

# Design and Analysis of Spinning Reserve Gravity Hydro Energy Storage Technology

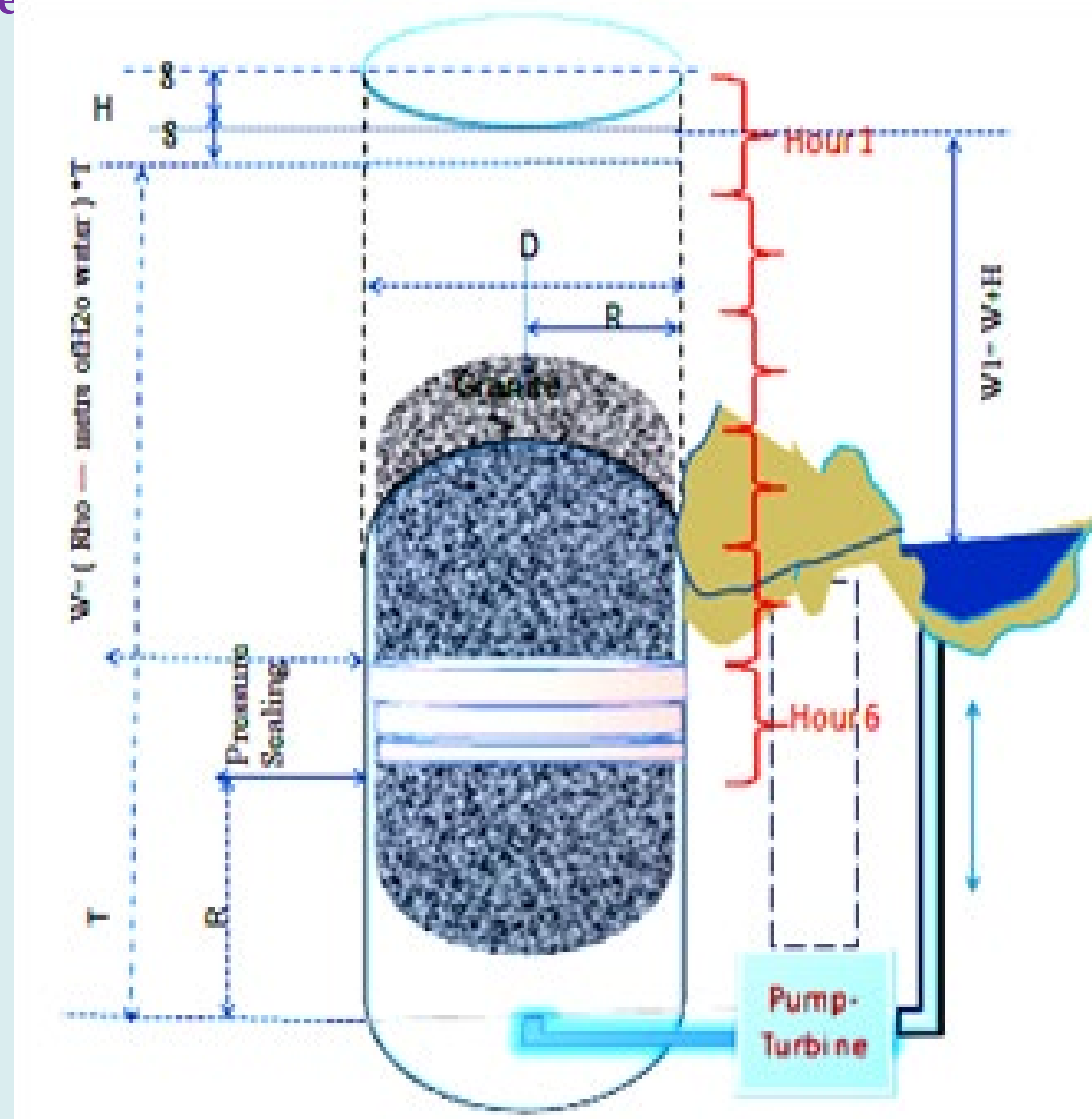
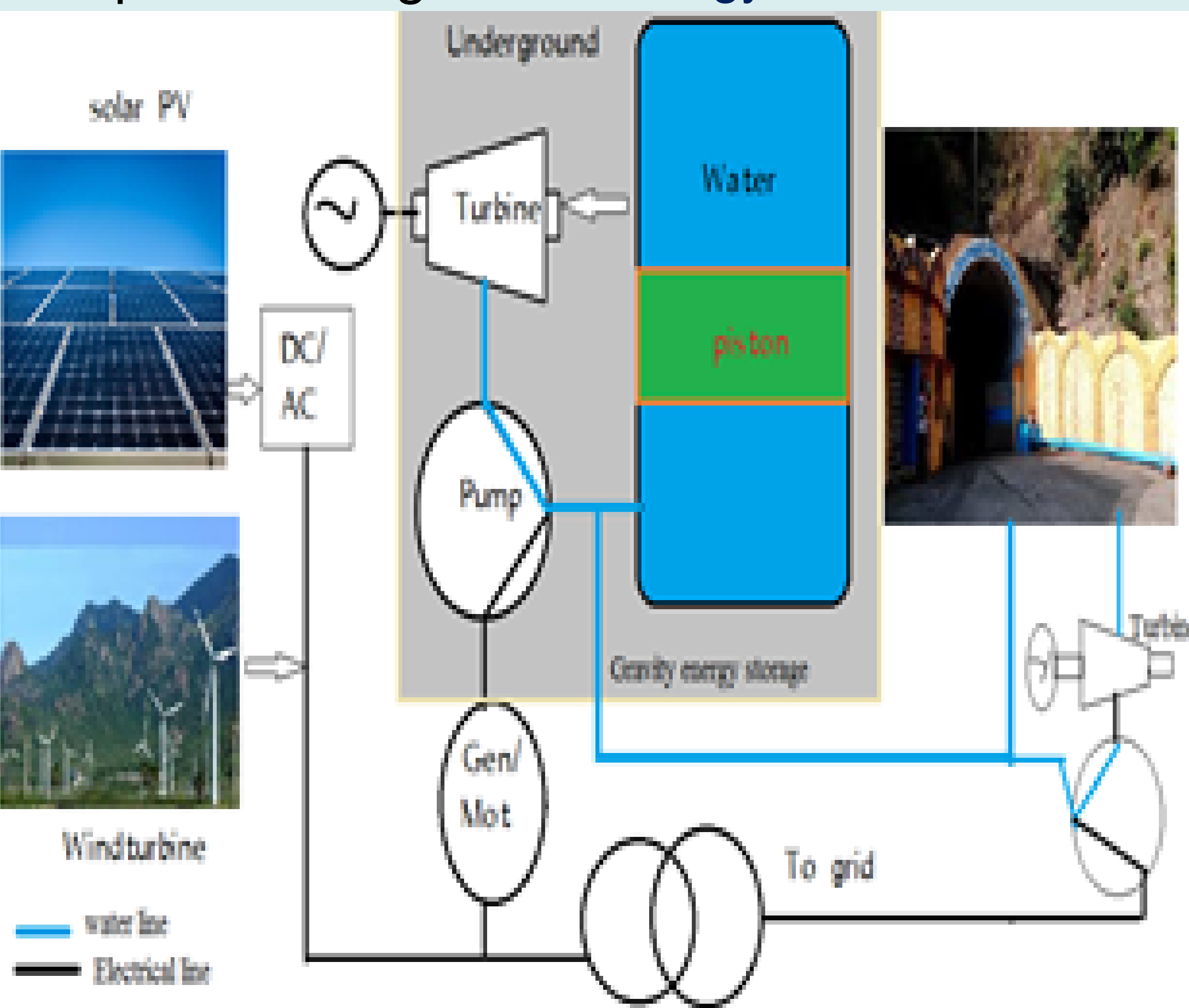
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**Abstract**— Southern region of India has more peak and valley on its geological surface which leads more waterfalls. Sustainable energies are trending now due to zero emission power generation. Earth is gifted by natural energy resources every routine of time. Energy storage system for combining all the resources provides uninterrupted power supply to year around. India assures reduction of Green House Gas emissions intensity per unit gross domestic product 35% below level of year 2005, using sustainable energies in generating power to Grid. The intermittency nature of energies affects the stability of grid can be avoided by energy storage system. Energy storing system also solving the extension of power grid, increasing percentage contribution of sustainable energy in power generation, and tallying demand, and supply of energy. Technology implementing for storing power still needed more new experiments to improve the interest on development of sustainable energy generation. Pumped hydro storage is bulky potential storage technology commonly used, however power generation in low water level due to depletion of monsoon, current frequency lag for pumping and reserve spinning are achievable only by gravity hydro storage. This research technically designs and testing the proposed model of gravity hydro storage in SIMULINK analysis tool for Kadamparai location at TamilNadu, India. The optimum design of cylinder and piston are analyzed by ANSYS WORKBENCH also dynamic modeling analysis of hybrid sustainable energies with proposed gravity storage is done. Hybrid model with energy storage can implement in large and small hydro power houses for year around generation. This paper also suggesting model makes all abandoned mines as zero emission energy batteries.

