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«Improving Energy Efficiency in Buildings» UNDP-GEF/00059937 Project

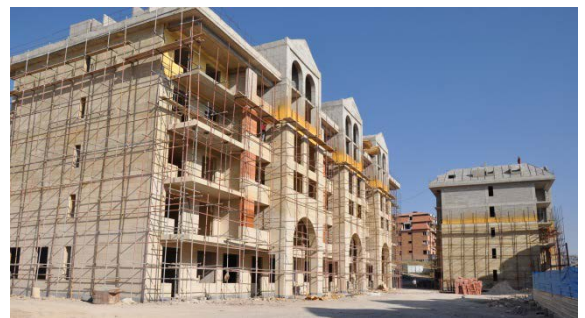
**Energy Performance Enhancing Measures Implementation
as a Result of Project Intervention**



In 2012 a Letter of Intent was signed between UNDP Armenia and “Al Hamra Real Estate Armenia” LLC, according to which the Project provides consultancy to the developer to ensure the highest possible energy performance of the buildings.

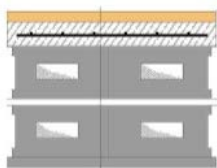
“Al Hamra Real Estate Armenia” LLC constructs “Cascade Hills” residential complex in Yerevan city. The complex is comprised of seven buildings.

At the time of Project intervention, external enveloping of two (baseline) buildings was already completed. As a result of the consultancy provided by the Project, changes were made to the initial design of the pilot buildings, in particular, to the wall structure. High quality insulation has been envisaged for the walls (on-site blown two-component polyurethane foam); certain solutions were provided for the covers as well.



**External wall section
without thermal insulation**

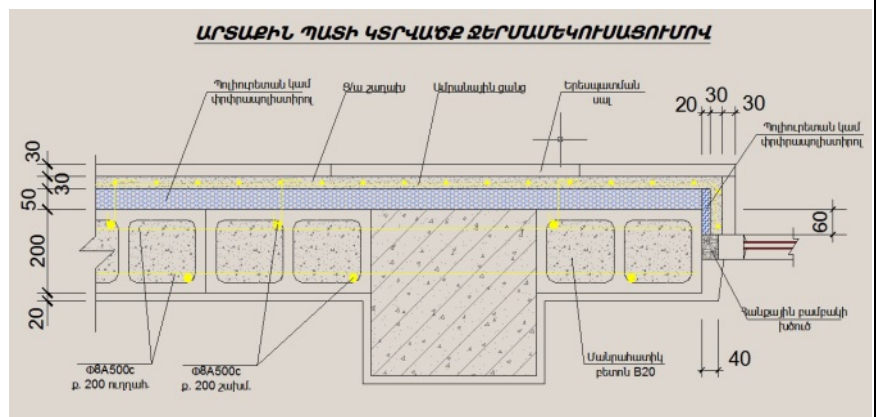
Արտաքին պատի կտրվածք առանց ջերմամեկուսացման



- Երեսպատում, 30մմ
- Ամրանավորված ց/ա շերտ, 70մմ
- Բլոկ, 150մմ
- Օդային միջնաշերտ, 50մմ
- Բլոկ, 150մմ
- Գաջային շերտ, 20-30մմ

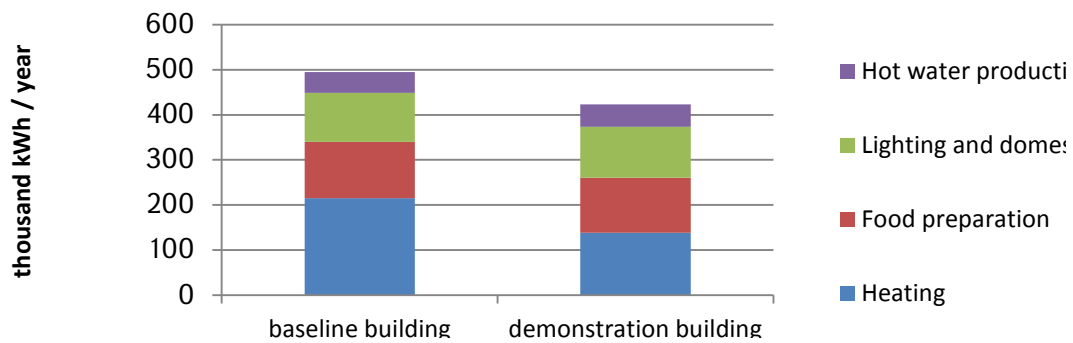
Legend: coating, 30mm
reinforced cement-sand mortar, 70mm
block, 150mm
inner layer of air, 50mm
block, 150mm
layer of gaj, 20-30 mm

