1. Record Nr. UNINA9911038526103321

Autore	Tiwari Shubham
Titolo	Energy Management Strategies for Multi-Vectored Energy Hubs to Achieve Low Carbon Societies
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2025 ©2026
ISBN	9781394267378
Edizione	[1st ed.]
Descrizione fisica	1 online resource (347 pages)
Altri autori (Persone)	SinghJai Govind SivaramanPalanisamy SharmeelaChenniappan PachauriRupendra Kumar PadmanabanSanjeevikumar
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright -- Contents -- About the Editors -- List of Contributors -- Preface -- Chapter 1 Evaluation of Power/Energy System to the Modern MultiVectored Energy Hubs (MVEHs) -- 1.1 Introduction -- 1.2 Problem Statement -- 1.3 Objective -- 1.4 Theoretical Framework -- 1.5 Evaluation Framework -- 1.5.1 Evaluation Criteria of MVEHs -- 1.5.2 Data Collection -- 1.6 Discussion -- 1.6.1 Regulatory and Policy Framework -- 1.6.2 Challenges and Future Trends -- 1.7 Conclusion -- References -- Chapter 2 Introduction of Transactive Energy Management in a Multi Energy Networked System -- 2.1 Introduction -- 2.2 Problem Statement -- 2.3 Objective -- 2.4 Conceptual Framework -- 2.5 Multi Energy Networked System -- 2.6 Integration of Transactive Energy Management -- 2.6.1 Objective function -- 2.6.2 Constraints -- 2.6.2.1 Power Balance Constraint -- 2.6.2.2 Power Generation Constraint -- 2.6.3 PV Constraints -- 2.6.4 Battery Storage Constraints -- 2.6.5 Market Constraints -- 2.6.6 Working Cases of Microgrids -- 2.6.6.1 First Case -- 2.6.6.2 Second Case -- 2.6.7 Benefits of Integration -- 2.6.8 Challenges of Integration -- 2.7 Discussion --

2.7.1 Advantages -- 2.7.1.1 Enhanced Efficiency -- 2.7.1.2 Expanded Adaptability -- 2.7.1.3 Further Developed Strength -- 2.7.2 Disadvantages -- 2.7.2.1 Complex Framework Joining -- 2.7.2.2 Information About Executives and Security -- 2.7.2.3 Administrative and Market Boundaries -- 2.7.3 Challenges -- 2.7.3.1 Technical Challenges -- 2.7.3.2 Regulatory Challenges -- 2.7.4 Future Directions -- 2.7.5 Possible Improvements and Innovations in Transactive Energy Management -- 2.8 Conclusion -- References -- Chapter 3 Energy Management Strategies for Optimal Scheduling of MultiEnergy Network Hubs -- 3.1 Introduction -- 3.1.1 Background -- 3.1.2 Related Work -- 3.2 System Architecture and Problem Formulation.
3.2.1 System Architecture -- 3.3 Problem Formulation -- 3.3.1 DSO Objective Function -- 3.3.2 EH Coordinator Objective Function -- 3.3.3 Electrical Network -- 3.3.4 Thermal Network -- 3.3.5 Supply-demand Balance in EHs -- 3.3.6 MultiObjective Optimization Formulation for DSO and EH Coordinator -- 3.3.7 Bargaining Game Between EHs -- 3.3.8 Economic Scheduling Model of Cooperative EHs -- 3.4 Results and Discussion -- 3.4.1 Case 1: Noncooperative Operation of EHs -- 3.4.2 Case 2: Cooperative Operation of EHs -- 3.5 Conclusion -- References -- Chapter 4 Impact of Hydrogen and PowertoGas Technology on MVEHs -- 4.1 Introduction -- 4.2 Objectives -- 4.3 Hydrogen Storage Technology -- 4.4 PowertoGas (P2G) Technologies -- 4.4.1 System Components -- 4.4.2 Integration with Power Systems -- 4.5 Role of Hydrogen in Sustainable MVEHs -- 4.5.1 Environmental Impact -- 4.5.2 Economic Considerations -- 4.5.3 Case Study and Examples -- 4.6 Conclusion -- References -- Chapter 5 Modeling and Analysis of MVEHs with Advanced Energy Storage Units -- 5.1 Introduction -- 5.2 Evolution of Energy Hubs, Their Components, Benefits, and Classification -- 5.2.1 Energy Hubs: Basic Definition and Structure -- 5.2.2 The Background of the EH Methodology -- 5.2.3 Elements of Energy Hubs -- 5.2.3.1 Adapting Converters -- 5.2.3.2 Converters for Switching -- 5.2.4 Benefits of Energy Hubs -- 5.2.4.1 Management of Incorporated Energy -- 5.2.4.2 Enhanced Effectiveness -- 5.2.4.3 Improved Adaptability -- 5.2.4.4 Savings on Costs -- 5.2.4.5 Diminished Emissions of Carbon -- 5.2.4.6 Adaptability and Dependability -- 5.2.4.7 Local Production and Storage of Energy -- 5.2.4.8 Assistance with Electric Cars (EVs) -- 5.2.4.9 Reliability in Scale -- 5.2.4.10 Information and Tracking -- 5.2.4.11 Engagement in the Energy Market -- 5.2.4.12 Support for Regulation and Policy.