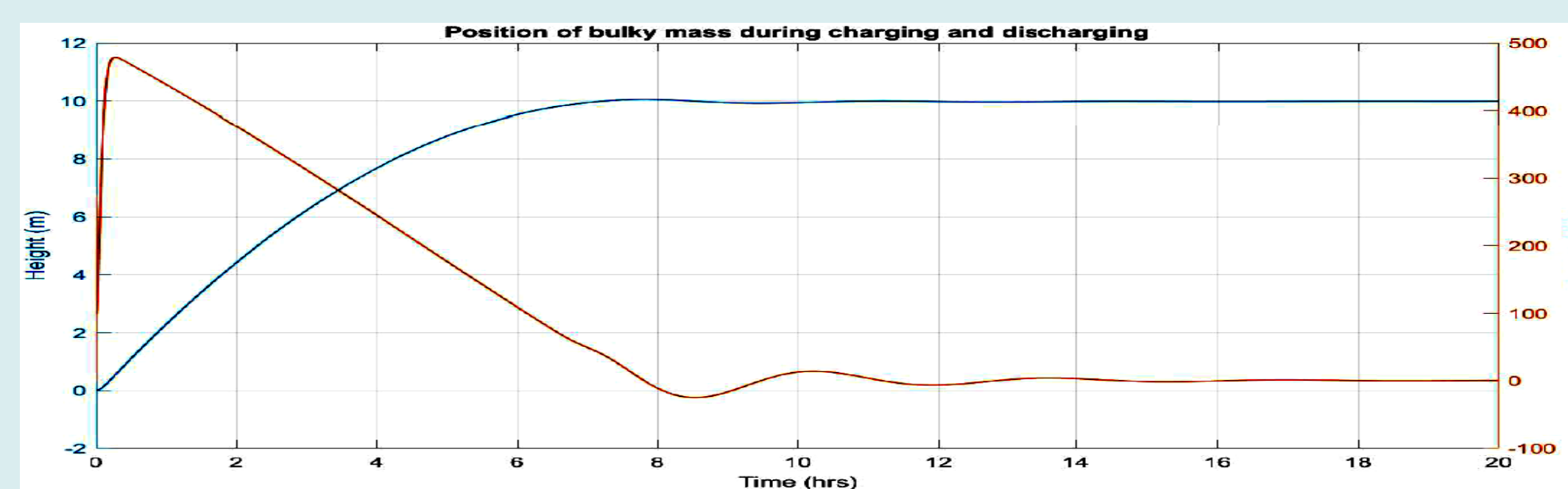
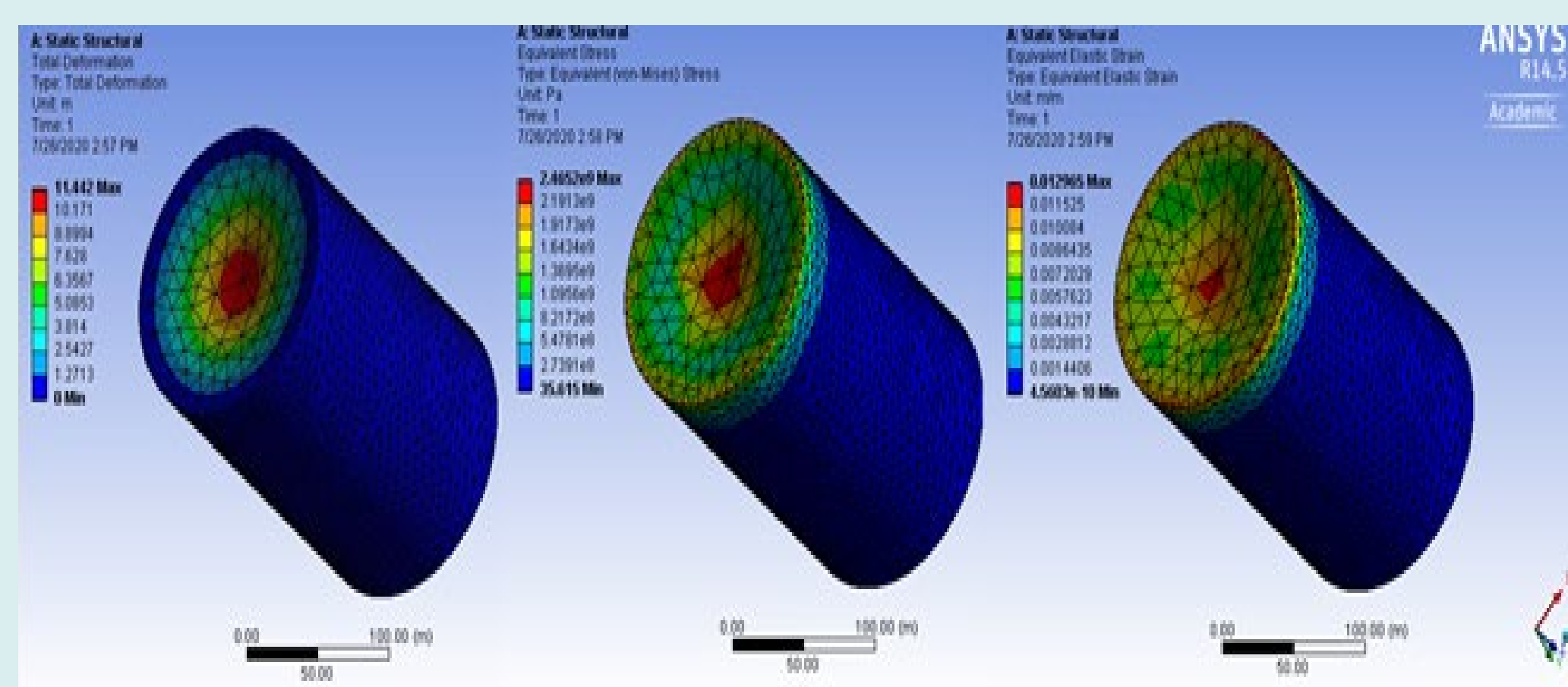
