Performance Evaluation of Residential Micro Grid with New DC-DC Converter Topology

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Abstract: Electrical energy consumption has been increasing in recent years and the technology moves towards On-Site power generation for mainly to reducing the transmission losses and gaining some benefits such as high reliability, modularity, high power quality. But unfortunately due to uncontrolled use of individual DG units can cause various problems thereby compromising their benefits. To improve performance the micro grids in integrated with main grid or standalone operations by using an efficient controllers and with high efficient converters/inverters. The paper introduces a residential micro grid with a new topology. These paper proposes i) a DC-DC converter along with regenerative clamping circuit, ii) Constant current controller for grid integrated power generation, iii) Constant voltage current controller standalone DG units. The residential grid performance is evaluated under grid connected and islanding conditions and performance is evaluated by using MATLAB tool.

Keywords: **DC bus interconnection, regenerative clamping circuit, energy storage system, micro grid, On-site power generation.**

I. INTRODUCTION

Recent trends in small scale power generation using the with the increased concerns on environment and cost of energy, the power industry is experiencing fundamental changes with more renewable energy sources (RESs) or micro sources such as photovoltaic cells, small wind turbines, and micro turbines being integrated into the power grid in the form of distributed generation (DG). These RES-based DG systems are normally interfaced to the grid through power electronics and energy storage systems [31]. One of the most critical sections of the control system for a distributed generation (DG) unit's interconnection to the utility grid lies within the grid-connected converter's control and protection system;. Difficulties in connecting these units directly to the bulky ac system due to their variable and intermittent power generation, voltage oscillation in the line to which the sources are connected, and protection issues are some of these problems. As an alternative to reduce such problems, the micro grid concept has been gaining more notoriety each day [32], [33]. Some advantages of the micro grids are the possibility to generate electric power with lower environmental impact and easier connection of these sources to the utility, including the power management capability among their elements.

Considering the local generation of distributed sources, residential micro grids are being proposed as an interesting solution for increasing renewable energy production and system reliability for household appliances. The residential micro grid under study here, as shown in Fig. 1 [9], comprises two DG sources (photovoltaic panels and bio fuel generator), an energy storage system (one battery and one super capacitor bank), and a plug-in hybrid electric vehicle (PHEV). Moreover, it is able to supply both ac and dc loads. The micro grid has two buses: one main dc bus in which the DG sources, storage devices, and dc loads are connected, and one ac bus in which the ac loads are connected and the point of common coupling (PCC) with the utility grid is located. The arrows beside each converter indicate the possible power flow directions. The investigated power converter in this paper is also indicated. Further information can be found in [9].

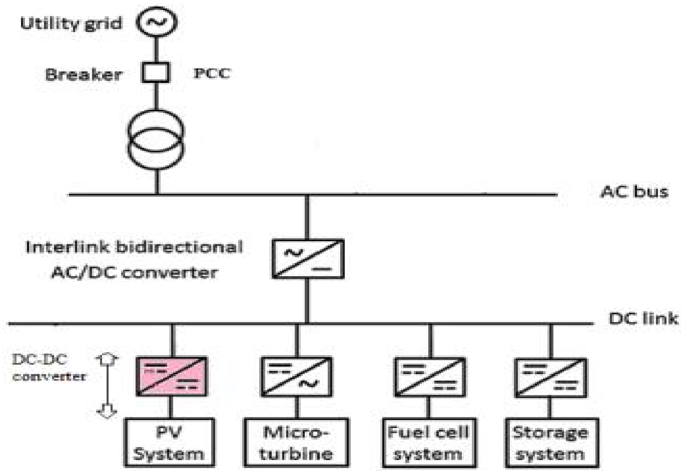

Fig. 1.a. Residential micro grid system.

In the micro grid systems, the energy storage system is of great importance. It is responsible for supplying energy to the loads when the main sources are not capable during short periods of time and steady-state operation. A dc–dc converter is necessary to connect the energy storage system to the micro grid dc bus. Once the super capacitor bank voltage is low and not controlled, the dc–dc converter must have a high voltage ratio between the input and output stages.

Moreover, it must be able to operate under a wide output power range. Several dc–dc converter topologies employing a super capacitor bank to complement the energy supplied by other sources, such as fuel cells, batteries, or generators, have been proposed in the literature [12]–[27]. These topologies are applied to hybrid vehicles, uninterruptable power supply (UPS) systems, buses in general and critical loads, among other applications.

