MORE-CONNECT project newsletter

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ISSUE #4 CZECHIA PILOT BUILDING

Development and advanced prefabrication of innovative, multifunctional building envelope elements for MOdular REtrofitting and CONNECTions

by MORE-CONNECT team

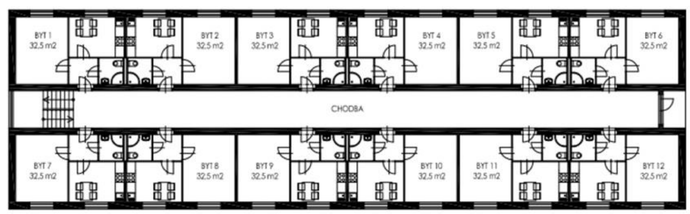
www.more-connect.eu

- *retrofitting technology and the components for buildings' renovation in five geo-clusters across Europe: Portugal, Netherlands, Denmark, Czechia, Estonia and Latvia.*

Description of target building typology in Czechia

The studied building was built in 1958 as a part of social housing settlement in Milevsko, South-Bohemian Region, intended for workers of the simultaneously constructed factory. The building has 24 studios (room, kitchen, bathroom, hall), 31 m² each, in three upper stories. Technical or housing facilities and cellars were put in the basement. Entrance to the building is on the northern façade, leading to the wide central hall with north-south orientation. At the southern façade, central hall is ended with a loggia. Each flat has two windows oriented either to the east or to the west. The building has a gable roof (33°), attic space is currently unused. Building has longitudinal wall structural system made of bricks (450 mm), ceilings are made of reinforced cast concrete. Façades are plastered, windows and exterior doors are partly original, partly (3 of 24 studios) replaced with insulating double-glazing, both with wooden frame.

Figure 1. Pilot building



Typical layout

In the time the reference building was build, usual U-values varied (there were no standards then): 0.76–1.72 W/(m²K) for the roof, 1.07–1.70 W/(m²K) for the wall, 0.76–1.22 W/(m²K) for floor and 2.18–3.44 W/(m²K) for openings. The total heat loss of the building is 2,037 W/K from which ventilation is responsible for 12 % and remaining 88 % is accounted to heat flow by transmission. The annual energy consumed by one reference building is around 1050 GJ.

General requirements on renovation process

The project objectives impose the following requirements on the construction process. It should:

- Enable fast installation without need of scaffolding
- Be based on modules that are transportable with standard means of transport
- Be compatible with alternative thermal insulation systems
- Fit for all situations where the renovation project requires complete, partial or no removal of existing structures.
- Speed up the renovation process, the accessories such as air ducts for HVAC systems, piping for heat distribution, wiring (electricity, internet, sensors, TV etc.) and renewable energy systems should be integrated in the modules
- Enable anchoring into concrete elements or masonry walls
- Ensure airtight connection to window openings or airtight all panel joints
- Provide system solutions for joints with balconies, chimneys

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Design targets

ITEM	DESIGN TARGETS
CHANGES IN LAYOUTS	Enable new balconies and loft extension
FAÇADES	Target U-values 0.08 – 0.21 W/m²K
WINDOWS	Planned replacement in all cases New windows Ug 0.6-1.0 – probably triple glazed Shading devices appropriate
ROOFS	Pitched roof, needed extension of rafters or complete replacement Target U-values around 0.11
UNDERGROUND FLOOR	Needed solutions to prevent moisture rise, perhaps additional thermal insulation of the building perimeter
NEW MODULES	Anchoring into concrete elements Airtight connection to window openings Needed system solutions for joints with balconies, chimneys In most cases needed high-performance insulation for detailing to reduce thickness of additional façade panels
ENERGY SOURCES	Various combinations of electricity, district heating, natural gas, biomass boiler, PV To get to zero in primary energy, PV on roofs needed, change heat source to pellet boiler
HEATING	Warm air central heating Possible source of heat for radiators in bathrooms is electricity or circulating DHW
VENTILATION	Mechanical ventilation with heat recovery Requirements on air ducts in modules Need for HVAC engine located in cellar Need for indoor air ducts for exhaust air
CONNECTORS	Air ducts, Low voltage for controls , PV wiring
MONITORING AND CONTROL	Temperature, humidity, CO_2, Heat flows, Individual room control

