Journal of Advances in Science and Technology
Vol. 19, Issue No. 1, March-2022, ISSN 2230-9659

Review on Microgrids for Hybrid Electric Vehicles Charging Station

Shailesh M. Deshmukh[1]*, Dr. Sunil Kumar[2], Dr. S. P. Gawande[3]

[1] Research Scholar, Department of Electrical Engineering, Kalinga University, Naya Raipur (CG)

[2] Prof. & Head, Department of Electrical engineering, Kalinga University, Raipur (CG)

[3] Assistant Professor, Department of Electrical Engineering, YCCE, Nagpur (MH)

***Abstract* — The exhausting petroleum derivative and developing natural concern have become the entryways for perfect and efficient power energy improvement utilizing environmentally friendly power sources. Likewise, the developing oil interest and fossil fuel byproducts have made a gigantic degree for (EV) Electric Vehicles use across the world which has brought about blossoming market of EV. (PV)Photovoltaic fueled Electricvehicle charging can significantly diminish the carbon impressions when contrasted with the customary utility network based electricvehicle charging. The blend of sunlight based engeras well as electric vehicle charging is perhaps the best technique in maintainable improvement for EV market. Ongoing insights recommend that utilization of EVs in various urban areas in India has multiplied and the improvement of the charging foundation is really difficult for country with population. Right off the bat, hypothetical interest model for EV traffic and asset usage design is created. Besides, the ideal setup and techno-financial evaluation of Solar controlled Electricvehicle Charging Station (EVCS) in microgrid is dissected for four unique Indian urban areas with differed sun oriented radiation conditions. In conclusion, the climate advantages of sunlight based PV fueled EVCS are evaluated and dissected. The outcomes show that the ideal arrangement and venture proficiency in each metropolitan region is incredibly impacted by the sun oriented light and feed-in-tax (FIT) cost of housetop sunlight based power. With high sun powered illumination conditions in Kashmir can put resources into the sun based EVCS contrasted with different urban communities.**

***Keywords* — (PV) Photovoltaic fuel Electricvehicle Charging, Solar energy, Ev traffic, Solar radiance, EVCS, Micro grid.**

----------X----------

INTRODUCTION

The present lifestyle of the human beings flourish on burning up of electric energy which In turn make it an unavoidable requirement. The energy requirement grows due to Increase in population. The need of electricity is mostly fulfilled by the conventional Sources. However due to these conventional sources there is a concern for environment. Due to the reduction of fossil fuel and the air contamination in urban areas, electric Vehicle (EV) are preferred all over the world. As per the rank of most energy usage in China it is seen that upto80% of production of electricity is provided by fossil fuel mostly coal.

Dynamically to boost the capability of renewable energy, in that way renewable energy which is ever increasing in the grid is being exploited [2-3]. The second one in to set up theAmenities which is involved in charging and discharging of electric vehicle and production of renewableenergy system unswervingly, through the form of microgridTo attain the usageof renewable resource energy [4-5].

LITERATUREREVIEW

During the peak hours the charging of EV increases the load curve for electric utilities.So, the management of large number of EVs must be correctly optimized for a variety ofCharging setups and machinery [8].There is an supplementary benefit to the microgrid/grid by troublesome thedemand for electricvehicles charging during the peak hour is demand response(DR). In preserved situation,EVs create or amass electricity which can be given back to the grid using suitableConnections which is known as V2G power . V2G is very important as there is aWorldwide move to emerging green and sustainable energy wealth. There is a very lessInvestment cost of vehicle power system as compare to generation of power in central , The similarly lesser speculation expenses of vehicle power frameworks and the little Incremental consumption to change EVs to create lattice power include monetary spending plan [5]. EVs maybe will not make massiveness power, since the unit cost of the energy from EVs is Superior than mass power

