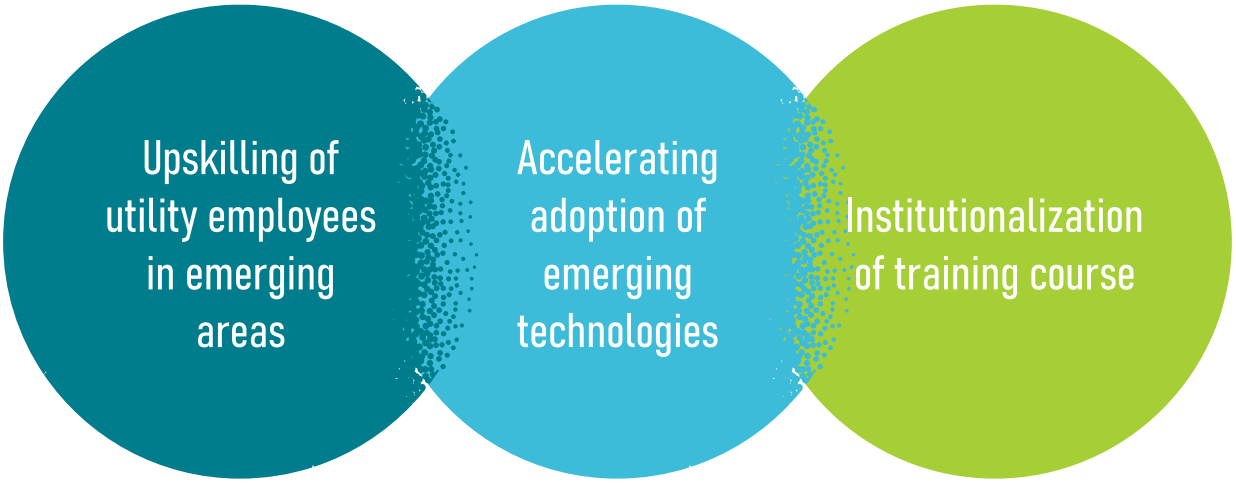
Technology adoption and implementation are also taking the centre stage under government schemes and policies e.g. Revamped Distribution Sector Scheme (RDSS), which focuses on smart metering, distribution grid automation and solutions based on emerging technologies such as AI, ML and Blockchain etc. For successful adoption and implementation of technologies, skill development becomes imperative for the entire sector, but especially in electricity distribution segment.

Foreign, Commonwealth and Development Office (FCDO), Government of the United Kingdom (GoUK) in partnership with the Ministry of Power, is undertaking a bilateral program "Accelerating Smart Power & Renewable Energy in India" (ASPIRE). The ASPIRE program is providing technical assistance to the Power Finance Corporation (PFC) in developing a training program 'Digital Utility Manager' for digital skilling of distribution utilities and institutionalization of learnings.

ABOUT THE DIGITAL UTILITY MANAGER CERTIFICATE COURSE

The 'Digital Utility Manager' is envisaged to be first of a kind course on digital technologies that is aimed to equip utility workforce with knowledge on new digital technologies, technology integration, operational aspects, business models, policy aspect etc. The aim is create awareness and institutionalize learnings to drive proactive technology adoption at utility level.

Objectives of the course are:



Course Components

Network Elements | **Digital Technologies**

Modules

Smart Grid-Foundation Blocks	EV Charging Infrastructure	Cyber Security	Blockhain Application
Advance Metering Infrastructure	DER Integration and Smart Microgrids	AI/ML, Robotic Process Automation and Advance Analytics	Digital Tech. for climate Resilience
Energy Storage			
Consumers			
Alternative Revenue Streams for Discoms			

Thematic Coverage

Technology Building Blocks	Use cases and Application	Business Models	Policy, Regulations and Standards
System Integration	Implementation Strategy	Challenges and Benefits	National and International Case Study

CONTENT DESIGN AND DELIVERY APPROACH

Selection of partners and trainers

- International and national academic partners
- Industry professionals

Course content development

- 360 degree coverage of digital technologies, network elements
- International case studies

Delivery of certificate course

- Physical offline mode
- Live online mode

Issuance of certificate

- Examination based certification
- Certificates with logo of academic partners

Institutionalization of the course

- Course to be hosted on online platform
- Remote access for self paced learning and certification

