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Final Project Report & Plenary Workshop

ENERGY COMMUNITY MANAGEMENT: DISTRIBUTED ALGORITHMS AND TOOLBOXES FOR EFFICIENT AND SUSTAINABLE OPERATIONS



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II



UNIVERSITÀ DEGLI STUDI
DEL SANNIO Benevento



UNIVERSITÀ
DEGLI STUDI
DI GENOVA



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA



Friendly Power
*think, live, act
green*

28 November 2025 - Naples, Italy
UNINA Federico II - DIETI
Seminar Room, Building 3, 1st Floor
Via Claudio 21

Welcome Remarks & Agenda



Prof Luigi Glielmo
Dept of Electrical Engg &
Info Tech,
University of Naples
Federico II
*"Optimal Design in REC:
Novel Business Models and
Algorithmic Perspectives"*

LEAD INVESTIGATORS/TEAMS: RESULTS & FUTURE DIRECTIONS

- 10:00 – 10:20: Welcome Remarks (Glielmo)
- 10:20 – 11:00: Joshi/Team UNINA
- 11:00 – 11:40: Notarstefano/Team UNIBO
- 11:40 – 12:00: Coffee Break
- 12:00 – 12:40: Casella, Ferro, Parodi/Team UNIGE
- 12:40 – 14:30: Discussion/Lunch break

Prof Michela Robba
Dept of Comp Science,
Robotics & Sys Engg,
University of Genoa
*"Renewable Energy
Communities: Optimization of
Shared Revenue and
Demand Response Services"*



Prof Giuseppe Notarstefano
Dept of Electrical Energy
& Info Engg,
University of Bologna
*"Distributed Optimization and
Learning for Aggregative
Management of Energy
Communities"*

Team UNINA/UNISANNIO: Chie Shin Fraser, Amit Joshi, Massimo Tipaldi, Kachhad Vishal, Shahram Yadollahi, Luigi Glielmo
Team UNIBO: Ruggero Carli, Guido Carnevale, Giuseppe Notarstefano
Team UNIGE: Virginia Casella, Lorenzo Farina, Giulio Ferro, Luca Parodi, Michela Robba

Dott Vincenzo Raffa
Director, Friendly Power Srl
*"RECs: Legal and Economic-
Financial Aspects within
the Constantly Evolving Italian
Framework"*



Prof Maria Prandini
Dipartimento di
Elettronica, Info e
Bioingegneria,
Politecnico di Milano
*"Balancing Service
Provision via Aggregation
of Flexible Prosumers"*

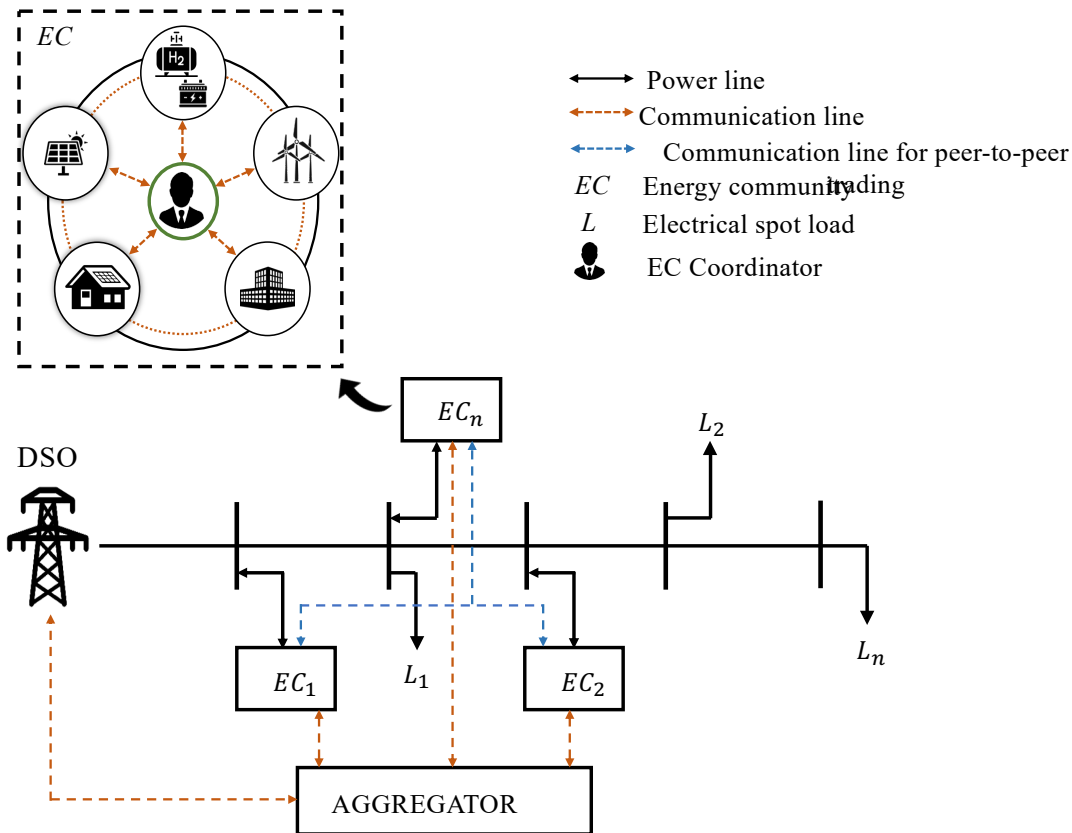
GUESTS: COMPLEMENTARY ADVANCEMENTS/DEVELOPMENTS

