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Grid-Connected PV-Wind-Battery based Multi-Input Transformer Coupled Bidirectional DC-DC Converter for Household Applications

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Abstract: ***Hybrid power system will be utilised to decrease energy storage wants. There's increasing interest for the use of exchange or property power sources to accomplish good and ease power for Residential Application the PV-wind hybrid system restores the foremost reduced cost esteems to stay up an identical level of DPSP once contrasted with independent solar and wind systems. For all heap requests the levelised energy taken a toll for PV-wind hybrid system is reliably below that of independent solar PV or wind system. The PV-wind hybrid various is techno financially possible for provincial zap. This paper proposes a completely unique incorporated device topology for interfacing between the energy storage system and therefore the dc transport for a personal micro grid application The planned coordinated full-bridge dc–dc device displays the incidental to elements: low range of dynamic gadgets contrasted with the converters usually connected to comparative applications, low data and yield current swell, high voltage proportion, duplex power stream, and galvanic disengagement.***
Keywords: Battery charge control, full-bridge bidirectional converter, hybrid system, solar photovoltaic (PV), coupled boost dual-half-bridge bidirectional converter, wind energy.

I. INTRODUCTION

Rapid depletion of fuel reserves, ever increasing energy demand and considerations over global climate change encourage power generation from renewable energy sources. star electrical phenomenon (PV) and wind have emerged as fashionable energy sources thanks to their eco-friendly nature and price effectiveness. However, these sources ar intermittent in nature. Hence, it's a challenge to produce stable and continuous power victimisation these sources. this will be self-addressed by expeditiously group action with energy storage components. The attention-grabbing complementary behaviour of solar insolation and wind rate pattern as well as the on top of mentioned benefits, has semiconductor diode to the analysis on their integration leading to the hybrid PV-wind systems. For achieving the mixing of multiple renewable sources, the standard approach involves using dedicated single-input converters one for every supply, that are connected to a standard dc-bus. However, these converters aren't effectively utilised, thanks to the intermittent nature of the renewable sources. additionally, there ar multiple power conversion stages that scale back the potency of the system. A two-way multiple input non-isolated dc-dc convertor is conferred to interface a ultracapacitor and battery for transport applications. The convertor is capable of attraction from multiple energy sources to produce the demand of car masses [1]. At every input port, some elements will be shared. However, the flexibleness of energy delivery is restricted. The parallel or series configuration will be extended at the output to derive multi-port dc-dc converters [2]. The circuit structure is simplified and also the power density is improved as a result of the facility devices ar fully shared within the primary facet. The 2 filter inductors within the bi-directional buck-boost converters and also the isolated electrical device within the full-bridge topology ar integrated and replaced by the coupled inductors. Further, the heartbeat breadth modulation (PWM) and - phase-shift (PPS) management strategy is introduced to attain voltage regulation inside a precise in operation vary [3]. In [4], the convertor is attention-grabbing for coupling renewable energy supplys like electrical phenomenon (PV) source, electric cell (FC) supply, and battery. To feed dc masses, an occasional capability multi-port convertor for a hybrid system is conferred. In [5], some power ports share a standard ground and these power ports are isolated from the remaining, for matching port voltage levels. By using pulse breadth modulation and phase-angle-shift management theme, Voltage laws between any 2 ports will be achieved. B. Mangu [6], projected a system that aims to satisfy the load demand, manage the facility result completely different sources, inject the excess power into the grid, and charge the battery from the grid as and once needed. The projected convertor design has reduced range of power conversion stages with less part count and reduced losses compared with existing grid-connected hybrid systems. This improves the potency and also the responsibility of the system. All the state of art on convertor topologies conferred to this point will provide solely single part masses. Whereas within the projected topology, voltage boosting capability is accomplished by a voltage number. Hence, it will be used for 3 part domestic applications.

