Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 3, Issue. 10, October 2014, pg.324 – 329

RESEARCH ARTICLE

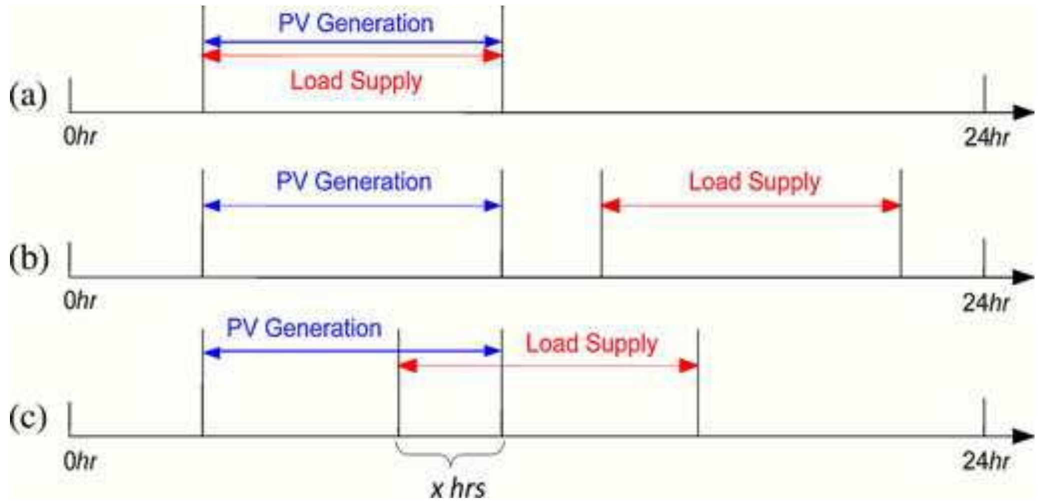
A SINGLE – STAGE SOLAR POWER CONVERTER FOR PV BATTERY SYSTEM

K Krishna Chaitanya[1]
M.Tech[1]
Project Guide: Sri. Khaja Khader Mohiuddin[2]
HOD: Sri. T.V.V. Pavan Kumar[3]
M.Tech, Associate Professor[23]
Global Institute of Engineering & Technology[123]

Abstract: The main concept of the new converter is to use a Single - stage three phase grid ties - solar PV converter to perform dc/dc and dc/ac operations. This converter solution is appealing for PV-battery applications, because it minimizes the number of conversion stages, improving efficiency and reducing cost, weight and volume. This converter solution is appealing for PV-battery application, because it minimizes the number of conversion stages, thereby improving efficiency and reducing cost, weight, and volume. In this paper, a combination of analysis and experimental tests is used to demonstrate the attractive performance characteristics of the proposed RSC.
Keywords: Converter, Energy Storage, Photovoltaic (PV), Solar

I. INTRODUCTION

Solar photovoltaic (PV) electricity generation is available sometimes higher or lower because it depending on the weather conditions. Solar electricity is also highly sensitive to shading; even small array or portion is shaded the output falls dramatically. Therefore output varies significantly from an energy source standpoint, a stable energy source and an energy source that can be dispatched at the request are desired as a result, energy storage such as batteries and fuel cells for solar PV systems has drawn significant attention and the demand of energy storage for solar PV system becomes stable energy source and it can be dispatched at the request. This results in improving the performance and the value of PV system [1]-[3]. There are different options for integrating energy storage into a utility-scale solar PV system. Specially energy storage can be integrated into the either ac or dc side of the solar PV power conversion system which may be consist of multiple conversion stages.



This paper introduce a novel single-stage solar converter called reconfigurable solar converter(RSC). RSC performs different operations modes such as PV to grid(dc to ac), PV to battery (dc to dc), battery to grid(dc to ac), and battery/PV to grid (dc to ac) for solar PV system with energy storage. Figure 1 Shows different scenarios for the PV generated system. In case a) the PV energy is always delivered to the grid and there is basically no need to energy storage. However, for cases b) and c), the PV energy should first stored in battery and then deliver to grid, and also we can supply from both PV and grid, integration of the battery is highest value and the RSC provide significant benefit over the integration options when t There is the time gap between generation and power consumption. Section 1 introduce a RSC circuit, different modes of operations and benefits in section 2 introduce a control of the RSC section 3 verifies the experimental results and performance characteristics. Section 4 conclusions.

