



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 6, June 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

A Literature Review: Electric Distribution Network

Bouabbadi Soufiane, Guennoun Karim, Tazi Said, Wahbi Mohammed

Laboratory Lages-SIRC, Hassania School of Public Works, Casablanca, Morocco

ABSTRACT: Smart grids are the next generation of electric power grids that use digital technologies to monitor and control the distribution and consumption of electricity. In this article, the author will discuss the steps of production, transmission and consumption of electrical energy. First, the article advances the sources of energy that are two types conventional and non-conventional. After, the aspects of electricity transportation will be discussed such as carbon emissions, air quality, costs, energy security, sourcing, sustainability. Finally, the distribution grid system will be discussed in terms of architecture, structure, outage, duties, planning process, demand forecasting and solutions for demand forecasting.

KEYWORDS: Electrical distribution network, demand forecasts, loading forecasting, planning process, planning objectives, structure of distribution networks.

I. INTRODUCTION

The Electric Distribution System is the final stage of electric power system where the generated power is converted into useful work through distribution lines and feeders. It deals with lower voltage magnitude as reverse of transmission system high voltage.

In a traditional power grid, electricity is generated at central power plants and then transmitted to homes and businesses through a network of power lines. However, this system is often inefficient and wasteful, as electricity is lost in transmission and there is little control over how much energy is consumed.

Smart grids address these issues by using advanced technology to monitor and control the flow of electricity. For example, smart meters are installed in homes and businesses to measure the amount of electricity being used in real-time. This information can then be used by utilities to better manage the electricity supply, reducing waste, and improving efficiency.

In this review, first, the article advances the sources of energy that are two types conventional and non-conventional. After, the aspects of electricity transportation will be discussed such as carbon emissions, air quality, costs, energy security, sourcing, sustainability. Finally, the distribution grid system will be discussed in terms of architecture, structure, outage, duties, planning process, demand forecasting and solutions for demand forecasting.

II. THE SOURCES OF ENERGY

Fossil fuels are fuels formed inside the earth from the remains of plants and animals after millions of years. The fossil fuels are coal, petroleum and natural gas. Fossil fuels are non renewable sources of energy so they should be conserved and used judiciously.



Figure. Fossil fuels energy

In thermal power plants the heat energy produced by burning fossil fuels like coal, petroleum or natural gas is used to heat water and change it into steam which rotates the turbines of generators to produce electricity.



Figure. Thermal power plant

In hydro power plants water from rivers are stored by constructing dams. The water from the dam flows down through pipes and rotates the turbines of generators to produce electricity.



Figure. Hydro power plants

Biomass energy is the waste materials and dead parts of living things are called biomass. Eg : wood, animal dung, vegetable waste, agricultural waste, sewage etc. Biomass is decomposed by anaerobic microorganisms to produce biogas. Biogas is a mixture of gases containing methane, carbon dioxide, hydrogen and hydrogen sulphide.



Figure. Biomass energy

Wind energy is used in wind mills which converts the kinetic energy of the wind into mechanical or electrical energy. The kinetic energy of wind can be used to do mechanical work like lifting water from wells or grinding grains in flour mills. It can also be used to rotate the turbines of generators to produce electricity. A single wind mill produces only a small amount of electricity. So a large number of wind mills in a large area are coupled together to produce more electricity in wind energy farms.



Figure. Wind energy

Solar energy is the combination of Solar cooker, Solar water heater and solar cells.



Figure. Solar energy

Geothermal energy The deeper regions of the earth's crust is very hot. This heat melts rocks and forms magma. The magma moves up and collects below at some places called Hot spots. The underground water in contact with hot spot gets heated into steam at high pressure. By drilling holes into hot spots the steam coming out can be used to rotate turbines of generators to produce electricity.



Figure. Geothermal energy

Nuclear energy is the energy released during nuclear reactions. During nuclear reactions some mass is converted into energy and so a very large amount of energy is produced during nuclear reactions. Nuclear reactions types are : Nuclear fission and nuclear fusion.

