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Hybrid Energy Storage System based Micro Grid Integration with Four Leg Three Level NPC Inverter

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ABSTRACT: This paper using Micro-Grids Integration for Power Quality Improvement for Four Leg Three Level NPC Inverter based on Hybrid Energy Storage System. A 4-leg 3L-NPC power converter is used in the micro-grid to interface RES to HESS (made by lead acid and Li-ion batteries). A foreground of structural introduced and implemented to take advantage of the full capacity of a 4-leg 3L-NPC converter to insure maximum power section between two ESS. The unbalanced load problem is addressed in the fourth step of the converter, which allows active power filter capabilities. The topology was studied and it was established that its HESS also has the ability to share power. The ability of the proposed control strategy to manage HESS to improve power quality and stability, as well as to control the renewable energy injected into the micro-grid, was demonstrated by experimental results. The system is compatible with solar panels (10 W) with a 12 V output and can operate on a 12 V battery, which allows to receive a 12 V supply, which is then passed through the MOSFET driver IC, the output of which is followed by a step up transformer. , 230V bulb allows to run on 10 watt solar panel or 12 volt battery. This system not only upgrades the existing system on a variable frequency basis, but also upgrades it. More about this source text Source text required for additional translation information send feedback Side panels

KEYWORDS: Inverter, PV panel, MOSFETS, Snubber circuit, photovoltaic cell, micro grid, renewable energy, inverter, battery charge controller etc.

I.INTRODUCTION

As interest for power gradually increases, so does electricity consumption. To meet the need, there is a valuable hotspot for the fuel source which is a sustainable energy source in that photovoltaic cell. A photovoltaic cell is a nonlinear well of energy so its formation does not stabilize after a while. Various processes are used to extract the largest force from the sun-facing cluster. The framework will be provided with solar energy which will have some problems including low voltage, high voltage, bad luck (I2Xr), dependence and so on which can be reduced by short matrix ideas. Renewable sources are nonlinear so a capacity frame is required to sustain stocks and this is accomplished by lithium particle batteries and lithium corrosive seed batteries each containing 12 volts. Charging and release is directed by the battery charge regulator. The snubber circuit used as a circuit protects the system from reverse current. All semiconductor devices are nonlinear that produce harmonics during the conversion process from DC to AC. The energy generated by the solar-powered power plant is DC and has the highest load on the air conditioner. So you need to convert DC to AC which converts AC activity on DC into a four leg three level NPC inverter. This inverter contains voltage controlled gadget MOSFETS

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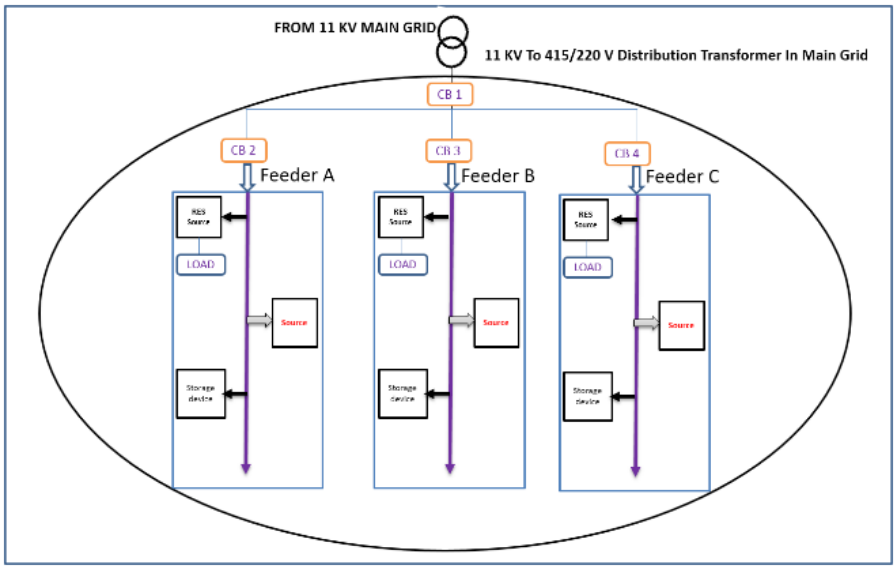
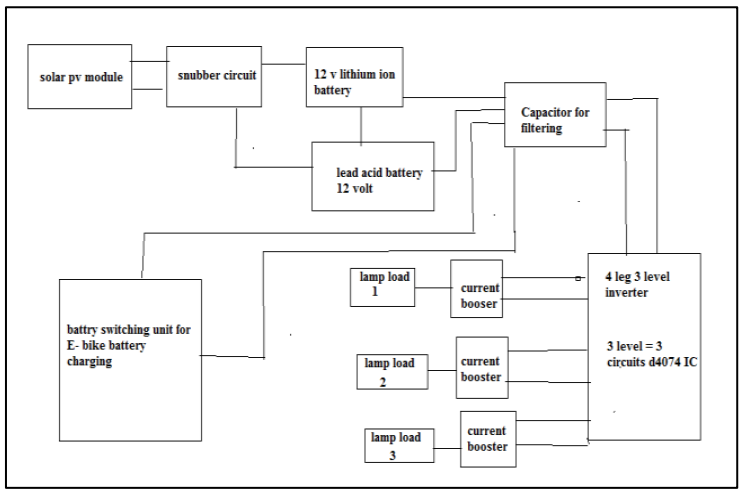


