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# Adaptive Neural Network MPTT for Enhancing Reliability of Hybrid Solar-Wind Systems in Smart Microgrids

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## Abstract

The world is in the problem of scarcity in the raw material for generating electricity for upcoming years. The researchers are suggesting opting for multiple distributed generation systems including the commercial non-renewable energy resources and non-commercial energy sources of electricity generation. In this aspect most versatile way of generating electricity is solar energy. Energy is capable to withhold any kind of condition whether it is geographical or environmental. It can perform in minimum investment of the world situations on the earth or in space. Still there is a lot of research that needs to be done to upgrade the system so that more electricity can be obtained. Along with the research and systems one has to scope up with the techniques to get maximum output. As the rhythm goes by maximum output can be obtained on maximum power conditions. MPPT techniques come in handy in this situation. The system here works on different types of MPPT techniques in hybrid mode along with the and techniques the system is actually verifying the results and simulated verifications.

***Keywords:*** Annmptt, Solar, Wind, Hybrid Systems, Smart microgrid

## Introduction

Is the design of today's energy systems adaptable and compatible with the problems facing the next generation? The majority of the current energy system's power comes from non-renewable power plants that are used for commercial purposes. To control pollution and the emission of harmful gases from power plants, government organizations oversee the majority of the power generation facilities. The stations in this area are the primary source of the enormous quantities of dangerous heavy metals that are even forbidden from use in typical ecosystems. The world is moving toward producing energy from renewable sources today. The primary sources of renewable energy are solar energy,hydroenergy, windenergy, biomassenergy, etc.

All of these approaches have their own sub-divisional sources of energy production; these sources are scrutinized and tried to be optimized so that people can use clean, environmentally friendly energy. The majority of non-renewable energy sources either release harmful by-products or extract large amounts of waste. These bio-hazardous by-products are not deserving of being sanctioned for work optimization. On the other hand, renewable energy sources are extremely clean and have a lot of room for development. Tidal and wind energy are used in coastal regions of various nations around the world. The limitation of solar and hydro power plants, on the other hand, is that they require specific environmental conditions in order to function. Although it is difficult to say that the by-products of renewable energy are roughly zero, they are significantly less or nonexistent when compared to non-renewable energy sources.

Hydro power plant has some negative effect on the environments, such as the ability of a single hydro plant to completely erode and threaten the extinction of a specific species of flora or fauna. It can completely wipe out a large city's civilization, which is also common in many parts of the world. There is no way to find many marine species in those specific areas because of erosion. Similar to hydropower plants, where every and each power generation unit, whether renewable or not, has its own benefits and drawbacks, there are numerous studies in the solar field that claim that the by-product of solar module cannot be broken down or dealt with in a simple and efficient way. Power generation is a crucial component of human evolution, making this a very practical and significant question. Modern humans need energy to survive, and they also need it to advance humankind. However, scientists can reduce the environmental harm that this process causes for the benefit of future generations. On these subjects, a growing number of research articles and journals are being published daily. The production of electricity from renewable sources is evolving and growing daily in India as well.

The entire world's water body can somehow be used for tidal energy on coastal lines, making renewable energy sources a much better option for producing electricity than non-renewable energy sources in many parts of the world. Solar and thermal solar energy can be used to operate even in the result area.
As we discuss thermal energy, the issue of the quick depletion of non-renewable resources is driving the global energy picture forward. We have the most common well-liked resources including the Petroleum, Natural Gas, Uranium, Hard Coal and Lignite as we mostly dependent on these resources for fulfilling energy needs.

**Related Work**

Electrical power quality (EPQ) problems are an issue that is becoming increasingly important to all levels of usage such as industrial, commercial and utilities. The power quality issues include short-term events such as voltage sags, swells or even transients with duration of less than a few seconds. Power system harmonic and flicker issues also fall into the category of power quality (PQ), even though these issues tend to occur much longer intervals than sags and transients [11]. The authors [12-16] discussed voltage sag and its characteristics in detail. M.R.Alam et al. [17] proposed an algorithm for detection; classification and characterization of voltage sag and swell in electricity networks, using three-phase voltage ellipse parameters. The proposed method employs the instantaneous magnitude of three-phase voltage signals in three axes, which are separated from each other by 120º.

From time to time different efforts have been carried out to provide an active and flexible solution to mitigate power quality disturbances. Before the advent of active filters, passive filters based on inductors and capacitors [22-24] were used and still used in many power transmission and distribution applications, but it has various disadvantages such as instability, fixed compensation, resonance with supply as well as loads and utility.

To overcome these drawbacks active power filters (APFs) have been used [25]. However, they are costly options for power quality enhancement because their ratings are sometimes very close to full load (up to 80%)

in typical applications.

The currently used energy generation units and systems are not as green and eco-friendly as solar, which is a booming industry right now. Researchers have been trying to understand and improve the efficiency of solar energy. Many maximum power point tracking techniques are currently being used and researched for useful and optimistic results. Temperature and radiance are the variables that influence solar reliability the most; they are both intimately related and serve as functional indicators of IV characteristics. As was previously discussed, it will be clear that mppt techniques are required in situations where the properties of pv models do not lend themselves to an optimistic outlook. The functional domain of an array's optimistic and characteristic structure has been stated on the characteristics of solar arrays. These outmoded techniques, short circuit current and open circuit voltage, act as commands to maintain an array's best output by keeping it within a fixed range of voltage and current. IV structurally linked with amp techniques. Currently, the PV industry is enthusiastically embracing a wide range of techniques that fall under the mppt domain. In the business world, direct, indirect, or hybrid MPPT techniques are being considered. To track the function, various hybrid techniques are combined in a hybrid manner.

Many researches in the field of mppt algorithm has been stating that the indirect mppt methods can also be termed as conventional and novel methods of maximum PowerPoint tracking algorithm. Currently these types of algorithm are very critical and also a booming concern of research in many dissertations and research patents.

In this section we will discuss the external factors which are affecting the solar array output. Please external measures can be environmental conditions or the alignment of the solar module according to the longitude and latitude position of the particular point at which it is been installed. But all the external conditions affecting the output are always unexpected and inconsistent. All the conditions are functionally independent to each other. These are not dependent on any of the physical materialistic characteristics of the panel. The system are working for operational fulfillment of load demand and the unexpected measures of temperature radians dust in the climate storm shading of any kind are always unpredictable.

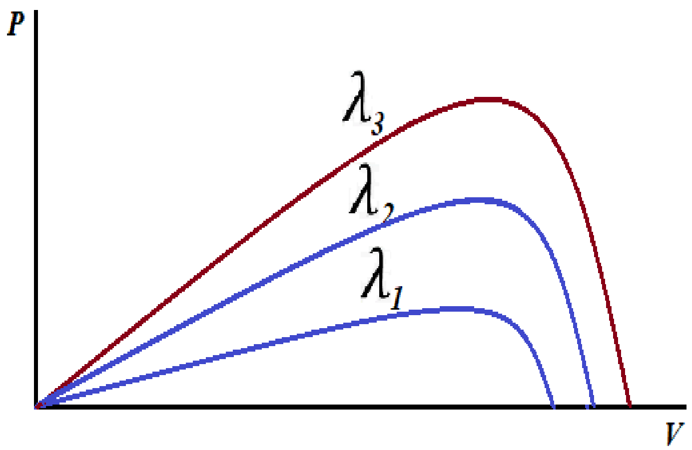


Figure 1: PV Array's P-V Curve Shown for Three Levels of Solar Irradiance (Λ), Where Λ1 < Λ2 <λ3

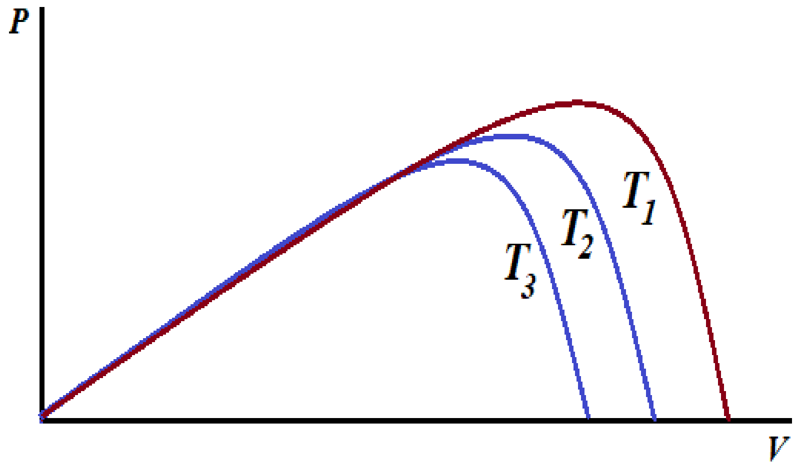


Figure 2: PV Array's P-V Curve Shown for Three Levels of PV Arrays' Temperature (T), Where T1 <T2 <T3

MPPT techniques as self explains that it is focusing on power of the model so it controls the conditions for maximum output. To study this it draws a power and a voltage curve in the section which gives us some local power maximum points and maximum power points. As the name states that the local power points are the points which gives maximum power but they are little less than the maximum power point so sometimes due to optimum working the operator also runs the machine or system on local PowerPoint if the maximum PowerPoint operation cannot be succeeded successfully. These maximum and local PowerPoints are stated and explain well in the figure,

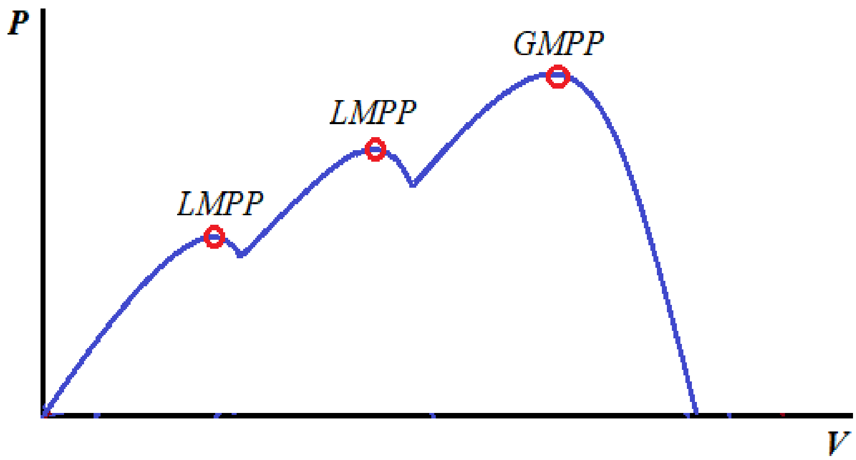


Figure3: PV Array's P-V Curve Shown for Rapidly Variations of External Impacts

Except these two points there is a third point of consideration that is global maximum power point this point is a point as itself states that it is a global point. This means that it will be maximum of all. This point GMPP will be instable and will not be fixed for all duration of operation. But it will have a particular range of domain the graph the function is to somehow bring the operation near to mppt domain so that it will give maximum output.

