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Efficient Design and Analysis Renewable Energy Based Grid Charging Station

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Abstract : This research basically focus wide range variable speed operation, especially at low-speed condition is obtained. At low irradiance, solar voltage is dropped due to V/f strategy and a boost converter is used to increase the voltage level to meet the higher and constant voltage requirement, such as in voltage source converter DC-link or offshore DC network applications. In the proposed topology STATCOM is controlled voltage vibration of model and control excitation of wind. Here we optimized conversion ration and power quality. A single voltage source converter (VSC) is used for multifunctional operation of proposed system. The WECS is emulated using a permanent magnet brushless DC generator without mechanical sensor.

***Index Terms* - Electric vehicle, solar PV array, wind energy conversion, bi-directional power flow, power quality.**

I. INTRODUCTION

The demand for the electrical system, in contrast, has increased significantly in recent years due to the introduction of new mobile loads like EVs and is anticipated to increase by 34% in 2035 in comparison to electricity in 2014. [5]. The current power system, even with a centralized CPS operation, cannot keep up with the demand, which is rising quickly [6]. Additionally, according to statistics from the World Bank [7], the USPS has observed significant power losses in the transmission and distribution networks of numerous nations worldwide. Worldwide average losses in annual electricity transmission and distribution between 1960 and 2013 were about 8.36%. For instance, the maximum losses in Haiti reached 54.20% as a result of a severe crisis marked by severe shortages and the lowest electricity coverage, indicating a significant generation deficit that restrains the nation's economic growth. To validate its needs in this area, this reflection must first reduce commercial and technical losses before constructing new infrastructure. [8]. Contrarily, climate change threatens our quality of life by raising pollution levels, which have a negative impact on our environment, our way of life, and the shielding of the earth from radiation. This issue has grown significantly in importance for the diversity of life on Earth. Climate change is primarily caused by carbon dioxide emissions [9–11]. The transportation and energy supply sectors are responsible for 14% and 25%, respectively, of the world's overall carbon dioxide emissions. Additionally, the majority of the generation units in a CPS are powered by fossil fuels. Many nations have been motivated to update their current power systems due to the impact of increasing electricity demand and the problem of climate change.

II. MICROGRID

A micro grid is a small subset of smart grid, it is a low voltage network which is used to transmit power, and it is flexible and programmable. This is converter which converter power from passive to active operational mode. Micro grid is switch single directional from two way or bidirectional power flow for distribution network architecture. Micro grid size is depend requirement of load or its structure depend upon available and demand of load. Micro grid is make for a particular person demand or group of person demand it's also depend upon load.

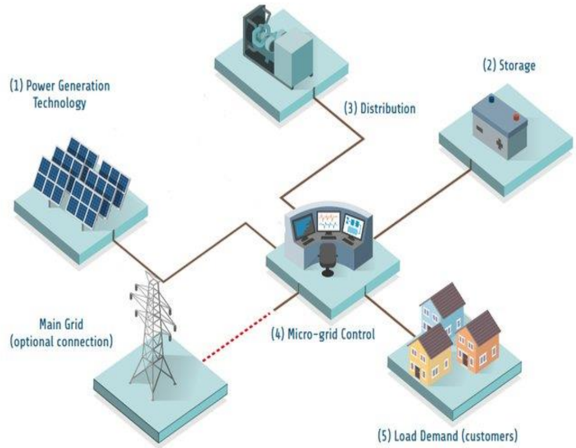


Fig.1 Micro grid Structure

As a result, a micro grid can consist of a single structure or a group of buildings. The function of a micro grid is to supply the neighborhood with electricity through a network of loads connected to minor power sources. Micro grids is a autonomous section of that particular load area here that structure is set if we switch on or off that particular no one have any issue in electricity. Microgram has independency of operation that why maximum architecture today is micro grid, its management and maintenance is easy. The passive distribution network of the micro grid will become an active network, resulting in a real-time, dynamically interactive infrastructure. Basically beauty of this system is working in both directions. It is possible that the distribution network will experience power outages.

