Optimal Charging and Discharging Planning for Electric vehicles in Energy saving system

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ABSTRACT

The increases in fuel consumption, we are in need of Electric Vehicles (EV) supplied by Renewable Energy Sources (RES) like Solar Energy Resources (Photovoltaic system), Photovoltaic cell fixed in solar panels, it convert the sun energy directly into electric energy, the term "Solar Vehicle" usually implies that electricity then fuels the battery that runs the car's motor. Instead of using a battery, some solar cars direct the power straight to an electric motor. Solar cars can accomplish this through photovoltaic cells (PVC). PVCs are the components in solar paneling that convert the sun's energy to electricity. Solar panels installed on your roof work best during daylight hours. When the sun is shining directly onto them, sunlight can be converted into electricity. Your solar panel efficiency drops at night because there is no sunlight to convert to electricity and solar panels can't generate power in.

Keyword: - *Renewable energy resources, Solar Electric Vehicle, Photovoltaic cell*

1. INTRODUCTION

It was 74% of total USA energy consumption in 2006, the residential buildings were 51% according to the US Environmental Protection Agency (EPA).
The research community has focused on the research community. Target Transformer evaluated the use of the callback as a loader design tool to improve the mode of transmission and to switch to the transformer. Mogenian rod and others. Proposed a convenient framework, which ims to reduce consumption of consumer feedback. owever, considering the same equipment and the waiting time to represent user consolation in this period, it is very easy to represent various attributes of grid equipment and user needs, considering user climate comfort to reduce the cost of HVAC system. It was used to compute many of the optimal control protocols used in the thermostat in dynamic programming, the authors introduced an application confirmation algorithm to schedule power consumption of heater power consumption to reduce consumers' fees The Electric Vehicle (EV) is another important phase element, which is of considerable economic and environmental benefits compared to ordinary cars in the next few years, the, which could reach $ 1 million in 2015. Where fifure 1 shows the grid connected electric system and figure 2 shows the V2G Electrical Network.

Fig.1 Grid connected electric system.

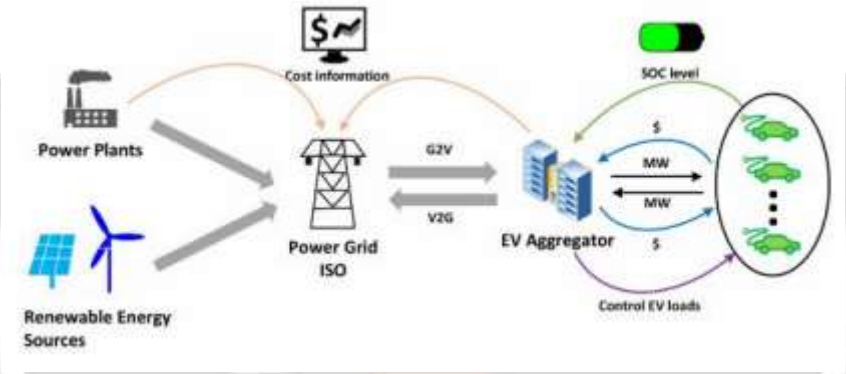

Fig3 V2G Electrical Network

The diffusion of electric vehicles (EVs) in the urban context is only a matter of time, since adoption of zero emission vehicles, either powered by chemical accumulators or fuel cells, is becoming mandatory, for the well-known reasons. As EVs are expected to be one of the main consumers of electricity, it may be substantially impact the operation of future smart grids. Hybrid systems have higher reliability than the systems with single source. Solar-wind hybrid system is one of the most common type of hybrid systems due to the availability of wind and solar energy. To optimize such a system, the number of wind turbines, solar panels and storage system is defined to minimize the production cost. In addition, reliability and energy requirements should be in a desirable level. The storage system, which is the backup system, should be optimized in terms of size or number of batteries. Askarzadeh et-al. modelled solar panels, wind turbines and battery and presented a discrete optimization method for determining the optimal size of hybrid systems. proposed a model to determine the optimal size of wind solar hybrid system's components, considering the size of the battery. In a measurement-based model of the production and consumption is suggested to determine the optimum size of batteries, solar panels and wind turbines to reduce the cost. A method for determining the optimal size of a standalone hybrid wind-solar- diesel using 6 months data is provided in. Wind speed, intensity of solar radiation and ambient temperature is used as hour-by-hour. Reference presented a hybrid system consisting of wind turbines, solar and fuel cell to supply the system with optimum reliability and with the aim of minimizing costs for 20-year energy production.

