Retraction

Retraction: Driving technology in the path of renewable energy-a review (IOP Conf. Ser.: Mater. Sci. Eng. 1055 012148)

Published 22 August 2023

This article has been retracted by IOP Publishing following an allegation that this article may contain tortured phrases [1].

IOP Publishing has investigated and agrees the article contains a number of nonsensical phrases that feature throughout the paper [2], to the extent that the article makes very little sense. This casts serious doubt over the legitimacy of the article.

IOP Publishing wishes to credit PubPeer commenters [3] for bringing the issue to our attention. The authors neither agree nor disagree to this retraction.

[1] Cabanac G, Labbe C, Magazinov A, 2021, Tortured phrases: A dubious writing style emerging in science. Evidence of critical issues affecting established journals, arXiv:2107.06751v1
[2] R Dhanasekar et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1055 012148
[3] PubPeer - Driving technology in the path of renewable energy-a review

Retraction published: 22 August 2023
Driving technology in the path of renewable energy—a review

Dhanasekar R1, Vijayaraja L2 Anandan R3, Gurusharan G M4, Keerthana M5 and Mahalakshmi E6

1-6Department of EEE, Sri Sairam Institute of Technology, West Tambaram, Chennai Email: 1dhanasekar.eee@sairamit.edu.in, 2vijayaraja.eee@sairamit.edu.in, 3sit19ee044@sairamtap.edu.in, 4sit19ee010@sairamtap.edu.in, 5sit19ee043@sairamtap.edu.in, 6sit19ee033@sairamtap.edu.in

Abstract—Renewable energy is abundant in nature, it is future of clean energy. The innovation brings down the cost. No damage is caused to the environment by the use of renewable energy, its inexhaustible at any time and is replenished constantly. For example, sunlight and wind is always present. But their availability is depending on the factors like time and weather. There are many sources for renewable energy that are accessible in many areas. They cause less pollution compared to conventional energy sources. With current technology, the availability of energy is not at all a problem, but the usage of energy is. The innovation of new technologies gives us hope to a rightful direction of clean energy and clean world without hazard to heavenly beings in the world. These will be the most economical way of future. For a bright future we must drive in the path of renewable energy. The conventional energy sources like natural gas, oil, coal or nuclear are finite and at some point they will get exhausted and more over, the usage of the conventional sources causes pollution and global warming. This paper generally deals about the recent innovations in the field of renewable energy.

Keywords: Conventional energy, Renewable energy, Clean energy, Global warming

1. Introduction

Humans are responsible for keeping surrounding clean and suitable in order to provide a better world for the future generations. The conventional energy sources are deteriorating nature, compelling the transition of our world toward the concept of clean energy which is abundantly available, leaving no residue which is hazardous to the nature. The renewable energy sources are available everywhere waiting to be tapped. The rise of technology in the field of consumption and management of renewable energy has risen from ground to a higher level. The improvised usage of renewable energy not only for production of the electricity, but also for other fields like solar cooking, wind irrigation etc. From [1] the extent of damage is caused by fossil fuel is seen caused due to the emission of carbon which leads to a result of global warming and how much all countries are interested stepping towards the clean and energy.

Electrical power is now considered as the fundamental need for the economic development and a routine life. Due to its needs the usage of conventional energy sources is used rapidly [1]. The survey shows that people are interested in renewable energy the reason is the oil and other things are going to be short as soon as possible. These technologies improvisations provide generation of useful products of renewable energy at any place we want it. They are only limited sources of renewable energy, the main sources are solar and wind energy the other are Geo-thermal, Hydro and so other. On the other hands obtaining renewable energy has some disadvantages like it requires suitable time, more place and certain weather conditions. The awareness of renewable energy is not over the world. The technology has risen to overcome the disadvantage of the problems that we can overcome in these developments in the technologies.
2. Solar Skills and Its Inventive Ideas

World case for vitality is extended to more than decade by 2050 and more than triple toward the century's end. Steady increase in existing energy network won't be satisfactory to flexibly this case in a reasonable manner. Tunisia choose to put resources into the field of renewable vitality and substantially the sun-oriented technique.

