IMPACT OF SOLAR AND WIND INTEGRATION ON FREQUENCY CONTROL SYSTEM

K. Punitha[1], M. Rajkumar[2], S. Karthick[3], Dr. S. Saravanan[4]

[1,2]PG Student, Dept. of Electrical and Electronics Engineering, Muthayammal Engineering College, Rasipuram
[3]Assistant Professor, Dept. of Electrical and Electronics Engineering Muthayammal Engineering College, Rasipuram, India
[4]Head &Professor, Dept. of Electrical and Electronics Engineering Muthayammal Engineering College, Rasipuram, India

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Abstract - *This paper proposes Micro grid is an autonomous gadget which can attain self-control, self-safety and self-control. It will not handiest comprehensively take advantage of the benefits of renewable power sources (RES) in environment protection and strength conservation, but also triumph over its intermittency and volatility, reduce the impact to distribution device when the dispensed power resources (DERs) are connected to the distribution network as micro grids. Deployment of micro grids can facilitate efficient demand facet control and integration of RESs at the distribution level. This venture proposed an interactive operation method for micro grid cooperated with distribution gadget based on demand response .In the prevailing paper, a day-ahead operation optimization version of micro grid on account of strength purchasing price, energy selling benefits, generation fee of disbursed generations (DGs) is proposed and then an interaction version wherein the micro grid responds to the interaction call for through adjusting the scheduling plan aiming at coping with the immoderate peak load of distribution gadget is presented. We analyzed the relationship between interaction potential and interaction value through sensitivity analysis and eventually completed the interaction among the micro grid and the distribution system. The simulation outcomes in a micro grid, which has a wind turbine (WT), photovoltaic (PV) gadget and loads, display the effectiveness of the proposed method.*

***Key Words*: Wind Turbine, Photo Voltaic, Ac-Dc Converter.**

1. INTRODUCTION

The micro grid has come to be a broadly accepted idea for dealing with the strength of various disbursed generators and the grid. In order to lessen the tactics of more than one opposite conversions in an man or woman ac or dc grid and to facilitate the connection of numerous renewable ac and dc sources and masses to strength system, the hybrid ac/dc micro grid is becoming a focus inside the area of micro grid.

The first step towards maximizing the performance of remoted bidirectional DC- DC converter is to study the quandary of the existing systems. These converters were the focus of substantial studies hobby over the last 4 ten years. In this section, previous works in the region of bidirectional DC-DC converter is reviewed with the goal of present day and voltage popularity of studies on this specialization project comparing topologies for their viable implementation in low strength LLC bi-directional DC-DC converter.

Bidirectional power converters are connected among ac sub grid and dc sub grid in hybrid ac/dc micro grid, and their reliability and operation performance directly have an effect on the reliability and financial efficiency of the hybrid ac/dc micro grid. Because the electrical parameters and output impedances of parallel bidirectional strength converters cannot be identical, the circulating modern and electricity-sharing deviation will be generated amongst parallel converters.

2. PROPOSED SYSTEM

The coexistence of a hybrid ac/dc infrastructure for Hybrid micro grid is in the foreseeable future. This paper provides a hybrid ac/dc infrastructure which entails DC distribution network connected to the current AC infrastructure thru an efficient ac/dc controlled converter. DC community in the home allows for green integration of renewable sources (solar and wind power) all of the native DC hundreds, even as the AC hundreds will stay related to an present AC infrastructure

