

STORAGE SCHEDULING SCHEME FOR DISTRIBUTED ENERGY GENERATION SOURCES

Nayana

Associate Professor,
Dept. of EE Engineering
NMAMIT, Nitte, Udupi, Karnataka.
Email id: nayanar401@gmail.com

Abstract: Innumerable methods of generating, delivering and consuming electricity has become very prominent in the recent days due to the emergence of the distributed energy resources that are comprised of renewable energy sources and the energy storage systems. The prevailing energy storage systems for the distributed energy resources has its own challenges that are related to the methods of storage, the cost of the storage and their functioning. So the paper puts forward a novel energy accumulator that is supported by a rotating magnetic core as storage for the distributed energy resources. The proposed method brings down the operational, technical and financial complexities in storage of the distributed energy resources.

Keywords: Renewable Energy sources, energy storage system, distributed energy resources, energy accumulator and rotating magnetic core.

1. INTRODUCTION

The usual micro-grid or the prevailing distributed energy resources (DER) is comprised of the following fundamental elements such as the (i) renewable generation that holds a solar photovoltaic or wind turbines or the both, for the major renewable resource generation, and an inverter system to connect to the renewable energy generation sources to the grid. Apart from the renewable generation sources the system also has a one or more (ii) standby generators, operated by the either the natural gas or the diesel, to deliver extra power when the energy generated by the renewable resources are insufficient and in the case of emergencies. (iii) The DER also holds the power factor correction equipment that is normally in the form of the capacitor banks to improve the quality of the power, (iv) ultra-capacitors that provide a short-term supplementary power to smooth the transitions in the distributed sources and support load steps, and finally a (v) controls system to arrange power supply possessions and

stabilize the supply with the load being serviced by the deployment. The fig .1 below shows the arrangement of the Distributed Energy Resources.

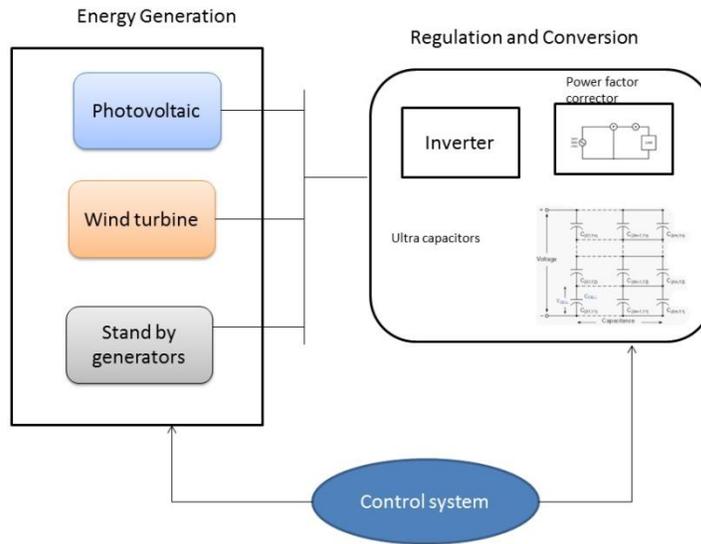


Fig.1 Distributed Energy Resources Deployment

Multitude of novel methods and applications are integrating the renewable energy sources in their task to improve the financial side of the applications. The energy accumulated minimizes the cost as well as enables to increase the revenue by the affording the grid to satisfy the requirement on the time of emergency. This is done by bringing down the utilization of the power on the regular applications such as the house holds works, charging of the car etc.

The lithium ion batteries that store a substantial amount of the renewable loads for a certain amount of period are engaged in most of the applications recently as the other batteries such as the lead acid and the flow batteries does not meet the requirement of the today's needs. The table .1 below shows the comparison of the different types of batteries available.

Parameters	Lead Acid	Flow batteries	NaS	Li-ion
Energy Density	Low	Lower than Li-ion	Low	High
Efficiency	87%	(55-80) %	High (92%)	High (100%)
Life Cycle	200-300	-	-	500-1000
Toxicity	Highly corrosive	Low	Highly corrosive	Non-Toxic
Cost	low	High	High	Not more than 600 \$
Others essentialities	Needs continuous maintenance	High power capacities for load leveling especially in grid system	Requires high operating temperature	-

Table.1 Comparison of Battery Parameters [7]

Initially the battery arrangement for the accumulating the renewable energy was tedious and highly challenging, as the batteries had very less lifetime, which depended on the total number of the discharges, the duration of the discharges, the rate of the recharges and the age of the batteries. So the lifespan of the battery directly depends on the number of the discharges faced by it.