It is found Monte Carlo beam following technique combined with optical validity to anticipate radiation execution of dish sun powered concentrator/hole collector frameworks. Concentrated scientifically and provisionally warmth adversity with rectangular or round line absorbers, for direct sunlight based focusing authority [3]. In request to enhance and for a productive usage of the fixation advances it is imperative to arrange the satisfactory growing technique instruments and methods of sunlight-based concentrators. As of late, building up these procedures and apparatuses is a wide examination region in concentrating sunlight-based vitality field. Another method deal with warmth moves in a cone shaped pit calorimeter for estimating warm intensity of a point centre concentrator framework named OEFRAR, created at the Centre for Energy Research of the National University of Mexico; they built up a CFO code for CA VICAL calorimeter.

Other calorimeter geometry (flat plate calorimeter) to calibrate solar flow, they demonstrated that the mean estimation of the temperature on the outside of the copper plate of the calorimeter is lower than when treated steel is utilized, and trail are likewise littler. Specifically, radiative trail can be dismissed in the warm equalization of the framework. Fig 1 represents the solar panel set up.

2.1. Uses of sun power in agriculture

Sunlight plays an important role in agricultural field. With today’s scenario, being depended on climate is not feasible [4]. Many alternate methods are to be considered. Firstly, an artificial method of lighting for growing weeds, impact of artificial light in agriculture field. Photosynthesis is the cycle utilized by plants to get vitality from daylight and transform it into substance vitality. Plants needn't bother with the entire range to do photosynthesis. They devour just Red 660nm and Blue 440nm frequency [5]. Secondly the Electromagnetic fields, appropriately applied, can be real partners to supportable horticulture, since they permit to complete soil medicines for bothers control and to improve plants germination and development without delivering air and water contamination and without utilizing compound substances unsafe to definite purchaser’s wellbeing and condition.
2.2. Methods of Wireless Sensor Detection

A Wireless Sensor Detection (WSD) is a method to detect lights and transfer it into a useful application [6]. The estimation of distant detecting in horticulture has been the basic certainty that all items mirror light diversely over the light range. Innovation of Artificial Intelligence (AI) playing an upcoming role for the productivity of crop fields. Internet of Things (IoT) framework, cloud innovations that give surrounding and PV condition checking, and empower the relating examination, that outcomes to the variables and markers for these impacts [7]. As the framework can bring an alert up in the event that these miracles are distinguished, a potential recovery cycle can occur to keep up the vitality creation of the board standard levels. Sun oriented offices in keen urban areas are regularly circulated as small farms, establishments of housetop, and parking garage conceal so as to utilize the accessible space and to reduce use of electric cables. This fill in as a test of observing and keeping up smudge boards because of the scale and conveyance of the establishments.

3. Breeze to the fullest

Wind energy is one the most promising source of energy, which is clean, easy, cost efficient and cheaper than solar.

3.1. Wind farm

This idea is made for the wellbeing of farmers, and to advance remote areas. This paper raised the off-grid renewable systems for cultivating and household appliances in theoretical manner. Solar and wind is more suitable for off-grid renewable systems [8]. Approaches on hybrid systems are more in Researches and Development. Utility framework has the great drawback in the remote areas where utility grids are not feasible. So, this paper made it to happen practical and reasonable for remote areas where off-grid renewable energy system introduced. This imported prosperity in farming who feed’s the individuals’ plate. Wind power as the storage system and back-up generator, has collected some data for the wind farm. Theoretical designing comprises the construction with wind turbine, wind monitor, inverter, battery bank, back-up generator, system protection and then implementation. This paper shares the experiences of selection of turbine and employments of Arduino. The calculation made in this paper is validated and implemented which prompts reformist cultivating. Wind farm is one of the sensible and worthy projects for the rural development and making of remote areas to progressive urbanization.

3.2. Off shore wind farm siting

Figure 2 depicts the offshore wind farm setup. From [9], it is known that the essential thought is the need of surplus amount of power. The efficiency of off-shore reserves of wind energy is higher than the land wind mills. This paper examines about the wind power and develop tools for off-shore wind farm, by having the information from the satellites, CCMP (Cross Calibrated Multi-Platform), Lidar’s(Light Detection and Ranging), buoys, and so forth. They are settling off the off-shore wind farm in the eastern part, as due to north - eastern part of Asia have tremendous flow of wind. The analysis of off-shore wind farming these locations is done with profundity of 30-50m water. Off-shore wind farm acquires wind power data from satellites, CCMP, Lidars, wind towers, buoys used to determine wind assets.
Figure 2. Offshore wind farm setup.

