



CTC(T&IT), CRPF



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Never stop learning, Because life never stop Teaching

“Technology is best when it brings people together.”

— Matt Mullenweg, Social Media Entrepreneur

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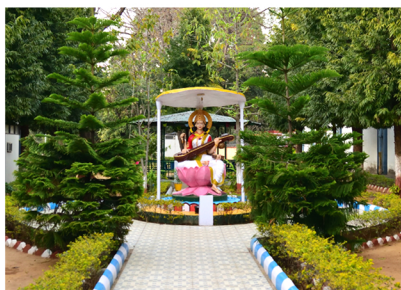
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READER'S CENTER

- 1. Cyber Attack**
- 2. Robotic process automation**
- 3. Path of the Smart Grid**
- 4. Software-Defined Networks**



Cyber Attack

Before coming to the main topics let us first know what is “Cyber Attack”. A Cyber attack is an assault launched by cybercriminals using one or more computers against a single or multiple computer or networks. It can disable computers, steal data, or use a breached computer as a launched point for other attacks.

According to EY’s latest Global Information Security Survey (GISS) 2018-19 India edition, one of the highest number of cyber threats have been detected in India, and the country ranks second in terms of targeted attacks. Although Banking and Telecom are the most attacked sectors but Manufacturing, Healthcare, and Retail have also faced a significant number of cyber attacks.

Motives behind Cyber Attacks

- To seek commercial gain by hacking banks and financial institutions.
- To attack critical assets of a nation.
- To penetrate into both corporate and military data servers to obtain plans and intelligence.
- To hack sites to virally communicate a message for some specific campaign related to politics and society.

Types of Cyber Attacks

- Malware, short for malicious software refers to any kind of software that is designed to cause damage to a single computer, server, or computer network. Ransomware, Spy ware, Worms, viruses, and Trojans are all varieties of malware.
- Phishing: It is the method of trying to gather personal information using deceptive e-mails and websites.
- Denial of Service attacks: A Denial-of-Service (DoS) attack is an attack meant to shut down a machine or network, making it inaccessible to its intended users. DoS attacks accomplish this by flooding the target with traffic, or sending it information that triggers a crash.
- Man-in-the-middle (MitM) attacks, also known as eavesdropping attacks, occur when attackers insert themselves into a two-party transaction. Once the attackers interrupt the traffic, they can filter and steal data.
- SQL Injection:
 - SQL (pronounced “sequel”) stands for Structured Query Language, a programming language used to communicate with databases.
 - Many of the servers that store critical data for websites and services use SQL to manage the data in their databases.
 - A SQL injection attack specifically targets such kind of servers, using malicious code to get the server to divulge information it normally wouldn’t.

Cross-Site Scripting (XSS):

Similar to an SQL injection attack, this attack also involves injecting malicious code into a website, but in this case the website itself is not being attacked.

- Instead the malicious code the attacker has injected, only runs in the user's browser when they visit the attacked website, and it goes after the visitor directly, not the website.

Social engineering

is an attack that relies on human interaction to trick users into breaking security procedures in order to gain sensitive information that is typically protected.

- Latest Cases
- WannaCry: It was a ransomware attack that spread rapidly in May, 2017. The ransomware locked users' devices and prevented them from accessing data and software until a certain ransom was paid to the criminals. Top five cities in India (Kolkata, Delhi, Bhubaneswar, Pune and Mumbai) got impacted due to it.
- Mirai Botnet: Mirai is malware that infects smart devices that run on ARC processors, turning them into a network of remotely controlled bots or zombies. This network of bots, called a botnet, is often used to launch Distributed Denial of Service (DDoS) attacks. In September 2016, Mirai malware launched a DDoS attack on the website of a well-known security expert.

Cyber Security

- Cyber Security is protecting cyber space including critical information infrastructure from attack, damage, misuse and economic espionage.
- Cyber Space: A global domain within the information environment consisting of the interdependent network of information technology infrastructures, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers.
- Critical Information Infrastructure: According to Section 70(1) of the Information Technology Act, CII is defined as a "computer resource, the incapacitation or destruction of which, shall have debilitating impact on national security, economy, public health or safety".

Components of Cyber Security

- **Application Security:** It encompasses measures or counter-measures that are taken during an application's development process to protect it from threats that can come through flaws in the app design, development, deployment, upgrade or maintenance.
- **Information security:** It is related to the protection of information from an unauthorized access to avoid identity theft and to protect privacy.
- **Network Security:** It includes activities to protect the usability, reliability, integrity and safety of the network.

- **Disaster Recovery Planning:** It is a process that includes performing risk assessment, establishing priorities, developing recovery strategies in case of an attack.

Need for Cyber Security

- **For Individuals:** Photos, videos and other personal information shared by an individual on social networking sites can be inappropriately used by others, leading to serious and even life-threatening incidents.
- **For Business Organizations:** Companies have a lot of data and information on their systems. A cyber attack may lead to loss of competitive information (such as patents or original work), loss of employees/customers private data resulting into complete loss of public trust on the integrity of the organization.
- **For Government:** A local, state or central government maintains huge amount of confidential data related to country (geographical, military strategic assets etc.) and citizens. Unauthorized access to the data can lead to serious threats on a country.