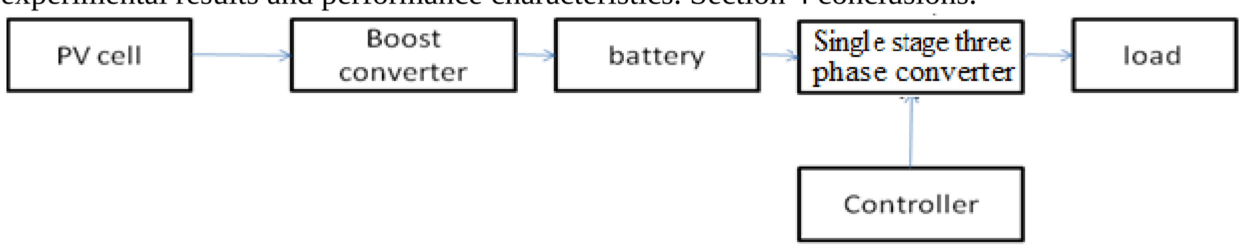


Fig 1.0 Block Diagram

1. RSC

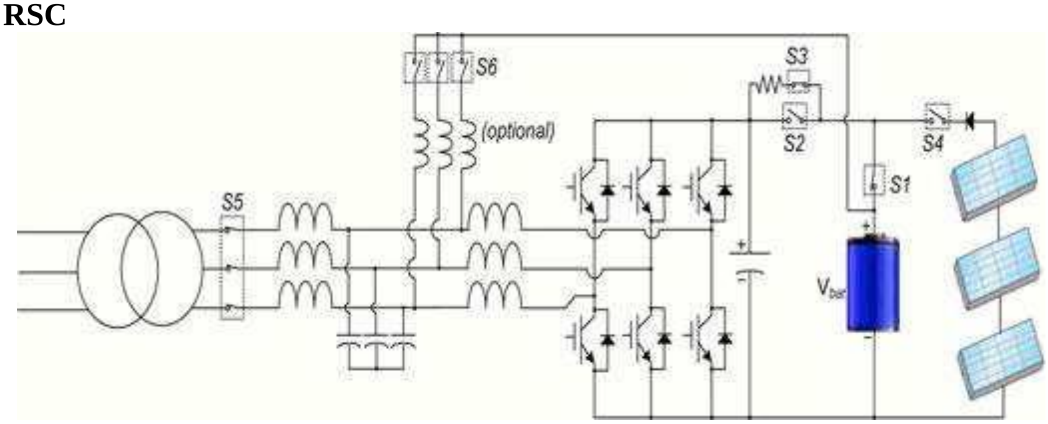


Fig 2.0 Diagram of the Suggested RSC

1.1 operation modes of rsc

All operation methods are shown in figure 4, in method 1 the PV is directly linked to the grid for dc to ac operation of the converter with prospect of maximum power point tracking (MPPT) monitor S1 and S6 switches are open. In method 2, the battery is charged with solar panels for dc to dc operation by closing S6 and opening the S5 switch in this method MPPT function is achieved. The PV and battery offered power to grid by closing S1. This operation shown in method 3, in this method MPPT is not possible because the Dc link voltage that is similar to the PV voltage that is imposed by the battery voltage, thus the MPPT monitor is not possible. Method 4 represent the energy stored in battery is offered to the grid

