

# **1st IFAC Workshop on Smart Energy System for Efficient and Sustainable Smart Grids and Smart Cities (SENSYS 2025)**

IFAC PapersOnline Volume 59, Issue 9

Bari, Italy  
18-20 June 2025

**Editor:**

**Marialuisa Volta**

ISBN: 979-8-3313-2637-1

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

To the extent permissible under applicable laws, no responsibility is assumed by the Owner, the Publisher or the Licensee for any injury and/or damage to persons or property as a result of any actual or alleged libelous statements, infringement of intellectual property or privacy rights, or products liability, whether resulting from negligence or otherwise, or from any use or operation of any ideas, instructions, procedures, products or methods contained in the material therein.

The publication of an advertisement in the POD Edition does not constitute on the part of the Owner, the Publisher or the Licensee a guarantee or endorsement of the quality or value of the advertised products or services described therein or of any of the representations or the claims made by the advertisers with respect to such products or services.

Copyright© (2025) by the authors  
Open access publication under the CC-BY-NC-ND License  
<https://creativecommons.org/licenses/by-nc-nd/4.0/>  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2025)

For permission requests, please contact the publisher, Elsevier Limited  
at the address below.

Elsevier Limited  
The Boulevard, Langford Lane  
Kidlington  
Oxford OX5 1GB UK

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

Distributed Virtual Power Plant Optimization via Scenario Approach..... 1 <i>Alessandro Del Duca, Fredy Ruiz</i>	1
A Cooperative Distributed Algorithm for Handling Reactive Power Saturation in Active Distribution Networks ..... 7 <i>G. M. Casolino, G. Fusco, M. Russo</i>	7
Semi-Decentralized Game Solution for Charging Schedule of Electric Vehicles..... 13 <i>M. Ghavami, F. Vasca, L. Iannelli, D. Liuzza, E. Mostacciuolo</i>	13
A Distributed MILP-ADMM Framework for Italian Energy Communities: Shared Energy Incentives, Renewables, and Shiftable Loads..... 19 <i>A. Mohamed Messilem, Riccardo Brumali, Guido Carnevale, Giuseppe Notarstefano, Ruggero Carli</i>	19
An Effective Energy Management System to Assess the Convenience of Participating in Electricity Markets..... 25 <i>M. Martino, M. Invernizzi</i>	25
Hosting Capacity Evaluation in Radial and Weakly Meshed Medium Voltage Networks ..... 31 <i>Maria Martino</i>	31
Photo-Set: A Dataset for Physics-Based Cybersecurity Monitoring in Photovoltaic Systems ..... 37 <i>Afroz Mokarim, Giovanni B. Gaggero, Giulio Ferro, Michela Robba, Mario Marchese</i>	37
Learning-Based Detection of Fault Type and Location in Electrical Distribution Networks ..... 43 <i>Sajjad M. Jalalat, Alberto Cavallo, Antonio Russo, Francesco Tucci</i>	43
Online Current Signature Analysis Approach for Cavitation Assessment in Hydraulic Pumps ..... 49 <i>David Cruz-Rangel, Naroa Perurena-Landache, Naiara De-La-Fuente-Azpeitia, Carlos Ocampo-Martinez, Javier Diaz-Rozo</i>	49
Estimating the Impacts of Topological Changes in Sub-Transmission Areas using Hybrid Observers..... 55 <i>Artur H. D. S. Heerd, Alessio Iovine, Guillaume Ganet-Lepage, Sorin Olaru, Antoine Girard</i>	55
Novel Model-Based Framework for Multi-Fault Analysis in Ball Bearings ..... 61 <i>Vanessa Arenas-Angulo, Carlos Ocampo-Martinez, Javier Diaz-Rozo</i>	61
Smart Residential Energy Management: Evaluating Seasonal and Tariff Impacts on Battery Aging..... 67 <i>Tayenne D. De Lima, Pedro Faria, Zita Vale</i>	67
Automated Thermal Fault Detection in Ultra-High Voltage Substation Equipment..... 73 <i>Nikolaos Kardaris, Panagiotis Mermigkas, George Moustiris, Costas Tzafestas, Petros Maragos</i>	73
Green Hydrogen Microgrids for Remote Areas: Design, Assessment, and Feasibility ..... 79 <i>Andrea Cusva-García, Guillermo Jiménez-Estévez, Nicanor Quijano</i>	79
Impact of Dust Accumulation on Solar Panel Performance: A Predictive Approach using Regression Models ..... 85 <i>Abdelali Abdessadak, Nadège Thirion-Moreau, Hicham Ghennioui, Mounir Abraim, Safae Merzouk, Brahim El Bhiri</i>	85