International Mechanisms:

- **The International Telecommunication Union (ITU)** is a specialized agency within the United Nations which plays a leading role in the standardization and development of telecommunications and cyber security issues.
- **Budapest Convention on Cybercrime:** It is an international treaty that seeks to address Internet and computer crime (cybercrime) by harmonizing national laws, improving investigative techniques, and increasing cooperation among nations. It came into force on 1 July 2004. India is not a signatory to this convention.
- **Internet Governance Forum (IGF):** It brings together all stakeholders i.e. government, private sector and civil society on the Internet governance debate. It was first convened in October–November 2006.
- **Internet Corporation for Assigned Names and Numbers (ICANN):** It is a non-profit organization responsible for coordinating the maintenance and procedures of several databases related to the namespaces and numerical spaces of the Internet, ensuring the network's stable and secure operation. It has its headquarters in Los Angeles, U.S.A.

Laws related to Cyber Security in India

Information Technology Act, 2000

- The act regulates use of computers, computer systems, computer networks and also data and information in electronic format.
- The act lists down among other things, following as offences:

- Tampering with computer source documents.
- Hacking with computer system
- Act of cyber terrorism i.e. accessing a protected system with the intention of threatening the unity, integrity, sovereignty or security of country.
- Cheating using computer resource etc.

Strategies under National Cyber Policy, 2013

- Creating a secure cyber ecosystem.
- Creating mechanisms for security threats and responses to the same through national systems and processes.
- National Computer Emergency Response Team (CERT-in) functions as the nodal agency for coordination of all cyber security efforts, emergency responses, and crisis management.
- Securing e-governance by implementing global best practices, and wider use of Public Key Infrastructure.
- Protection and resilience of critical information infrastructure with the National Critical Information Infrastructure Protection Centre (NCIIPC) operating as the nodal agency.
- NCIIPC has been created under Information Technology Act, 2000 to secure India's critical information infrastructure. It is based in New Delhi.
- Promoting cutting edge research and development of cyber security technology.
- Human Resource Development through education and training programs to build capacity.

Challenges

- Increased use of mobile technology and internet by people.
- Proliferation of Internet of Things (IoT) and lack of proper security infrastructure in some devices.
- Cyberspace has inherent vulnerabilities that cannot be removed.
- Internet technology makes it relatively easy to misdirect attribution to other parties.
- It is generally seen that attack technology outpaces defence technology.
- Lack of awareness on Cyber security.
- Lack of Cyber security specialists.
- Increased use of cyberspace by terrorists.

Recent Steps taken by Government

- **Cyber Surakshit Bharat Initiative:** It was launched in 2018 with an aim to spread awareness about cybercrime and building capacity for safety measures for Chief Information Security Officers (CISOs) and frontline IT staff across all government departments.
- **National Cyber security Coordination Centre (NCCC):** In 2017, the NCCC was developed. Its mandate is to scan internet traffic and communication metadata (which are little snippets of information hidden inside each communication) coming into the country to detect real-time cyber threats.
- **Cyber Swachhta Kendra:** In 2017, this platform was introduced for internet users to clean their computers and devices by wiping out viruses and malware.
- **Training of 1.14 Lakh persons through 52 institutions under the Information Security Education and Awareness Project (ISEA)** – a project to raise awareness and to provide research, education and training in the field of Information Security.
- **International cooperation:** Looking forward to becoming a secure cyber ecosystem, India has joined hands with several developed countries like the United States, Singapore, Japan, etc. These agreements will help India to challenge even more sophisticated cyber threats.

Way Forward

- Real-time intelligence is required for preventing and containing cyber attacks.
- Periodical 'Backup of Data' is a solution to ransomware.
- Using Artificial Intelligence (AI) for predicting and accurately identifying attacks.
- Using the knowledge gained from actual attacks that have already taken place in building effective and pragmatic defence.
- Increased awareness about cyber threats for which digital literacy is required first.
- India needs to secure its computing environment and IoT with current tools, patches, updates and best known methods in a timely manner.
- The need of the hour for Indian government is to develop core skills in cyber security, data integrity and data security fields while also setting stringent cyber security standards to protect banks and financial institutions.

ASI/C L. Haokip

Robotic process automation

What exactly is RPA? Why is it such a big deal? In this blog, I will help you through all these questions and, by the end of it, you will know everything you need to know about RPA. Let us look at the topics we are going to cover today in this blog:

- What Is RPA?
- How Does RPA Work?
- Why RPA
- RPA Tools
- Benefit of RPA
- Applications of RPA
- Top Companies that use RPA
- Future of RPA



What is RPA?

Robotic process automation is the process of automating business operations using robots (bots) in order to reduce human intervention. Confused? Don't worry. I'll clear all your doubts as we move along in this blog.

Let me explain RPA by breaking it down:

- **Robotic:** Involving a machine that mimics human actions
- **Process:** A step-by-step sequence that can complete a task
- **Automation:** Having no human intervention

Keeping this in mind, let us now define RPA.

Mimicking human actions to perform a sequence of steps without any human intervention is known as RPA.

How does RPA work?

Now that we know what RPA is, let us see how it works with the help of a simple example. Let's say, a group of candidates has taken an aptitude test for a company that is hiring them. The hiring team enters the test scores into an Excel sheet, alongside the names of the candidates and their email IDs. Now, imagine that email messages have to be sent to those candidates with a score above the cut-off, saying that they have been called for the next round of interviews. Before the inception of RPA, these messages had to be sent manually to the candidates by the team. But now, RPA saves the team from this tedious work by extracting the data from the Excel sheet, comparing the candidates' scores with the cut-off, and sending automated email messages to those who are eligible for the next interview round, all using just a handful of commands and a click. This way manual intervention is reduced at a large level. Clearly, RPA is a technology. It is not a programming language or a tool. To implement this technology, we have a lot of tools.

