

Research Group

Carbon Neutral Buildings - CNB

Reference year:

2024

Scientific Coordinator:

VIOLANO ANTONELLA / Associate Professor / Department of Architecture and Industrial Design (DADI) / Università degli Studi della Campania “Luigi Vanvitelli”

Group members:

Group members at the DADI of the Università degli Studi della Campania “Luigi Vanvitelli”:

CANNAVIELLO Monica/ Ricercatore a t.d. - t.pieno (art. 24 c.3-b L. 240/10)

CAPOBIANCO Lorenzo/ Associate Professor

CARILLO Saverio/ Full Professor

CENNAMO Claudia/ Associate Professor

ESPOSITO Monica / Researcher (art. 24 c.3-a L. 240/10)

FRANCHINO Rossella/ Associate Professor

FRETTOLOSO Caterina/ Associate Professor

MANZO Elena/ Full Professor

OTTIERI Simona/ Ricercatore a t.d. - t.pieno (art. 24 c.3-b L. 240/10)

Research fellow

MEROLA Marica/ Università degli Studi della Campania “Luigi Vanvitelli”

Ph. D. Student

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FIORILLO Federica/Ph.D. student/ Università degli Studi della Campania “Luigi Vanvitelli”

Scientific collaborations with professors from other Italian and foreign Department/Universities:

ANGELUCCI Filippo/ Professore Associato/Università di Chieti-Pescara “G. D’Annunzio”

BATTISTI Alessandra/ Professore Ordinario/Università La Sapienza di Roma

BOUDEN Chiheb/ Professor / University of Tunis El Manar (UTM), Tunisia

CASANOVAS Boixereu F. Xavier/ Professor/Universitat Politècnica de Catalunya Barcellona (ES)

D’AMBROSIO Valeria/ Professore Associato / Università di Napoli “Federico II”

DAVOLI Pietromaria / Professore Ordinario/ Università di Ferrara

FERCHICHI Souha/ MEDREC - Mediterranean Renewable Energy Centre

FUMO Marina/ Professore Ordinario/Università degli Studi di Napoli “Federico II”

GALLO Paola / Professore Associato/ Università degli studi di Firenze

GIORDANO Roberto/ Professore Ordinario/Politecnico di Torino

HATPULUGIL Timucin / Associate Professor/ Cancaya University, Ankara (Turchia)
IBRIK Imad / Professor /An-Najah National University - Energy Research Centre (ERC), Palestine
LOPEZ-IZQUIERDO Pia/ Professor/ Universidad Politecnica de Madrid (ES)
LUCIANO Dario / Architetto
MAIO Antonio/Direttore scientifico/ Museo Diffuso Diamare Sessa Aurunca (MUDISE)
MOLINA José L./ Professor / Universidad de Sevilla, Departamento de Ingeniería Energética,
Escuela Técnica Superior de Ingenieros
MUZZILLO Francesca/ Professore Ordinario/Università della Campania “L. Vanvitelli”
OLIVARES Lucio/Professore Ordinario/ Università della Campania “L. Vanvitelli”
PALMERO Luis Iglesias/ Professor/Universitat Politècnica de València (SPAIN)
PALMERO Pedro/ Professor/ Universidad Politecnica de Madrid (ES)
PEPINO Ilaria/ Designer
PEREZ-HERNANDEZ Julio Cesar/Associate Professor/School of Architecture/ University of Notre
Dame (USA)
PORTELLA Palmachiara / Architetto
RACOLTA Andrei-Gheorghe/Professore Associato/Università Politecnica di Timisoara (Romania)
SABBARESE Carlo/Professore Associato/ Università della Campania “L. Vanvitelli”
SATIROPOULOU Alexandrà/ Professor/National Technical University of Athens (GR)
SAVARESE Giuseppina/ Designer
SPOSITO Cesare/ Professore Associato/ Università di Palermo
TRIANI Euphrosine/ Professor/Department of Architecture/University of Patras (GR)
TUCCI Fabrizio / Professore Ordinario/ Università La Sapienza di Roma

Description of research lines:

The Research Group investigates, with a multidisciplinary and multiscale approach and circular and regenerative thinking, the technical, procedural and methodological aspects of Technological and Environmental Design for the decarbonization of the built environment, the reduction, rationalization and optimization of energy consumption, the use and integration of renewable energy sources, and the development of innovative technological solutions while making innovative use of traditional technological solutions. Reducing carbon dependence (carbon footprint), recycling carbon from biomass and waste (negative carbon emission) and removing excess carbon (embodied carbon neutrality) are the three supporting pillars for a real ecological transition of the built environment.

