1. Record Nr. UNINA9910592991503321

Titolo	Electric vehicle integration via smart charging : technology, standards, implementation, and applications / / Vahid Vahidinasab, Behnam Mohammadi-Ivatloo, editors
Pubbl/distr/stampa	Cham, Switzerland : , : Springer, , [2022] ©2022
ISBN	3-031-05909-3
Descrizione fisica	1 online resource (250 pages)
Collana	Green energy and technology
Disciplina	629.286
Soggetti	Battery charging stations (Electric vehicles)
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Preface -- Contents -- Editors and Contributors -- About the Editors -- Contributors -- 1 Standardised Domestic EV Smart Charging for Interoperable Demand Side Response: PAS 1878 and 1879 -- 1.1 Introduction -- 1.1.1 Purpose of Demand-Side Response -- 1.1.2 Status Quo, Challenges and Outlook -- 1.1.3 Assumptions of the Standardised Framework -- 1.1.4 Overview of Operation -- 1.1.5 Underpinning Principles -- 1.1.6 Scope -- 1.2 System Architecture -- 1.2.1 Functional Architecture -- 1.2.1.1 Compatibility with International Standards -- 1.2.1.2 Key Requirements -- 1.2.2 Descriptions of Functional Devices and Entities -- 1.2.2.1 DSR Service Provider (DSRSP) -- 1.2.2.2 Customer Energy Manager (CEM) -- 1.2.2.3 Home Energy Management System (HEMS) -- 1.2.2.4 Chargepoint (The ESA Functionality) -- 1.2.2.5 Chargepoint Manufacturer -- 1.2.2.6 Electric Vehicle (EV) -- 1.2.2.7 System Operators and Market Participants (SOMPs) -- 1.2.2.8 Electricity Supplier -- 1.2.2.9 National Electricity Regulator -- 1.2.3 Descriptions of Interfaces -- 1.2.3.1 Interface A -- 1.2.3.2 Interface B -- 1.2.3.3 Manufacturer Interface -- 1.2.3.4 Interface C -- 1.2.3.5 Interface M -- 1.2.3.6 External System Interface -- 1.2.3.7 Chargepoint and EV Interface -- 1.3 Operation Framework -- 1.3.1 Operation Process and DSR Modes -- 1.3.1.1 (a) Consumer Registration with the DSRSP -- 1.3.1.2 (b) Discovery, Authentication and Device Registration -- 1.3.1.3 (c) Initialisation --

1.3.1.4 (d) Normal Operation -- 1.3.1.5 (e) De-registration -- 1.3.2 Power Profiles for DSR -- 1.3.2.1 Flexibility Offers as Power Profiles -- 1.3.2.2 Frequency Response Indicator -- 1.3.2.3 Information Required for Power Profiles -- 1.3.2.4 Power Reporting -- 1.3.3 Cyber Security Approach -- 1.4 EV Smart Charging for DSR Services -- 1.4.1 Mapping to IEC/ISO Standards for EVs.