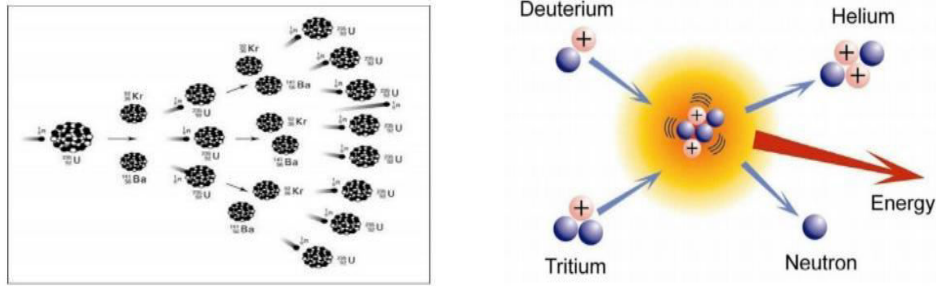


Figure. Nuclear fission and fusion

III. ELECTRIC TRANSPORTATION AND DISTRIBUTION SYSTEM

Transportation electrification refers to the use of electricity from external sources of electrical power. It is considered to be a potential quadruple win for the electric utilities and the society as it enables companies to support environmental goals while building customer satisfaction, reduce operating costs and assure the future value of existing assets.

Reshoring and Nearshoring of electric transportation system : Both ongoing supply chain disruptions and new government legislation are triggering a rise in reshoring and nearshoring efforts.

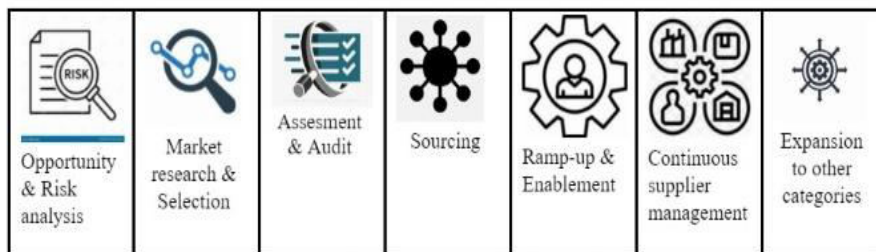


Table. Reshoring and Nearshoring

Sourcing Alternative Materials : Because many of the raw materials required to produce lithium-ion batteries are in increasingly short supply, automakers are considering cheaper and more readily available alternatives.



Table. Electricity sources

Sustainability Efforts in electric transportation system : Several entities within the transportation sector are already expanding their facilities to accommodate large-scale battery recycling operations. For example, recently launched a research center on lithium-ion battery recycling.

<u>Environment</u> Clean energy Climate action	<u>Governance & infrastructure</u> Industry, innovation and infrastructure	<u>Society & stakeholders</u> Good health and wellbeing Economic growth
------------------------------------------------------	-----------------------------------------------------------------------------------	-----------------------------------------------------------------------------------

Figure. Sustainability efforts

The architecture of a distribution system refers to the design and structure of the electricity system, including the components and technologies used to generate, transmit, distribute, and consume electricity.

