Renewable Energy Based Electric Vehicle Charging station

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Abstract — Finding a technically feasible, financially feasible, and environmentally responsible way to meet the rising demand for electricity from electric vehicles and charging stations is becoming more and more important. Even better would be to use renewable sources as primary sources with conventional sources serving as a backup. The EV charging station is created in the proposed system using renewable energy sources (wind and solar power), whose output is coordinated with the existing grid. Switching between the sources could be done using circuit breakers and analysis of the State of Charge of the battery is seen.

Keywords: Renewable Power System, EV

I. INTRODUCTION

Given the current situation, when fuel prices for automobiles are rising rapidly. EVs have shown to be the most widely adopted new form of transportation. Although the EVs' restrictions limit their use to the majority of the people.

Limited travel range, high production costs, and a lack of charging outlets are some of their drawbacks.

In order to ensure that the usage of EVs remains entirely environmentally beneficial, a good selection of power sources is necessary for the development of charging infrastructure for EVs.[1]-[2]

Now days Coal, gas, and oil make up the majority of the energy sources used, providing around 70% of the energy produced.

Harmonics, frequency variations, shocks, and other issues with the grid-connected energy generation system cause problems in the power system.[8]Applications for power converters in the renewable energy system, including solar and wind energy sources [3]-[5]

II. PROPOSED SYSTEM

Two power sources are used in the proposed system:

- This grid uses a three-phase AC supply.
- A synchronous generator for the wind and a photovoltaic array.[6]

The PWM approach, which uses the values of grid parameters as a reference, is used to manage the output of renewable energy sources.[4]

This is a block diagram of the suggested system.

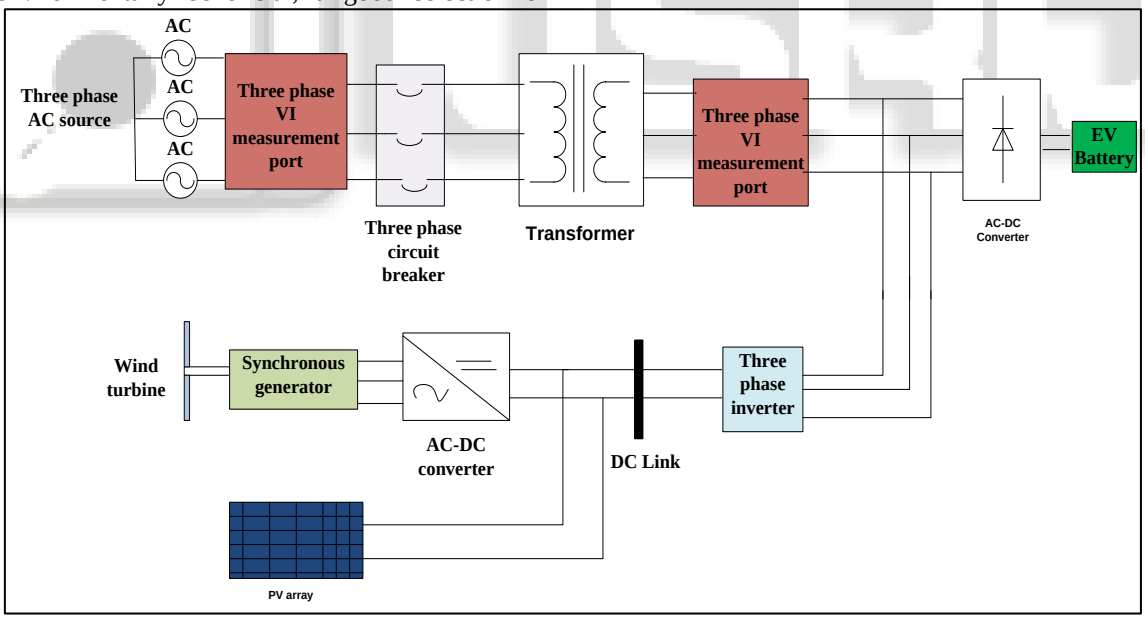

Fig. 1: Model of an EV charging system based on renewable energy system

The above-shown block diagram shows the working of the proposed system, which includes the power sources included in the system and the power conversion at various steps after which the power is finally delivered to the battery of the EV.[7]-[9]

III. DESCRIPTION OF SYSTEM

The system makes use of a 25 KV three-phase AC source, whose output voltage and power waveform is depicted in Fig. 2 below.