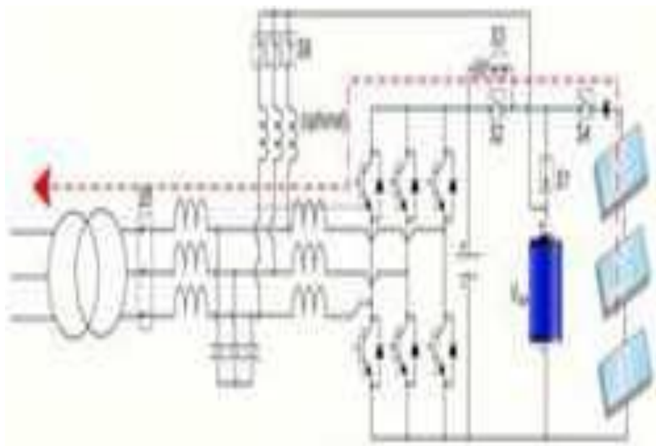


Fig 3.0 PV to Grid

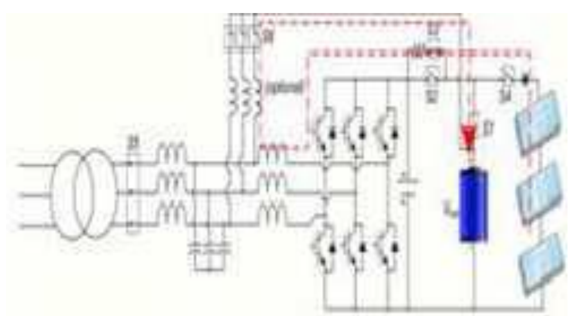


Fig 4.0 PV to Battery

1.2 pv power plant with the rsc method 1

The RSC method 1 offers major gains to system planning of utility –scale solar PV power plants. The current state of the art technology is to combine the energy storage into the ac side of solar PV systems. An example of viable energy storage solutions is the ABB issued energy storage (DES) solution is that is a complete package up to 4MW, which is linked to the grids directly with its communication means, can be used as a mean for peak shifting in solar PV power plants
The RSC method 1 permits not only the system owners to have an flexible ability that assist them to arrange and run the power plant correspondingly although manufacturers to preset a cost –aggressive dispersed PV energy storage solution with the RSC and the current state of art tools the technical and financial gains that the RSC solutions is able to offer are more apparent in larger solar PV power plant using the RSCs can be monitor more economically since of the

flexible operation Developing a full operation characteristics of a Solar PV power plant with the RSC is further than the scope of this project. But, different system monitor s as shown in figure 6 can be suggested based on the requested power from the grid operator p required and available generated power from the plant p generation these two values being results of an optimization problem (such as a unit commitment method Serve as variables to monitor the solar PV power plant accordingly. In other words, in response to the request of the Grid operator, different system monitor plans can be realized with the RSC –based solar PV power plant as follows:

- System monitor 1 for p gen > p req;
  - System monitor 2 for p gen < p req;
  - System monitor 3 for p gen = p req;
  - System monitors 4 charges from the grid (operation method 5).

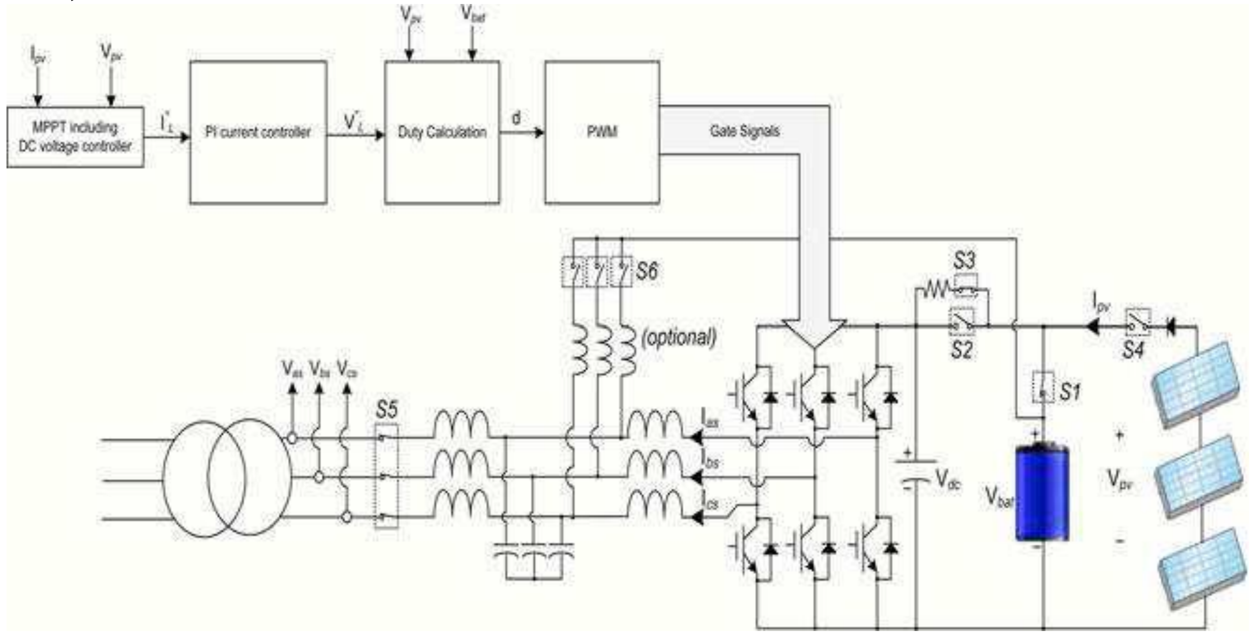
II. RSC MONITORS

2.1 Monitor of the RSC in the dc/ac Operation Methods (Method 1, 3, 4, 5)

The dc/ac operation of the RSC is used for delivering power from PV to grid, battery to grid, PV and battery to grid, and grid to battery. The RSC performs the MPPT algorithm to deliver maximum power from the PV to the grid. Like the usual PV inverter control, the RSC control is implemented in the synchronous reference frame. The synchronous reference frame proportional integral current monitor is employed. In a reference frame rotating synchronously with the fundamental excitation, the fundamental excitation signals are transformed into dc signals. As a result, the current regulator forming the inner most loop of the monitor system is able to regulate ac currents over a wide frequency range with high bandwidth and zero steady state error. For the pulse width modulation (PWM) scheme, the usual space vector PWM scheme is used. Figure 7 presents the overall monitor block diagram of the RSC in the dc/ac operation.
For the dc/ac operation with the battery, the RSC monitor should be matched with the battery management system (BMS), which is not shown in figure

