GENEVA (Switzerland)

80% energy saving

Moderate rise of total living expenses after renovation

Very high envelope performance and high efficiency conventional heat production

Project data

Location, address:	Rue de Lancy 1-3, Carouge
Region:	Geneva
Surroundings:	City
Climate:	Dry and cold in winter, mild / hot in summer
Heating degree days:	3028
Year of construction and renovation:	1953 (constructed); 2005-2007 (renovated)
Typology:	Apartment building
No of dwellings:	62 dwellings
Total floor area:	3845
Owner:	Fondations Immobilières de Droit Public (housing association)
Architect and Builder:	Architecture Plurielle
Costs of energy saving measures:	€ 37.654 per flat, (3.500 €/flat façade + 1.200 €/flat scaffolding, 2.250 €/flat windows, 530 €/flat roof or floor insulation, 250 €/flat control of natural ventilation)
Renovation financed by:	The owner

Figure 1: The building before renovation

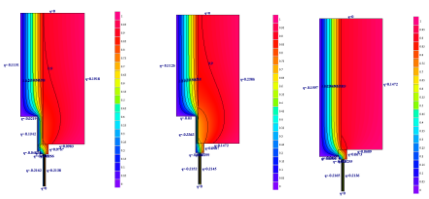
Objectives and Results

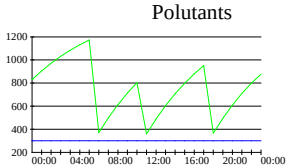
The "*Fondations Immobilières de Droit Public*" presented to the government an ambitious refurbishment project upgrading the building by adding new balconies, transforming the apartments layout and reducing the energy consumption to 26 kWh/ m^2 (87% reduction) for a budget of 64'500 € / apt. The project was refused for political reasons and the budget was cut to 35'650 €/apt. The design team managed to preserve a high energy standard (42 kWh/m^2 - class A) with 44% less financial resources. The secret of this success is the sobriety in the technical choices: high-performance envelope and heat production system and controlled natural ventilation.

Renovation concept

Key renovation features

- Façade and roof Insulation
- High efficiency insulation of glazing and frames
- High efficiency boiler
- Low temperature heating
- Noise protection
- Controlled natural ventilation
- MINERGIE label





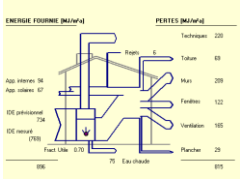


Figure 2: Some simulation results for optimization of thermal bridges, natural ventilation and heat balance

State-of-the-art

Before renovation	After renovation
Constructions [U-values: W/m²K] • Non-insulated roof • Non-insulated ground floor • Non-insulated façades • Double glazing [3]	*Constructions [U-values: W/m²K]* • Insulation of roof [0,2] • Insulation of façades [0,17] • High efficiency glazing (HR++) [1,1][1] • Insulation of floor [0,3]
Installations • Collective central heating boiler with very poor efficiency • Natural ventilation not controlled	*Installations* • High efficiency boiler (condensation, gas, low emission) • Low temperature heating (radiators) • Control of natural ventilation by humidity sensible devices (extraction) • Self controlled air inlet devices

Energy saving and monitoring

Energy consumption before renovation:
KWh/m²: 214 (for heating and DHW)
Energy Index[2]: unknown

Energy consumption after renovation:
KWh/m²: 42 (for heating and DHW)
Energy index: unknown
Percentage saving[3]: 80%

Figure 3: After refurbishment

Additional information

- The energy saving measures have been decided in an integral planning process (collaboration of architects, engineers, building physicists on the very initial phase of the project).
- The diagnosis of the building was performed with the EPIQR method (Energy Performance Indoor Environment Quality Retrofit, developed in the 5th EU research program framework). The energy performance and the indoor environment quality were taken into account on an equal basis with the deterioration state of the building, architectonic considerations and costs.
- The building is conform to the Swiss MINERGIE® label standard
- Indoor environment quality is improved not only by thermal comfort naturally offered by a high energy performance standard, but also regarding acoustic comfort (acoustical insulation of the separating walls, high acoustical insulation of windows), lighting (very thin frames and light colours to maximise natural lighting) and air quality (controlled air inlet and stack driven extraction).

Lessons learned and conclusions

- This project proves that even buildings with very low rents and limited refurbishment budgets can afford high energy performance and indoor environment quality.
- High energy performance means also high building quality. Energy planning and monitoring offers to the owner a global quality control guarantee.
- High energy performance does not necessarily mean complex, expensive and exotic technical installations. It can also be achieved by robust conventional solutions like high insulation thicknesses, high performance double glazing and high quality conventional gas boilers (condensation, low emission devices). The initial plan was an innovation oriented project. Cost constraints have driven the project towards a radically different strategy (economic, robust and well known common technical solutions). The result in kWh/m² is not very different.

References

[1] http://www.estia.ch/ (CH) or http://investimmo.cstb.fr/english/epiqr.asp (FR) or www.epiqr.de (DE) or www.epiqr.it (IT)

[1] U-value of the glazing only
[2] Calculated by EPA - Energy performance Advice programme
[3] Compared to the situation before renovation