from the unified generators because of their basic Engineering highlights. V2G comes into the contention on account of extra help markets of turning stores and guideline, chiefly when there is a limit installment to Be on the web and accessible, with an extra energy imbursement when power is really Send off. In such cases. Notwithstanding, in top power markets, V2G can contribute, when Remunerated simply for energy, then again, actually just when power levies are peculiarly far Above the ground [6] The rollout of EV innovations is a well known subject that turned into a focal point of upheaval in EV industry. In spite of the proof of such up-sides, there are still a few drawbacks of Such innovations that the partners need to mull over on, before they mediate to Invest in electric vehicle rollouts [7]. The entanglements might emerge because of scant accessibility of re-energizing places, intimidation of Underlying energy matrix, longer re-energizing deferral, or more everything is the intrinsic electric Vehicle range nervousness (EVRA) condition that exists in an impressive level of EV Users [3].Thus, the various national as well as international organizations, energy centers, andInstitutions such as IEC, IEEE defined microgrids in some identifiable constraints, theUnited states (US) energy department, defined the Microgrid as a clutch of electricalLoads, distributed energy generation units, with some electrical boundaries and behave asOne single controllable entity and capable of being used in islanded as well as gridConnected mode . CIGRÉ stated that, Microgrids are power dispersion frameworks Containing loads and circulated DESs, (like disseminated generators, stockpiling gadgets, or Controllable burdens) that can be worked in a controlled, facilitated way either while associated with the fundamental power organization or while is landed Microgrid in IEC 62257 isDefined as Subsystem of DERS intended for power distribution of which the capacityDoes not exceed 100 kVA, the prefix micro being intended to express the low level ofTransmitting capacity [8].The load system in microgrids is broadly divided into two parts, fixed and springy i.e.Adjustable. The fixed part of the load's system cannot be rehabilitated and under standardOperating conditions it must be satisfying while adjustable loads should be quick toRespond to the monitoring signals. Spring loads might be curtailed or deferred (i.e.,Shiftable loads) in response to economic enticements or landed requirements [9].Distributed energy generation unites consist of DGs and ESSs which might be installed atElectrical utility system and/or electricity user sites. Microgrid DGs are categorized in toTwo types namely dispatchable and nondispatchable. In the current scenario, a varietyDispatchable DG systems is being integrated into microgrids to fulfill the energy demandIn the efficient and reliable approach in concern of environmental aspects. Some of themAre Reciprocating engines, Gas Turbine, Micro-turbine, and Fuel cell (FC) . The keyDisadvantages associated with the conventional/dispatchable type DGs are limited fuelAmount and GHG emission, which enforces the energy sector for Renewable/Non-dispatchable DG systems [10].Dispatchable resource components are controlled by a master controller in MICROGRIDS And while non-dispatchable resource components have uncontrollable inputs. RESs suchAs solar photovoltaic (PV) system and wind energy generation units come under the category of non-dispatchable generation system due to their intermittent and volatileNature. The intermittent nature tells about the unavailability of continuous generation ofElectrical energy while volatile nature represents fluctuations of power out in variousTemporal scale, these characteristics of non-dispatchable energy generating units causeHigh forecasting error and forced for energy storing devices [11].The primary ESSs are being used as a coordinating device with distributed energyGenerating units to assure the continued constant power output from a microgrid. DuringHigh market price, the energy storing system may be used as arbitrage by feeding backThe stored electrical energy to microgrid, however, it plays a more effective role inStandalone microgrids [12].In [13] the significant benefits from microgrids are accomplished by propinquity of age to Load as to bring down the misfortunes and T&D expenses, and rival the regular Generation units. An overall expense investigation shows that the estimate cost is separated as 30-40% in energy assets, 20% for exchanging, assurance, and transformers, while Communication and control require 10-20%, site specialist and development contributes 30% roughly.In [14], a energy management services are demonstrated which is done by energy gridTechnology. A smart plug is used for home energy grid method. This paper provides anIntroduction and several cases for home energy grid techniques. The home energy grid Server oversees clients, gadgets, meetings, energy data, reports energy-related Events to the assigned client, and controls apparatuses to save energy. The power consumption data is sent to the server and then the data is processed by the server whichIn turn provides energy management services. The mobile device can control theMachines through server.The authors provides [15] an energy ecosystem which is of good value. The smart homeWhere distributed energy source is present this type of eco system can be applied. TheGoal of the proposed system is to gain high class energy service with low consumptionCost. The micro grid is functioning in grid connected mode. For implementation purposeJAVA is considered .They have considered 10 houses for configuration purpose. TheProposed ecosystem is compared with conventional distribution system.A bidirectional electric vehicle is considered for household work[16].The demandResponse is pretty much used in residential areas. Electric vehicle can be used as storageUnit through the choice of vehicle to grid and vehicle to home. This paper explains theEnergy storage system considering the demand response.In [17], A framework for demand response is considered with less cost. The constraintsFor the appliances and cost function for user are modeled. An algorithm is designedWhich only need the price