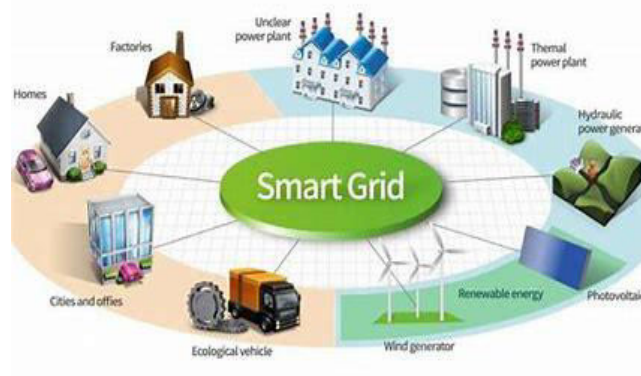


Figure. Smart grids architecture

Smart grids outage

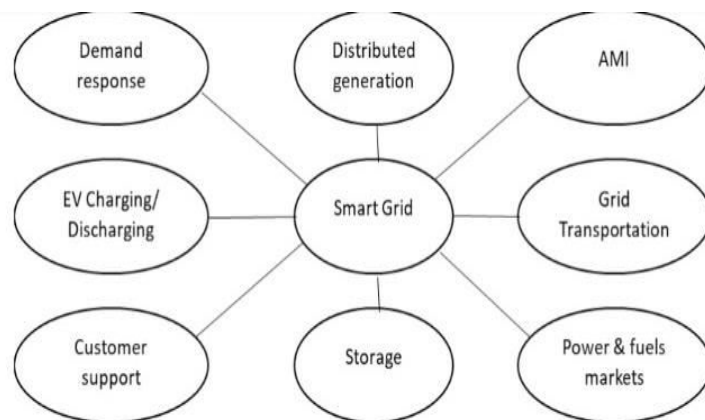


Figure. Smart grids outage

Solutions for meeting Demand Forecasts

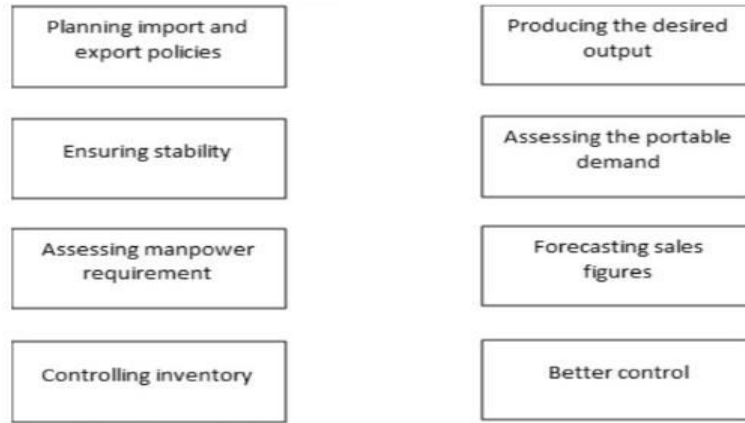


Figure. Solutions for meeting Demand Forecasts

IV. EXPERIMENTAL RESULTS

Here are some data and descriptive statistics of energy and electricity sources.

Secteur	Total capacity	Pourcentage
Coal	116333.38	56.64
Hydroelectricity	39291.40	19.12
Renewable energy source	24832.68	12.09
Gas	18903.05	9.20
Nuclear	4780	2.32
Oil	1199.75	0.58

Table. Quantity of energy by sources

Secteur	Total capacity	Pourcentage
state sector	86275.40	42.01
Central sector	62073.64	30.32
Private sector	56991.23	27.75

Table. Quantity of energy by sectors

There are multiple sources of energy. And we remark that renewable energies have a majoritory part in the production of elctricity. In addition, the alimentation differs by sectors (public, central and private). So, every sector must choice the right source of energy for its use. Also, we do respect the rules of connecting our consumption to the electrical networks (distribution networks, distribution grids)

There are many factors influencing the electrical disribution system.

- Environmental specifications (location, position, temperature and humidity)
- Distribution System Voltage and Frequency (Frequency is usually determined by standards in the region. Voltage selection tends to be a little more complicated.)
- Acceptable Variation in Distribution System Parameters (Control Variation Extent, Automated Interfaces to Limit Variations, Certain Equipment to Enhance Variation Levels)
- Capacity to Withstand Faults (Equipment selection must have ratings that are higher than short circuit currents where this could occur)

- Planning Distribution System Configuration (Overall Configuration, Number of Incoming Feeders, Incoming and Distribution Voltage Levels, Major Equipment Ratings, Type of Distribution, Integration of Emergency Standby Equipment and Protective System Earthing)
- Rating/Sizing for Equipment (Rated Voltage, Current, and Frequency, Voltage and Frequency Variation, Fault Withstanding Current and Time, Fault Breaking Capacity, Clearance and Creepage)
- Designing and Planning Summarized (modeling and documenting important aspects of the distribution system)

V. CONCLUSION

In this article, the author discusses the sources of energy. It can be classed into conventional energies and non-conventional energies. In addition, the use of the type of source depends on the quantity of energy and the sector. Consequently, the electric network inserts a source of energy into distribution grids or smart grids.

After that, the article discusses the structure of distribution networks, the duties of distribution systems, factors affecting the planning process, planning objectives and solutions for meeting demand forecasts.

Thus, these systems have a role to optimize the production, transport and distribution of electrical networks. So, if there any specific methods for optimizing the electric distribution system?