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II. RELATED WORK

With the reason for enhancing the proficiency of the drivetrain and to limit the reliance on the oil fills at least two wellsprings of the impetuses (counting ICE) are being utilized in the vehicles. This are known as the Hybrid Electric Vehicles (HEVs). The topological diagram of the different hybrid drive trains and the comparision between them has been introduced in [1, 2, 4]. The part and the prerequisite of the power gadgets and dc converter in the HEV innovation was investigated and clarified in [3, 5]. The comparision between the different no detached Bidirectional DC-DC converters on the premise of their execution has been done in [7,8,10]. Engine choice and the different drive prepare issues depending up on the footing drive necessities and operational execution has been done in [5, 6]. The power arrange plan technique and the ZVRT exchanging was presented in [9]. It likewise the executed the DCM operation for the power nook sity boost of the converter. The ideas of the delicate exchanging strategies for the effectiveness change and the gadget stretch decrease was displayed in the [4, 5].

III.PROPOSED SYSTEM

The grid-connected hybrid PV-wind-battery based mostly system for house applications, which may work either in complete or grid connected mode. this method is appropriate for house applications, wherever a low-priced, straightforward and compact topology capable of autonomous operation is fascinating. The core of the planned system is that the multi-input electrical device coupled two-way dc-dc device that interconnects varied power sources and therefore the storage part. The planned device consists of a electrical device coupled boost dual-half-bridge two-way device amalgamate with two-way buck-boost device and a single-phase full-bridge electrical converter. The planned device has reduced variety of power conversion stages with less part count and high potency compared to the prevailing grid connected schemes. The topology is easy and desires solely six power switches. The boost dual-half-bridge device has 2 dc-links on each side of the high frequency electrical device. dominant the voltage of 1 of the dc-links ensures dominant the voltage of the opposite. This makes the management strategy straightforward. Moreover, further converters are often integrated with anybody of the 2 dc-links. A two-way buck-boost dc-dc device is integrated with the first facet dc-link and singlephase full-bridge two-way device is connected to the dc-link of the secondary facet. the most objectives of this method area unit as follows:

1) To get "clean" and economical energy victimisation hybrid renewable energy supply, so as to decrease each environmental pollution and therefore the energy dependence.
2) To provide un-interruptible power to hundreds.
3) To cut back the amount of power conversion stages and to confirm evacuation of surplus power from the 2 renewable sources to the grid, and charging the battery from the grid as and once needed.

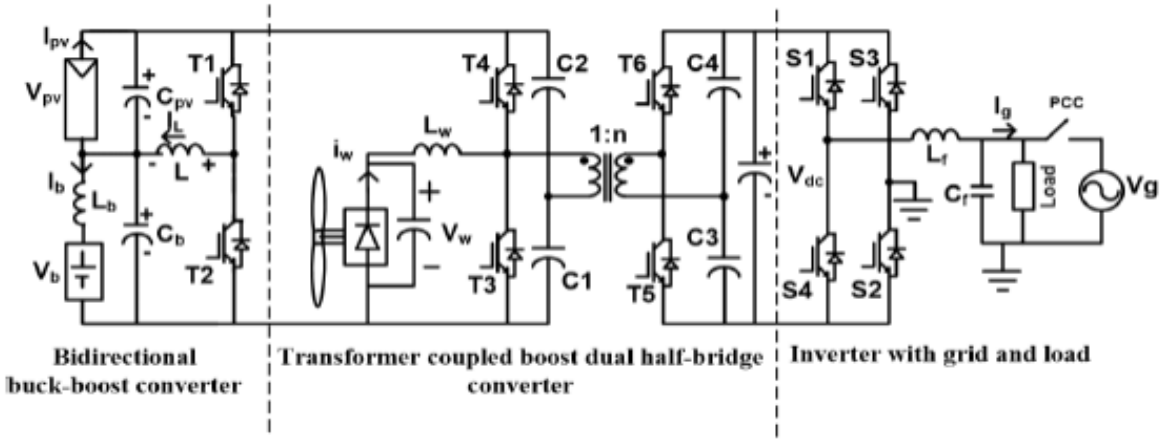


Fig 1 – The proposed system

IV.BLOCK DIAGRAM

The hybrid grid-connected PV-wind-battery based system for household applications is shown in Fig. 2, which can work either in autonomous or grid-connected mode. This system is suitable for domestic three phase applications, where a Low-cost, simple and compact topology capable of autonomous operation is desirable. The core of the proposed system is the voltage multiplier that boosts up the voltage and makes it suitable for three phase applications.