5.3 MultiVector Energy Hubs -- 5.3.1 Different Types of Interactions and Interdependencies Among Energy Vectors -- 5.3.2 Interdependencies Between Natural Gas and Electricity Networks -- 5.3.3 Interdependencies Between District Heat and Electricity Networks -- 5.3.4 Interdependencies Between Natural Gas, District Heating, and Electricity Networks -- 5.3.5 Advantages of MVEHs -- 5.3.6 Challenges in MVEHs -- 5.3.6.1 Technical Difficulties -- 5.3.6.2 The Financial Challenges -- 5.3.6.3 Social and Environmental Challenges -- 5.4 Role of Advanced Energy Storage Technologies in MVEHs -- 5.4.1 Flywheel Energy Storage -- 5.4.1.1 Significant Progress to Improve the Energy Storage Performance of Flywheels -- 5.4.1.2 Challenges in Integrating Flywheels into MVEHs -- 5.4.2 CAES Technology -- 5.4.2.1 Challenges Faced by Compressed Air Storage Systems in MVEHs -- 5.4.3 Pumped Hydro Storage (PHS) -- 5.4.4 Batteries and Electrochemical Systems for Energy Storage -- 5.4.4.1 Merits and Demerits of Battery ESSs -- 5.4.4.2 Challenges in Integrating Battery Energy Storage in MVEHs -- 5.4.5 Thermal Energy Storage Technology -- 5.4.6 Magnetic Energy Storage Technology -- 5.4.7 Chemical and Hydrogen Energy Storage -- 5.5 Mathematical Model of MVEHs -- 5.5.1 Modeling Approaches --

5.5.1.1 Mathematical Modeling -- 5.5.1.2 Tools for Simulation -- 5.5.1.3 Hybrid Models -- 5.5.2 Analytical Techniques -- 5.5.2.1 Optimization Algorithms -- 5.5.2.2 Performance Analysis -- 5.5.2.3 Economic and Environmental Analysis -- 5.5.3 Challenges and Opportunities -- 5.5.3.1 Challenges -- 5.5.3.2 Opportunities -- 5.5.4 Policy and Incentive Design -- 5.5.4.1 Future Research Directions -- 5.6 Conclusion -- References -- Chapter 6 Market and Energy Trading Mechanism in MVEHs -- 6.1 Introduction to Different Market Clearing Mechanisms in MEH -- 6.2 Concepts of Market Equilibrium Models. 6.3 Mechanisms of Energy Trading in MEH -- 6.3.1 Market Structure and Participants -- 6.3.2 Spot and Futures Markets -- 6.3.3 Pricing Mechanisms and Instruments -- 6.3.4 Environmental and Regulatory Considerations -- 6.3.5 Technological Innovations and Market Integration -- 6.4 Types of Market Equilibrium in MEHs -- 6.4.1 Stable Equilibrium -- 6.4.2 Unstable Equilibrium -- 6.4.3 Dynamic Equilibrium -- 6.4.4 Partial Equilibrium -- 6.4.5 General Equilibrium -- 6.4.6 Long Run Equilibrium -- 6.4.7 ShortRun Equilibrium -- 6.5 Graphical Representation of Market Equilibrium -- 6.5.1 Demand and Supply Curves -- 6.5.2 Equilibrium Point -- 6.5.3 Shifts in Curves -- 6.5.4 Surpluses and Shortages -- 6.6 Factors Affecting Market Equilibrium Models -- 6.7 Energy Market Designs -- 6.7.1 Types of Energy Markets -- 6.7.2 Market Clearing Mechanisms -- 6.7.3 Regulatory Framework -- 6.7.4 Incentives for Renewable Energy -- 6.7.5 Demand Response Programs -- 6.7.6 Integration of Distributed Energy Resources -- 6.7.7 Market Interconnections -- 6.7.8 Pricing Mechanisms -- 6.7.9 Environmental Considerations -- 6.7.10 Challenges and