of electricity. For smart grid appliance programmed demandResponse is discussed. The authors in [19] explains an optimization technique to get the optimal biddingMethod of hybrid power station manufacturer ,including wind ranches and hydro Storage. In [20], a fixed bid closeout plot zeroing in on multi-trait is introduced which Concentrates on the security issues of the multi-subjective quality sale and uses The Pedersen responsibility plan to tie the bid data into a pledge to Strong bid protection.In [21], A look ahead bidding technique is explained for storing energy. The method canFind the offer for vendor using energy storage. The profit is exploited for two daysContinuously.In [22], A model is described for different demand side resource. A risk averse optimalBidding method is proposed which is very efficient for minimizing day ahead electricity.In [23], A stochastic model is discussed which is utilized to get the ideal offering Scenario for wind power . In [24], an ongoing execution of a game hypothesis invert closeout model which is Based on a multi-specialist calculation for microgrid exchanging activity containing Conventional and RESs in network associated mode is given. In [25], A structure is proposed for the assessing the DR through strategies by Using the Sequential Monte Carlo recreations. Both, the vulnerability and adaptability were Considered for the present moment just as long haul choices. In [26] a constant market for incline capacity is proposed to explore and assess the Need for generator adaptability because of the coordination of RESs.

GAPS IDENTIFIED IN DESIGN

The past idea of force stream was basically not compatible with electricalenergy is produced at focal power stations and afterward sent to the Consumers. In light of the complete burden prerequisites, the power plants are worked to Produce the vital electrical power. Nonetheless, because of the steady straightforwardness in the Integration of dispersed energy sources (DESs) especially sustainable power sources (RESs) and electric vehicles (EVs), the power stream hasbecomedirectional, i.e., Generation isn't concentrated .The purchasers are likewise effectively taking part in electric Power association. They are educated, have options, motivations, and disincentives which Modify their power buying example and conduct These choices direct the coming Of new advances and markets. The public authority driven energy area is seeing Large-scale private investment, accordingly expanding intensity, answerability, and obligation [27-30]. It is accepted that sustainable power can assist with facilitating the deficiency of Fossil fills, and to secure climate. Besides, microgrid gives a commonsense way to Renewable energy and electric vehicles to get to the lattice without any problem. For instance in the USA, for EVs establishing the half of the all out vehicles being used constantly 2050 will involve just 8% Increment in power age and an addition of 4% in age limit, Meanwhile likewise extensively diminishing the emanations from ordinary vehicles and reducing the fuel use in travelling area [31]. Along these lines, the use of huge number of EVs should be precisely upgraded for different

Charging arrangements and advances [33, 34]. Request reaction is an extra benefit To the microgrid/framework by disturbing the charging of electric vehicles request at the pinnacle hours. In stopped scenario, EVs create or store power which can be taken care of back to the framework utilizing Appropriate associations this is known as V2G power [35 -38]. The batteries of EVs connected To charging framework can go about as circulated energy stockpiling frameworks. (ESSs) for the Electrical framework. The electrical energy conveyed back to the framework should be valued with the end goal that The extra expense brought about should be recuperated back as the battery's life cycle is decreased Due to visit charging and releasing. The conveyed stockpiling gives benefits Such as making the lattice all the more consistent, secure and tough by controlling recurrence and the Spinning hold as reinforcement power in the dissemination framework. Enormous scope mix of Intermittent wellsprings of energy, e.g., the breeze and sun powered sources into the framework are worked with by the V2G framework. For the overall shift to the arising green and economical energy Economy, V2G is a significant empowering agent. Contrasted with unified power age, the Comparatively lesser venture expenses of vehicle power frameworks and the little Incremental cost to modify EVs to produce lattice power infer financial moderateness [39-42]. Be that as it may, in top power markets, V2G can partake, when Compensated distinctly for energy, yet just when power taxes are uncommonly high [43-46]. In the event that the charging heaps associated with 380VDC straightforwardly and provided by PV, we can decrease such transformations, diminish misfortunes and Save energy. The rapidly rising game plan of metropolitan and savvy urban communities working with the transportation Era at top. Hence, the rising example of regular vehicles prompting the high Contribution of ozone harming substance (GHG) emanation. To reduce the risky layout of GHG emanations, the electric vehicles (xEVs) as the piece of shrewd urban areas, are getting colossal Concern [47-49] . Notwithstanding, the unscheduled EVs availability with customary matrix framework Leading questionable and intruded on power supply, which might prompt the lattice disappointment.

