

Power Management by RAPS Based Wind Dominated DFIG System For Power System Enhancement in Demand-Generation Fluctuations

P. Dathu Ram Reddy¹, Kothuri Ramakrishna²

¹Research Scholar, Dept of EEE,

B.V.Raju Institution of Technology,
Narsapur Medak(Dist),Telangana, India

²Associate Professor, Dept of EEE,

B.V.Raju Institution of Technology,
Narsapur Medak(Dist),Telangana, India

April 19, 2018

Abstract

A control strategy for managing the demand generation fluctuations using a hybrid energy storage system in a wind-dominated remote area power supply system consisting of a DFIG, a battery storage system, a super capacitor, a dump load and main loads. Operation of battery storage system is coordinated with a super capacitor with a view to improving the performance of the battery. In this regard, the battery storage system is connected to the load side of the RAPS system, whereas the super capacitor is connected to the dc bus of the back to back converter of the DFIG.

The project emphasizes on the application of hybrid energy storage systems to mitigate the effect of wind speed fluctuations, thereby ensuring smooth power output as well as improving the power quality at the PCC

Key Words:RAPS; DFIG; FUEL CELL;

1 INTRODUCTION

Power is identified as one key ware which can be utilized as a medium for financial development in rustic and provincial zones. As indicated by service of new and sustainable power source, nation's available introduced control age limit has dramatically increased to 2, 34,600 MW in the previous 10 years[1]. Sustainable power source adds to almost 34351.39 MW to the aggregate producing limit and in which wind vitality contributes 20149.5 MW as appeared in Fig.1.1. Despite the fact that we have 20149.5 MW of introduced limit, India faces a blackout of in excess of 30000 MW because of increment popular. This lack can be decreased by utilization of sustainable power source, since sustainable power source is solid, bounteous and will possibly be exceptionally modest once the innovation move forward.

The electrical business has started to enhance increasingly as of late. Important issues, for example, an unnatural weather change, vitality cost, control advertise, and expanding vitality request have influenced control industry development. Over the previous years improvement of littler dispersed vitality sources nearer to burdens, for example, Remote Area Power Supply framework has expanded. Hence, sustainable power sources, for example, wind, sun oriented, biomass, and geothermal are given more significance.

Sustainable power source frameworks offer a few points of interest over customary vitality sources, for example, gaseous petrol or coal. To begin with, sustainable power source frameworks are spotless wellsprings of vitality found in many locales, and they transmit no ozone depleting substances. Sustainable power sources are likewise rich and free. Despite the fact that the underlying capital cost for most sustainable power sources is more noteworthy than petroleum gas or coal control plants, inexhaustible might be more cost compelling for long haul when contrasted with ordinary sources in light of lower working and upkeep costs.

Be that as it may, the inexhaustible assets have a few hindrances, essential drawback that they are usually situated in remote territories at incredible separations from extensive burdens. What's more, sustainable power source asset utilize is confined by restricted accessibility.

As of late, the vitality utilization has expanded fundamentally.

It is evaluated that vitality utilization will increment 44% worldwide by 2030. The requirement for cleaner, greener vitality has prompted upgrades in the catch of sustainable power sources to create control. Generally, most vitality is created and transmitted through electrical cables to loads, which means awesome misfortune for task and upkeep. Among all sustainable power source alternatives, wind control has picked up the significance as a standout amongst the most across the board sustainable power source age advancements. In this proposal, wind vitality is stressed in light of the fact that it can be utilized to create power in remote zones where lattice isn't accessible nor power is conservative to exchange by means of framework.

2 WIND ENERGY

Wind vitality age started in the 1980s when twist turbines with just a couple of many kW rating were associated with control lattices without much control. Because of varieties of wind speed, it wound up troublesome in creating power and associating it specifically to the matrix. Moreover, this framework had no control on dynamic and receptive power exchange. Today, incredible changes has been made in wind vitality age and the utilization of energy hardware gadgets to the framework so as to control and exchange dynamic and receptive power between wind turbines and principle matrices.

Contrasted with all breeze vitality has the best offer in sustainable power source assets. The limit of wind has dramatically increased amid the most recent two decades and the cost has diminished by one 6th. Fast advance in wind innovation has diminished breeze vitality cost to such a degree, to the point that it is focused with regular vitality. Most business wind frameworks incorporate an even pivot wind turbine, and generator associated with the network utilizing power electronic converters.

As per the World Wind Energy Report 2014, all breeze turbines introduced internationally before the finish of year 2014 contribute conceivably 430 Terawatthours to the overall power supply which supply 2.5 % of the worldwide power request every year. India's breeze control introduced limit according to 2014 2015 is appeared in Fig.1.2 which has definitely expanded from 1666 MW to 21923

MW.