The dual active bridge (DAB) or modified DAB converters are approached in [12]–[20]. Paper [13] proposes an optimal modulation scheme that enables minimum conduction and copper losses for a DAB converter. In [14], an input stage composed of a qZSI converter is proposed, which guarantees the voltage boost during the super capacitor discharge, but increases the number of active switches. In [15], a DAB converter including unified soft-switching scheme (voltage clamp branch on the current-fed bridge) is proposed.

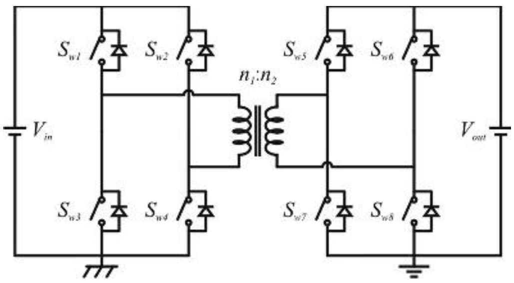

Fig. 1.b. DAB converter

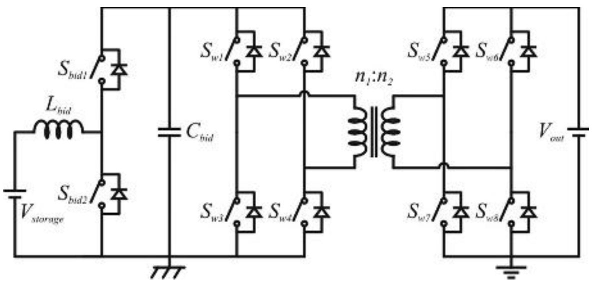

Fig. 1.c. DAB including a bidirectional converter

Topologies from [21] and [22] need six active switches and present low input current ripple, but high output current ripple. Topology presented in [25] has a particular configuration, in which the super capacitor bank is situated between two dc–dc converters that connect another energy source to the load. Paper [26] applies a full-bridge with active clamping and a half-bridge converter, but uses batteries and fuel cells. These last two topologies present eight and seven active switches, respectively, and both present high output current ripple. A common feature of these topologies is that a transformer is used to aid voltage boosting due to the low-voltage level of the super capacitor bank, besides providing galvanic isolation. The exception is a non-isolated converter presented in [27]. However, in this case the super capacitor bank voltage level is much higher than in the other topologies. Consequently, the desired converter must present the following features: bidirectional power flow, high power operation, galvanic isolation, high usage of the super capacitor stored energy, and long battery lifetime. High usage of the super capacitor stored energy is achieved through a deeper discharge, making it reach lower voltage levels (requiring high voltage ratio). A long battery lifetime is achieved by draining from and providing to the battery a low ripple dc current.

A dc–dc bidirectional converter can be added between the energy storage device and one of the full-bridges [20]. It provides advantages, such as to extend the battery lifetime by maintaining the supplied current with a low ripple, to obtain better usage of the super capacitor stored energy (over 85%) by lowering the super capacitor voltage level, and to reduce the full-bridge switches current level and cost by boosting the voltage from the energy storage system to an intermediate value.

II. PROPOSED RESIDENTIAL MICRO GRID

The paper proposed a new configurable residential micro grid based on PV system with energy storage element and DC-DC converter with a regenerative clamping circuit is employed in this micro grid to improve the output of the dc bus voltage.

The proposed residential micro grid energy storage system composed of a battery bank and a super capacitor bank has two main functions. The battery bank acts as a backup device due to its high energy density [10], providing energy under the steady-state condition when the other sources are not capable. The super capacitor bank acts as a quick discharge device due to its high power density [11], providing energy to the micro grid during transitory periods, mainly during the bio fuel generator start-up time. Consequently, due to the importance of the energy storage system, this paper focuses specifically on the dc power module of the micro grid energy storage system.