Barriers -- 6.7.11 Future Trends in Energy Market Design -- 6.8 Blockchain Technologies -- 6.8.1 Key Components of Blockchain Technology -- 6.8.1.1 Blocks -- 6.8.1.2 Chain -- 6.8.1.3 Nodes -- 6.8.1.4 Consensus Mechanisms -- 6.8.1.5 Cryptographic Hash Functions -- 6.8.1.6 Smart Contracts -- 6.8.1.7 Tokens and Cryptocurrencies -- 6.8.1.8 Wallets -- 6.8.2 Types of Blockchain Technology -- 6.8.2.1 Public Blockchain -- 6.8.2.2 Private Blockchain -- 6.8.2.3 Consortium Blockchain -- 6.8.2.4 Hybrid Blockchain -- 6.8.2.5 Sidechains -- 6.8.2.6 Layer 2 Solutions -- 6.8.3 Features of Blockchain Technology -- 6.8.4 Benefits of Blockchain Technology -- 6.8.5 Challenges and Limitations of Blockchain Technology -- 6.8.6 Applications of Blockchain Technology.
6.9 Role of Market Makers in MEHs -- 6.9.1 Providing Liquidity -- 6.9.2 Reducing BidAsk Spreads -- 6.9.3 Price Discovery -- 6.9.4 Stabilizing Markets -- 6.9.5 Reducing Information Asymmetry -- 6.9.6 Risk Management -- 6.9.7 Facilitating Arbitrage -- 6.10 Smart Contracts Between EHs -- 6.10.1 Role of Smart Contracts Between Energy Hubs -- 6.10.1.1 Energy Trading -- 6.10.1.2 Dynamic Pricing -- 6.10.1.3 Automated Energy Distribution -- 6.10.1.4 Microgrid Management -- 6.10.1.5 Energy Storage Management -- 6.10.1.6 Grid Balancing and Stability -- 6.10.1.7 Carbon Credits and Sustainability Incentives -- 6.10.1.8 Grid Services (Demand Response) -- 6.10.1.9 Dispute Resolution -- 6.10.2 Benefits of Smart Contracts in Energy Hubs -- 6.11 Algorithms for Energy Trading Among EHs -- 6.11.1 MarketBased Algorithms -- 6.11.1.1 Auction Mechanisms -- 6.11.2 Game Theory Approaches -- 6.11.2.1 Nash Equilibrium -- 6.11.2.2 Cooperative Game Theory -- 6.11.3 Optimization Algorithms -- 6.11.3.1 Linear Programming (LP) -- 6.11.3.2 MixedInteger Programming (MIP) -- 6.11.3.3 Dynamic Programming -- 6.11.4 Machine Learning Techniques -- 6.11.4.1 Reinforcement Learning (RL) -- 6.11.4.2 Neural Networks -- 6.11.5 Multiagent Systems -- 6.11.5.1 Distributed Algorithms -- 6.11.5.2 Consensus Algorithms -- 6.11.6 Forecasting Models -- 6.11.6.1 Time Series Analysis -- 6.11.6.2 Weather

	Forecasting Models -- 6.11.7 Blockchain and Smart Contracts -- 6.11.7.1 Decentralized Trading Platforms -- 6.11.8 Heuristic Methods -- 6.11.8.1 Genetic Algorithms -- 6.11.8.2 Particle Swarm Optimization -- 6.12 Regulatory Framework for MEHs -- 6.12.1 Market Structure and Design -- 6.12.2 Price Formation Mechanisms -- 6.12.3 Transparency and Reporting -- 6.12.4 Market Power and Competition -- 6.12.5 Consumer Protection -- 6.12.6 Environmental and Sustainability Standards. 6.12.7 Grid Reliability and Security.
Sommario/riassunto	Comprehensive reference on multi energy hub (MEH) modeling, management, protection, and trading across energy exchange markets with supporting case studies Energy Management Strategies for Multi-Vectored Energy Hubs to Achieve Low Carbon Societies discusses the complex exchange process across different sources within an evolving set of.