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Moxie Energy Group

Development of Fast-Charging within Ulgham Village

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My proposal discusses the development of fast charging technologies within the village of Ulgham as it adopts V2G (Vehicle-to-grid) technology. Due to the negative characteristics of petroleum-based transportation, such as environmental pollution, the generation of hazardous compounds, and the finite number of resources, there has been a continuous transition from petroleum-based to electric-based transportation during the last few decades [1]. Many technical problems are being met and overcome due to this impetus. One of which is the availability and development of fast-charging technology. The number of electric vehicles connected to the national grid is increasing. These connections create several issues associated with grid operation, such as; increased peak load, grid equipment overload, and power quality degradation. The electric vehicles have batteries that can be charged at scheduled power intervals, enabling the development of charging strategies that address the aforementioned issues while also providing grid service providers capacity for bi-directional charging [2]. It is the next big step in innovation in the automotive industry. V2G was thought to be a future technology in 2015 with only a handful of chargers, but the technology has improved quickly, with about 325 V2G units in the UK [3]. With V2G technology, grid resilience can be enhanced, which is of great need when utilising renewable energy sources.

There are mainly two fast-charging protocols that are widely accepted CHAdeMO, defined by Japan, and Combined Charging System (CCS), defined by the EU [4]. However, current V2G technology is only supported by CHAdeMO based charging technology, a DC fast-charging technology that can deliver up to 62.5KW. CHAdeMo based technology is slow compared to fast-charging technologies based on CCS. Nevertheless, a new next-generation CHAdeMO 3.0 technology is currently being co-developed by the CHAdeMO Association and China Electricity Council (CEC) . This latest version will push charging power upwards of 900KW [1]. V2G technology based on CCS is said to be ready for the market by 2025, enabling more V2G compatible vehicles and furthering EV uptake generally. These developments will help more people adopt V2G as the charging speed is higher than current strategies.

The other aspect is safety related when using fast chargers. Fast chargers typically push higher currents than conventional electronic appliances, which can be dangerous if used incorrectly by the general user. Firstly, the users must be aware not to play with the chargers. A switching system should be modelled to recognise where and when the charger is connected to only start charging when it is safe to do so. Lastly, a self-diagnosing system should be introduced on the charger to check for any errors. These additions to the charging technology can help Moxie Energy group by utilising renewable energy sources and cutting-edge solutions. Moreover, it will make the decision to adopt V2G technology more accessible and stress-free.

As an industrial engineering intern, I aim to bring Moxie Energy Group to the forefront of V2G technology implementation and development. I want to help decrease the charging time and make the charger easy to use while keeping the size of the charger as small and discrete as possible. Furthermore, I would like to make the charging process as effortless as possible for use with minimal any safety concerns. I plan to tackle these problems by studying fast chargers and the new CHAdeMO 3.0 and CSS protocols. In this way, V2G

can be integrated and implemented more efficiently when the new technology is ready. Furthermore, I plan to research other advancements in this space so that they can be adopted to implement V2G effectively.

V2G technology faces two significant challenges: the amount of public adoption; and the integration of V2G technology with all fast charging technologies. The size of chargers typically increases with faster-charging technology. Suppose V2G technology is further added, which increases the size of the charger again. It won't be easy to sustain public support for V2G adoption in such a scenario.

Concerning what I bring to the team, I have completed a bachelor's in mechanical engineering and currently pursuing a master's in industrial engineering and management. Furthermore, I have prior knowledge of python software and currently studying MATLAB. With the experience from my bachelor's degree and by doing further study on these topics, I plan to be a valuable asset to the Moxie Energy Group LTD.

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