The Research Group has selected five approaches, among the main ones proposed by the European Union Circularity Plan, which are integral to the scientific working method: Cradle to Cradle, Design for Adaptability (DfA), Design for Disassembly and Deconstruction (DfD), Design for Recycle (DfR), as well as the possibility of performing the built environment as "material banks"(BAMB).

A specialist focus is on Product and Process innovation of advanced bio-based building materials, of which the carbon footprint, embodied energy, and identification of environmental carrying capacity are studied, through:

- the design integration of nature-based solutions (such as living walls, green roofs, etc.) to address the goals of decarbonization and environmental integration of bioclimatic, technological, energy and "carbon sequestration" dimensions.
- The evaluation of carbon storage in building materials to achieve the Carbon Neutrality goal;

- the analysis of the potential use of carbon-storing materials, with particular reference to the two classes of building materials that possess an inherent capacity to store CO₂: cementitious materials (e.g., concrete, mortar and aggregates) and biogenic materials (e.g., thermal insulation). There is also a focus on historical analysis and regeneration of urban spaces that require an active and adaptive process of conservation and reuse of historical heritage. Energy restoration and adaptive reuse interventions, implemented as tools of the circular economy, open up scenarios of sustainability also in the complex and multifaceted sector of architectural heritage valorisation.

The Research Group's activities, some conducted in collaboration with the innovative start-up DReAM-IT srl, linked to the SITdA Research Clusters: "Energy Climate Architecture" (Coord. Pietro Davoli), "Architectural Heritage" (Coord. Alessandra Battisti) and "Environmental Design" (Coord. Mario Losasso), which are joined by lecturers/researchers from 20 different Italian universities.

Relationships with other research groups of the University of Campania L. Vanvitelli during the last three years:

- BIM technology and material innovation: from efficiency to environmental compatibility (coord. prof. R. Franchino/DADI)
- The Memory of Sites. History and Preservation for promoting the environmental and architectural heritage (MemoS)
- Political, legal e sociological profiles of phrenological research in Italy (Resp. prof. A. Cesaro/Dipartimento di Scienze Politiche)

Participation in research projects during the last three years:

Project Title: From Common Goods to Ecological Resources. Environmental Development Prospects for Areas Subject to Civic Use in Campania and Molise

Scientific Responsible: Elena Manzo

Announcement Title: PRIN PNRR 2022

Staff involved: M. D'Aprile, F. Fiorillo, M. Calabrò, S. Losco, F. Muzzillo, A. Violano.

Project status: in corso

Project status: 01/12/2023 – 30/11/2025

Project Title: BIO-BASED REGENERATIVE MATERIALS

Scientific Responsible: Antonella Violano

Announcement Title: Industrial research project

Staff involved: M. Cannaviello

Project status: ongoing

Project submission/start/end dates: 01.12.2021 – 30.11.2023

Project title: THERMAL HERITAGE FOR ECOSUSTAINABLE REGENERATION, MOBILITY AND ECONOMY (THERME)

Scientific Responsible: Monica Esposito

Announcement Title: Young researchers project DR 509/2022 VALERE

Staff involved: M. D'Aprile, C. De Biase, E. Manzo, D. Matricano, R. Serraglio, A. Violano, M. Cerro, F. Fiorillo, M. Merola, M. Perticarini.

Project status: in progress

Project submission/start/end dates: 17.10.2022-17.01.2024

Project title: DEVELOPMENT&RESEARCH ACTION ON MATERIALS INNOVATION TECHNOLOGIES. Activities of the innovative start-up DReAM-IT srl born from the academic spin-off of the University of Campania "Luigi Vanvitelli".