SIGNIFICANCE AND SCOPE OF THE DESIGN

The Electric vehicles are contributed with Dc andAc charge. Here the Dc is fast charge and AC is slow charge [50]. The amount of DC fast charge in the microGrid is elevated, the proportion of AC loads is small. The micro grid will get highHarmonic current due to several AC and DC conversions, which in turn boost the powerUsage , decrease the solidity and wealth of the complete micro grid system. For

thatReason, the usual hybrid AC/DC microgrid that employ an AC microgrid as the majorPart is not appropriate for such instances. . A mixture microgrid-fueled charging station Decreases transmission misfortunes with better influence stream control in the cutting edge influence System.

CONCLUSION

First and foremost, stochastic model is created for EV traffic profile, appearances and asset usage design. EV parking garage inhabitance, EVs in a framework and asset usage in MG zone are introduced. Besides, techno-monetary examination of PV-controlled EV charging stations in Microgrid for various sun oriented light conditions in India are talked about completely and ideal framework not really set in stone utilizing HOMER network. It is found from the acquired outcomes that more noteworthy the sun based illumination, lesser is the expense of NPC, COE which brings about further developed venture productivity for PV power EVCS. It saw that the proportion of PV power and network power in the aggregate sum of created power for the EVCS stays unaltered for both the situations in light of the fact that PV framework limit of 100 kW is still most ideal arrangement. The more the FIT cost falls the COE of two urban communities will expand somewhat and Kashmir is viewed as possible center for sun based power EVCS speculation because of high sunlight based illumination as indicated by both the situations.

REFERENCES

[1] Ma Jun, NianChenning. A scheme for renewable grid for EV of 2020 in Chongmingisland. Agricultural Equipment & Vehicle Engineering, 2011(2): 1 - 7.

[2] QianKejun, Yuan Yue, Shi Xiaodan, et al. Environmental benefits analysis ofdistributed generation. Proceedings of the CSEE, 2008, 28(29): 11 - 15.

[3] Fan Yang, Yu Xinmei, Wang Lu. Analysis on the comprehensive benefit of the electric vehicle development in the region of China southern power grid. Southern Power System Technology, 2011, 5(04): 51 – 54.

[4] 16A. Genta, D. Lobiyal, J. A.- Sensors, and undefined 2019, “Energy Efficient Multipath Routing Algorithm for Wireless Multimedia Sensor Network,” mdpi.com.

[5] B. Mahdian, M. Mahrami, M. M. - J. of S. C. and, and undefined 2019, “A Method for Deploying Relay Nodes in Homogeneous Wireless Sensor Networks Using Particle Optimization Algorithm,” jscdss.com.

[6] H. Rahman, Z. Rehena, and N. Mukherjee, “Sink Mobility To Ensure Coverage in Multi - Partitioned Wireless Sensor Network,” Jun. 2019.

[7] V. Kumar and A. Kumar, “Improving reporting delay and lifetime of a WSN using controlled mobile sinks,” J. Ambient Intell. Humaniz. Comput., vol. 10, no. 4, p. p. 1433–1441, Apr. 2019.

[8] Ahmed Y S, Ganesh K V. Plug – in vehicles and renewable energy sources for costAnd emission reductions. IEEE Transactions onIndustrial Electronics, 2011, 58(4): 1229 –1238.

[9] Ahmed Y S, Ganesh K V. Resource scheduling under uncertainty in a smart grid with Renewables and plug – in vehicles. IEEE Systems Journal, 2012, 6(1): 103 – 109.

[10] Xin L, Luiz A C L, Sheldon S W. On the suitability of plug – in hybrid electric vehiclePHEV) charging infrastructures based on wind and solar energy[C]. Power &EnergySociety General Meeting, Calgary, Canada, 2009: 1 – 8.

