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A Review on Vehicle to Grid Integration Using Renewable Energy Sources and Electric Vehicles

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ABSTRACT

The efficiency, stability, and reliability of the electricity grid can all be enhanced by the V2G concept. Reactive power support, load balancing, active power control, tracking of variable renewable energy sources, harmonic filtering and current are all features of a V2G technology. Ancillary services like frequency and voltage control and spinning reserves may be made possible by these technologies. Battery deterioration, the need for frequent grid-to-vehicle communication, impacts on grid power systems, infrastructure changes, and social, cultural, and technical barriers are a few of the costs associated with V2G. Even though V2G execution can shorten an electric vehicle's lifetime, it is anticipated to be more cost-effective for both grid operators and vehicle owners. This paper reviews these benefits and challenges of V2G technology for both individual vehicles and vehicle fleets.

Keywords: *Vehicle to Grid (V2G), Electric Vehicles, renewable energy Sources (RES), Green House Gases (GHG), Global Warming, Power Grid.*

1. INTRODUCTION:

The term "vehicle-to-grid" (V2G) describes the idea of enabling a two-way power transmission between both the electrical grid and electric vehicles. Large- scale systems use wind and solar energy in particular as a suitable alternative to fossil-fuelled power plants. It will act as the building block for upcoming infrastructure for power generation. Moreover, due to local consumption, V2G reduces cost and losses associated with electricity transportation [5].

Electric vehicles (EVs) are becoming more commonplace due to environmental and climate change legislation, rising energy prices, worries about energy security as well as fossil fuel reserves, and rising consumer expectations. Although there are technical constraints, social barriers, but also cost premiums when compared to conventional internal combustion engine (ICE) vehicles, EVs have not been widely adopted. Grid managers and vehicle owners are both interested in V2G concepts, which also have environmental advantages.

[6] According to Global EV Outlook 2018, there are now more than 3 million electric vehicles on the road globally, an increase of more than 50% from 2016. In 2017, there were approximately 430 000 publicly accessible chargers worldwide, 25% of which were fast chargers. These numbers reflect the increasing demand for EVs on a global scale.

The increasing usage of EVs does, however, raise questions about how well the infrastructure for charging will be able to handle changing charging schedules and rising peak power demands. Injection of harmonics into grid networks, voltage dips, power losses, phase imbalances, peak power demands, and instability difficulties are the main issues with EV charging. To meet the EV demands, more power generation capacity is needed, and an appropriate communication infrastructure between EVs and EV Supply Equipment (EVSE) is also needed.

2. INTEGRATION OF RES USING V2G SYSTEM:

[2] Interest in using RESs in the grid system has increased as a result of recent advancements in the field of RES. It is important not to throw away the clean RE that is produced because it is very valuable. RESs, particularly wind and solar energy, have variable power output, which limits their use. To maximize the interaction among EVs and RES, there has been a rise in curiosity in studies that compare various charging strategies, EV penetration rates, as well as RES integration levels. It has received a lot of attention in the past ten years to use the connection among EVs and RESs to maintain a balance between supply and demand.

[3] It is very fascinating that renewable energy sources (RES) are becoming more and more integrated into the electrical grid. The supply of electricity from these sources, particularly wind and PV solar energies, is unpredictable and intermittent. Depending on the available energy sources, such as wind speed and solar radiation, the electricity generation from these RES can be very high (more than the power demand) or very low (less than the power demand). The addition of EVs to this position will significantly support and enhance further RES grid penetration. However, because this idea is cross-cutting, a more thorough technical and cost-benefit analysis is required. To evaluate the effects and viability of the EV interaction with RES, there are already a few demonstration projects in place.

3. EVS INTEGRATION WITH PV SOLAR ENERGY:

[4] Since the late 1800s, solar energy production has been very popular, and current technology is still being used to increase the efficiency of solar cells. Today, it's common to find solar panels linked together to create electricity-generating arrays. EVs will probably be integrated into the grid and used for grid support and charging. Solar panels are frequently used in large, open parking lots as an example of this.

Fig. 2. Integration with PV cell

The decrease in CO_2 emissions that these solutions provide, which in turn slows the overall greenhouse effect, is one of their main advantages. However, creating large, expensive battery storage to store the extra solar energy is not a workable or cost-effective solution at the grid level.

4. EVS INTEGRATION WITH WIND ENERGY:

Due to its inherent ability to produce clean energy, wind energy, another renewable energy source, has drawn attention from many. The applications and literary works for integrating the production of wind energy and PEVs are somewhat similar to those for solar energy. A few recent studies published in the literature focus on frequency control, comparative analysis of isolated power grids, use of electric vehicles (EVs) to provide regulation with wind energy, and evaluation of wind and EVs as a viable use for the grid.