The types of wind speed, vector, wind wave is satellite information, CCMP analysis, Lidars and so on. Strategies utilized for off-shore wind farm setting are wind energy, stability of wind, must focus on the direction of wind and afterward on submerged link. For the well understanding the study of wind assets could be useful. They are gathered from satellites of scatter meter, radiometers, CCMP examination and from SAR like GF-3.

3.3. Validation

Approval happens through in-situ information for winds from satellites. Wind speed directions are reliable. Variations of wind are higher in wind tower than far off detecting. Since winds from wind tower are estimated for 24 hrs. The breeze vector wing was dissected for CCMP for every single month. Differentiation was done to show wind speed, direction for month wise, which is to estimate north – eastern and southern breeze. The operation is closed by saying substantially more information is required for area function underwater cables for the proper well-structured off-shore wind farm.
3.4. Energy from moving vehicles

The basic thought behind wind turbine is to raise the Kinetic Energy into electrical Energy. Finding the best spot for wind Turbines to get extraordinary potential breezes are the highways. Here the Computational Fluid Dynamics’s (CFD) computational liquid elements is talked about to raise the breeze speed profiles [10]. This is raised to raise more results by utilizing winds. In spite of the fact that the control up the utilization of non-renewable energy sources is not controlled, the setup is arranged so as to get help with those fuel vehicles which convey up greatest breeze on the highways to energy. Wind speed in the higher altitude and coastal territories are most extreme, however energy produced because of vehicles on highways have low wind speed that can likewise be utilized to create power for some small needful applications.

Due to low wind speed in highways, Wind Turbines are proposed in minimized ones with vertical axis wind turbines (VAWT). VAWT is relevant in light of the fact that it is modest, less noisy, utilized in urban zones, cheap, directional free. To get useful measure of energy, need to gather information's of wind speed. In highways, the placing of VAWT is determined by the size and state of vehicle that go through the highways. Different model of vehicles is considered to analyse and classify the wind speed based on vehicle models. Various vehicles that are in the single lane single vehicles are taken in consideration to determine the wind stream streamlined in CFD analysis are discussed [11] in this paper, with knowing the top height, lateral of the vehicles that are taken. At that point examined with cluster of vehicles in single lane kept up with subtleties and with three-second principle for safe driving distance. With acquired wind velocity profiles, they move to energy estimation. This application with VAWT is more appropriate for less energy devouring appliances. Moreover, in future with this advancement in the highway’s energy created by sun powered, wind is to run up an electric vehicle and making out of charge stations of energy generation. Figure 4 shows the placing of VAWT in highways.
3.5. Technology

The advent of recent technologies and innovations strengthen the nation by helping standardize the technologies for market competitiveness. Technological modelling is developed by the basic learning curves to absorb information, that is innovation's cost reduction, installed capacity, and with multi factor learning. The essential innovation learning model is fragmented by one factor learning curve to multi factor curve; they are associated to knowledge stock. Innovative upgrades are appeared by knowledge stock, which is accumulated by R&D expenditures and by research activities done by scientists and specialists. Though researches made on expectations to absorb information with hypothetical information for mechanical learning with input-based proportion of advancement. This paper takes into advance with patent information on wind power technology with output-based measure.

From [12], Ten years back the Research and Technology was utilizing the wind effectively for wind power generation, for that ideal control strategy was proposed, confirmed by simulation. Maximum power point tracking (MPPT) was utilized to extemporize the effectiveness of wind power generation system. Initially, the exploration was to acquire the maximum wind speed and to give maximum power output.

4. Innovation on Conventional Sources of Renewable Energy

Renewable Energy Sources (RES) is around for a quite long time. Having greater good and helping globe in moving towards the goal of sustainable development, the practical usage of RES is not being implemented on a wide scale. The reason behind this is, RES has a long way of innovations to be made upon to compete with the impeccable efficiency of conventional sources of energy. With the advent of recent technologies, the transition towards the goal of sustainable development with the innovated RES is turning to reality. The commonly known RES is Hydroelectric, Solar, Wind, energy. Some of the lesser known RES includes tidal, geothermal, ocean thermal, bio fuels etc. RES Being in many forms and better advantages has its own limitations. This paper discusses some of the innovations made in these domains on the recent years to overcome the prevailing limitations.