III. Proportional Integral (PI) Controller

An alternative name for an integral controller is a proportional plus integral (PI) controller. It is a type of controller that uses proportional and integral control operations. It is referred to be a PI controller as a result.

The proportional-integral controller employs both proportional and integral controller control actions. The shortcomings of each individual controller are eliminated when two distinct controllers are merged to produce a more potent controller.

In this case, the proportionality between the control signal and the integral of the error signal is evident. The mathematical representation of the proportional plus integral controller is:

$$m(t) = K_p e(t) + K_i \int e(t)$$

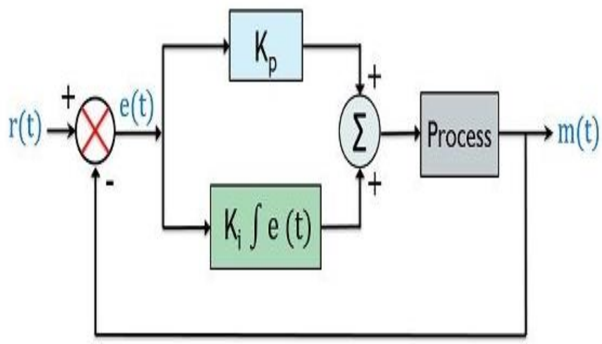


Fig.2 PI controller for a control system

IV. P& O (PERTURBATION & OBSERVATION)

This control strategy makes use of the P&O approach. Voltage (v) and current I are the two inputs used in any MPPT technique (i). In our suggested system, dc current is used as a perturbation variable.

To find the local optimal point of a given function, mathematicians utilize the perturbation and observation (P&O) or hill-climb searching (HCS) approach. In wind energy systems, it is frequently utilized to identify the ideal operating position that will maximise the energy extracted.

This approach is based on changing a control variable in tiny steps and tracking how the target function changes as a result until the slope is zero. In accordance with the findings of a comparison between successive measurements of the output power of wind turbine generators, P&O control modifies the turbine speed toward the MPP. Due to the lack of a requirement for an anemometer and the requirement for system expertise, it is particularly appropriate for small-scale WECSs.

