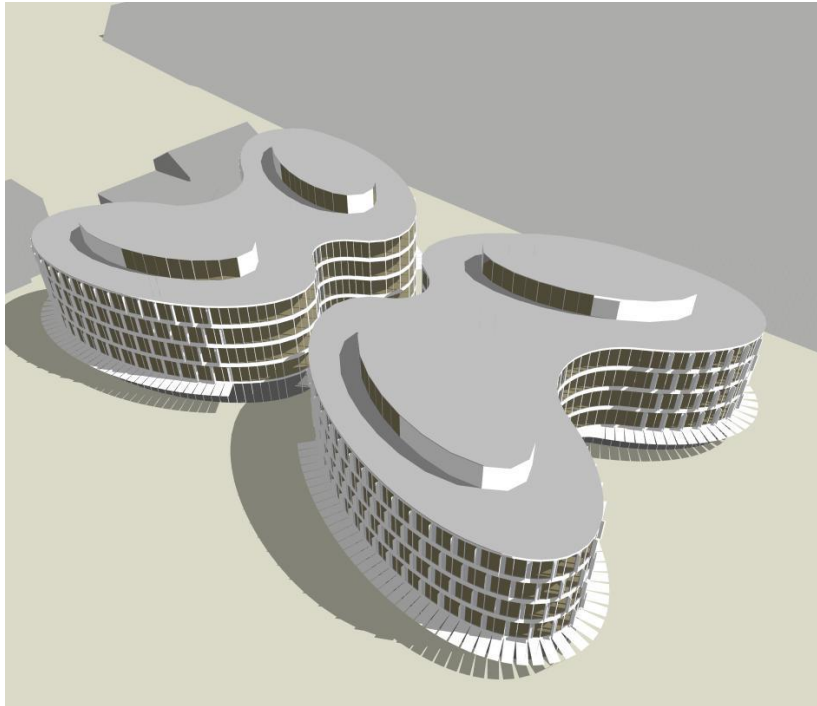


Comparison of Design Alternatives for BREEAM Certification Project

A project in Prague using DesignBuilder to identify the best design alternatives to maximise BREEAM credits.



At a glance:

- Office building with multiple design alternatives.
- Analysis provided recommendations for further operational costs savings.
- BREEAM 2011 credits - Ene 01 (Reduction of emissions), Hea 07 (Potential for Natural ventilation), Hea10 (Thermal comfort).

Project details

Project description: Office new-build, 24,000 m²

Performance criteria: BREEAM certification

Location: Prague, CZE

Project status: Planned

Introduction

The design team had multiple design alternatives and wanted to include the energy performance in the decision-making process. The aim was to find the most cost and energy effective design in line with architectural concept. The energy performance analysis tools typically used in the Czech market

are limited to monthly calculation steps and are not suitable for such a complex building. Therefore a fully integrated dynamic simulation in DesignBuilder was introduced.

Approach and Analysis

We were invited into the design team at the point where the form and the volume of the building had been set. Three major questions to be answered were:

- Is an atrium cost beneficial?
- Could a 0.9 m high window sill bring some extra savings on operational costs?
- Which glazing system and thermal insulation thickness would be most cost-effective for the building?

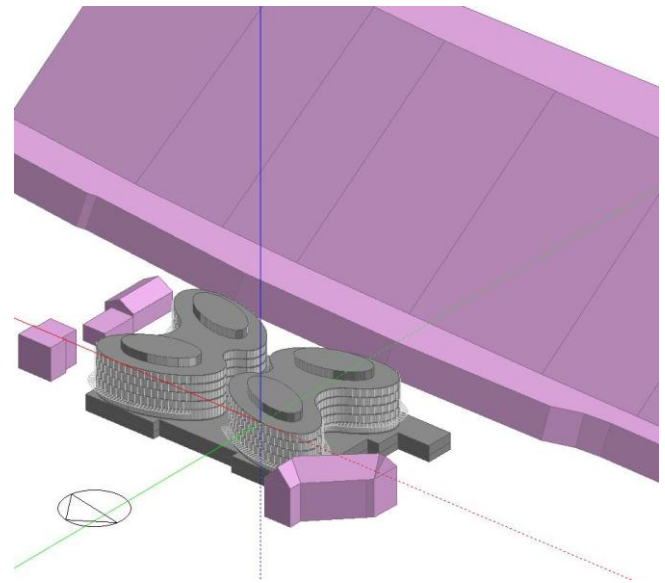
Using DesignBuilder's user-friendly interface to EnergyPlus we found suitable possibilities that satisfied requirements of all members in the design team (architects, investors, HVAC engineers).

For each combination a full annual thermal simulation was run. The results are stated in the table below.

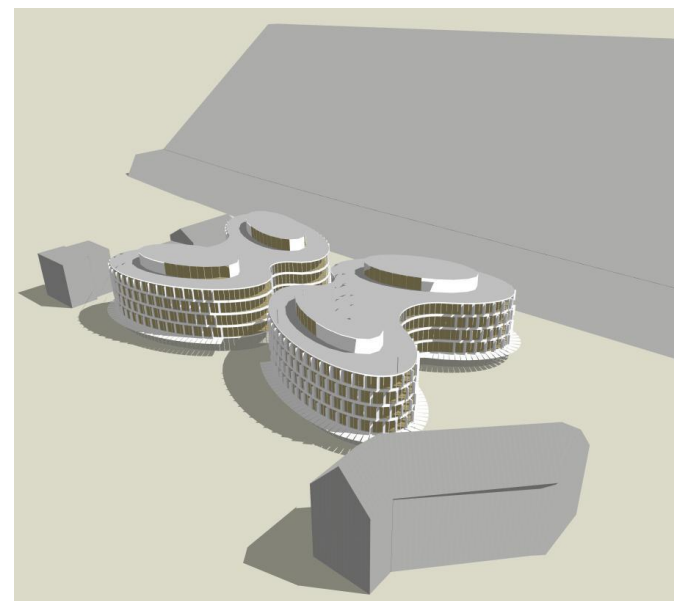
On completion of the initial analysis the client asked us to undertake additional studies with the prepared model, including:

- The influence of the amount of fresh air supplied to the building.
- The difference between sensible-only and sensible with latent heat recovery device.
- Comparison of different lighting sources and lighting control.
- Thermal comfort study focusing on the use of convectors under the windows.
- Cooling and heating design loads calculation.

