

# Simulation of Hybrid Electric Energy Storage System (HESS) for Hybrid Electric Vehicle for Power Applications

Geetha Reddy Evuri, G. Srinivasa Rao, T. Ramasubba Reddy, K. Srinivasa Reddy

**Abstract---** In recent years, the use of hybrid energy storage systems has become a global solution for delivering energy-efficient and reliable energy. With the use of these technologies, many of the energy-saving systems may be suitable for this and sufficient power may be provided for specific applications. In today's world, the need to continue using the power of the world should be cleaner than traditional technology.

This need helps to Widespread use of energy in today's energy sources will reduce global warming and climate change hazards. Use of renewable energy sources and the advantages of using energy derived from the fuel described in this clause. This paper examines the various energy conservation tools and examines their strengths and weaknesses. Some energy storage systems are designed and modeled in MATLAB/Simulink. The necessary electrical circuits are included in the hybrid storage system. Lastly, it presents, model of the hybrid power system (such as the Battery-Supercapacitor).

**Keywords---** Ultra-capacitor, HESS, hybrid power system, dc/dc converter, supercapacitor.

## I. INTRODUCTION

It is important that reliable and reliable electric power supply is reliable. Sometimes the use of undesirable interruptions or the use of low energy sources is harmful to the electrical system. The demand for renewable energy is increasing due to the increase in fuel costs, the reliability and demand of energy sources, and the ineffective effects on the environment. [1], [2].

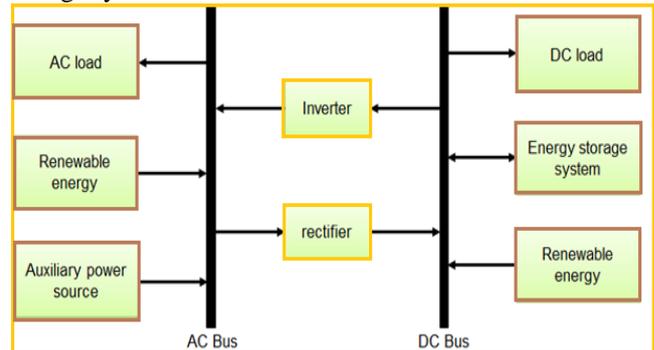
Wind turbines and photovoltaic cells are a variety of parameters, such as radiation intensity, temperature, and wind speed. [3] Renewable energy sources, such as wind power and power supply, improve these properties [2].

Jib is an hourly load on power generation systems [1], [14].

Inlet power supply system consists of a variety of sources and the output power is constant. In recent years, HES (Hybrid Electric Energy Storage) offers more models.

The main obstacle to electric propulsion is the provision of portable storage or electricity; The problem is ambiguous; (1) providing long-distance power supply, and (2) providing sufficient power to meet the peak demand. Gasoline can be burned at almost any level, so it is difficult to store large amounts of energy and supply high speeds. In addition, the

system of rehabilitation braking requirements requires a shift to permanent rotation to minimize the lifetime of some storage systems.



**Figure 1: An example of hybrid electric energy system**

The device may be suitable for one of either the energy storage or the transmission of energy. The Energy-efficient Energy Storage System (HESS) seeks to meet the needs of electric vehicle storage combined with the two most technological technologies. Lithium ion batteries, high-capacity, high capacitance are ideal for high-voltage and permanent cycles. In this study, two GSP types were studied. Energy combines with ultra-high-energy batteries uses ultra-capacitor and lithium ion batteries using lithium ion batteries. These two systems can be compared only with batteries using control systems. The size of each system is the same size for each size. The Pacific model compares energy saving, energy efficiency, vehicle size, mass and relative demand volatility through each of the five driving sessions.

## Use Hybrid Energy in the power system

The main advantages of using hybrid power in the power system are:

- Create load parameters for storage resources and emergency units, avoid system dynamics from production dynamics.
- Control arrangements for production units outside chamber networks
- Sustainability of storage
- Connectivity unit for installation

Hybrid storage systems using battery and capacitors are most commonly studied, which are more flexible, enhancing the service life and efficiency of the components, and reducing cost and mass compared to storage systems using only batteries or only ultra-capacitors (Hoelscher, Ba and others, 2006).