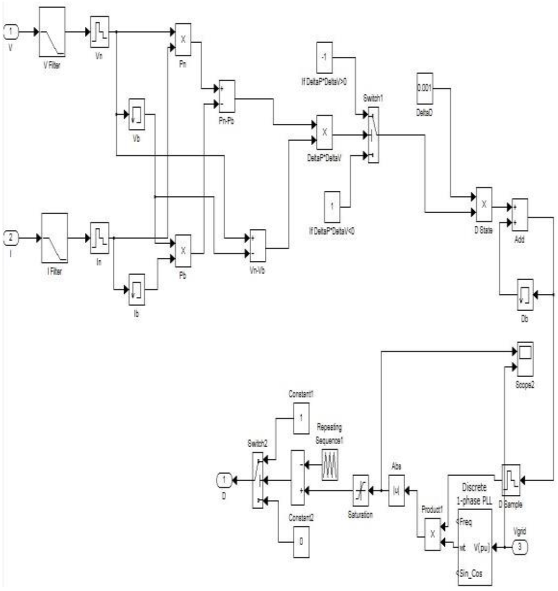


Fig.3 Used MPPT Model

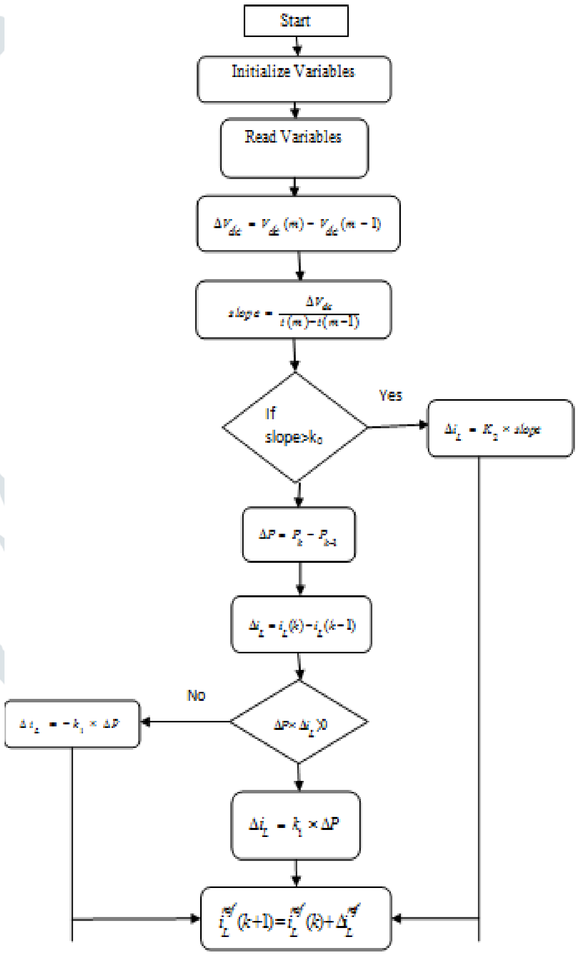


Fig.4: MPPT flow chart which used in proposed model

V. RESULT

The proposed renewable energy-based grid model is designed on MATLAB tool and simulated in MATLAB Simulink.