For the renewable energy storage arrangement, the battery utilized faces a continuous discharge and recharge which in turn reduces the lifetime of the batteries and causes the continuous replacement of the batteries before its life expectancy. So in order to minimize the energy storage problem and the battery problem in the distributed energy resources, the paper puts forward the incorporation of the a novel energy accumulator that is supported by a rotating

magnetic core as storage for the distributed energy resources to bring down the operational, technical and financial complexities in storage of the distributed energy resources.

The remaining paper is arranged with the, 2.Related works, 3.Proposed storage scheme with the reduced operational, technical and financial complexities in storage of the distributed energy resources, 4. The result evaluation and 5.Conclusion

2. RELATED WORKS

The sections present the prevailing storage schemes available and the measures taken to improve the prevailing storage system of the of the distributed energy sources. The author Manikandan et al [1] presents the "Controller based performance measures of speed control of electrical motor for industrial applications." The author Kumar, N. Mohan et al [2] details the "energy and power efficient system on chip with Nano sheet FET." Nirmal, D. et al [3] provides the "design and efficiency analysis of Nano carbon interconnect structures" and the author Bahn, Hyokyung et al [4] proposes the . "Efficient management of probe-based nano storage devices"

Bhalaji, N. et al [5] utilizes the soft computing in the task scheduling and the storage management in the cloud. Smys, S., and G. Ranganathan et al [6] provides the details of the manufacturing industry run by a robots Mohanty, Parimita, et al [7] presents the "PV system design for off-grid applications." and the author Zhao et al [8]proposes the "Review of energy storage system for wind power integration support" the author Yao, D. L., San Shing et al [9]puts forward the "Determination of short-term power dispatch schedule for a wind farm incorporated with dual-battery energy storage scheme."

The "Smart home energy management systems: Concept, configurations, and scheduling strategies." Was proposed by the author Zhou, Bin et al [10]. The author Yi, Jialiang et al [11] put forth the "Robust scheduling scheme for energy storage to facilitate high penetration of renewables" and the Singh, et al [12] proposes the. "Optimal power scheduling of renewable energy systems in microgrids using distributed energy storage system."

Salinas, et al [13] puts forth the "Dynamic energy management for the smart grid with distributed energy resources." and the Régis, Nibaruta, et al [14] in his paper develops an Energy Flow Strategy For A Small Scale Grid-Tied Photovoltaic System Under Net-Metering." Kumar, R. Praveen, and S. Smys et al [15] details the "A novel report on architecture, protocols and applications in Internet of Things (IoT)"

3. PROPOSED ENERGY ACCUMULATION STRATEGY

The proposed method put forth, integrates the rotating magnetic core with the accumulator to provide a grander energy accumulation facility for the distributed energy resources for both the long as well as the short power requirements. The proposed system includes the rotating magnetic core, a DC/DC inverter system, an accumulator or a battery, a static disconnect switch, two bidirectional invertors and the lifter and the lie inductors. The fig .2 below shows the block diagram of the proposed energy accumulation system.