The expected losses of load, the expected energy that is not being supplied, and the probability of power supply are used as objective function for optimization with Particle Swarm Optimization (PSO) algorithm. A method of determining the optimal size of solar-wind power system considering the cost and reliability using Genetic Algorithm (GA) is proposed. Most of the published works on EV's charging assume that the charging takes place at home. However, given that vehicles employing internal combustion engines are refueled at gas stations, EVs can also be charged at electric vehicle charging stations (EVCSs). This paper presents an optimal design of hybrid wind-solar system with batteries for EVCSs. The goal is to minimize the annual investment and maintenance costs using

TLBO considering reliability index. The optimum size of system is evaluated in different scenarios. The result show shat Teaching Learning Based Optimization (TLBO) provides a high computational speed and a good precision in optimization process.

2. LITERATURE SURVEY

" M. S. Alam Chowdhury, K. A. A. Mamun and A. M. Rahman", [1]. This paper analyzed an electrical system for the powertrain of Hybrid Electric vehicle which is powered by Fuel cell, Battery and PV panel. A Simulink model is prepared and simulated successfully. Permanent magnet synchronous motor drive system is used in the Simulink model.

"M. F. Bhuiyan, M. R. Uddin, Z. Tasneem and K. M. Salim",[2]. This paper presents the basic configuration of a partially solar powered electric tricycle and analyse the overall performance by it in the ambient condition of Bangladesh. The efficiency and maximum rated power of solar PV array is also observed and calculated.

"S. Bhadra, P. Mukhopadhyay, S. Bhattacharya, S. Debnath, S. Jhampati and A. Chandra", [3]. In this paper design and development of a Hybrid charging station for electric vehicles is discussed. The charging station is powered by a combination of solar power and grid power. The system works in an integrated way to optimize the energy use from the grid.

"M. Ali, S. Mohammad and M. M. Rahman", [4]. At present, EVs are running in Bangladesh are auto rickshaw and easy bike. Although these easy bikes and auto rickshaw seem eco - friendly, they are partly responsible for environmental pollution as they use grid power.

"S. Bhadra, P. Mukhopadhyay, S. Bhattacharya, S. Debnath, S. Jhampati and A. Chandra", [5]. In this paper design and development of a Hybrid charging station for electric vehicles is discussed. The charging station is powered by a combination of solar power and grid power. The system works in an integrated way to optimize the energy use from the grid.

"R. Kavin, T. Kesavan, S. Sheebarani Gnanamalar and K. Rameshkumar", [6]. Photovoltaic cell fixed in solar panels, it convert the sun energy directly into electric energy, the term "Solar Vehicle" usually implies that electricity then fuels the battery that runs the car's motor. Instead of using a battery, some solar cars direct the power straight to an electric motor. Solar cars can accomplish this through photovoltaic cells (PVC).

"A. Aliakbari and V. Vahidinasab", [7]. This paper proposes an optimization model with a mixed-integer linear programming (MILP) formulation that utilizes the effect of solar panels and two separated batteries provided in SPHEVs for optimal charging scheduling.

"Y. Gurkaynak, Z. Li and A. Khaligh", [8]. In this system, PV arrays and battery packs are cascaded to supply power to the load. Solar energy is harvested by PV arrays, the terminal voltage of PV arrays is regulated by a DC/DC converter to track maximum power point (MPPT) using the incremental conductance method.

"K. Nogita, J. Kennedy, J. Amsler, M. Greaves, C. Tuesley and T. Nishimura", [9]. In this paper, we have proposed the most feasible solar power generation system mounted on the electrical vehicles to charge smart battery during running. In our experiments, about 700 W to 800 W electrical power is supplied on a usual daytime, which is about 2 times of conventional power level.

"T. Harakawa and T. Tujimoto", [10]. This paper deals with a normal charging station implemented at a workplace. A Solar power plant is used as the major source of electrical energy. An alternate connection to the station storage battery is used for importing/exporting the electrical power at times of deficient/excess solar power generation.

"K. S. Vikas, B. Raviteja Reddy, S. G. Abijith and M. R. Sindhu", [11]. The optimization is implemented in GAMS to find the minimum daily cost. The optimal charging-discharging regime is denoted for EV s. The results illustrate that V2H - V2G operation can efficiently minimize the energy cost under solar-load volatility.