In this section here we will discuss the mppt techniques which are currently being utilized by the industry and the consumers. Here all the algorithms of mppt will be showing the results for getting mppt in the operating zones. In this section we will state all the different MPBSE techniques which are currently in or outdated in last few years here we will go in detail of 6 techniques which are functionally operating. Some of the techniques are updated and are not been utilized nowadays. There are nearly more than 20 techniques which are win demonstrated as a block diagram in this presentation.

The MPPT techniques studied here are stated as fractional open circuit voltage vocv fractional short circuit current vs CC per term and observe p and o incremental conductance algorithm Inc hill climbing HC local search family optimization algorithms.

MPPT techniques are direct indirect also termed as online and offline techniques respectively. The conventional techniques offline techniques are optimistically utilized.

All the techniques were brought to existence only due to the operation of a system is complex the algorithms makes the operation simple and also it's very low in costing. All the fluctuations and harmonics in the system.

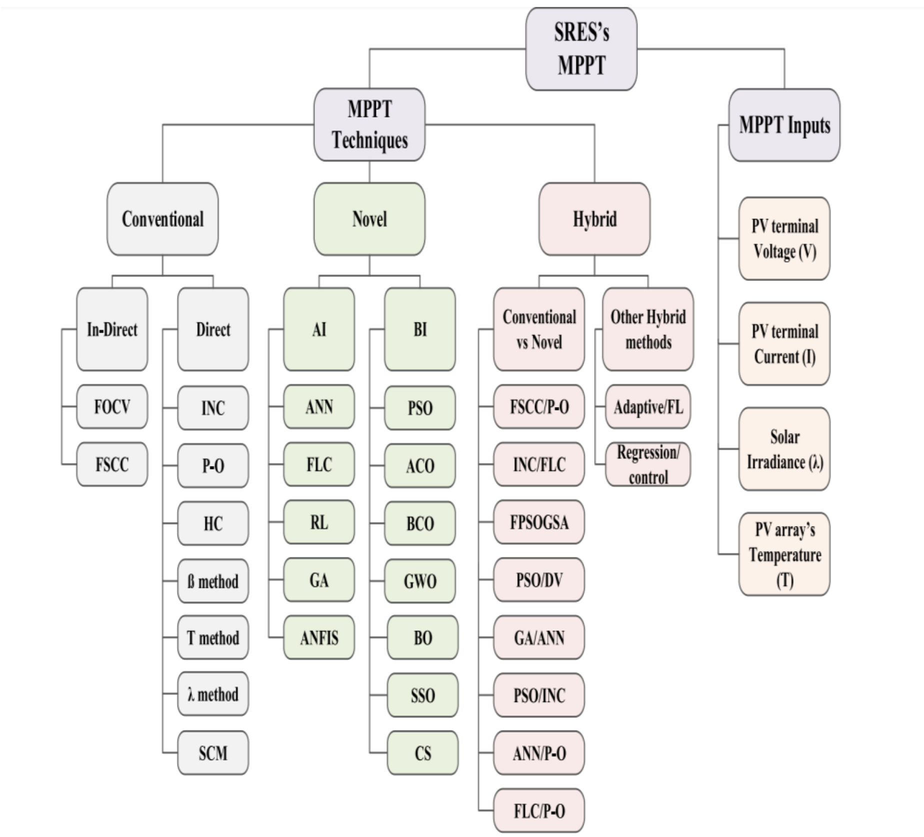


Figure 4: A flowchart of the Existing MPPT Techniques and MPPT Input variables

**CONVENTIONAL MPPT, INPUT VARIABLES: V AND I**

Conventional method or offline method is a basic way of tracking the power points. Maximum PowerPoint can be trapped according to the lord requirement. In conventional way of tracking feedback is not considered. The required load is not compared with the output so it is in official to control and calibrate the power. As there is no feedback considered for tracking of PowerPoint it is impossible for the system to change according to any kind of sudden in elements of operation. This will not give efficient power point for solar PV array. The main external variation is caused in radians and temperature of the panel these vote points will be just as a UN calibrated inputs. Conventional to big names in the market that is P&O and INC. These method are working according to perturbation techniques. These techniques will be measuring voltage current and power step by step till the favorable mppt is reached. At the time of sudden change in current the power of the module will also change in this situation conventional technique is in capable to find its global maximum power point. Example if the current will change Δ I is equal to I1-I2, Δv=vq-v2 similarly Δ P=Pt − Pt−1

The control term S is defined as;

$$S = dP/dV = I + V\,dI/dV$$

where the open switch (u = 0) and the close switch (u = 1) are given

$$u = 0, S \geq 0$$

$$u = 1, S < 0$$

As the power Δp also changes it will not point out towards maximum PowerPoint so it will always be oscillating or moving to and fro the gap this can be controlled by reducing the step size but it will be more complex with some modification in algorithms. these all will happen only due to the external factors. The control system s such as slide control mode SCM which is robust and more utilized secondly the ripple correlation.

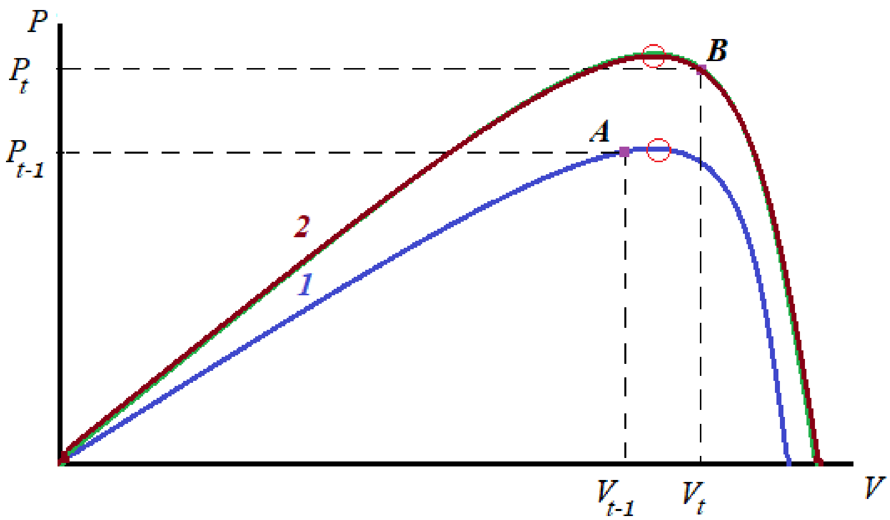


Figure 5: Divergence in Conventional MPPT Algorithm

**MODIFIED CONVENTIONAL MPPT, INPUT VARIABLES: λ, T,V, AND I:**

Modified conventional mppt techniques in this the input variables will be a radiance temperature voltage and input and like the simple conventional immunity technical display in one. The modification helps in controlling the external variables. Mostly the conventional technique does not hold for nonlinear aspects. To this condition modified function try to control the lambda and temperature tea which is provided to simple mppt methods. In case of the temperature is inconsistent in simple words we can say is fluctuating. So kocv will be applied on this. Open circuit voltage coefficient is multiplied with open circuit voltage this will give us maximum PowerPoint voltage. And it will be very dependent on reference temperature.

$$Vmpp\ (t) = kocv \times Voc\ (t)$$

As the equation states that the technique is dependent on t so temperature dependency will be increased for this particular and PPT technique.the second case is if we try to make a radiance as a base of mppt technique to optimise the selection of global maximum power point. This will help in working of mppt algorithm. Vmpp (t) represents the output voltage at MPP, kocvdefines as open circuit voltage coefficient, and Voc (t) represents the open circuit voltage.

$$Vmpp\ (t) = VmppTref + TkVoc\ (T - Tref)$$

All the complexity in the maximum power tracking points is around the circuitry points. The system here is so generated so that it comes to the maximum point with minimum no. of oscillation around the stable point. VmppTref are the functional values for the reference values. in contrast to the temperature sensing terminology this is way far then normal value estimation. Offline measurement of the functioning is the variation based procedure

**NOVEL MPPT METHODS INPUT VARIABLES: V AND I:**

To obtain the GMPP in SRES, a variety of novel (delicate registering) enhancement calculations were used. The GMPP was acquired using novel advancement calculations that included artificial knowledge (simulated intelligence) and organically roused [2], [22]. Novel MPPT strategies are arranged in this paper as a means of communication with and T.

Figure 5 (Plan 3) depicts the main elements of plan 3. In this scheme, the GMPP is obtained by advancing V and I using novel MPPT strategies, including AI and BI calculations. Cuckoo search (CS) was used in [23] to improve the execution of MPPT, transient behaviour, and combination speed. The main advantages of CS were revealed as exceptionally low swaying around MPP at constant state condition and high capacity to deal with the PSC, according to the reenactment results for CS, molecule swarm enhancement, and P&O calculations. The complexity of the CS calculations was higher than P&O but lower than PSO. Additionally, the technique's low execution complexity and cost as well as equipment approval were looked at.