1.4.2 Example Use Case: EV Implementation for DSR Services -- 1.4.2.1 Registration -- 1.4.2.2 Normal Operation -- 1.4.2.3 De-registration -- Bibliography -- 2 The Concept of Li-Ion Battery Control Strategies to Improve Reliability in Electric Vehicle (EV) Applications -- 2.1 Introduction -- 2.2 Battery Management System (BMS) -- 2.3 Battery Fault Detection -- 2.4 Battery State-of-Function Estimation -- 2.4.1 Battery SoH Estimation -- 2.4.2 Battery SoC Estimation -- 2.5 Conclusions -- References -- 3 Recognition of Electric Vehicles Charging Patterns with Machine Learning Techniques -- 3.1 Introduction -- 3.1.1 Electric Vehicles -- 3.1.1.1 Taxonomy of EVs -- 3.1.1.2 EV Integration's Benefits -- 3.1.1.3 Challenges and Problems of EVs High Penetration -- 3.1.2 Data Challenges of the High Penetration of the EVs -- 3.1.3 Energy Management of the EVs' Smart Charging -- 3.1.3.1 Concepts and Applications -- 3.1.3.2 Challenges and Opportunities -- 3.1.4 Literature Review on EV Integration -- 3.2 Identification of EV Charging Patterns -- 3.2.1 Clustering Concept and Principles -- 3.2.1.1 Concept of the Clustering -- 3.2.1.2 Principles of the Clustering -- 3.2.2 Clustering of the Charging Patterns -- 3.2.3 Utilization of ML Algorithms for Clustering the Charging Patterns -- 3.2.3.1 Unsupervised Learning -- 3.2.3.2 Supervised Learning -- 3.2.4 ML-Based Approach to Cluster the EV Charging Behaviors -- 3.2.4.1 Preprocessing -- 3.2.4.2 EV's Charging Behavior Clustering Using K-Means Algorithm -- 3.2.4.3 K-NN Classification for EV Charging Behavior -- 3.2.5 A Toy Example -- 3.2.6 Application of Charging Pattern Recognition in Smart Charging -- 3.3 Status Quo, Challenges, and Outlook -- 3.4 Concluding Remarks -- References -- 4 Cybersecurity and Data Privacy Issues of Electric Vehicles Smart Charging in Smart Microgrids -- 4.1 Introduction.
4.2 Cyberattacks and Security Issues of EVs -- 4.2.1 Various Attacks on EVs -- 4.2.1.1 Attacks on Control Systems -- 4.2.1.2 Attacks on Driving System Parts -- 4.2.1.3 Attacks on V2X Communication -- 4.2.2 The Vulnerability of EV Charging Stations to Cyberattacks -- 4.2.2.1 Web-Based Vulnerabilities -- 4.2.2.2 Human-Machine Interface Vulnerabilities and Physical Access Points -- 4.2.2.3 The Vulnerability of Servers -- 4.2.2.4 The Vulnerability of Smartphones -- 4.2.2.5 The Vulnerability of Building Energy Management System and Grid Interface -- 4.2.2.6 The Vulnerability of Original Equipment Manufacturers/Vendors -- 4.2.3 Cybersecurity Challenges in EV Communication -- 4.2.3.1 Limited Connectivity -- 4.2.3.2 Limited Computational Performance -- 4.2.3.3 The Scenarios and Threats of Unpredictable Attacks -- 4.2.3.4 Critical Hazard to the Life of Drivers and Passengers -- 4.2.4 Data Privacy Challenges in Smart EV Networks -- 4.2.5 Classifying the Cybersecurity Threats of On-Board Charging -- 4.2.5.1 Modification -- 4.2.5.2 Interference -- 4.2.5.3 Interruption -- 4.2.5.4 Interception -- 4.2.6 Risk Assessment -- 4.2.7 The Review of Attacker-Defender Models -- 4.2.8 Cybersecurity Requirements -- 4.2.8.1 The Security Goals for EV Ecosystem -- 4.2.8.2 Security Requirements Based on NISTIR 7628 -- 4.3 Status Quo, Challenges, and Outlook -- 4.4 Learned Lessons and Concluding Remarks -- References -- 5 Evaluation of Cyberattacks in Distribution Network with Electric Vehicle Charging Infrastructure -- 5.1 Introduction -- 5.2 Status Quo, Challenges, and Outlook -- 5.2.1 EV2EVSE -- 5.2.2

EVSE2EVSE -- 5.2.3 EV2EV -- 5.3 Related Work -- 5.4 Cyberattack Model -- 5.4.1 Response Model -- 5.5 Experimental Results -- 5.6 Conclusion -- References -- 6 Electric Vehicle Services to Support the Power Grid -- 6.1 Introduction.