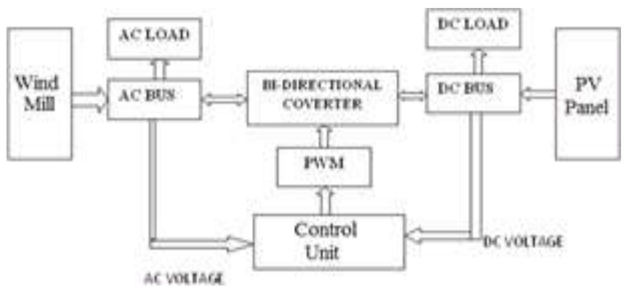

Fig -1: Proposed block diagram

2. BLOCK DIAGRAM CONFIGURATIONS

Bi-Directional Converter

Most bidirectional DC-DC converter topologies can be illustrated as block diagram shown beneath and it also characteristics electricity flows in both directions. Energy storages in general makes use of bidirectional DC- DC converter for charging and discharging applications may be either in half-bridge or full-bridge association of semi-conductor switching devices. The buck form of converter has electricity storage on the high voltage side, while boost kind of converter has power storage on the low voltage side.

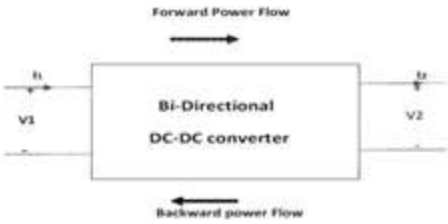

Fig- 2: Bi-Directional converter

The concept of energy glide in both path for bidirectional dc-dc converter is operation of switching devices recognize modern-day go with the flow in every way. Bidirectional dc-dc converters are evolved from two unidirectional semiconductor switching devices such as; MOSFET, Transistors and IGBT energy switches built with parallel diodes. These parallel diodes serve double sided energy drift. Even though there are numerous topologies of bidirectional dc-dc converter; basically they're divided into two sorts such as remoted bidirectional DC-DC converters and non-remoted bidirectional DC-DC converters based totally on the isolation fabric between enter and load.

Non-isolated Bidirectional Converter

Non-isolated bidirectional DC-DC converters energy flow with none isolation between input and load. The transformer-much less non-isolated dc-dc converters may be either boost, buck or greenback- boost converters. Even though it's appealing to reap isolation for excessive frequency conversion packages among the weight and the source however non- isolated type of converter is more attractive from the efficiency, size, weight and price point of view. The most familiar DC-DC converters, such as buck and raise converters have only one direction power flow

Since step-up and step-down converters comprise diode on their structure which has characteristic of one direction strength flow. However it has superb to alternate unidirectional converter into bidirectional by using replacing the diodes with controllable switches like MOSFETs and IGBTs. As Fig.3 shows that the structure of converter is a mixture of unidirectional step-up and step-down converters. So that the unidirectional converters are transferred into bidirectional converters by way of changing the diodes with controllable switches like MOSFETs and IGBTs proven in unidirectional dc-dc converters

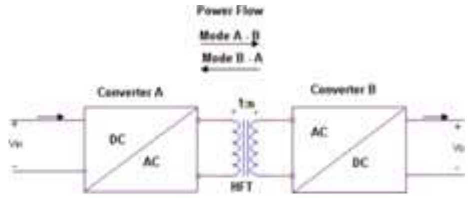

Fig- 3: Non-isolated Bidirectional Converter

Dc to Dc Converters

DC to DC converters are critical in portable electronic devices such as cellular phones and pc computers, which can be supplied with electricity from batteries primarily. Such electronic devices frequently contain several sub-circuits, every with its own voltage level requirement specific from that supplied via the battery or an external deliver (on occasion better or lower than the supply voltage). Additionally, the battery voltage declines as its stored electricity is drained. Switched DC to DC converters offer a technique to growth voltage from a partially decreased battery voltage thereby saving space as opposed to the use of a couple of batteries to accomplish the same thing. Most DC to DC converters also regulate the output voltage. Some exceptions include high-efficiency LED power sources, which are a kind of DC to DC converter that regulates the current through the LEDs, and simple charge pumps which double or triple the input voltage.