Insect state enhancement calculation [24] was checked as having a superior exhibition to find GMPP in contrast with the P&O and the consistent voltage following calculations as well as being straightforward in contrast with the PSO calculation as far as emphases number and in-reliance to the underlying circumstances. Likewise, in different examinations, honey bee state advancement calculation [25], bat enhancement calculation [26], swarm streamlining calculation [27], (all have a place with the BI calculations), were utilized in the sun based MPPT units for the most part for their capacity of following and distinguishing the GMPP under PSC. Notwithstanding, their proficiency, execution intricacy, and materialness in the large-scale sunlight based SRES should be additionally explored. Among simulated intelligence and AI calculations, support learning (RL) was utilized to limit the set-up time and to follow the MPP for various PV sources (different PV's qualities) under different working circumstances [28]. Additionally, in [29], fluffy rationale control based MPPT strategy was proposed and featured due its capacity to quickly answer outside varieties and its security concerning circuit boundaries' varieties. Notwithstanding, the difficulties of developing FLC framework was referenced, when the unwavering quality of FLC is likewise relied upon master information and fluffy boundaries, for example, membership capabilities.

**ALTERED NOVEL MPPT, INFO FACTORS: Λ, T, V, AND I:**

Figure 5 (Plan 4) shows a representation of the main plan 4. Additionally used in this scheme as novel MPPT contributions are and T. Writing research on this MPPT plot has focused on a few different areas. Memetic swarm calculation, a novel BI streamlining technique, was introduced in [30] to obtain GMPP under rapidly changing weather patterns, where a quick and stable combination was obtained. Additionally, the fluctuation (power fluctuation) under step change of was obtained at 34% for MSSA or at more than 66% for other investigated MPPT techniques , hereditary calculation, PSO, dim wolf streamlining and so on. Other novel calculations prepared for use in this MPPT conspiracy were examined on in [14], [19], [20].

**HYBRID BASED MPPT, INPUT VARIABLES: V AND I:**

Figure 5 (Scheme 5) shows the main plan 5. To obtain the underlying working point using the FSCC technique and to follow GMPP by switching to the P&O calculation, an exchanging-based control strategy was used in [32]. By routinely resetting the calculation boundaries and evaluating the GMPP in each cycle, this tactic lessened the wavering around the MPP in the face of abrupt outside variations, but its reliance on the disconnected following was increased. By reducing their unwelcome aggravations (counting quick changes of , FLC has been used in some tests to improve the display of common MPPT strategies like P&O and INC [33], [34].It was primarily used to simplify the duty cycle of DC converters, either by fuzzification and reducing the discrepancy between rapid and gradual conductance [33] or by improving the results of regular calculations [34]. In the constant state condition, the proposed strategies resulted in strong proficiency, rapid GMPP following, and low power wavering; however, the calculation complexity was increased. Additionally, the conventional MPPT strategies, such as P&O and INC, were combined with fake brain organization calculations [35]–[37]. They were either used to select the underlying Vamp or to improve the outcome of conventional MPPTs. Table 1 also evaluates additional crossover MPPT strategies, such as novel/novel and traditional/customary MPPT calculations.

**CHANGED CROSS BREED MPPT, INFO FACTORS: Λ, T, V:**

Figure 5 (Plan 6) shows a representation of the main plan 6. The outer effects are also applied in the extremely effective half and half MPPT calculations, making this plan the most reliable MPPT plot. Table 1 examines the complexity of the calculation and execution as well as the various highlights of this MPPT plot [38], a combination of a flexible estimation block for calculating the reference voltage point of MPPT (using and T estimations) and an FLC block for altering the duty cycle of the heartbeat width machine was introduced. A high exactness and low wavering MPPT was obtained by four and five times faster than the conventional P&O and INC calculations, separately 28% quicker than a single FLC based MPPT. In any case, its drawbacks were cited as the execution expense and complexity factors.A vision-based MPPT framework based on ANNs and a back-venturing regulator under PSC were planned in [39]. A robust and non-straight backstepping regulator was used to direct the DC/DC converter by controlling the differential error between the PV yield voltage estimated by voltage sensor and the most extreme reference voltage obtained by ANN. The fake vision was used to distinguish the PSC and varieties to give the most extreme reference voltage and greatest power. Under various PSC and varieties, the proposed MPPT strategy effectively followed the GMPP. It was mentioned that the necessaryWebcams and image processing systems would be more expensive than other climate detection methods, but their complexity and applicability in the vast SRES as well as the need for an implanted processor were not investigated. A clever MPPT calculation using the ANN was introduced, prototyped, and tested in [40] in light of the fluffy molecule swarm streamlining gravitational pursuit calculation, A blend of fluffy based gravitational hunt calculation, from heuristic techniques, and it was successful. Recreational and exploratory findings supported settling the reference voltage around MPP as opposed to conventional MPPT strategies and reducing power motions.

In [10], the estimations of and T were used to evaluate the PSC, and the estimations of were used to modify the FOCV's connection to P&O in order to deliver the GMPP. By comparing the proposed MPPT strategy to other conventional MPPT techniques, high MPP following efficiency was obtained.

**PROPOSED METHODOLOGY:**

Here in this section suggested two strategies for MPPT of PV cells: ANN controller. They use MATLAB/Simulink to investigate the planned task.

The PV and wind energy sources are joined with separately specific Lift converters to make a half breed framework. The PV framework takes care of the DC Lift converter, while the breeze framework's result is redressed utilizing a diode span rectifier prior to being shipped off the DC converter. To make a half and half framework, the two sources are joined at a common DC connect transport capacitor. The proposed crossover energy framework is portrayed in Fig.6 as a schematic figure with a solitary MPPT.

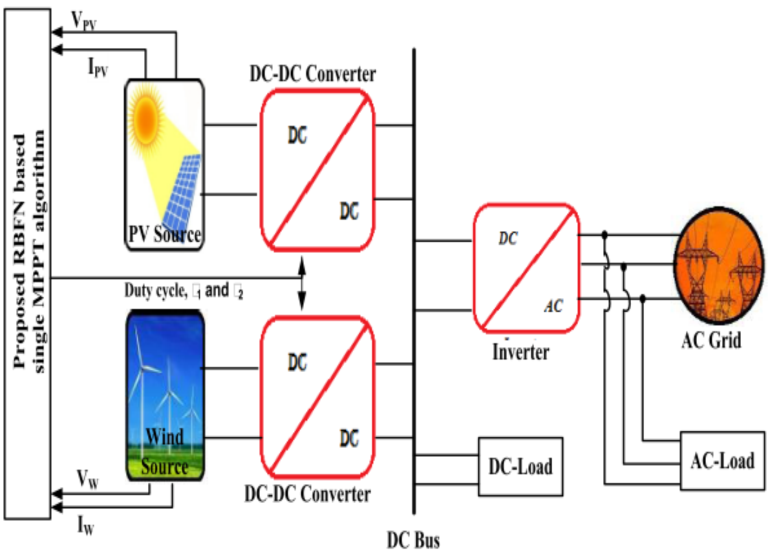


Figure 6. Block Diagram of Proposed System

The most extreme power from the two sources (PV and wind) is recovered in this proposed MPPT control method by running the following calculation simultaneously. The demonstrating of a PV framework, a breeze framework, and the development of a straightforward Lift converter are shrouded in the subsections that follow.

**ANN MPPT**

To follow most extreme power from both the PV and wind energy frameworks in this half and half environmentally friendly power framework, a RBFN-based savvy MPPT regulator is utilized. Figure 7 portrays the essential engineering of a RBFN-based network. The exhibition of the RBFN not entirely set in stone by the framework's interconnection design, loads, and actuation capability. It requires a different MPPT regulator for each environmentally friendly power source, expanding the size and intricacy of framework execution.