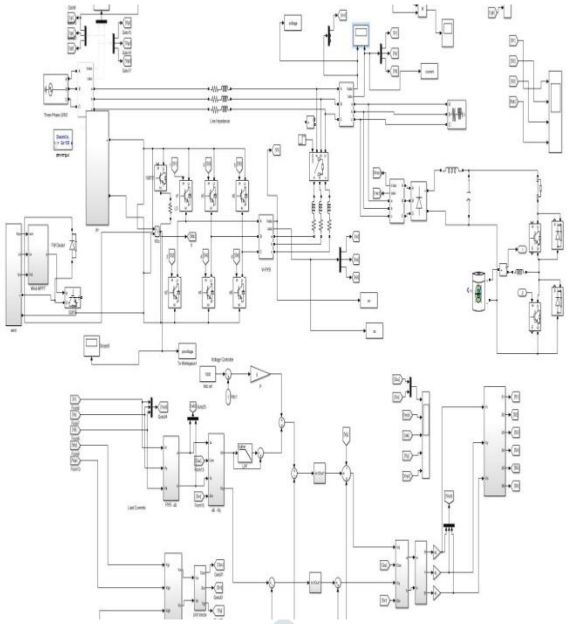


Fig.5 Proposed model

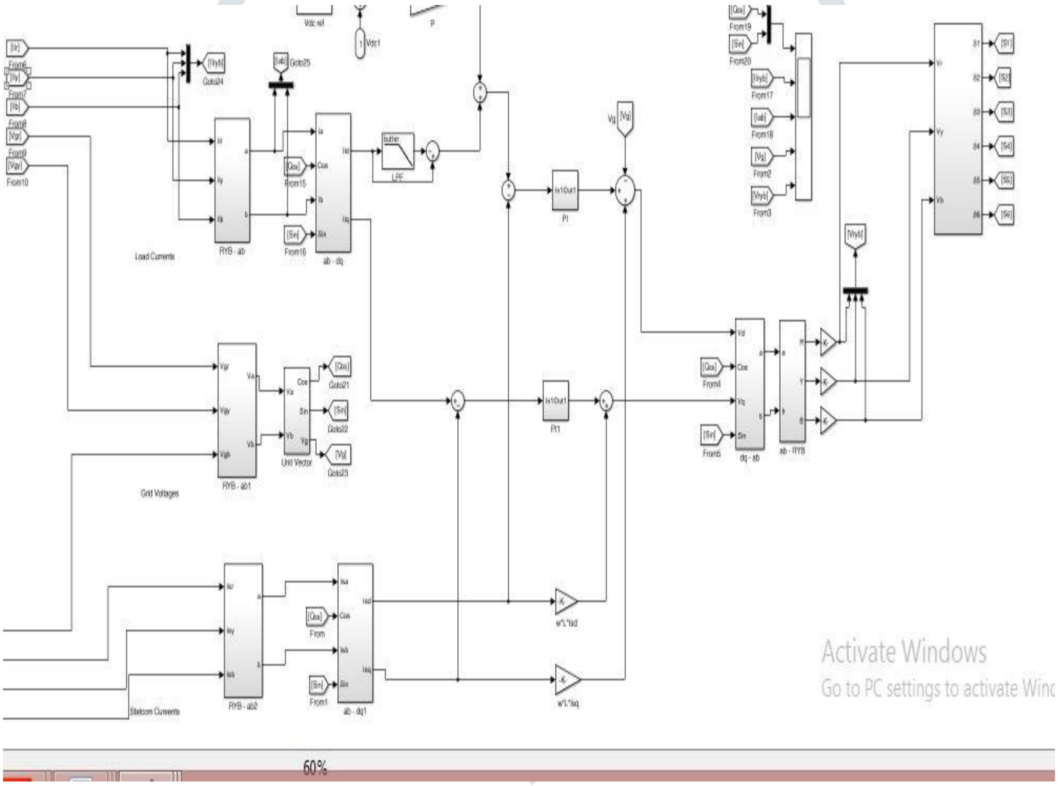


Fig.6 Voltage Controller