- 14:30 – 15:10: Guest/Dott Vincenzo Raffa, Friendly Power
- 15:10 – 16:00: Guest/Prof Maria Prandini, POLIMI
- 16:00 – 16:10: Coffee break
- 16:10 – 17:00: Guest/Prof Ruggero Carli, UNIPD

Prof Ruggero Carli
Associate Professor
Dept of Info Engg,
University of Padua
*"A Step Towards
Decarbonization: the Role
of Distributed Coupled
Constraint Optimization
in Energy Systems"*



Project Overview



Multiple ECos, each equipped with Info & Comm Tech (ICT) infrastructure, participate in external energy markets and simultaneously self-organize through internal negotiation policies. An EC coordinator supervises internal operations of associated ECos, to maximize self-consumption, and ensure fairness to users. Each ECo may include individual/collective prosumers and/or consumers and/or producers: individual prosumers may be a households with local PV panels and storages, while a collective prosumer may be a microgrid or a “sustainable district”.

ECos: proximate end-users, including public/private entities, having electrical and/or thermal energy demands, who enter mutually agreed, resource-sharing contracts, to pool/optimize use of respective (individually/jointly-owned) distributed renewable energy generation/storage assets; effectively deliver potential environmental, social, and economic benefits - i.e. “triple bottom-line” benefits.

ECODREAM:

- delivers innovative “ECo” solutions to harness the potential of Energy Communities (ECos), key to developing sustainable urban environments supported by flexible, stable smart energy grids.
- facilitates effective and reliable ECo operations, thereby enhancing grid stability and flexibility
- provides a synergic suite of solutions: *mathematical models; distributed control and optimisation algorithms, and software toolboxes to ensure global optimality and safety*
- ensures validation/testing on real ECo test-bed of effectiveness, performance, scalability of solutions.

Expected Outcomes

ECODREAM Solutions/Deliverables

Models; Distributed Algorithms; Software Toolboxes; Experimental Testing for:

❖ *ECo Design*

- Optimal component sizing and community sizing

❖ *ECo Operations & Management*

- Internal (intra-community) operations assuming cooperative behaviours
- External (inter-community) operations involving multiple ECos under a common aggregator assuming cooperative or competitive behaviours
- Generating localised control policies ensuring global optimality, safety

❖ *Validation & Scalability Testing*

- Testing on emulated, scaled-down ECo integrating the Smart Polygeneration Microgrid (SPM) and Smart Energy Building (SEB) at UNIGE (University of Genova) Savona Campus
- Realistic large-scale simulations based on real data from Roseto Valfortore ECo

ECo “Triple Bottom-Line” Benefits

▪ *Environmental:*

greater RES production and self-consumption, leading to lower overall carbon footprint

▪ *Social:*

increased end-user/community engagement and participation

▪ *Economic:*

lower distribution/transmission costs and grid losses; energy cost savings and revenue potential for ECos