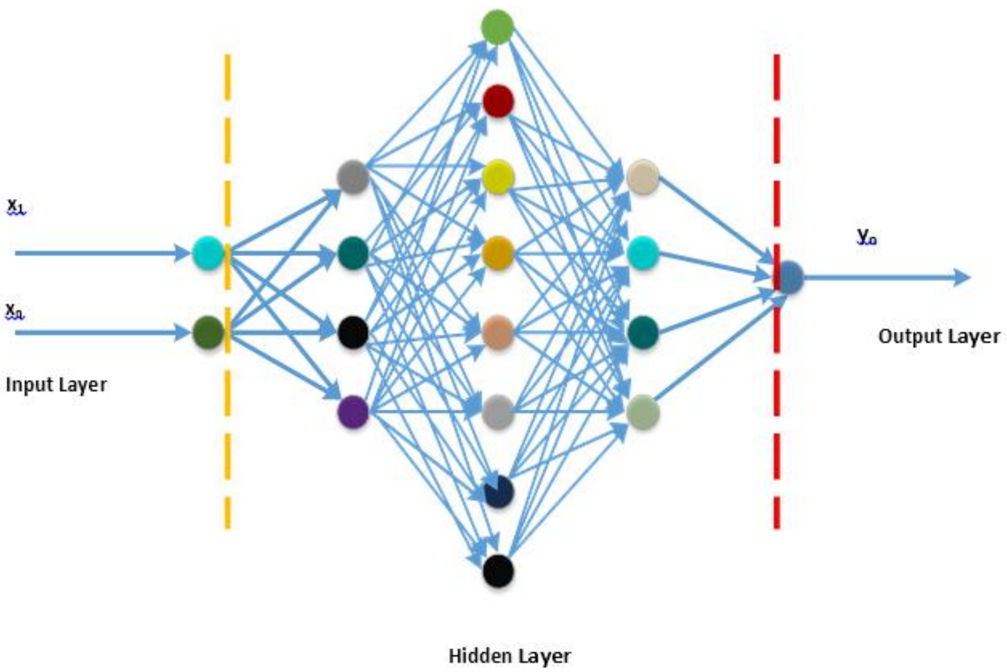


Figure 7 ANN internal structure

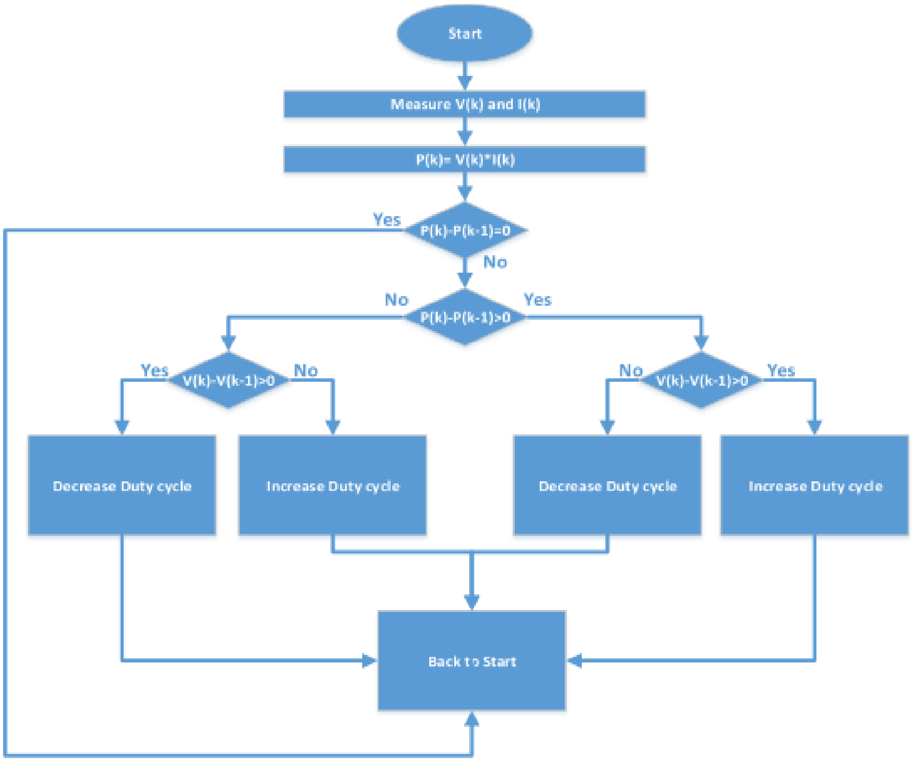


Figure 8: Proposed MPPT Algorithm

**LC Filter:**

LC channels allude to circuits comprising of a blend of inductors (L) and capacitors (C) to cut or pass explicit recurrence groups of an electric sign. Capacitors block DC flows yet pass AC all the more effectively at higher frequencies. Alternately, inductors pass DC flows as they are, however pass AC less effectively at higher frequencies. As such, capacitors and inductors are latent parts with totally different properties. By joining these parts with inverse properties, calmer can be cut and explicit signs can be distinguished Here is a circuit graph of a L-type channel in view of the real comparable circuits of a capacitor and an inductor.

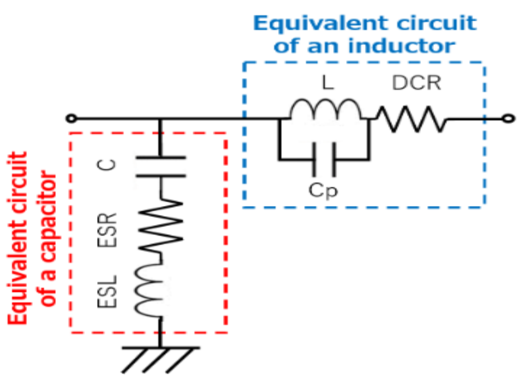


Figure 9 LC filter

The capacitor incorporates an identical series obstruction (ESR) and a comparable series inductance (ESL) notwithstanding a capacitance (C), while the inductor incorporates a DC opposition (DCR) and a wanderer capacitance (Cp) notwithstanding an inductance (L). In the event that a capacitor comprises just of a C part, the impedance becomes lower and the commotion retention impact increments with higher frequencies. Notwithstanding, the lower furthest reaches of the not entirely set in stone by the ESR in genuine capacitors. Moreover, the impedance expansions in high-recurrence ranges because of the ESL, making it challenging to retain commotion. Similarly, in the event that an inductance comprises just of the L part, the impedance increments and the surrounding sound cancelling impact turns out to be more critical at higher frequencies. Notwithstanding, in all actuality, the impedance diminishes in high-recurrence ranges because of Cp remembered for the inductor, accordingly lessening the outside sound cancelling impact.

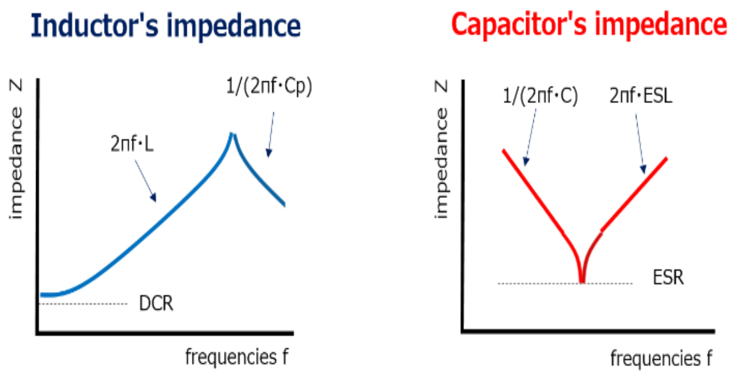


Figure 10 Capacitor and Inductor Response with Respect to Frequency

## 1.9 DC AC Inverter

In simple lemon language, these DC to AC power converters are more commonly referred to as inverters. They are essentially source converters for stockpiles. Different power circuits require DC to AC converters that meet different standards. Voltage source inverters and current source inverters are the primary factors to consider when choosing DC to AC inverters. Single phase inverters and voltage source inverters are both shown in the working waveform, and a thorough explanation is provided in the figures in this section. Figures 4.4 and 4.5 show the three-stage partners of the single-stage half and full scaffold voltage source inverters. Low-range power applications are covered by single-stage VSIs, while medium- to high-range power applications are covered by three-stage VSIs.

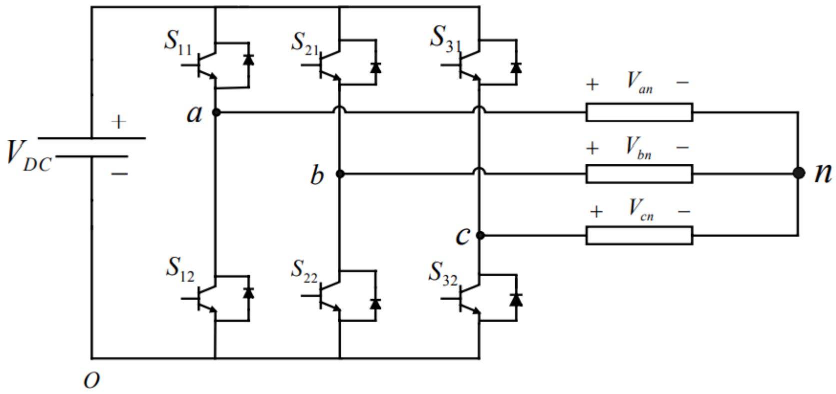


Figure 11 Three Phase Full Bridge Inverter

The main goal of these geographies is to provide a three-stage voltage source that allows for control over the sufficiency, stage, and recurrence of the voltages. In order to produce controllable recurrence and ac voltage sizes using various pulse width modulation (PWM) systems, three-stage dc/ac voltage source inverters are widely used in engine drives, dynamic channels, and combined power stream regulators in power frameworks and continuous power supplies. The six switches on the typical three-stage inverter shown in Figure 4.5 are exchanged using a tweak conspire. A diode-span rectifier, an LC or C filter, and a utility power supply are typically used to obtain the information dc.

The Table here is displaying the different switch configuration. As made sense of before all together Woking should be bound to follow bot Kirchhoff's rule. That are the current one and voltage one. To keep this rule active the circuit is stating that the switching single leg can't be activated simultaneously. the ideal working is done accordingly. as it is visiblethat ETHE s11, s22, s31 switches are the key controlling elements of the circuit. AC yelled lines and the system yield line are defiantly working.

Table 4.1 THE EXCHANGING STATES IN A THREE-STAGE INVERTER

| **S11** | **S12** | **S31** | **VAB** | **VBC** | **VCA** |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | -VDC | VDC |
| 0 | 1 | 0 | -VDC | VDC | 0 |
| 0 | 1 | 1 | -VDC | 0 | -VDC |
| 1 | 0 | 0 | -VDC | 0 | -VDC |

| | | | | | |
|---|---|---|---|---|---|
| 1 | 0 | 1 | VDC | -VDC | 0 |
| 1 | 1 | 0 | 0 | VDC | -VDC |
| 1 | 1 | 1 | 0 | 0 | 0 |

**BOOST CONVERTER**

Boost converters raise a power source's voltage. A boost converter, for instance, may increase a 5V power source's voltage to 25V. DC-DC boost converters are typically used in solar panels or battery chargers. They can also be used to power devices from the same battery that require a different operational voltage. With this setup, the DC voltage is increased to a level indicated by the circuit components you choose. Here is a boost converter's general schematic.

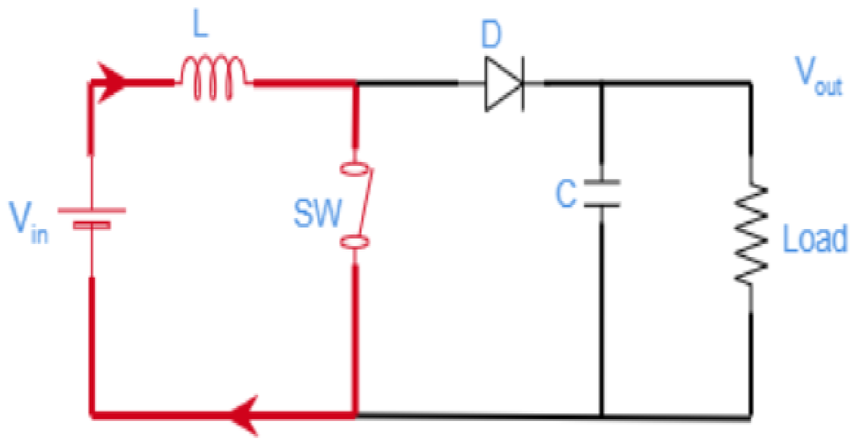


Figure 12 Boost Converter

A DC power source (Vin), an inductor (L), a diode (D), a switching mechanism (SW), a smoothing capacitor (C), and the load resistance make up the basic configuration (Load). The output voltage is Vout. Typically, a PWM signal controls a power electronics switch, such as a MOSFET or BJT transistor. The transistor is quickly switched by this PWM signal, typically thousands of times per second.

