Curriculum Vitae

Dr. SULABH SACHAN

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Google Citation: ***https://scholar.google.com/citations?view_op=list_works&hl=en&user=smIwoxcAAAAJ***

Career Objective:

- Being an Electrical Engineer, my endeavor would always be in providing 100% of my energy & effort in fulfillment of the mission of an institution.
- To strive for academic excellence & impart quality education with an emphasis on Electrical Engineering.

Education:

1. **Ph.D. in Electrical Engineering**

   College/University: - Motilal Nehru National Institute of Technology (M.N.N.I.T.), Allahabad, U.P., India.

   CGPA*:* 8.50/10

   Year*:* 04 May 2018

   Status: Completed

2. **Master of Technology** in **Power System**

   College/University: - Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, India.

   CGPA*:* **7.0/10**

   Percentage*:* **75.00%**

   Year*:* July 2011-Jun 2013

3. **Bachelor of Technology** in **Electrical Engineering**.

   College/University: - Kamla Nehru Institute of Technology (**KNIT**), Sultanpur, U.P., India.

   Affiliated to **Uttar Pradesh Technical University, Luck now, India**

   Percentage*:* **65.82%**

   Year*:* August 2007- Jun 2011

Experience:

- Worked as **Assistant Professor (TEQIP-III)** in Electrical Engineering Department of MJP Rohilkhand University Bareilly since **28/12/2017 to 30/09/2021.**
- Joined Electrical Engineering Department, IIT Kanpur as **Senior Research Fellow** since **08/11/2021.**

Research Projects:

1. Research Proposal entitled, "**Stochastic Charging of Electric Vehicles in Distribution Grid**" has been approved under "**TEQIP Collaborative Research Scheme**" to the team of following Collaborators:

Dr. SULABH SACHAN	**Principal Investigator**	**FET MJP Rohilkhand University, Bareilly**
Dr. DESH DEEPAK SHARMA	Co-Principal Investigator	FET MJP Rohilkhand University, Bareilly
Dr. SRI NIWAS SINGH	Co-Principal Investigator	Indian Institute of Technology, Kanpur

A grant of *INR 1167000 (Rupees Eleven Lakh Sixty Seven Thousand Only)* has been sanctioned for the project by NPIU, Ministry of Education, Gov of India.

2. Research Proposal entitled, ***"Gas Evolution Through burning of agricultural waste and their impact on environment"*** has been approved under "TEQIP Collaborative Research Scheme" to the team of following Collaborators:

Mr. PRAKASH CHANDRA MISHRA	Principal Investigator	FET MJP Rohilkhand University, Bareilly
Mr. RAKESH MAURYA	Co-Principal Investigator	FET,MJP Rohilkhand University
Mr. ANURAG GAUR	Co-Principal Investigator	NIT Kurukshetra
Mr. ANKIT VARSHNEY	Co-Principal Investigator	FET MJP Rohilkhand University
Dr. SULABH SACHAN	**Co-Principal Investigator**	**FET MJP Rohilkhand University**

A grant of *INR 1430000 (Rupees Fourteen Lakh Thirty Thousand Only)* has been sanctioned for the project by NPIU, Ministry of Education, Gov of India.

3. Research Proposal entitled, ***"Different Charging Infrastructure for Electric Vehicle"*** as Principal Investigator has been approved under **TEQIP-III** as **SEED GRANT**.

A grant of *INR 200000 (Rupees Two Lakh Only)* has been sanctioned for the project by TEQIP-III.