3 SUPER CAPACITORS

Supercapacitor is a twofold layer capacitor; the vitality is put away by charge exchange at the limit amongst anode and electrolyte. The measure of put away vitality is capacity of the accessible terminal and electrolyte surface, the span of the particles, and the level of the electrolyte deterioration voltage. Supercapacitors are constituted of two anodes, a separator and an electrolyte. The two cathodes, made of actuated carbon give a high surface territory part, characterizing so vitality thickness of the segment. On the anodes, current gatherers with a high leading part guarantee the interface between the cathodes and the associations of the supercapacitor. The two anodes are isolated by a layer, which permits the portability of charged particles and prohibits no electronic contact. The electrolyte supplies and leads the particles from one terminal to the next.

Generally, supercapacitors are isolated into two kinds: twofold layer capacitors and electrochemical capacitors. The previous relies upon the component of twofold layers, which is aftereffect of the division of charges at interface between the terminal surface of dynamic carbon or carbon fiber and electrolytic arrangement. Its capacitance is relative to the particular surface zones of terminal material. The last relies upon quick faraday redox response. The electrochemical capacitors incorporate metal oxide supercapacitors and conductive polymer supercapacitors. They all make utilization of the high reversible redox response happening on terminals surface or inside them to deliver the capacitance worried with cathode potential. Capacitance of them depends fundamentally on the use of dynamic material of cathode. The working voltage of electrochemical capacitor is generally lower than 3 V. In view of high working voltage of electrolytic capacitor, the half and half supercapacitor consolidates the anode of electrolytic capacitor with the cathode of electrochemical capacitor, so it has the best highlights with the high particular capacitance and high vitality thickness of electrochemical capacitor. The capacitors can work at high voltage without interfacing numerous cells in arrangement.

The most imperative parameters of a super capacitor incorporate the capacitance(C), ESR and EPR (which is additionally called spillage protection).

4 FUEL CELL

A power device is a gadget that changes over the concoction vitality from a fuel into power through a substance response of emphatically accused hydrogen particles of oxygen or another oxidizing agent.[1] Fuel cells are not the same as batteries in that they require a ceaseless wellspring of fuel and oxygen or air to maintain the synthetic response, though in a battery the chemicals show in the battery respond with each other to produce an electromotive power (emf). Power modules can create power persistently for whatever length of time that these data sources are provided.

The principal power modules were concocted in 1838. The principal business utilization of energy components came over a century later in NASA space projects to create control for satellites and space cases. From that point forward, power devices have been utilized as a part of numerous different applications. Energy units are utilized for essential and reinforcement control for business, modern and private structures and in remote or difficult to reach zones. They are additionally used to control energy unit vehicles, including forklifts, cars, transports, water crafts, bikes and submarines.

There are numerous kinds of power modules, yet they all comprise of an anode, a cathode, and an electrolyte that permits emphatically charged hydrogen particles (or protons) to move between the two sides of the energy component. The anode and cathode contain impetuses that reason the fuel to experience oxidation responses that create decidedly charged hydrogen particles and electrons. The hydrogen particles are drawn through the electrolyte after the response. In the meantime, electrons are attracted from the anode to the cathode through an outside circuit, delivering direct current power. At the cathode, hydrogen particles, electrons, and oxygen respond to frame water. As the primary contrast among energy component writes is the electrolyte, power devices are arranged by the sort of electrolyte they utilize and by the distinction in startup time extending from 1 second for proton trade film energy

units (PEM power modules, or PEMFC) to 10 minutes for strong oxide energy components (SOFC). Singular energy units deliver moderately little electrical possibilities, around 0.7 volts, so cells are "stacked", or put in arrangement, to make adequate voltage to meet an application's requirements.[2] notwithstanding power, energy units create water, warm and, contingent upon the fuel source, little measures of nitrogen dioxide and different emanations. The vitality productivity of an energy unit is for the most part between 40 60%, or up to 85% effective in cogeneration if squander warm is caught for utilize.

5 DFIG OPERATION

In this Paper, DFIG is given much importance because it feds ac currents into both the startor and the rotot windings. The primary advantage of DFIG when compared to other generators is that when used in wind turbines they allow the amplitude and frequency of their output voltage to be maintained at a constant value, no matter the speed of wind blowing on the wind turbine rotor. A typical configuration of a DFIG based wind turbine generator system is shown in Fig.3.1, the operation of which can be categorised into two modes: (a) super synchronous and (b) sub synchronous. The difference between operations of these two modes can be determined from the rotor speed , compared to the synchronous speed , and the direction of power flowing through the back to back converter.