Fig. 1 A Micro grids Configuration

Micro Grid Configuration The representation of a typical block archive is shown in Fig. 1.
The micro-grid concept, which has been defined as a small weak article grid and is capable of operating in island mode, has been extensively addressed in the RES integration solution. The weak form of the micro-grid is the RES access fight and its stability suggests the use of energy storage systems (ESS). The chemical energy storage energy system is called a battery. Energy
Radiation, chemical, gravitational potential, electrical potential, electricity, elevated temperature, latent heat, kinetic, etc. are micro-sources connected to electrical load and low-voltage network in many ways. Sources and loads are combined to reduce transmission losses. These micro-sources are plug-and-play, providing protection between power electronic control and grid mode and company standalone mode.

II.SYSTEM MODEL AND ASSUMPTIONS



Block diagram of HESS micro grid integration to improve power quality using a four leg three level NPC inverter.

A. Model of PV cell
PV begins with two different words - photo, which represents light and voltic, which signify the formation of energy. Finally, the term PV specifically focuses on generating energy from the sun. An array powered by solar energy consists of several combinations of sun-based modules, each module containing different solar cells. Solar cells formed in a thin layer of semiconductor contain P-N diodes. They look like P-N diodes and their properties are also comparable. Shows the equivalent circuit of a perfect PV cell. This ideal design is accurate enough to understand PV properties and PV cell

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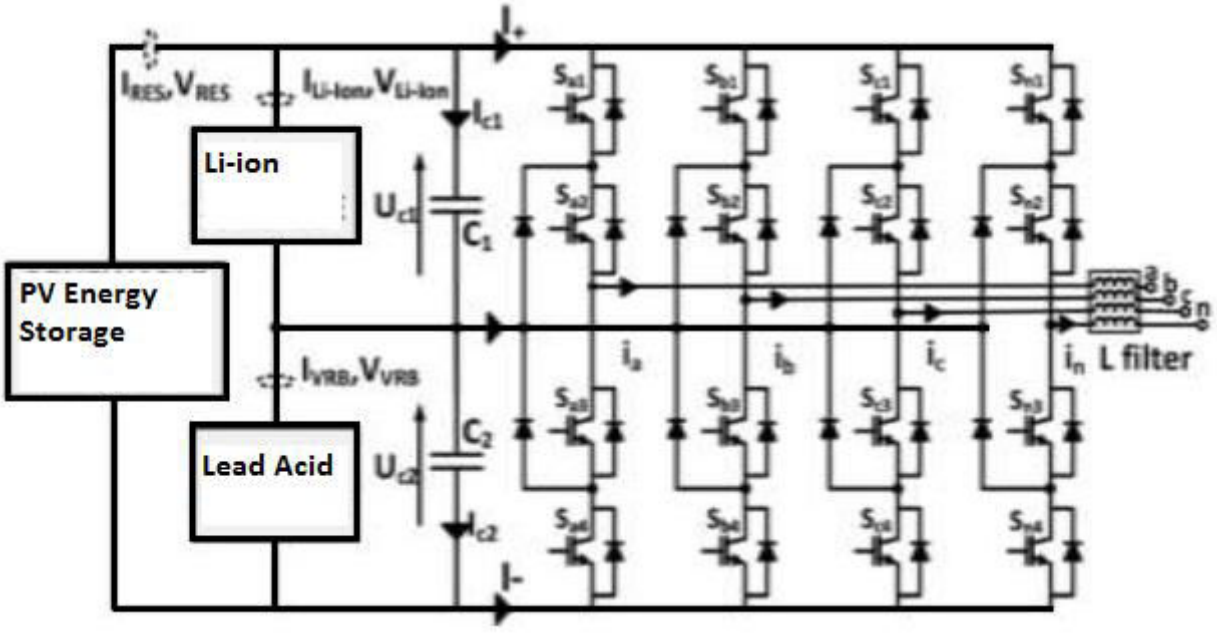
dependence on different climatic conditions. Solar panels are created by adding several solar cells in series and in parallel to achieve the desired product output under nominal conditions. When designing a panel on a protease, the solar cell in its equivalent form is considered.