4.1. Robotics

Robotics is a topic which gives much interest and hope to be worked with, which could be used for the betterment of humanity. Robotics on innovation of renewable sources of energy [13] improves...
efficiency of working of renewable energy sources better than ever. Processes like producing, installation, maintenance of the equipment’s of RES can be assisted with robotics to finish it in faster and better rate. Table 1 shows the usage of robotics in respective fields of RES.

Table 1. Usage of robots in the respective fields of RES.

| TYPE OF RENEWABLE ENERGY | USAGE |
|--------------------------|-------|
| WIND ENERGY              | Colouring of Wind towers, smoothing of wind turbines (sanding), Removing dirt from blades, setting up of vortex generators, Identification of errors, covering lead energy protecting tape etc. |
| SOLAR ENERGY             | Movement and setting up of panels, improving efficiency by periodic maintenance and cleaning panels, tracking of solar etc. |
| HYDRO ENERGY             | Under water installation, cleaning of blades, checking the structures, grinding and peening etc. |
| BIO ENERGY               | Used in setting up floating algae farms. |

The intrusion of robotics in the arena of renewable energy is not on full extent, and due to the slow growth of renewable energy. Due to this, it takes time to see the full extent of Robotics in the arena of RES.

4.2. Gusty power

Windmills, which runs the turbines from the kinetic energy of flowing wind is not beneficial as it seems to be. Winds, with good kinetic energy, produces beneficial amount of Energy from the turbines. Rest of the times, it is not likely to get the most out of the wind turbines. To overcome this, Wind Turbines employ various MPPT techniques and uses controllers to improve the power output, throughout the year. Even it has some limitations, and is not as efficient as it sounds. The proposed system shows that the Tip Speed Ratio (TSR) control along with bidirectional controllers which take over the rectifier of the medium and small turbines during the swaying winds, helps us to achieve the maximum power output even during the gusty winds which is usually unlikely for a windmill to produce energy from it [14]. Wind meter which records the TSR speed from the wind, check with the optimal TSR speed and detects the wind gust. By implementing Fatigue, Aerodynamic, Structure and Turbulence (FAST) s-block function, the function polishes and the high frequencies and the wind variations are extracted from the available derivative. The TSR speed is constantly being compared with the optimum TSR speed in order to check for improving the efficiency. When the value is in the considerable range $k_1$, normal protocol of TSR control is being employed. When the value of derivative exceeds $k_2a$ value which is obtained from respective moment of inertia and wind turbines rotor speeds, the bidirectional controller is activated and the $I_q$ current, which is obtained from Permanent Magnet Synchronous Generator (PMSG) in the d-q reference, is varied from $-I_q$ to $I_q$ with respect to the obtained values which are positive and negative. The positive value activates PMSG torque cooperated with aerodynamic torque provides acceleration to the speed of Rotation and in case of Negative values, only Generational torque reduces the rotation speed, and the bidirectional
controller turn off when it laps with TSR and the general operation of Normal controller along the
general MPPT techniques are used. The PMSG not only records the errors and speeds, it is used to
record general losses and power. A PMSG system which gives correct and precise values is necessary
to employ this method. The strategy from \(^{14}\) is beneficial when losses from PMSG is lower than
energy from the gusts.

4.3. Grids of future

Grid, generally speaking is the method of power transmission. When taken a closer look, it expands to
be the system of flow of energy from the sources of power to the loads which makes today’s world a
reality. When energy saving and sustainable development is being key concern to be taken for
betterment of everyone, innovations in grid is a key player. Optimal dispatching of Multi Energy
Micro Grid (MEMG) in the section of Management of RES discusses about Microgrids in a detailed
manner. Optimising the existing system to adapt future needs and requirements helps us make use of
the existing infrastructure in away better than before. The future grid from \(^{15}\) highlight improvements
of Superconducting Magnetic Energy Storage (SMES), Electric vehicles (EV), Superconducting wind
generators, innovations in magnetic bus for its utilization in the future grid.

