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Review Grid Connected Wind Photovoltaic Cogeneration Using Back to Back Voltage Source Converters

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Abstract:

With developing concerns, in renewable energy sources can improve which is an increasing amount. This paper reviews both the vitality of the wind and the photovoltaic (PV) energy conversion strategies. and theirmaximum-power-point tracking (MPPT) methods.Then, a new Grid tied wind–PV cogeneration generation using back to back voltage source converters system is proposed.For the wind power generationpermanent-magnet synchronous machine is used to capture the maximum wind power byusing optimum speed control. For the PV power generation boost converter is adopted to harnessthe maximum solar power by tuning the duty cycle. Simulation validations are providing to fiancée of proposed system.

Keywords:-Boost Converter, Controller, MPPT, Solar Power System, Wind energy, utility Grid and Voltage Source Inverter

I. INTRODUCTION

Because of the preferences of nature natural energy sources practically no pollutants, renewable energy wellsprings need pulled in broad consideration. Wind energy is a standout amongst the renewable energy guaranteeing clean energy sources on account of it might be effectively caught toward a wind generator for delivering power into electric energy. Photovoltaic (PV) control is an alternate guaranteeing clean energy wellspring a result it will be worldwide Furthermore could a chance to be utilized without utilizing a rotational generator. Clinched alongside fact, wind energy the more PV control need aid to some degree reciprocal Similarly as solid winds happen basically toward evening and shady days same time sunny days need aid frequently cool for powerless winds [1].

To change over wind energy to electrical energy, two type of wind turbines need aid employed; altered variable velocity wind turbines introduced or Fixed velocity [4]. Fixed speed wind turbines, the control generator is straightforwardly associated with the control grid. Therefore, the generator works during an consistent recurrence What's more pace. Those dynamic Furthermore sensitive force control from claiming these turbines may be portrayed in control [5, 6]. Variable pace wind turbine (VSWT) will be utilized for more excellent fascination of vitality starting with wind. VSWT, which attracts.

10–15% more energy, has lower mechanical stress and less power fluctuation in comparison with the fixed speed ones. To addition, wind turbines are separated under two significant classes:horizontal wind turbines and vertical, more Sherbious are those practically popular verticalaxis wind turbines (VAWT). Those air motion facilitating effectiveness of the VAWT will be more level over that of the level of horizontal yet the multifaceted nature Furthermore cost for these is low [7].

A standout amongst those the greater part significant investigations in the VSWT is the requisition about Different control schemes for a few purposes in the plant. There need aid some techniques with control VSWT. These systems would used to track those greatest power, will control those voltage Also recurrence of the load Also diminish control variance [8–10]. Pitch control is a system will control concentrated starting with the VSWT [11]. Most extreme energy fascination starting with those VSWT may be attained utilizing straight control; fuzzy logic control furthermorehill claim searching (HCS) strategy [12–15].

Due to efficient and economical utilization of renewable energies, some of renewable energy resources such as wind turbine and solar array are integrated [16]. Because of dependency on wind speed and sun irradiance in such systems, their reliability in satisfying the load demands decreases under all conditions. Hence, some studies propose the combination of a diesel generator as a back up and wind/solar power generation systems [17, 18].

This effectiveness expansion of the PV energy preparing system will be futile In the MPPT control doesn't guarantee that greatest energy may be concentrated starting with those PV array, both toward an enduring state and under fluctuating climatic states. In fact, the total efficiency of the power processing system is almost the product of the conversion efficiencies, which must be maximized by taking into account the extremely variable operating conditions throughout the day [19] as well as the MPPT efficiency.

There are multiple MPPT techniques [20] that could be compared using different criteria (Table 1). The main techniques are dP/dV or dP/dI feedback control, incremental conductance (IncCond), and hill climbing {or perturbation–observation (P&O)}.

Table 1
MPPT Comparision for Photovoltaic System

S. no	mppt technique	PV array Dependent	True mppt	Convergence Speed	implementation complexity	Sensed parameters
1	P&O	No	Yes	Varies	Low	Voltage, current
2	IncCond	No	Yes	Varies	Medium	Voltage, current
3	Fractional *Voc*	Yes	No	Medium	Low	Voltage,
4	Fractional *Isc*	Yes	No	Medium	Medium	current
5	Fuzzy logic	Yes	Yes	Fast	High	Varies
6	Neural network	Yes	Yes	Fast	High	Varies
7	*dP/dV* control	No	Yes	Fast	Medium	Voltage, current

On photovoltaic framework a front-end support converter will be by and large obliged toward the enter about inverter will match the load prerequisites. Previously, such DC-AC alternately DC-DC AC energy converters, there will be An likelihood for concurrent exchanging from claiming switches (IGBTs/MOSFETs) of the same leg(s) from claiming inverter because of EMI effect, inappropriate terminating of switches, aggravation out breaking and nonattendance of cross-conduction security inside the gate-drivers itself and so on. This prompts shorting from claiming wellspring alternately dc connection capacitor through the shortedleg(s) of inverter, causing a large current flow and damage tothe system. A voltage source inverter is one of the examples.