The red-colored line, for the PV, indicates a most voltage importance of 0.9982 pu and a minimal voltage value of 0.9870 pu with corresponding losses of 118.6 kW. The base case energy flow with none VRG, offers a voltage value of 0.9861 pu at bus14. The output voltage of the sun/wind device at different hours of the day, because of the combination of solar PV is proven in Fig.4

Fig -4: AC Output during Source From Solar To Wind

The boom in gadget losses due to hybrid solar and wind turbine is a end result of a minor increase in its size. The losses on distribution device lessen to a minimum because the DG increases in length up to an most efficient level. However, the losses start to increase if the scale of the DG is similarly increased. It may also even overshoot the base case losses. There is appreciable voltage increase in the hybrid solar and wind in comparison to the person use of solar PV and wind.

Meanwhile, the output voltage and modern-day with the wind turbine linked independently to the micro grid is proven in Fig.5. Its most voltage is 0.9972 pu and the minimal is 0.9933 pu and the losses of 116.2 kW.

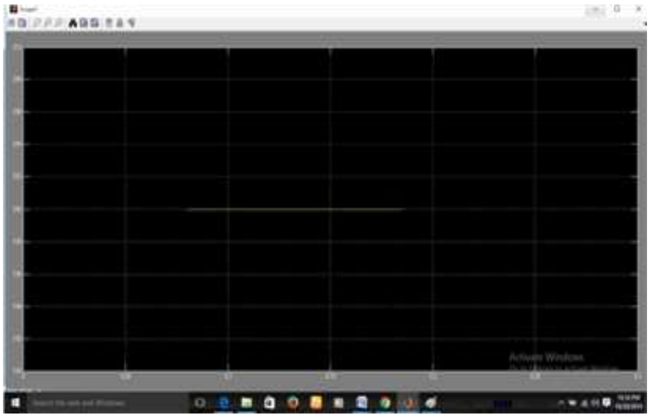

Fig -5: AC Output during Source from Wind to Solar

WIND MILL

A windmill is a machine which converts the power of wind into rotational motion through adjustable vanes referred to as sails. The predominant use is for a grinding mill powered via the wind, lowering a solid or coarse substance into pulp or minute grains, via crushing, grinding, or pressing. Windmills have moreover provided power to sawmills, paper mills, hammer mills, and wind pumps for obtaining sparkling water from underground or for drainage (specifically of land under sea level)

Vertical-axis windmills

The first realistic windmills were the vertical axle windmills invented in Japanese Persia (what is now Afghanistan), as recorded with the aid of the Persian geographer Estakhri within the 9th century. The authenticity of an earlier anecdote of a windmill involving the second caliph Umar (AD 634–644) is questioned due to the fact that it appears in a 10th- century document. Made of six to 12 sails covered in reed matting or material, those windmills have been used to grind grain or draw up water, and had been quite one-of- a-kind from the later European horizontal-axis versions. Windmills had been in great use across the Middle East and Central Asia, and later unfold to China and India from there.

Some popular treatments of the problem have speculated that, by way of the 9th century, the Persian- style vertical-axle generators unfold to Europe through Al-Andalus (Islamic Spain).This has been denied manner of the professional of medieval European technology, Lynn White Jr., who elements out that there's no evidence (archaeological or documentary) that the Afghanistan-fashion vertical-axle windmill spread as some distance west as Al-Andalus, and notes that every one Iberian windmills turned around on horizontal axles until toward the middle of the fifteenth century.

Another historian of generation, Michael Jonathan Taunton Lewis, recommended an alternative path of transmission for the Islamic horizontal-shaft windmill, with its diffusion to the Byzantine Empire and its next transformation into the vertical-shaft windmill in Europe. Late medieval vertical-axle windmills much like the Islamic/Persian design may be observed alongside this direction, in particular in Karpathos, Greece, and Candia, Crete.

The Crusades has also been recommended as another viable direction of transmission, though within the sense of stimulus diffusion, wherein the concept became diffused in place of the technology itself. However, the controversy about whether or not the European vertical- shaft windmill developed from the Islamic horizontal- shaft windmill or changed into an independent development remains unresolved.

