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SMART MANAGEMENT: WASTE AS A RESOURCE

Nidhi
Research Engineer, Vishwaniketan, Navi Mumbai

ABSTRACT

Recent developments in technology and communication means have transformed the society, living standards, day-to-day needs etc. The smart phones and touchscreens, concept of smart cities, electric vehicles, high speed data etc. are becoming the eminent necessity. These digitized transformations have resulted into questions on existing century-old power grids. The conventional grids are unable to meet trending demands and thus, persuaded for an upgrade. The Smart Grid concept as an intelligent, inventive power network incorporating two-way electricity flow is evolving over the existing traditional power grids. These rapid advancements along with population growth will trigger total waste volume to increase by nearly 50% over the next decade. The globe will be under the terror of huge environmental changes and climatic issues in addition to industrial and urban wastes. Policies and practices need to be enforced to manage wastes in a constructive way with innovations to make smart cities more sustainable.

Keywords- *Smart Grid, Smart cities, types of wastes, waste management.*

I. INTRODUCTION

Conventional power grids fail to stand over the trending technological advancements and thus lead to a highly off-balanced difference between the energy generated and wielded. As a solution to this off-balanced energy difference, smart grid provides an intelligent way to handle power generation and distribution [1]. It amalgamates advanced two-way communication and electricity flow with ubiquitous features enhancing the grid control, efficiency, reliability and safety. Smart grid marked the revolutionary era of power generation and distribution. Smart grid monitor, control, protects and optimizes associated grid components. It broadens the traditional path from exploiting renewal resources to distributed generators to well defined elaborated transmission and distribution network. It also enhanced the market from its industrial consumers to home users including extensive usage in electric vehicles and intelligent appliances. Smart Grids have open the path for smart cities as being one of the founding stones [2]. The concept of developing the world into smart world where the things are connected to provide seamless accessibility whenever wherever it is required.

With advancements come great responsibilities and challenges to handle the adverse effects. Every development is followed by its consequent effects over mankind, environment, wild life, atmosphere etc. Energy will be one of the prime issue to be handled to achieve ecological welfare and sustainability [3]. Smart grids integrate renewable resources as the source for generating electricity and thus have an account of the waste produced.The work in this paper is divided in four stages; Smart Grid background followed by the overview of the Smart City concept, waste and its types followed by innovative techniques to turn wastes into resources. Following this introduction, Section II describes smart grid's evolution, needs, challenges, area networks and working. Section III discusses the Smart city concept. Section IV defines Waste and other by-products. Section V discusses the waste handling techniques. Finally, Section VI discusses Smart grid as a solution for efficient waste management and finally Section VII concludes the paper.

II. SMART GRID

The existing power grids were built over 100 years ago and were focused to deliver electricity. With the enormous growth in the technologies, living standards and significantly in human population, past decade have witnessed many situations where the conventional grid failed to withstand the need and supply ratio. Numerous massive blackouts, accelerating cost rate of electricity, over exploitation of non- renewable resources resulting into rising Green House Gas (GHG) emissions etc. have alarmed the need for grid revolution [4] [5]. The foundation of Grid revolution was led by the Information and Communication Technologies [4]. The eminent Smart Grid features incorporated advance sensing, two-way communication and control flow. It targets to enhance the grid efficiency, robustness, reliability while maintaining the Eco-friendly environment. It also ensures security as its prime motto [5].

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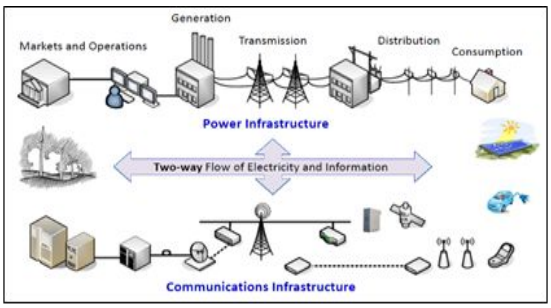

Figure 1-Integrated communication infrastructure with the Power infrastructure

Figure 1 briefly explains the integration of communication technologies over the conventional grid. Figure explains how the electricity is generated in the grids then via cables, distributed to houses for the consumption. This defines the conventional power infrastructure which is further accompanied with the communication infrastructure which includes the sensor networks in the grid. Table 1 summarizes the difference between the conventional and the Smart Grid.

Table 1Comparison between Conventional Grid and Smart Grid

TRADITIONAL ELECTRIC GRID	SMART GRID
Electro mechanical devices	Digital devices
Few sensors used	More sensors will be used
Radial topology network	Meshed topology network
Unidirectional Communication	Bidirectional Operation
Manual Operation	Self-automated and remotely operation
Central Control	Distributed Control
Power flow control are limited	Control in Power flow
Failure and blackouts in emergency	Adaptive Protection
Little monitoring	Self-monitoring
Centralized Generation system	Distributed Generation system
Limited Consumption Price information	On demand consumption price information
Consumers are passive	Consumers are active

III. SMART CITY CONCEPT

Incorporating trending ICT solutions to day-to-day activities to ensure seamless connectivity lead the foundations of Smart City evolution. This advanced societal set-up intends to ease the access to services and even fasten it. For example: Parking guidance systems notifies for empty spaces that can save fuel consumption, automated accidental awareness etc. [6].

Smart city tends to improve the life's quality with the intervention of technologies. The quality urban services will be provided to reduce costs and resource consumption and to improve contact between citizens, government and interconnected objects. People, Processes, and Technology will the pillars of the success of a smart city initiative.