Proposed system is designed for maximum energy captured from the wind turbine / solar array and deliver to utility grid. This paper is organized as follows: descriptionof the proposed system is illustrated in Section 3. Section 4 describesthe control system design. Optimal design and economicanalysis is fulfilled in Section 5. Simulation results and discussionare presented in Section 6. Section 7 is the conclusions

II. PROPOSED SYSTEM DESCRIPTION

The proposed hybrid energy generation system is depicted inFig. 1. This system consists of a horizontal axis and variable speedwind turbine, a solar array, permanent magnet synchronous generators, sinusoidal pulse width modulation (SPWM)converters, DC/DC converters, an adaptive feedback linearizationcontroller,

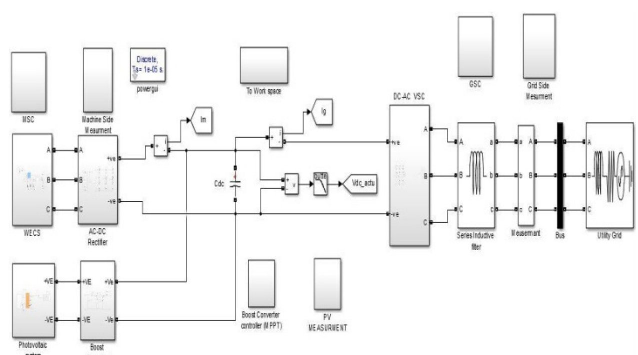

Fig. 1 Proposed System modeling

III. MPPT CONTROL FOR SOLAR ENERGY CONVERSION SYSTEM

To enhancing the efficiency of the photovoltaic panel MPPT is utilized. According to the maximum power point theorem, the output power of any circuit will be maximum whenever source impedance equivalent to the load impedance, so the MPPT algorithm is utilized to the problem of impedance coordination. In this paper work, the Boost Converter is utilized as impedance coordination device between input and output by changing the duty cycle of the converter circuit. Favorable position of the Boost is that low to high voltage is acquired from the accessible voltage. Control algorithm, the PV voltage and current are sensed and then estimate the power, after that find the change in power and voltage by comparing the previous power and voltage; if change in power is zero then duty cycle will be same as previous otherwise duty cycle will change according to the fallowed condition which is shown in Fig. 2.

IV. GRID CONVERTER CONTROL

Most inverters operate as currentsources injecting a current that is sinusoidaland in phase with the gridvoltage, with a power factor equalor very close to unity. It is required that the inverter synchronizes withthe fundamental component of the grid voltage, even in the caseswhen the grid voltage is distortedor unbalanced or when the grid frequencyvaries.An example of synchronization insteady state for a three-phase systemis shown in Fig.3, in which three phase wind photovoltaicco generation system with load.