Horizontal-axis windmills

In northwestern Europe, the horizontal-axle or vertical windmill (so called because of the measurement of the movement of its sails) dates from the remaining quarter of the twelfth century inside the triangle of northern France, Japanese England and Flanders. Lynn White Jr. Claims that the first sure reference to the European horizontal-axle windmill is dated to 1185 in Weedley, Yorkshire. These earliest turbines have been used to grind cereals. The proof at gift is that the earliest type become the sunk put up mill, so named because of the large upright submit on which the generators primary structure (the frame or greenback is balanced).By mounting the frame this way, the mill is able to rotate to face the wind direction an critical requirement for windmills to function economically in North-Western Europe, wherein wind guidelines are variable. By the end of the thirteenth century the masonry tower mill, on which most effective the wooden cap rotated as opposed to the whole body of the mill, had been introduced. In the Netherlands these stone tower like generators are known as spherical or eight-sided stone degree mills, ground-sailers (windmills with sails reaching nearly all the way down to the ground) mound turbines, etc. Are continuously cylindrical (along with atop castle or metropolis wall towers). Because handiest the cap of the tower mill had to be grew to become the precept structure can be made a whole lot taller, permitting the sails to be made longer, Such turbines frequently have a small auxiliary set of sails called a fantail at the rear of the cap and at proper angles to the sails; this rotates the cap thru gearing so that the sails face into the wind.

Multi-sailed windmills

The majority of windmills had four sails. An boom inside the wide variety of sails supposed that an increase in strength might be obtained, at the cost of an boom within the weight of the sail assembly. The earliest record of a multi-sailed mill within the United Kingdom becomes the five sail Flint Mill, Leeds, cited in a file with the aid of John Smeaton in 1774. Multi-sailed windmills were stated to run smoother than four sail windmills. In Lincolnshire, more multi-sailed windmills were located than everywhere else within the United Kingdom. There were 5, six and eight sail windmills. If a four sail windmill suffers a broken sail, the only opposite can be removed and the mill will paintings with two sails, generating approximately 60% of the electricity that it'd with all four sails. A six sail mill can run with two, three, 4 or six sails. An 8 sail mill can run with two, four, six or 8 sails, thus allowing more than a few of alternatives if an accident occurs. A five sail mill can best run with all 5 sails. If one is damaged then the mill is stopped till it is replaced.

3. SOLAR PANEL

A sun panel (photovoltaic module or photovoltaic panel) is a packaged interconnected meeting of solar cells, also called photovoltaic cells.. The solar panel is used as a thing in a bigger photovoltaic device to offer power for commercial and residential applications. Because a unmarried sun panel can simplest produce a limited quantity of energy, many installations contain numerous panels. This is called a photovoltaic array. A photovoltaic installation usually consists of an array of solar panels, an inverter, batteries and interconnection wiring.

Solar panels use light strength (photons) from the sun to generate strength thru the photovoltaic effect. The structural (load carrying) member of a module can either be the top layer (superstrate) or the returned layer (substrate). The majority of modules use wafer-based totally crystalline silicon cells or a thin-film mobile based totally on cadmium telluride or silicon. Crystalline silicon, which is usually used within the wafer form in photovoltaic (PV) modules, is derived from silicon, a commonly used semi-conductor.

Electrical connections are made in collection to acquire a preferred output voltage and/or in parallel to offer a favored quantity of modern-day source capability.

Diodes are protected to keep away from overheating of cells in case of partial shading. Since cellular heating reduces the working efficiency it's far acceptable to decrease the heating. Very few modules incorporate any design capabilities to lower temperature; but installers try and offer top ventilation behind the module.

New designs of module encompass concentrator modules in which the light is concentrated by an array of lenses or mirrors onto an array of small cells. This allows the usage of cells with a completely high-value per unit area (inclusive of gallium arsenide) in a value-competitive way.