Why RPA?

In a business organization, there are a lot of repetitive tasks that are performed on a daily basis. All these redundant tasks that a human does on a regular basis can be replaced by a robot that works on RPA technology. It follows exactly the same steps that are defined by a human and complete the task without any human intervention. This way, the time spent on doing these repetitive tasks by a user can be utilized to do some other important work. For instance, at the data entry level, the data entry clerk visits the same source every day and gets the data from there and fills it, say, in an Excel sheet. This process has a set of defined steps, such as, visiting the website, extracting the data from there, and adding it to a sheet. But, if a robot can be trained to do this by just giving it a few simple commands, then why not, right? The robot follows those commands and completes the work faster and more accurately. This is just one of the millions of tasks RPA can do. Most organizations use RPA for end-to-end automation for everyday business operations.

RPA Tools

Here are three major RPA tools that are widely used by business organizations across the world.

1) UiPath:



Key Features:

This is an open and extensible platform that features hundreds of built-in, customizable, and shareable activities.

- UiPath offers worldwide implementation support and a vast network of partner integrators.
- It has built-in OCR and deep learning to reduce maintenance.

2) Blue Prism:



Key Features:

- This RPA tool provides access to the leading-edge cloud, artificial intelligence, and cognitive capabilities.
- It provides companies with flexible infrastructure choices since the application can run in both on-premise and cloud platforms like AWS.
- It provides a wide variety of languages to choose from, making it easy to access for people around the world.

Automation Anywhere:



Key Features:

- This tool stands out with its best-in-class intelligent digital workforce which is suitable for most organizations across the globe.
- It combines the most complex RPA along with cognitive and analytical technologies.

- With its enterprise-grade technology, organizations can build smart bots for deploying in a wide variety of business fields.

Benefits of RPA

RPA offers many benefits because of which it stood as the top automation technology and being used by many companies. So, the following are some top advantages of RPA:

- RPA improves productivity by reducing manual tedious work.
- By using RPA, companies can avoid errors and work more efficiently.
- There is no possibility of information leakage from one side to the other with Robotic Process Automation
- RPA also offers scalability which is crucial when your company is constantly growing.
- When there are no repetitive tasks, employees can work on providing the best customer service.
- RPA does not involve any complex automation.
- RPA implementation does not necessitate API configuration and requires little technological knowledge.
-
- It is less investment and great use.

Applications of RPA

From small firms to MNCs, RPA should be utilized by every company.

Majorly, right now, RPA is being heavily utilized in the banking and BPO sectors. Because most of the works in these domains are redundant. Here are a few sectors where Automation Anywhere is used to automate end-to-end business operations.

1) Banks

Automation Anywhere is renowned for its horizontally sealed architecture where bank-grade security is paramount. It has relied upon more by banks and financial institutes than on any other RPA provider in the world with its best-in-class security.

2) Healthcare

The RPA tool, Automation Anywhere eases the administrative burden by automating and processing patient data, reporting work for doctors, bill processing, automating insurance data, claim status, and eligibility, and triggering emails from medical billing systems.

3) Government

As a secure digital workforce, Automation Anywhere can handle populating subcontractor forms, integrating legacy systems with new applications, verification processes, and automating daily reports.

4) Hiring Process

During the hiring process, this RPA tool automates the tasks of PeopleSoft (a company that provides Human Resource Management systems), email notifications, and populating.

5) Sales

In sales, Automation Anywhere is used for creating and printing invoices and for adding, deleting, updating, and editing the customer information into the customer relationship management (CRM).

6) Operations

In operations, Automation Anywhere is used to create accounts and set up the software, system integration, testing, etc.

These are just a few of its applications. Most industries rely on this Automation Anywhere RPA tool for their end-to-end automation.

Top Companies that use RPA

The following is the list of top companies that are using Robotic Process Automation.

- Walgreens entrusted the labor-intensive process of modernizing its HR and payroll systems to Blue Prism. Walgreens' HR efficiency increased by 73 % thanks to Blue Prism.
- RPA has long been a part of Siemens' digital strategy. Within a year of using RPA, the organization has increased productivity by automating 170 new procedures and saving 280,000 hours of labor.
- Blue Prism was used by World Hotels to automate hotel audits and deliver reports to the hotels and the WorldHotel account manager.
- According to Karla Younger, Vice President of HR Services at Coca-Cola, Blue Prism assisted us in time savings and increased efficiency also improved the customer experience by freeing up human resources to focus on issues that may affect consumers.
- Many more MNCs like Cognizant, Accenture, Walmart, Deloitte, IBM, Tata Consultancy Services, AT&T, and Tech Mahindra.

Future of RPA

Many major companies are already using Robotic Process Automation (RPA), and there's still a lot more that can be done with the technology to improve production, efficiency, and customer service. RPA can provide significant additional advantages to organizations, their clients, and their employees as it grows stronger in the upcoming years. By 2024, the RPA industry is forecasted to be worth around USD 8.75 billion.

In terms of jobs and career opportunities, a growing career like RPA will surely offer numerous opportunities in the future for professionals who are experts in Robotic Process Automation. According to Naukri.com, there are around 58,000+ RPA jobs available in India. So, this number is just going to increase in the future.