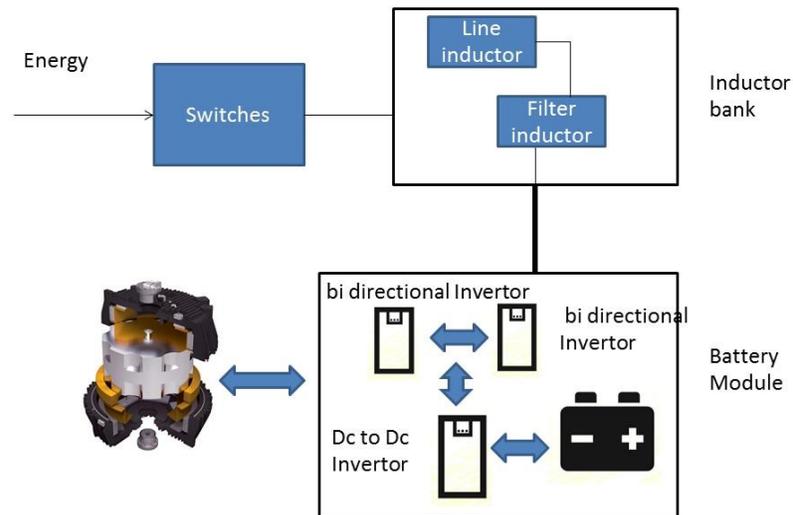


Fig.2 Proposed Block Diagram

3.1. WORKING

The rotating magnetic core constantly spins the rotor in the low friction environment and stores the energy produced due to the movement. In cases of short power requirement due to the variations in the renewable energy production , or peak power utilization , the rotating magnetic core inertia enables the continuous spinning of the allowing the stored energy to be transformed and distributed to the grid. The battery cabinet found in the system includes a DC to DC convertor and a supplementary accumulator. The battery is usually utilized for the long term power storage and is discharged through the driver module; the rotating magnetic core is clubbed with the accumulator in the system so this seems as a single energy source. Apart from the above mentioned devices the proposed system employs two DC distribution systems to regulate and monitor the flow of the power between the DC and the Ac grid. The DC distribution system receives the DC input and converts it into AC output.

The integration of the rotating magnetic core and the energy accumulators over the potential barriers in its functioning by breaking the operational complexity and works at a much reduced cost. The proposed system expands the life span of the battery by minimizing the total number of durations.

4. RESULTS

The proposed rotating magnetic core integrated with the battery allows the accumulator to start discharging only for the large scale requirements thus protecting the load frequency and resulting in lower maintenance as well as the replacement cost. The fig.3 below shows the cost reduction achieved by the proposed method.

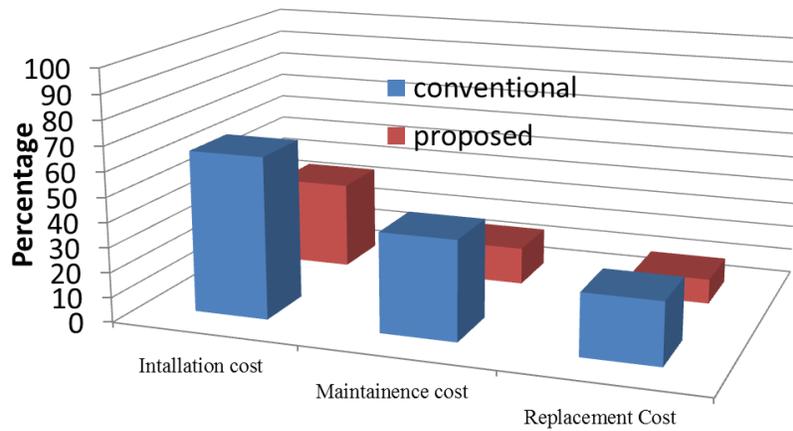


Fig.3 Cost Percentage

The fig .4 given below shows the minimization in the sharp voltage dip by installing proper sized energy accumulators, the rotating magnetic core delivers the load to the battery in the controlled manner and minimizes the initial step load discharge.

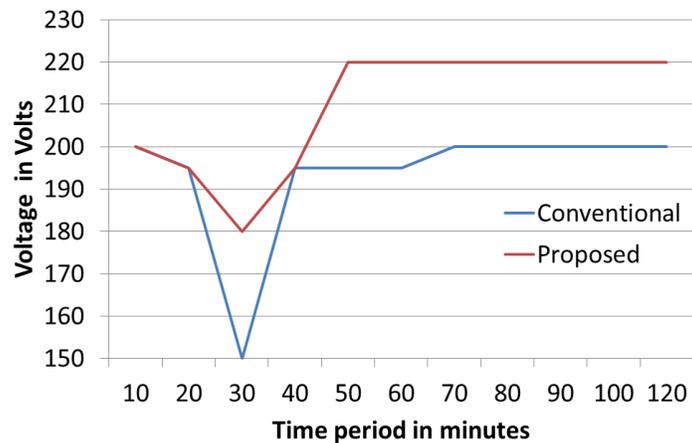


Fig.4 Minimized Sharp Voltage Dip

The Table.2below provides the charging rate, number of discharges and the initial investment cost and the total maintenance and the replacement cost of the proposed accumulator and the prevailing system

Parameters	Proposed – Battery system	Conventional Battery
Charging rate %	100	95
Number of Discharges	20 (per year)	(40-65) per year
Investment Cost %	35	65
Maintenance Cost %	15	40
Replacement Cost %	10	25

Table.2 Comparative Analysis

5.CONCLUSION

The proposed novel integrated energy accumulators, remains as an optimal technology to handle the power factor challenges. This method achieves the minimized operation complexity as well as the cost by vividly altering the finance of the distributed energy resources. The system seems to be a less expensive alternative to the conventional back up generation system. The results obtained proves the capability of the proposed system in terms of cost , Charging rate , discharging rate etc.

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