

## Research Group

# Zero Energy Building towards Zero Embodied Energy Building (ZEB twd ZEEB)

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### Group members:

- BOSCO Antonio/ Associate Professor /DADI/Università della Campania “L. Vanvitelli”
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- MUZZILLO Francesca/ Associate Professor /DADI/Università della Campania “L. Vanvitelli”
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- FUMO MARINA/ Professore Ordinario/Università degli Studi di Napoli “Federico II”
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- PALMERO PEDRO/ Professor/ Universidad Politecnica de Madrid (ES)
- PEREZ-HERNANDEZ JULIO CESAR/Associate Professor/School of Architecture/ University of Notre Dame (USA)
- SATIROPOULOU ALEXANDRÀ/ Professor/National Technical University of Athens (GR)
- SPOSITO CESARE/ Associate Professor / Università di Palermo
- TRIANTIS EUPHROSINE/ Professor/Department of Architecture/University of Patras (GR)
- TUCCI FABRIZIO/ Full Professor /University La Sapienza di Roma

### **Description of research lines:**

The Research Group, which until 2019/12/31 had the name "Zero Energy Building and Urban Regeneration for Climate Friendly Cities", investigates the technical, procedural and methodological issues of technological design and energy retrofit/restoration, with a multidisciplinary and multiscale approach (from urban landscape and open spaces, to building materials and components), as well as with circular and regenerative methods, for the improvement of energy-environmental performance of the built heritage, enhancement of the passive bioclimatic performance of the building, reduction, rationalization and optimization of primary energy consumption, integration and use of energy from renewable sources and definition of innovative technological solutions and, at the same time, innovative use of traditional technological solutions. A specialist focus is given by the role played, in this system, by innovative bio-based materials, whose application in the architectural field is possible if not desirable from the point of view of the "cradle-to-cradle" approach as an opportunity given by technological progress in order to orient the construction sector towards environmentally conscious behaviour. The compatibility analysis allows to define for each material the limitation of the carbon footprint, embodied energy and identification of the environmental load capacity, which can be defined as the ability to absorb and control the phenomena of environmental transformations with a sustainable impact for the ecosystem.

The activities of the Research Group are part of the national SITdA-nZEB Cluster, to which 54 lecturers from 16 different Italian universities belong (<http://www.sitda.net/index.php/cluster/nzeb.html>).

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

Acoustics, Vibration and multisensory Interactions – ACOUVI

### **Participation in research projects during the last three years:**

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

Staff involved: Antonio Bosco, Monica Cannaviello, Lorenzo Capobianco, Caterina Frettoloso, Rossella Franchino, Fabrizia Ippolito, Francesca Muzzillo, Sergio Rinaldi, Antonella 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, in progress

Dates of submission/start/end of project: 1/10/2019-30/09/2021

Project title: 3x3 Zero Energy Building (3x3ZEB)

Scientific Responsible: Antonella Violano

Announcement title: Industrial research project

Staff involved: Monica Cannaviello, Lorenzo Capobianco, Sergio Rinaldi, Antonella Violano

Partners: LSF Italia srl

Project status: in progress

Dates of submission/start/end of project: 12/03/2019 - 12/03/2021

Project title: 'LIVES - Let'sInclude Values of Environment and Sport'.

Scientific Responsible: Antonella Violano (for DADI)

Announcement title: Urban Innovative Actions (UIA)

Staff involved: Antonio Bosco, Monica Cannaviello, Lorenzo Capobianco, Caterina Frettoloso,

Rossella Franchino, Fabrizia Ippolito, Francesca Muzzillo, Sergio Rinaldi, Antonella Violano

Partners: Municipality of Castel Volturno (Main Urban Authority)

Project status: evaluated positively but not funded

Dates of submission/start/end of project: 2017

Project title: *RIS3 Research Project: 'nZero Energy Box (nZEBox)'*.