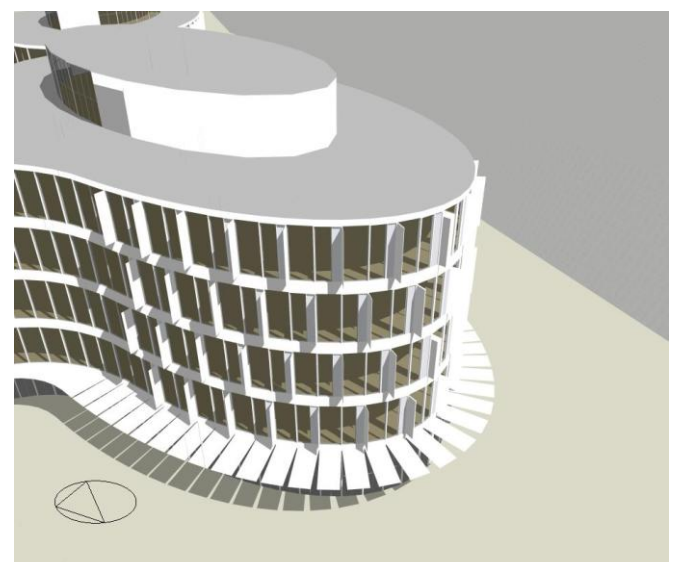
These additional studies were very quick and easy to complete, with minimum time needed to adjust the DesignBuilder model to the new conditions.



3-D Modeller



Visualisation



Façade and external shading

Design Alternative	Change in Annual Heating Energy [%]	Change in Annual Cooling Energy [%]	Change in Annual Heating and Cooling Energy [%]
A) Atrium, full height windows, double-glazing	Baseline	Baseline	Baseline
B) Atrium, full height windows, triple-glazing	↓ 4%	↑ 2%	- 0%
C) Atrium, sill, double-glazing	↓ 1%	↓ 4%	↓ 3%
D) Atrium, sill, triple-glazing	↓ 5%	↓ 2%	↓ 3%
E) No atrium, full height windows, double-glazing	↑ 3%	↑ 5%	↑ 4%
F) No atrium, full height windows, triple-glazing	↓ 1%	↑ 7%	↑ 4%

G) No atrium, sill, double-glazing

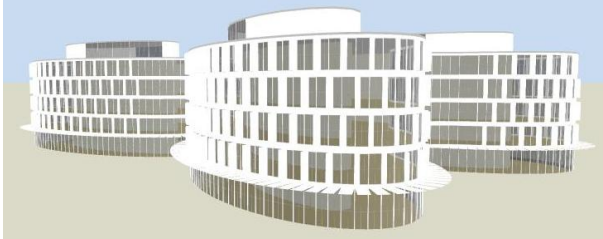


↑ 1%

- 0%

- 0%

H) No atrium, sill, triple-glazing



↓ 3%

↑ 2%

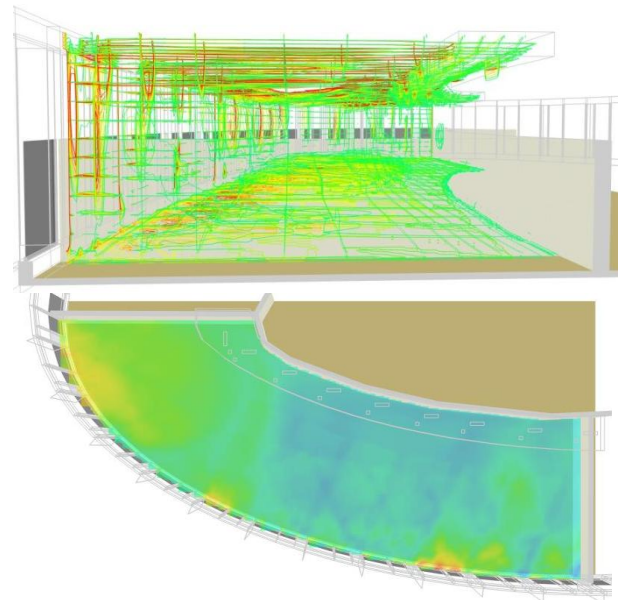
- 0%

Results

The final choice was the option D) Atrium, sill windows, and triple-glazing.

Triple-glazing has quite similar energy performance compared to the double glazing, however, it provided better thermal comfort during the cold season. Reducing heat losses via triple glazing meant that convectors were not required beneath windows, and the higher price of the glazing was offset by these savings on the heating system. Omitting the convectors also enables a wider range of possible fit-out solutions.

The window to wall ratio remains high despite adding the sill, so the offices remain well daylight.



Thermal comfort study using DesignBuilder's fully-integrated CFD tool

ATELIER DEK

Established as a technical department of DEKTRADE in 1997, and since 2007 Dekprojekt exists separately as a limited company. Our major activities are: technical assessments and designs of building envelopes with specialization on waterproofing, thermal insulation, and water vapour regime. Further building energetics, building physics, micro environmental engineering, building services engineering and sustainable building consultancy.