Deliverables



Project GANTT: Deliverables & Milestones	Y1												Y2											
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
WP1 - Project management, dissemination and comm (Leader - UNISAN)																								
Task 1.1 Project management (UNISAN*)																								
Task 1.2. Dissemination and communication (UNIBO*, UNISA, UNIBO)																								
WP2 - ECs modeling (Leader - UNIGE)																								
Task 2.1 Models for sizing and internal operations (UNISAN*, UNIBO)																								
Task 2.2 Models for external operation (UNIGE*, UNIBO)																								
WP3 - Algorithms and toolboxes for Ecs sizing and operations (Leader - UNIBO)																								
Task 3.1 Sizing (UNISAN*, UNIGE)																								
Task 3.2. Internal operations (UNIBO*, UNISAN)																								
Task 3.3. External operations (UNIGE*, UNIBO)																								
WP4 - Validation and testing (Leader - UNIGE)																								
Task 4.1. Toolbox development and synthetic data simulations (UNIBO*, UNISAN)																								
Task 4.2. Toolbox validation with realistic data (UNISAN*, UNIBO)																								
Task 4.3. On- field tests at Savona Campus SPM and SEB (UNIGE*, UNISAN, UNIBO)																								
Milestones																								
				MS1							MS2							MS3	MS5					
																		MS4						
Deliverables																								
											D2.2	D2.2	D1.1		D3.1	D3.2	D4.1						D1.2	
												D1.3											D1.4	
																							D4.2	
																							D4.3	

MS1-Preliminary models available (M4); **MS2**-Final models available (M12); **MS3**-Baseline from the EC in Roseto Valfortore (M18); **MS4**- Algorithms for sizing and internal/external operations available (M18); **MS5**-Toolboxes available (M20)

PROJECT DURATION: October 2023-September 2025
NOTE: PRIN Ecodream Extension until February 2026 Approved

Work Packages (WP1): **Lead – UNINA/UNISAN**

❖ WP1 - Project Management, dissemination and communication (M1-M24)

Project Management:

❖ Overall Organisation-Coordination, PRIN Administrative & Compliance Requirements

- Setup of MS Teams ECODREAM Channels to better organise inter-university work flows and communications
- Setup of ECODREAM Online Presence
 - LinkedIn [https://it.linkedin.com/company/ecodream-sustainable-eco-solutions?trk=public_post_feed-actor-name]
 - ECODREAM Website [<https://ecodream.dieti.unina.it/index.php>]
- Project Meetings
 - Virtual: 2 meetings
 - ECODREAM Kickoff Meeting - 27 Nov 2023
 - Interim Progress Update Meeting – 7 July 2025
 - In-person: 2 meetings in Naples, at DIETI
 - Work-planning & Collaboration Meeting – 12 April 2024
 - Final Project Report & Plenary Workshop – 28 Nov 2025



Work Packages (WP1): Lead – UNINA/UNISAN

❖ WP1 – Project Management, dissemination and communication (M1-M24)

Communication and Dissemination:

- ❖ Primary public-facing communication vehicles:
 - Regular posts and updates
 - ECODREAM LinkedIn Group
[https://it.linkedin.com/company/ecodream-sustainable-eco-solutions?trk=public_post_feed-actor-name]
 - ECODREAM Website
[<https://ecodream.dieti.unina.it/index.php>]:
Dedicated website hosted through UNINA – provides full details about the project and related events/developments, etc

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ECODREAM

HOME PROJECT TEAM TARGETS RESULTS FUNDING DISSEMINATION

ENERGY COMMUNITY MANAGEMENT: DISTRIBUTED ALGORITHMS AND TOOLBOXES FOR EFFICIENT AND SUSTAINABLE OPERATIONS

ECODREAM – ENERGY COMMUNITY MANAGEMENT: DISTRIBUTED ALGORITHMS AND TOOLBOXES FOR EFFICIENT AND SUSTAINABLE OPERATIONS

PROJECT OVERVIEW

ECODREAM seeks to deliver innovative "Eco" solutions designed to harness the potential of Energy Communities (ECos), which are key to developing sustainable urban environments supported by flexible and stable smart energy grids. ECos are formed by proximate end-users, including public and private entities, having respective electrical and/or thermal energy demands, who enter mutually agreed, resource-sharing contracts, to pool and optimise use of their respective (individually/jointly-owned) distributed renewable energy generation and storage assets. In so doing, ECos effectively deliver potential environmental, social, and economic benefits - i.e. "triple bottom-line" benefits.

Read more: [Project](#)

ANNOUNCEMENT: ECODREAM FINAL PROJECT REPORT & PLENARY WORKSHOP - 28 NOVEMBER 2025

Venue: UNINA Federico II, DIETI - Seminar Rm, Building 3, Via Claudio 21, Naples, Italy

WORKSHOP OVERVIEW

The workshop will showcase the results of the 2-year ECODREAM project presented by the lead investigators and deliberate future activities. Complementary presentations on related developments/advancements will also be delivered by guest speakers from an industrial partner as well as from two other prominent Italian universities not directly involved in the PRIN project.