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With ultra-condenser adds the bank to the battery pack, the battery packs increase the power capacity rather than the energy density.

The capacitor can be used to absorb renewable energy because it is suitable for current rotational frequency.

This effect combines with broken clumps, which can significantly stabilize the battery load and reverse transfers, which will increase the battery life and increase the effective capacity. Since the power and energy devices have different voltages, DC-DC conversion requirements are changing (Lachichi and Schofield 2006), (Lukic, et al 2006), (Yalamanchili and Ferdowsi 2006), (Hoelscher, et al, 2006). In particular, each device must have a special connection to the vehicle electrical bus.

Connecting only spaces and capacitors can be linear with condenser voltages, so the bulk of the load will be available. Each device can have its own DC-DC converter, compilers are parallel or series serial connections.

Battery and ultrasonic apparatus are energy-efficient, energy-efficient and energy efficient. Security issues are more serious than hydrocarbons. Both batteries and ultracapacitors are suffering from power outages and energy densities.

Ultrasound devices can easily reach the desired power output, but do not store enough energy to move a few kilometres away. The battery is a bit of a problem for both energy density and energy density. Both technologies create relationships between energy and energy.

**II. ENERGY STORAGE SOURCES**

The most important technology for thermal energy, compressed air, hydropower, chemical battery, supercharger, supercharger, flywheel and fuel element. The performance index of the energy storage system is the core cost, cycle efficiency, life cycle, self-charging speed, energy density and energy density [10].

The activities of these systems provide other energy-efficient fuels for renewable energy.

**a) Supercapacitor**

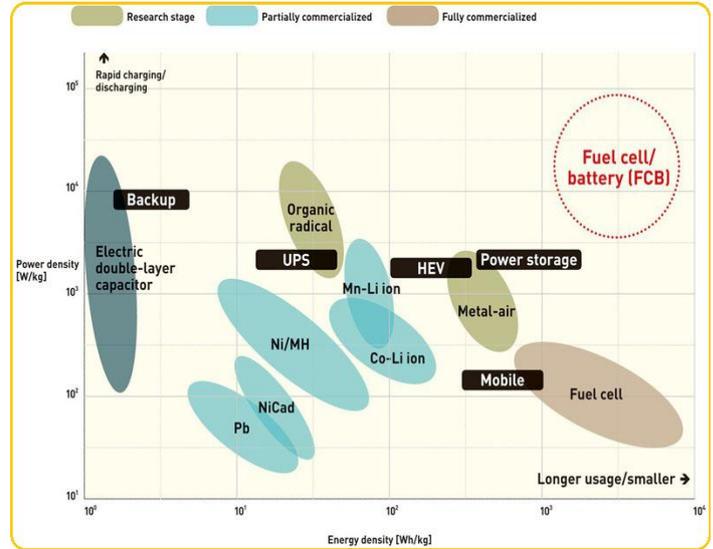
The simplest method is that capacitors are two metal plates, not called dielectric. One plate is fed from a direct-current source, but another plate is charged with an anti-charge charge.

The transmitters are fast-charging from traditional batteries and are highly charged, with tens of thousands of rechargeable batteries.

During normal operation, the normal capacitor runs less than one hour. However, the main problem with conventional capacitors is low energy density. If large capacities are required, the dielectric area must be very large.

This makes the condenser very effective and makes it difficult.

This is true of uncontrolled HESS applications [12].The figure 2 shows Comparison of various energy saving/Storage technologies and



**Figure 2: An Comparison of various energy saving/Storage technologies**

The most important technology is heat energy, compressed air energy, hydropower, chemical battery, supercharger, supercharger, flywheel and fuel element. The performance index of the energy storage system is the core cost, cycle efficiency, life cycle, self-charge rate, energy density and energy density [10],[14]. The activities of these systems provide other fuels for energy providing renewable energy. Use adequate technology with energy and energy. Tab. 1 compared four energy storage devices [14] used in the hybrid energy system.