4.3.1. Superconducting Magnetic energy Storage

SMES generally has a faster rate of charge and discharge which calls out a need for a new design of
SMES to store high amount of energy for its utilization in RES linked systems. This is important for
applications such as solar energy which is periodic and not continuous. The High Temperature
Superconducting materials (HTS), Low Temperature Superconducting materials (LTS) material are
used in the improvisations of SMES. This is seen as a promising future for improvement in grids, due
to the reduction in the cost of Superconducting materials such MgBr\(_2\) which made this innovation a
possible one.

4.3.2. Electric Vehicles

The integration of grid with the charging stations ensures equal distribution of power for meeting the
future requirements. Usually the EV’s are charged from low voltage sources. A charging system based
on State of Charge (SoC) to improve the speed of charging and storage capacity. By analysing the real
time geographical power requirement data, and integration of EV’s to the grid the distributor can find
the insights to set up the charging stations at appropriate intervals and with suitable capacity for
overall advantages.

4.3.3. Superconducting wind generators

Wind generators with armature of superconducting materials produces wind turbine with megawatt
ratings. This made possible by Fully Super Conductor (FSC), Fully Superconducting Direct Drive
(FSDD) are very promising to produce a high output power to weight ratio. With no gearbox, the
operation of wind turbine is made easier and economical, increasing reliability of wind Turbine. An
8MW FSDD produces twice the output power to weight ratio than the conventional Double Fed
Induction Generator (DFIG). The Fault Ride Tolerance (FRT) of FSDD is yet to be analysed and to be
worked upon, which stops it from being fully utilised.

4.3.4. Magnetic bus

With the conventional DC grid, so many setbacks are there such as Galvanic isolation and common
mode. The proposed methods of DC-DC converter transformer come with its own lags such as
additional components for line filter, Step-up transformer and with increase in volume and weight
simultaneously. To overcome these blocks, Magnetic bus is proposed in \(^{15}\) as a solution. The
amorphous magnetic materials have high permeability and low specific core loss stability and greater
magnetic saturation. This provides a highly efficient magnetic bus with high energy density. The
design of this has to be optimized as it affects the operation of whole system.
5. Innovative storage methods of RES:

RES unlike the conventional energy is not something which could instantaneously produce and procured by Producers and Consumers. With the existing technologies, Most of the RES are intermittent in nature which is in need to be assisted with storage methods for its working. The availability of energy for the storage system is limited so there is a desperate need to increase the storage capacity exponentially, as the SoC gets reduced during dissipation from the storage. From[15]when the storage of the battery is low, the active power from the storage is high and when the storage is high, the Active power is low and high reactive power is to be injected from the storage to curtail the impacts of PV, because the reactive power flows between the source and load in order to reduce the impacts on PV when there is no active power available and to the case of storage by the battery, when the storage is high the active power is to be absorbed more than the reactive power. And when the storage is low, low amount of active power is to be absorbed. Reactive power is necessary to curtail the impacts of PV.

5.1. Superconducting Magnetic Energy Storage

In [15], it is seen that when it is coupled with battery banks, the storage capacity could be increased exponentially, for high presence of RES in distribution grid.

5.2. Mini Pumped Hydro Energy System

The innovation in hydroelectric energy known as Mini Pumped Hydro Energy Systems (MPHES) is one of the recently found eco-friendly method which helps us towards the transition of our sources of energy from renewable to non-renewable [16]. The Geographical Information System (GIS) based mapping of NASA’s satellite has found 616,000 sites around the world, for setting up of MPHES. This operates in two modes: operating and generating mode. Usually, when the price of power is low, The MPHES runs on operating mode, pumping water from a lower to upper reservoir. When the load is in high peak or in demand, it operates in generating mode.i.e. The water flows from upper to lower reservoir passing through a turbine and producing energy. This generally don’t require sophisticated and complex constructions. This proves to be a source as well as plant. Being multifunctional, it gives good hope regarding its part in the future world of clean energy. It generally uses induction generator and, in some case, synchronous generators are also used to produce energy. Induction generators are used in remote areas due to its robust and reliable nature. The MPHES is generally run in solar energy cutting the need for any other conventional sources. When MPHES is added to the system the efficiency of the system is increased multi fold when compared to a system of micro grid without MPHES [17].