"R. Hemmati, H. Mehrjerdi, N. A. Al-Emadi and E. Rakhshani", [12]. This paper reports on the team's participation in the largest solar car race, The Bridgestone World Solar Challenge 2013, from Darwin to Adelaide, Australia in mid October 2013.

"Mohamad Azlan Hussin, A. N. Abdalla, R. Ishak, R. Abdullah and Zailini Mohd Ali", [13]. The objective of this project is to propose drive range improvement for electric vehicle using solar energy. First, power consumption modeling based on Proton Savvy using torque analysis to achieve 45mph vehicle top speed when converted to electric vehicle. Second, for continuous battery charger three solar panel (each panel with 125W) controllers had been developed.

"T. S. Biya and M. R. Sindhu", [14]. An efficient design of charging station with MPPT, PID and current control strategy is developed for the optimal power management between solar, BESS, grid with the EVs in the charging station.

"M. T. Turan, Y. Ates and E. Gokalp",[15]. The study represents the simulation results and grid response which varies during daytime in accordance with solar power generation and consumption considering altered connection point scenarios.

3. STUDIED SYSTEM AND FORMULATION

The studied hybrid system is shown in Fig.1.The system consists of wind turbines, Photovoltaic panels and batteries for energy storage. If the total power coming out of solar panels and wind turbines is more than the required power for EV charging, extra power is fed to the battery. When the required power is more than the total production capacity, the batteries compensate the lack of power in discharge mode. The system block diagram shown in figure 3 and observer control algorithm shown in figure 4. Also figure 5 shows the solar-wind hybrid system with battery storage.