A. Proposed DC-DC Converter Topology

To improve the residential micro grid DC bus output because renewable sources are acting as a source. The proposed converter will lead task i.e., the improvement in output voltage. The proposed converter is the integration of a full bridge and forward converter. The proposed converter must be designed for both charging and discharging processes. The maximum designed power for the micro grid energy storage system discharging process is equal to 1.4 kW (high power during transistorizes), which is supplied by the super capacitor bank. The charging process of the micro grid energy storage system does not need to be performed with the same power level of the discharging process. Once the energy storage system of a residential micro grid is not often demanded due to the low electric energy supply interruption indices, there is a long period of time available between two interactions. This way, the charging process can have a longer duration and, consequently, be performed with lower power levels (100 W, for example). Therefore, it is not necessary to use another full-bridge converter for the charging process. Due to the presence of the full-bridge converter for the discharging process, it is possible to utilize the respective active switches to rectify the converter output voltage during the charging process. This way, it is necessary to add only the input stage of the respective converter for the charging process. One of the simplest converters for this application is the forward converter, which demands only one active switch and is appropriate for the related power levels. Therefore, the proposed dc–dc converter is the integration of a full-bridge and a forward converter. The full-bridge converter is responsible for the energy storage system discharging stage, while the forward converter is responsible for the energy storage system charging stage. This forward converter resultant by the integration process is called a double-ended forward converter [28]. DC-DC bidirectional converter can also be added between the energy storage device and the full-bridge converter [20], providing the same advantages to the proposed topology. The storage system voltage can be reduced without penalizing the full-bridge converter operation, once its input voltage is kept constant. During the energy storage system discharging stage, the bidirectional converter boosts the voltage from the energy storage system to an intermediate level, while during the energy storage system charging stage it performs voltage post regulation or remains with S_{bid1} ON and S_{bid2} OFF acting as a low-pass filter, thus eliminating the switching losses. The second option is chosen in this paper, where only the conduction losses are present, which are of very low value due to the low power stage.

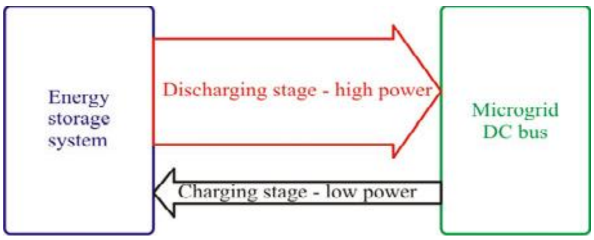

Fig. 2. Power level transfer diagram for the application

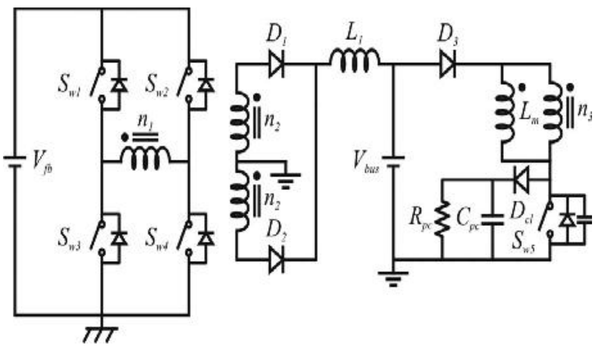

Fig. 3. Proposed converter with dissipative passive clamping circuit

Taking into account the full-bridge-forward topology without the bidirectional converter, it presents a reduced part count compared to the full-bridge and forward topologies without the integration process achieved due to the elimination of one transformer, two diodes, and one inductor, resulting in a lower implementation cost. The integration process and the bidirectional power flow characteristic provide for the use of only one converter to connect the energy storage system to the dc bus, simplifying the dc bus voltage regulation and micro grid management process. The proposed topology has a simple energy storage system charging process compared to the DAB converter, once it requires only one active switch and drive circuit compared to four in its counterpart.

A three-winding transformer is required in this topology. Windings 1 and 2 are used in the full-bridge operation, and windings 1 and 3 in the forward operation. One diode needs to be added in series with the transformer tertiary winding to avoid current circulation through the anti parallel diode of the forward converter switch during full-bridge converter operation mode.

B. Proposed Converter Including Regenerative Active Clamping Circuit

One alternative for reducing the losses over the clamping circuit even more is to use a regenerative active clamping circuit. For the double-ended forward topology under study special attention should be taken, since the active clamping circuit cannot regenerate energy to the micro grid dc bus through the transformer tertiary winding due to the presence of the series diode, thus eliminating the possibility of use of some traditional active clamping circuits. Considering this fact, the proposed forward converter with an active clamping topology is shown in Fig. 4. Basically, the clamping resistor is replaced by an active switch, a diode, and an inductor.