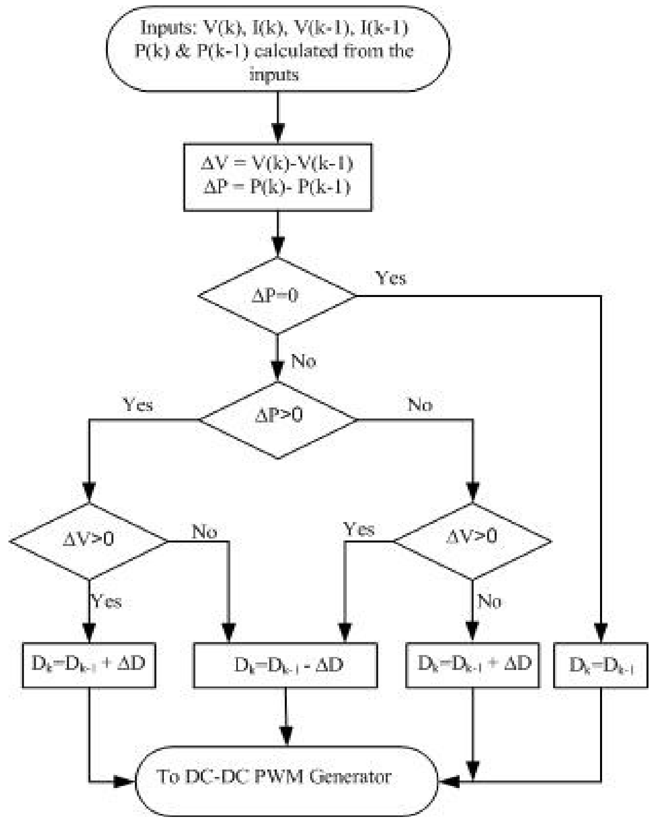

Fig. 2: Perturb and Observe control algorithm

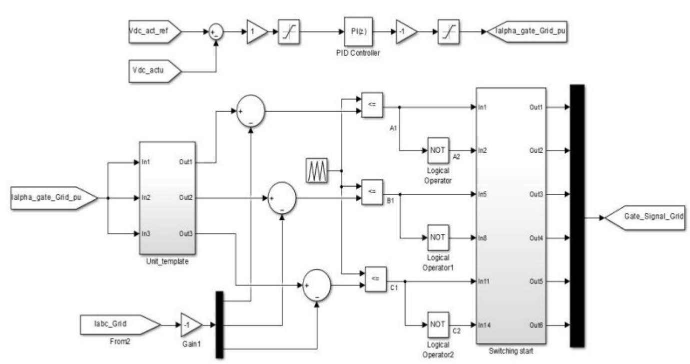

Fig. 3 Grid side converter control

V. RESULTS AND DECEPTIONS

MATLAB Simulink™ 17a is used to evaluate the performance ofthe proposed co generation system and controllers.For the energy conversion system utilized in this paper, pitchangle is assumed zero and yaw control mechanism is not considered.It consists of an aerodynamic system based on wind speedmodel, wind power versus wind speed model and etc., permanent magnet synchronous generator (PMSG), a SPWM AC/DC converter, a DC/DC boostconverter, a DC/AC inverterand AC filters, PID controllers.

A. *Performance of PV system*

Fig. 4 shows the performance of PV system with time 0 to 10 second of 100kW rating solar irradiation increases and decreases to perform the system. This section is divided into five section in which first section represent to solar irradiation profile, second section present to PV voltage, third waveform represent to PV current which is depends on solar irradiations profile if irradiation is increases then PV current is increases and whenever irradiations decreases then current is decreases. Fourth wave shows the dc link voltage which is constant of magnitude 1400V. Fifth one represents to PV power generated.

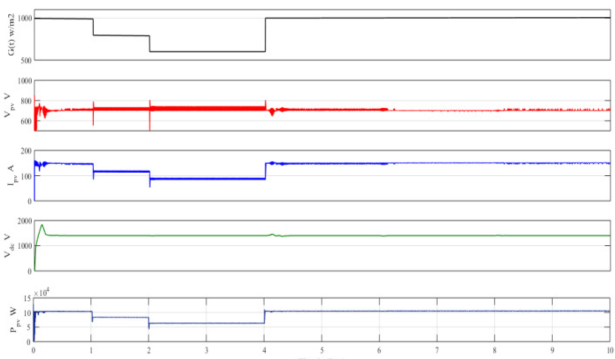

Fig. 4. Performance of PV system

B. *Performance of wind energy conversion system of co generation unit*

Demonstrating the performance of proposed system under normal conditions when wind speed is fixed at 12 m / s with disturbance depicted in Fig. 5. When PMSG operated near rated speed at 2.72 rad/s, active power generated from wind turbine is 2 MW and electromagnetic torque of generator is -0.68 MN-m (negative sign indicate that machine operated as generator). Machine side converter maintained DC link voltage at 1400V.

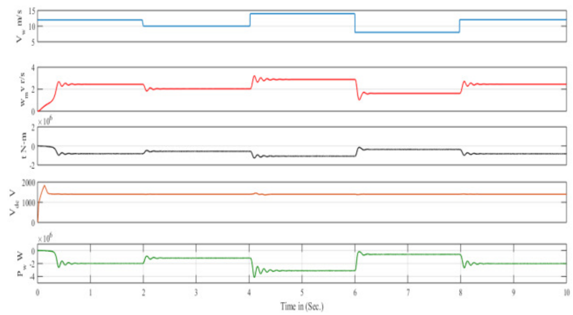

Fig. 5: Performance of wind energy co-generation system

C. *Performance of grid of proposed cogeneration unit*

Fig. 6 shows the performance of grid of cogeneration unit. Here performance of proposed system analyzed, in which first wave represents to grid voltage second one to grid injected current third one is grid injected active power while fourth one reactive power wave. It is observed that whenever power generation by wind and PV increases then grid injected current is increases and therefore active power is increases.

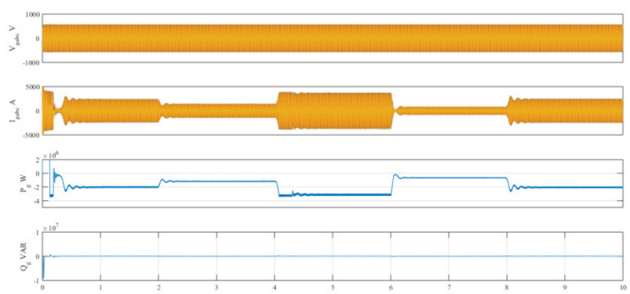

Fig. 6 performance of grid of proposed co generation unit

VI. CONCLUSION

Wind-PV Co-generation system connectedto the grid are increasing both in thenumber of installations and also inthe rated power of each plant, andwill cover a significant percentage ofthe electric generation mix. In thisarticle, a comprehensive overview ofgrid-connected wind PV co generation systems is presented.

Different control techniques for proposed system such as PV mppt, WECS MPPT control. And Inverter control andit performance is validated through the MATLAB Simulink version 2017a.

Grid side converter control is done to grid synchronization with power (active and reactive) control.

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