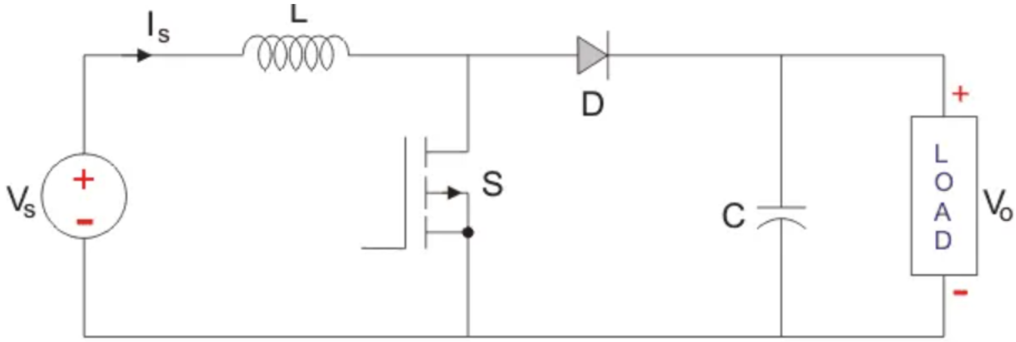


Figure 13 Simulation Diagram of Boost Converter

An inductor is connected to the voltage source for the information. The switch-functioning strong state device is connected across the source. A diode is the next switch that is used. The capacitor and diode are connected, and the two are arranged in a line as shown in the above diagram.

The input source's associated inductor generates a constant information current, which is then perceived as coming from the lift converter. The heap should also be discernible as a constant voltage source. Pulse Width Modulation is used to move the controlled switch around (PWM). PWM can be based on recurrence or be time-sensitive. Recurrence-based tweaking has drawbacks such as requiring a lot of frequencies to achieve the ideal switch control, which will then produce the ideal voltage.The majority of DC converters use time-sensitive balance. It is simple to create and use. This particular PWM balance maintains the same recurrence. There are two ways the Lift converter can function. The switch's on and leading state is the primary mode.

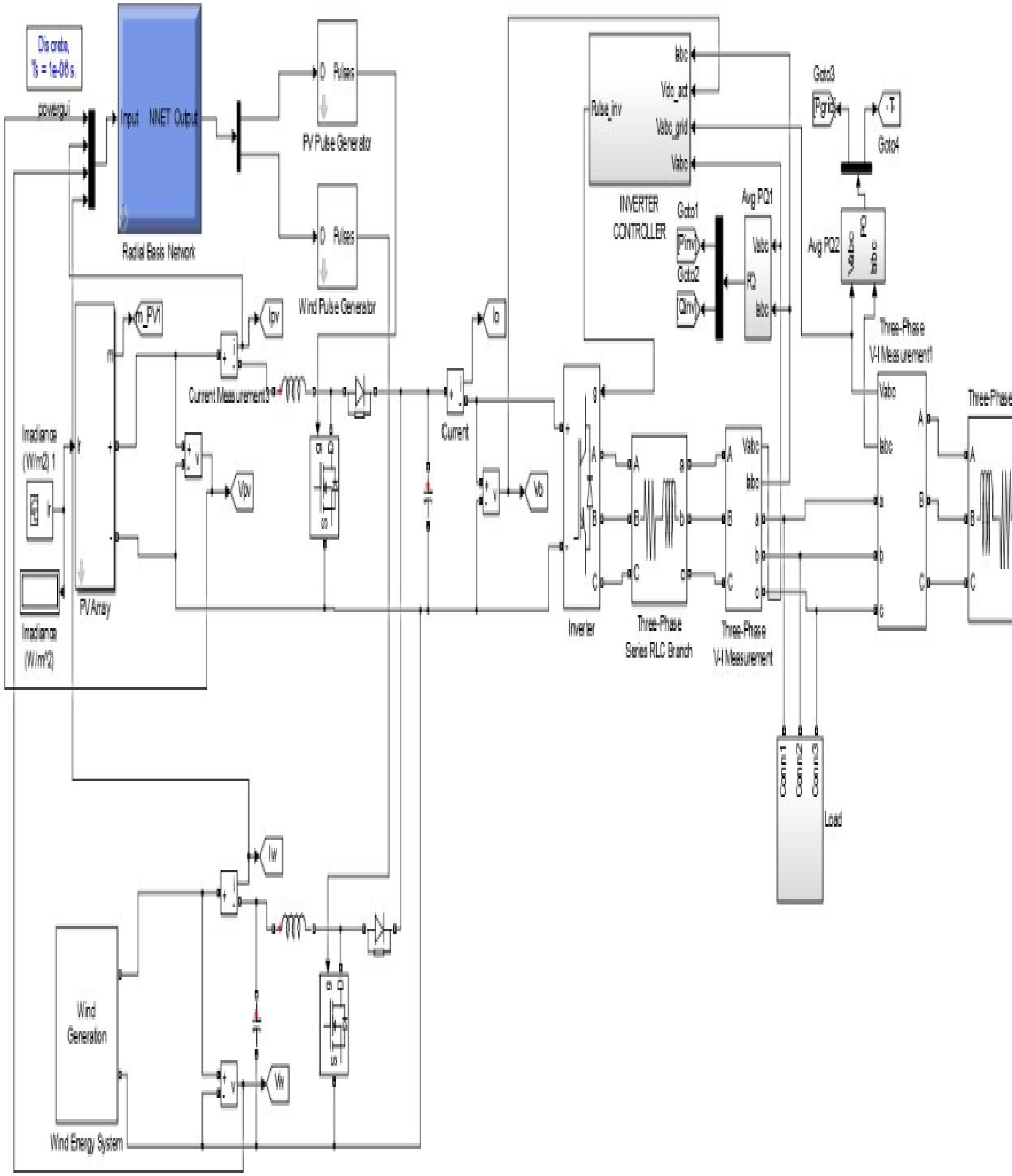


Figure 14 Simulink Model of Proposed System

**RESULTS & DISCUSSION:**

Section here is displaying the results of the research work all the different types of proposed techniques integrated to each other for this paper have a remarkable and considerable results which are shown from figure 5.1 onwards. In figure 15 solar in radians is displayed on y axis and x-axis is showing the time period for which the particular Weber per metre square of a radiance values are present. 3 different conditions according to the shading on the solar module. These are the basic elements values of PV system. Radiance has been shown with 0% shading 20% shading and 40% of the shading these are the values which are analysed from MATLAB simulation outcomes. As per Indian geographical condition the solar light a radiance for the standard values is 1000 Weber per metre square so the resultant graph on 0% of shading is showing thousand weber per metre square. If the shading is so that the solar light is only 20% stopped so the shading will be considered as 20% as a result it will stop the radiance by 20% of total estimated in radians for 20% shading radiance will be 800% resulting the drop in radians for solar module. Similarly if the shading is stopping 40% of the solar radiance than total radiance will be 600 per metre square which will be a drop of nearly 400 Weber per metre square. All the values as we are considering the simulation points but in actual field models the results have very unique and unpredictable values of radiance and shading.

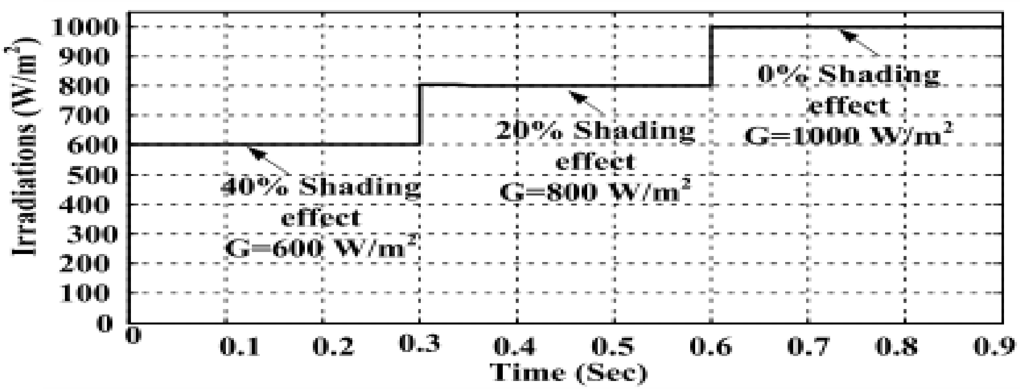


Figure 15: Input Irradiance

Figure point 16 here is displaying the simulated PV outputs of proposed work. The system is well calibrated according to the time scale for each power current and voltage. Figure 16 is showing the current comparison between Power current and voltage by comparing them from the starting of the experiment to unlimited times scale. The functioning of current can be seen from the graph that it has very less fluctuations in initial stage. But this is not so in voltage graph is showing lot of disturbance is in the starting of the experiment. as a result the voltage is showing all the disturbance are transferred to the power graph as voltage multiplied by current will be resulting in power so power current and voltage graphs are nearly similar to each other but they have the common disturbance is in the time scale of voltage and power.

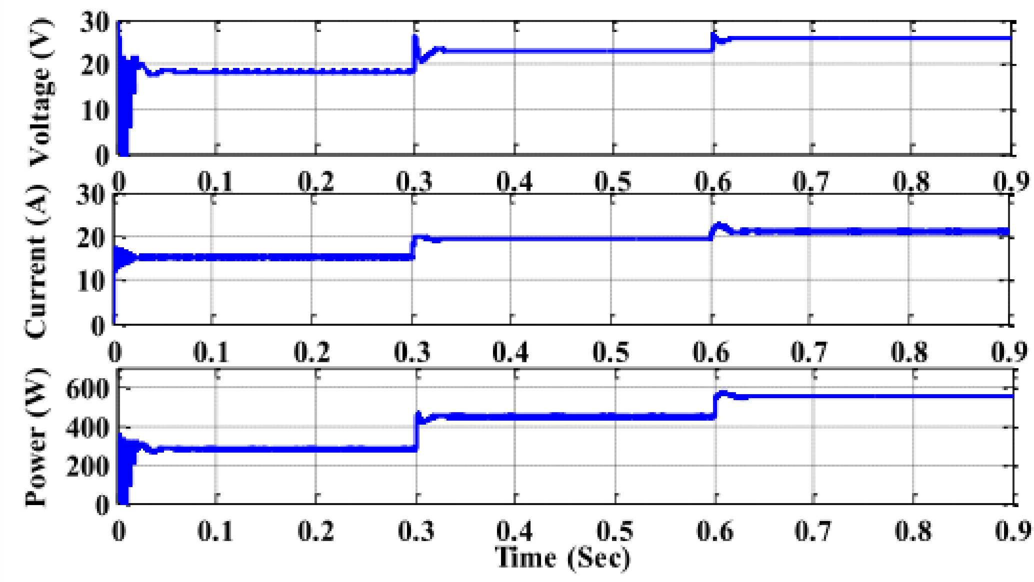


Figure 16 PV Output

In the next result 17 the simulated results of wind speed data are shown according to the time scale on x axis. Wind velocity has been shown on the y-axis on the scale of zero to 12. As the shading are displayed in the initial stage the different wind velocity are shown in the starting range till second wind velocity is 8 m per seconds. and it gradually increases with 2 scale. Wind velocity is increasing from 0.30 seconds from 8 m per second to 10 m per second. Then after 8 reaches the maximum value of 12 m per second in the final stage of the simulated result.

