

Goal of the project:

The key objectives of the INSPIRE project are to evaluate retrofit strategies of existing buildings regarding their technological applicability, economic performance, impact on primary energy and CO₂-emissions, and interactions with other retrofit needs and to seek for adequate and tailored policy strategies and instruments, depending on building types, actors and institutional or country contexts.

Short description of the project:

The National Research Financing Bodies (NRFB) of Denmark, Finland, Romania, Sweden and Switzerland have jointly agreed to finance the work in the INSPIRE Project. Therefore, for formal reasons the work done in each country is defined as a sub-project of that country. However, the achievement of the goals of the project requires close cooperation between the partners and consequently international coordination of the work.

"Politehnica" University of Timisoara together with VTT Technical Research Centre have been involved in developing the Working Package 2 of the project, entitled: *Case studies on Sustainable Renovation in Eastern and Northern Europe*.

The goal of WP2 is to adapt the renovation experience of prefabricated concrete residential buildings in Finland to Eastern European countries, with focus on technological, economic, institutional and policy settings. Concrete residential buildings represent the largest retrofitting challenge in Eastern Europe and one of the best opportunities to substantially improve energy efficiency of residential buildings.

Project implemented by:

TEP Energy GmbH, Switzerland.

Implementation period:

01.03.2011 – 15.12.2012.

Main activities:

The project has the following focus areas: (1) Inventory of building typologies; (2) Design practices in Romania; (3) Renovation experience in Finland; (4) Technology overview; (5) Retrofit market in Romania and Eastern European countries; (6) Business models for sustainable retrofitting; (7) Implementation of technology; (8) Detailed analysis of case studies.

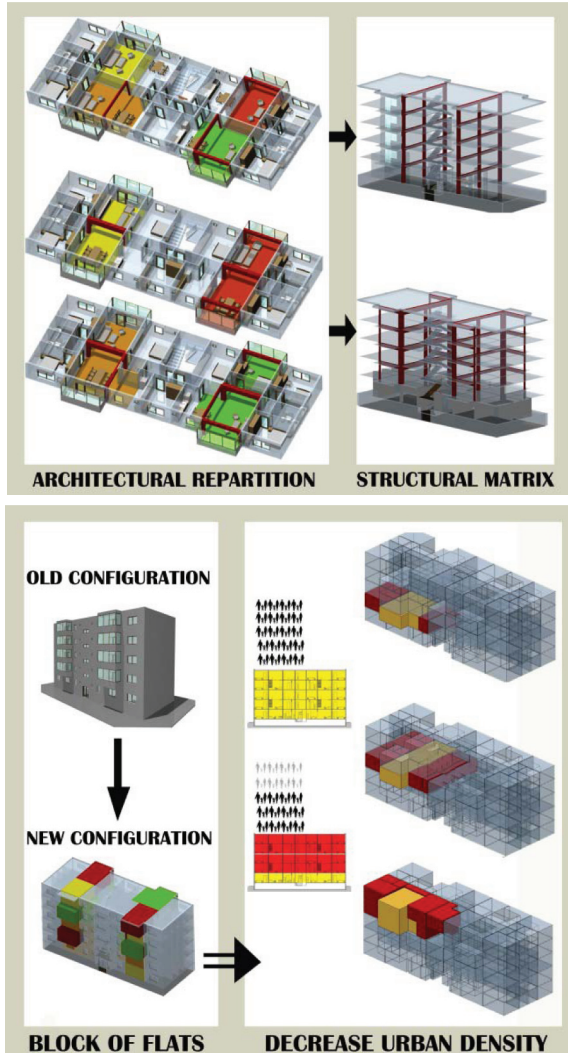
Results:

The increasing number of retrofitted buildings reaching requirements of advanced building standards is an indicator for the availability and feasibility of energy-efficient technologies. The project assesses the economic effectiveness and viability of such retrofits and reveals the impact of factors such as scope, time horizon, interest rate as well as energy price expectations and preferences. Retrofit strategies to reach ambitious targets of primary energy reduction and CO₂ mitigations at low life cycle costs are identified for different building typologies. This is done both in a generic way referring to the building stock of the countries involved in the research, Denmark, Finland, Romania, Sweden and Switzerland, and for a selection of case studies. Some recommendations for retrofit strategies are given as conclusions.

In particular, related to WP2, one of the main issues of the existing building stock in precast reinforced concrete large panels is related to the small living area of the apartments. The repartitioning of the internal spacing through the horizontal and/or vertical unification of two or more apartments is a good solution for the improvement of interior comfort. This solution will also lead to reducing urban density. However, the repartitioning could only be performed by operating openings into the diaphragm walls and by strengthening the affected zones.

"Science is a way of thinking much more than it is a body of knowledge."

Carl Sagan



In consequence, solutions are proposed for the strengthening the affected diaphragms. They are steel-based solutions that create composite reversible structures thought for an easy erection.

Another important aspect related to these buildings represents the low thermal efficiency of envelopes. In case of the majority of buildings the thermal resistances of envelopes do not fulfil the current requirements for thermal resistance.

In a modern design, the retrofitting process is based on a multi-criterial analysis, assessing all the issues that may interfere. In the case of thermal rehabilitation at least the technical, structural and economical aspects should be considered. The sustainability should be considered

as an additional parameter in the design and constructional phase. Four solutions were proposed for thermal rehabilitation of the envelope. In the decisional process three parameters were considered: thermal resistance, environmental impact and economic aspect. A realistic estimation of parameters was performed.

Fields of interest: Retrofitting of existing concrete residential buildings.

Financed through/by:

ERACOBUILD - "Strategic networking of RDI Programmes in Construction and Operation of BUILDings" & Project type PN II ERA NET, financed by the Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Romania.

Research team: TEP Energy GmbH, Switzerland (coordinator); Econcept AG, Switzerland; IIIIEE, Lund University, Sweden; Aalborg University, Denmark; VTT Technical Research Centre of Finland; "Politehnica" University of Timisoara, Romania.

Research centre: The Research Centre for Mechanics of Materials and Structural Safety (CEMSIG), Department of Steel Structures and Structural Mechanics, Faculty of Civil Engineering.

Applicability and transferability of the results:

The use of such solutions leads to technical advantages such as reversibility, easy erection, onshop partial manufacturing, easy interventions in case of impairment, execution quality, with impact on the existing building stock.

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