



G. Papanikolaou Hospital

Thessaloniki


EUROPEAN ALUMINIUM

/ Preface

To illustrate how the energy performance of existing buildings can be upgraded, the European Aluminium compiled the below case study.

The administration building of the public “Papanikolaou” hospital in Thessaloniki was built in 1969 and offers 3500 m² of offices on 5 levels. Its renovation took place in 2010 and mainly included the replacement of old single glazed wooden openings by new double glazed aluminium openings.

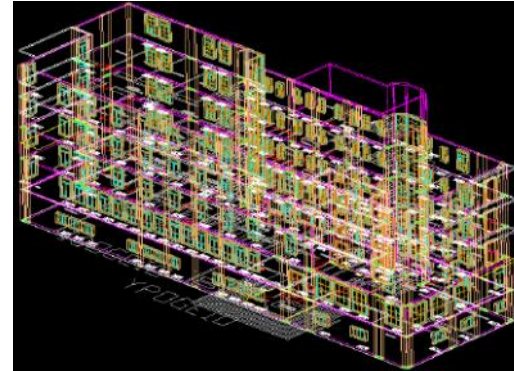
A simplified life cycle assessment (LCA) of the new openings, focused on greenhouse gases, has been carried out and concluded a CO₂ payback period of 28 months, when recycling is neglected, and a payback period of 10 months when recycling is taken into consideration. The use phase data were modeled according to “KENAK”, i.e. the Greek transposition of the EU Energy Performance of Buildings Directive. The production phase was modeled based on the material composition. The end-of-life phase was calculated as two scenarios, i.e. with and without recycling.

An independent expert has been involved in order to secure the scientific validity and technical quality of the life cycle assessment.

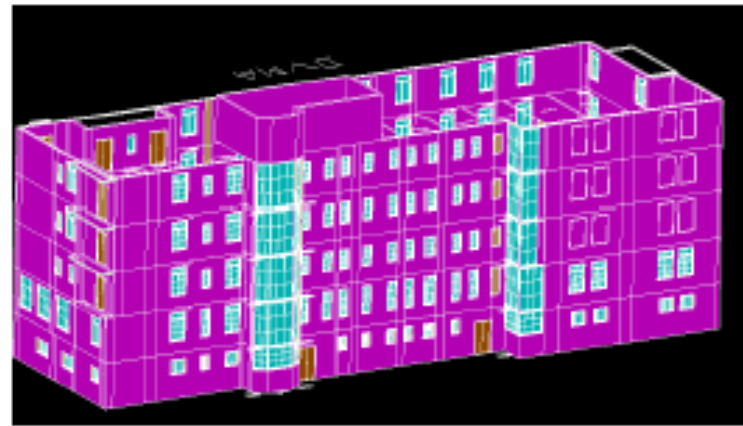
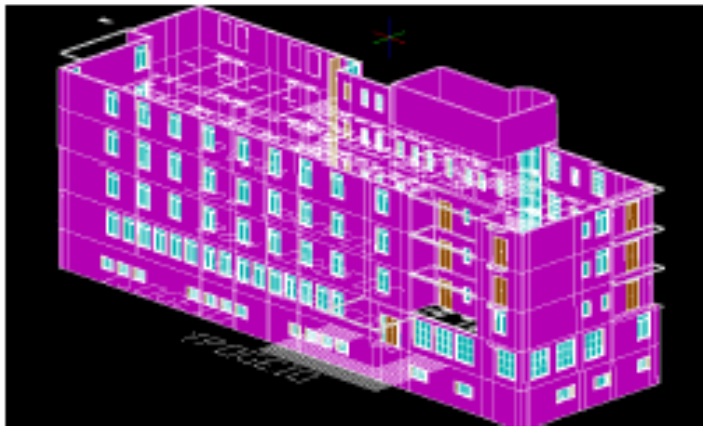
/ G. Papanikolaou: Description



- Building type: office
- Location: Thessaloniki (GR)