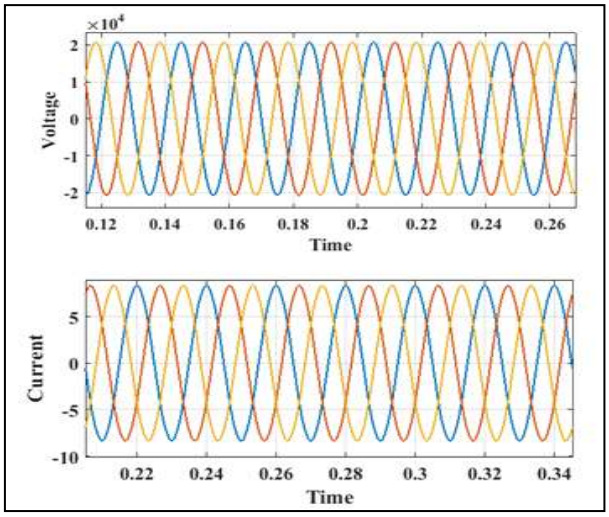

Fig. 2: Three-phase source output waveforms

The transformer further steps down this three-phase voltage to 440 volts. The following list contains the transformer ratings:

- Nominal Power-[105e3 50]
- Nominal frequency-50Hz
- The average line-to-line voltages are [64510.4, 260 .03]
- Resistances in the windings—[0.01 0 .01]
- positive progression Losses at no load: 1000W
- positive progression 0.08 short circuit reactance

The output waveform after the step down from 25KV to 440V is shown in Fig. 3 below.

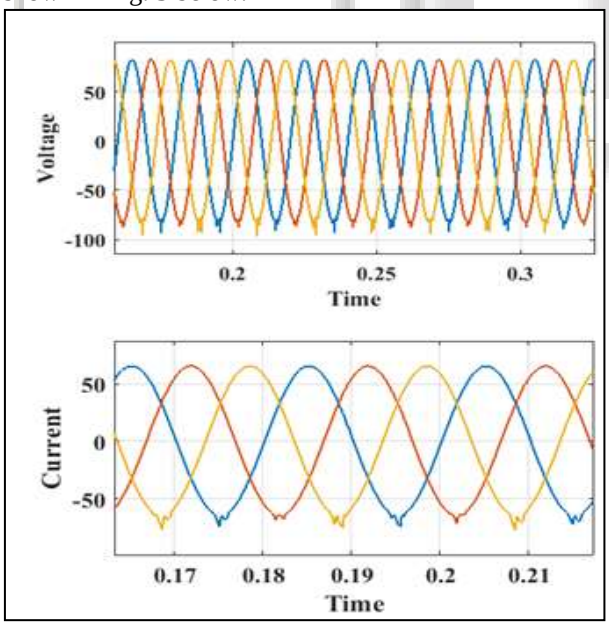

Fig. 3: Output Voltage and current waveforms at the three-phase source transformer secondary

This 20 KV three-phase source's output is timed to match that of the hybrid sources. The PWM approach combined with grid settings is used to synchronise the output of the hybrid sources.

In the figure 4 provided below, the output of the hybrid energy sources is depicted.

