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

Ramendra Kumar[1], Mrs. Varsha Sharma[2], Mrs. Seema Mishra[3]
[1,2,3]*Electrical and Electronics Department, RSR Rungta College of Engineering*

Abstract: ***A control strategy for power flow management of a grid-connected hybrid physical phenomenon (PV)–windbattery- a based mostly system with associate economical multi-input electrical device coupled bi-directional dc–dc converter is conferred. The planned system aims to satisfy the load demand, manage the power be due utterly totally different sources, inject the surplus power into the grid, and charge the battery from the grid as and once needed. A transformer-coupled boost half-bridge device is employed to harness power from the wind, whereas a duplex buck– boost converter is used to harness power from PV beside battery charging/discharging management. A single-phase full-bridge bi-directional converter is used for feeding as lots and interaction with the grid. The planned device style has reduced variety of power conversion stages with less part count and reduced losses compared with existing grid-connected hybrid systems. This improves the efficiency and so the dependableness of the system.***

Keywords: Battery charge control, full-bridge bidirectional converter, hybrid system, solar photovoltaic (PV), coupled boost dual-half-bridge bidirectional converter, wind energy.

I. INTRODUCTION

Solar electrical phenomenon (PV) and wind have emerged as well-liked energy sources because of their co friendly nature and price effectiveness. Hence, it's a challenge to provide stable and continuous power using these sources. this could be addressed with efficiency desegregation with energy storage components. The fascinating complementary behavior of star insulation and wind speed sabot in addition to the on top of mentioned blessings, has light-emitting diode to their integration leading to the hybrid PV wind systems. For achieving the combination of multiple renewable sources, the standard approach involves using dedicated single input converters one for every supply, that are connected to a typical dc bus .However converters aren't effectively utilised ,due to the cut off 10 nature of the renewable sources. additionally, there square measure multiple power conversion stages that cut back the potency of the system. important quantity of literature exists on the combination of star and wind energy as a hybrid energy generation system with focus principally on its size and optimisation. within the size of generators during a hybrid system is integrated. during this system, the sources and storage are interfaced at the dc-link, through their dedicated converters. alternative contributions are created on their modeling aspects and management techniques for a complete hybrid energy system

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].

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III.PROPOSED SYSTEM

The projected device consists of a electrical device coupled boost dual-half-bridge two-way device coalesced with two-way buck-boost device and a single-phase full-bridge electrical converter. The projected device has reduced range of power voltage boosting ar accomplished through one device. The projected device has reduced range of power conversion stages with less element count and high potency compared to the prevailing grid-connected converters. the facility ensue wind supply is controlled through a simplex boost half-bridge device .For getting MPP effectively; swish variation in supply current is needed which may be obtained mistreatment Associate in Nursing inductance. within the projected topology, Associate in Nursing inductance is placed asynchronous with the wind supply that ensures continuous current and therefore this inductance current will be used for maintaining MPP current. once switch T3 is ON, the present flowing through the supply inductance will increase. The capacitance C1discharges through the electrical device primary and switch T3 as shown in Fig2.In secondary facet capacitance C3 charges through electrical device secondary and anti-parallel diode of switchT5.When switch T3 is turned OFF and T4 is turned ON, at first the inductance current flows through anti-parallel diode ofswitchT4and through the capacitance bank. the trail of current is Is Shown in Fig. throughout this interval, the present flowing through diode decreases which flows through electrical device primary will increase. once current flowing through the inductance becomes capable that flowing through electrical device primary, the diode turns OFF.Since,T4 is gated ON throughout this point, the capacitance C6 currently discharges through switch T4 and electrical device primary. throughout the ON time of T4, anti-parallel diode of switch T6 conducts to charge the capacitance C4.The path of current flow is shown in Fig. throughout the ON time of T3, the first voltage VP=−VC1.The secondary voltage VS=nVp=−nVC1=−VC3, or VC3=nVC1 and voltage across primary inductance element is Vw.
WhenT3isturnedOFFandT4turnedON, the first voltage VP=VC6.Secondary voltage VS=nVP=nVC6=VC4 and voltage across primary inductance element is Vw−(VC1+VC6). Conversion stages with less element count and high potency compared to the prevailing grid-connected schemes.
In the projected configuration as shown in Fig2. a two-way buck-boost device is employed for MPP pursuit of PV array and battery charging/discharging management. Further, this two-way buck boosts device charges/discharges the capacitance bank C1-C6 of electrical device coupled half-bridge boost device supported the load demand. The [*fr1] bridge boost device extracts energy from the wind supply to the capacitance bankC1-C6. throughout battery charging mode, once switchT1 is ON, the energy is hold on within the inductance L. When switch T1 is turned OFF and T6 is turned ON, energy hold on in L is transferred to the battery .If the battery discharging current is quite the PV current, inductance current becomes negative.