International Journal Paper Published:

1. **Sulabh Sachan,** "Stochastic Charging of Electric Vehicles in Smart Power Distribution Grids" *Sustainable Cities and Society***,** Elsevier, July, 2018. (**SCI**) (**Impact Factor: 7.587**)
2. **Sachan S, Amini MH.** Optimal allocation of EV charging spots along with capacitors in smart distribution network for congestion management. *International Transaction on Electrical Energy System*, Wiley, 2020; 1–14. https://doi.org/10. 1002/2050-7038.12507 (**SCI**) (**Impact Factor: 2.80**)
3. **Sulabh Sachan, Sanchari Deb, Sri Niwas Singh** "Different charging infrastructures along with smart charging strategies for electric vehicles", *Sustainable Cities and Society*, Elsevier, Volume 60, September 2020, 102238 (**SCI**) (**Impact Factor: 7.587**)
4. **Sulabh Sachan**, "Integration of Electric Vehicles with Optimum Sized Storage for Grid Connected Photo-voltaic System*" Energy, Aims Press*, October,2017 **(E-SCI, Scopus)**
5. **Sulabh Sachan, Sanchari Deb, Sri Niwas Singh, Praveen P Singh "**Planning and Operation of EV Charging Stations by Chicken Swarm Optimization Driven Heuristics" Energy Conversion and Economics, IET, June 2021. https://doi.org/10.1049/enc2.12030
6. **Sulabh Sachan, Sanchari Deb, Praveen P. Singh, M. S. Alam, "**A Comprehensive Review of Standards and Best Practices for Utility Grid Integration with EV Charging Stations" *Wires Energy and Environment*, Wiley, November 2021 https://doi.org/10.1002/wene.424 (**SCI**) (**Impact Factor: 3. 80**)
7. **Sulabh Sachan "**Automatic learning-based charging of electric vehicles in smart parking" Electric Power Components and systems, Taylor & Francis. **(Accepted)**
8. **Sulabh Sachan, Praveen P. Singh, Sanchari Deb,** "Charging Infrastructure Planning for Electric Vehicle: Present Status and Future Challenges" *Energy Conversion and Economics*, IET, 2022 (Under Review)

Book Chapters:

1. **Sulabh Sachan**, and Nand Kishor," Optimal location and charging of electric vehicle with wind penetration "*ICT for Electric Vehicle Integration with the Smart Grid.*", IET, **Editors:** Nand Kishor and Jesús Fraile-Ardanuy ,Dec, 2019
2. **Sulabh Sachan**, and Nand Kishor," Deploying stochastic coordination of electric vehicles for V2G services with wind "*ICT for Electric Vehicle Integration with the Smart Grid.*", IET, **Editors:** Nand Kishor and Jesús Fraile-Ardanuy ,Dec, 2019
3. Sanchari Deb**, Sulabh Sachan, "**Proposed Power Systems Planning in Indian Scenario for Integrating EV Charging Infrastructure", '*Developing Charging Infrastructure and Technologies for Electric Vehicles',* IGI Global, **Editors:** Mohammad Saad Alam, Reji Kumar Pillai and N. Murugesan, Sep, 2021
4. Sanchari Deb, **Sulabh Sachan**, Mohamamd Saad Alam, Samir M Shariff **, "**Electric Vehicle Integrated Virtual Power Plants: A Systematic Review" , '*Smart Charging Solutions for Hybrid and Electric Vehicles',* Wiley, **Editors:** Sulabh Sachan, P. Sanjeevikumar, Sanchari Deb, May, 2022
5. Sanchari Deb, **Sulabh Sachan , "**Optimal Location of EV Charging Stations by Modified Direct Search Algorithm" , '*Smart Charging Solutions for Hybrid and Electric Vehicles',* Wiley, **Editors:** Sulabh Sachan, P. Sanjeevikumar, Sanchari Deb, May, 2022

Book:

1. *'Smart Charging Solutions for Hybrid and Electric Vehicles'* WILEY (**ISBN Number: 9781119768951**) **Editors:** Sulabh Sachan, P. Sanjeevikumar, Sanchari Deb, Feb, 2022

International Conference Paper Published:

1. **Sulabh Sachan,** and Sanchari Deb, "*Dynamic Economic Dispatch with Electric Vehicle",* "International Conference on Emerging Electronics & Automation" (E2A - 2021), at NIT Silchar, India, Dec 17-19, 2021.
2. **Sulabh Sachan**, Lalit Kumar and Sanchari Deb," Smart Charging of Electric Vehicles Considering User Behavior" IEEE PES Asia Pacific Power & Energy Engineering Conference (APPEEC-2021), at Trivandrum, Kerala, November 21-23, 2021.
3. **Sulabh Sachan**, and Marta Zurek Mortka," Fuzzy Logic Triggered Charging Infrastructures for Electric Vehicles" IEEE International Conference on Smart Technologies for Power, Energy and Control" (IEEE-STPEC 2020), at VNIT Nagpur, September 25-26, 2020.
4. Jerzy Ryszard Szymanski, Marta Zurek Mortka and **Sulabh Sachan**," Simulation Research of Low-Voltage Modules of Rectifier in 3kV Railway Substation" IEEE International Conference on Smart Technologies for Power, Energy and Control" (IEEE-STPEC 2020), at VNIT Nagpur, September 25-26, 2020.
5. **Sulabh Sachan,** and Sanchari Deb," *Renewable based Charging Station for Electric Vehicles* "IEEE International Conference on Advances in Computing, Communication & Automation" (ICACCA- 2019), at MJPRU Bareilly, India, Nov 29-30, 2019.
6. **Sulabh Sachan,** and Sanchari Deb," *Contribution of Electric Vehicles to Frequency and Voltage Control ancillary Services* "IEEE International Conference on Advances in Computing, Communication & Automation" (ICACCA- 2019), at MJPRU Bareilly, India, Nov 29-30, 2019.
7. S. Mishra, S. Reddy, S. Bharti, S. Kumar, Payal, and **Sulabh Sachan,**" *Performance Index based Method to Sort Out the Severity of Lines* "IEEE International Conference on Computational and Characterization Techniques in Engineering & Sciences (CCTES), at Lucknow, India, Sep 14-15, 2018.
8. **Sulabh Sachan,** and Nand Kishor," *A Probabilistic Approach for DG with Electric Vehicles* "IEEE International Conference on Power Electronics, Drives and Energy Systems" (PEDES- 2018), at IIT Madras, India, Dec 18-21, 2018.
9. **Sulabh Sachan,** and Nand Kishor," *Optimum Sizing of Storage and Charging Strategy for Grid Connected Photo-voltaic System* "International Conference on Smart Cities" (IEEE-TENSYMP 2017), at Cochin, Kerala, July 14-16, 2017.

10. **Sulabh Sachan,** and Nand Kishor," *Charging of Electric Vehicles under Contingent Conditions in Smart Distribution Grids* "IEEE International Conference on Power Electronics, Drives and Energy Systems" (PEDES-2016), at Trivandrum, India, Dec 14-17, 2016.
11. **Sulabh Sachan,** and Nand Kishor," *Optimal Location for centralized charging of Electric Vehicle in distribution network* "18th IEEE Mediterranean Electro technical Conference" (MELECON- 2016), at Limassol Cyprus, April 18-20, 2016.
12. **Sulabh Sachan**, and Nand Kishor," *Optimal Location and Optimum Charging of Electric Vehicle based on Sensitivity Indices* "International Conference on Innovative Smart Grid Technologies" (ISGT-ASIA 2015), at Bangkok Thailand, Nov 4-6, 2015.
13. **Sulabh Sachan**, and C P Gupta," *Influence of Optimally Placed TCSC on Social Welfare in Deregulated Market* "International Conference on Electrical, Computer and Electronics Engineering and Technology" (UPCON-2015), at IIIT Allahabad, Dec 4-6, 2015.
14. **Sulabh Sachan**, and C P Gupta," *Analysis of Contingent Conditions in Power System*" IEEE Conference, StudentsConference on Engineering & System (SCES-2014), MNNIT Allahabad, May 28-30,2014.
15. **Sulabh Sachan**, and C P Gupta, *"Maximization of Social Welfare Considering Congestion in Deregulated Market* "National Conference on Recent Trends in Energy Systems" (NCRTES-2013), at KNIT Sultanpur, April 5-6, 2013.
16. J. Singh, B. Singh, S. P. Singh, and, **Sulabh Sachan "**Performance *Investigation of Permanent Magnet Synchronous Motor Drive using Vector Controlled Technique"* 2'nd International Conference on "Power Control & Embedded Systems" (ICPCES-2012), at MNNIT Allahabad, Dec.17- 19,2012.

