



# INTEGRATION OF VEHICLE TO GRID TECHNOLOGY

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## ABSTRACT

With the increasing pollution level and environmental threats, the 21st century is moving towards green and sustainable like plug-in hybrid electric vehicles. They have vast scope and capabilities of energy storage. This feature of vehicles is making them to utilize for energy storage and distribute/sell it during 'peak' demand. The vehicle to grid (V2G) technology with some improvement may present a promising solution for future energy problems. The features, applications and advantages of V2G are presented here, along with the challenges to implement it. Many programs by automotive industries, power generation units and government of different countries are being performed to make V2G technology viable for future use.

## 1. INTRODUCTION

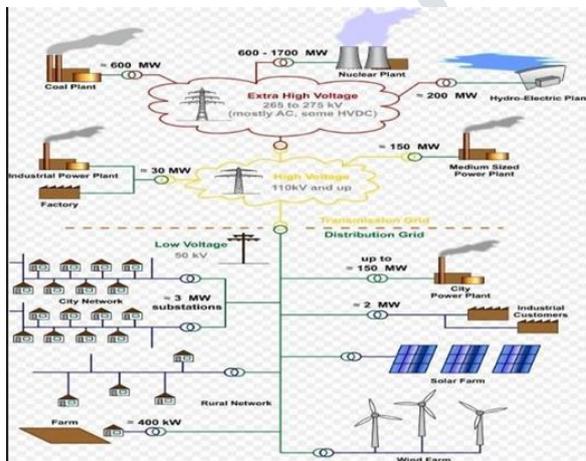
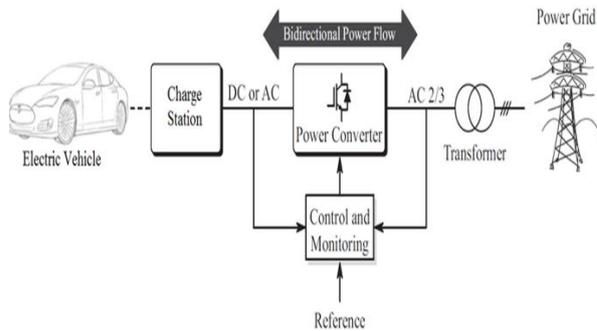
Increasing pollution level and global warming are the major areas of concern as the era head deeper into the current century. Emissions of greenhouse gases, carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>) and unburned hydrocarbons (HCs) in large amount have caused environmental pollution and global warming. A lot of these emissions are caused for the fulfillment of the basic human requirements such as electricity production, transportation, industrial and commercial purposes. 28 percent of total greenhouse gas emission is caused by the transport sector in the United States . 23

percent of total CO<sub>2</sub> emissions in the world are caused by the transport sector which is 87 percent in India. The modern transport sector relies on the internal combustion engine based vehicles which use petroleum to propel the vehicle and emit toxic gases; ultimately causing harm to the environment and human life . Eventually, there has been a search for a more efficient and clean vehicle. Due to the continuous decreasing level of fuel and energy resources, hybrid and plug-in hybrid electric (PHEVs) vehicles are in the spotlight for quite a while now. They are being seen as the future of transportation with combustible fuel resources depleting fast.

Vehicle to grid (V2G) technology can be defined as a system in which there is a capability to control, bi-directional flow of electric energy between a vehicle and the electrical grid . The integration of electric vehicles into the power grid is called the vehicle-to-grid system. Any electric-drive vehicle, has within them the energy source and power electronics combining making it capable to drive the power requirements of homes and offices. It has been calculated that 92% of the total vehicles remain parked even during the peak hours . When a vehicle is not being operated, the on-board battery is connected to a nearby electrical grid via appropriate communication devices. The idea is to use the power from the idle vehicles to provide load-shedding and peak shaving and many other functions. The vehicle batteries can be fully charged during low-demand hours and the flow can be reversed at any time according to the requirements. This can be fulfilled

by utilizing the concept of 'smart grid' which is an electricity network capable of processing the information, manages the electricity flow to fulfil the end users varying power demand and is able to provide communication between generation sources and end users. This concept works on the balance the 'off-peak' and 'peak' demand. The Vehicle can get charged during off-peak hours and can sell it back to the grid during peak hours.

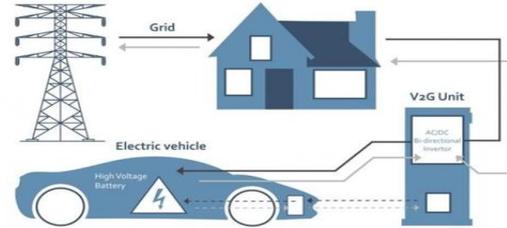
## 2. BLOCK DAIGRAM



A new technology has emerged by giving the excess generated power through the renewable energy to the existing grid. The generated power can be contributed to the grid which can help the electricity generation and distribution. These are done using the renewable energies installed in industries or the houses which can be given back to grid, the excess energy, for which the electricity boards pay some amount for their contribution towards the electricity. This technology has a move towards the battery operated vehicle or the electric vehicle too, which is getting scope in supplying the excess energy to the grid called namely by Vehicle to Grid technology. This paper focuses on the study on the vehicle to grid (V2G) technology and its impact, advantage and necessity for the electricity.

