

PhD in Energetics

Research Title: Advanced models to evaluate the energy performance of the building and the implementation of the international technical standards

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Context of the research activity	<p>Recent European directives introduce issues that are the subject of research at an international level. In particular:</p> <ul style="list-style-type: none">- ambitions are set for the reduction of greenhouse gas emissions, the share of renewable energy, the improvement of energy efficiency (Directive 2009/29 / EC),- the improvement of the energy performance of buildings is promoted, asking States to identify common methodologies for calculating and certifying the energy performance of buildings, setting minimum requirements for the energy performance of buildings and methods of inspection and maintenance of HVAC systems and DHW production, develop national action plans to promote the construction of nearly zero-energy buildings and the refurbishment of the existing building stock, starting with the public buildings, as the public sector is invited to lead the way (Directive 2010/31 / EU), and- the strategic role of energy efficiency in the civil sector is stressed and Member States are asked to save energy by setting national energy efficiency targets (Directive 2012/27/EU). <p>At national level, strict minimum requirements and prescriptions in terms of energy efficiency and use of renewable sources in construction have been introduced (Ministerial Decree 26/06/2015 on minimum requirements). As part of the sustainability plan for the public administration, Minimum Environmental Criteria (CAM) are introduced for the various stages of the purchasing process,</p>
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	<p>aimed at identifying the design solution, the product or the best service from an environmental point of view along the cycle of life, also taking into account market availability. In the above picture, there is a strong need to develop models of energy performance simulation and environmental sustainability assessment, which allow to correctly model the most advanced materials, components and technologies, related to the fabric, to technical building systems and to building automation and control. These models must meet requirements for accuracy, simplification, robustness and repeatability.</p>
Objectives	<p>The main objective of the research activity is the implementation of the most advanced models to evaluate the energy performance of the building.</p> <p>The research starts from the recent international standards, developed under EC mandate M/480 "<i>Mandate to CEN, CENELEC and ETSI for the elaboration and adoption of standards for a methodology calculating the integrated energy performance of buildings ...</i>".</p> <p>Specific activities will concern the followings:</p> <ul style="list-style-type: none"> – implementation of calculation models specified in international standards aimed at increasing their robustness and accuracy in analysing advanced components and technologies, – comparison between simplified models and detailed simulation aimed at validating the main simplifying assumptions and finding the best trade-off between accuracy and simplifications, – investigating model calibration procedures as to reduce the gap between actual energy consumptions and calculated demands, – performing uncertainty and sensitivity analyses, – investigating multi-object optimisation procedures, with the aim of introducing this approach both in new buildings design and in energy audits of existing buildings.
Skills and competencies for the development of the activity	<ul style="list-style-type: none"> a) Expertise in building physics and building performance modelling b) Skill in using energy simulation tools c) Knowledge of legislation and technical standards on energy efficiency of buildings d) Knowledge of economical evaluation methods and of energy efficiency measures in buildings