Renewable, Pollution Free, Clean Charging Station Development for Electrical Vehicles

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Abstract— In today's world, fossil fuel is the main power source as it provides energy for automobiles, airplanes, and it is also used to produce electricity. However, fossil fuel cause environment problem by emitting C02 into atmosphere when producing energy, which eventually leads to global warming. For example in 2012, vehicles have contributed for 34.3% of worlds energy-related CO2. This shows that there is a need to change in vehicle system to reduce the pollution to the environment. While electric vehicles are generally seen as clean vehicles, they are not completely clean because the production of electricity might generate emissions as well. This paper on a multifunctional solar charging station is a working solution to close the gap in achieving a truly renewable and clean vehicle. In order to solve this problem, there are two paths: first, through designs which consume less energy and improve fuel efficiency; second through usage of alternative energy with storage such as hydrogen or battery. Recently, in the field of automobiles, many companies have developed commercially available electric cars that consume alternative fuels. Nevertheless an electric car or electric vehicle is only as clean as the primary energy used to power it. That means we also have to look at clean electricity generation if we want to improve the traffic based air pollution with electric vehicles.

Keywords: Renewable, Pollution Free, Clean Charging Station, Electrical Vehicles

I. INTRODUCTION

With the push to move to electric mobility at a national scale, and with the government being very enthusiastic about deployment of electric vehicles, the electronic industry can expect to see a lot of activity around indigenous development and manufacturing.

While electric vehicles are being worked upon by major OEMs, an ecosystem for development of chargers, charging stations and software & cloud services is steadily being built. Established companies as well as various start-ups, have started working on these areas and results are starting to show.

However, there is still a lot of opportunity to make even better, the electronics side of it. The government, with the help of BIS, ARAI, EESL and other bodies, has already released technical specifications on charging stations and some of the original specifications like the AC-001 and the DC-001 have already been developed and charging stations have been deployed at select locations. The newer guidelines require the charging stations to be equipped with multi standard chargers, viz. AC Type 2, the CCS and the CHADEMO, in addition to the lower power AC and DC-001. However, these systems are reliant entirely on the grid, are subject to real estate availability at prime urban and semi-urban locations, and the question of the grid being ready and equipped for these added loads, still remains. This is where, solar energy and storage comes into picture to not only supplement the grid but to also work standalone at feasible location across the country.

II. DESCRIPTION OF PROJECT

Fortunately, India has seen successful solar deployment and the abundance of solar energy due to its geographic location. The one-time installation and capital expense, works well for at least 2025 years, with the return on investment, taken care of in a few years. The energy input henceforth, becomes virtually free. The subsequent sections will illustrate a feasible implementation that may be adopted to harness solar energy, store it and use it for EV charging. It will touch upon energy harnessing & storage schemes, distributed battery management, power conversion and connectivity, which are the basic building blocks for a modular, scalable, solar powered EV charging station. A typical solar EV charging station implementation is depicted through the diagram below. The major building blocks are self-explanatory.

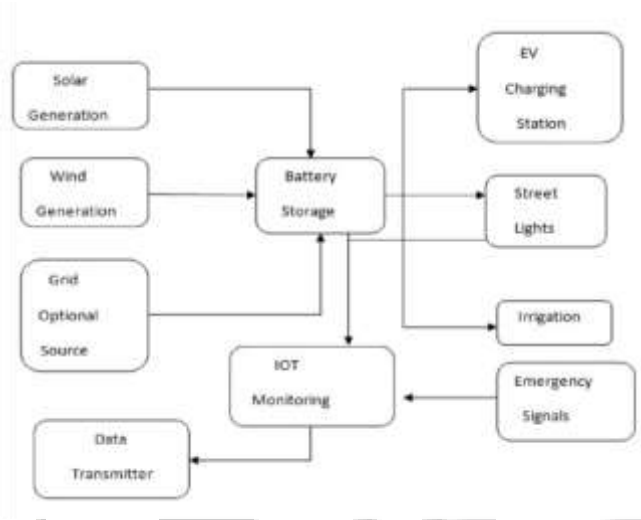
Power flow and energy management: The system has 3 sources of power. First and foremost, are the solar panels. The sizing estimation is beyond the scope of this article, but, it is typically a few kilowatts at the minimum. A panel would typically produce at rated irradiance, about 150W/square meter. The solar panels feed the MPPT module. This is a DC-DC converter with a maximum power point tracking algorithm running inside it. These are typically very high efficiency units, running at excesses of 98% electrical efficiency.

These are typically multiphase interleaved buck or buck boost converters, and operating levels are at a few hundred volts at both the input and output side. Isolation may or may not be a requirement, but most implementations are galvanically isolated for regulatory and safety reasons. The output feeds a common DC bus, from which downstream energy may be provided to the load. The implementation may be analog, fully digital or mix of analog and digital control. The second source is the grid. This may be optional, as the intent is to maximize the usage of solar. However, in areas where intermittent grid is available, or where the solar insolation is not entirely sufficient for operation year-long, or during certain seasons, grid helps in fulfilling the demand. Since the system is essentially a solar energy storage setup, it is also possible to use this station to supplement the grid, during peak hours or as a solar farm, using bidirectional grid tied inverters. With proper policies in place for exporting to the grid from solar farms or from captive plant with net metering, this serves a double purpose too.

The third source and the sink/storage, is the battery. The trend these days is to use Li Ion batteries which have very high cycle life, lends itself well to quick charging, very high depth of discharge and very high volumetric efficiency. It is possible to house these batteries underground, to save real

estate. These Li Ion battery packs are arranged in a suitable series parallel combination, and in several strings. The batteries terminate themselves into a junction box and termination unit, which also functions as a supervisor. Each battery has a data port, typically CAN or RS485, and these are daisy chained and fed to this termination unit, which then has a top level view of the health and status of every individual battery, string or the entire battery bank. This is essentially a data concentrator and a switching unit, putting battery packs IN or OUT of circuit. In addition, this communicates with the central controller to decide the charge and discharge of batteries.

III. BLOCK DIAGRAM



IV. ADVANTAGES

1) These station is good for environment as they are working on renewable energy.
2) They are of great role in solar industry competition with fossil fuel.
3) Solar industry is growing so it is good for job employability
4) They are easy to maintain.

V. CONCLUSION

Both developed and developing countries become more active in EV introduction and diffusion. In developed countries, the government has led the promotion of next-generation environment-friendly vehicles. This will be possible through renewable energy sources such as solar and wind. In the industrial world, not only conventional auto manufacturers but also large and small enterprises have joined the EV business as new business opportunities. In accordance with the implementation of many pilot projects and EV related events, public expectation on EVs is high. However, there is no clear indication for full-fledged diffusion. This is because of high prices of EVs, limited models, lack of charging infrastructure. This problem of lack of charging infrastructure is the one of major issue stopping electric v3hicles from becoming popular. Design and development of solar charging station integrated with wind turbines will help us to make electric mobility more and more popular.

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