

The IBIS ECO project: a holistic approach for improving energy efficiency, building comfort and health in public buildings

Carmelina Cosmi¹, Rosa Caggiano², Alessandro Bellucci³, Antonio Santagata⁴, Daniele Trucchi⁵, Antonello Pagliuca⁶, Nicola Cardinale⁷, Sara Laurita⁸, Simone Colace⁹, Nazzareno Sileno¹⁰, Antonio Galotta¹¹, Antonio Imbrogno¹², Michele De Buono¹³, Andrea Vennera¹⁴.

Keywords: Smart Public Buildings; Indoor Environmental Quality; Energy Efficiency; IoT; Smart Readiness;

In recent years, the optimization of building performance, i.e. energy consumption and indoor comfort, has become a topics of great interest.

¹ National Research Council of Italy – Institute of Methodologies for environmental analysis (CNR-IMAA), C.da S. Loja, Tito Scalo (PZ) – Italy, carmelina.cosmi@imaa.cnr.it

² National Research Council of Italy – Institute of Methodologies for environmental analysis (CNR-IMAA), C.da S. Loja, Tito Scalo (PZ) – Italy, rosa.caggiano@imaa.cnr.it

³ National Research Council of Italy – Institute of Structure of Matter (CNR-ISM), Montelibretti branch, DiaTHEMA Lab, Via Salaria km 29-300, Monterotondo (RM) – Italy, alessandro.bellucci@ism.cnr.it

⁴ National Research Council of Italy – Institute of Structure of Matter (CNR-ISM), Tito Scalo branch, C.da S. Loja, Tito Scalo (PZ) – Italy, antonio.santagata@ism.cnr.it

⁵ National Research Council of Italy – Institute of Structure of Matter (CNR-ISM), Montelibretti branch, DiaTHEMA Lab, Via Salaria km 29.300, Monterotondo (RM) – Italy, daniele.trucchi@ism.cnr.it

⁶ University of Basilicata - Department of European and Mediterranean Cultures, Environment, and Cultural Heritage (DICEM) via Lanera 20, Matera – Italy antonello.pagliuca@unibas.it

⁷ University of Basilicata - Department of European and Mediterranean Cultures, Environment, and Cultural Heritage (DICEM) via Lanera 20, Matera – Italy nicola.cardinale@unibas.it

⁸ WISH srls - Napoli, Rende (CS), Roma - Italy laurita@wishinnovation.it

⁹ WISH srls - Napoli, Rende (CS), Roma – Italy simone.colace@wishinnovation.it

¹⁰ Meteo7 srl, Via Vincenzo Verrastro 29, Potenza (PZ) – Italy, nazzareno.sileno@gmail.com

¹¹ Meteo7 srl, Via Vincenzo Verrastro 29, 85100 Potenza (PZ) – Italy, antonioagalotta@gmail.com

¹² Ecopraxi S.r.l. Via dell'Edilizia, 85100 Potenza (PZ) – Italy a.imbrogno@ecopraxi.it

¹³ SCAI Lab srl, via Venezia 24, 87036 Rende (CS) – Italy michele.debuono@scailab.it

¹⁴ SCAI Lab srl, via Venezia 24, 87036 Rende (CS) – Italy andrea.vennera@scailab.it

Buildings contribute significantly to CO₂ production throughout their life cycle (supply of materials, construction, maintenance, operation / use, energy consumption, etc.). Furthermore, the existing building stock is old and energy inefficient, with a slow pace of renovation. In this context, indoor environmental quality (IEQ) has a key role in people's health, safety and productivity, as emphasized by the World Health Organization (WHO). In this context, the revised Energy Performance of Buildings Directive (EPBD) of the European Union (EPBD) (Directive 2018/844/EU and the Renovation Wave Strategy aim at improving the energy performance of buildings to help meet climate and social needs. In particular, the EPBD Directive, currently under revision to upgrade the existing regulatory framework, adopts a holistic approach which includes: I) "smart readiness" of the buildings through the use new technologies to adapt to the needs of the occupants, interact with the energy network and optimize operation and maintenance; II) adoption of smart technologies (building automation, control systems and devices for temperature regulation at the single room level); III) increase in indoor well-being of users (improved indoor air quality and comfort). The IoT-based Building Information System for Energy Efficiency & COMfort (IBIS ECO) project develops within this framework and aims at contributing to the requalification and decarbonization of public real estate assets by promoting their "smart-readiness" with a holistic and data-driven approach based on the integration of smart technologies (Key Enabling Technologies, IoT, data analytics) and advanced methodologies for building management. Its operational objective is to develop a monitoring and management system capable of improving both energy performances and comfort of existing buildings supporting a systemic integration of innovative solutions.

Two experimental sites in the Basilicata region (Southern Italy) were identified for the experimental validation of the approach: The University Campus of Matera and the School Building in the Municipality of Montemurro in the Agri Valley. Integrated monitoring of the meteorological and microclimatic indicators, indoor air quality (CO_x, SO_x, NO_x and O₃, PM₁, VOCs and radon) and comfort parameters (temperature, relative humidity and noise) will be carried out on the two experimental sites to implement, calibrate, optimize and engineer the prototype.

The ultimate goal is to demonstrate the usefulness of building Smart Energy Analytics models, algorithms and tools to ensure indoor well-being, achieve the building performance standards established by the EU policies and national guidelines, improve building management and support innovation.