External wall section with thermal insulation



Legend, the line above: polyurethane or foam polystyrol, cement-sand mortar, reinforcement mesh, coating slab, polyurethane or foam polystyrol
the line below: Φ8A500c increment 200 vertical, Φ8A500c increment 200 staggered, concrete fines B20, mineral wool hurds

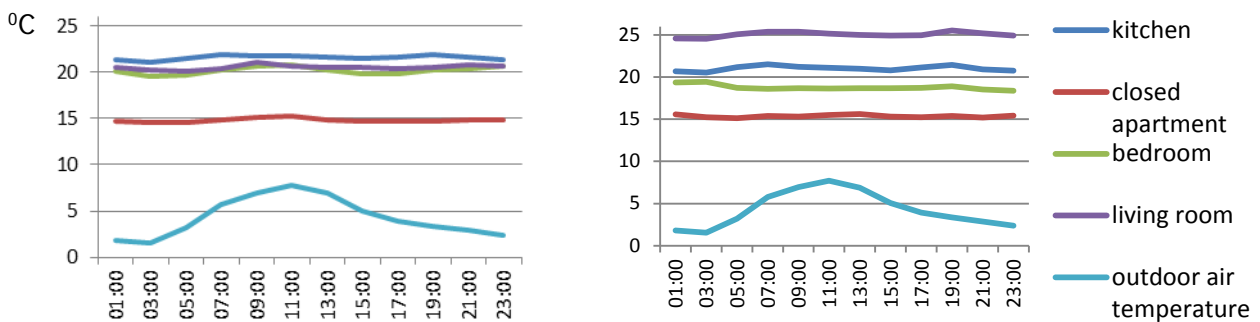
Energy consumption metering in buildings is implemented on apartment level.



Level of thermal comfort in the heating season, defined as ratio of actual and normative values of specific consumption of thermal energy, made 64% in the demonstration and 70% - in the baseline building. At the same time, specific consumption of thermal energy is about 38% lower in the demonstration building than in the baseline one.

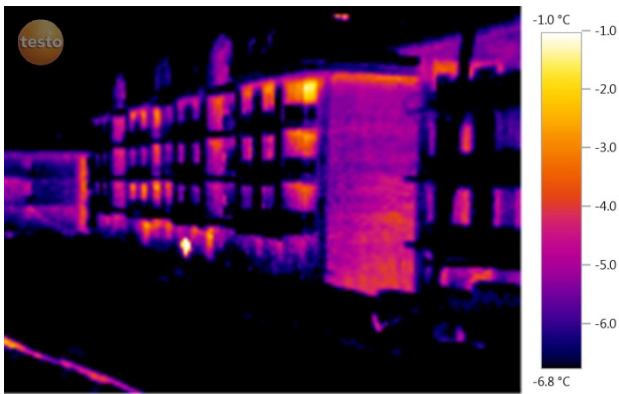
Indicator titles	Values		demonstration	
	actual	normative	actual	normative
Indoor air temperature in apartments, °C	18.8	20	18.7	20
Outdoor air temperature, °C	4.3	1	4.3	1
Specific consumption of thermal energy for heating and ventilation, kWh/m ² per year	48	69	30	44

Indoor air temperature in the apartments and outdoor air temperature as well as energy consumption data are presented below.