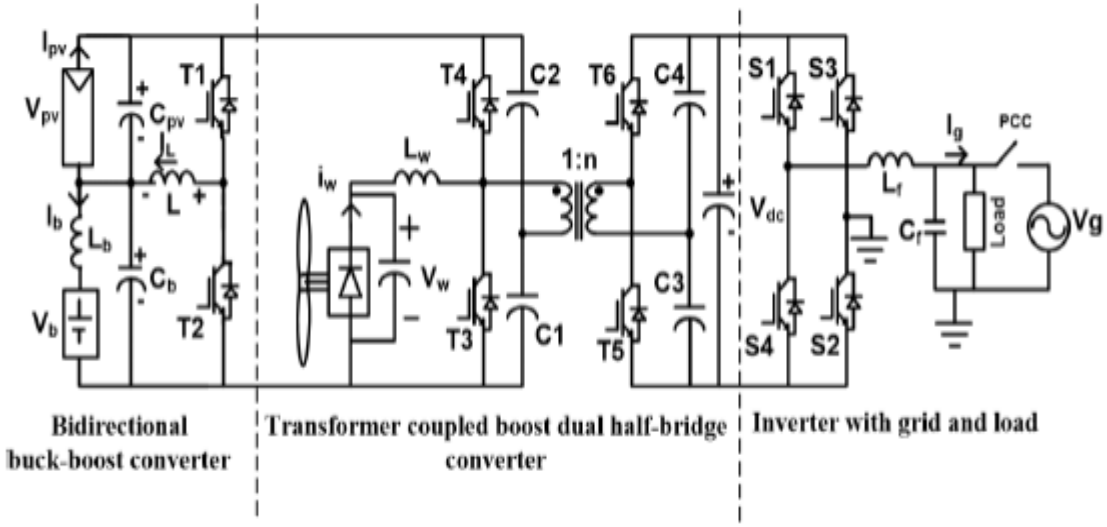


Fig 1 – The proposed system

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.

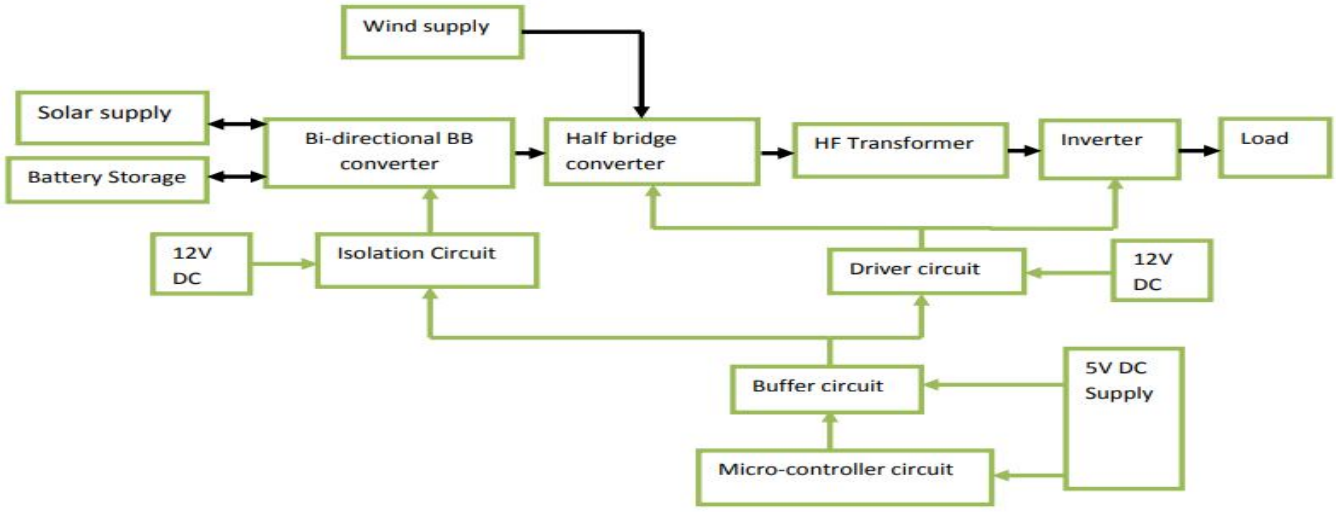


Fig 2 : Block Diagram

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.