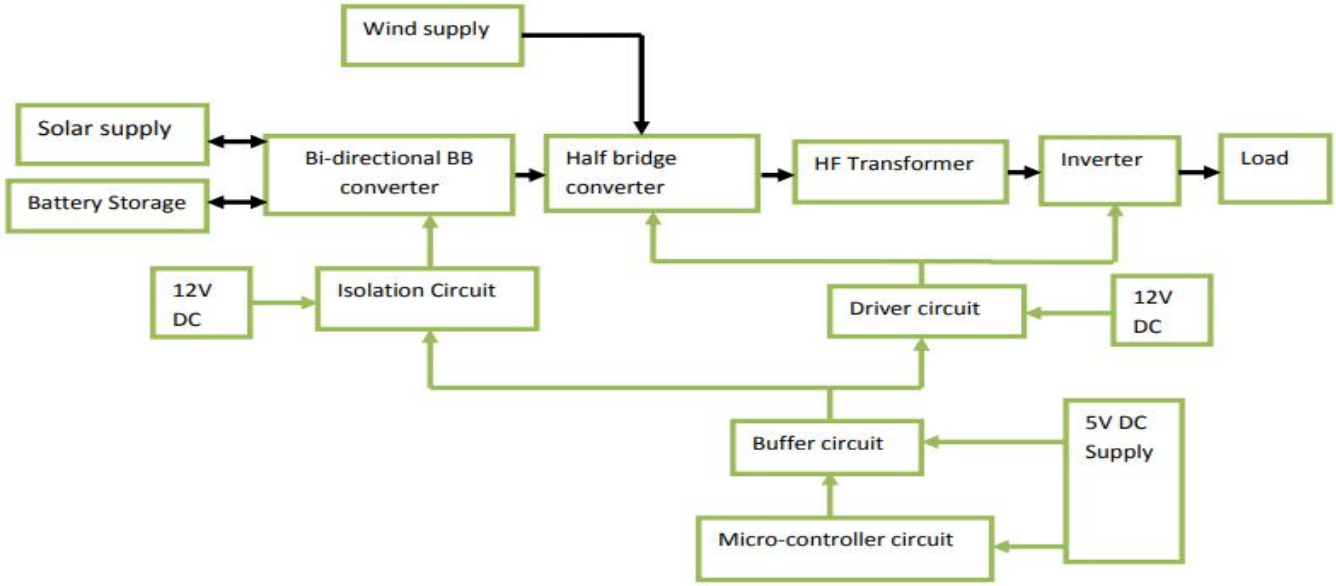


Fig 2 : Block Diagram

The grid-connected hybrid PV-wind-battery based system for household applications, which can work either in stand-alone or grid connected mode. This system is suitable for household applications, where a low-cost, simple and compact topology capable of autonomous operation is desirable. The core of the proposed system is the multi-input transformer coupled bidirectional dc-dc converter that interconnects various power sources and the storage element.

A. Advantages

1) Less component count and reduced losses.
2) Reduced number of power conversion stages.
3) Inject surplus power into the grid and charge the battery from grid as and when required.

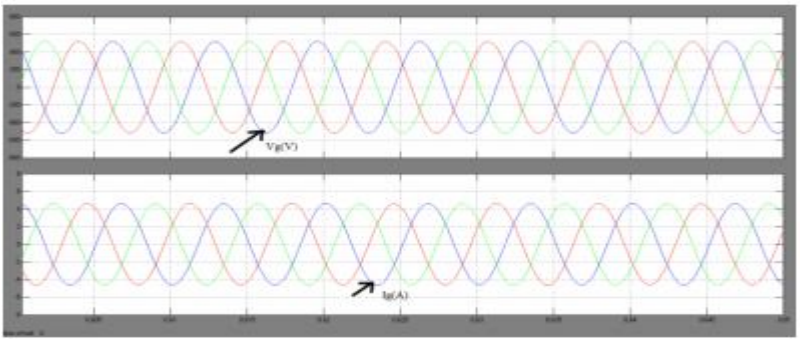
B. Applications

1) Household Application.
2) Grid-connected hybrid PV-wind-battery system.