Scientific Director: Antonella Violano

Staff involved: M. Cannaviello, M. Merola, A. Violano

Project status: in progress

Dates of start/end of project: 01.06.2022/ 31/12/2100

Project title: MEDITERRANEAN UNIVERSITY AS CATALYST FOR ECO-SUSTAINABLE RENOVATION (MedEcoSuRe)

Scientific Responsible: Antonella Violano (for DADI)

Announcement title: ENI CBC MED Project - European Union

Description of the project research activities

The project brings together researchers and stakeholders to build a common awareness on eco-sustainable building retrofits and aims to enhance the regional knowledge-action process, starting from the university's immediate neighbourhood, which is the university building. Through a 'Living Lab', energy retrofit solutions are proposed to university energy managers on the basis of decision support tools that take into account social, economic and environmental aspects.

Staff involved: R. G. Aenoai, M. Cannaviello, L. Capobianco, M. Merola, Portella P., F. Muzzillo, A. Violano

Partners: Mediterranean Renewable Energy Centre (MEDREC), Tunisia

University of Tunis El Manar (UTM), Tunisia

University of Florence - Department of Architecture (UNIFI-DIDA), Italy

University of Seville - Thermal Energy Engineering Department (TMT-US), Spain

An-Najah National University - Energy Research Centre (ERC), Palestine

Naples Agency for Energy and Environment- (ANEA), Italy

Spanish association for the internationalization and innovation of solar companies (SOLARTYS), Spain

University of Campania- Department of Architecture and Industrial Design (DADI), Italy

National Cluster of the Sectors of Home Automation, Smart Buildings and Smart Cities

(DOMOTYS), Spain

University of Naples Federico II - Department of Industrial Engineering, Italy

Project status: funded, closed

Dates of start/end of project: 1.10.2019-31.08.2023

Project title: 3x3 ZERO ENERGY BUILDING (3x3ZEB)

Scientific Responsible: Antonella Violano

Announcement title: Industrial research project

Description of the project's research activities: The research project, conducted in partnership with LSF ITALIA SRL, which funded the research, is aimed at the design and construction of a demonstrator building: Minimum single-user residential unit 3x3 m, built with the LGS

Construction System, for which high-tech performance envelope packages were designed. In response to the provisions of Directive 2018/844/EU, the prototype responds to the need for strong decarbonization, uses new technologies and electronic systems to adapt to consumer needs.

Staff involved: M. Cannaviello, L. Capobianco, S. Rinaldi, A. Violano

Partners: LSF Italia srl
Project status: in progress
Dates of start/end of project: 12.03.2019 – 12.03.2024

International Research: Green Ways. Wissensrouten und Netzwerke zwischen Orten mit besonderen regionalen, historischen und kulturellen Prägungen” (*Green Ways. Percorsi di conoscenza e reti ecosostenibili tra luoghi dal particolare valore storico e culturali*).

Announcement title: Deutsche Akademische Austausch Dienst (DAAD) (E.F. 2020-2021).

Scientific Responsible: Elena Manzo

Staff involved: M. D’Aprile, E. Manzo, M. Merola, M. Perticarini, A. Violano

Partner: Hochschule Bochum - Department of Architecture -Bochum University of Applied Sciences (Germany)

Project status: Closed

Dates of start/end of project: 01.01.2021 / 31.12.2021

Scientific products of the last three years:

10 scientific publications on Class A journals and/or indexed in the Scopus/WoS databases:

- [1] Carillo S. (2023) Napoli. Il paesaggio culturale di una città regione, in NeMLA Italian Studies, Journal of Italian Studies, Italian Section Northeast Modern Language Association, Special Issue: Revisioning/Revisiting Naples in the New Millennium, volume XLIV, ISSN 1087-6715, pp.1-35
- [2] D'Ambrosio, V., Violano, A. (2022). Re-inhabiting the building stock: technical policies and design innovations. *TECHNE*, p. 15-19, ISSN: 2239-0243, doi: 10.36253/techne-13437
- [3] Franchino R., Muzzillo F. (2022) The Innovation Keller Center Renovation, *Abitare la Terra Journal*, n. 58/2022, Roma; Gangemi Editore
- [4] Maio A., Violano A., (2024). The Regeneration of Architectural Heritage to Manage the Reversibility of Adaptive Reuse Technology Design: Two Italian Case Studies. In: AA.VV.. (a cura di): Battisti A. Baiani S., *ETHICS: Endorse Technologies for Heritage Innovation. Designing Environments*. p. 209-226, Cham: Springer Nature, ISBN: 978-3-031-50120-3, doi: 10.1007/978-3-031-50121-0_13
- [5] Olivieri, C., Adriaenssens S., C., Cennamo (2023), A novel graphical assessment approach for compressed curved structures under vertical loading, *International Journal of Space Structures*, 2023, 38(2), pp. 141-155
- [6] Violano A., Cannaviello M. (2022). Design process innovation through flexible and circular technological solutions. *VITRUVIO*, vol. 7(2), p. 60-73, ISSN: 2444-9091, doi: 10.4995/vitruvio-ijats.2022.18715
- [7] Violano A., Cannaviello M. (2023). The Carbon Footprint of Thermal Insulation: The Added Value of Circular Models Using Recycled Textile Waste. *ENERGIES*, vol. 16, p. 1-24, ISSN: 1996-1073, doi: 10.3390/en16196768
- [8] Violano A., Capobianco L., Cannaviello M. (2021). The Future Now: An adaptive tailor-made prefabricated Zero Energy Building. *TECHNE*, vol. Special Issue 2/2021, p. 122-127, ISSN: 2239-0243
- [9] Violano A., Ibrik I., Cannaviello M. (2021). Human-Centred Design: participated energy retrofit for educational buildings. In: **SUSTAINABLE MEDITERRANEAN**

CONSTRUCTION Journal, vol. 13/2021, p. 106-116, ISSN: 2420-8213

- [10] Violano A., Merola M. (2022). Energy Communities in smaller Mediterranean urban centres. In: Sustainable Mediterranean Construction Journal, vol. 14, p. 168-174, ISSN: 2420-8213

Additional 10 scientific products:

- [1] Capobianco L. (2023) Rigenerazione urbana: oltre l'architettura una sfida culturale e sociale. In: Aveta A., Castagnaro A. (a cura di), "Patrimonio culturale e naturale della Campania. rigenerazione urbana", VOL. 9, PP. 23-24, Editori Paparo, Roma, 2023; ISBN 979-12-813890-5-2
- [2] Carillo S. 2023 (h) Castelcicala, da borgo rurale a paesaggio culturale. Accessibilità e Conservazione, Presentazione al volume di Federico Cordella, Il territorio storico di Castelcicala, Michelangelo 1915 editore, Palma Campania 2023, pp. 7-9. ISBN 978-88-969555-40-6
- [3] Franchino R., Frettoloso C., Muzzillo F. (2021). Use of Natural Light for Catholic Sacred Architecture: Technological Strategies and Symbolic Values. In: AA. VV.. (a cura di): C. Gambardella, C. Cennamo, M. L. Germanà, M. F. Shahidan, H. Bougdah, Advances in Science, Technology & Innovation, vol. 1, p. 169-176, Cham: Springer International Publishing, ISBN: 978-3-030-50765-7, ISSN: 2522-8714, doi: 10.1007/978-3-030-50765-7, SCOPUS: 2-s2.0-85101088932
- [4] Franchino R., Frettoloso C., Muzzillo F. (2021). Use of Natural Light for Catholic Sacred Architecture: Technological Strategies and Symbolic Values. In: AA. VV.. (a cura di): C. Gambardella, C. Cennamo, M. L. Germanà, M. F. Shahidan, H. Bougdah, Advances in Science, Technology & Innovation, vol. 1, p. 169-176, Cham: Springer International Publishing, ISBN: 978-3-030-50765-7, ISSN: 2522-8714, doi: 10.1007/978-3-030-50765-7, SCOPUS: 2-s2.0-85101088932
- [5] Fumo M., Violano A. (a cura di) (2023). IM-MUTAZIONI. L'altro volto della piazza. Di AA.VV.. vol. 3, Napoli:Luciano Editore, ISBN: 978-88-6026-339-1
- [6] Manzo E., Violano A., D'Aprile M. (2022). The enhancement of Biocultural landscapes: history, heritage, and environment driving sustainable mobility in internal areas. In: (a cura di): Claudio Gambardella, BEYOND ALL LIMITS International Conference on Sustainability in Architecture, Planning, and Design. Complesso monumentale di San Leucio (CE), 11-12 maggio 2022, p. 79-83, DADI_PRESS 2022, ISBN: 978-88-85556-23-2
- [7] Ottieri S. (2022), Design and craftsmanship for urban regeneration, in 2nd edition of "Beyond All Limits. International Conference on Sustainability in Architecture, Planning and Design", 11-12 Maggio 2022, ISBN 978-88-85556-23-2, DADI_PRESS
- [8] Palmero Iglesias L., Bernardo G., Aenoai R. G., Violano A. (2023) The performed based regeneration of Author Social Housing Districts In: Zerlenga O., Jacazzi D., Corniello L.(ed by) CLIMATE CHANGE AND CULTURAL HERITAGE. Proceedings del IV International Forum on Architecture and Urbanism IFAU 2023, 22 - 23 June 2023, p. 91, DADI Press, ISBN: 9788885556270
- [9] Violano A., Barbato N., Cannaviello M., Ferchichi S., Ibrik I., Khalifa I., Molina J. L., Trombadore A. (2022). Digital-green transition of knowledge buildings. In: (a cura di): Gambardella Claudio, BEYOND ALL LIMITS International Conference on Sustainability in Architecture, Planning, and Design. p. 211-215, Aversa (CE): DADI Press, ISBN: 978-88-85556-23-2