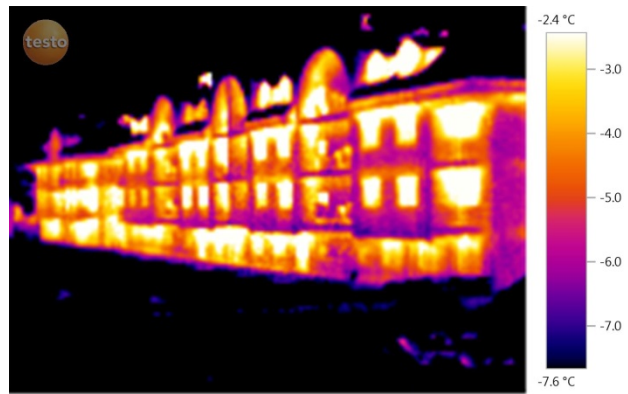


a *b*
Average data on indoor and outdoor air temperatures
in demonstration (a) and baseline (b) buildings in 2014-2015 heating season

The pattern of thermal protection of the building's envelope was taken using Testo 875-2 thermal imager.



a



b

Thermal-graphical facade images of demonstration (a) and baseline (b) two-room residential buildings of “Cascade Hills” residential complex in Yerevan, January 14, 2015

Design value of specific consumption of thermal energy in the demonstration building makes 44 kWh/m² per year with 69 kWh/m² per year in the baseline one; both values were confirmed during the consequent monitoring activities.

Saving of primary energy for the building’s heating purposes, defined as difference between normative values for baseline and demonstration buildings, makes about 36% equivalent to 115,964 kWh/year or 1.9 million AMD/year (given 92% efficiency factor of boilers and 8,000 kcal/nm³ bottom working heat output of natural gas).

CO₂ emission reduction, compared to baseline design option, makes:

- 19.7 ton annually,
- 394 ton for the building’s lifetime of 20 years,
- 59 ton by the Project’s closure in 2016.

Based on the energy audit, energy passports were compiled for the buildings and energy efficiency certificates issued.

Շենքի էներգետիկ բնութագիր	
Համաձայն ՀՍ 362-2013 «Էներգախնայողություն. Շենքի էներգետիկ անձնագիր (ցեռոցում, օդափոխում). Հիմնական դրույքներ. Տիպային մ.»	Ցուցանիշ
<p>Էներգաարդյունավետ</p> <p>A++</p> <p>A+</p> <p>A</p> <p>B+</p> <p>B</p> <p>Սորման</p> <p>C+</p> <p>C</p> <p>C-</p> <p>D</p> <p>E</p> <p>Ոչ էներգաարդյունավետ</p>	B+
<p>Էներգաարդյունավետության ցուցանիշը հաշվարկվել է շենքի նախագիծ էներգետիկ ատյիտի հիման վրա:</p> <p>- Պատերը՝ ցերմամեկտապլան</p> <p>- Տանիքը՝ ցերմամեկտապլան</p> <p>- Լուսաթափանց կոնստրուկցիաները՝ պլյումին շրջանակներով, ցերմային կամրջակներով, երկշերտ ապակեպատմամբ</p> <p>- Օդափոխումը՝ բնական</p> <p>- Օդի լավորակումը՝ անհատական</p> <p>- Ցեռոցումը՝ անհատական</p> <p>- Ընդհանուր տարածքները՝ զջեռուցվող</p>	44 կՎտ/մ ² տարի
<p>Վարչական տեղեկատվություն</p> <p>Շենքի հասցեն՝ ՀՀ ք. Երևան, Անտառային 160/5</p> <p>Շենքի ընդհանուր մակերեսը՝ 4 563 մ²</p> <p>Պիտակի տրման ամսաթիվը՝ 30.07.2015թ.</p> <p>Տրամադրողը՝ «Շենքերի էներգետիկ արդյունավետության բարձրացում» ՄԱԶԾ-ԳԷՖ/00059937</p>	

As a result of the Project intervention, energy performance of the buildings was improved by around 35%, living area in the residential complex increased by more than 900m² ensuring additional income exceeding 1.5 million USD for the developer.