2.2 Monitor of the RSC in the dc/dc Operation Method (Method 2)

The dc/dc operation of the RSC is also used for delivering the maximum power from the PV to the battery. The RSC in the dc/dc operation is a boost converter that monitors the current flowing into the battery. In this research, Li-ion battery has been selected for the PV battery system. Li-on batteries need a stable current, stable voltage type of charging algorithm. In other words, a Li-ion battery should be charged at a set current level until it achieves its final voltage. At the last voltage, the charging process should switches over to the stable voltage method, and offer the current essential to posses the battery at this final voltage thus the dc/dc converter performing charging process must be able of offering stable monitor for maintaining either current or voltage at a stable value, depending on the state of the battery. Typically, a few percent capacity losses happen by not performing stable voltage charging. But, it is not uncommon only to use stable current charging to simply the charging monitor and process. The latter has been used to charge the battery. Thus, from the monitor point of view, it is just sufficient to monitor only the inductor current. Like the dc/ac operation, the RSC performs the MPPT algorithm to convey maximum power from the battery in the dc/dc operation Figure 8 shows the overall monitor block diagram of the RSC in the dc/dc operation. In this method, the RSC monitor should be managed with the BMS, which is not shown



CONCLUSIONS

A passive MPPT technique, to be utilized mostly in large grid connected PV plants, has been introduced and discussed; it is essentially based on the energy storage capabilities of batteries that are proposed to be put in parallel to a proper number of PV subs –fields, so as to be used in a distributed manner. If well designed in their location, in their nominal voltage value and in their capacity, batteries can naturally catch the MPP of each PV sub-field, also compensating for critical unbalanced solar irradiation conditions Furthermore, the presence of an energy storage system can make more attractive grid-connected PV plant, due two some important additional capabilities not common of currently conceived grid- current control for each phase should be done asynchronously. Using the interleaving operation reduces the ripples on the charging current flowing into the battery. Thus, the filter capacitance value can be decreased considerably.

REFERENCES

1. U.S. Department of energy, “Solar energy grid integration systems – energy storage (SEGIS-ES),” may 2008.
2. D. Bundestag, “Gesetz zur Neuregelung des Rechts der erneuerbaren Energien in Strombereich und zur a “nderung damit zusammenha” ngender Vorschirften,” Bundesgesetzbltt, 2008.
3. H. Konishi, T. Iwato, and M. Kudo, “Development of large scale power conditioning system in Hukuto mega solar power project,” in proc. Int. Power electron, Conf. 2010, pp. 1975-1979.
4. J.H. Ensilin and D.B. Snyman, “Combined low cost, high efficient inverter, peak power tracker and regulator for PV application ns,” IEEE Trans. power electron. Vol 6, no. 1, pp. 73-82, Jan, 1991.
5. H. Ertl, J.W. Kolar, and F. Zach, “A novel multicoil dc-ac converter for application in renewable energy system,” IEEE Trans. Ind. Electron. Vol.49, no 5, pp 1048-1057 Oct, 2002.

6. C. Zhao, S. D. Round, and J. W. Kolar, “an isolated three-port bidirectional dc/dc converter with decoupled power flow management,” IEEE Trans. Power Electron, vol, 23 no, 5 pp, 2443-2453, Sep, 2008.
7. M. Bragard, N. Soltau, R.W. De Doncker, and A. Schiemgel, “Design and implementation of 5 kw photovoltaic system with Li-ion battery and additional dc/dc converter” in Proc. IEEE Energy Conveyor Congr. Expo, 2010, pp, 2944-2949.
8. W. Li, J. Xiao, Y. Zhao, and X. He, PWM plus phase angle shift control scheme for combined multiport dc/dc converters, IEEE Trans. Power Electron vol, 27, no.3, pp. 1479-1489, Mar, 2012.
9. N. Benavidas and P.Chapman, “power budgeting of a multiple –input buck –boost converter,” IEEE Trans. Power Electron, vol.20, no.6, pp.1303-1309, Nov, 2005.
10. P. Barrade, S. Delalay, and A. Rufar, “Direct connection of super capacitors to PV panels with on-off maximum power point tracking,” IEEE Trans. Sustainable energy, vol.3, no.2, pp. 283-294, Apr, 2012.