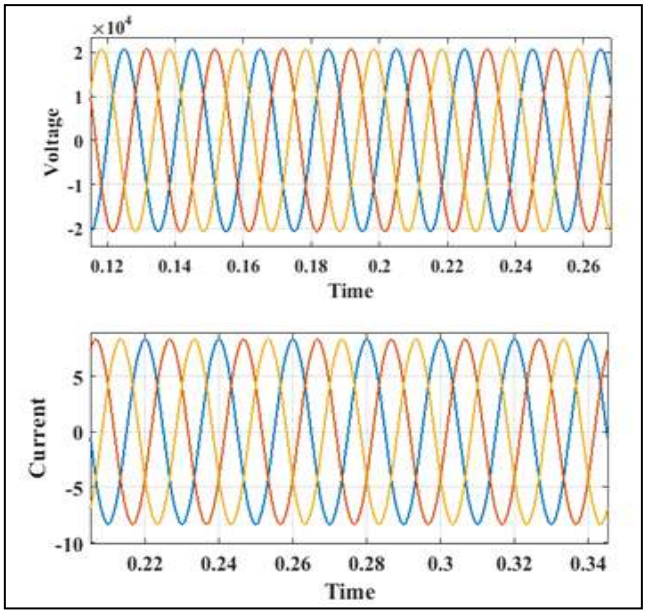

Fig. 4: Renewable energy sources' output

The transformer receives this renewable energy source output and steps the voltage down to 440 volts. The transformer's ratings are displayed below:

- Nominal Power-[105e3 50]
- Nominal frequency-50Hz
- The standard line-to-line voltages are as follows: [260.03 260 .03]
- Resistances in the windings—[0.01 0 .01]
- positive progression Losses at no load: 1000W
- positive progression 0.08 short circuit reactance

In Fig. 5, the output waveform following the transformer is displayed.

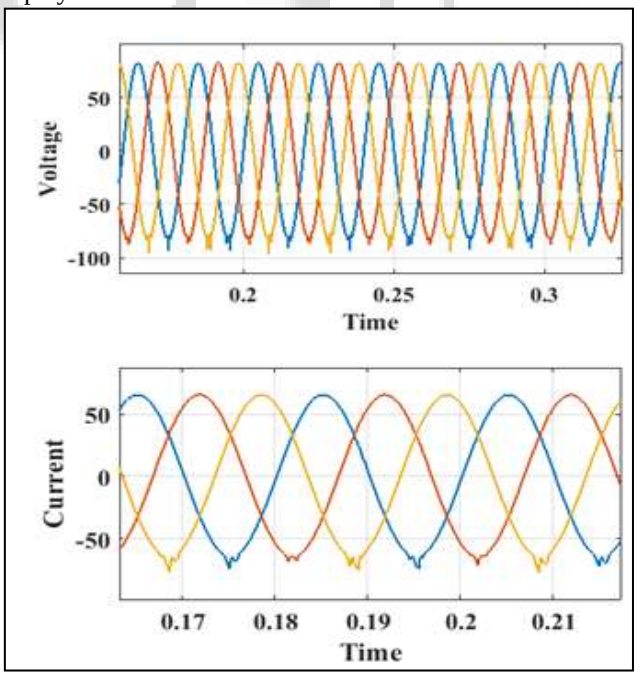

Fig. 5: Output at transformer (After renewable sources) secondary

Here, the output from both sources—renewable energy sources and the traditional grid—is pooled and turned into DC power, which is then utilized to charge electric vehicles.[10]

The output DC voltage utilized to charge the battery of EVs is depicted in Figure 6 below.

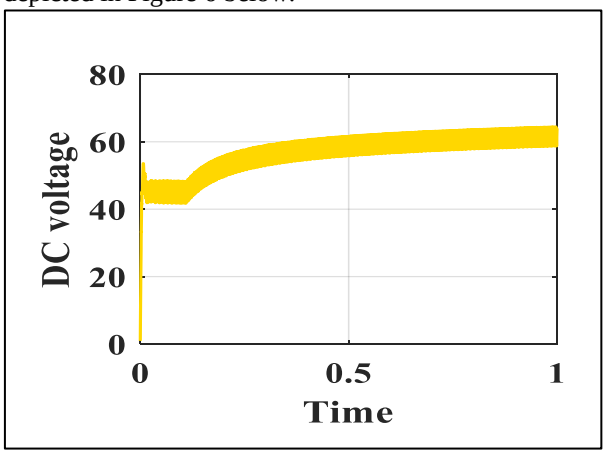

Fig. 6: DC voltage output for an EV charging station

The EVs' lithium-ion battery is charged via this DC output. The system's battery is a

