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Project Title: Preparing Energy Storage Systems User Guide

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Project Necessity:

The challenge of energy is inevitable in the future, and important reasons for this include increased population growth, rising indicators and living standards, increased transportation and communications, and more. Therefore, we should look for ways to expand the use of new technologies, especially the production of energy from renewable sources.

Apart from the other benefits of using renewable energy sources, these sources are mainly periodic. That is, in a certain time interval, the energy source is able to produce maximum energy or there is a possibility of extraction and exploitation of more energy source, and in another time interval, this issue is minimized. For example, solar energy as an important source of energy in nature is periodic, so that during the day, especially on sunny days, the intensity of solar energy is maximum and the possibility of using it by solar cells is possible only at certain hours and During the night, the intensity of radiation is minimal and it is not possible to use it. Also wind energy, sea wave energy are other sources of energy that have a periodic nature with the difference that Their periodicity may be more or less than one day. This phenomenon of periodicity of energy resources is one of the factors that prevent the possibility of optimal and maximum utilization of them. On the other hand, energy demand usually behaves in the opposite way and its maximum is equal to minimum production and its minimum is equal to maximum production.

Energy storage is one of the methods that can be used to overcome the above problem and use the excess energy when needed. Meanwhile, the role of storage devices in the optimal production of electrical energy is doubly important. Explain that the process of generating electricity in power plants is such that in the hours of the day and night when there is a peak of electricity consumption, equipment with higher power should be used to generate electricity, and in other hours of the day and night that the amount of electricity consumption At a minimum, the efficiency of this equipment is severely reduced. Therefore, the storage of electrical energy is one of Methods of uniform load consumption during the day and thus increase the efficiency of power plant equipment. In addition, by using the energy storage system, the extra load that is applied to the network during peak consumption and has a higher cost for the consumer can be transferred to non-peak consumption time, which in turn reduces and saves money.

There is considerable cost savings. In recent decades, energy storage systems with different motives to improve the performance of the power system have been considered. In general, in the power system, there is a momentary balance between the generated and consumed electrical power, and There is no energy storage in it. Therefore, it is necessary for the network production rate to exceed the consumption curve of the region. It is clear that operating the

system in this way is uneconomical given the conventional shape of the consumption curve. The use of high capacity energy savers to balance the consumption curve and increase the load factor is one of the first applications of energy storage in the power system for economic exploitation. In addition, various disturbances in the network, sudden changes in load and disconnection of transmission lines lead to the system going out of equilibrium. In these conditions, first from the location of the kinetic energy of the axis of the generators Energy is synchronized, then the system control loops are activated and balanced. This process causes oscillation of various variables such as frequency, electrical power on the lines, etc., which leads to various problems in the operation of the power system. If some energy is stored in the system, the above problems can be significantly reduced by quickly exchanging it with the grid when needed. In other words, the energy saver can also be used to improve the dynamic performance of the system.

With the increase of permeability of renewable resources in the country's electricity production in the coming years and also the existence of many climatic changes in different parts of the country in different seasons of the year (the result will be a significant difference between peak load and base load and impose heavy costs on the electricity industry. The need to use storage facilities in order to eliminate fluctuations in electricity consumption at different hours of the day and to create a balance between production and consumption of electricity is felt more than ever. One of the measures required to prepare the necessary conditions for the optimal and widespread use of storage facilities is the development of technical documents containing technical specifications and instructions and requirements related using these systems. In this regard, documents should be prepared to determine the technical and executive specifications for the use of this equipment. The preparation of these documents will help policy makers and decision makers to manage the storage process and pave the way for the best use of storage devices. It also helps investors in the private and public sectors to follow the process of installing and operating a variety of storage facilities more easily and achieve predetermined goals faster. At the same time, confusion and loss of capital, time and energy are prevented.

Project Goals:

- 1- Familiarity with the concepts of energy storage and types of related methods
- 2- Preparing and compiling a technical guide for energy storage according to the methods and equipment used

Abstract:

In this project, in the first step, the concepts of energy storage and its methods in general were studied. In fact, this step includes a review of the literature on the subject and general aspects of the problem under study. In the second step, the electrical methods of energy storage and related technologies were studied and the specifications and concepts of the mentioned methods and technologies were simply described. In the third step, the mechanical methods of energy storage and related technologies were studied and the specifications and concepts of the mentioned methods and technologies were described. In the fourth step, the electrochemical methods of energy storage and related technologies were studied and the specifications and concepts of different types of batteries were discussed and investigated. In the fifth step, thermal methods of energy storage and related technologies were studied and the specifications and concepts of the mentioned methods and technologies were described. In the sixth step, the chemical methods of energy storage and related technologies were studied and the specifications and concepts of the mentioned methods and technologies were described.

Steps and Methodologies:

- 1- Reviewing the existing literature and existing experiences
- 2- Preparing and compiling technical and executive specifications for designing, installing and operating various types of storage devices

Main Results (technical outputs, patents, papers, books, reports, etc.):

- 1- Technical report on the principles of design, manufacture and use of electrical storage devices
- 2- Technical report on the principles of design, construction and use of mechanical storage devices

- 3- Technical report on the principles of design, manufacture and use of electrochemical storage devices
- 4- Technical report on the principles of design, construction and use of thermal storage devices
- 5- Technical report on the principles of design, manufacture and use of chemical storage facilities
- 6- Technical report related to studies and documentation of energy storage devices