Course Development

The content of the certification course will be developed by the ASPIRE project team in partnership with leading national and international institutions such as Imperial College London, Indian Institute of Technology Tirupati and Veermata Jijabai Institute of Technology, Mumbai, who will bring their subject matter experts in specific areas. The modules to be designed by respective institutions are provided below

Name	Strength	Modules to be designed and delivered
Imperial College London (UK)	Smart Grid Technologies (IT & OT)	· Smart Grid- Foundation Blocks · Standards for Smart Grid Applications
IIT Tirupati, (India)	Distributed Energy Resource (DER) Integration, Smart Inverters, Energy Storage etc.	· DER Integration · Smart Microgrids · Energy Storage System
Veermata Jijabai Technological Institute, Mumbai (India)	Cyber Security	· Cyber Security
ASPIRE Team	Advance Metering Infrastructure (AMI), Electric Vehicle (EV), Artificial Intelligence (AI) and Robotics etc.	· AMI; Business Model for Smart Grid Applications; Policy and Regulations · Consumers, Alternative Revenue Streams for Discoms · EV Charging Infrastructure; Blockchain Applications; Advanced Analytics · AI, ML and Robotics

Course Delivery

Live training sessions are planned to be delivered through a mix of online and offline modes, by national and international experts in respective areas. Online modes will utilize widely used online communication platforms, whereas offline modes will include classroom training at partner institutions or alternative physical set-ups. Sessions will include a mix of lectures, doubt clearing sessions, exercises and national and international case studies.

The course is aimed primarily at training mid to senior level officials of Centre and State utilities and SERCs. The physical session is proposed to include 50-60 participants, whereas the online program can have higher participation. The course delivery aims to encourage strong participation by women.

Certification

Training sessions will be followed by an online examination of the participants as a means to ensure assimilation of learnings and enable institutionalization. In addition, certification will also add value to the experience profile of participants. The response sheet for each of the participants will be evaluated by ASPIRE team and certification will be provided to those scoring more than 80% marks. Participants who do not score more than 80% marks in first attempt will be required to take another examination for scoring the required marks.

The certificates will carry official logos of British High Commission, ASPIRE program, partner academic institutions and ISGF etc. depending on the delivery partners for respective modules.

BENEFITS OF THE CERTIFICATE COURSE

- The training will give extensive coverage of all the topics related to advanced technologies, their functionality and impact on utility operations, creation of new revenue opportunities etc. thereby helping participants to have full understanding of digital utility and the role of different technologies and innovative business models in improving business and operational efficiency of the utilities
- The training program will provide the utility professionals the opportunity to contribute in implementation strategy, operation of advanced technologies etc. and their knowledge in the digital utility space in their respective job functions within utilities.
- This program will also enable women professionals to enhance their opportunities to lead engagement related to implementation of digital technologies and their operations and can also head key processes/roles within Digital/IT/Operations effectively in their current position etc.
- The live training sessions will provide opportunity to the participants for one-to-one doubt clearing sessions with experts
- Institutionalization of the training program will provide access of the certified course to everyone across the country who will be interested in completing the course.
- Interested participants can complete the course at their own pace and this will help especially field utility professionals and women participants who have competing demand for their time

MODULE-WISE COURSE CONTEXT AND HIGHLIGHTS

MODULE 1:

Smart Grid – Foundational Blocks

The electricity distribution companies have embarked on their digital journey through several programs promoted by the Ministry of Power (MoP), Government of India. Although, the actual implementation in many utilities may still be not satisfactory, there is already a unanimous voice for taking this journey to full digitalization. The industry and utilities have time and again raised concerns about the dearth of trained people and knowledge gap among the workforce in the fast-changing technology domains. In order to successfully implement new programs, it is necessary to create a pool of talented and skilled manpower. Considering this requirement, this module will help the participants to understand the smart grid fundamentals including technology building blocks, functions of various smart grid operational technologies and IT applications like SCADA, GIS, demand response, enterprise IT systems, self-healing grids etc.

In addition, this module will also focus on the standards related to smart grid and business model for smart grid applications for utilities

MODULE 2:

Advanced Metering Infrastructure

With formal launch of RDSS program in 2021, India has embarked on an ambitious journey to install smart meters for 250 million+ electricity customers nation-wide in next 4-5 years; out of which about 100 million are targeted to be completed by end of 2023. This is a herculean task as today there are only 3.3 million smart meters in operation in the country. While availability of smart meters domestically is not considered to be a major challenge, rest everything is a challenge owing to lack of clarity in DISCOMs on how to procure what is best suited for them. In addition, DISCOMs' expertise is also limited when it comes to telecommunication and IT.