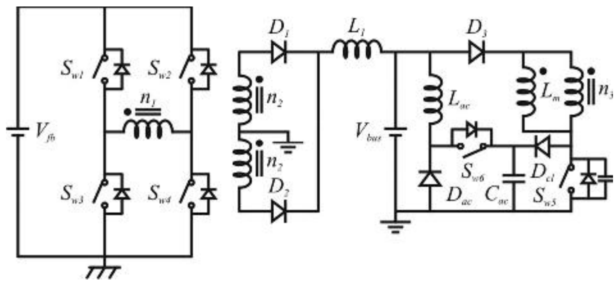

Fig. 4. Proposed converter with regenerative active clamping circuit

The energy stored in the clamping capacitor due to the current i_{Dc1} is delivered back to the dc bus, instead of being dissipated over a resistor. The active clamping circuit switch can be turned ON during any forward converter operation stage. The switch on time (duty cycle) is an important factor to determine the voltage level across the clamping circuit. The lower the switch on time, the higher the clamping circuit voltage and, consequently, a lower portion of energy is deviated toward the clamping circuit, reducing the switching and conduction losses on this circuit, and increasing the converter efficiency.

C. Proposed Controllers for Constant Load Current

This system consists of the micro source that is represented by the dc source, the conversion unit which performs the interface function between the dc bus and the three-phase ac world, and the LCL filter that transports and distributes the energy to the end use and the load [32], [33]. The controller presented provides a constant DG output and maintains the voltage at the point of common coupling (PCC) before and after the grid is disconnected. Under normal operation, each DG system in the micro grid usually works in a constant current control mode in order to provide a preset power to the main grid. When the micro grid is cut off from the main grid, each DG inverter system must detect this islanding situation and must switch to a voltage control mode. In this mode, the micro grid will provide a constant voltage to the local load.

For grid-connected operation, the controller shown in Fig.5 is designed to supply a constant current output.

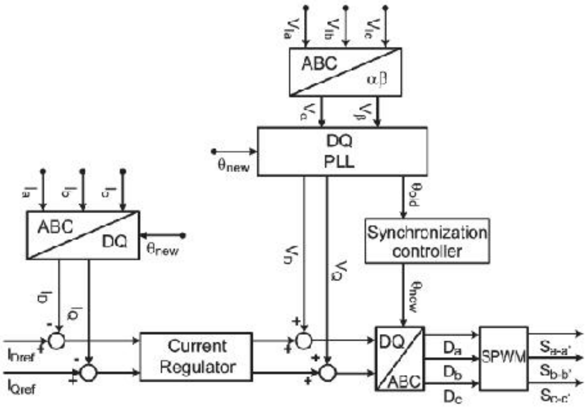

Fig.5. Constant Current Controller

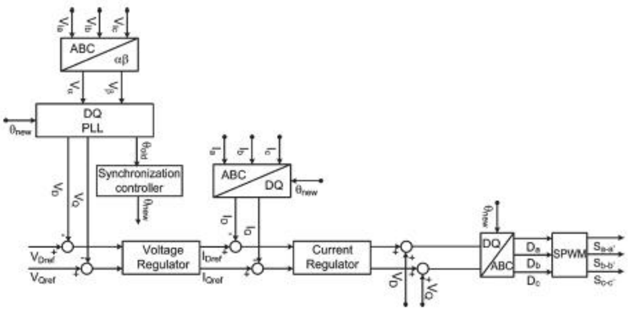

Fig.6. Constant Voltage Current Controller

A phase locked loop (PLL) is used to determine the frequency and angle reference of the PCC [32], [33]. An important aspect to consider in grid-connected operation is synchronization with the grid voltage. For unity power factor operation, it is essential that the grid current reference signal is in phase with the grid voltage. This grid synchronization can be carried out by using a PLL. Fig. 6 shows the control topology used. When using current control, the output current from the filter, which has been transformed into a synchronous frame by Park's transformation (1) and regulated in dc quantity, is fed back and compared with the reference currents I_{DQref} . This generates a current error that is passed to the current regulator (PI controller) to generate the voltage references for the inverter. In order to get a good dynamic response, V_{DQ} is fed forward. This is done because the terminal voltage of the inverter is treated as a disturbance, and the feed forward is used to compensate for it. The voltage references in dc quantities V_{DQref} are transformed into a stationary frame by the inverse of Park's transformation (2) and are utilized as command voltages in generating high-frequency pulse width modulated voltages.