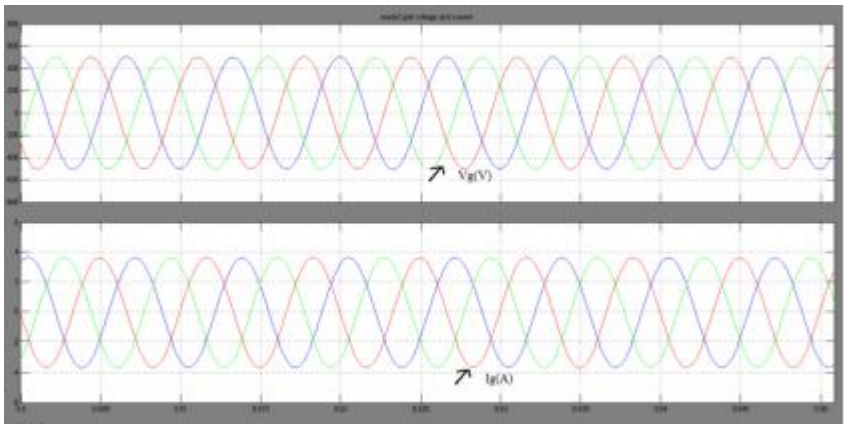
V. RESULT AND DISCUSSION

Simulation results are obtained for various operating conditions using MATLAB platform. Simulation parameters used in the model are listed in Table I. The simulation circuit diagram of proposed hybrid grid connected transformer coupled bidirectional dc-dc converter for three phase domestic applications is shown.

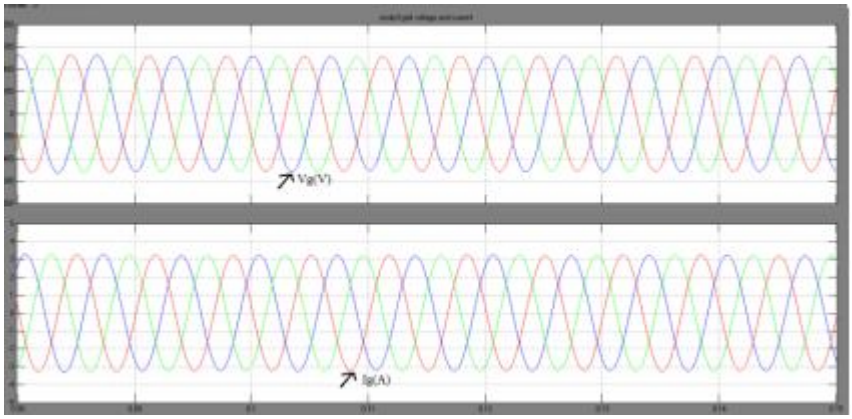
A. Steady state operation in MPPT mode.



B. Response of the system in the absence of PV source while wind source continues to operate at MPPT



C. Response of the system in the absence of wind source while PV source continues to operate at MPPT



VI. CONCLUSION

The efficient use of hybrid energy for three phase domestic applications, which can work either in autonomous or grid connected mode is proposed. The proposed hybrid system manages the power flow from wind-solar-battery sources and the battery is charged when required from the grid. The proposed converter consists of a half bridge converter to harness the power from solar and battery through bidirectional buck-boost converter and power from wind through the diode rectifier. The core of the proposed system is the voltage multiplier that boosts up the voltage and makes it suitable for three phase applications. Simulation results for various operating modes are obtained using MATLAB. The the power by operating at their corresponding MPPT and charging the battery at the constant magnitude of the current, and the remaining power is being fed to the grid. The improved voltage performance of the various operating modes is validated and results are obtained.