Compared to this single technology, ESS, Hybrid ESS (HESS) can combine the advantages of each technology used in ESS and hybrid, thus making it more suitable for a large number of renewable energy systems. This research presented that micro-grid (MG) is an indispensable infrastructure of HESSThe topology is working with smart grid efficiency nowadays, however, volatility caused by fluctuations and mediation but micro resources and nonlinear loads will have a significant impact on MG's operation. Energy storage technology is the gift for the preferred solution that has emerged in the smart grid of the above problem. The paper gives a full overview of the main functions of energy storageTechnology and is being developed, and the features and advantages of energy are storage systems (ESS). In [2] the authors represent that 2D flows and 3D connected species / charges / fluid transport can be used to obtain electrodes by going beyond the model and studying the pore scale. Better results and understanding of flow at the hole level. In [4], an integrated energy management and plan for renewable energy grid integrated systems with battery capacitor hybrid storage is proposed. The nature of renewable-energy sources (RES), with unexpected sudden changes in loads, demands the existence of high-power and high-energy, density storage systems in today's micro-grid environment. A capacitor with sufficient energy storage and its equivalent series resistor (ESR) must be small enough to reduce the voltage drop and spikes to distribute the current pulse for the required time. Capacitors meet these requirements. This paper monitors performance improvement when a capacitor with a battery is used. The researchers used a DC-connected structure to differentiate grid voltage and frequency from other sources. All sources are connected to the main supply DC bus Before connecting to the grid by the main inverter topology. [5] The authors proposed that the large-scale use of renewable energy (i.e. wind energy and solar PV) be completely new.

Challenges in power micro grid systems and greater volatility in electricity prices in the use of the electricity market. [6] An updated review of the state introduced several energy storage technologies and installations and analyzed their various features in [8]. [9] distributed power generation as a new technology to meet the growing demand for electricity. There are micro gridsIntegrating, distributing and creating reliably and neatly in the main grid has attracted a great deal of attention with a single system. They claim that the significant advantages associated with micro-grids have led to wider efforts to expand their access to electric power systems. This paper studies DC-connected wind / solar / capacitor hybrid power systems. Capacitors have high power density and exceptional durability for charging. Li-ion batteries benefit from high specific power and moderate auto-discharge compared to lead acid seeds. This technology has also been developed for high power standalone backup applications in recent years. More about this source textSource text required for additional translation informationSend feedbackSide panels



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III. PROPOSED SYSTEM DEVELOPMENT

The snubber circuit protects the system from reverse current. It consists of forward bias diodes and capacitors, the forward bias diode is loaded from the current source and filtered through a capacitor and goes to the battery and charges the battery. When the battery is fully charged it acts as a short circuit and current flows from the load to the source, in this case the diode switches open and does not allowFlow current from the load to the source If the diode starts to run in any position, the capacitor acts as an open switch because the capacitor does not supply DC, the system battery supplies the inverter continuously in the absence of sunlight. The battery supplies 12V DC to work efficiently, the system uses MOSFET driver IC CD4047 with output pins 10 and 11Both are opposite to each other. The output frequency depends on the input timing circuit which is a combination of resistor and capacitor, the resistor provides a discharging path to the capacitor from the ground. The discharging period depends entirely on the capacitance of the capacitor; This creates a timing circuit that acts as an input to the driver IC. This system uses a solar charge controller.To protect the battery from damage, there are many types of batteries but our system allows lead acid batteries and lithium-ion batteries, while the battery requires low current and constant voltage for the charging period. When the battery is fully charged, the charge controller disconnects the battery from the system.

