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Analysis of Hybrid Grid Tied Power System with DC-DC Converters and Filters

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Abstract*— The involvement of converters at various stages leads to introduction of harmonics into the system which leads to the poor power quality at the consumer end. A high-power quality is required for smooth functioning of electrical equipment, to bring good results for precise and accurate evaluation. Power electronic components and circuits are basically nonlinear in nature. And they also have their applications in industries and commercial places. In this work a grid tied hybrid power system is being analyzed for the power quality output. Various types of filters have been used in the system for eliminating the harmonics present in the system. The waveforms after filtration of harmonics have been shown in this paper.

***Index Terms*— PV, EV, THD, Converter**

I. INTRODUCTION

Hybrid power systems are a backbone of today's energy requirements, The tremendously increasing electricity demands with industrialisation, urbanisation and adoption of EV's has lead to a significant increase in the no. of hybrid power generations and standalone power generation systems.[1]

The combination of two sources is defined as a hybrid power system, The two sources selected in a hybrid power system are such that the input parameters effecting one source will not affect another source. [2-3]

The combinations which are majorly seen are of Solar - Wind, Solar – Thermal, Biogas – Solar, etc. [4]

The combination of two sources involves the AC – AC and DC – DC converters at various stages of the power system,[5] These converters are mainly used to convert one form of electricity into another form of electricity, The converters mainly involve DC-DC converters like Boost converter, Buck-Boost converter, Cuk converter, zeta converter and Buck converter, DC-AC inverters. [6-7]

The involvement of converters at various stages leads to introduction of harmonics into the system which leads to the poor power quality at the consumer end.[8] A high-power quality is required for smooth functioning of electrical equipment, to bring good results for precise and accurate evaluation. Power electronic components and circuits are basically non-linear in nature. And they also have their applications in industries and commercial places.[9]

II. PROPOSED SYSTEM

The proposed system is a blend of two renewable sources whose output is synchronized with the grid parameters, the outputs of the system is compared by using three different types of DC-DC converter and their power output is evaluated after using filters (LC).[10]

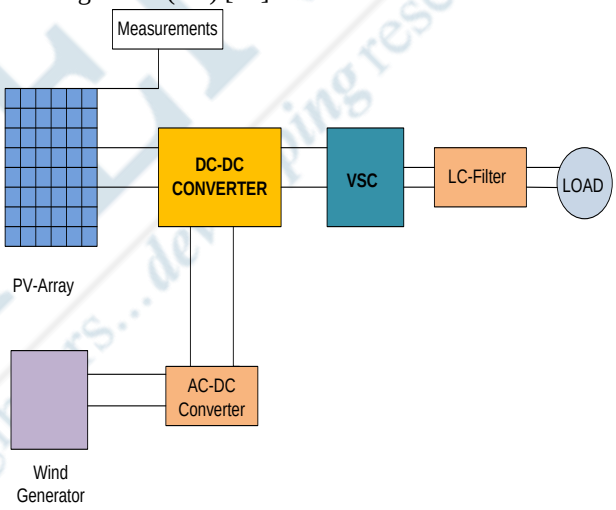

Fig 1.1. Block Diagram of the proposed system

III. FILTERS USED

The potential negative impacts of harmonic voltage or current produced by nonlinear loads can be reduced with a filter. By using a series or shunt design of capacitors, inductors, and sending them towards the ground, it can trap both current and voltage. Between the power source and the object to be protected are the filters installed.