- Construction year: 1969
- Floor: 3 482 m²
- Façade: 10 447 m²



/ G. Papanikolaou: Window replacement

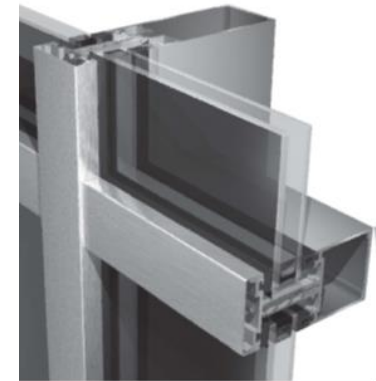
Old windows:

- Wooden windows
- Steel Curtain Wall
- Single glazing
 - $g_{gl}=0,87$
 - $\tau_{gl}=0,85$
- $U_w=5,60 \text{ W/m}^2\text{K}$
- $L_{50Pa}=15\text{m}^3/\text{m}^2*\text{h}$



New windows:

- Thermally-broken aluminium frames
- Double glazing
 - $g_{gl}=0,78$
 - $\tau_{gl}=0,73$
- $U_w=2,7 \text{ W/m}^2\text{K}$
- $L_{50Pa}=1,5\text{m}^3/\text{m}^2*\text{h}$



/ G. Papanikolaou: Data for CO₂ calculation

Bill of material for renovation

- Aluminium: 5.281 kg
- Glass: 5.400 kg
- Polyamide: 305 kg
- PVC: 85 kg
- EPDM: 420 kg
- Coating: 210 kg
- Others: 110 kg
- TOTAL: 11.811 kg

Heating energy demand

- Before renovation: 545 MWh/year
- After renovation: 396 MWh/year

Heating energy source

- Natural gas

/ G. Papanikolaou: CO₂ calculation results

Savings during operation:

- Energy: 149.000 kWh/year
- CO₂ emissions: 34 tonnes/year
- Acc. to KENAK (Greek EPBD)

Windows production

- CO₂ emissions: 69 tonnes without considering any benefit of aluminium recycling, i.e. frames based on primary Al only
- CO₂ emissions: 25 tonnes by considering the benefits of aluminium recycling

Payback period

- 28 months without recycling
- 10 months with recycling



REVIEW STATEMENT

Case Study: G. Papanikolaou Hospital, Thessaloniki, Greece
Commissioner: European Aluminium Association AISBL, Brussels, Belgium
Reviewer: Prof. Dr. Matthias Finkbeiner, Berlin, Germany

Scope and Reference of the Review

The review of the case study is focused on the general criteria of scientific validity and technical quality. The review assessed whether the methods used to carry out the CO₂ and energy calculation are scientifically and technically valid, whether the data used are appropriate and reasonable in relation to the case study and whether the interpretations reflect any limitations of the study in a transparent and consistent manner.

The assessment of formal compliance with a particular reference document or standard as well as the verification of individual data or results is outside the scope of the review.

This review statement is valid for the presentation and calculation provided on 01.12.2012.

Review Process

The review process started with the delivery of the case study documentation to the reviewer. The reviewer provided questions for further clarification on the data used for the case study. The calculation was checked for plausibility and spot-checks were performed to assess the reproducibility of the calculation.

Review Results

The calculation was documented transparently in a spreadsheet and provides a CO₂ payback period of 28 months (no recycling) respectively 10 months (with recycling). The use phase data were modeled according to the Greek Regulation on Energy Performance of Buildings. The production phase was modeled based on the material composition, i.e. without production losses. The end-of-life phase was calculated as two scenarios, i.e. with and without recycling.

The data used are appropriate and reasonable in relation to the case study. The use of simulation data for the use phase and the simplification to model the production based on the material composition should be clearly documented.

Overall, the assessment was found to be technically and scientifically valid.

Prof. Dr. Matthias Finkbeiner
Berlin, 07.12.2012

/ Study realized in cooperation with...

- Building owner: Nosokomeio Papanikolaou
- Energy consultant: Dr. Michalis Agraniotis
- Window system supplier: Alumil Building Systems
- Window manufacturer: Domical
- Demolition & recycling: Domical
- Life-cycle analysis: European Aluminium
- External review: Prof. Dr. Matthias Finkbeiner