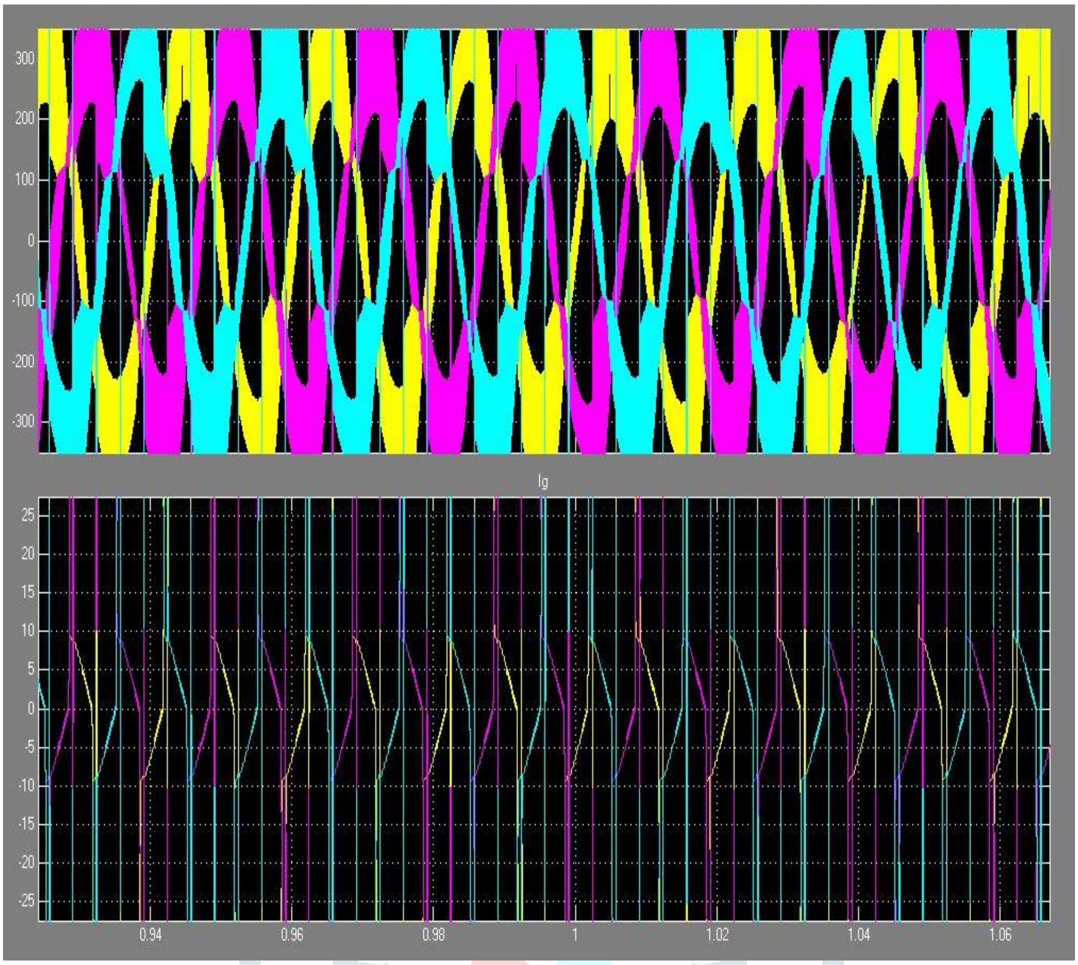


Fig.7 Voltage Current Output

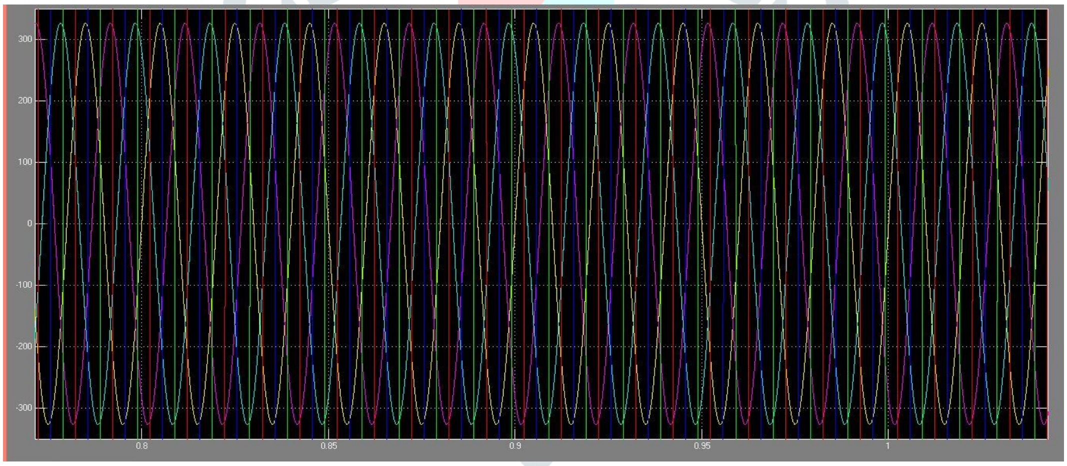


Fig.8 Three Phase Current