Nonlinear Dynamic Modeling and Control of Ethanol Steam Reforming for Hydrogen Production.....	91
<i>Mateo Arcila-Osorio, Francesco Destro, Carlos Ocampo-Martinez, Jordi Llorca, Richard D. Braatz</i>	
Decarbonizing Steel Production: Economic and Environmental Implications of Green Hydrogen-Based Direct Reduction.....	97
<i>M. Iodice, L. Ardito, S. Lisi, G. Digregorio, A. C. Garavelli</i>	
Energy Management for EV Owners in V2H: Case Study in Colombia.....	103
<i>Diego Gelvez, Cesar Diaz-Londono, Gibran D. A. Tinajero, José Vuelvas, Josep M. Guerrero</i>	
Optimal Co-Design of a Hybrid Energy Storage System for Truck Charging.....	109
<i>Juan P. Bertucci, Sudarshan Raghuraman, Theo Hofman, Mauro Salazar</i>	
Electrochemical-Model-Based Estimation of Li-Ion Battery SoC: Performance and Limitations of EKF Method in an Electromobility Use Case .....	115
<i>Shahbaz Ali, Antoneta I. Bratcu, Pierre-Xavier Thivel, Iulian Munteanu</i>	
PSO-Based Energy Management Strategy for Electric Vehicles Integrating Batteries and Supercapacitors .....	121
<i>Fatimzahra Asnai, Hamid Ouadi, Amine Yazidi, Hassan Rafia, Saida El Bakali</i>	
Model Identification Frameworks for V2G Available Aggregated Capacity Prediction: Transferability and Explainability .....	127
<i>Francesca Sapuppo, Luca Patanè, Maria G. Xibilia</i>	
Operational Management of Multiple Energy Communities in the Energy Market: A Bilevel Optimization-Based Approach .....	133
<i>Virginia Casella, Lorenzo Farina, Giulio Ferro, Luca Parodi, Michela Robba</i>	
Grid Decarbonization: Examination of Data-Driven Methods for Emission Factor Estimation .....	139
<i>Jonghyun Choi, Byungkwon Park</i>	
Improving Self-Sufficiency of a Net-Zero Multi-Energy System Through CHP Fuel Cell and Hydrogen Storage.....	145
<i>Francesco Lorusso, Rodrigo Fiorotti, Maria Valenti, Sergio Bruno</i>	
Optimizing Collective Pitch Control in Wind Turbines using Deep Reinforcement Learning and OpenFAST Simulation .....	151
<i>Victor Espinoza, Carolina Ormaza, Yolanda Vidal, Christian Tutivén</i>	
Experimental Validation and Design of Nonlinear Predictive Control and Moving Horizon Estimation for District Heating.....	157
<i>Lorenzo Nigro, Simone Polimeni, Claudio Anderis, Marcelo Muro, Alessio La Bella</i>	
A Cohort-Based Optimization Model for Electric Vehicles Charging.....	163
<i>Giuseppe C. Calafiore, Luca Ambrosino</i>	
Advanced Fault Detection in Steam Turbines using Welch’s Method and Probabilistic Modeling.....	169
<i>Cristian Puerto-Santana, Nagore L. Lizarraga-Odriozola, Javier Diaz-Rozo, Carlos Ocampo-Martinez</i>	
AI-Based Solution for Efficient Disturbance Rejection in Mini Hydropower Plant .....	175
<i>Roxana Motorga, Vlad Muresan, Mihail Abrudean, Daniel Moga, Nicoleta Stroia, Cristian Bondici</i>	

Interpretability of the ML-Based State of Risk Predictions for the Electric Grid Forced Outages .....	181
<i>R. Baembitov, A. Karmacharya, M. Kezunovic, D. Saranovic, Z. Obradovic</i>	
Leveraging Neural ODEs for Power System Dynamic Analysis: Parareal Algorithm and System Identification .....	187
<i>Wonjune Song, Georg Pangalos, Nils Wiese, Roland Singer, Seungpil Moon, Byungkwon Park</i>	
Personalized Federated Deep Reinforcement Learning for Smart Home Energy Management.....	193
<i>Zhiqiang Chen, Jiadong He, Liang Yu, Qianchuan Zhao</i>	
Dynamic Modeling and Simulation of Gas Distribution Networks with Decentralized Hydrogen Injections .....	199
<i>Guido Sassaroli, Marcelo Muro, Vincenzo Casamassima</i>	
BIM-Python Synergy for Energy Analysis.....	205
<i>Francesca Porcellini, Enrico P. Zitiello, Antonio Salzano, Maurizio Nicoletta</i>	
Natural and Mechanical Ventilation Management for Indoor Air Quality MPC .....	211
<i>C. Pepe, S. M. Zanoli</i>	
AI-Enabled Early Faults and Anomalies Detection in Electric Inverters .....	217
<i>Armin Mazinani, Luca Davoli, Laura Belli, Gianluigi Ferrari</i>	
Thermal Environment Analysis for Energy Efficiency and Heritage Conservation via Regression Trees and Random Forests.....	223
<i>Francesco Smarra, Tullio De Rubeis, Giovanni Pasqualoni, Fabio Franchi, Alessandro D'Innocenzo, Dario Ambrosini</i>	
Novel Strategy for Optimal Active and Reactive Power Flows Management in a Small-Scale Microgrid System Under Forecasting Uncertainties .....	229
<i>S. Gheouany, H. Ouadi, S. El Bakali, H. Rafia</i>	
PSO Optimization-Based Control for Floating Offshore Wind Turbine: Maximizing Power Generation and Reducing Platform Motion.....	235
<i>H. Rafia, H. Ouadi, A. Boulal</i>	
A Cost-Optimal Predictive Operation Scheme for Sector-Coupled Energy Plants with Start-Up Delays and Start-Up costs .....	241
<i>Gökçen D. Şen, Juan E. Machado, Johannes Schiffer</i>	
Smart Metering and Hardware Trojan Electronic Digital Twin Based on Artificial Intelligence .....	247
<i>A. Massaro, N. Epicoco, G. Loseto, G. Starace, C. A. Ardito</i>	
Economic Reinforcement of Low Voltage Power Grids with Battery Energy Storage Systems: Combined Grid Service and Spot Market Trading .....	253
<i>Daniel Friedrich, Carsten Jungandreas, Benny Gottschalk, Mirko Bodach, Matthias Schirmer, Pu Li</i>	
Game-Theoretic Incentive Design for Sustainable Groundwater Management .....	259
<i>Joo S. Lee, Anil Aswani</i>	
Adaptive Set Membership Photovoltaic Energy Generation Forecasting.....	265
<i>Andres Cordoba-Pacheco, Eduard Godayol, Fredy Ruiz</i>	
Design of a Multicasting Based Communication Architecture for Local Microgrid EMS using OPC UA.....	271
<i>Changdae Lee, Ngoc-Duc Ngu, Jinsu Shin, Young I. Lee</i>	