Research Interest:

- Electric Vehicle
- Distributed Generation System
- Renewable Energy resources
- Deregulation in Power System
- Smart Grid

Achievements: (Award / Grant obtained)

- Gate Qualified in year **2011** with **661** gate score **(99.32 percentile), AIR (504).**
- **Gate Qualified in year 2012 with 632 gate score (99.01 percentile), AIR (980).**
- **Certificate of Participation in international conference on Innovative Smart Grid Technologies, ISGT-ASIA-2015, Thailand at Bangkok in year 2015.**
- **Institute Fellowship sanctioned by Ministry of Human Resource and Development, India.**
- **Amount: Indian Rupees (IRs). 8, 000/ - per month (July 2011- June 2013)**
- **Institute Fellowship sanctioned by Ministry of Human Resource and Development, India.**
- **Amount: Indian Rupees (IRs). 28, 000/ - per month (Jan 2014- Nov 2017)**
- **Centre for International Co-operation in Science (CICS) travel grant to attend and present paper in IEEE ISGT ASIA, Nov. 04-06, 2015, Bangkok Thailand.**
- **Amount of 200 USD from IEEE Power Energy Society for well deserving PhD student to presents a paper in ISGT, ASIA Conference 2015.**

Technical Reviews for International Conferences

- **IEEE PES Innovative Smart Grid Technologies 2016 Conference (ISGT Asia 2016), 28th Nov.-1 st Dec. 2016, Melbourne, Australia.**
- **IEEE TENCON 2016 — Technologies for Smart Nation (TENCON 2016) 22nd – 25th November 2016, Marina Bay Sands, Singapore.**
- **IEEE International Conference on Advances in Computing, Communication & Automation" (ICACCA-2019), at MJPRU Bareilly, India.**

Technical Reviews for International Journals

- IEEE Systems Journal
- IEEE transaction on Industrial Informatics
- IEEE transaction on smart grid
- Electric power components and system, Taylor & Francis
- Energy Storage, Elsevier
- Sustainable Cities and Society, Elsevier
- Energy, Elsevier

Session Chaired in International Conferences

- Chaired a session in IEEE ISGT ASIA-2015, Nov4-6, Thailand, Bangkok
- Chaired a session in UPCON-2015, Dec 4-6, 2015 at IIIT Allahabad.
- Chaired a session in ICAREMIT-2019, April 16-18, 2019 at MJP Rohilkhand University Bareilly.
- Chaired a session in IEEE ICACCA- 2019, Nov 29-30, 2019 at MJP Rohilkhand University Bareilly

Professional Affiliation

- IEEE Member
- IEEE Power and Energy Society
- Institution of Engineers (IEI)

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I hereby declare that all the information stated above, is true to my knowledge and I bear the responsibility for the correctness of the above-mentioned particulars.

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References:

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Stochastic charging of electric vehicles in smart power distribution grids

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ARTICLE INFO

Keywords:
Electric vehicles
Distribution grid
Greedy charging
Smart charging
Smart grids
Feeder deformation

ABSTRACT

This work investigate the substantial factors that impact a consumer's choice with regards to the electric vehicle reception. There are numerous viewpoints that rely on the selection of the electric vehicle. Henceforth, social and additionally psychological components have a place with the center choice of the selection. In this work, authors have managed the area enveloping the distinctive hypotheses that can anticipate the conduct of the purchasers. In this paper, the impact of different electric vehicles charging methods on distribution grid is assessed. This comparison is based on reduction of network peak load demand and improvement in its operating condition in perspective to voltage violations. In another charging strategy, wind power flow and resulting variation in electricity price is considered with stochastic availability of electric vehicles, i.e. arrival and departure times. Then, the charging cost is optimized (minimized) and consequently the resulting network constraints are evaluated by performing simulations. Further, in study the improvement in integration of the electric vehicles with modification in network, i.e. reformation is also suggested.