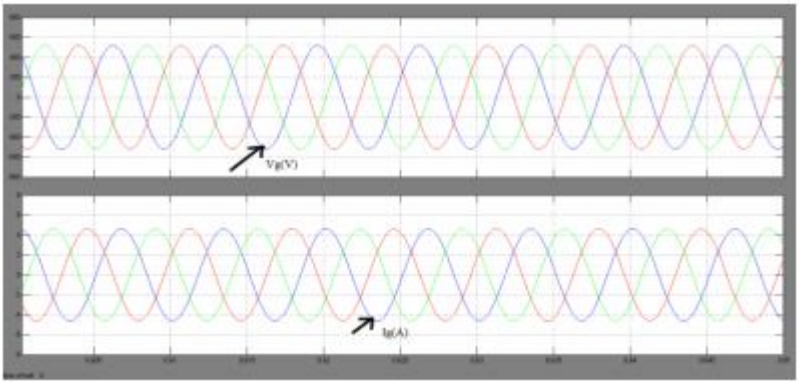
B. Applications

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

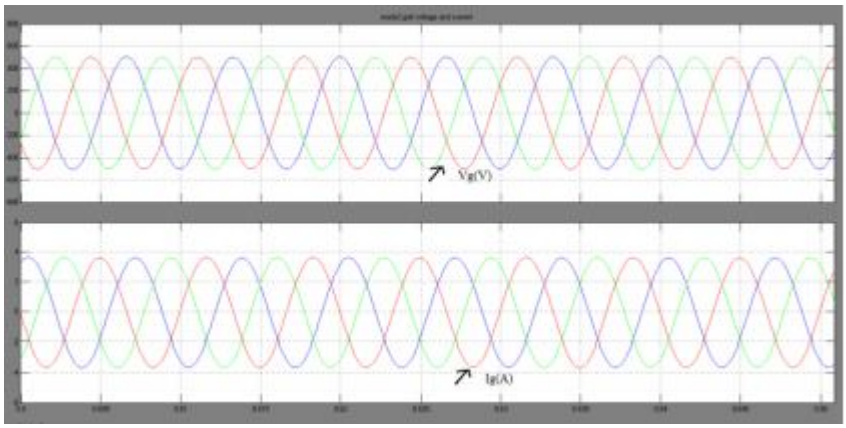
V. RESULT AND DISCUSSION

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.

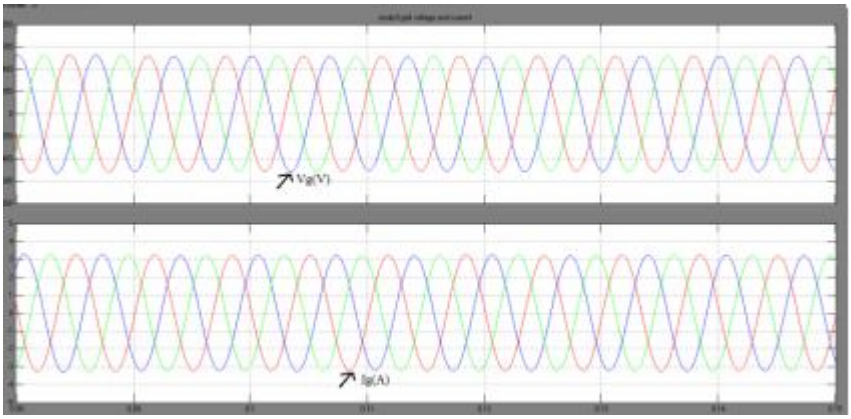
1) Steady state operation in MPPT mode.



2) Response of the system in the absence of PV source while wind source continues to operate at MPPT



3) Response of the system in the absence of wind source while PV source continues to operate at MPPT



VI. CONCLUSION

A grid-connected hybrid PV-wind-battery based mostly power evacuation theme for house application is projected. The projected hybrid system provides a chic integration of PV and wind supply to extract most energy from the 2 sources. it's realised by a completely unique multi-input electrical device coupled biface dc-dc device followed by a standard full-bridge electrical converter. a flexible management strategy that achieves higher utilization of PV, wind power, battery capacities while not effecting lifetime of battery and power flow management in an exceedingly grid-connected hybrid PV-wind-battery based mostly system feeding ac masses is conferred. elaborated simulation studies area unit administered to establish the viability of the theme. The simulation results obtained area unit in shut agreement with simulations and area unit certificatory in demonstrating the aptitude of the system to control either in grid feeding or complete mode. The projected configuration is capable of supply un-interruptible power to ac masses, and ensures evacuation of surplus PV and alternative energy into the grid.

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