Sr. No.	Name Of Component	Specifications	Quantity
1	Solar panel	12 volt & 10 watt	1
2	Snubber	12 volt	1
3	Lead acid Battery	12 volt & 3 amp, capacity 10AH	1
4	Lithium ion battery	12 volt & 3 amp, capacity 10AH	1
5	MOSFETs	24 volt & 25 amp (IRFZ44)	2
6	Step up Circuit	12 volt to 230 volt AC & 3 Amp	1
7	Filtering circuit	12 volt	1
8	PWM signal generator	12 volt (CD4047)	1
9	Lamp Load(CFL)	230 volt & 3 watt	3

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IV. RESULT AND DISCUSSION

PRACTICAL OBSERVATION TABLE

Load (Watt)	Input voltage	Input current	output voltage (Before transformer)	Output Current (Before transformer)	output voltage (After transformer)	Output current (After transformer)	Inverter Efficiency
No Load	12.20 V	0.254 A	13.33 V	0.213 A	230 V	-	-
3 W	12.02 V	0.794 A	12.85 V	0.486 A	227 V	27.88 mA	66.23 %
18 W	11.86 V	1.385 A	12.27 V	0.768 A	203 V	74.9 mA	92.61%
21 W	11.76	1.758 A	11.94 V	0.815 A	197 V	100.91 mA	96.83 %

As shown in the table, the efficiency of the NPC inverter connects the 3W LED lamp to the load as a load then the observation efficiency is 66.23%, resulting in reduced efficiency, when the load is changed from 3W to 18W the efficiency increases to 90.23%. % Based on the inspection results we can conclude that this inverter is suitable for 20W-25W as it operates in this range with high efficiency.

Voltage Reading for 7 hours

Nominal voltage (V)	Operating hours						
	1	2	3	4	5	6	7
	Voltage of the Battery (V)						
12.41	12.13	11.90	11.59	11.06	9.11	2.57	-
12.65	12.41	12.13	11.67	11.13	8.41	2.27	-
12.69	12.45	12.17	11.56	11.12	7.98	3.05	-

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V.CONCLUSION

This system works efficiently between 20W-25W loads also this system can operate continuously 4 hours without solar energy as we reduce the load in wattage the backup time increase for 5 w load it works for 15 hours..

REFERENCES

[1] Quentin Tabart, Ionel Vechiu, "Hybrid Energy Storage System Micro Grids Integration For Power Quality Improvement Using Four Leg Three Level NPC Inverter and Second Order Sliding Mode Control" IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS ,2017

[2] R.R.Sawant and M. C. Chandorkar, "A Multifunctional Four-Leg Grid Connected Compensator," IEEE Trans. Ind. Appl., vol. 45, no. 1, pp.249–259, Jan. 2009.

[3] Vechiu, A. Etxeberria, H. Camblong, and Q. Tabart, "Control of a microgrid-connected hybrid energy storage system," in Renewable Energy Research and Application (ICRERA), 2014 International Conference on, 2014, pp. 412–417.

[4] N. Celanovic and D. Boroyevich, "A comprehensive study of neutral- point voltage balancing problem in threelevel neutral-point-clamped voltage source PWM inverters," IEEE Trans. Power Electron., vol. 15, no. 2, pp. 242–249, Mar. 2000.

[5] J. Pou, J. Zaragoza, S. Ceballos, M. Saeedifard, and D. Boroyevich, "A Carrier-Based PWM Strategy With Zero-Sequence Voltage Injection for a Three-Level Neutral- Point-Clamped Converter," IEEE Trans. Power Electron. vol. 27, no. 2, pp. 642–651, Feb. 2012.

