Flywheel Use in Solar System for Energy Storage

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Abstract— In this paper deals with concept of replacing battery use in solar system with flywheel which help to increase storage capacity as well as less losses as comparative to battery. Flywheels have attributes of a high cycle life, long operational life, high round-trip efficiency, high power density, low environmental impact, and can store Megajoule (MJ) levels of energy with no upper limit when configured in banks. Not only battery life is less but also more expensive. Solar technology massive growth in recent days but more expensive due to price of battery.

Keywords: Flywheel, Solar System, Battries, FESS

I. INTRODUCTION

Energy storage systems (ESS) can be used to balance electrical energy supply and demand. The process involves converting and storing electrical energy from an available source into another form of energy, which can be converted back into electrical energy when needed. The forms of energy storage conversion can be chemical, mechanical, thermal, or magnetic ESS enable electricity to be produced when it is needed and stored when the generation exceeds the demand.

In few last decades Indian government has taken several steps to reduce the use of fossil fuels-based energy while promoting renewable generation. Solar energy constitutes the most abundant renewable energy resource available and in most regions of the world even its technically available potential is far in excess of the current total primary energy supply. As such solar energy technologies are a key tool to lower worldwide carbon emissions. Which is the storage system proposed in this report, is a viable alternative to battery storage.

In rural areas long distance between power station and village. If not possibility of grid then we majority use to prefer the solar system. Solar technology more efficient as compare to other renewable resource. But the cost of solar system is more. In solar system more expensive is battery to use energy storage system .so we can replace the battery with flywheel. The price of flywheel is less as well as life also more longer than batteries if we can use flywheel as an energy storage system then price of the solar system decrease. Also life of flywheel minimum 18 to 20 years more than battries.

II. LITERATURE REVIEW

For initializing this project, we searched different information regarding of pressurized our topic with literature review of different research paper.

1) In this paper we found lithium ion battery better performance than other battries .Catastrophic failures due to excessive temperature variations especially high temperatures can cause a thermal runaway reaction that ignites a fire and consequently cause an explosion. Operating temperature of Li-ion battery is 25°-55°C.
2) From this paper we found that the explosion of battery results from the heat and pressure accumulation reaction under abuse condition .such as overheating, overcharge, and short circuit .The main heat source such as cathode and anode decomposition.
3) From this paper we find electronic and electrical waste increase fast from 2013-14 to 2019-20 an increasing amount of waste requires more land area for disposal, and adds to the amount of harmful chemicals that eventually re-enter the environment. The increasing use of portable electronic devices is also the increasing disposal of portable batteries that consist of various toxic substances.

III. COMPONENTS & WORKING

Compressor: The main work of compressor is suck the air from atmosphere and compress to high pressurized air.

A. Rare-Earth Magnet

It is use for lifting the weight of flywheel & also use for energize coil.

B. Solar Panel

Solar panel trap solar energy from sun it use to energize coil use to help rotate flywheel.

C. Dial Gauge

It is use monitoring lifting height of flywheel & provide signal to controller.

D. Controller

Controller get signal from dial gauge about variation of lifting height of flywheel & manipulate by changing supply air pressure.

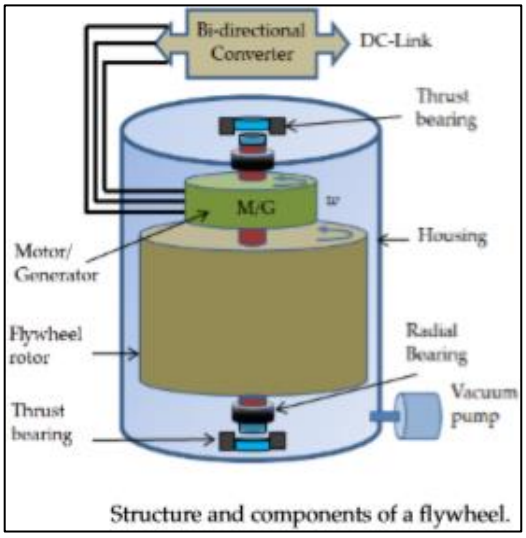

Fig. 1: Flywheel Sealed in Vaccum Chamber

IV. WORKING METHODOLOGY

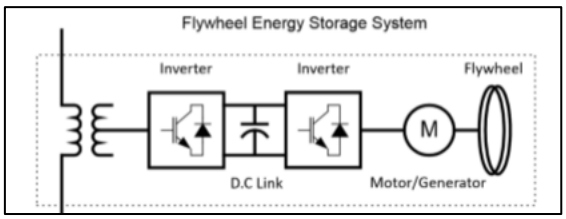

Fig. 2: Flywheel Energy Storage System Schematic Diagram

Solar energy trap the solar plates. That energy transfer to energize coil it works as motor or generator it helps to rotate the flywheel. Flywheel store energy day time.as per need provided also needy area & remaining energy store in flywheel. At night or evening discharge energy to the requirement area. Flywheel arrangement such way that place in vaccum chamber that help to avoid air restriction which help to avoid losses. Thrust bearing use in flywheel arrangement it is also frictionless it helps give maximum energy output. We show in fig 1. A flywheel energy storage system and the experimental techniques to ascertain the modal parameters. The complete system schematic is described in Fig. 2. Energy is stored as rotational kinetic energy in the flywheel. When energy is surplus, the flywheel speed increases by virtue of the motor, till it reaches its design speed. In idol mode, this energy can be stored for long durations as there is minimal loss incurred due to the use of low friction gas magnetic bearings. When energy is needed, the stored kinetic energy is retrieved by using the generation mode of the motor. Overall process of charging, idling and discharging is depicted in Fig.3.

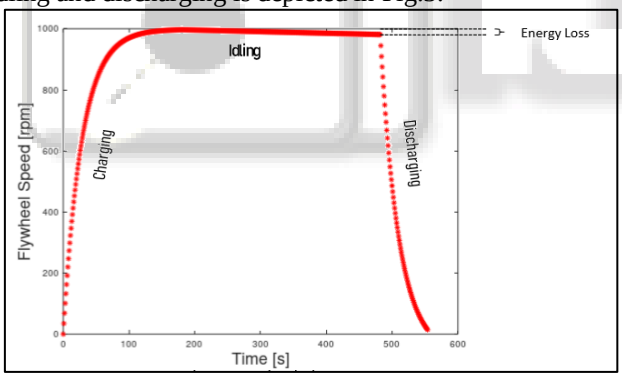

Fig. 3: FESS Simulation

V. VALIDATION

In batteries continues chemical reaction. Heating problem major issues in batteries so its affects discharging of battery very fast. Solar system place larger temperature areas but that temperature also affect battries it's reduce battries life. Battries in solar system replace after 2-3 years.

In other hand flywheel environmental friendly. Its life about minimum 18-20 years. Temperature does not affect energy discharging rate.

VI. CONCLUSION

Flywheel is not new technology but recent decades flywheel use as power generation as well as in energy storage system. We concluded that flywheel use in solar system any climate condition not affect the output and environmental friendly as compare to battery. After some testing some result we found that as follows:

Loss of energy in case of an FES is primarily due to bearing viscous losses and pumping power loss. Figure 30 shows the energy loss with time for an ideal FES system. The FES prototype used for this analysis stored 10.5 W of energy at 1000 rpm and a cost down analysis showed a good coherence with theoretic values.

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