1. Introduction

Electric vehicles (EVs) are receiving much attention recently because of their ability as environmental friendly power source. EVs have potential to be substitute against combustion engine vehicles for general transportation. A strategy for ideal allotment and measuring of RES and EV charging stations along with managing vehicle charging process is discussed in Mozafar, Moradi, and Amini (2017) and Aljanad et al. (2017). Enhancing the strength of clients through utilizing Electric Vehicles (EV) is researched in Rahimi and Davoudi (2018). This arrangement is particularly powerful in the event of inaccessibility of grid for a lot of time. Author proposed a stochastic reproduction technique to create a calendar of every day travel and charging profiles for a populace of electric vehicles with GPS travel information (Brady & O'Mahony, 2016). Towards smart grid paradigm, coordinated charging/discharging relies on two-way communication. Its architecture includes data collection about state of charge of EVs batteries, base load demand, prediction and optimization section. Broadly, on the basis of studies available, EVs charging schemes are categorized as; centralized charging and decentralized charging control scheme. In order to test the theoretical construct, an investigation was carried out in Malaysia (Adnan, Nordin, Rahman, Vasant, & Noor, 2017). This research provides a methodological contribution to the body of knowledge by using the partial least squares-based structural equation modelling (PLS-SEM) to analyse the conceptual framework.

EVs integration into grid issues several challenges. Due to considerable base loads, charging EVs can certainly affect distribution network. For example, EVs integration amplifies the peak load demand (Kelly, Rowe, & Wild, 2009), increases power losses (Deilami, Masoum, Moses, & Masoum, 2011) and voltage variations (Dharmakeerthi, Mithulananthan, & Saha, 2014), etc. In charging mode EV demands more power than general house hold appliance. Due to this voltage drop and power flow violation may occur on distribution grid (Dharmakeerthi, Mithulananthan, & Saha, 2015). Some effects of EVs on distribution network have been deliberated in Green et al. (2011) and Amini, Moghaddam, and Karabasoglu (2017). The voltage will fall substantial and losses in the network could also rise (Fernańdez, Román, Cossent, Domingo, & Frías, 2011; Kristoffersen, Capion, & Meibom, 2011). Different charging strategies have been proposed for EVs so far. Amini et al. proposed an enhance autoregressive integrated moving average method to deal with the uncertainty of electric vehicle charging demand. The results of the EV charging demand forecaster were utilized to formulate a chance-constrained unit commitment problem (Amini, Kargarian, & Karabasoglu, 2016). In Amini and Islam (2014), a probabilistic EV model was deployed to optimize the effect of EV charging demand on the power distribution networks in terms of loss reduction. In Bessa and Matos (2012), the controlling of an aggregation agent for EVs in terms of economy and technology is discussed. In D'hulst, De Ridder, Claessens, Knapen, and Janssens (2015) a smart charging method is suggested to

Abbreviations: RoC, rate of charge; DKK, Danish Krone; pdf, probabilistic distribution function; RES, renewable energy sources.
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RESEARCH ARTICLE

WILEY

Optimal allocation of EV charging spots along with capacitors in smart distribution network for congestion management

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Peer Review
The peer review history for this article is available at https://publons.com/publon/10.1002/2050-7038.12507.

Summary

Rapid growth of electric vehicles (EVs) has necessitated the devolvement of sustainable and easily accessible charging stations. Transport sector electrification and increased popularity of EVs make researcher to search for charging stations. In this paper, a new methodology regarding electric vehicle charging spot is proposed. In the study, allocation of the parking lot and capacitor is suggested for congestion management along with reactive power compensation. To this end, sensitivity analysis is performed by evaluating the inverse Jacobian matrix from the power flow studies. In order to optimally determine the size of parking lot, biogeography-based optimization (BBO) technique is adopted. The effectiveness of the anticipated technique is tested on adapted IEEE 34-bus distribution network. The outcome attained by BBO technique is equated with particle swarm optimization.