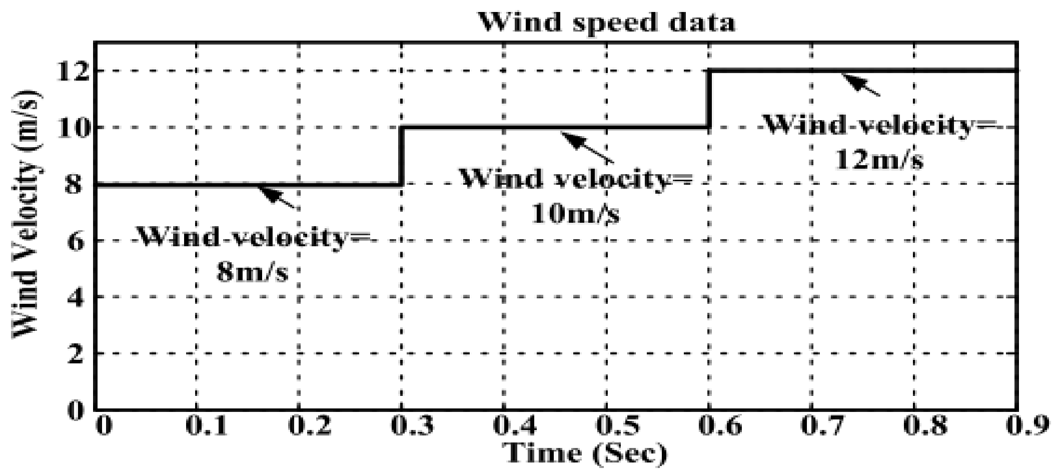


Figure 17 Wind Speed Input

The following factors are taken into account when determining whether sunlight is accessible for the proposed framework: As shown in Fig. 9, the values for 600 W/m$^2$ for a time of 0.0 to 0.30 sec, 800 W/m$^2$ for a time of

0.30 to 0.60 sec, and 1000 W/m2 for a time of 0.60 to 0.90 sec are calculated by assuming, separately, concealing effects of 40%, 20%, and 0% on sun-oriented illumination. When accessible sun-oriented light is taken into account, Figure 10 shows the voltage, current, and power waveforms of a PV board as a result. Given that sun illuminations are accessible at 600.0 W/m, they produce 324.0 W for a duration of 0.0 to 0.30 seconds; in turn, sun-oriented lights are accessible at 436.80 W and 554.40 W for durations of 0.30 to 0.60 sec and 0.60 to 0.90 sec, respectively.

For a time period of 0.0 to 0.30 sec as 8 m/s, 0.30 to 0.60 sec as 10.0 m/s, and for the period considering accessible information from each source, the accessibility of wind speed information is considered as follows. A single MPPT in the made-combination framework results in a typical DC interface force of 587.0 W from 0 to 0.30 sec, 721.0 W from 0.60 to 0.90 sec.

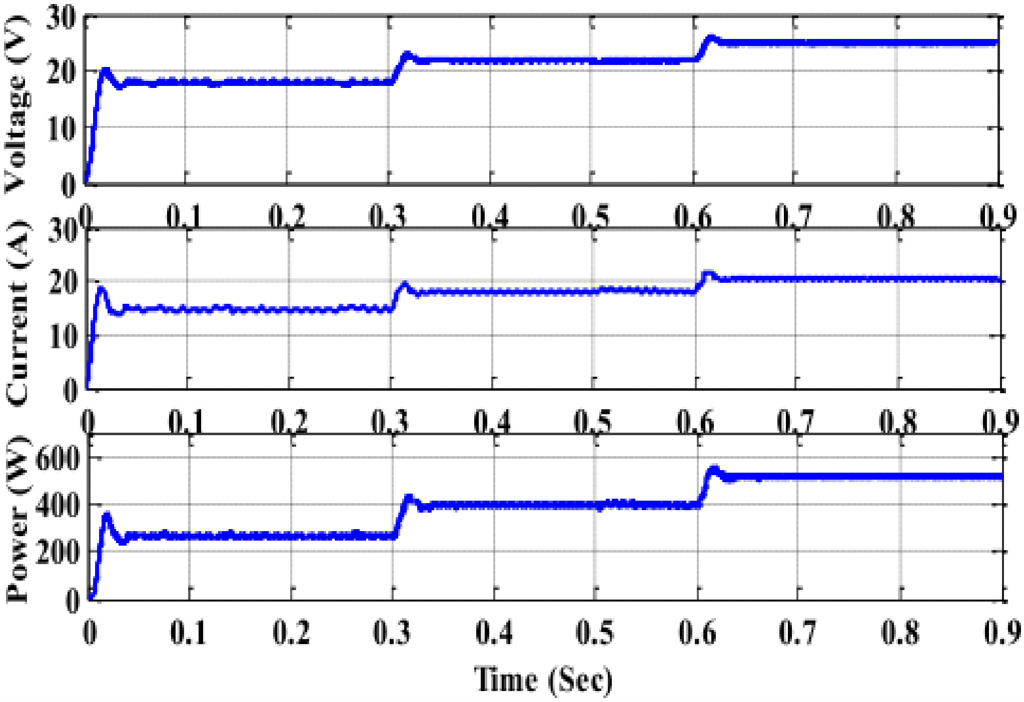


Figure 18: WECS Output

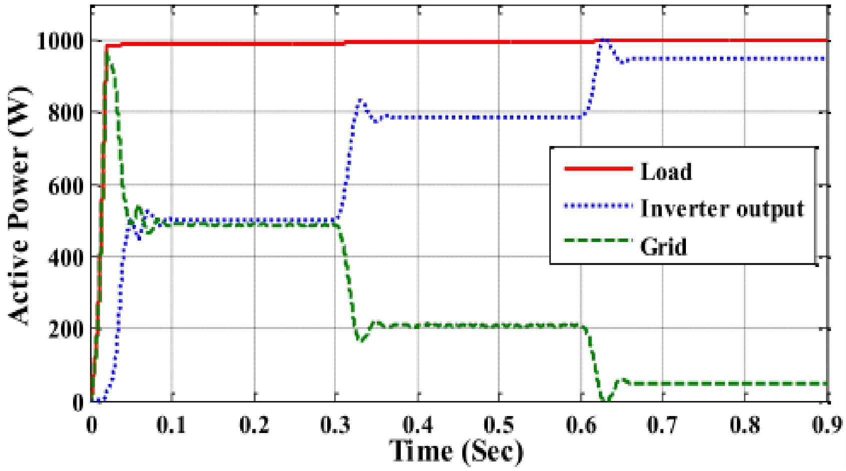


Figure 19: Active Power in System

Here is showing the active power according to 3 particular sections that is load inverter output and grid power. The figure is quite complex as the load active power is fluctuating just once and remains constant throughout the experiment. But inverter output and gripped active out power are not so changing and as a result they have some inverse type of graph between each other.

Figure 20 and 21 here is showing grid voltage. Figure 20 here is showing three phase grade voltage according to the times scale t on x-axis for Va. 21 is only a sub part of figure 20. it is been displayed so to just get a clear cut and magnified view for three phase grid voltage till 0.34 sec.