5.3. Maglev-vacuum pipeline storage system

The so far proposed systems provide localized sources for storage of energy, lacking the mobile nature. The system Maglev-vacuum pipeline system gives us the opportunity to break all the barriers and to provide an easy to transport, on localized, bulky storage of RES. The fundamental concepts root back the concepts of Maglev train and vacuum pipeline. The acceleration is being controlled by linear motor, followed by the uniform speed and deceleration completing the stages of producing RES respectively. The steps involved are:

1. Getting charged with accelerated motion:
   The system is charged with energy during this stage of acceleration of train.

2. Uniform speed motion:
   During this stage, the system runs on uniform speed in no load condition

3. Production of electricity with Deceleration:
When the train starts to decelerate, the system gets charged with its charging system.

Due to zero friction between the surfaces of maglev train and track, and no air-resistance as it is travelling in the vacuum pipeline the overall efficiency is improved. When the train is operated in no-load state, the linear motor acts in the motor state, to maintain the uniform speed. The three-phase armature winding of the track is being controlled by power electronics devices in order to produce a travelling magnetic wave which is repelled by the excited magnetic field of the maglev magnets. This repelling force is used to accelerate the train in forward direction. Generally, at this stage the Train utilises power from grid and during the deceleration stage the linear motor work in generating mode producing power giving the power back to grid. This is achieved by induction of three-phase symmetrical in the armature of the winding of the track which is fed back to the grid by appropriate power systems device. Diving deep into the details, the limitations found in this technology are:

a) The cryogenic system cooling system, wheel-rail system used in the Electro Dynamic Suspension (EDS) maglev trains large load ratio, so this cost fourfold than the Electro Magnetic Suspension (EMS) maglev trains.

b) The required load ratio and high speeds cannot be met by existing maglev trains in a reasonable cost.

More research has to be done regarding the optimization of existing design of maglev trains, to which the cost of operation is mainly based upon the Magnetic levitation mode, speed, and load ratio.

6. Management of renewable energy

The existing RES is unable to replace the conventional sources of Energy in the current reality. As a matter of fact, only about 25% of the world’s energy is effectively being produced by RES. Being with its own limitations, RES when managed effectively can cater the world’s needs in greater amounts. Microgrid is one such method of management, which has RES as sources of Energy. It enables the use of RES than ever before. When there is extra energy available, the extra energy is supplied to the grid strengthening the existing system or it is stored in the storages such as batteries etc. It can also be used to power a small locality, or a zone. Fig 5 shows the components of microgrid.

Microgrid, a system of decentralized loads and electricity sources such as solar, mega batteries, combined with the connecting devices which helps running the neighbourhood. Figure 5 shows the components of Microgrid. Microgrid operates in parallel with the main grid to help when there is a power shut down by providing enough power to run the neighbourhood for certain amount of time. When there is excess energy produced from the microgrid, it is supplied to the main grid strengthening the existing system too. It can also help running the local areas independently, wirelessly from the main grid. This is the future of energy. But it needs some innovations before it could help the public in greater extent, in a way better than today. Here come MEMG, an improvisation made for microgrid which enables multi inputs and multi outputs. Its components include distribution level transformer, PV generation system, a Battery Energy Storage System (BESS), a Gas Boiler (GB), an Electric Boiler (EB), Combined Heat and Power plant (CHP), a ground source Heat Pump (HP), In which local gas, electric utilities and solar, Wind energy, are energy sources of MEMG.

