

# REVIEW ON NECESSITY & IMPORTANCE OF RENEWABLE ENERGY STORAGE TECHNIQUES

## Abstract

The energy consumption in the world is continuously increasing. The energy need is also increasing to fulfill social, economic and human welfare. Renewable energy sources are not only economical and sustainable but are capable of fulfilling energy requirement of future generation. Presently conventional resources are used for generation of energy but are no longer capable of generating energy demand for future because they are limited in quantity so once they exhausted they will not be available in future. The use of conventional resources cause global warming and with the use of them quality of environment deteriorates. So there is a need of using renewable energy resources because they have potential to fulfilling the future energy demand in the world and can do sustainable development. Solar energy, wind energy, tidal energy, geothermal energy are some of renewable energy which have a potential to meet future needs of energy. In this paper some of renewable techniques are mentioned.

**Keywords:** Renewable energy sources, Electrical storage, electrochemical storage, solar power storage techniques, Geo thermal energy, Superconducting Magnet Energy Storage, Compressed Air Energy Storage

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## **I. INTRODUCTION**

There is a big possibility of developing renewable energy such as solar energy, wind energy, geothermal energy, tidal energy etc. It contributes 5% of total energy generation in the country. The ministry of new and Renewable energy (MNRE) has done an excellent effort for growing and utilization of renewable resources in the country. Our country has set target of producing 20% energy from renewable energy resources by 2030. All remote areas can be planned to cover for power generation with the help of renewable energy resources. Solar cell has the potential to generate sufficient energy from sunlight. Wind mill is able to produce energy from wind energy. However there is a need to develop energy storage techniques from renewable resources. In this chapter some of efficient energy storage techniques are explained.

## **II. OBJECTIVES**

- Conventional energy resources are fixed. If they exhausted they will not be available in future so there is a need of saving energy.
- Renewable energy resources are not used in full extent, it is necessary to develop techniques to use these resources completely.
- To create sustainable development.
- To economize the use of energy.
- To develop energy efficient system.
- Use of renewable energy sources donot contributes to global warming and emissions of greenhouse gases.

## **III. LITERATURE REVIEW**

Now a day's world is struggling with different problems such as global warming and green house effect, it is necessary to generate the techniques which can create pollution free environment and sustainable development. Energy storage techniques reduce the problem of storage of energy and making it available on demand. Energy storage techniques can be used to stored energy which can be used for future needs. Various literature studies give a highlight of energy storage techniques which can be used to store the various forms of energy for future needs.

## **IV. RENEWABLE ENERGY STORAGE TECHNIQUES**

### **1. Electrical storage**

- Energy storage techniques can be divided into two types.
- Energy storage system for electrical supply system(Input & output are in electrical form)
- Energy storage system not related with electrical supply system.(Input & output are non electrical form)

## 2. Electrochemical Storage

- **Battery energy storage system:** Storage batteries are very famous and have many applications. While charging battery electrical energy is converted into chemical energy and is stored. During discharging the electrical energy is delivered to the connected load. The energy conversion in secondary batteries is reversible & for primary batteries it is non-reversible.

Two major applications of storage batteries are:

- Use as a chargeable primary cells for supply of dc power but cells are recharged after discharge, e.g. rechargeable cells used for torch light, flash-gun etc.
  - Secondary batteries used as energy storage devices being charge by main power supply via battery charger for obtaining energy for load on the demand, e.g. Uninterrupted power supply, battery energy storage with PV solar power plant.
- **Lead Acid Battery Cells:** Lead acid battery cells are most widely used in many applications such as automobiles, UPS, renewable energy conversion, standby power, submarines, telephone supply systems, computer supply systems & electrical vehicles.

**Table 1: Types & applications of Lead acid battery Energy Storage**

Types	Applications
Automotive	Transport vehicles, lighting, ignition
Motive power	Transport & handling, lifting vehicles
Stationary	Emergency power, UPS, dc source

3. **Chemical Energy Storage:** Chemical Energy Storage is presently in early stage of development. Gas based power plant & gas pipe lines have been commercially alternative to coal based power plant. Chemical energy storage has three different categories:

- Reversible chemical reactions to release thermal energy: This type of energy storage schemes used for storing & releasing heat of reaction.
- Energy storage in form of chemicals: The energy storage media are solid chemicals, solutions of solids, gases in chemicals.
- Hydrogen economy: Hydrogen is obtained by electrolysis of water using electrical energy during off peak hours. Hydrogen is supplied as secondary energy for use in fuel cells, fuel, various chemical processes. Hydrogen is stored in gas or liquid form.

4. **Thermal Energy Storage System:** Energy stored in thermal forms is most widely used in industry & residential applications. The industry application involves cement plants, iron & steel plants, rubber plant, paper mills, plastic industry, cold storage etc.