$$\begin{bmatrix} X_D \\ X_Q \\ X_0 \end{bmatrix} = \frac{2}{3} \begin{bmatrix} -\cos\theta & -\cos(\theta+2\pi/3) & -\cos(\theta-2\pi/3) \\ \sin\theta & \sin(\theta+2\pi/3) & \sin(\theta-2\pi/3) \\ 1/2 & 1/2 & 1/2 \end{bmatrix} \times \begin{bmatrix} X_a \\ X_b \\ X_c \end{bmatrix} \qquad (1)$$

Where θ = ωt and ω is the frequency of the electric system

$$\begin{bmatrix} X_a \\ X_b \\ X_b \end{bmatrix} = \begin{bmatrix} -\cos\theta & \sin\theta & 1/2 \\ -\cos(\theta-2\pi/3) & \sin(\theta-2\pi/3) & 1/2 \\ -\cos(\theta+2\pi/3) & \sin(\theta+2\pi/3) & 1/2 \end{bmatrix} \begin{bmatrix} X_D \\ X_Q \\ X_0 \end{bmatrix} \qquad (2)$$

III. SIMULATION MODELS AND RESULTS

The proposed residential micro grid is constructed by using MATLAB tool and the proposed DC-DC converter with/without regenerative active clamping circuit is also constructed as shown below. The fig. 8 shows the response of the DC-DC converter with a regenerative active clamping circuit. The fig.9 shows the response of DC-DC converter without regenerative clamping circuit. By comparing these results as shown fig. 8 & 9 the output voltage profile improvement is clearly observable.

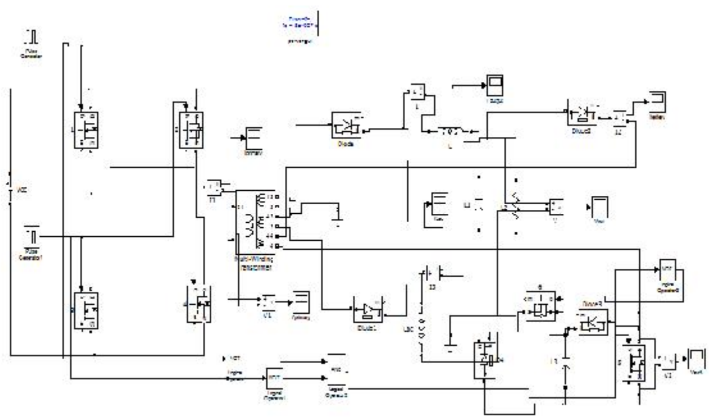

Fig.7. Converter regenerative clamping circuit

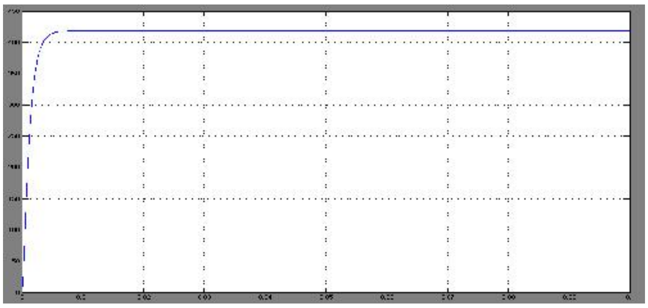

Fig.8. Converter output regenerative clamping circuit

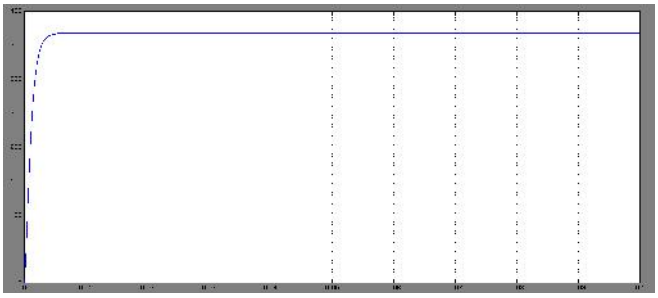

Fig.9. Converter output without regenerative clamping circuit

The fig.10 shows the complete model of an integrated residential micro grid with proposed controller as shown below. The integrated system having two sources namely main grid and micro grid & the micro grid is desinged with PV system along with enegry storage element. As early mentioned DC-DC converter with a regenerative active clamping circuit is bidirectional converter and it strоes the enegry in the abnormal conditions. The output of the converter is connected to the inverter input & it is operated by the two controllers with reference to load current changes.The LCL resonent filter is used to filter ripples in inverter output. The following model operating time (t_s) is 0.4sec. In these operating period two stages are integrated, first one residential grid connected with conventional grid in these time the constant current controller is in controlling mode. Second one is when the islanding issutation (cut-off from the main grid) occurs the controller will be automatically changed from current controller to constant voltage current controller. At these stage two grid voltages are away from the synchroinization, it can be shown in fig. 11 at the time 0.3sec.The islanding condition is operated by circuit breakar at the point PCC.