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IV. WASTES

The by-products in any process which cannot be further used up are considered as Waste i.e. Unwanted or useless materials.The electronic industry is the world's largest and fastest growing manufacturing industry and during the last decade, it has seen as the major contributor to the degrading environment.Thus the technological advances are emerging as threat to the ecological balance in the society. The growing electronic menace is considered as Electronic Waste or e Waste. These eWastes constitutes both toxic and valuable materials. For example- fractions of iron, copper, aluminium, gold, plastics etc. recent study showed that plastics accounts for about 30% approx. and others contribute to roughly 60% which is a huge share [10].

The ugly picture of wastes is the result of our ignorance, lacking awareness and knowledge about hazardous impact of wastes.Increasing population had worsen the waste problem and has become acute. The annual per capita water availability is declining to 1.140 cubic meters in absence of proper waste disposal means. Waste management need to be focused. Developing countries lack waste disposal and sewage treatment plants as their focus remains more on economic stability [11].

CLASSIFICATION OF WASTES

Wastes can be hazardous depending upon their toxicity level and reactive affects.These can be classified as [11]:

- **Municipal Solid wastes:**Solid wastes that include household garbage, rubbish, construction & demolition debris, sanitation residues, packaging materials, trade refuges etc. are managed by any municipality.
- **Industrial wastes:** Liquid and solid wastes that are generated by manufacturing & processing units of various industries like chemical, petroleum, coal, metal gas, sanitary & paper etc.
- **Agricultural wastes**: Wastes generated from farming activities. These substances are mostly biodegradable.
- **Radioactive wastes:** Waste containing radioactive materials. Usually these are byproducts of nuclear processes. Sometimes industries that are not directly involved in nuclear activities, may also produce some radioactive wastes, e.g. radio-isotopes, chemical sludge etc.
- **E-wastes:**Electronic wastes generated from any modern establishments. They may be described as discarded electrical or electronic devices. Some electronic scrap components, such as CRTs, may contain contaminants such as Pb, Cd, Be or brominated flame retardants.

IMPACT OF WASTES

- Yearly increase in waste generation is around 5% annually
- The annual per capita water availability is declining to 1.140 cubic meters
- India produces more than 42.0 million tons of municipal solid waste annually.
- Per capita generation of waste varies from 200 gm to 600 gm per capita / day.
- Adverse health conditions
- Socio-Economic degradation
- Increase in Greenhouse gas emissions causing global mean surface air temperature and subsurface ocean temperature to rise.
- Changing regional climates could alter forests, crop yields, and water supplies.
- Waste breaks down in landfills to form methane, a potent greenhouse gas

V. WASTE MANAGEMENT& HANDLING

Waste management involve actions required to manage waste. Waste management includes waste generation, prevention, monitoring, treatment, handling, reuse and ultimate disposal.

The waste handling cycle includes:

- **Minimisation**
- **Reuse**
- **Recycling**
- **Energy Recovery**
- **Disposal**

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\INNOVATIVE WASTE HANDLING

Incorporating innovative technologies in waste management solutions will be more effective as it will reduce human interventions, bring more efficient measures to handle wastes and will lead to more sustainable cities.By 2030, almost two thirds of the world's population will be urbanized and thus sustainable solutions are dire need to support urban living [7].

Efficient and energy-saving street lighting and traffic light systems, water and waste water management, reducing CO2 and vehicle exhaust emissions—these are just a few examples for the demands of future cities. The efficient use and responsible handling of resources becomes much more important, too.

Few examples of existing/ recently developed means to manage wastes are mentioned [9]:

- A Germany based company developed a Smart Waste Management System that enables garbage containers to report automatically to concerned authorities when they are full.
- In Barcelona's Smart city Project, the garbage containers transmit signals to indicate that they are over 80 percent full and should be emptied.
- The European Strategic Energy Technology Plan considers the following to have strong potential to reduce Europe's carbon footprint: wind, solar, electricity grids, bio-energy, carbon capture and storage, sustainable nuclear energy, fuel cell and hydrogen, and smart cities.
- In the United States, envisioned to double the use of clean energy by 2035 and to put one million electric vehicles on the road by 2019.
- Japan is promoting the use of renewable resources, building an infrastructure for electrical vehicles and creating new services in smart grids.
- China is integrating renewable energy sources into the grid and improve energy efficiency.
- In the Republic of Korea, the focus is on monitoring energy use and increasing production from green sources.

The waste fill level measurement uses Ultrasonic technology, intelligent sensors etc. Mobile communication technologies can also be used for relaying information.

VI. SMART WASTE MANAGEMENT: SMART GRID

New technologies and challenges are stimulating the current global market. The trending technology to handle waste is to make waste into a resource. This transition of waste to energy is often termed as WTE: Waste-to-Energy.

Smart grid uses [7] ICT to gather and act on information from suppliers and consumers in an automated way which allows it to integrate energy from unpredictable and intermittent renewable sources. It delivers electricity cost-effectively with lower greenhouse gas emissions.

In order to manage wastes smart grid developers should avoid deploying equipment that would itself raise greenhouse gas emissions [8].Electricity and heat generation are major contributors to greenhouse gas emissions [9].

At present, electricity is mostly generated from large fossil fuel plants so effective smart grid implementations can cut down the GHG emissions to a great extent. The use of renewable energy sources makes grids unpredictable for which advanced ICT is required. This will together transform command and control of traditional grid.

The International Smart Grid Action Network promotes global partnership on smart grids, focusing on policy, standards and regulation, finance and business models, technology and systems development, user and consumer engagement, and workforce skills and knowledge [9].

VII. CONCLUSION

Together using technology with advancements can control the alarming issue of waste management. Our intelligent waste management solution involves applying technology (electronics and applications) to the current operating system to enable two-way communication between the infrastructure deployed in the city and service operators. Smart grids provide the Smart cities with resilient energy delivery that will support and make other functions to function and also a concrete mean to conserve, improve efficiency etc. it let the smooth interoperability in the urbanized society while maintaining the wastes.

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