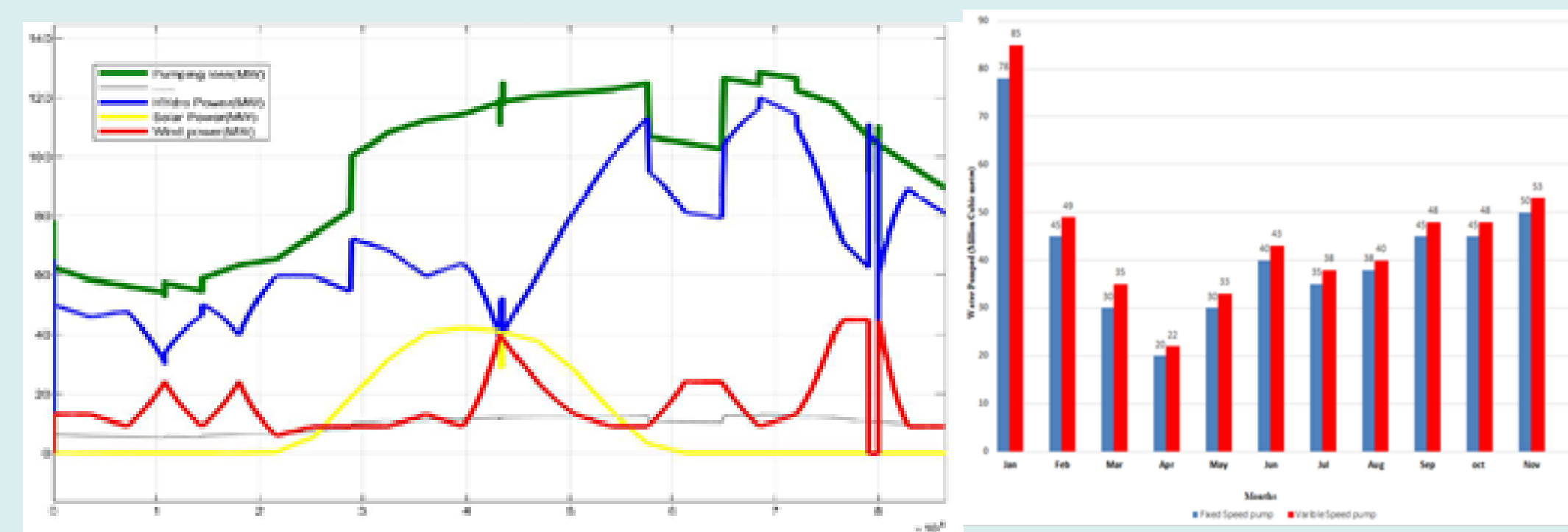
## Introduction