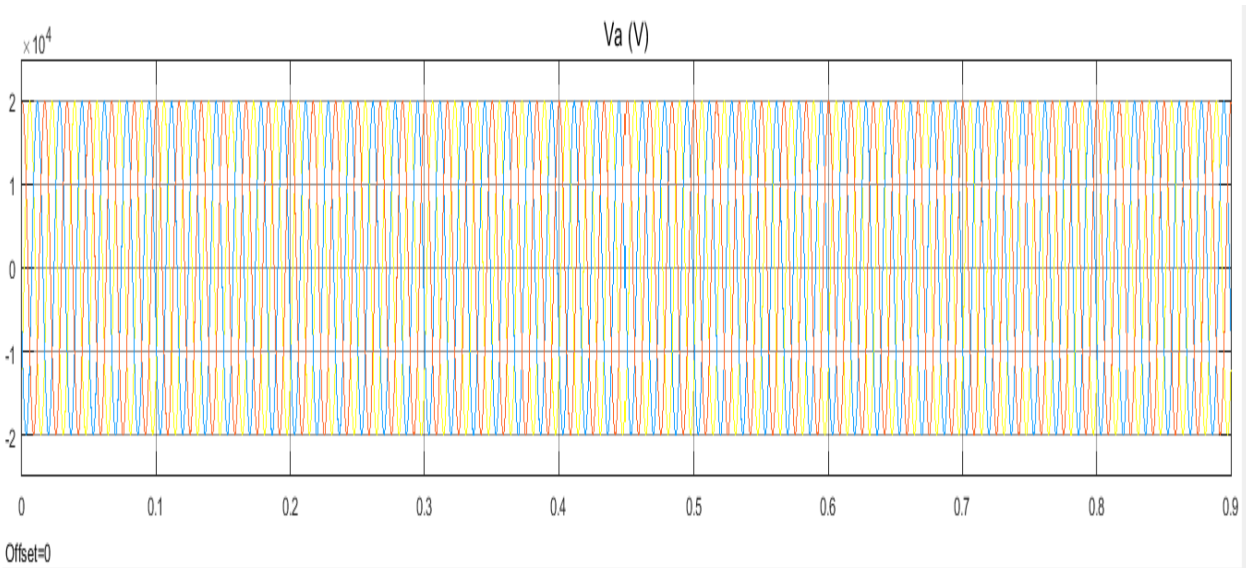


Figure 20 Grid voltage

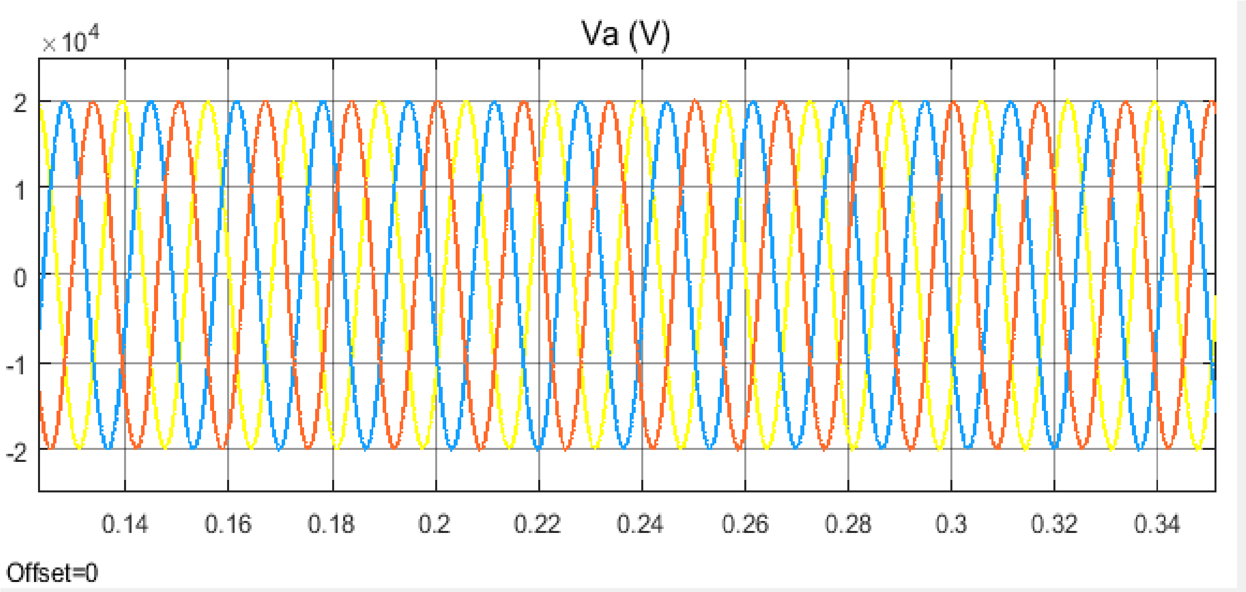


Figure 21: Three Phase Grid Voltage

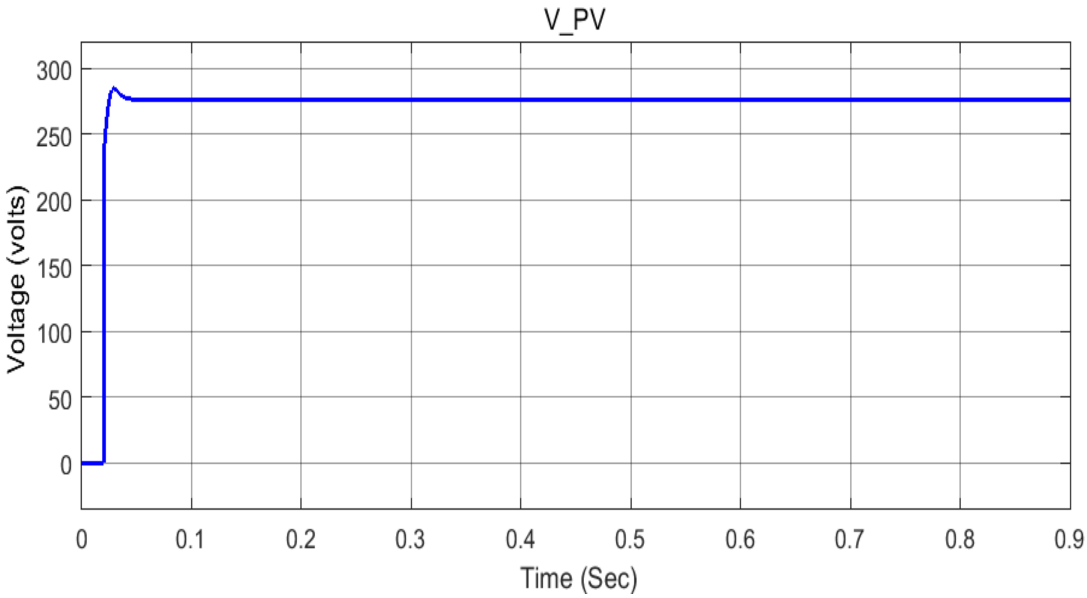


Figure 22: PV module output Voltage

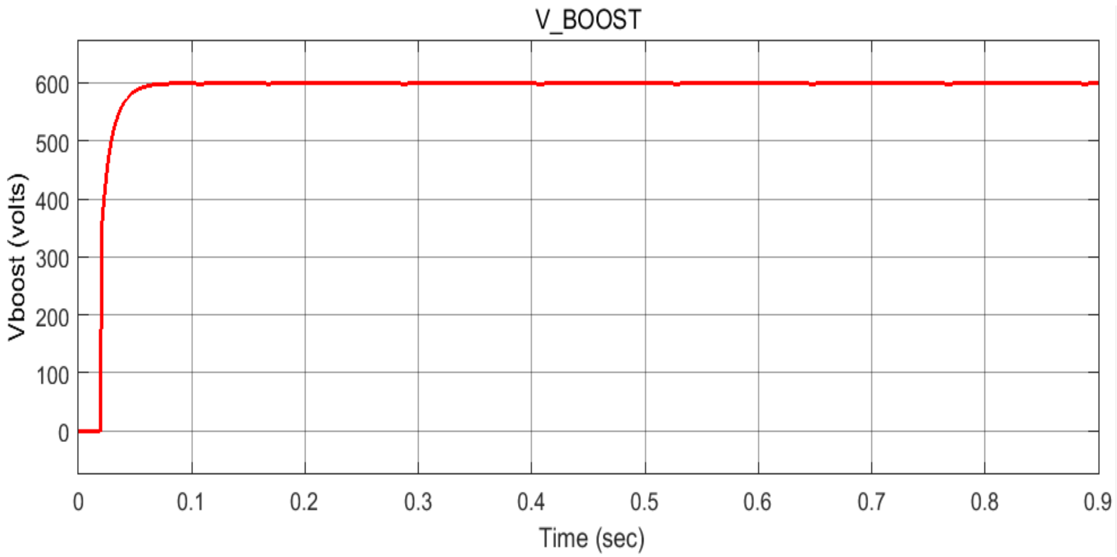


Figure 23: Vboost output Voltage after boost converter (PV)