**Table 1: comparison of four energy storage devices in hybrid energy systems**

<i>Characteristics</i>	<i>Battery</i>	<i>Flywheel</i>	<i>Supercapacitor</i>	<i>Fuel cell</i>
Power density (w/kg)	To 400	1-200	1-10	Different
Energy Density (wh/kg)	To 650	100-900	1-5	Different
Lifetime (cycle)	To 1000	10000	100000	Different
Self-Discharge	Up to 30% in	Low	50% in month	Not possible

The key issue of electric start is accumulation or electrical regulation; These challenges are twice as large; (1) restricting the viability of long-term insulation associated with, (2) a wide range of power transmission controls to drive driving requirements. Fuel is a very important density, and it's hard to keep up with a huge amount of radioactive and electric power and keep it at high speed in any situation. In addition, the brake regeneration requirement requires a flow retention capacity, which shortens the life of some electrical systems. When storing a specific device with the other, it may increase the power saving or transferring power. HESS is working to consolidate the two most important advantages of accumulating electric vehicle capacity.



It is ideal for lithium particles, high strength, ultra high capacitance, voltage distribution, and sequential cycles. Two types of NCCD studies have been studied in this study. Strong lithium-ion batteries use relatively strong and lithium-ion batteries with ultra-capacitor and other ultra-powerful batteries. These two frames check only by the control frame used by the battery.

The three dimensions of each dimension shall be indicated on a parallel volume in each dimension. While the Pacific fuel model is well-perceived in each of the five driving sessions, storage capacity, productivity capacity, vehicle size, weight, and relative requirements will change.

Using the battery and capacitors, the most common tools to access the gateways are that they are more flexible, increase segment life, and increase the cost and mass in the range of performance using space or ultra-capacitor (Hoelscher, et al 2006).

The ultra-capacitor bank will increase the capacity of the vial to increase its viability. The capacitors are suitable for the current flow, so they can be used to keep the brake back to the importance of it. This effect is combined with the mountain trunk, which means that the battery box is firmly opened, turning the spin and opening long-range, long-lasting, effective spacecraft. Life and energy need to make DC-DC changes at different voltage levels (Lachichi and Schofield 2006), (Lukic, et al., 2006), (Yalamanchili and Ferdowsi 2006), (Hoelscher et al., 2006). In particular, any instrument should have an associated connection with vehicle control. Connecting between battery and capacitors leads to the capacities of the capacitors driven by the FI, so the bulk of the coups will be provided. Every use may have its own DC-DC converter, and the compilers may be parallel or agreed. Ultracapacitors battery and energy-efficient high-capacity are fuel-efficient and energy-efficient.

*b) Battery / Supercapacitor Hydraulic system*

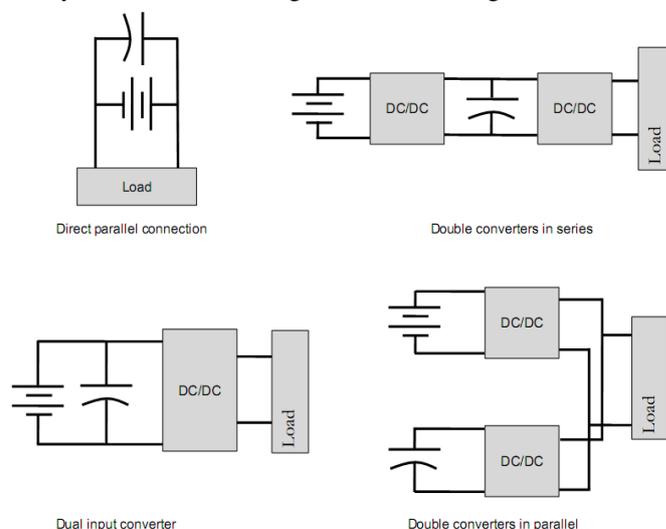
The battery has a high energy density and an overvoltage has a high voltage. High voltage density and high energy density can be combined with battery and overvoltage. Battery and overheated connections include passive or direct connection, active connection, or controlled connection. When the batteries are switched off, batteries and overcharges are connected in parallel to any control unit. With the inactivation connection, the supercharger works with maximum battery life. When the load in this structure is connected to a mixed source, the initial charge of the charge is provided by the capacitor and depending on the voltage drop, the charge current is charged for a long charge. When using a DC / DC converter, the energy flow between sources and causes can be stopped.