6.2 Classification of EV Services Presentable to the Power Grid -- 6.2.1 EV's Active and Reactive Power Support Services -- 6.2.1.1 Frequency Control -- 6.2.1.2 Load Variance Minimization, Peak Shaving, and Valley Filling -- 6.2.1.3 Loads Restoration -- 6.2.1.4 Loss Minimization -- 6.2.1.5 Voltage Control -- 6.2.2 Support Services for Renewable Energy Sources Integration -- 6.3 Combination Capability of EVs' Different Services -- 6.4 Mathematical Modeling of EVs' Charging and Discharging Optimization Problem in the Power System -- 6.4.1 Constraints on EVs' Charging and Discharging Optimization Problem -- 6.4.1.1 EV Constraints -- 6.4.1.2 Network Constraints -- 6.4.2 Mathematical Models and Problem-Solving Methods for Optimizing Charge and Discharge of EVs -- 6.5 Current Status, Challenges, and Outlook -- 6.6 Conclusion -- References -- 7 Smart Charging of EVs to Harvest Flexibility for PVs -- 7.1 Status Quo, Challenges and Outlook -- 7.2 Introduction -- 7.2.1 Background and Literature Review -- 7.2.2 Contributions -- 7.2.3 Chapter Organization -- 7.3 Determination of Optimal EV Demand Profile -- 7.3.1 Assumptions -- 7.3.2 Mathematical Formulation -- 7.4 Numerical Studies -- 7.4.1 Data -- 7.4.2 Case-I: EVs Profile Optimization, Without Considering PVs -- 7.4.3 Case-II: EVs Profile Optimization, Considering PVs -- 7.4.4 Comparative Analysis of Cases -- 7.5 Conclusion -- Bibliography -- 8 A Robust Optimization-Based Model for Smart Charging of PEV Under Multiple Uncertainties -- 8.1 Introduction -- 8.2 Mathematical Representation of the Deterministic PEV Smart Charging -- 8.2.1 Constraints -- 8.3 The Proposed IGDT-Based Model for Robust Smart PEV Charging -- 8.3.1 The Information Gap Decision Theory (IGDT) -- 8.3.2 The Proposed IGDT-Based PEV Smart Charging -- 8.3.3 Multi-objective Particle Swarm Optimization (MOPSO).
8.3.3.1 Concise Review of PSO Algorithm -- 8.3.3.2 The Concept of Dominance in a Multi-objective Problem -- 8.3.3.3 The MOPSO Step-by-Step Implementation -- 8.3.4 Fuzzy Satisfaction Method -- 8.4 Numerical Results -- 8.4.1 Input Data -- 8.4.2 The SOC and Power Analysis -- 8.4.3 Robustness Assessment -- 8.5 Conclusion -- References -- 9 The Role of Smart Electric Vehicle Charging in Optimal Decision-making of the Active Distribution Network -- Nomenclature -- Sets and Indices -- Parameters -- Variables -- Binary Variables -- 9.1 Introduction -- 9.2 Status Quo, Challenges, and Outlook -- 9.3 Formulation -- 9.3.1 Hybrid Stochastic Programming/Robust Optimization Model -- 9.3.2 Electric Vehicles -- 9.3.3 Combined Heat and Power Unit -- 9.3.4 Solar Distributed Generations -- 9.3.5 Distribution System -- 9.3.6 The Objective Function -- 9.4 Results and Discussions -- 9.5 Conclusion -- References -- 10 Operational Challenges of Electric Vehicle Smart Charging -- 10.1 Status Quo, Challenges, and Outlook -- 10.2 Definition -- 10.3 Electric Vehicle Technology -- 10.4 Electric Vehicles Charging -- 10.4.1 Charging Standards for Electric Vehicles -- 10.4.2 Charging Speed and Duration -- 10.4.3 Electric Vehicle Smart Charging (EVSC) -- 10.5 Control of EVSC: Centralized and Decentralized Control Approaches -- 10.6 Benefits of EVSC -- 10.7 Main Challenges of Using EVSCs -- 10.7.1 Connectivity and Infrastructure in EVSC -- 10.7.2 The Minimum Requirements for EVSC -- 10.8 Conclusion -- References -- Index.