Drawbacks in the MEMG system includes highest amount of energy waste in heating and cooling of appliances and of components of microgrid. To overcome it, innovations made on it was made based on the static and linear nature of demand-supply flow of energy. Dynamic nature should be considered, as the linearity is not always the case. The optimal dispatching model for microgrid explained in [1] extends the operation of microgrid to the real-life dynamic nature of demand-energy flows. The optimal dispatch of MEMG, given in uses Mixed Integer Linear Programming (MILP) framework is used for the generalized static and dynamic flows and for optimization of MEMG [18]. The optimal dispatching model is shown in Figure 6.
The results in this final optimal despatch model of MEMG are derived and obtained from the DAG (Directed Analytic Graph) from the obtained quantities as mentioned in the flowchart and by combination of PWL (Piece Wise Linear) approximation and linear approximation of the function of linear and non-linear components into a MILP function, which helps in better analysis and provided a generalised solution, better from the previous solutions. The table of results of Energy and Energy losses when considered with two cases in which case1: SOE (State Of Energy) is kept at initial values and in case2: SOE is allowed to change from upper to lower bounds is observed and verified that the generalized solution given works well with non-linear complex nature of energy demand-supply, and works well for analysis of input energy. The general charging and discharging of loads in supply and demand energy in the current technology of MEMG results in additional losses, which can be removed by the use of generalized expression of MILP function [18].

![Figure 5. Components of Microgrid](image-url)
7. Conclusion

Few years from now, the fossil fuels would be deprived and the only way to meet the energy requirements would become the RES. To achieve that goal, Developments, innovations has to be made from now to be prepared. This paper generally describes the innovation in respective fields of RES and gently seeds about the future innovations. Added to this, RES remains extraordinary choice to reduce the climatic change global warming and degradation of air quality. Developing projects and improvising the technologies for the generation of energy using renewable resources will safeguard our planet, which will provide an incredible way of life for our future generation. Contamination free source of energy will power the Environment in eco-friendly way. With our current development our technology is advanced to use all our ample supply of renewable energies. Once, transportation empowers exchange, trade between individuals which utilizes more fuel utilization prompts air contamination, unnatural weather change, complications to the world, now those obstacles supplanted by solar cars, trucks and with enhanced electric vehicles modernization. The innovations to overcome
the disadvantages of RES is progressive which includes beginning speculation for the arrangement, geographic, capacity abilities, etc. That are now faced up with the utilization of Arduino tasks, IOT and AI applications. Arduino ventures includes for the catch of sun powered radiations adequately for the generation of energy. Co-generation of sun powered and wind plants will be more productive. Major drawback of upfront investment is overseen by assembling of subjective parts with less driving weight. Technologies like Microgrid which is fed by RES, is giving a promising hope for a clean energy, strengthening the existing system of grid to a greater extent. This enables easy transition from the existing system of energy transfer to the clean RES. The goal is sustainable development, for which RES is the perfect doorway.

References

[1] D. Yang, X. Zhou, Z. Yang, Y. Guo and Q. Niu, "Low carbon multi-objective unit commitment integrating renewable generations," in IEEE Access, doi: 10.1109/ACCESS.2020.3022245.

[2] E. Irmak, M. S. Ayaz, S. G. Gok and A. B. Sahin, "A survey on public awareness towards renewable energy in Turkey," 2014 International Conference on Renewable Energy Research and Application (ICRERA), Milwaukee, WI, 2014, pp. 932-937, doi: 10.1109/ICRERA.2014.7016523.

[3] S. Skouri, S. bouadila and S. Ben nasrallah, "Experimental study of two types of solar heat exchanger used to determine concentrated solar energy in solar parabolic concentrator," 2014 International Conference on Composite Materials & Renewable Energy Applications (ICCMREA), Sousse, 2014, pp. 1-4, doi: 10.1109/ICCMREA.2014.6843801.

[4] N. Pasha and M. H. Akash, "Impact of Artificial Lights in Cultivation & Generate Electricity Besides Agriculture: Feasibility & Constraints Analysis in Bangladesh," 2020 IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT), Bangalore, India, 2020, pp. 1-4, doi: 10.1109/CONECCT50063.2020.9198365.

[5] B. Bisceglia and S. Valbonesi, "ELF fields in agriculture: New techniques for a sustainable development," 2017 International Applied Computational Electromagnetics Society Symposium - Italy (ACES), Florence, 2017, pp. 1-2, doi: 10.23919/ROPACES.2017.7916415.

[6] J. L. Hatfield, M. Cryder and B. Basso, "Remote Sensing: Advancing the Science and the Applications to Transformed Agriculture," in IT Professional, vol. 22, no. 3, pp. 42-45, 1 May-June 2020, doi: 10.1109/MITP.2020.2986102.