[11] W. Khan, F. Ahmad, A. Ahmad, M. S. Alam, and A. Ahuja, “ ElectricVehicle Charging Infrastructure in India: Viability Analysis, ” Lect. Notes Electr. Eng., vol. 487, P. 193 – 206, 2018.

[12] USDE, “ Microgrid Definitions, ” United State Department of Energy, 2018. [Online].Available: https://building – microgrid.lbl.gov/microgrid – definitions. [Accessed: 05 –Oct – 2018].

[13] S. M. Amrr, M. S. Alam, M. S. J. Asghar, and F. Ahmad, “ Low cost residential Microgrid system based home to grid (H2G) back up power management, ” Sustain. Cities Soc., vol. 36, no. January, p. p. 204 – 214, 2018.

[14] S. Parhizi, H. Lotfi, A. Khodaei, and S. Bahramirad, “ State of the Art in Research On Microgrids : A Review, ” IEEE Access, vol. 3, no. 3, p. p. 890 – 925, 2015.

[15] F. Ahmad, M. S. Alam, and M. Asaad, “ Developments in xEVs charging Infrastructure and energy management system for smart microgrids including xEVs, ” Sustain. Cities Soc., vol. 35, no. September, p. p. 552 – 564, 2017.

[16] F. Ahmad and M. S. Alam, “ Optimal Sizing and Analysis of Solar PV, Wind, and Energy Storage Hybrid System for Campus Microgrid, ” Smart Sci., vol. 6, no. 2, p. p. 150 – 157, 2018.

[17] Ivette Sanchez, " Microgrid Technology: Enabling Energy Reliability and Security Opportunities in Campus, Commercial & Industrial Communities, " 2015.

[18] H. Lee, W. - K. Park, and I. - W. Lee, " Energy management services based on home Energy grid technology, " in 16th International Conference on Advanced Communication Technology, 2014, p. p. 1274 – 1277.

[19] B. Jiang and Y. Fei, " Smart home in smart microgrid: A cost – effective energy Ecosystem with intelligent hierarchical agents, " IEEE Trans. Smart Grid, vol. 6, no. 1, p.p. 3 – 13, 2015.

[20] O. Erdinc, N. G. Paterakis, T. D. P. Mendes, A. G. Bakirtzis, and J. P. S. Catal??o,"Smart Household Operation Considering Bi – Directional EV and ESS Utilization by Real – Time Pricing – Based DR, " IEEE Trans. Smart Grid, vol. 6, no. 3, p. p. 1281 –1291, 2015.

[21] P. Chavali, P. Yang, and A. Nehorai, " A distributed algorithm of appliance Scheduling for home energy management system, " IEEE Trans. Smart Grid, vol. 5, no. 1, p. p. 282 – 290, 2014.

[22] F. Ahmad, M. SaadAlam, R. Suri, A. Awasthy, and M. Shahidehpour, " Power Exchange and its Significance to Enhance the Deployment of Smart Microgrids in India And Key Barriers in its Adoption, " Lect. Notes Electr. Eng., vol. 487, p. p. 156 – 162, 2018.

[23] A. V. Ntomaris and A. G. Bakirtzis, " Optimal Bidding of Hybrid Power Stations in Insular Power Systems, " IEEE Trans. Power Syst., vol. 32, no. 5, p. p. 3782 – 3793, 2017.

[24] W. Shi, W. E. I. Wei, and J. Wang, " A Verifiable Sealed – Bid Multi – Qualitative –Attribute Based Auction Scheme in the Semi – Honest Model, " IEEE Access, vol. 5, p. p.12380 – 12388, 2017.

[25] Y. Wang, Y. Dvorkin, R. Fernandez – Blanco, B. Xu, T. Qiu, and D. S. Kirschen, "Look – Ahead Bidding Strategy for Energy Storage, " IEEE Trans. Sustain. Energy, vol.8, no. 3, p. p. 1106 – 1117, 2017.

[26] Z. Xu, Z. Hu, Y. Song, and J. Wang, " Risk – Averse Optimal Bidding Strategy for Demand – Side Resource Aggregators in Day – Ahead Electricity Markets underUncertainty, " IEEE Trans. Smart Grid, vol. 8, no. 1, p. p. 96 – 105, 2017.

[27] T. Dai and W. Qiao, " Optimal bidding strategy of a strategic wind power producerIn the short – term market, " IEEE Trans. Sustain. Energy, vol. 6, no. 3, p. p. 707 – 719, 2015.