REFERENCES

- [1] A. Lotfipour, H. Afrakhte. A discrete teaching-learning-based optimization algorithm to solve distribution system reconfiguration in presence of distributed generation. *Int. J. Electr. Power Energy Syst.*, vol. 82, pp. 264–273, Nov. 2016
- [2] Arul A. *An Analysis of Opportunities and Barriers of Integrating Renewable Energy with Smart Grid. Technologies in India*; 2015
- [3] Aydin, Dem R. Smart grid integrated with hybrid renewable energy systems. *Eskehr Technical University journal of Science and Technology*. 2019; 120-131
- [4] Blaifi SM. An enhanced dynamic model of battery using genetic algorithm suitable for photovoltaic applications. *Journal of Applied Energy*. 2016 ;888-898
- [5] Bouabbadi Soufiane. Optimization of the electrical distribution using the profile of electrical consumption, *ResearchGate* (November 2023)
- [6] Bouabbadi Soufiane. A literature review: the sources of energy, *ResearchGate* (September 2023)
- [7] Bouabbadi Soufiane. A Survey on Hybrid SCADA/WAMS State Estimation Methodologies in Electric Power Transmission Systems, *ResearchGate* (September 2023)
- [8] Bouabbadi Soufiane. ML-Based Intermittent Fault Detection, Classification, and Branch Identification in a Distribution Network, *ResearchGate* (September 2023)
- [9] Demir Z. Smart grid integrated with hybrid renewable energy systems. *Eskehr Technical University Journal of Science and Technology*. 2019 ;120-131
- [10] Ekneligoda N, Weaver W. N.C. Ekneligoda, W.W. Weaver, Game theoretic optimization of DC micro-grids without a communication infrastructure. *Proceedings of the 2014 Clem- Son Univ. Power Syst. Conf*; 2014
- [11] F. Capitanescu, L. F. Ochoa, H. Margossian, and N. D. Hatziargyriou, “Assessing the potential of network reconfiguration to improve distributed generation hosting capacity in active distribution systems,” *IEEE Trans. Power Syst.*, vol. 30, no. 1, pp. 346–356, Jan. 2015
- [12] Gilani M.A., Kazemi, A., Ghasemi M. Distribution system resilience enhancement by microgrid formation considering distributed energy resources. *Energy* 2020,191, 116442
- [13] Hossain E. Micro grid testbeds around the world: State of art. *Energy Conversion and Management*. 2014, 132-153
- [14] Kazerani M., Tehrani K. Grid of Hybrid AC/DC Microgrids: A New Paradigm for Smart City of Tomorrow. In *Proceedings of the IEEE 15th International Conference of System of Systems Engineering (SoSE)*, Budapest, Hungary, 2–4 June 2020; pp. 175–180
- [15] Li R., Wang W., Chen Z., Jiang J., Zhang W. A Review of Optimal Planning Active Distribution System: Models, Methods, and Future Research. *Energies* 2017,10, 1715

- [16] L. W. de Oliveira, E. J. de Oliveira, F. V. Gomes, I. C. Silva, A. L. M. Marcato, and P. V. C. Resende. Artificial immune systems applied to the reconfiguration of electrical power distribution networks for energy loss minimization. *Int. J. Electr. Power Energy Syst.*, vol. 56, pp. 64–74, Mar. 2014
- [17] Maradin D. Advantages and Disadvantages of Renewable Energy Sources Utilization. *International Journal of Energy Economics and Policy* 2021
- [18] MS A. Viability of grid-connected solar PV energy system in Jos, Nigeria. *Internal Journal for Electric Power*. 2014 ;61-64
- [19] Shahidehpour, M. Ding, T. Ming, Q. Huang, C. Wang, Z. Du. Multi-Period Active Distribution Network Planning Using Multi-Stage Stochastic Programming and Nested Decomposition by SDDIP. *IEEE Trans. Power Syst.* 2020,99, 1
- [20] S. Naveen, K. S. Kumar, and K. Rajalakshmi. Distribution system reconfiguration for loss minimization using modified bacterial foraging optimization algorithm. *Int. J. Elect. Power Energy Syst.*, vol. 69, pp. 90–97, Jul. 2015
- [21] Yesilbudak M. A novel intelligent approach for yaw position forecasting in wind energy systems. *International Journal of Electrical Power & Energy Systems*. 2015 ;406- 413



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details