KEYWORDS

biogeography based optimization, electric vehicles, parking lots, vehicle-to-grid (V2G)

1 | INTRODUCTION

These days, energy efficiency is an essential criterion, boosted by major concerns about climate change and rising oil prices in nations that depend vigorously on imported crude oils. The transport sector currently receives a major part of oil consumption, and much of it is used by road vehicles.[1] With all these, the oil prices are going high day by day, burdening the common man's life. With energy conservation and the environment, the global focus in the future will be on alternative transports such as electric vehicles (EVs).[2] Inventing rechargeable batteries found the application in electric vehicles with wide application and electricity distribution in the nineteenth century with electric motors. By charging their batteries when needed, people were more comfortable riding these electric cars in the city. The best possible position additionally empowers the framework to ease the voltage issues at different nodes with lesser current spill out of the capacity component. With the growing popularity of EVs, charging infrastructures need to be improved, and new affordable models offered. Due to the cleanest solution that will help to live in a healthy environment, governments

LIST OF SYMBOLS AND ABBREVIATIONS: P_i, real power at i_{th} node; PEV_i, EVs charging spot power to i_{th} node; P_{gi}, Grid power; P_{di}, Demand at i_{th} node; P_{ij}, Q_{ij}, Real and reactive power flow; G_{ii}, B_{ii}, Conductance and Susceptance at bus i; θ_{ij}, Angle magnitude of self-admittance at line i to j; n, Number of nodes in distribution network; [J], Jacobian matrix; U1, U2, U3, U4, Voltage variation; J_R, Reduced Jacobian matrix; V^0, Base Voltage; V_n, Voltage of nth bus; NL, Number of load buses; P_{ij}^{max}, Rated power between bus i and j; ECCRP, Electric car sharing charging and repositioning problem.

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Different charging infrastructures along with smart charging strategies for electric vehicles

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ARTICLE INFO

Keywords:
Plug-in electric vehicles
V2G
Battery charging
Integration into grid
Charging infrastructure

ABSTRACT

The accelerating energy demand, growing concern regarding global warming and climate change has paved the path of electrification of the transport sector. Large scale adoption of Electric Vehicles (EVs) call for availability of sustainable and easily accessible charging infrastructure. The sporadic energy demand, different battery storage capacity and diverse penetrating patterns of electric vehicles have significantly raised the load elasticity on a power grid. Smart-grid environment promises to assist the addition of EVs into national grids by enabling both EV-charging and discharging (G2V and V2G) load. This will modify the load profile and reduce cost.This paper discusses comprehensively three basic infrastructures by which charging of EVs can be done. These infrastructures are studied and compared on the basis of some parameters. It has been found that distributed infrastructure shows best results for the charging of electric vehicles. The other two infrastructures prove costlier and increase power demand. Also, this paper examines three specific smart charging strategies and the impact of each strategy on the power system load profile and realization cost. Simulation results establish the superiority of smart charging over dumb charging.

1. Introduction

The International Panel on Climate Change (IPCC) released a report on climate change which concluded that the increase in average temperatures at the global level since the past few decades is mainly due to the increase in Green House Gases (GHG) concentrations (Adnan, Nordin, Rahman, Vasant, & Noor, 2017). And, the transport sector is one of the major emitters of GHG. Also, European Union (EU) targets reduction of GHG emissions by 25 % till 2020 Thus, the ever escalating energy demand accompanied by the concerns on greenhouse gas emissions from use of Internal Combustion Engine (ICE) driven vehicles have provoked mankind to look for alternative energy options for mobility. Electric Vehicles (EVs) have the potential to reduce these emissions due to higher efficiencies along with the possibility to be powered by renewable energy. Also, in recent years EV batteries have become an attractive option to actively manage the load by either returning electricity back to the grid or by throttling the charging rate of the EVs. EVs are gaining popularity these days as demonstrated by the various vehicles made available in the market by almost all automobile companies. The main energy storage systems of these vehicles are the electrochemical batteries which impose a limit on driving distances, hence different models of EV can have different range depending upon their battery capacity and charging methods.