Scientific Responsible: Antonella Violano

Announcement title: Regione Campania 'Research grants for Open Innovation processes in the priority technological areas of RIS 3'.

Staff involved: Monica Cannaviello, Antonella Violano

Partners: /

Project status: closed

Dates of submission/start/end of project: 15/04/2017-15/04/2018

Project title: *Guidelines for the energy and functional requalification of school buildings in the Mediterranean area*

Scientific Responsible: Sergio RINALDI

Announcement title: Regione Campania - Regional Research Project L R 5/2002, annuality 2007

Staff involved: Antonio Bosco, Monica Cannaviello, Lorenzo Capobianco, Caterina Frettoloso,

Rossella Franchino, Francesca Muzzillo, Sergio Rinaldi, Antonella Violano

Project status: closed

Dates of submission/start/end of project: 20/05/2015 - 31/03/2017

### **Scientific products of the last three years:**

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

[1] CAPOBIANCO, L. (2019). Continuum: The Vanvitelli district in Caserta, a legacy for the contemporary city. In: "Abitare la Terra", Quaderni nr. 3, allegato al nr. 50 della Rivista, p. 119

[2] CENNAMO, C., ANGELILLO, M., CUSANO, C. (2017). Structural failures due to anthropogenic sinkholes in the urban area of Naples and the effect of a frp retrofitting.

DOI:10.1016/j.compositesb.2016.09.043. pp.190-199. In COMPOSITES. PART B,

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- [3] CUSANO, C.; CENNAMO, C.; ANGELILLO, M. (2019). Stability Analysis and Seismic Vulnerability of Large Masonry Domes. In MASONRY INTERNATIONAL - ISSN:2398-757X vol. 32 (2)
- [4] DI DOMENICO, C. (2019). Seven Thresholds©, per il Sito di Interesse Nazionale di Bagnoli. In: Abitare la Terra, vol. 50 (3)/2019, pp.41-41
- [5] FUMO, M., & FORMISANO, A., & SIBILIO, G., & VIOLANO, A. (2018). Energy and Seismic Recovering of Ancient Hamlets: the Case of Baia e Latina. SUSTAINABILITY, vol. 10, ISSN: 2071-1050, doi:10.3390/su10082831
- [6] GALLO, P., & ROMANO, R. (2018). The SELFIE façade system. From Smart Buildings to Smart grid. TECHNE - Journal of Technology for Architecture and Environment, (1), 166-172. <https://doi.org/10.13128/Techne-22702>
- [7] IPPOLITO, F., & ESPOSITO, I. M. (2019). Spazio collettivo. Progetto di mobilitazione. In: Abitare la terra, Quaderni, supplemento al numero 50/2019
- [8] TUCCI, F. (2018). Resilience and green economies for the future of architecture and the built environment. TECHNE - Journal of Technology for Architecture and Environment, (15), 153-164. <https://doi.org/10.13128/Techne-22098>
- [9] VIOLANO, A. (2018). Beyond Materials: the experimentation of bio-based grown materials from mycelia. TECHNE - Journal of Technology for Architecture and Environment, 16, 299-307. <https://doi.org/10.13128/Techne-23029>
- [10] VIOLANO, A., DELLA CIOPPA A. (2017). An unusual landscape: technological design for roof. In: (ed. by): Amoruso G., Putting tradition into practice: Heritage, Place and Design. p.1282-1292, Cham:Springer International Publishing, ISBN: 9783319579368, Milano, 5-6 Luglio 2017, doi: 10.1007/9783319579375

Additional 10 scientific products:

- [1] BOSCO, A. (2019). Scuola e territorio. Un rapporto complesso. In: Bosco A. (Ed. by), Schola novissima. Criteri e modelli di ecodesign per gli spazi educativi. La Scuola di Pitagora Editrice, Napoli
- [2] FRANCHINO, R., FRETTOLOSO C., MUZZILLO F., VIOLANO, A. (2019). Fortified cityscapes: from the materiality of the past to the vision of the future. Sustainable Mediterranean Construction (SMC), vol. Special Issue 2019, p. 639-646
- [3] GAMBARDELLA C., RUSSO D. (2018). A museum system of design/craft for sustainable development in southern Italy. In: BEYOND ALL LIMITS / 2018 International Congress on Sustainability in Architecture, Planning, and Design. Proceedings Book of Extended Abstracts. p. 379-383, Çankaya | Ankara:Çankaya University Press, ISBN: 978-975-6734-20-9
- [4] MUZZILLO, F. (2018). Aesthetic and Ethic Design against Environmental Disasters. In: Muzzillo F. (ed by), Art and Culture for Flood Prevention, La Scuola di Pitagora, Napoli
- [5] RINALDI S. (2019). Nuovi scenari del rapporto tra ideazione e costruzione nel processo edilizio digitalizzato. In: Calderoni A., Di Palma B., Nitti A., Oliva G., IL PROGETTO DI ARCHITETTURA COME INTERSEZIONE DI SAPERI Per una nozione rinnovata di Patrimonio. Atti del VIII Forum ProArch, Napoli, 21-23 novembre 2019
- [6] VIOLANO A., Perez-Hernandez J. C. (2018). Il valore comunicativo-visivo dei festival d'arte ambientale/ Communicative-visual value of environmental art festival. AGATHÓN, vol. 4/2018, p. 219-226, ISSN: 2464-9309, doi:10.19229/2464-9309/4272018
- [7] VIOLANO A., Sposito C. (2018). Technological Design. The innovation in the method.

Project. Essays and Researches, p. 1-152, Palermo:Palermo University Press, ISBN: 978-88-31919-89-0, ISSN: 2704-6087

- [8] VIOLANO, A. (2019). Design tecnologico rigenerativo per nutrire gli scenari urbani del futuro. In: (a cura di): Mussinelli E., Lauria M., Tucci F., La PROduzione del PROgetto. Santarcangelo di Romagna (RN):Maggioli Editore, ISBN:978-88-916-3602-7, Reggio Calabria, 14-15 giugno 2018
- [9] VIOLANO, A., Cannaviello, M. (2019). Green-algae resilient architecture. Sustainable Mediterranean Construction (SMC), vol. 9, p. 142-149
- [10] VIOLANO, A., DEL PRETE, S. (2018). A bio-based grown material for living buildings. In: AA.VV., Beyond all limits. p. 762-768, ISBN: 9789756734209, Ankara - Turkey, 17-19 ottobre 2018

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

- Associazione RehabiMed Barcellona (ES)
- LSF Italia, srl
- National Technical University of Athens – School of Architecture (GR)
- Service Biotech srl
- Universitat Politecnica de Madrid (ES)

Project title: Survey of the school building heritage of the Metropolitan City. Energy-environmental requalification and seismic safety in school buildings

Scientific Responsible: Marina FUMO

Staff involved: Antonella Violano, Sergio Rinaldi, Monica Cannaviello

Partners: DICEA - University of Naples "Federico II";

Project status: closed

Dates of submission/start/end of project: 1/12/2017 - 1/12/2018

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

Benecon Scarl

**ISI Web of Science Subject Categories:**

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

**Scientific-Disciplinary Sectors:**

- ICAR/ 09

- ICAR/10
- ICAR/12
- ICAR/13
- ICAR/14

**Keywords:**

- Zero Energy Buildings
- Embedded Energy
- Carbon Footprint
- Energy Restoration
- Resilience
- Regenerative Design
- Adaptive Design
- Renewable Energy Sources
- Bio-based Materials
- "Cradle-to-Cradle"

**ERC Categories:**

- PE8\_11 Sustainable design (for recycling, for environment, eco-design)
- SH2\_6 Sustainability sciences, environment and resources
- PE8\_3 Civil engineering, architecture, maritime/hydraulic engineering, geotechnics, waste treatment