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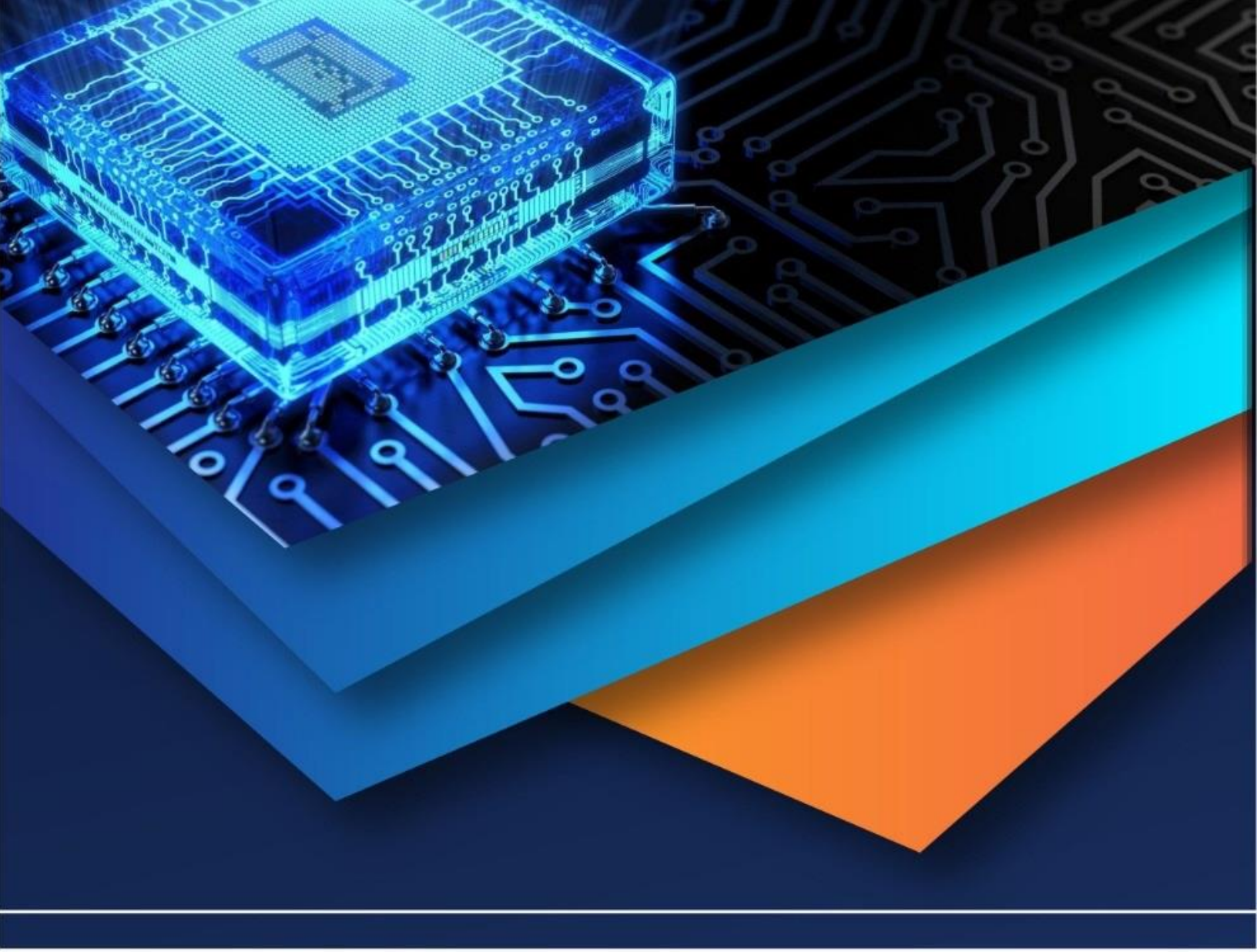

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