[7] G. Filios, I. Katsidimias, E. Kermakis, S. Nikoletseas, A. Souroulagkas and P. Spirakis, "An IoT based Solar Park Health Monitoring System for PID and Hotspots Effects," 2020 16th International Conference on Distributed Computing in Sensor Systems (DCOSS), Marina del Rey, CA, USA, 2020, pp. 396-403, doi: 10.1109/DCOSS49796.2020.00069.

[8] J. Calderon, J. Cureg, M. Diaz, J. Guzman, C. Rudd and H. T. Le, "Smart Agriculture: An Off-Grid Renewable Energy System for Farms using Wind Power and Energy Storage," 2019 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT), Washington, DC, USA, 2019, pp. 1-5, doi: 10.1109/ISGT.2019.8791576.

[9] Y. Zhang, M. Lin, B. Zou, X. Yin, T. Liu and W. Zhou, "Preliminary Analysis of Wind Resources and Wind Energy Reserves in the off-Shore Region of Guangdong Province," IGARSS 2019 - 2019 IEEE International Geoscience and Remote Sensing Symposium, Yokohama, Japan, 2019, pp. 8209-8212, doi: 10.1109/IGARSS.2019.8899218.

[10] F. Han, A. W. Bandarkar and Y. Sozer, "Energy Harvesting from Moving Vehicles on Highways," 2019 IEEE Energy Conversion Congress and Exposition (ECCE), Baltimore, MD, USA, 2019, pp. 974-978, doi: 10.1109/ECCE.2019.8912688.
[11] Xingjia Yao, Shu Liu, Xuedong Wang, Hong Liang Jiang, Faming Sui and Zuoxia Xing, "Research on maximum wind energy capture control strategy." 2010 International Conference on Optics, Photonics and Energy Engineering (OPEE), Wuhan, 2010, pp. 34-37, doi: 10.1109/OPEE.2010.5508114.

[12] J. Iqbal, A. Al-Zahrani, S. A. Alharbi and A. Hashmi, "Robotics Inspired Renewable Energy Developments: Prospective Opportunities and Challenges," IEEE Access, vol. 7, pp. 174898-174923, 2019, doi: 10.1109/ACCESS.2019.2957013.

[13] M. Sajadi, J. D. M. De Kooning, L. Vandevelde and G. Crevecoeur, "Harvesting wind gust energy with small and medium wind turbines using a bidirectional control strategy," in The Journal of Engineering, vol. 2019, no. 17, pp. 4261-4266, 6 2019, doi: 10.1049/joe.2018.8182.

[14] K. M. Muttaqi, M. R. Islam and D. Sutanto, "Future Power Distribution Grids: Integration of Renewable Energy, Energy Storage, Electric Vehicles, Superconductor, and Magnetic Bus," IEEE Transactions on Applied Superconductivity, vol. 29, no. 2, pp. 1-5, March 2019, Art no. 3800305, doi: 10.1109/TASC.2019.2895528.

[15] S. Dhundhara and Y. P. Verma, "Application of micro pump hydro energy storage for reliable operation of microgrid system," IET Renewable Power Generation, vol. 14, no. 8, pp. 1368-1378, 8 2020, doi: 10.1049/iet-rpg.2019.0822.

[16] M. Stocks, A. Blakers, C. Cheng and B. Lu, "Towards 100% renewable electricity for Indonesia: the role for solar and pumped hydro storage," 2019 International Conference on Technologies and Policies in Electric Power & Energy, Yogyakarta, Indonesia, 2019, pp. 1-4, doi: 10.1109/IEEECONF48524.2019.9102581.

[17] W. Tang et al., "Research on the Principle and Structure of a New Energy Storage Technology Named Vacuum Pipeline Maglev Energy Storage," in IEEE Access, vol. 8, pp. 89351-89366, 2020, doi: 10.1109/ACCESS.2020.2992525.

[18] L. Tian, L. Cheng, J. Guo and K. Wu, "System Modelling and Optimal Dispatching of Multi-energy Microgrid with Energy Storage," in Journal of Modern Power Systems and Clean Energy, vol. 8, no. 5, pp. 809-819, September 2020, doi: 10.35833/MPCE.2020.000118.