ASI/RO Manoj Kumar Singh

Path of the Smart Grid -The New and Improved Power Grid

Abstract

Smart Grid Technology, a reasonable move in modern Power System, assures coveted resiliency, consistency, and the utmost efficiency of the entire Grid System utilizing renewable energy sources such as solar, wind, geothermal, and ocean energy by integrating on-site generation strategies. Apart from its environmental aspect, the renewable energy based smart grid technology has a broad scope of research, application, and commerce. In this paper, an inclusive review is outlined on smart grid and its prospect in imminent future. Besides the conventional grid system, the architecture, function, pros, cons, and the environmental aspect of the smart grid technology are illustrated to describe this modern contrivance. After that, the growth and the market scenario of the renewable are shown for the different regions of the world. Finally, a prognosis of the smart grid technology is presented from the comprehensive study.

Keywords Smart grid, Micro grid, Renewable Energy, Distributed Energy Resources, Power grid.

1. Introduction

Smart grid/Micro grid is a limited power supply network that is planned to deliver power for a small municipal area. It allows indigenous power generation for local loads. It contains many low capacity power generating resources that makes it highly flexible and efficient. Micro grid can be connected either islanded generating units, or the utility grid, or both of them to avoid undesired power outages. Additional power can be supplied to the utility grid. The size of the micro grid can be varied i.e. ranged from single house to community. The definition of micro grid could be, “a micro grid is a confined to a small area group of power generating units and loads that usually function interconnected, and acts as a single controllable unit that is analogous with the conventional unified grid (macro grid), but can be able to function autonomously in the absence of utility grid as physical and/or financial situations edict [2].” The organization and the orientation of the paper will follow the given manner: the structural difference, pros and cons, and the environmental aspect between the conventional utility grid and smart grid will delineate in the introduction section, after that, the efficiency, reliability, energy security, economic savings, and the sustainability of the smart grid will be discussed in the micro grid value proposition, at segment 2. Next, to describe the micro grid components, the distributed generation, loads, intermediate storage, advanced controller, and the point of common coupling will be discussed in detail at section 3. Furthermore, the types of micro grid operation will be figured out with necessary description at section 4. Finally, the prognosis and future recommendation will be discussed about the prospect of the smart grid.

Interconnected Micro grid/Smart grid

Generally, the generation size of micro grid is of a several MVA. In case of larger loads, it is required to integrate a number of micro grids to form a superior micro grid complex termed as Power Parks. The micro grid assembly assures better stability and controllability for the Power Parks. Besides that, a unified network of limited capacity micro grids with smart energy management and controllability features can be termed as the smart grid. Figure 1 shows the schematic view of a standard micro grid with possible components.

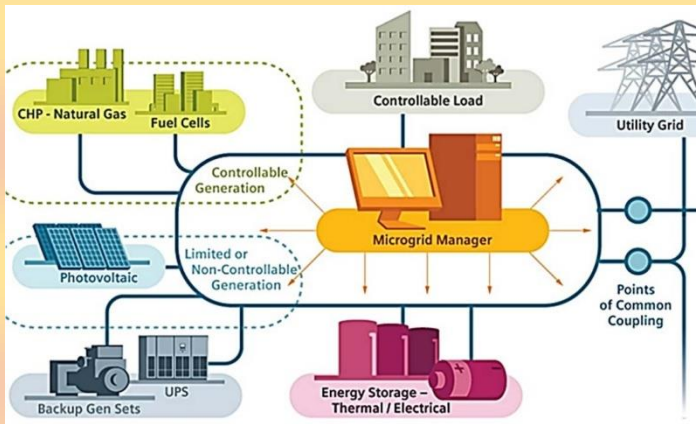


Fig. 1. Standard Micro grid with Components [1]

Conventional Grid vs. Micro grid

Micro grids that are analogous to a conventional grid arrangement in terms of power generation, distribution, transmission, and control features are considered as a minor model of actual grid form. However, micro grid technology differs from a conventional grid owing to the distance between power generation and consumption cycles as a micro grid is installed near the load-sites. There are some key point comparisons

- Efficiency of traditional Powergrid is significantly low compared to Micro grid.
- Wastage of energy as heat in case of traditional Powergrid is significantly high.
- Micro grids generally utilizes the Distributed Energy Generations (DEGs) which remains close proximity to the functional loads.
- Smart controllability and energy management system makes micro grids more reliable.
- Secure communication and smart networking makes Micro grids more accessible.

Micro grids are also integrated with the distributed generation plants such as combined heat and power (CHP), as well as the renewable energy plants powered by solar energy, wind power, geothermal, biomass, and hydraulic resources.