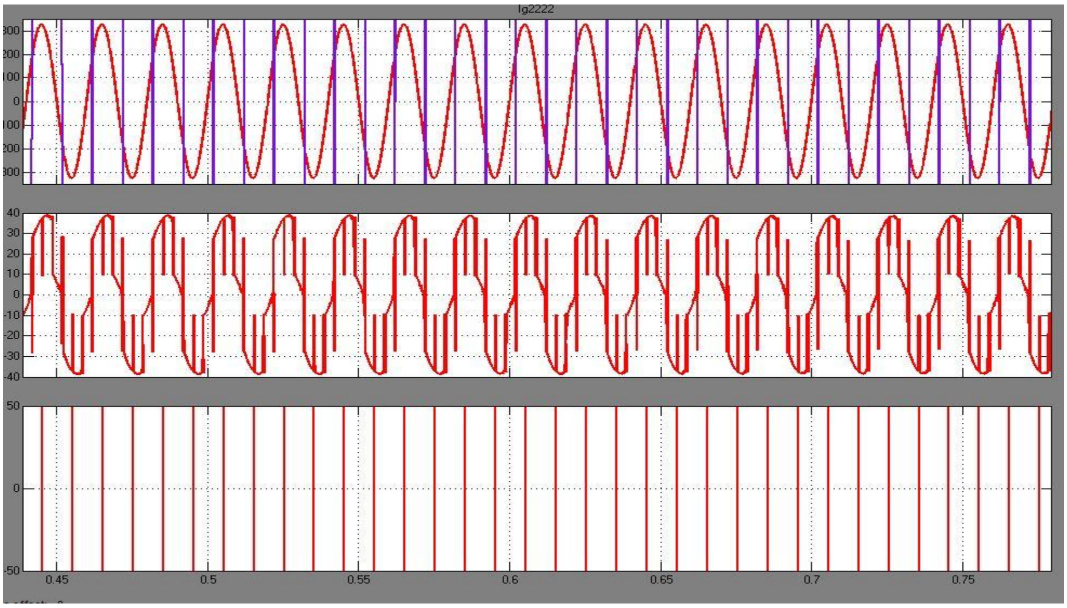


Fig.9 VSC Response

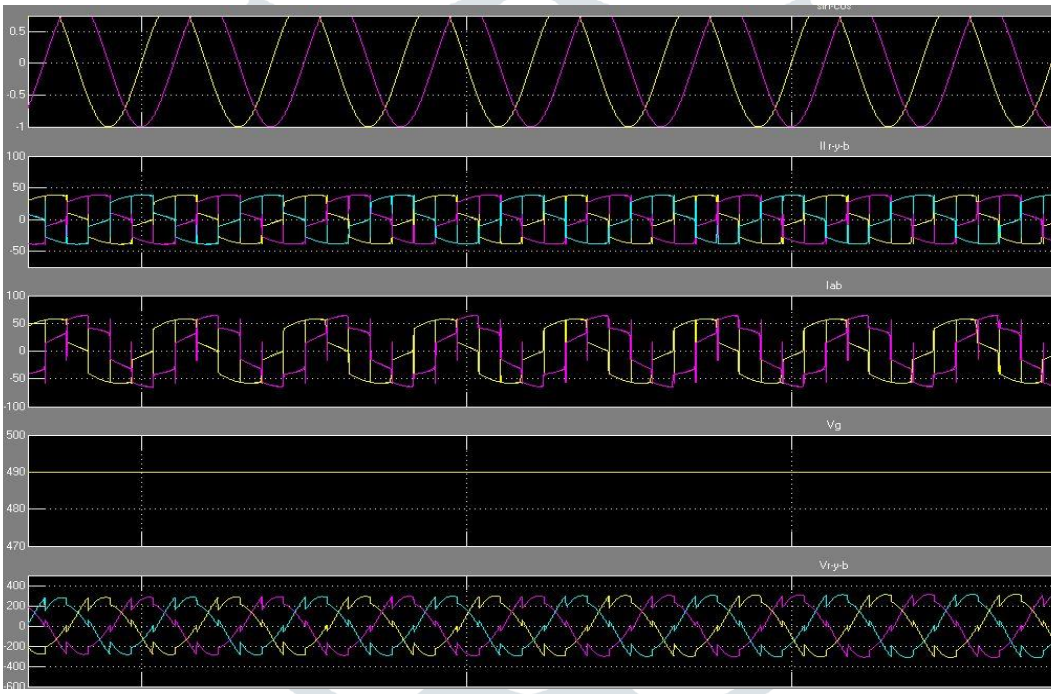
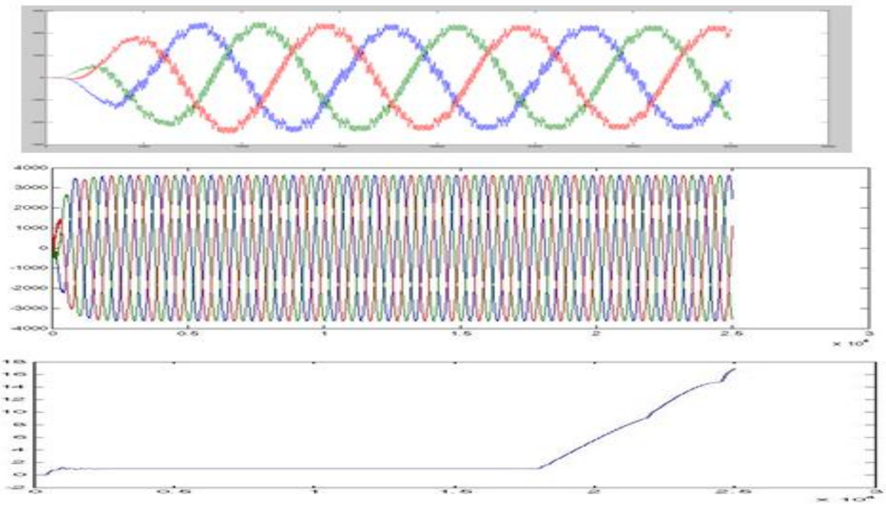