Considering the above challenges, this module will cover AMI technologies including smart meter, head end system, meter data management system etc., roll out challenges, various business and procurement models, Smart Meter Operation Center and its framework, AMI analytics etc. in order to make the participants understand the technology, system integration, operational and commercial benefits that utilities can accrue through AMI implementation, customer services etc.

MODULE 3:

Energy Storage System (ESS)

Decarbonisation and clean energy transition being at the forefront of various government policies, energy storage will be one of the key actors in supporting these policy objectives through grid integration of intermittent renewable energy sources, providing clean power for electro mobility, grid support services etc. A study by ISGF estimated that 17 GWh of battery energy storage systems (BESS) is required for integration of 175 GW of RE to the grid by 2022. Besides this, BESS required for other stationary applications such as data centres, telecom towers, UPS and inverters, DG replacement and etc., is calculated at 121 GWh making an aggregate requirement of 138 GWh for stationary applications. Electric Vehicles (EVs) would require another 40 GWh of BESS during the same period, up to 2022.

With Government of India targeting 500 GW of renewables by 2030, implementation of energy storage system by both transmission and distribution utilities will be crucial in order to support increase in integration of renewable energy sources as well as to maintain grid stability and reliability. To facilitate utility professionals and other stakeholders in understanding of energy storage technologies, implementation requirement etc. this module will cover various energy storage technologies, implementation and revenue models, grid support service that they can provide and benefits to utilities.

MODULE 4:

DER Integration and Smart Microgrids

Grid flexibility as well as demand side flexibility will play an important role in managing the influx of DERs as well as in delivering high value on both sides of the meter as well as allowing better monitoring and dispatch of DER. Successful integration of DERs is best possible using DER tools like Distributed Energy Resource Management Systems that maximize the use of distributed generation resources by providing monitoring, control, and forecasting abilities of different DERs installed across the grid so utilities can observe, operate, and coordinate their use while ensuring power quality and grid reliability. This module will cover the DER integration challenges faced by utilities in terms of intermittency, impact on power quality and how flexibility solutions like distributed storage, vehicle to grid which can facilitate in providing grid flexibility for utilities. In addition application and functionality of tools like DERMS and smart inverters and benefits they will impart in operation and integration of DERs will also be covered.

Smart microgrid components and its architecture and different use cases for urban and rural areas will also be included in this module

MODULE 5:

Cyber Security

A cyber-attack on the power grid could result in complete disruption of all activities in the society and it can cause electrical blackouts and pose threat to national security. It is a growing concern and a key success factor for reliable power generation and distribution as security has become a crucial factor for wide deployment of IT and automation and technologies in the power systems. According to an IT Governance Report, there were more than 1.7 billion data breaches and cyber-attacks in January 2019 alone. A cyber-attack can have far-reaching implications including financial losses, theft of intellectual property, and loss of customer confidence and trust.

The industry and utility managers have raised concerns about the dearth of trained cyber security professionals and there is a critical knowledge gap among the workforce about the need and availability of cyber security resources, assets and solutions. This module has been designed to facilitate utility and industry professional in understanding the different types of cyber-attacks and corresponding required solutions to prevent those attacks. This will also help utilities and regulators to frame the cyber resiliency guidelines and understand the design principles and implementation requirement of state - of the art Cyber Security Solutions and maintain them securely.

MODULE 6:

Alternate Revenue Streams for Discoms

The conventional power system is undergoing a rapid transformation with increasing penetration of decentralized and clean energy resources such as Solar Rooftops and Electric Vehicles as well as adoption of digital technologies such as AI, ML, Robotics etc. With constantly declining prices and increasing efficiencies of solar panels and batteries, a large section of customers could generate, store and consume their own electricity. Today, the primary revenue for electric utilities is from the sale of energy (kWh) to their customers which is going to be seriously impacted in the near future. Since these changes are already on the horizon, it is important for utilities to consider New Revenue Streams for growth and sustainability.

During the lockdown in 2020, electric utilities, like all other organizations, quickly adopted to paper-less and contact-less operations. This alone has pushed forward the digitalization process in utilities. The level of automation and digitalization that would have taken another decade in power utilities would now happen in a much shorter period. Most processes have become paper-less. The culture of remote working and use of third-party owned digital platforms for meetings and collaborations have instilled confidence in utilities to adopt cloud technologies and applications hosted on the cloud. So, many systems that utilities used to buy earlier will now move to the services model for a monthly or quarterly fee.