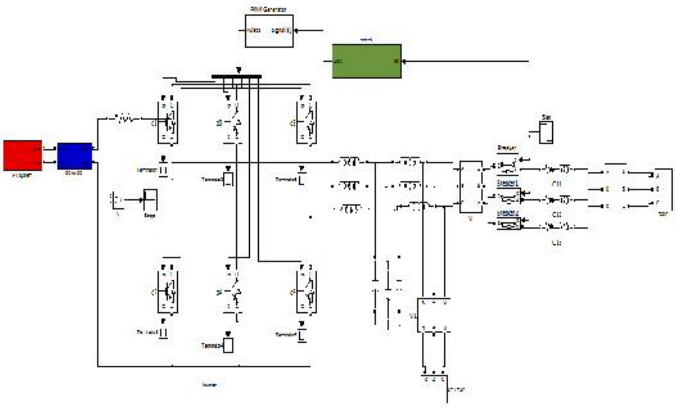

Fig.10. Converter output without regenerative clamping circuit

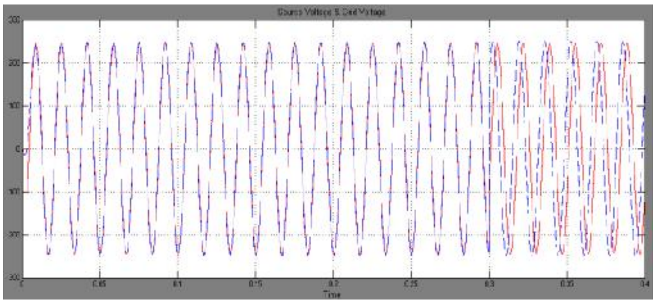

Fig.11 Synchronization of Source Voltage & Grid Voltage

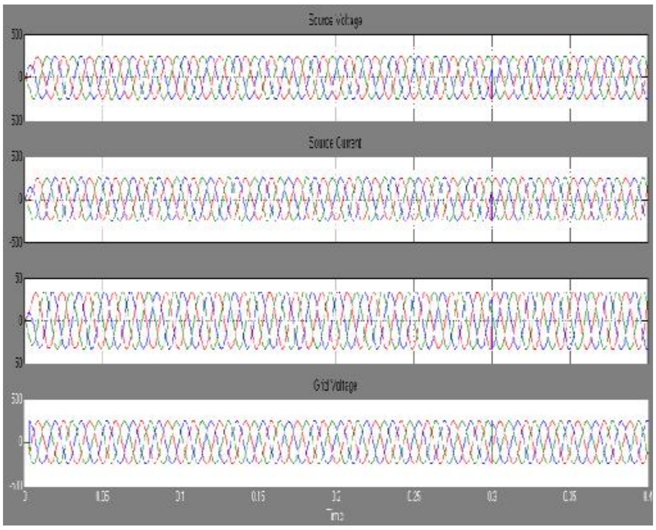

Fig.12 Source Voltage, Load Voltage, Load Current, Grid Voltage

Fig.12 shows the response of load current, load voltage in grid connected and islanding operations, the control action is changed from one controller to another controller i.e., constant voltage current controller and then it can be clearly observe at 0.3sec on-words the load current, voltage magnitudes are maintained constantly.

IV. CONCLUSION

The output voltage profile will be improved by using the regenerative active clamping circuit as discussed in section – III. These shows the great merit as compared to other converters i.e., it requires less number of switches and it will results the reduction of cost of the converter. The less number switches will automatically reduces switching losses. The both proposed converters constant current controller and constant voltage current controllers are maintained the continuous power supply to the load center. Enhance the reliable power supply in either grid connected or islanding conditions. Finally we conclude that the proposed micro grid over comes problems which are discussed in earlier, and supply the required power to the load center avoiding voltage collapse.

REFERENCES

[1]. K. Sun, L. Zhang, Y. Xing, and J. M. Guerrero, “A distributed control strategy based on DC bus signaling for modular photovoltaic generation systems with battery energy storage,” *IEEE Trans. Power Electron.*, vol. 26, no. 10, pp. 3032–3045, Oct. 2011.