Pros and Cons of Micro grid/Smart grid

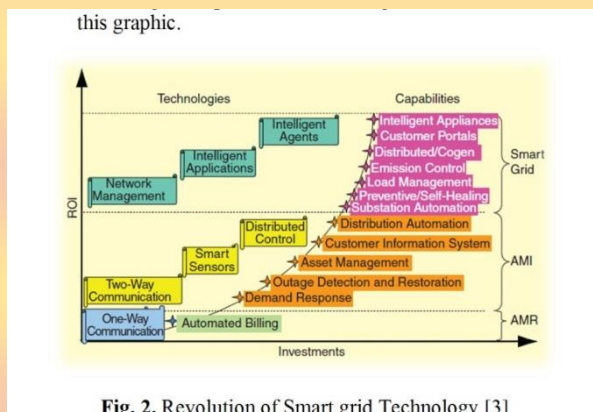
A micro grid is a modern distributed power system using indigenous sustainable power resources. It provides energy security for a local community as it can be operated without the presence of main utility grid. Some benefits of the micro grid technology are enlisted as key terms below

- Micro grid acts like a self-sustainable power grid which can be separated from Utility Grid in case of any disturbance or Power failure and functions autonomously. This feature gives the micro grid superiority over the conventional power grid.
- It can aid utility grid by load switching and load shaving in case of peak load demand and transient load.
- Micro grid can run using 100% renewable resources which make micro grid technology less emission of greenhouse gasses and eco-friendly.
- As micro grids utilize the DEGs, consumers are allowed to use both electricity and heat energy. It will improve the overall energy efficiency and reduce the generation cost.
- Micro grid can ease the electricity the tariff and charges to its consumers by producing some or all of its electricity necessities.

Micro grid technology is surely advantageous, but it also has some minor drawbacks. Some are enlisted below

- Voltage, frequency and power quality are three main parameters that must be considered and controlled to acceptable standards to maintain the power and energy balance.
- For backup power, micro grid might need energy storage units which may cause larger space requirement.
- Sometimes, when trying to reconnect with the utility grid, micro grid may face synchronization problems.
- Design and implementation of protection schemes for micro grid are sometimes challenging.
- Concerns such as standby charges and net metering may pretend difficulties for micro grid.
- Interconnection principles requirements have to be established to guarantee reliability. IEEE P1547, a standard suggested by Institute of Electrical and Electronics Engineers is required to satisfy.

Revolution of smart grid is given in figure 2. Investment, technologies, capabilities of micro grid can be seen from



Environmental Aspects of Micro grid/Smart grid

The smart grid decreases the negative environmental impact by two ways: proper management and greater addition of the renewable sources. It is evident that the smart grid increases the proportion of the consumer-sided generation that the utility grid can dependably and efficiently accommodate. It is possible to decrease the greenhouse gas emission by adopting the smart grid technology due to certain reasons. Some key reasons are enlisted below;

- Micro grid/Smart grid inspires the use of the renewable energy sources.
- Utilizes lesser land area.
- CO₂/Greenhouse gasses releases are concentrated.

Micro grid – Value Proposition

Efficiency

Reducing the consumption is the easiest way to impact on the energy costs. But, while considering the issues, a first step is to create transparency throughout the system with advanced metering to drive savings – “what gets measured gets managed.” Implementing other technologies, such as energy efficient lighting, variable frequency drives (VFDs) on motors and chiller/boiler upgrades, will further improve the energy efficiency. Growing the amount of on-site generation has the added benefit of minimalizing transmission and distribution line losses – as much as seven percent of electricity generated (EIA estimate, 2008). So, the key ways to improve the efficiency are below.

- Decrease fossil fuel consumption
- On site generation minimizes the distribution losses
- Both electricity and heat generation can be utilized

Reliability

Consumers always desire for the more reliable and consistent energy supply at low price. Utilizing on-site generation and energy storage facilities in a micro grid system reduces the risk of a disastrous power failure and may reduce energy costs.

- Efficient management of on-site energy resources 24/7
- Improved Power quality and reliability at the consumer level

Energy Security

Energy supply is vulnerable to the acts of terrorism, natural disasters, and other risks. Micro grid utilizes the on-site generation strategy in smaller supply area which guarantees the energy security of

consumers.

- Utilization of on-site generation ensures the energy supply for critical loads.
- Autonomous functioning capability

Economic Savings

Peak shaving/load shifting and supply management with demand response permits distinctness against energy cost oscillation and tariff ambiguity. Micro grid reduces cost of power generation by utilizing on-site generation and effective energy management systems. Besides that, it is possible to avoid the tariff ambiguity, if the smart grid is adopted.

Sustainability

An inspiring number of investments have already been taken place on renewable energy generation, and committed to long-term targets, regardless of the expected time to recoup the investment. For example, a university may want to serve as a “living laboratory” for environmental engineering and technology developed by its students and researchers, or a manufacturer may want to increase its Dow Jones Sustainability Index score by reducing GHG in their production processes. By integrating cleaner fuel resources CO₂ emission can be mitigated.

Micro grid candidates

- Institutional/Campus sites – Hospitals, Universities
- Commercial/Industrial facilities
- Remote “off grid” communities
- Military Bases
- Data Centers
- Municipalities

2. Key Components of Micro grid/Smart grids

Distributed Generation

Distributed Generation (DG) is the way to produce power by small scale sources at various points throughout the grid. Examples of DG sources include wind turbines, solar/photovoltaic cells, geothermal, micro turbines and backup diesel generators. The use of wind energy has rapidly increased all over the world by a rate of around 30% per year and has become a significant resource in micro grids, along with solar energy. These emerging technologies and well- established generation

technologies are adopting by the several developed and developing countries. Growth in DG

has been supported by regulatory policy, and embraced as a revenue model by independent generation ventures.

Loads

A micro grid system has various kinds of load and it creates a number of challenges for its operation, stability and control. An electrical load can be characterized as a static or motor/electronic load. The micro grid can supply various kinds of loads (such as household or industrial) which are presumed to be sensitive and demand high-level reliability. This kind of operation needs several attentions such as priority to critical loads, power quality enhancement supplied to specific loads, and improvement of reliability for pre-specified load categories. Moreover, local generation precludes unexpected disturbances with fast and precise protection systems.