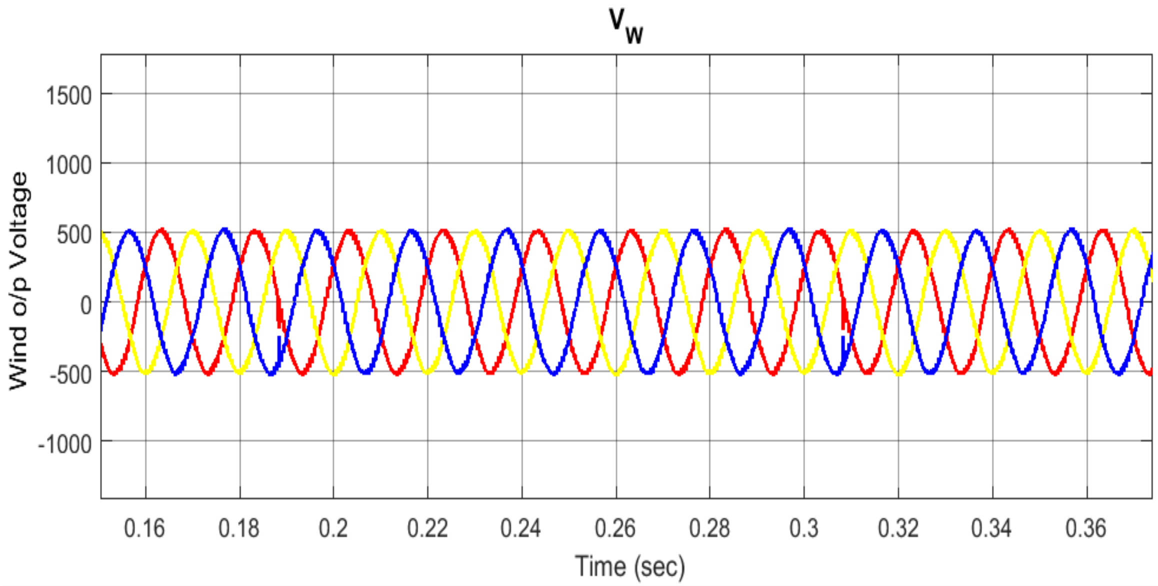


Figure 24: Wind Output Voltage

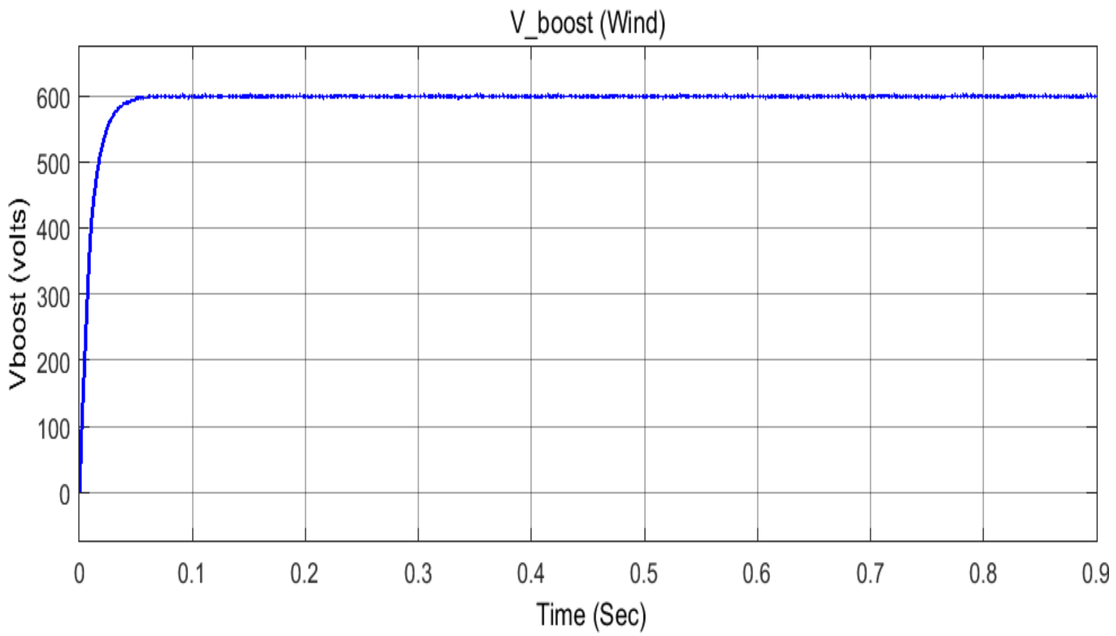


Figure 25: Vboost Output Voltage after Boost Converter (wind side)

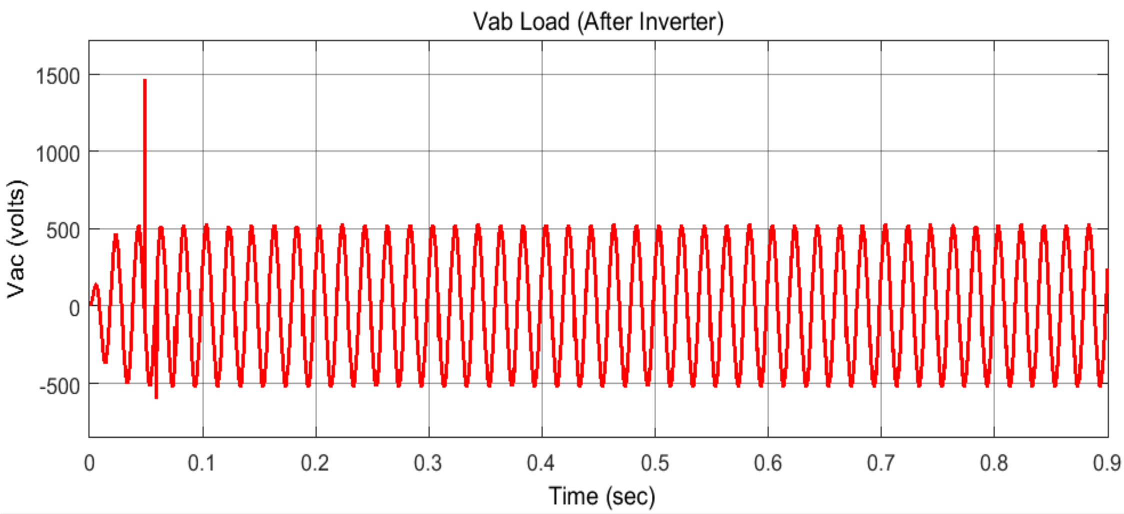


Figure 26: Va Inverter O/P Voltage

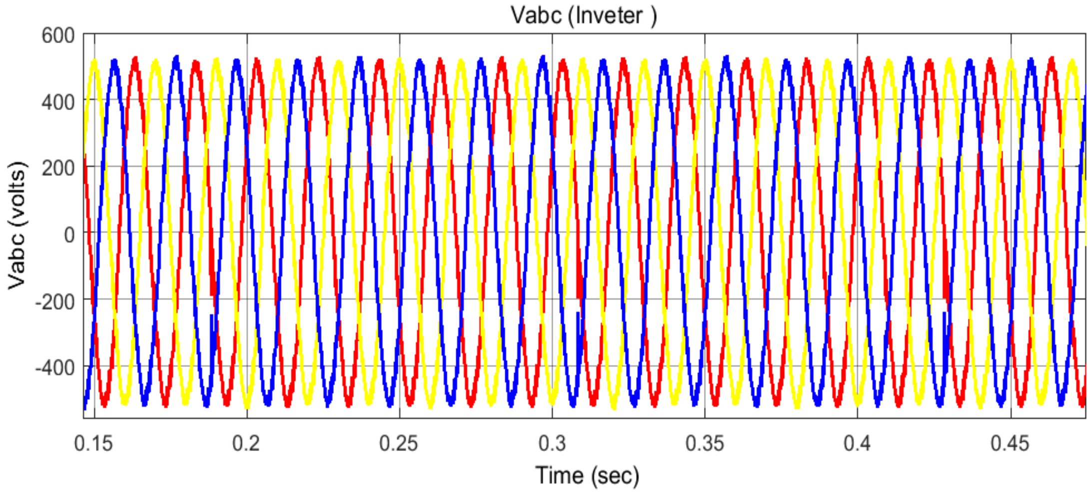


Figure 27: Vabc Inverter O/P Voltage

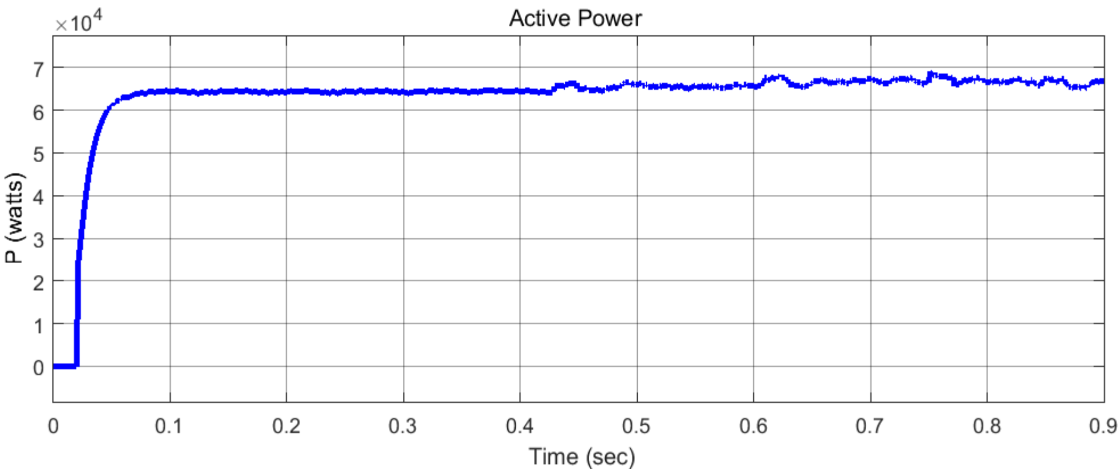


Figure 28: Active Power Generated

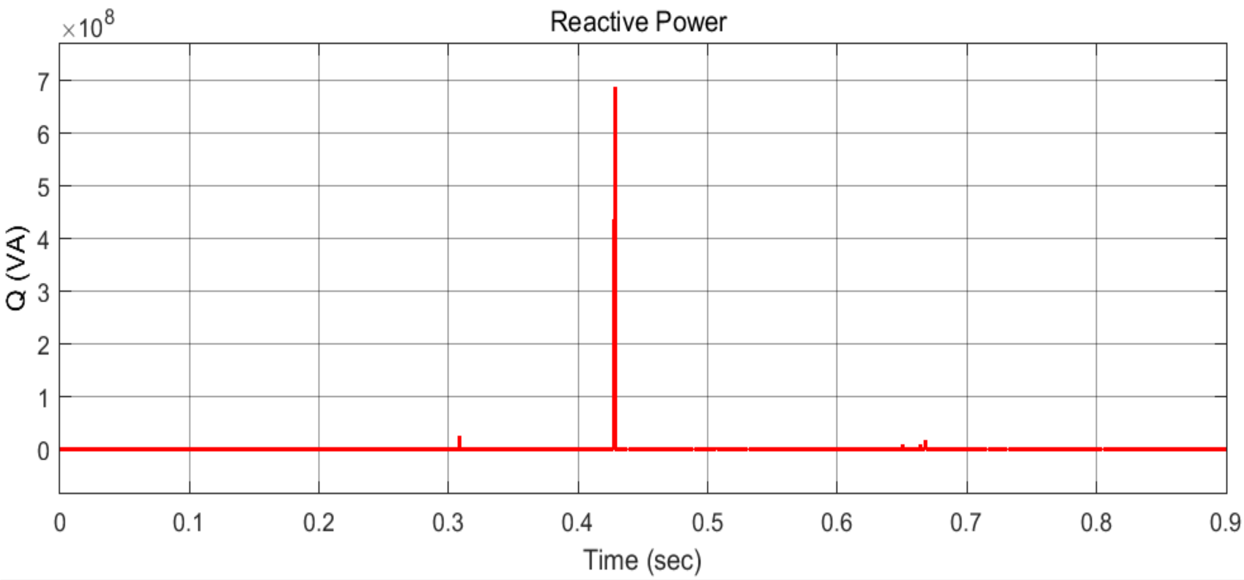


Figure 29: Reactive Power Generated

**CONCLUSION AND FUTURE SCOPE**:

Currently power sector is embracing more and more new options in it. Power sector going to worlds distributed power generation. In this solar has come up with great scope. The mppt techniques currently used on solar are working in efficiently. In efficiently. So combination of different techniques are opted for better output. The research share has shown multiple functioning of mppt with ANN.

Although the cost of installation is high, designing such a model into a large panel and on a large scale is more challenging because its construction is challenging. Despite the extensive research that has been done in this area, the proposed architecture can still be improved by employing a variety of techniques that reduce the shortcomings of solar cells or modules while increasing efficiency. Some of these techniques include the use of reflections, the use of trackers, cooling techniques, cleaning techniques, etc.

**Declaration of Conflicting Interests**

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

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