[2]. F. A. Farret and M. G. Simoes, *Integration of Alternative Sources of* Energy, 1st ed. New Jersey: Wiley, 2006.

[3]. Y. A.-R. I. Mohamed, “Mitigation of converter-grid resonance, grid induced distortion, and parametric instabilities in onverter-based distributed generation,” *IEEE Trans. Power Electron.*, vol. 26, no. 3, pp. 983– 996, Mar. 2011.

[4] . R. H. Lasseter and P. Paigi, “Microgrid: A conceptual solution,” in *Proc. IEEE Power Electron. Spec. Conf.*, Jun. 2004, vol. 6, pp. 4285–4290.

[5] . H. Zhou, T. Bhattacharya, D. Tran, T. S. T. Siew, and A. M. Khambadkone, “Composite energy storage system involving battery and ultracapacitor with dynamic energy management in microgrid applications,” *IEEE Trans. Power Electron.*, vol. 26, no. 3, pp. 923–930, Mar. 2011.

[6] J.-Y. Kim, J.-H. Jeon, S.-K. Kim, C. Cho, J. H. Park, H.-M. Kim, and K.-Y. Nam, “Cooperative control strategy of energy storage system and micro sources for stabilizing the micro grid during islanded operation,” *IEEE Trans. Power Electron.*, vol. 25, no. 12, pp. 3037–3048, Dec. 2010.

[7] R. S. Balog and P. T. Krein, “Bus selection in multi bus DC micro grids,” *IEEE Trans. Power Electron.*, vol. 26, no. 3, pp. 860–867, Mar. 2011.

[8] J. Chen, J. Chen, R. Chen, X. Zhang, and C. Gong, “Decoupling control of the non-grid-connected wind power system with the droop strategy based on a DC micro-grid,” in *Proc. World Non-Grid-Connected Wind Power Energy Conf.*, 2009, pp. 1–6.

[9] L. Roggia, C. Rech, L. Schuch, J. E. Baggio, H. L. Hey, and J. R. Pinheiro, “Design of a sustainable residential microgrid system including PHEV and energy storage device,” in *Proc. Eur. Conf. Power Electron. Appl.*, 2011, pp. 1–9.

[10] F. Ongaro, S. Saggini, and P. Mattavelli, “Li-ion battery-super capacitor hybrid storage system for a long lifetime,