The load classification is important to define the operating strategy in a micro grid arrangement under the following considerations

- The load/source operation strategy required to meet the net active and reactive power in grid-tied mode, and stabilization of the voltage and frequency in island mode
- Improvement of power quality
- Reduction of maximum load to enhance the der ratings
- Maintaining desired operation and control

Immediate storage

Energy storage is a vital factor in order to legitimize renewable energy resources as a reliable contributor to main sources and to provide a successful operation of micro grid. The energy storage process plays an important role in the balance between the generation of power and energy demanded [5, 11]. The requirements of energy storage components in a micro grid are listed below;

- Balancing power demand between the generation side and the load side is the first priority for energy storage devices
- Storage of maximum energy demands during off- peak hours and being able to supply loads when required
- To eliminate loaded parts from micro grid that causes to face unpredicted and sudden demands.
- To provide smooth transient conditions from grid- tied to islanded operation or vice versa.

Advanced Controller

The control processes in a micro grid should be performed by the collaboration of several controllers at various levels such as distribution, micro grid, and unit where data acquisition and control signals are transmitted.

Point of Common Coupling

DER refers to both DG (renewable and non-renewable) and energy storage technologies as well. Grid-tied inverters are required in most of the emerging DER technologies in order to convert the generated energy into grid-compatible AC power, capable of controlling the voltage and frequency of a micro grid through respective control interfaces [12]. Power electronics of a typical DER system is shown in Figure 3 and also the key components of micro grid is given in Figure 4.

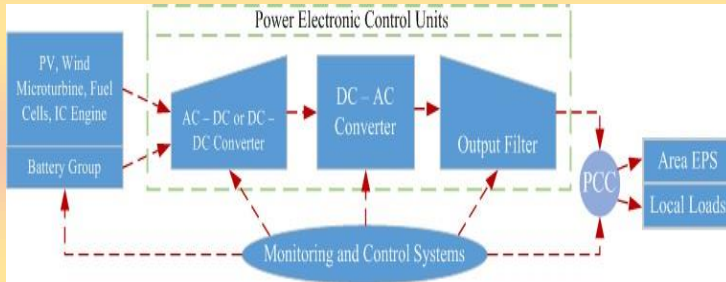


Fig.3. Power electronics of a typical DER system [3]

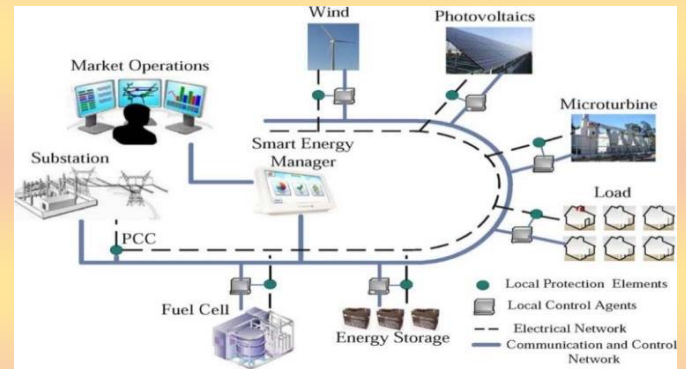
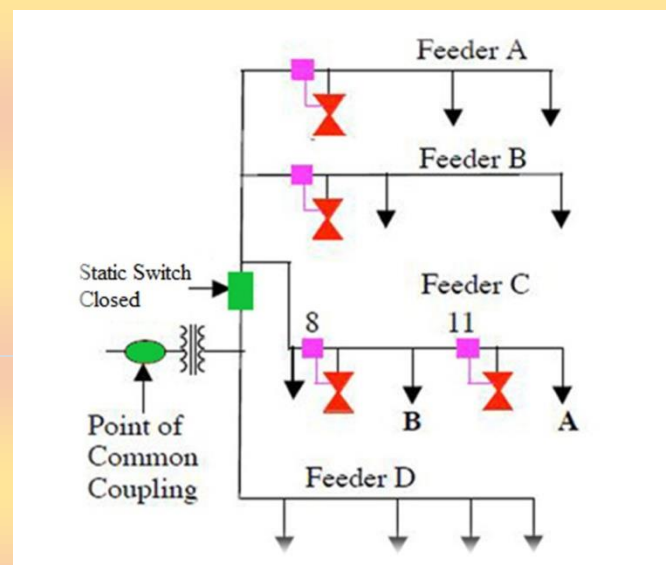


Fig. 4. Key Components of Micro grid/ Smart grid [3]

There are several functions of power electronics interface modules such as power conversion, power conditioning (PQ), protection of output interface & filters, Distributed Energy Resources (DER) and load control, ancillary services, and monitoring and control. Power electronics are used to change the characteristics (voltage and current magnitude, phase and/or frequency) of electrical power to suit any particular application. Micro grid can operate in two different modes based on the grid connected or independent operating modes.

Grid Connected Mode

Figure 5 represents and explains the grid connected mode of operation of micro grid. According to Figure 5, functional grid is live and static switch is closed. Here, all the feeders are being supported by the utility grid.