Output-Constrained Linear Decision Trees for Optimal Energy Management Approximation of Hybrid Batteries .....	275
<i>Sam Weckx, Maxime Monsieur, Taranjitsingh Singh, Ankit Surti</i>	
Understanding Smart Sustainable Buildings Nexus to the New Smart Energy System .....	281
<i>Pasquale Capezzuto, Maria Rizzi, Graziano De Scisciolo, Cataldo Guaragnella</i>	
Optimization of Bidirectional Electric Vehicle Charging Management to Address Domestic Load Imbalance .....	286
<i>N. Mounir, H. Ouadi, I. Jrhilifa, Y. Lahrarti, S. El Bakali, H. Rafia</i>	
Predictor-Based Dynamic Event-Triggered Digital Control for Islanded Microgrids .....	292
<i>Amedeo Andreotti, Bianca Caiazzo, Alberto Petrillo, Stefania Santini</i>	
Design of an Energy Management-Based Model Predictive Control for Catenary-Free Hybrid Trains .....	298
<i>Manuel Camarda, Gian P. Incremona, Alessio La Bella, Patrizio Colaneri, Edward Boje</i>	
Optimal Siting and Sizing of Electric Vehicles Charging Stations in a Logistic Network .....	304
<i>Lorenzo Farina, Giulio Ferro, Mohammad J. Jafari, Luca Parodi, Michela Robba</i>	
An Analysis of Modeling Battery Storage System Ramping Effect and Their Impact on Operational Costs of Residential Houses .....	310
<i>Ricardo Faia, Pedro Faria, Zita Vale</i>	
Optimal Positioning of Electric Vehicle Chargers for Efficient Land Use in Smart Cities: Integration with Fuel Stations.....	315
<i>Federico Signorile, Fabio Mastromarino, Paolo Scarabaggio, Valeria Gialò, Raffaele Carli, Mariagrazia Dotoli</i>	
A DC Microgrid as Electric Vehicle Supply Infrastructure: Energy Management Architecture and Field Implementation.....	321
<i>F. Marasciuolo, M. Dicorato, G. Forte, G. Tricarico</i>	
Adaptive Inertia Controller for Grid-Forming Converters .....	327
<i>Diego Rigato, Davide Biadene, Paolo Magnone, Tommaso Caldognetto</i>	
Ancillary Services Through Coordinated Distributed Power Electronic Converters in Three-Phase Microgrids .....	333
<i>A. Mohamed Messilem, Andrea Lauri, Guido Carnevale, Davide Biadene, Tommaso Caldognetto, Ruggero Carli</i>	
Multi-Objective Fitted Q-Iteration: Random Sampling for Enhanced Weights Simplex Exploration.....	339
<i>Emiliano Longo, Davide Spinelli, Matteo Giuliani, Andrea Castelletti</i>	
A Multi-Objective Optimization Approach for Air Quality and Energy Plans .....	345
<i>Laura Zecchi, Michele F. Arrighini, Claudio Marchesi, Maria Luisa Volta</i>	
Global Carbon Cycle: Model Complexity and BIBO Stability .....	351
<i>Enrico Canuto, Carlo Novara, Alessandro D'Apice</i>	
Multi-Objective Optimization of Microgrid Sizing Integrating a Water Heating System Under a Tranche Electricity Tariff.....	357
<i>Saida El Bakali, Hamid Ouadi, Saad Gheouany, Nada Mounir, Youssra Lahrarti, Fatimazahra Asnai</i>	

## Author Index