Thermal energy storage is classified in following categories:

- Sensible heat storage

- Latent heat storage
- High temp. Storage
- Low temp. Storage

Thermal storage is economically attractive for thermal cycle where input & output both are in thermal form. Sensible heat storage is gained by the material by raising the temp. Of material without change of state. Latent heat energy storage involves change in face of selected materials. Heat is added for melting solids, vaporising liquids. Heat is extracted for solidifying, liquefying vapours, regaining original face.

**5. Geo Thermal Energy:** The thermal energy obtained in interior of the earth is called geothermal energy. Geo thermal energy is enormous and will be available for millions of years & therefore called renewable energy.

- **Compressed Air Energy Storage (CAES) energy storage techniques:** In this technique energy is stored in form of compressed air at a pressure of 50bar. The compressed air is stored in large underground salt caverns or hard rock caverns. The storage volume is around 3,50,000 m<sup>3</sup>. The compressed air system may be used with gas turbine power plant for compressor stage. Air storage is the main criterion in CAES. For 1500 MW energy storage by CAES compressed AIR required is:

- 20,00,000 m<sup>3</sup> at 10 bar storage pressure
- 64000 m<sup>3</sup> at 100 bar storage pressure

Hence high pressure is important for storing more energy in available volume.

**6. Solar Energy Storage Techniques:** A Solar thermal energy collector is equipment in which solar energy is saved by absorbing radiation and transferring to a liquid.

There are two types of collectors:

- Flat plate solar collector
- Concentrating type solar collector

Flat plate collector has no optical concentrator. Collector area and absorber area are numerically same, efficiency is low and temperature of working fluid can be raised upto 100°C. In concentrating solar collector area of receiving solar radiation is many times greater than absorber area and efficiency Of such collector is very high. Mirror & lenses are used to concentrate sun rays on absorber and fluid temperature can be raised up to 500°C.

**7. Photovoltaic Technology:** The device which converts sun energy in to electrical energy is called solar cell. The technology develop to convert sun energy in to electrical energy with the help of solar cell is called photovoltaic technology. Solar cell is a semiconductor device which has pn junction which is light sensitive. When light strikes the junction D.C emf is produced. Silicon based photovoltaic cell have significant contribution due to its fabrication capabilities. CdTe, CIGS are the two most common thin film solar cell used

for conversion of high power from sun light. CIGS solar cells have highest production of any thin films solar cells. The conversion efficiency of CIGS solar cell is currently reaching 20%. Its flexible nature resistance to solar radiation and high power has lead CIGS cells to be used for space applications. It also has high absorption coefficient at band gap of 1.5 eV.

**8. Superconducting Magnet Energy Storage:** Energy is stored in magnetic field of superconducting coil which carries a direct current. The energy is available for damping oscillations in the power system. When electric current flows through a coil energy is stored in form of magnetic field energy. This concept has not yet commercialized.

Advance batteries use simple electrochemical energy conversion with easily available, cheaper materials.

- Some advanced batteries operate at high temperature.
- Some advanced batteries use flowing electrolyte.

**9. Compressed Air Energy Storage (CAES):** CAES technology has been implemented successfully in 1970. In this technique rise of electrical energy during low load hours is transmitted to compressed air by compressor unit of motor. Energy is stored in form of compressed air at a pressure of about 50 bars. The compressed air is stored in large underground salt caverns or hard rock caverns. During peak load hours the compressed air is released to drive expander-generator and electrical energy is fed to the electrical network.

**10. Advance Flywheel Energy Storage:** Fly wheel energy storage has two basic types.

- Conventional heavy, large diameter flywheel at moderate speed
  - Advanced flywheel of very high speed, high strength and low frictional losses for large/ short term energy storage.
- The energy is stored in advanced flywheels in the form of inertia of rotor of the electrical machines.

**Table 2: The economics of important technologies is given in following table.**

Energy storage technology	Conversion cost Rs/KW	Storage cost Rs/KW
Thermal Storage	NIL	NIL
Advanced flywheel	L,M	VH
Superconducting magnet(SMES)	L	VH
Compressed air(CAES)	M	L
Storage batteries	L	H
Chemical reactants	M	M

**L= LOW M=MODERATE H=HIGH VH=VERY HIGH**

## V. CONCLUSION & RECOMMENDATIONS

The energy storage techniques can be developed efficiently to fulfill the energy demand in the world. Different storage techniques can be used according to new renewable energy sources leading to store more energy efficiently. World is fighting with the sources of energy. The energy sources used for producing energy is continuously decreasing. The energy demand is continuously increasing. However the conversion energy sources are fixed. Once they exhausted they will not be available in future. So there is a need to store the energy for the future generation. However we should try to produce energy from renewable energy sources to create sustainable development.

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