Islanded Mode

Micro grids can also operate independently as self-sustainable small scale grid by the supports of distributed generation (DEGs). Figure 6 represents a schematic view of power grid explaining the islanded mode of operation of micro grid. According to Figure 6, when utility grid is not providing power and static switch is open. Feeder A, B, C are being supported by micro sources. Feeder D (not sensitive) is dead

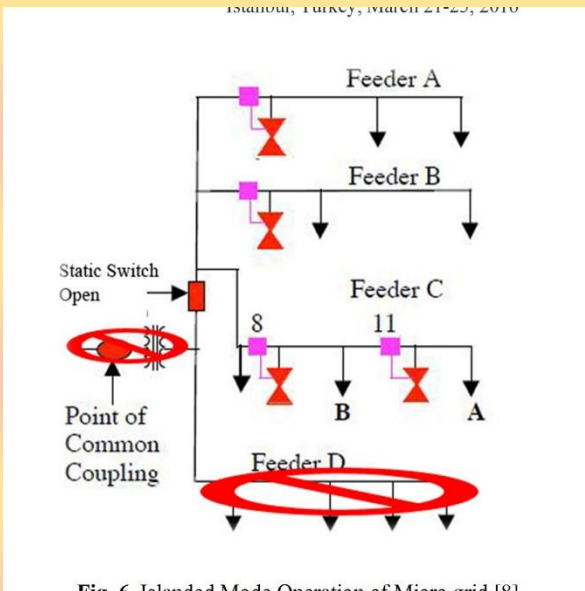


Fig. 6. Islanded Mode Operation of Micro grid [8]

3. Smart grid/Micro grid Control and Communications

Coordination is required in order to integrate variable generation sources (such as PV modules) in the grid. Centralized control requires significant communication resources (i.e., large bandwidth spectrum allocation) which in general are not available. The alternative is to provide all active nodes with an autonomous control that allows

controlling power interactions with the grid without dedicated communication links. These more intelligent nodes become agents. Figure 7 represents a typical centralized hierarchical control scheme of Micro grid/Smart grid. And Figure 8 represents the general control architectures of Smart grid/ Micro grid Control Systems.

There are several control techniques, which are stated below that help to manage the component level of a distribution system.

- Master and slave control: master fixes the voltage and frequency values while the slaves control the current sources.
- Current and power flow control: this method controls the current and power distribution by using control signals.
- Droop control: this method is improved to combine with previous methods, since the converters behave as non-ideal voltage sources.

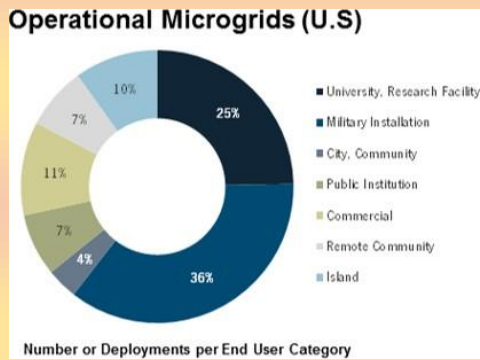


Fig. 7. Centralized Hierarchical Control of Smart grid Micro grid

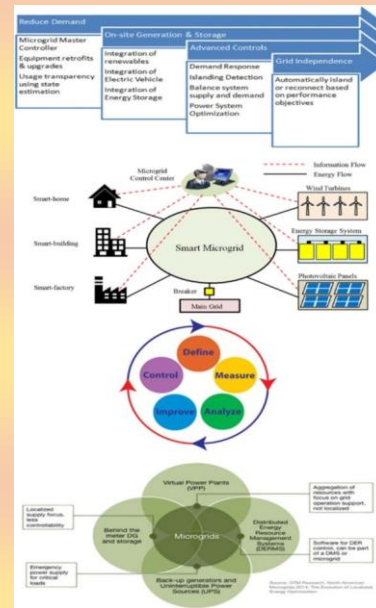


Fig. 8. Control Architecture of Smart grid/Micro grid

Figure 9 is representing the micro grid facility in use now a days in United States and forecasting of micro grid implementation within 2022 is represented in Figure 10. Economic market growth of micro grid implementation by 2022 is represented in Figure 11 and Figure 12 is representing growth of micro grid revenue by region up to 2022.

Fig. 9. Micro grid facilities in USA [5, 16]

4. Future Prediction of Smart grid/Micro grid

Forecasting of Future Acceptability of Micro grid

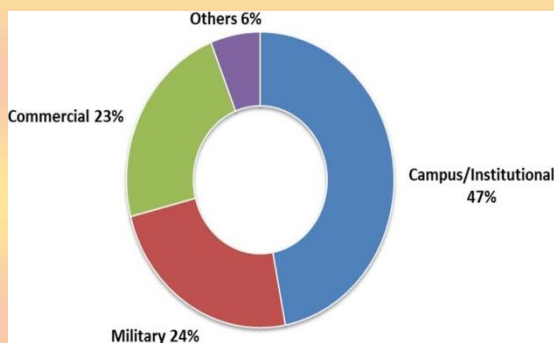


Fig. 10. Applications of Micro grid within 2022 [3]

[3]