6 SIMULATION RESULTS

A. Performance Of The Hybrid Energy Storage In A DFIG Based Raps System

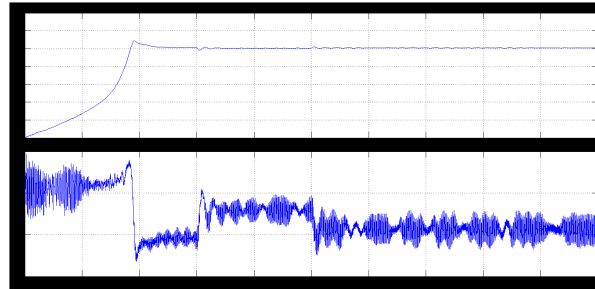


Figure 1: Torque and speed of DFIG

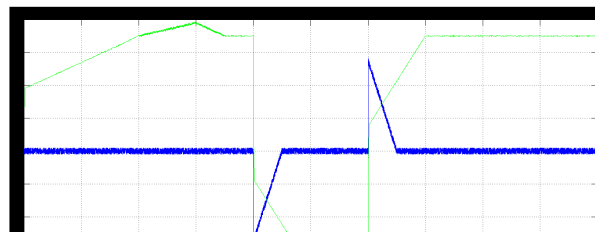


Figure 2: Hybrid Energy storage power

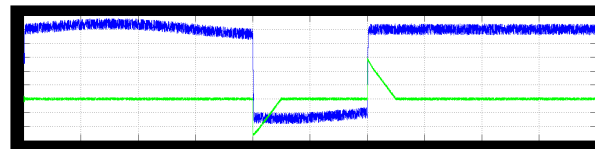


Figure 3: Hybrid Energy storage current

Performance Of The Hybrid Fuel Cell In A DFIG Based Raps System.

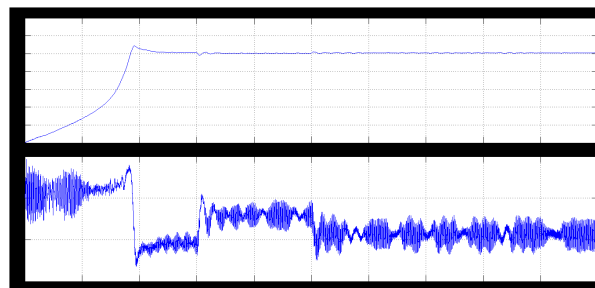


Figure 4: Torque and speed of DFIG

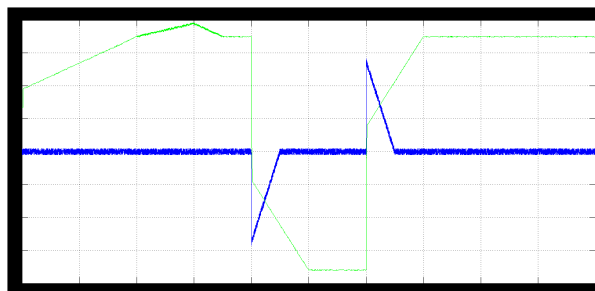


Figure 5: Hybrid Energy storage power

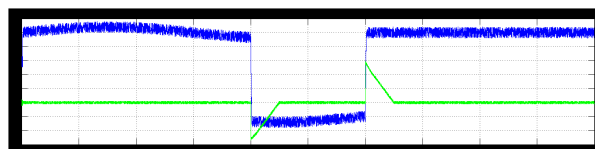


Figure 6: Hybrid Energy storage current

7 CONCLUSION

DFIG with batter and Fuel cell are presented and concluding by saying that the hybrid operation of the RAPS systems were capable in maintaining the voltage and frequency at the load end with proper power sharing between the devices.

References

- [1] Akhmetshin, E.M. &Osadchy, E.A. 2015. New requirements to the control of the maintenance of accounting records of the company in the conditions of the economic insecurity. *International Business Management*, 9(5): 895-902.
- [2] Akhmetshin, E.M. &Vasilev, V.L. 2016. Control as an instrument of management and institution of economic security. *Academy of Strategic Management Journal*, 15(Special Issue 1): 1-7.
- [3] Dadalko, V.A., Mikhalko, E.R. &Savchuk, E.A. 2010. Economic-mathematical model for assessing the effectiveness of managing a complex of federal targeted

- programs in the spheres of ensuring security and scientific and technological development of Russia. *Economic sciences*, 6(67): 223-230.
- [4] Dareev, G.E. 2012. Mathematical model of agricultural production state support mechanism. *Bulletin of Buryat State Academy of Agriculture*, 3: 105-110.
- [5] Kolesnikov, A.M. & Vidyakina, V.A. 2013. Special features of the strategic management system of decision-making for small business. *Vestnik of Pushkin Leningrad State University*, 6(1): 69-76.
- [6] Latyshev, I.O. & Akhmetshin, E.M. 2015. Methodological approaches to analyzing the indicators of human capital management in the interests of innovation development of enterprise. *International Business Management*, 9(6): 1565-1570.
- [7] Lukyanova, N. & Soldatova, S. 2013. The role of statistical and economic and mathematical modelling in applied research. *IKBFU's Vestnik: Humanities and social science*, 3: 73-79.
- [8] Stepanov, V. (n./d.) A direct and dual linear programming problem. URL: <http://www.mathelp.spb.ru/book1/lprog5.htm>.
- [9] Von Neumann, J. & Morgenstern, O. 1970. *Theory of Games and Economic Behaviour*. Moscow: Science.
- [10] Wallis, J.J. & North, D. 1986. Measuring the Transaction Sector in the American Economy, 1870-1970. In: *Long-Term Factors in American Economic Growth (95-162)*. Chicago: University of Chicago Press.