Monsoon depletion and frequent intermittency of sustainable energy completely disconnected the plant from uninterrupted power supply to grid. To solve this problem most of the hydro plant must be designed with reserve spinning power capacity storage technology. Comparatively pumped and Gravity Hydro Storage (GHS) is cheaper, long lasting, more efficient than all other energy storage technology. Hybrid model of GHS structure diagram explained in Fig. GHS stores hydraulic potential energy by pumping and lifting a bulky mass (BMS) against gravity, during surplus power used from sustainable energy also conversion this energy into electrical power when pressurized water discharged back through turbine. Overall plant capacity in megawatt hour dependent on radius, density of the BMS, and height of water column lifted. Radius of the (Granite) BMS is single parameter behave as pivotal variable in this storage technique.

## Proposed Design Methodology



## Results



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## CONCLUSION

The analysis exposes the solution of issues raised in Kadamparai pumped hydro storage that lag of current frequency during pumping mode solved by variable speed pumping with voltage source converter and hybrid of proposed model connected to grid consciously for supplying instead of withdrawal from the grid.

Next issue addressed in existing pumped hydro storage that insufficient power for pumping mode, water scarcity, and non-spinning reserve capability are solved by implement this Gravity hydro storage model to run the plant year around. We can recommend this proposed model for most of the hydro power plant in India.

Indian Bureau of Mines had identified 297 abandoned mines including 106 Public Sector mines. All mines we can convert as bulky storage water batteries by using as mineshafts for this proposed Gravity hydro storage