Availability of digital data of all assets, processes and operations in near real-time will enable utilities with better visibility and control; and they can now deploy analytical tools to optimize their operations. This is a quantum leap from their paper-based operations in the pre-Covid era. Covid-19 has presented never before opportunities for innovation and transformation with profound implications that are gainful in the long term. We are building data driven smart utilities which will open up new business opportunities for organizations providing tools and services to host and manage the enormous amounts of data utilities are expected to generate in the coming days. While the typical physical assets of utilities depreciate, the digital assets will constantly appreciate. Therefore, the module focuses on are different ideas on how these digital assets can be monetized through appropriate business models.

MODULE 7:

EV Charging Infrastructure

Government of India has set an ambitious plan to electrify the transport sector through aggressive policy interventions that would mandate phasing out manufacturing and sales of ICE based vehicles in a phased manner in the country by 2030. In order to support large scale rollout of EVs, it is necessary to build charging infrastructure and strengthen the electricity distribution infrastructure to support the EV charging load. This module will focus more on the electric vehicle charging and battery swapping technology, standards and communication protocols along with various business models and grid integration requirement which will help utilities to seamlessly integrate and cater the additional load of EV charging. In addition it will also focus on market design principles and technology related to vehicle to grid which can be utilized for providing grid support services. It will also help participants to have an understanding of the EV charging standards published by Bureau of Indian Standards (BIS) i.e. IS:17017 series

MODULE 8

Blockchain Applications

Blockchain is a distributed, digital transaction technology that allows for securely storing data and executing smart contracts in peer-to-peer (P2P) networks. It has attracted the attention of the power industry with its potential to unleash an energy revolution in which both electric utilities and consumers will produce and sell electricity. Blockchain could offer a reliable, low-cost way for financial or operational transactions to be recorded and validated across a distributed network with no central point of authority.

While there are more than 24 use cases of blockchain technology in the power sector, the one that is currently gaining the most attention is P2P power trading, where small-scale generation owners may directly sell excess energy to other consumers. Energy trading in P2P network is enabled through smart contracts executed on blockchain. Blockchain- enabled technologies can add to the speed of adoption as they can be applied to applications for Community Net Metering, Virtual Net Metering, EV Charging, Virtual Power Plant etc. This training program aims to introduce the participants with the technology, deep dive into the applications and platforms; address the maturity of blockchain technology; share relevant power sector use cases regulations and policy support required to incorporate these use cases.

MODULE 9

AI, ML, Robotic Process Automation and Advanced Analytics

Artificial Intelligence (AI), Data Science (DS), Machine Learning (ML), Virtual Reality (VR), Augmented Reality (AR), Drones and other types of Robots could play crucial roles in various infrastructure and services in city management including utility operations. These new technologies and tools could make the operations more efficient, faster, reliable and economical. For example, artificial intelligence (AI) will be able to balance electricity grids, manage demand, negotiate actions, enable self-healing functions and facilitate a host of new products and services leading to the energy transition. It will also enable more efficient and e□ective utility operations by helping to analyse the massive amounts of data gathered from the digital devices. Robotic Process Automation (RPA) on the other hand, could automate all measurable, repeatable and predictable transactions in all domains of city management and utility operations. In this module, we will cover the use cases and applications of artificial intelligence, machine learning and robotic along with infrastructure requirement, available tools. It will also cover the concept and functioning of data driven smart utilities and the benefits that the utilities will gain with the adoption of these technologies in terms of accurate demand forecasting, reduction in power purchase cost, new revenue opportunities etc.

MODULE 10

Digital Technologies for Climate Resiliency

High-impact weather events such as heavy rainstorms, high winds and seasonal flooding are becoming more frequent and severe around the world which is increasing operational issues for transmission and distribution utilities. In addition it also increase the cost of operation along with cost to life and property. A survey carried out by Accenture as part of Digital Enabled Grid Research found that 92% of the more than 200 respondents expect extreme weather events to increase and 83% see this trend as a threat to grid stability. Electric utilities mainly used to focus on grid reliability, however, and considers extreme weather events such as earthquakes, geomagnetic storms, warfare, wildfires, and pandemics such as COVID-19 occurs as secondary, the situation can quickly move from bad to worse.