photovoltaic-based wireless sensor network," *IEEE Trans. Power Electron.*, vol. 27, no. 9, pp. 3944– 3952, Sep. 2012.
[11] J. Cao and A. Emadi, "A new battery/ultra capacitor hybrid energy storage system for electric, hybrid, and plug-in hybrid electric vehicles," *IEEE Trans. Power Electron.*, vol. 27, no. 1, pp. 122–132, Jan. 2012.
[12] H. Zhou and A. M. Khambadkone, "Hybrid modulation for dual-active bridge bidirectional converter with extended power range for ultra capacitor application," *IEEE Trans. Ind. Appl.*, vol. 45, no. 4, pp. 1434–1442, Jul. 2009.
[13] F. Krismer and J. W. Kolar, "Closed form solution for minimum conduction loss modulation of DAB converters," *IEEE Trans. Power Electron.*, vol. 27, no. 1, pp. 174–188, Jan. 2012.
[14] D. Vinnikov, I. Roasto, and J. Zakis, "New bi-directional DC/DC converter for super capacitor interfacing in high-power applications," in *Proc. Int. Power Electron. Motion Control Conf.*, 2010, pp. T11-38–T11-43.
[15] K. Wang, F. C. Lee, and J. Lai, "Operation principles of bi-directional full-bridge DC/DC converter with unified soft-switching scheme and soft starting capability," in *Proc. IEEE Appl. Power Electron. Conf.*, 2000, vol. 1, pp. 111–118.
[16] L. Corradini, D. Seltzer, D. Bloomquist, R. Zane, D. Maksimovic, and B. Jacobson, "Minimum current operation of bidirectional dual-bridge series resonant DC/DC converters," *IEEE Trans. Power Electron.*, vol. 27, no. 7, pp. 3266–3276, Jul. 2012.
[17] Z. Zhang, Z. Ouyang, O. C. Thomsen, and M. A. E. Andersen, "Analysis and design of a bidirectional isolated DC–DC converter for fuel cells and super capacitors hybrid system," *IEEE Trans. Power Electron.*, vol. 27, no. 2, pp. 848–859, Feb. 2012.
[18] N. M. L. Tan, T. Abe, and H. Akagi, "Design and performance of a bidirectional isolated DC–DC converter for a battery energy storage system," *IEEE Trans. Power Electron.*, vol. 27, no. 3, pp. 1237–1248, Mar. 2012.
[19] M. N. Gitau, G. Ebersohn, and J. G. Kettleborough, "Power processor for interfacing battery storage system to 725 V DC bus," *Energy Convers. Manage.*, vol. 48, no. 3, pp. 871–881, Mar. 2007.
[20] M. Nowak, J. Hildebrandt, and P. Luniewski, "Converters with AC transformer intermediate link suitable as interfaces for supercapacitor energy storage," in *Proc. IEEE Power Electron. Spec. Conf.*, Jun. 2004, vol. 5, pp. 4067–4073.
[21] H. Tao, A. Kotsopoulos, J. L. Duarte, and M. A. M. Hendrix, "Multi input bidirectional DC–DC converter combining DC-link and magnetic coupling for fuel cell systems," in *Proc. IEEE Ind. Appl. Conf.*, Oct. 2005, vol. 3, pp. 2021–2028.
[22] H. Tao, J. L. Duarte, and M. A. M. Hendrix, "Three-port triple-half-bridge bidirectional converter with zero-voltage switching," *IEEE Trans. Power Electron.*, vol. 23, no. 2, pp. 782–792, Mar. 2008.
[23] G. Chen, Y.-S. Lee, D. Xu, and Y. Wang, "A novel soft-switching and low-conduction-loss bidirectional DC–DC converter," in *Proc. Int. Power Electron. Motion Control Conf.*, 2000, vol. 3, pp. 1166–1171.
[24] F. G. Capponi, P. Santoro, and E. Crescenzi, "HBCS converter: A bidirectional DC/DC converter for optimal power flow regulation in super capacitor applications," in *Proc. IEEE Ind. Appl. Conf.*, Sep. 2007, pp. 2009– 2015.
[25] M. H. Todorovic, L. Palma, and P. N. Enjeti, "Design of a wide input range DC–DC converter with a robust power control scheme suitable for fuel cell power conversion," *IEEE Trans. Ind. Electron.*, vol. 55, no. 3, pp. 1247–1255, Mar. 2008.
[26] S.-J. Jang, T.-W. Lee, W.-C. Lee, and C.-Y. Won, "Bi-directional dc–dc converter for fuel cell generation system," in *Proc. IEEE Power Electron. Conf.*, Jun. 2004, vol. 6, pp. 4722–4728.
[27] M. B. Camara, H. Gualous, F. Gustin, and A. Berthon, "Design and new control of DC/DC converters to share energy between super capacitors and batteries in hybrid vehicles," *IEEE Trans. Veh. Technol.*, vol. 57, no. 5, pp. 2721–2735, Sep. 2008.
[28] Y.-S. Lee and B.-T. Lin, "Modeling, analysis, & design criteria of actively clamped double-ended converters," *IEEE Trans. Circuits Syst.*, vol. 47, no. 3, pp. 312–323, Mar. 2000.
[29] R. W. Erickson and D. Maksimovic, *Fundamentals of Power Electronics*. New York: Kluwer, 2004.
[30] A. I. Pressman, *Switching Power Supply Design*. New York: McGrawHill, 1998.
[31] J. C. Vasquez, J. M. Guerrero, A. Luna, P. Rodríguez, and R. Teodorescu, "Adaptive droop control applied to voltage-source inverters operating in grid-connected and islanded modes," IEEE Trans. Ind. Electron., vol. 56, no. 10, pp. 4088–4096, Oct. 2009.
[32] M. Brucoli, T. C. Green, and J. D. F. McDonald, "Modelling and analysis of fault behaviour of inverter microgrids to aid future fault detection," in Proc. IEEE Int. Conf. SoSE, 2007, pp. 1–6.
[33] M. Castilla, J. Miret, and J. M. Guerrero, "Linear current control scheme with series resonant harmonic compensator for 1-Φ grid-connected photovoltaic inverters," IEEE Trans. Ind. Electron., vol. 55, no. 7, pp. 2724–2733, Jul. 2008.

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