Depending on construction, the photovoltaic can cowl quite a few frequencies of mild and may produce strength from them, however sometimes can't cover the entire sun spectrum (specifically, ultraviolet, infrared and coffee or diffused light). Hence much of incident sunlight electricity is wasted whilst used for solar panels, even though they can give far higher efficiencies if illuminated with monochromatic mild. Another design idea is to break up the light into one of a kind wavelength degrees and direct the beams onto special cells tuned to the ideal wavelength levels. This is projected to raise efficiency with the aid of 50%. Also, the usage of infrared photovoltaic cells can boom the efficiencies, producing strength at night.

4. BUCK CONVERTER

A greenback converter is a step-down DC to DC converter. The schematic illustration of buck converter is as proven in Fig 6. Its layout is similar to the step-up enhance converter, and like the improve converter it is a switched- mode strength supply that makes use of two switches (a transistor and a diode), an inductor and a capacitor.

The handiest manner to reduce a DC voltage is to use a voltage divider circuit, but voltage dividers waste energy, given that they function by way of bleeding off excess energy as heat; also, output voltage isn't regulated (varies with input voltage).. Buck converters, on the other hand, can be remarkably efficient (effortlessly as much as 95% for included circuits) and self-regulating, making them beneficial for obligations such as converting the 12–24 V typical battery voltage in a laptop right down to the few volts wished through the processor. The Fig 7 suggests the waveform of input and output of dollar converter wherein the output voltage is much less than the input voltage.

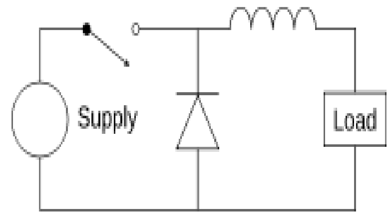

Fig 6: Buck Converter

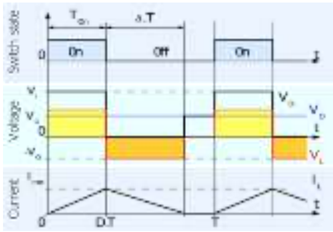

Fig 7: I/P and O/P Waveform

5. BOOST CONVERTER

A boost converter (step-up converter) is a energy converter with an output DC voltage more than its input DC voltage. It is a category of switching-mode energy supply (SMPS) containing at the least semiconductor switches (a diode and a transistor) and as a minimum one power storage element. Filters made of capacitors (once in a while in mixture with inductors) are generally added to the output of the converter to lessen output voltage ripple. The Fig.8 indicates the model of raise converter and enter and output waveform of improve converter wherein output is greater than the input.

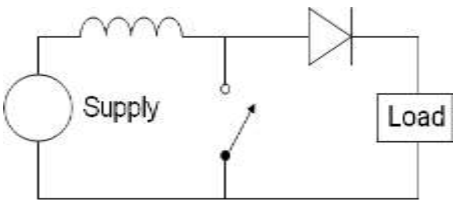

Fig 8: Boost Converter

6. IGBT

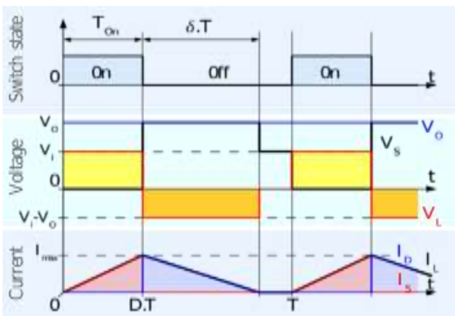

Fig 9: I/P and O/P Waveform

powered electricity in many modern-day appliances: electric powered cars, trains, variable pace refrigerators, air- conditioners or even stereo structures with switching amplifiers. Since it's miles designed to rapidly turn on and off, amplifiers that use it regularly synthesize complex waveforms with pulse width modulation and low-pass filters.

The IGBT is applied in medium- to immoderate-electricity applications including switched-mode energy supply, traction motor control and induction heating.