Many cities in America such as California, New York, Massachusetts, Vermont and Maine have taken up policies of developing the renewable energy through the electric drives which will result in less pollution and less use of conventional type motors by increasing the reliability and the efficiency of the electrical grid

according to the report of 2001 by Willett Kempton . The report represents the study of the V2G with respect to its size, availability and economic potential for the grid. It presented about how the V2G might the change the course of the electricity grid economically and reliably. The paper talks about the various parameters needed to be considered while designing or implementing an EV. The base load power (power taken from the power station, which can be supplied by EV in the same manner), spinning reserves (an auxiliary power sources which will work in reserve only if the main power system fails to works) and the regulations are much needed knowledge for designing an EV. When to take everything in account, the interface and infrastructure, resource size and analysis of vehicles is a must. The interface and the infrastructure covers the topic related to the connection between the grid/the power system to the EV and vice versa as shown in figure.



## 3. HARDWARE MODULES

ESP-12E Wi-Fi Module (esp8266)

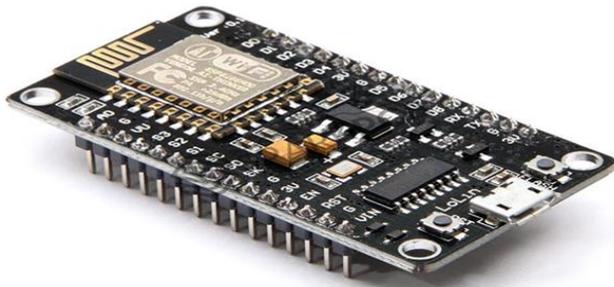
ESP-12E Wi-Fi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LNA, on-board antenna. The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking, or building a separate network controller. ESP8266 is high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.

ESP8266EX offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor. When ESP8266EX hosts the application, it boots up directly from an

external flash. ESP8266EX is among the most integrated Wi-Fi chip in the industry; it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

The ESP8266 has seen a wide adoption as a cost-effective solution for IOT and Wi-Fi-capable devices. The ESP8266 was developed by Shanghai-based Express if systems, as a Serial (UART) to Wi-Fi SoC (System on a Chip) based around a Ten silica X ten LX3DPU. This tiny IC includes an RF front end, RAM, and (usually) an onboard TCP/IP

stack that allows it ready to connect to a nearby Access Point, to act as an Access Point itself, or both.

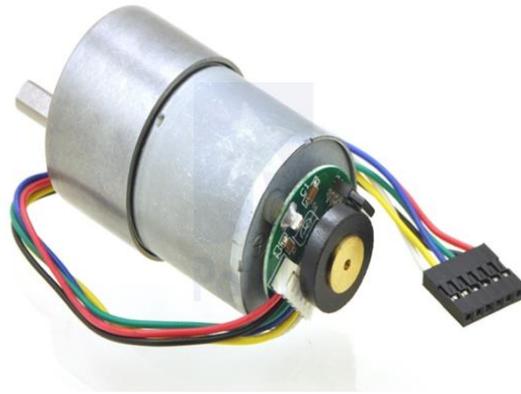


#### 4..DC GEAR MOTORS

Electric motors are broadly classified into two different categories: Direct Current (DC) motor and Alternating Current (AC) motor. In this article we are going to discuss about the DC motor and it's working. And also how a gear DC motors works.

A DC motor is an electric motor that runs on direct current power. In any electric motor, operation is dependent upon simple electromagnetism. A current carrying conductor generates a magnetic field, when this is then placed in an external magnetic field, it will encounter a force proportional to the current in the conductor and to the strength of the external magnetic field. It is a device which converts electrical energy to mechanical energy. It works on the fact that a current carrying conductor placed in a magnetic field experiences a force which causes it to rotate with respect to its original position. Practical DC Motor consists of

field windings to provide the magnetic flux and armature which acts as the conductor.



#### 5. APPLICATIONS

- Power is provided to help balance the load by valley filling, peak shaving (that is charging during the low peak hours and discharging during high peak hours into the grid). This is nothing but peak leveling.
- V2G can also provide peak power for 3- 4 hours a day. [Peak power is nothing but giving the supply during high demand time]. This helps in reducing gap between the energy demands in power system, also reduces transmission losses, investment in transmission losses, mainly the stress in power system.

#### 6. CONCLUSION

The applications of V2G are vast and provides a wide array of possibilities for reliable power generation and storage. V2G also promises a more sustained approach where the environment is also a major concern. However, it still faces a lot of criticism. The major reasons for this criticism are high initial cost, lack of government subsidy, resistance to change, be the people and manufacturers. The view of most people can be considered as narrow and negligent as they are only looking at the initial situation, they are ignoring the future prospects of V2G. The recent projects in the V2G implementation have shown promising results and encouraged further research in the field. As and when more durable batteries and cost efficient grid lines become common, V2G will become a widespread phenomenon. Until then the views of people and manufacturers must be monitored. Lastly, a widespread propagation of the V2G idea, its prospects and opportunities by the governments of developing and developed countries will make the path of V2G implementation much easier. And definitely, smart grid technologies have the latency to meet up the future power demand, which will support V2G.

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