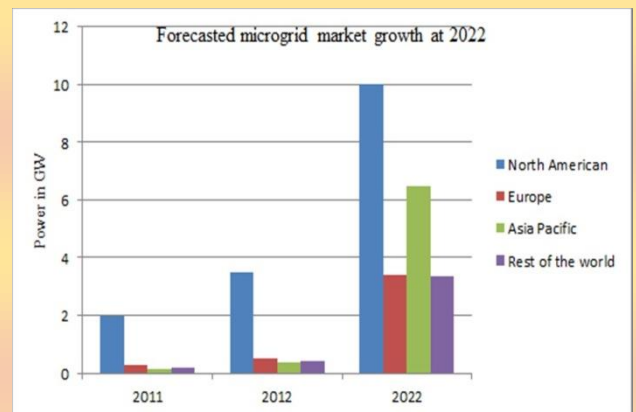


Fig. 11. Market Growth of Micro grid within 2022

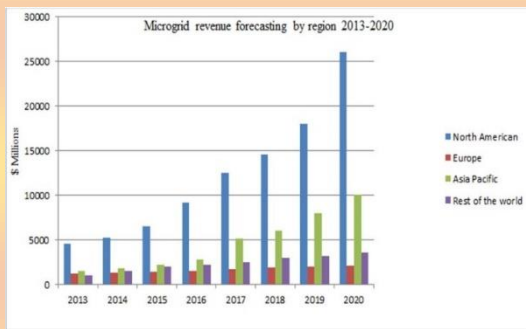


Fig. 12. Growth of micro grid revenue by region [3]

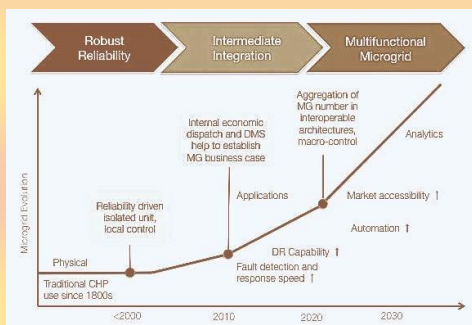
Future Direction on Micro grid Research

To examine full-scale improvement, ground demonstration, investigational performance assessment of frequency and voltage control methods under numerous operation modes should be studied. Switching is required between grid-connected and islanded modes on collaboration occurrences

between distribution generation and high penetration of distributed generation. Transforming micro grid systems in a way more secure, intelligent and efficient energy management and cost effective Power grid in future is the goal of scientist and researchers. Future micro grid is shown in Figure 13.

Fig. 13. Direction to Future Micro grid [5]

Future Smart Features of Micro grid/Smart grid



- Networked, lightly integrated independent Micro grids
- Harnessed heat and Electricity (CHP) Allowing demand response
- Prevention of transmission losses
- Integration of the Renewable Energy Sources
- Flexibility to domino failures
- Authorization of consumers and independent power producers to be proactive players and shareholders in energy

transactions

- Forecast of load and generation
- Introduction of several loads for inverter and converters
- Introduction of distributed generation with DC output for numerous energy sources
- Requirements for higher quality power.

5. Conclusion

In this letter, a comprehensive study has been delineated on smart grid and its prospective scope in the future era. Besides the conventional grid system, the function of the smart grid has been illustrated including the pros, cons, and the environmental aspect of this modern endeavor. Later, the efficacy, reliability, security, sustainability, economic scenarios of the smart grid have been analyzed for the potential consumers such as Institutional/Campus sites, Commercial/Industrial facilities, Remote “off grid” communities, and Military Bases. After that, the compact architecture of the smart grid has been depicted and the constituent subsections of the entire arrangement have been discussed in brief. Next, followed by the Smart grid/Micro grid Control and Communications, the prospective research, scope, and impact of the smart grid in the field of power engineering have been delineated with a number of pictorial diagrams. In short, the cardinal focus of the Micro grid/Smart grid technology is to provide much secure, energy efficient, and cost effective power supply to consumers by utilizing the renewable energy sources and integrating on-site generation strategies in an environment-friendly way.

ASI/T Pradeep V.S

Software-Defined Networks (SDNs)

In today's increasingly digital environment, business applications require high-performing and extensive networking operations. Particularly for cloud computing, it is essential for businesses to deploy, manage, and support connectivity across a variety of environments. Typically, complex tools are required to build and manage modern software-defined networking technology. Some vendors only provide solutions that work on their equipment, which then limits the extent of communications capabilities. Startups develop SDN to improve network performance, monitor its performance, and enable centralized control.

EdgeNEXUS develops Load Balancing solutions for SDNs

UK-based startup EdgeNEXUS develops network load-balancing solutions for SDNs. edgeNEXUS optimizes routing changes based on a number of factors including load volume and application performance, thus adding a layer of intelligence between applications, networks, and SDN controllers. The startup's *Global Server Load Balancer (GSLB)* provides tools for multi-datacenter, multi-cloud, and hybrid cloud load balancing and failover. *GLSB* is suitable for enterprises looking to control their application delivery service depending on the user or region.

Ethica provides SD-WAN for Small & Medium Enterprises (SMEs)

Ethica is a Canadian startup providing *CloudAccess*, an easy-to-deploy and inexpensive Software-Defined Wide Area Network (SDWAN) solution focusing on SMEs. The solution reduces the downtime of the network by aggregating multiple internet connections and using them when they are available. Also, *CloudAccess* provides Quality of Service (QoS) by prioritizing more important types of traffic which is useful, for example, in distributed teams using video calls. Further, all the solution's features are manageable through a cloud-hosted orchestration utility.

ASI/RO RANJIT KUMAR OJHA

Acknowledgement

We are highly thankful for reading out this compilation and hope it will be useful for you in day to day professional and personal life .We would like to hear your interest areas, suggestions from you to make this newsletter more informative and interesting. Your views will definitely help us to create this newsletter as an effective medium to reach you with latest development in the fields of communication and technology.

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