Virtual Participation: **Open to students, researchers/academics, other stakeholders. MS Teams link.**

Read more: [Announcement: ECODREAM Final Project Report & Plenary Workshop - 28 November 2025](#)

AUTOMATIC CONTROL IN THE ERA OF ARTIFICIAL INTELLIGENCE - SEMINAR

Seminar Announcement

Seminar Organised by: **Profs. Luigi Gielimo & Bruno Siciliano**

Automatic Control in the Era of Artificial Intelligence

PROF. FRANCESCO BORRELLI, FANUC
Chair in Mechanical Systems
Department of Mechanical Engineering, University of California, Berkeley
<https://me.berkeley.edu/people/francesco-borrelli/>

Monday, 24 March 2025, 09:00–10:00
Venue: UNINA Federico II – DIETI, Via Claudio, Bldg 1, Floor 2, Room II.3, 80125 Naples, Italy
Virtual: MS Teams Online.

In an era where Artificial Intelligence (AI) is often seen as a universal solution for any complex problem, this presentation offers a critical examination of its role in the field of automatic control. It will focus on Optimal Control techniques, navigating through its history and addressing the evolution from its traditional model-based roots to the emerging data-driven methodologies empowered by AI.

Read more: [Automatic Control in the Era of Artificial Intelligence - Seminar](#)

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Work Package WP1 - Project Management, Dissemination & Communication

Communication and Dissemination:

- ❖ Events/Conferences and Expert Panels
 - Conferenza Energia e Ambiente della Regione Basilicata "Strategia energetica e traiettorie di sviluppo" - participation on Expert Panel



- 20th China National Conference on Complex Networks (CCCN 2024) - Nanjing, China / 26 October 2024: Plenary Presentation "Modelling and Optimization for Green Transition of Complex Energy Networks"
- 22nd Conference on International Exchange of Professionals "Gathering Global Talents, Fostering Win-Win Cooperation" - Shanghai, China / 2 November 2024: Presentation "Towards Green Transition of Complex Energy Networks"



Communication and Dissemination: Seminar Series - Guest Speakers



Automatic Control in the Era of Artificial Intelligence

Prof Francesco Borrelli,
FANUC Chair in Mechanical Systems
Dept of Mechanical Engineering,
University of California, Berkeley
Monday, 24 March 2025



Optimisation-based Control of Flexible Resources in Sustainable Energy Networks

Prof Alessandra Parisio
University of Manchester
Dept of Electrical & Electronic Engg
5 February 2025



Learning MPC: a Data-efficient Model-based Reinforcement Learning Strategy for Iterative Tasks"

Ugo Rosolia
Senior Research Scientist &
Science Manager, Amazon USA
29 May 2025

Work Packages

- ❖ WP2 - ECs Modeling (M1-M12); Lead - UNIGE
- ❖ WP3 - Algorithms & toolboxes for ECs sizing and operations (M8-M18); Lead - UNIBO
- ❖ WP4 - Validation and testing (M11-M24); Lead - UNIGE

❖ UNINA/UNISAN Contribution to WPs 2/3/4: Tasks 2.1; 3.1, 3.2; 4.1, 4.2, 4.3

➤ Technical Presentation:

“Optimal Design in REC: Novel Business Models and Algorithmic Perspectives”

➤ Publications:

- Joshi, A. and Glielmo, L., 2025. **A Reinforcement Learning based Decision Support System for Multi-stage Rooftop Solar Panel Investment in a Renewable Energy Community** (under review in Engineering Applications of AI, submitted November, 2, 2025)
- Kachhad, V., Joshi, A. and Glielmo, L., 2025. **Techno-Economic Modelling and Component Sizing in Renewable Energy Communities: A Participant Perspective**. *arXiv preprint arXiv:2511.15321*.
- Musicò, E., Ancona, C., Iudice, F.L. and Glielmo, L., 2024. **An Optimal Control Approach for Enhancing Efficiency in Renewable Energy Communities**. IEEE Control Systems Letters.
- Kachhad, V., Joshi, A., Mariani, V., Raffa, V. and Glielmo, L., 2024, August. **A Techno-Economic Modelling and Component Sizing in Renewable Energy Communities: The Perspective of Technical Facilitators**. In 2024 IEEE 20th International Conference on Automation Science and Engineering (CASE) (pp. 329-334). IEEE.
- Kachhad, V., Joshi, A., Mariani, V., Raffa, V. and Glielmo, L., 2023, October. **A Periodicity Based Approach for Optimal Sizing of Grid-Connected Household PV-BESS System**. In 2023 IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids (SmartGridComm) (pp. 1-6). IEEE

THANK YOU!