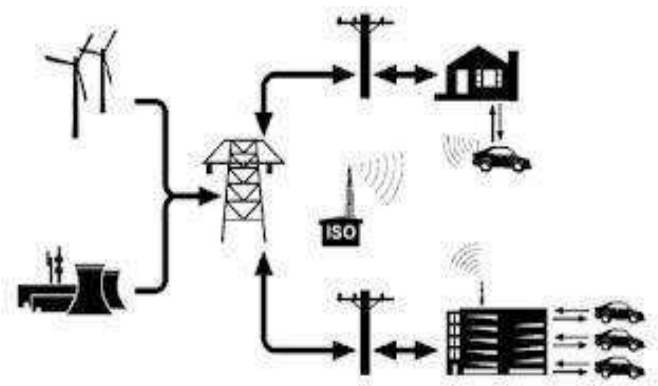

Fig. 3. Integration using wind energy

5. BENEFITS OF V2G SYSTEM:

5.1 Active/Reactive Power Support

By actively supporting the grid's power needs whenever a peak power requirement is undertaken and charging during off-peak hours, EVs can control the power load. As a result, grid components are protected from overloading and last longer. Using V2G-enabled bidirectional chargers, the fleet of EVs can be used to generate or sink reactive power locally within distribution grids with the aid of V2G technology. Voltage stability and improved power quality are provided by effective reactive power management within the grid.

5.2 FREQUENCY REGULATION

In order to increase market value and lessen strain on EV power systems, regulation services are the first step in integrating V2G technology. For active power, frequency regulation maintains a balance between supply and demand. Large generators are cycled to control frequency, but this comes at a high cost. The V2G system, which uses EV batteries to enable quick charging and discharging rates, is a useful substitute for frequency regulation. Reactive power supply and demand are balanced thanks to voltage regulation.[2].

6. Impacts of V2G system:

6.1 Impacts on Distribution Parameters

[1] Overloading will occur if electric vehicles are charged in large numbers, putting transformers at risk. Similarly, if there is a lot of quick charging, the main feeder conductors will be overloaded. Power losses during the charging process are an economic issue for distribution operators and should be minimised to avoid overloading of the transformer and feeder. Power losses, harmonic generation during charging, and voltage profile deviations are all examples of power quality issues.

6.2 Transformer Overloading and Heating:

The widespread use of EVs raises power requirements, which in turn puts additional strain on distribution transformers. According to the study, the transformer ages more quickly as the ambient temperature rises. Some factors that affect the life expectancy of trans people are the ambient temperature, the penetration of EVs, and charging levels. Even at lower levels of EV penetration, the transformer becomes overloaded as the charging level rises. Since EV charging results in harmonic distortion, harmonics have a significant impact on transformer life.

Conclusions

This essay examines the advantages of V2G technology. It has been demonstrated that while V2G can shorten an electric vehicle's lifespan, it is more cost- effective for both grid operators and vehicle owners. It will speed up the deployment of EVs and be good for the environment. The grid's technical performance in areas like efficiency, stability, reliability can all be enhanced by the V2G concept.

Vehicles with V2G capability provide active power regulation, reactive power support, current harmonic filtering, peak shaving, and load balancing by filling in the valleys. Additionally, they support effective integration of intermittent power generation and provide a potential backup for renewable energy sources such as wind and solar energy. Ancillary services like voltage and frequency regulation and spinning reserves can be made possible by these systems. They cut back on utility operating expenses and may even bring in money. Convenient recharging and access to electricity supplies are required to reap these benefits. V2G strategies help vehicle owners save money as well.

REFERENCES

1. L. Ianniciello, P. H. Biwole, P. Achard, and P. Henry Biwolé, “A review of the state of research on vehicle-to-grid (V2G): Progress and barriers to deployment,” Eur. Batter. Hybrid Fuel Cell Electr. Veh. Congr., no. March, pp. 14–16, 2017, [Online]. Available: https://www.researchgate.net/publication/315144641%0Ahttps://hal.archives-ouvertes.fr/hal-01652212

2. S. S. Ravi and M. Aziz, “Utilization of Electric Vehicles for Vehicle-to-Grid Services: Progress and Perspectives,” Energies, vol. 15, no. 2, 2022, doi: 10.3390/en15020589.

A. Dik, S. Omer, and R. Boukhanouf, “Electric Vehicles: V2G for Rapid, Safe, and Green EV Penetration,” Energies, vol. 15, no. 3, 2022, doi: 10.3390/en15030803.

3. F. Mwasilu, J. J. Justo, E. K. Kim, T. D. Do, and J. W. Jung, “Electric vehicles and smart grid interaction: A review on vehicle to grid and

4. renewable energy sources integration,” Renew. Sustain. Energy Rev., vol. 34, pp. 501–516, 2014, doi: 10.1016/j.rser.2014.03.031.

5. Yilmaz, M., & Krein, P. T. (2012, September). Review of benefits and challenges of vehicle-to-grid technology. In 2012 IEEE Energy Conversion Congress and Exposition (ECCE) (pp. 3082-3089). IEEE.

6. Saini, S., Thakur, T., & Kirar, M. (2019, April). A Review of Electric Vehicles Charging Topologies, its Impacts and Smart Grid Operation with V2G Technology. In Proceedings of the International Conference on Advances in Electronics, Electrical & Computational Intelligence (ICAEEC).