[10] Violano A., Cannaviello M. (2022). Bio-based thinking: ricerca e innovazione sui materiali carbon-zero per la circular economy. In: AA. VV. (a cura di): Tiziana Ferrante Fabrizio Tucci, BASES - Benessere, Ambiente, Sostenibilità, Energia, Salute. Programmare e progettare nella transizione. p. 387-395, Milano: Franco Angeli, ISBN: 9788835138310

Relationships with international and national Companies, Institutions, Research Centers, Universities during the last three years:

since 2023 - Scientific collaboration with the Universitat Politècnica de Timisoara (Romania)
since 2022 - Scientific collaboration with the Department of Architecture, Faculty of Architecture of Çankaya Üniversitesi (Turkey)
since 2022 - Scientific collaboration with the Escola Tècnica Superior d'Enginyeria d'Edificació of the Universitat Politècnica de València (ES)
2022 - Scientific collaboration with the Museo Diffuso Diamare Sessa Aurunca (MUDISE)
since 2019 - Scientific collaboration with Service Biotech srl for the design, analysis and prototyping of innovative biobased materials
since 2017 - Scientific collaboration with Escuela Técnica Superior de Edificación" of the "Universidad Politécnica de Madrid (ES)
since 2011 - Participation in the Network RehabiMed Barcelona (ES) Mediterranean interdisciplinary network aimed at sustainable rehabilitation, heritage restoration and urban regeneration.
since 2011 - Scientific collaboration with the School of Architecture of the National Technical University of Athens - (GR)

Collaborations with Consortia, Scarl or other Institutions participated by the University of Campania L. Vanvitelli during the last three years:

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ISI Web of Science Subject Categories:

Architecture; Engineering, Civil; Rehabilitation; Green & Sustainable Science & Technology; Environmental Studies; Materials Science, Biomaterials.

Scientific-Disciplinary Sectors:

- ICAR 07
- ICAR 08
- ICAR 09
- ICAR 10
- ICAR 12
- ICAR 13
- ICAR 14
- ICAR 19

Keywords:

Decarbonization, LEVEL(s) framework, Reduce, Reuse, Sequester approaches, Buildings as

Materials Banks, Whole Life Carbon, Carbon Footprint, Regenerative Design, Life Cycle Impact Analysis; Adaptive Reuse, Renewable Energy Sources, Bio-based Materials; "Cradle-to-Cradle, Energy Restoration, Architectural Heritage.

ERC Categories:

- PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics
- PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration of recovery of compounds, carbon capture & storage
- SH7_5 Sustainability sciences, environment and resources