Design in three variants

The Czech case study followed all the mentioned goals and according to the intervention range the three variants were developed:

LOW-COST: A minimalistic variant with no intervention in the flats, only adjustments leading to building's nZEB level. The architecture is very simple. Thin plaster is used around the whole building, the difference between small and bigger windows is eliminated and the former façade order is kept because of the change of plaster colour. New roof is put on the existing wooden structure and the attic space is not used. Because a lot of new technology (including HVAC, for example) is installed in the basement, new chimney comprising air ducts is created on the southern gable facade.

ECO-ECO: Design comes from the low-cost variant and it keeps the ideas, however some extensions are made and also minor changes in the disposition of the flat. In this variant, the so far unused attic space is divided and parts are connected to the flats in the upmost floor – the duplex is created. Disposition of flats tries to respect the current state of social housing.

HI-TECH: Design follows the concept of the ECO-ECO variant but the attics are completely new. Separate flats created which can be sold to reduce the costs of the deep refurbishment. In addition to that the most advanced technologies are used to significantly improve the indoor comfort. In the standard floors, radical changes in the disposition are designed to improve the social variety of users offering not only social low-area housing but also larger flats (for young families, for example).

Designed modules

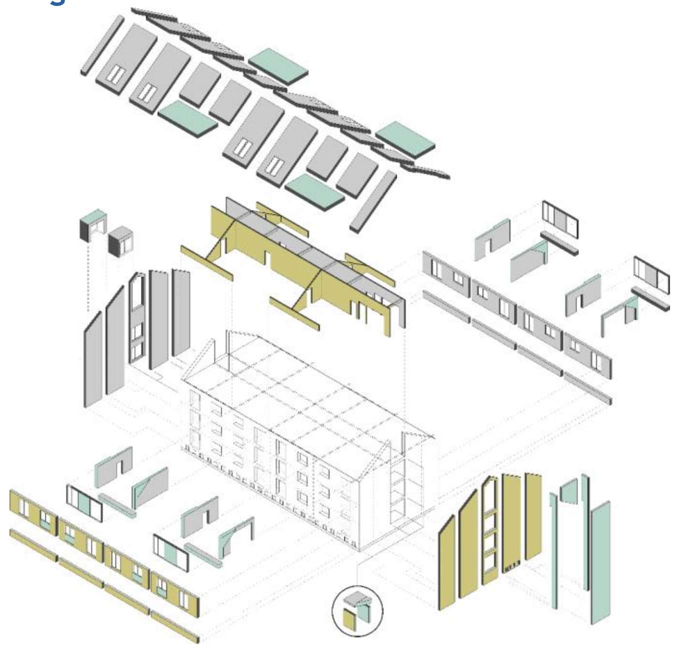

Figure 2. Set of modules for the Czechia case in advanced variant with loft extension.

More information is available on project web-page and publications:

- ✓ LUPÍŠEK, A., et al. Introduction of a Methodology for Deep Energy Retrofitting of Post-War Residential Buildings in Central Europe to Zero Energy Level. *Komunikacie.* 2016, **18**(4), pp. 30-36. ISSN 1335-4205.
- ✓ HEJTMÁNEK, P., et al. First Stepping Stones of Alternative Refurbishment Modular System Leading to Zero Energy Buildings. In: *Proceedings of the 8 th International Conference on Sustainability in Energy and Buildings Proceedings SEB16.* 8th International Conference on Sustainability in Energy and Buildings. Turin, 11.09.2016 - 13.09.2016. Torino: Politechnico di Torino. 2017, pp. 121-130. Energy Procedia. vol. 111. ISSN 1876-6102. Available from: http://dx.doi.org/10.1016/j.egypro.2017.03.014

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