**REVIEW ON NECESSITY & IMPORTANCE OF RENEWABLE ENERGY STORAGE TECHNIQUES**

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**Abstract**

The world is fast becoming a global village due to the increasing daily requirement of energy by all population across the world while the earth in its form cannot change. The need for energy and its related services to satisfy human, social & economic development, welfare and health is increasing. Returning to renewable to help mitigate climate change is an excellent approach which needs to be sustainable in order to meet energy demand of future generations. Renewable energy resources sector growth in India has been significant, even for electricity generation from renewable sources. Renewable energy is energy generated from natural resources such as sunlight, wind, biofuel, fuel cells, tides, and geothermal heat. The electricity requirements of the world including India are increasing at alarming rate and the power demand has been running ahead of supply. It is also now widely recognized that the fossil fuels (i.e., coal, petroleum and natural gas) and other conventional resources presently being used for generation of electrical energy may not be either sufficient or suitable to keep pace with ever increasing demand of the electrical energy of the world. Also generation of electrical power by cold based steam power plant or nuclear power plants causes pollution, which is likely to be more acute in future due to large generating capacity on one side and greater awareness of the people in this respect.

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

**1. INTRODUCTION:**

Renewable energy sources available in nature are solar energy, wind energy, geo-thermal, and hydro power, bio-mass, tidal & wave energy. India is implementing one of the world’s largest programs in renewable energy. Renewable energy sources contribute to about 5% of total power generating in the country. The ministry of new & renewable energy (MNRE) has made excellent effort during past few years to develop & utilized different renewable resources in the country. Now a day’s electric generators, solar water heaters, bio-gas plants, small hydro electric generators are available commercially. Wind farms, solar arrays, hydro & biomass power generation are started to produce electricity without any degradation of environment.

Now a day’s total contribution of renewable sources is 4% of power generation and India has set target of producing 10% of electricity from renewable sources by 2020.It is planned to cover all the remote areas for power generation with the help of renewable energy sources.

**2. 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.

3. **LITERATURE REVIEW**

When countries were developing fully renewable energy resources were not developed on a large scale. Fossil fuels, such as coal, oil, and natural gas, were cheap but create the pollution in the world. 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.

A sustainable energy resource can be used renewably over human life and conducts small scale to no impact on our world’s ecosystems. According to the Institute of Asian Research (2006), Mongolia has broad natural resources, mainly coal, copper, molybdenum, fluorspar, tin, tungsten, and gold, and therefore potential to develop into a strong country. The report stresses to the Mongolian government that a sustainable and energy efficient future is necessary to succeed. The report suggests that the Mongolian government should require a certain amount of renewable energies to be used for mining natural resources.

**4. RENEWABLE ENERGY STORAGE TECHNIQUES**

**4.1 Electrical storage**

Energy storage system can be classified into two categories:

1. Energy storage system for electrical supply system(Input & output are in electrical form)
2. Energy storage system not related with electrical supply system.(Input & output are non electrical form)

Energy storage system used in electrical energy supply system.

* Medium & low capacity energy storage system for vehicles, plant auxiliaries and remote installation
* Energy storage for peaking power supply
* Energy storage for renewable energy plants
* Uninterrupted power supply
* Smoothing of fluctuation in load & power supply
* Transient stability during sudden load changes

Non electrical energy storage system includes following:

* Mechanical energy storage
* Hydro potential energy storage
* Hydraulic energy storage
* Thermal energy storage
* Chemical energy storage

**4.2 Electrochemical storage**

*4.2.1 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:

1. 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.
2. 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.

*4.2.2 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 |

**4.3 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.

**4.4 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:

1. Sensible heat storage
2. Latent heat storage
3. High temp. Storage
4. 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.

**4.5 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.

*4.5.1 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 m3. 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 m3 at 10 bar storage pressure
* 64000 m3 at 100 bar storage pressure

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

**4.6 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:

1. Flat plate solar collector
2. 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 upto 500°c.

**4.7 Photovoltaic Technology:**

In solar PV system the intermediate thermal energy stage is omitted and energy is converted directly from solar to electrical form. The problems of high temperature materials and excessive thermal loss are absent. The main component in this system is solar cell. Solar cell is semiconductor device which has light sensitive pn junction. When solar light strikes the pn junction DC emf is produced with p-terminal as positive & n-terminal negative. Solar PV panels are installed outdoors to receive maximum sun light during the day & year. Solar PV panels may be fixed type or tracking type. Fixed type flate plate panels are commonly used because they are cheap, simple & maintenance free.

**4.8 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.

**4.9 Compressed Air Energy Storage (CAES)**

CAEStechnology has been developed successfully in 1970. In this technology the excess electrical energy during low load hours is converted to a compressor air by the motor compressor unit. 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.

**4.10 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 electrical 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

**5. CONCLUSION & RECOMMENDATIONS**

It is clear that there is a strong need to integrate more renewable energy sources into the grid of the future. These kinds of energy sources, when coupled with energy storage, can greatly benefit the grid by providing a variety of different services and daily peak load reductions. Storage technologies will vary according to different renewable energy sources and a greater variety of sources will lead to more grid stability. Word 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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