- Nominal voltage-20 volts
- Initial charge: 0%
- Rated Capacity: 7.0 Ah
- battery response time-30 second

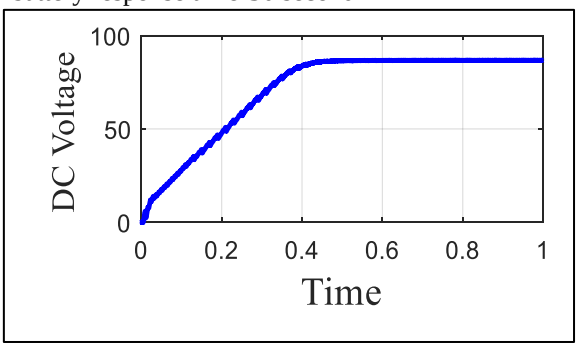

Fig. 7: Waveforms of Battery

IV. Simulation Model of the System

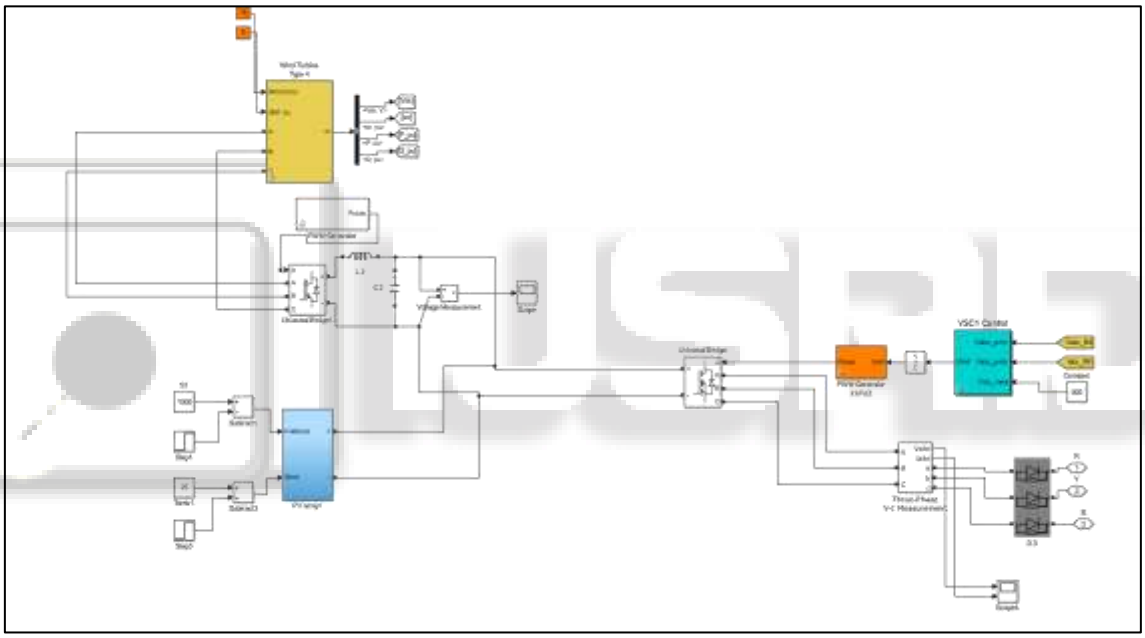

Fig. 8: Simulation model of the renewable power system

V. Results

The results suggest that the battery's SOC (State of Charge) increases from 0% to 3% in 1 minute. The battery would be fully charged in 30 minutes, according to the graph. Most of the energy used to charge the electric vehicle battery comes from renewable sources, yet in case of an emergency, grid power may be used.

VI. Conclusion

As the infrastructure for charging EVs is powered by renewable resources, running an EV is an entirely environmentally benign process. The eventual generation of flue gases from the power plants would be significantly reduced thanks to the utilization of renewable energy sources. Thus, the system is both affordable and environmentally benign.

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