The IGBT is a fairly recent invention. The first-era devices of the Eighties and early 1990s had been relatively sluggish in switching, and at risk of failure via such modes as latchup and secondary breakdown. Second-era devices were tons improved, and the modern third-technology ones are even better, with pace rivaling MOSFETs, and fantastic ruggedness and tolerance of overloads. An IGBT cell is constructed similarly to a n-channel vertical construction electricity MOSFET besides the n+ drain is changed with a p+ collector layer, as a consequence forming a vertical PNP bipolar junction transistor.

This additional p+ area creates a cascade connection of a PNP bipolar junction transistor with the floor n-channel MOSFET. This connection consequences in a drastically lower ahead voltage drop as compared to a conventional MOSFET in higher blocking off voltage rated gadgets. As the blocking voltage score of each MOSFET and IGBT devices increases, the intensity of the n- drift region ought to boom and the doping need to decrease, ensuing in roughly square relationship boom in forward conduction loss in comparison to blocking off voltage functionality of the device. By injecting minority carriers (holes) from the collector p+ place into the n- drift area at some point of forward conduction, the resistance of the n- drift area is appreciably decreased. However, this resultant reduction in on-country ahead voltage comes with several penalties:

• The additional PN junction blocks reverse modern-day flow. This means that in contrast to a MOSFET, IGBTs can't conduct inside the reverse direction. In bridge circuits where opposite modern-day flow is wanted a further diode (called a freewheeling diode) is located in parallel with the IGBT to behavior cutting-edge inside the opposite direction. The penalty isn't always as excessive as first assumed though, because at the better voltages wherein IGBT usage dominates, discrete diodes are of considerably higher overall performance because the body diode of a MOSFET. • The opposite bias score of the N-drift location to collector P+ diode is usually great of tens of volts, The insulated gate bipolar transistor or IGBT is a three- terminal strength semiconductor device, cited for high performance and speedy switching. It switches electric so if the circuit software program applies a reverse voltage to the IGBT, an additional collection diode need to be used. • The minority carriers injected into the n- drift location take time to go into and exit or recombine at spark off and flip off. This consequences in longer switching time and hence higher switching loss in comparison to a energy MOSFET. • The device turns off slowly because of long recombination times, which makes it improper for tough turn-off packages (inclusive of increase or fly back electricity converters). • The more PN junction gives a diode-like voltage drop to the device. At lower blockading voltage ratings, this greater drop method that an IGBT should have a higher on-nation voltage drop.

As the voltage rating of the device increases, the gain of the decreased N- drift area resistance overcomes the penalty of this diode drop and the overall on-state voltage

4. CONCULSIONS

A unified manipulate for parallel operation of more than one dc-ac interlinking converters in hybrid ac/dc MGs is proposed on this paper. Theoretical evaluation and simulation/experimental outcomes have proven that plug- and-play feature can be found out with the offered unified manage. Moreover, the ICs may be adaptive to operation mode change of the hybrid micro gird, achieving easy transition intelligently, routinely and seamlessly among extraordinary operation modes.

For destiny work, the following elements might be recommended. In addition, in an actual hybrid ac/dc micro grid, those droop functions in both ac and dc MGs may be changed due to the variations of these slack terminals, or secondary manage for ac frequency and dc voltage. So the up to date hunch characteristics of ac and dc micro grids are needed for the proposed unified control. In order to clear up the aforementioned issues, and recognize independent and intelligent control of hybrid MGs under complex operation conditions, secondary coordinated manage among ac micro grid, dc micro grid and ICs may be a viable approach.

As the secondary manipulate structures for ac frequency and dc voltage recovery are continually contained in a hybrid micro grid, the proposed unified control as a nearby controller may be quite like minded with those secondary control structures. Moreover, the manipulate variable K may be flexibly designed in keeping with other energy control objectives, inclusive of interlinking electricity dispatch, and different optimal electricity dispatch algorithms. Thereby, the proposed unified control scheme has better flexibility and compatibility.

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