Fig.10 Controller Response



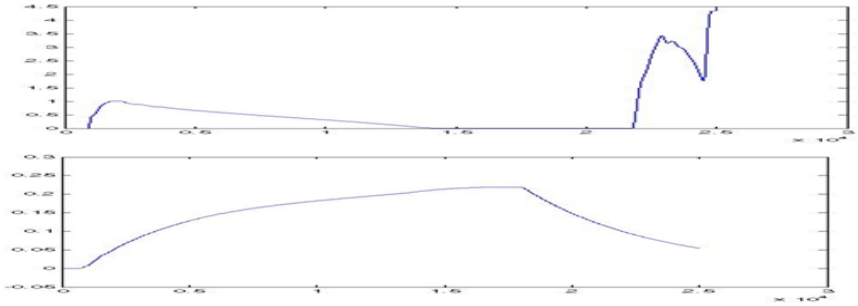


Fig.11: Solar With EV's Load Variation

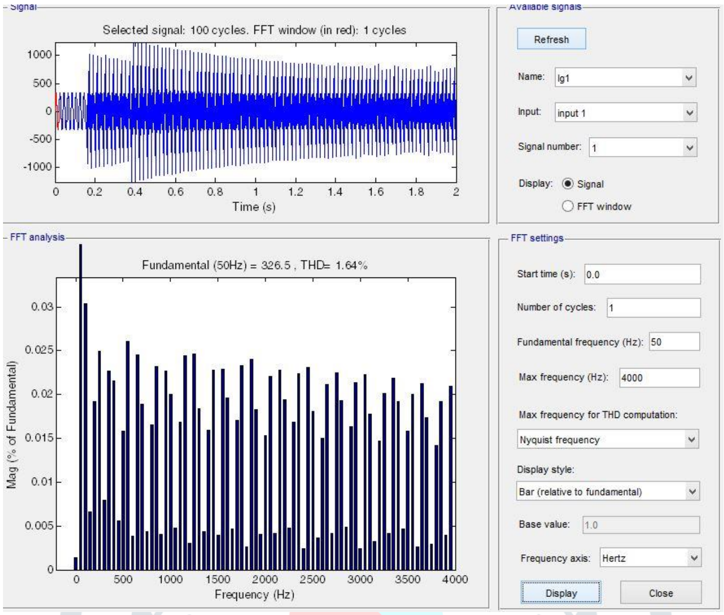


Fig.12: THD of Proposed model

VI. Conclusion

Here is the proposed VSC controller to control the power and for power quality, we used SPWM to get less than 5% THD. Here we get 1.64% THD Value. In this project proposed model is shown in the result, the section is implemented in MATLAB Simulation software and tested in the same software and shows the result in the result section. This also used MPPT to control the pitch angle of wind turbine to get high power from renewal energy also used the pi controller to control errors in power switching in the VSC controller.

The proposed topology uses VSC to control the model's voltage vibration and wind excitation. Here, we improved the EV charging station's conversion ratio and power quality. In the suggested model, we used MPPT to provide the most power and SPWM to control effective switching and power conversion.

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