According to McKinsey & Company, a typical utility saw USD 1.4 billion in storm-damage costs and lost revenues due to outages caused by storms over a 20-year period.

Therefore utilities need to expand their idea of grid reliability considering the extreme climate related events by developing and incorporating supporting capabilities that can add to grid flexibility and quick response time in the face of stressed or extreme conditions. There are plethora of options today with decentralized generation, smart microgrid, reduction in cost of battery based energy storage, technologies for system flexibility etc. Some of the key areas where utilities need to invest and this module will focus are mentioned below

System hardening: Reinforcement of transmission and distribution infrastructure is required both in terms of physical hardening e.g. replacement of wooden poles, elevated control houses, strengthening of overhead lines etc. as well as system hardening through implementation of digital technologies for grid isolation, AI enhanced replacement of poles, AI driven decision intelligence, weather forecasting etc.

Non-wire alternatives: Grid hardening is expensive and may not always cope with extreme weather events e.g. Florida Power & Light experienced damage to the tune of USD one billion dollar during Hurricane Irma in 2017 even after completing USD three billion dollar system hardening program. Therefore utilities also need to explore and invest in non-wire alternatives like decentralized generation, battery storage, smart microgrids etc. to ensure grid reliability and protection from extreme weather events.

In addition, utilities also need to redesign their risk assessment framework to include extreme weather events and prioritize their investments to mitigate the impacts.

MODULE 11

Customers

The customer's relationship with utilities is evolving as digitalization, decentralization, and decarbonization are reshaping the electricity industry and transforming customer expectations. Various global utilities have recognised the role of customers i.e. from rate payers to prosumers to transactive market participants and the value that they can bring with implementation of different digital technologies and accordingly undertaken various transformation activities DER platform for energy services, demand response, EV charging, P2P trading etc. by connecting customers digitally and facilitating regular interaction to realize the demand side potential. In addition, the data generated as part of various customer services provided by the utilities will also help utilities to provide more personalized approach accounting for different values that customers assign to various energy attributes thereby delivering enriching customer experiences.

This module will help utilities in understanding the changing role of customers as prosumers and the value these customers bring to the table in terms of new revenue opportunities and flexible grid operations.

This module will cover key topics as mentioned below:

- Changing Role of Customers with Decentralization of Grid
- Mapping of Consumer Behaviour through AI
- Customer Engagement and Value Added Services
- Digitised Mode of Payment and its Integration
- Digitisation in Customer Service
- Customer Load Monitoring and Analytics

Implementation Partners

The Digital Utility Manager Certificate Course will be implemented by ASPIRE team along with its national and international partners e.g. Imperial College London, Indian Institute of Technology (IIT), Tirupati and Veermata Jijabai Institute of Technology (VJTI), Mumbai.

Imperial College London, UK

Imperial College London is one of the world's leading energy research institutions engaged in multidisciplinary, cross-faculty collaborations to tackle the broad range of energy challenges that the world faces. The Department of Electrical and Electronic Engineering has about 50 research-active academic staff with strong expertise in power system, control, communications, and signal processing, robotics and information systems. In the 2013 Research Excellence Framework, it was the highest-ranked Electrical & Electronic engineering department in the UK. The department has long-standing collaborative links with energy industry

IIT, Tirupati

IIT Tirupati is the first among the 3rd phase of IITs, announced in 2014, to have its foundation stone laid in March 2015. IIT Tirupati started functioning with the support of its mentoring institute, IIT Madras, from the academic year of 2015-16. The academic program was launched in August 2015 by admitting students in the B.Tech programme in the fields of Civil Engineering, Computer Science & Engineering, Electrical Engineering, and Mechanical Engineering. The research programs namely, the MS and Ph.D. programmes have started from the academic year 2017. The curriculum for various programs have an emphasis on theoretical knowledge and practice-oriented laboratories. Courses are well planned to nurture innovation, creativity, quality, teamwork, communication skills, ethics, and societal interaction

VJTI, Mumbai

VJTI, Mumbai (established in 1887) is one of the oldest technological institutes in India. It has shaped country's technological landscape both pre and post-independence. It is an autonomous institute located in the heart of Mumbai city and is owned by Government of Maharashtra. It offers undergraduate, postgraduate and PhD programs in all major branches of engineering and technology. VJTI has contributed immensely in the energy sector and has created unique test-bed for research in smart grid.

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