**III. HYBRID BATTERY / SUPERCAPACITOR SIMULATION SYSTEM DESIGN**

Learn how MATE / Simulink works and how this HEES system behaves in this section (reading "aid menu" and other lessons). The simulation of the battery and ultrasonic hybrid energy reservoir was introduced. In addition, the flywheel hybrid system, designed in MATLAB, is not included in this book. This study has educational objectives and the results help other learners to learn more about HEES behavior habits and to continue their work. The battery has a high energy density and an overvoltage has a high voltage.

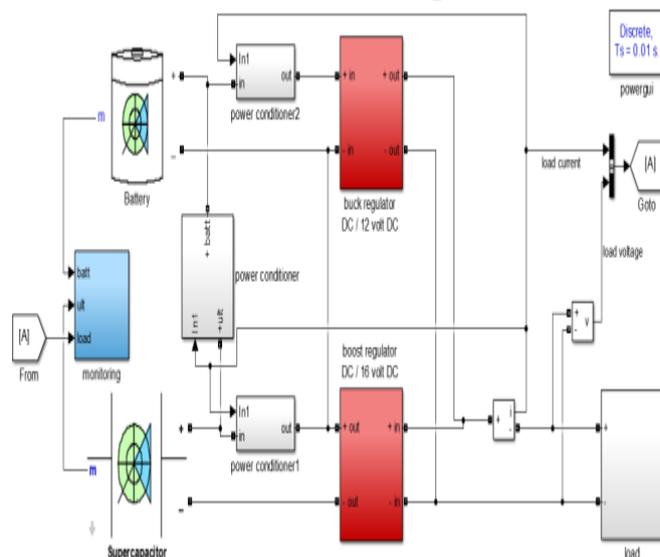
Mixed batteries and overcharging systems are both energy storage systems, as well as energy density and energy density.

This hybrid system is a good choice for electricity generation and renewable braking power for electric vehicles [11],[12]. There must be an energy storage system for storing energy-saving brake systems. It can save a lot of energy in just a few seconds. Supplier owns this ability but is able to charge itself at higher prices. This loss can be solved with battery consumption with the battery. Thus the supercapacitor is recharged after the power of the braking system is removed. The purpose of this simulation is to analyze the dynamics of dynamics and over-voltage behaviour in the transmission cycle. In this system, the battery and excessive voltage are shown in Figure 3.



**Figure 3: Different configurations of a hybrid battery/super capacitor system a boost convertor and three Switch**

A boost converter and three switching elements are also used.



**Figure 4: Hybrid battery/supercapacitor system model in simulink/MATLAB**

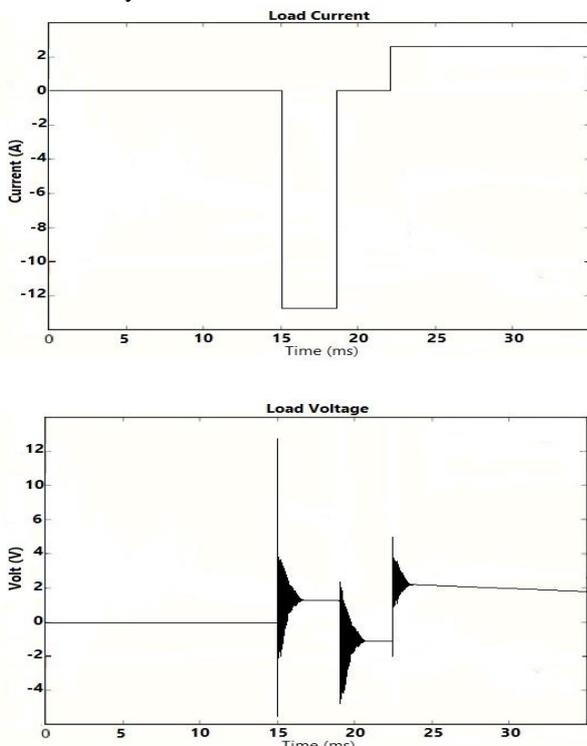


The system is designed to absorb the regenerative brakes and then carry them regularly. Thus the system strategy is:

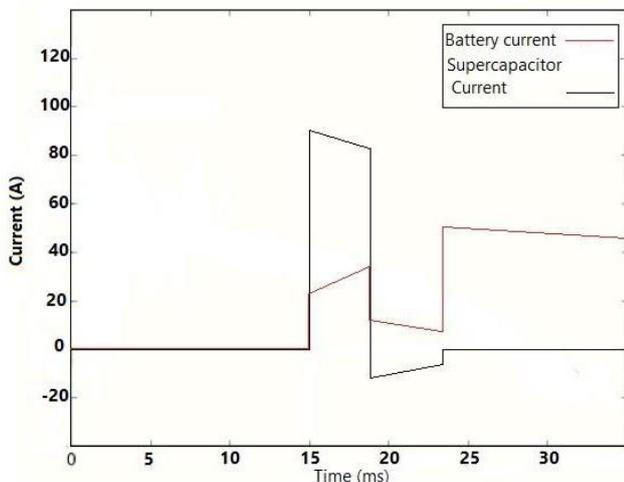
- Today's load should be balanced by negative (energy flowing in the system) and battery and overload should be cut off. In such cases, the supercapacitor energy is absorbed in the absorption system of the renewable energy.
- When the load current is greater than or equal to zero, the supercapacitor depends on load and energy load.

**IV. SIMULATION RESULTS**

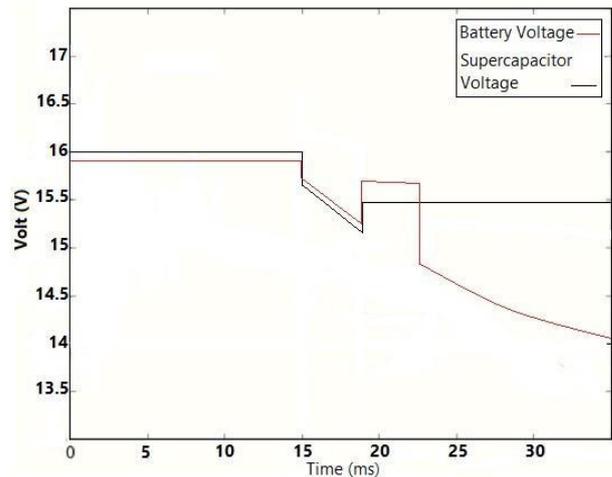
The simulations results are shown in Figs. 5-7. Load's current is zero until 15 seconds and supercapacitor's energy discharges in battery. From the second of 15 to 19 (4 seconds) load's current is -15A that must be absorbed by supercapacitor. After the second of 22, a constant 3A load stands on the system.



**Figure 5: load current and voltage changes**



**Figure 6: Battery and supercapacitor current changes**



**Figure 7: Battery and supercapacitor output voltage change**

**V. CONCLUSION**

This paper applies to obtaining a hybrid energy storage system. This research work will help further understand the Hybrid Electric Storage (HEES) system. For example, the hybrid / supercapacitor / storage system can introduce the result of MATLAB / Simulink simulation. Simulation results show more energy storage systems than more reliable storage systems. Hybrid storage system, investigative, behavioral etc. All future Workspace / supercapacitor / Flywheel hybrid storage system is investigated. High capacity, high efficiency, system, energy storage element, energy storage decision variable full life cycle hybrid super capacitor Or the amount of Ragone plank number of energy storage components for energy conservation and mixing of batteries, the amount of consumption of the data for the calculation of the total cost of data compilation of the relevant calculation method for consumption of energy analysis to save energy analysis AGR loop elements are recommended.

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