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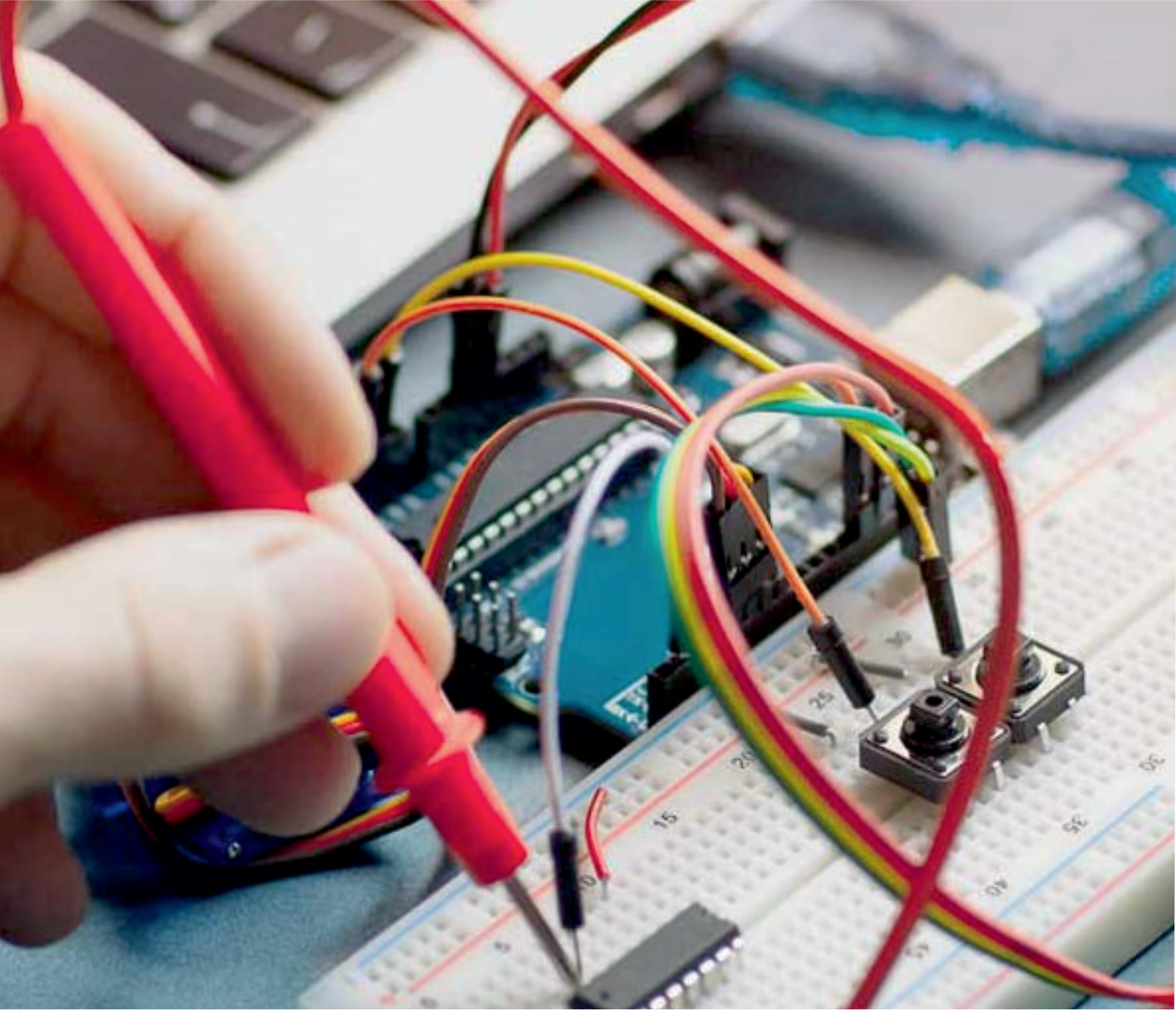
[6] Chebabhi, M. K. Fellah, A. Kessal, and M. F. Benkhoris, "A new balancing three level three dimensional space vector modulation strategy for three level neutral point clamped four leg inverter based shunt active power filter controlling by nonlinear back stepping controllers," ISA
Trans., vol. 63, pp. 328–342, Apr. 2016.
[7] N Reddy,K Mishra "Dynamic Energy Management of Renewable Grid Integrated Hybrid Energy Storage System" IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS vol. 62, no. 12, pp. 7728–7737,Dec. 2015.
[8] Etxeberria, I. Vechiu, H. Camblong, and J.-M. Vinassa, "Comparison of three topologies and controls of a hybrid energy storage system for micro grids," Energy Convers. Manag, vol. 54, no. 1, pp. 113–121, Feb.2012
[9] Vechiu, O. Curea, and H. Camblong, "Transient Operation of a Four-Leg Inverter for Autonomous Applications With Unbalanced Load,"IEEE Trans. Power Electron, vol. 25, no. 2, pp. 399–407, Feb. 2010.



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