[28] M. H. Cintuglu, H. Martin, S. Member, and O. A. Mohammed, " Real – Time Implementation of Multiagent – Based Game Theory Reverse Auction Model for Microgrid Market Operation, " IEEE Trans. Smart Grid, vol. 6, no. 2, p. p. 1064 – 1072, 2015.

[29] J. A. Schachter, S. Member, P. Mancarella, and S. Member, " Demand Response Contracts as Real Options : A Probabilistic Evaluation Framework Under Short – Term And Long – Term Uncertainties, " IEEE Trans. Smart Grid, vol. 7, no. 2, p. p. 868 – 878,2016.

[30] B. Wang and B. F. Hobbs, " Real - Time Markets for Flexiramp : A Stochastic Unit Commitment - Based Analysis, " IEEE Trans. Power Syst., vol. 31, no. 2, p. p. 846 – 860,2016.

[31] Vyas, A.D., Ng, H.K., Santini, D.J. and Anderson, J.L. (1997) "Batteries for Electric Drive Vehicles: Evaluation of Future Characteristics and Costs through a Delphi Study," Argonne National Laboratory, SAE International Spring Fuels and Lubricants Meeting, May 5 - 7, Detroit, Michigan.

[32] Wan, P. and Lemmon, M. (2010) "Optimal power flow in microgrids using event - triggered optimization," Proceedings of the American Control Conference (ACC 2010), 30 June – 2 July, Baltimore, MD.

[33] Waraich, R., Galus, M., Dobler, C. , Balmer, M. , and Andersson, G. (2009) "Plug - in Hybrid Electric Vehicles and Smart Grid: Investigations Based on a Micro - Simulation," The 12thIntl.Conference of the International Association for Travel Behaviour Research, 3 - 6 December, Jaipur, India. Weather.com (2001) "Average Monthly Temperatures in Kabul, Afghanistan", http://www.weather.com/outlook/health/allergies/wxclimatology/monthly/graph/AFXX0003, accessed January 6, 2011.

[34] Whitefoot, J.W., Ahn, K., and Papalambros, P.Y. (2010) "The Case for Urban Vehicles: Powertrain Optimization of a Power - Split Hybrid for Fuel Economy on Multiple Drive Cycles," ASME International Design Engineering Technical Conferences, Montreal, Quebec, Canada, August 15 - 18.

[35] Whitefoot, J.W., Mechtenberg, A.R., Peters, D.L., and Papalambros, P.Y. (2011) "Optimal Component Sizing and Forward - Looking Dispatch of an Electrical Microgrid for Energy Storage Planning", ASME International Design Engineering Technical Conferences, Washington, DC, August 29 – 31

[36] Shiau, C.S., Peterson, S.B., and Michalek, J.J. (2010) "Optimal Plug - in Hybrid Vehicle Design and Allocation for minimum life cycle cost, petroleum consumption, and greenhouse gas emissions," ASME International Design Engineering Technical Conference, August 15 - 18, Montreal, Quebec, Canada, DETC2010 - 28198.

[37] Shiau, C.S. and Michalek, J.J. (2010) "A MINLP Model for Global Optimization of Plug - In Hybrid Vehicle Designadn Allocation to Minimize Life Cycle Greenhouse Gas Emissions," ASME International Design Engineering Technical Conference, August 15 - 18, Montreal, Quebec, Canada, DETC2010 - 28064. Stadler, M., Marnay, C., Siddiqui, A., Lai, J., Coffey, B., and Aki, H. (2009) "Effect of Heat and Electricity Storage and Reliability on Microgrid Viability: A Study of Commercial Buildings in California and New York States," Ernest Orlando Lawrence Berkeley National Laboratory, Report LBNL - 1334E - 2009.

[38] Stadler, M., Momber, I., Mégel, O., Gómez, T., Marnay, C., Beer, S., Lai, J. and Battaglia, V. (2010) "The added economic and environmental value of plug - in electric vehicles connected to commercial building microgrids," Ernesto Orlando Lawrence Berkeley National Laboratory, LBNL - 3885E

[39] Papalambros, P., T. Ersal, I. Hiskens, H. Peng, A. Stefanopoulou, J.L. Stein, C. Ahn, A. Mechtenberg, D. Peters, J. Whitefoot, E. Kallio (2011) "Vehicle Supported Military Microgrids: Design, Scheduling, and Regulation for a Forward Operating Base," Automotive Research Center Conference presentation, May 24, Ann Arbor, MI.