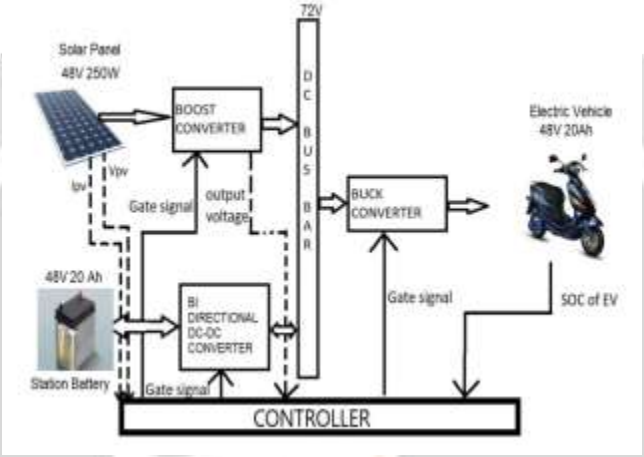

Fig 3. System block diagram

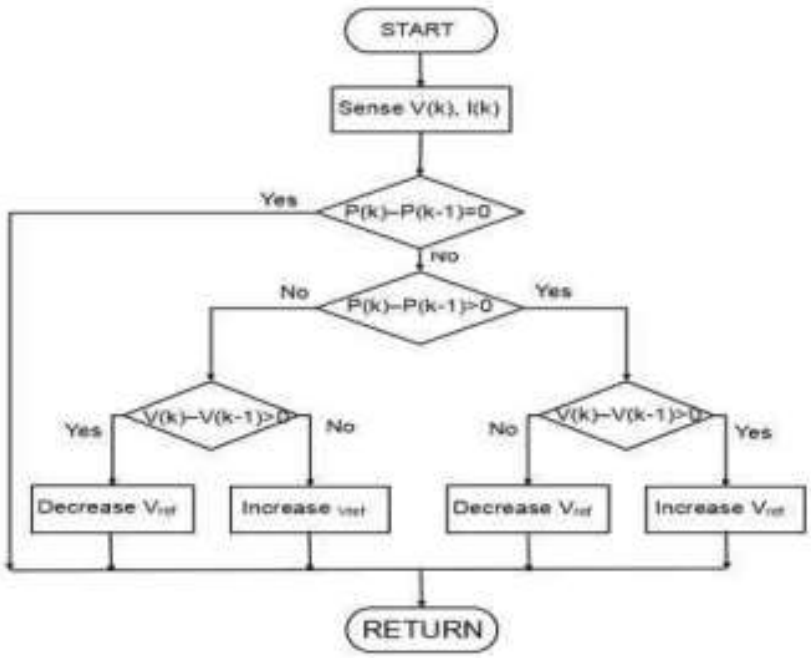

Fig 4. Observer control algorithm

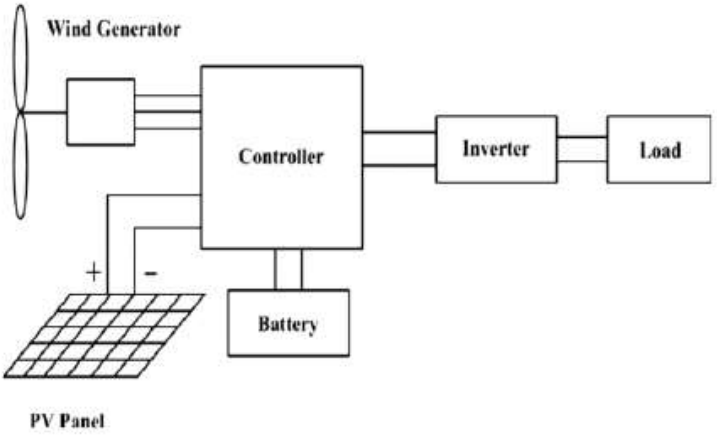

Fig. 5. Solar-wind hybrid system with battery storage.

The goal is to find the optimal capacity of hybrid system, including the production capacity of solar arrays, wind turbines and batteries production capacity to meet the EV demand with the least cost.
The total annual cost is the sum of the cost of annual investment and maintenance costs. The objective function canbe suggested by the following equation.

$$MIN_{ACS} = C_{Cap} + C_{Main} \quad (1)$$

The ACS, CCap, CMain are annual capital cost, the initial investment cost and the maintenance cost, respectively. To convert the initial investment cost to the annual investment, Capital Recovery Factor (CRF) is defined as follows

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1} \quad (2)$$

.
In the above equation, i and n are the interest rate and the life span of the system, respectively. We get annual costs by multiplying CRF in capital cost of system elements

$$C_{cap} = CRF\left[N_{PV}.C_{PV} + N_{WG}C_{WG} + \left(\frac{n}{LS_{Batt}}\right).N_{Batt}C_{Batt}\right] \quad (3)$$

where NPV, NWG, NBatt, are the number of photovoltaic panels, wind turbines and battery storage, respectively. CPV,CWG, CBatt are the sum of equipment price and installation fee for photovoltaic panels, wind turbines and battery storages, respectively. LSBatt is battery life span. The annual maintenance cost is also defined as follows.

$$C_{main} = \left(C_{main}^{PV}.\sum_{t=1}^{T} E_{PV}^{T}(t) + C_{main}^{WG}.\sum_{t=1}^{T} E_{WG}^{T}(t)\right).365 \quad (4)$$

where, CMain, is the maintenance cost per kWh.

The TLBO algorithm in [15] and [16] is developed based on the behavior of learners and teachers in a class. The quality of teachers depends on behavior of the learners in class strongly.
A good teacher improves the average performance of the class by motivating the learners in class. Thus, every learner in a class tries to improve its own performance according to teacher. Similarly, each learner also tries to improve its own performance by interaction with the other learners of the class. TLBO algorithm has been

developed by taking this concept in class between teacher and learners [16]. The procedure of TLBO is divided in to two phases, the teacher phase and the learner phase.

4. ADVANTAGES, DISADVANTAGES AND APPLICATION

4.1. Advantages

- Renewable, Clean Energy Source. Solar power is a renewable energy source in that the sunlight you use today does not leave less for tomorrow; the sun will continue to shine for billions of years.
- Modest Available Power.
- No Energy Costs.
- Poor Practicality.

4.2. Disadvantages

- Cost. The initial cost of purchasing a solar system is fairly high. ...
- Weather-Dependent. Although solar energy can still be collected during cloudy and rainy days, the efficiency of the solar system drops. ...
- Solar Energy Storage Is Expensive. ...
- Uses a Lot of Space. ...
- Associated with Pollution.

4.3. Application

- Solar Water Heating:
- Solar Heating of Buildings:
- Solar-distillation:
- Solar-pumping:
- Solar Drying of Agricultural and Animal Products:
- Solar Furnaces:
- Solar Cooking:
- Solar Electric Power Generation:

CONCLUSIONS

In this way, efforts should be made to manage power companies. These paper EVs provide optimal charging / discharging, the power company purchases V2G power at 1.5 times the maximum current power burden, and future battery costs will be less than half of the current coal. In this case, the V2G is a viable project because it can be lowered to users for performance, and suppresses the increase of the maximum load on power companies, thus reducing system losses, and both companies and consumers benefit.

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