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IV. SIMULATION RESULTS

Simulation results of a Boost converter

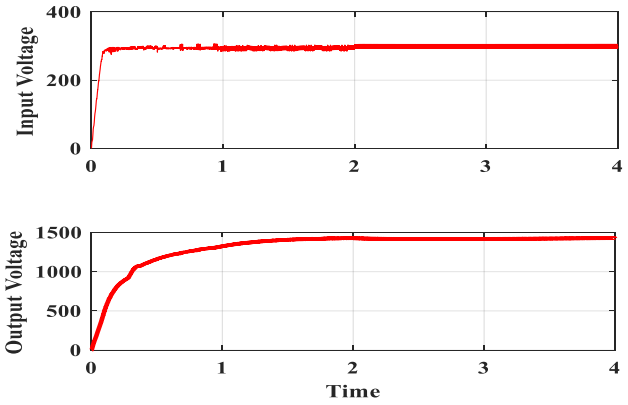

Fig 1.2 DC converter input and output waveforms of the Boost converter

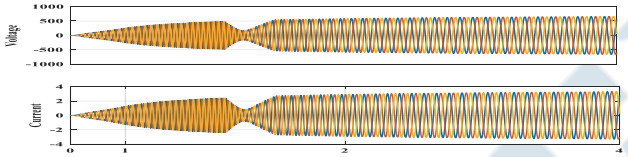

Fig 1.3 Voltage source converter output waveforms

Simulation results of the Cuk converter

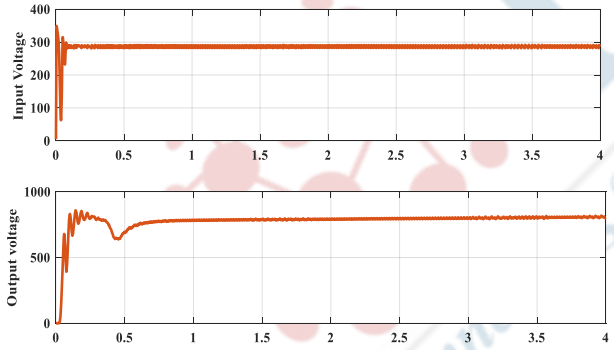

Fig 1.4 DC converter input and output waveforms of the Cuk converter

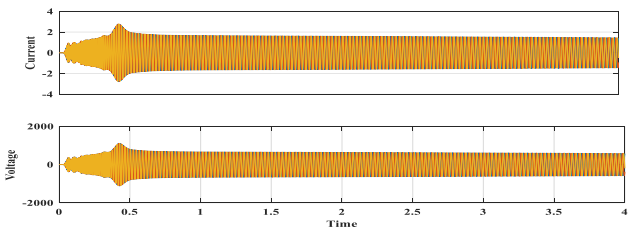

Fig 1.5 Voltage source converter output waveforms

Simulation results of the Zeta converter

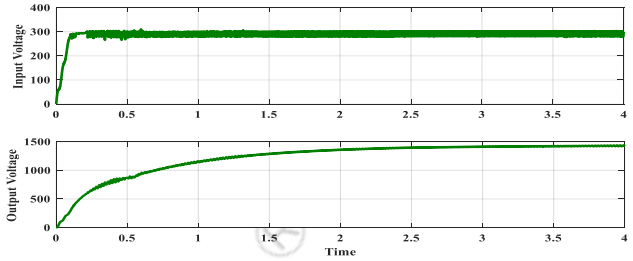

Fig 1.6 DC converter input and output waveforms of the Zeta converter

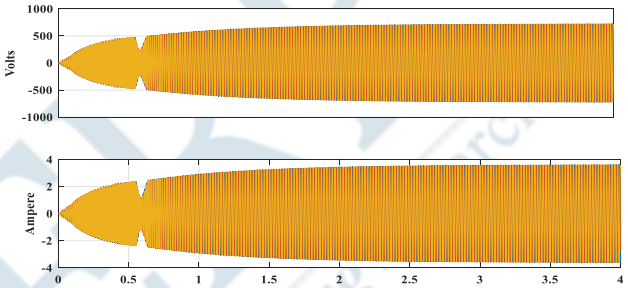

Fig 1.7 Voltage source converter output waveforms

TABLE 1: Power Quality evaluation table

Converter	DC Converter Output Voltage	Settling Time	THD %	THD after Filteration
Boost Converter	1500	0.34 sec	46%	39 %
Cuk Converter	750	0.48 sec	20%	15 %
Zeta Converter	1480	0.64 sec	5.86%	4 %

V. CONCLUSION

The combination of filters should be used in power systems where power electronics converters and devices are used. In order to improve the power quality at the consumer end. The analysis done on the output of three different types of DC-DC converters is shown in this paper.

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