Electric vehicles (EVs) have significantly increased the load on conventional substations and national grids. The increased load due to introduction of EV charging load have severe impact on power system such as voltage instability, harmonics, degradation of reliability indices (Deb, Tammi, Kalita, & Mahanta, 2018; Deb, Kalita, & Mahanta, 2017; Mozafar, Moradi, & Hadi Amini, 2017; Sachan & Adnan, 2018). Development and availability of sustainable charging infrastructure within a suitable distance from the charging demand points, the rate of charging that can be provided, the volume of EV traffic that needs to be attended and can be handled at a charging station along with safety measures and standards that need to be followed are some of the issues to be addressed to popularize EV on yet a larger scale (Aljanad et al., 2017; Amini & Islam, 2014; Amini, Moghaddam, & Karabasoglu, 2017; Rahimi & Davoudi, 2018). In recent years, much research effort has been devoted to the analysis, design and performance evaluation of

Abbreviations: EV, Electric vehicle; G2V, Grid to vehicle; V2G, Vehicle to grid; Parked (w), Vehicle available in week days; Parked (wn), Vehicle available in weekends; SOC, State of charge; pdf, probabilistic distribution function

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ORIGINAL RESEARCH PAPER

Planning and operation of EV charging stations by chicken swarm optimization driven heuristics

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[1] Electrical Engineering Department, MJP Rohilkhand University, Bareilly

[2] ERCIM, VTT Research Centre, Finland

[3] Electrical Engineering Department, IIT Kanpur

[4] EED, Tallinn University of Technology (TalTech), Estonia

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Sulabh Sachan, Electrical Engineering Department, FET, MJP Rohilkhand University, Bareilly-243006, Uttar Pradesh, India.
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Abstract

Successful deployment of electric vehicles demands for establishment of simple reachable charging stations (CSs). Scheduling and action of CSs is a composite problem and that should not affect the smooth operation of the power grid. The present paper attempts to solve the planning and operation of CSs by a novel chicken swarm optimization-based heuristics. The placement of CS is modelled in a multi-objective framework as cost-effective parameters secures the operation of the power grid. Further, the operation of CSs is examined for three scenarios such as uncoordinated charging, coordinated charging, as well as bidirectional vehicle to grid. The proposed approach is tested on IEEE 33-bus, and on a distribution network of Guwahati, India.

1 | INTRODUCTION

In recent years, researchers and environmentalists are preoccupied with fossil fuel depletion, degradation of air quality, and energy crisis. Electric vehicles (EVs) are a clean mode of transportation and are viable alternatives to deal with the aforementioned problems. However, successful deployment of EVs calls for enlargement of charging station (CS). The planning and operation of CS are critical aspects. Improper planning and operation of CS may be detrimental to the power grid resulting in voltage instability, degraded reliability, increased power losses, and harmonic distortion [1–5].

Globally, the planning and operation of charging stations have attracted much attention from researchers to deal with various problems [6, 7]. Despite their advantages, EVs are not becoming widespread at the desired level since there are no common charging stations, and the reason for this fear is that the private traditional vehicles are on the road [8, 9]. To alleviate this problem, it is assumed that car parks can be used as charging places. Normally, the EVs are not used for a long time as they are often left in parking lots. For this reason, these long times can be measured as a prospect to recharge EVs in smart car parks [10]. The focus of this technology is to prevent damage to the grid by multiple EVs and HEVs being charged simultaneously. The aim of this paper is to ensure the satisfaction of EV and HEV users while eliminating the negative effects [11]. There is a need for a control mechanism to control the power supplied to parked vehicles which is fed from the grid as well as by other forms of electricity production [12–14].