[40] Patil, R., Adornato, B. and Filipi, Z. (2009) "Impact of Naturalistic Driving Patterns on PHEV Performance and System Design", Society of Automotive Engineers Technical Paper, 2009 - 01 - 2715. Peças Lopes, J. A., F.J. Soares and Rocha Almeida, P. M. (2009) "Identifying Management Procedures to Deal with Connection of Electric Vehicles in the Grid," IEEE Bucharest Power Tech Conference, June 28 – July 2, Bucharest, Romania.

[41] Pelet, X., Favrat, D., and Leyland, G. (2005) "Multiobjective optimisation of integrated energy systems for remote communities considering economics and CO2 emissions," Intl. Journal of Thermal Sciences, 44(12), p. p. 1180–1189.

[42] Peters, D. L., Papalambros, P. Y., and Ulsoy, A. G. (2009) "On Measures of Coupling Between the Artifact and Controller Optimal Design Problems," ASME International Design Engineering Technical Conferences, San Diego, CA, Aug. 30 – Sept. 2, DETC2009 - 86868.

[43] Peters, D.L., Mechtenberg, A.R., Whitefoot, J.W., and Papalambros, P.Y. (2011) "Model Predictive Control of a Microgrid with Plug - in Vehicles: Error Modeling and the Role of Prediction Horizon," ASME Dynamic Systems and Controls Conference, Arlington, VA, Oct. 31 – Nov. 2, DSCC2011 - 6030.

[44] Mills, A., Ahlstrom, M., Brower, M., Ellis, A., George, R., Hoff, T., Kroposki, B., Lenox, C., Miller, N., Stein, J., and Wan, Y - H. (2009) "Understanding Variability and Uncertainty of Photovoltaics for Integration with the Electric Power System," Lawrence Berkeley National Laboratory, Report LBNL - 2855E

[45] Momber, I., Gómez, T., Venkataramanan, G., Stadler, M., Beer, S., Lai, J., Marnay, C., and Battaglia, V. (2010) "Plug - in Electric Vehicle Interactions with a Small Office Building: An Economic Analysis using DER - CAM," Proceedings of the 2010 IEEE PES General Meeting, 26 - 29 July, Minneapolis, MN.

[46] Moura, S., Fathy, H.K., Callaway, D.S., and Stein, J. (2008) "A Stochastic Optimal Control Approach for Power Management in Plug - in Hybrid Electric Vehicles," Proceedings of the 2008 ASME Dynamic Systems and Control Conference, 20 - 22 October, Ann Arbor, MI.

[47] Moura, S., Fathy, H.K., Callaway, D.S., and Stein, J. (2010) "Tradeoffs between Battery Energy Capacity and Stochastic Optimal Power Management in Plug - in Hybrid Electric Vehicles," J. of Power Sources, 195(9), p. p. 2979 - 2988.

[48] Griffiths, M. and Coates, C. (2006) "Modelling and Performance of Low Voltage Distributed Generation Systems," Proceedings of the 2006 Australasian Universities Power Engineering Conference (AUPEC'06), 10 - 13 December, Melbourne, Australia.

[49] Guenther, M. and Dong, Z. (2005) "Modelling and Design Optimization of Low Speed Fuel Cell - Battery Hybrid Electric Vehicles," Proceedings of the Intl. Green Energy Conference, 12 - 16 June, Waterloo, Ontario, Canada. Gupta, A., Saini, R.P., and Sharma, M.P. (2010) "Steady - state modelling of hybrid energy system for off grid electrification of cluster of villages," J. of Renewable Energy, 35(2), p. p. 520 - 535.

[50] Guzzella, L., Amstutz, A. (1999) "CAE - Tools for QuasistaticModeling and Optimization of Hybrid Powertrains," IEEE Transactions on

Vehicular Technology, 48(6), p. p. 1762 - 1769.

Corresponding Author

Shailesh M. Deshmukh*

Research Scholar, Department of Electrical Engineering, Kalinga University, Naya Raipur (CG)