The operation of charging stations signifies the charging strategy that will be adopted in the charging stations such as uncoordinated charging, coordinated smart charging etc. In [15, 16], authors have analysed the advantages of smart charging schemes and found that coordinated charging is beneficial. In [17], authors provided a DR strategy of EV CS by using dynamic programming. In [18], the authors presented a two-stage linear programming-based approach for the operation of charging stations. In [19], authors have proposed an adaptive strategy to manage EV charging load. Further, in [20], the authors presented a load management strategy in EV charging stations in the presence of renewable energy sources.

Researchers have made significant attempts to improve energy efficiency of CSs. In a category, researchers have considered different technologies such as renewable energy sources, ESS and DR programs in studying the operation of energy systems in the presence of EVs. The authors have proposed a

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Research article

Integration of electric vehicles with optimum sized storage for grid connected photo-voltaic system

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Abstract: The necessity of energy storage by means of battery/EV is exceedingly expected in event of energy blackouts. Different advantages incorporate sparing the cash in purchasing top time power and support the grid when grid power is deficit against the load demand. In this paper, ideal size of energy storage in a grid associated photovoltaic (PV) framework is proposed. The methodology of energy flow choice is produced with the appraisal on accessibility of PV yield control and the load demand. The energy flow decision is changed by peak and off peak hours to shorten the functional cost of the grid associated PV framework with storage. Naturally, the quantities of electric vehicles that can be associated are resolved.

Keywords: distribution grid; energy storage; electric vehicle; photo voltaic system; cost-benefit analysis

Nomenclature

EV	Electric Vehicle
PV	Photo Voltaic
$P_{PV,DC}(d,t)$	Power output from the PV panel (kW)
$P_{PV,AC}(d,t)$	PV power at the AC bus (kW)
η_{inv}PV	inverter efficiency (%)
$P_{DC,bat}$	Charge/Discharge power of the battery (kW)
E_{bat}	Stored energy in the battery (kWh)
P_{AC-bat}	Charge/Discharge rate of the battery on the AC bus (kW)
$P_{DC,bat}$	Charge/Discharge rate of the battery (kW)
η_{bat}	Battery inverter efficiency (%)

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ADVANCED REVIEW

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A comprehensive review of standards and best practices for utility grid integration with electric vehicle charging stations

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Abstract

The present work presents a comprehensive state-of-the-art bibliographical review of standards related to utility grid integration and best practices of the electric vehicle (EV) charging stations. The presence of a robust tuning method is essential for successful utility grid integration with the charging stations. The lack of system standardization may hamper the EV uptake as well as successful utility grid integration with the charging stations. The distributed energy resources (DER) and vehicle to grid (V2G) are going to play a vital role in the power system operation and control. The applicability of criterions within the utility grid integration with charging station area is important to the grid operators, charging service providers, manufacturers, fleet operators, and so forth to ensure safety, dependability, and interoperability. Hence, this work tries to deliver a comprehensive and systematic review of standards and best practices for utility grid interaction with charging stations. It will help the specialists of power as well as transport sectors to track down every one of the norms and best practices, which are accessible at one stage to compare different guidelines.

This article is categorized under:

Energy Infrastructure > Systems and Infrastructure

Wind Power > Systems and Infrastructure

Fossil Fuels > Economics and Policy

Fossil Fuels > Systems and Infrastructure

KEYWORDS

charging, DER, electric vehicle, standards

1 | INTRODUCTION

The ever-increasing energy demands as well as environment concerns have led to an increase in the adoption of electric vehicles (EVs) as sustainable alternatives.[1] EV charging stations are growing exponentially, based on the future environmentally friendly demand of vehicles. The ecosystem of EVs depends on several factors such as market demand (high capital costs and consumer perceptions), government policies (taxation on vehicles and components, subsidies), available infrastructure (charging and battery swapping infrastructures), and technical solutions (e.g., those concerning

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Reviewer(s)' Comments to Author:

Reviewer: 1

Comments to the Author
add few references,add key words,give the brief explanation of proposed charging approach

Reviewer: 2