CASE STUDY

LIVE IN POSITIVE ENERGY

Commercial Building Kobra: Integrated Design for Efficiency and Renewable Energy Generation

The commercial building commissioned by the Kobra Team was realized in 2011 and demonstrates that buildings that produce more energy than they consume can be realized in Slovenia and beyond. Whilst the building was financed privately in its entirety, more public support would undoubtedly help the broader replication of such innovative projects in the region.

The project stands out in particular for the carefully considered building form that incorporates bioclimatic design principles, the use of passive house specifications and the integration of multiple building technologies in an advanced building management system.

By adopting an integrated design approach that emphasized interdisciplinarity, collaboration and close consultation with end-users, involved experts were able to realise a building that is a source of pride for the client, contractors and the municipality.

Moreover, it should be noted that without the client Kobra Team, who embraced environmental sustainability considerations, such an ambitious building could not have been developed.

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The PEB in its Local Context

Kobra is a Slovenian company, offering and developing telecommunication services and products. After 31 years of activity, the company decided to relocate to a modern industrial zone. Following the company ethos, it was imperative for the client to make a contemporary, plus energy commercial building. The building, is located in the Municipality of Šentjernej - in the traditional region of Lower Carniola in southeastern Slovenia. The positive energy building was developed by PROTIM RZISNIK PERC Architects and Engineers, in collaboration with a number of external experts.

The Kobra office building has a floor area of 1,437 m2 with two floors (ground floor and first floor). Based on the needs for usable space and consequentially the number of floors the volume of the building was designed compact to ensure the smallest possible surface area of the building envelope.

Rounded corners ensure lower transmission loss than the rectangular ones and, at the same time, they serve to define the architectural character of the building. An indent of the basic ground plan shape clearly marks the main entrance. The visual division of the façade, with a minimalist horizontally oriented ground floor pedestal and an upper floor that is defined by colourful vertically aligned striped façade elements, contributes to the dynamic visual impact of the building. Moreover, the façade design articulates the public function of the ground floor and the intended business use of the upper floor.

After 10 months of construction work, the Kobra Team's new office building was finished in 2011. Based on the company's philosophy and climate change awareness, the investor wanted to use as many renewable energy sources as possible. The contemporary plus-energy building can be seen as a true lighthouse project in Slovenia and a source of pride for investors, involved contractors, as well as the municipality.

Image 1 & 2
Photographs of the building and carpark, showing the large PV installation [Source: © Kobra Team d.o.o]

The Building's Special Features

To achieve positive energy performance, the building harnesses geothermal and solar energy. All renewable energy sources are hydraulically interlinked through a reversible heat pump, which - in addition to heating the building and its sanitary water - also enables passive and active cooling of the building. By implementing a photovoltaic power plant on the roof and the car parking canopy, the building is able to produce all the electrical energy it requires.

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The low energy consumption principles have influenced the placement of the building on the construction plot and the strict orientation of the southern facade. The shape of the ground plan is therefore a consequence of the defined construction line and the orientation of the southern facade. Based on the needs for usable space and consequently the number of floors, the volume of the building was designed to be compact to ensure the smallest possible surface area of the building envelope (thus minimising heat losses).

Rounded corners ensure lower transmission loss than the rectangular ones, at the same time they are co-creating the architectural character of the building.

Selected Performance Indicators

Breakdown of Energy Consumption

Heating: 6,1 kWh/m2,a

Cooling: 4,5 kWh/m2,a

Ventilation: 4,2 kWh/m2,a

Other: 37,6 kWh/m2,a

Renewable Energy Generation

Photovoltaic: 63,800 kWh

Other: 63,8 MWh

Awards: GB ID Award 2014

Further Key Technologies Installed

- Standard Central Supervisory System (SCADA): "The brain" of the building connects lighting regulation, fire detection and reporting, technical surveillance as well as the HVAC system.
- By implementing a photovoltaic power plant on the roof and the car parking canopy the building is able to produce all of its own electrical energy.
- Entrenched rain water reservoir with a hydrophire station - vol 40m3: An underground rain water reservoir substitutes flush water in toilettes.
- Further building technologies include a water bore (2 m3/h), 2 back-up water boreholes (0,5 m3/h) as well as three 100m deep geoprobes and four 8m deep water sinking probes.

Catalysts, Challenges & Results

The main enabling factor for the realization of the positive energy building (PEB) was the wish of the client to develop a contemporary, environmentally friendly building. With the help of the architects, knowledge of up-to-date technology as well as a good team of contactors, the team was able to build a contemporary PEB, which is exploiting almost all natural energy sources. Key challenges for realising the privately financed PEB included the lack of standards for integrating complex solutions, as well as the lack of government subsidies for such construction.

Fine-tuning optimum operational settings is of key importance and is an ongoing process. While this may be regarded as a disadvantage at first, the benefits are multiple. For example, after monitoring the building in 2012, it was established that the main energy consumers in the building were lighting and IT equipment. In 2013, investor implemented LED lighting and therefor achieved plus-energy building standard.

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Replication Potential

The planning process followed the principles of integral design. Designers from all fields of expertise exercised day-to-day harmonization and cooperated closely with the investor, end users as well as potential technical solution providers and contractors. Already in the phase of concept design all functional details, technical solutions, key construction principles and materials were determined as well as the specific and detailed investment frame set. To replicate this approach, it is important to be aware of the considerable effort and time such a comprehensive and integrated process requires. The investment frame was set based also on the comparable assessment of life-cycle costs for the building and built-in devices (LCA and LCCA principles).

The project was privately financed in its entirety and thus demonstrates that PEBs can be realized under regular market conditions in many Eastern European countries. Indeed, through careful planning and procurement, the project companies could drive down estimated costs by a few per cent and realise the project at a cost of approx. 2 million Euro (1,391 EUR / m²).

Conclusions & Lessons Learned

Integrated design relies on the interdisciplinary and collaborative efforts of all parties involved, not only at the concept and design stages, but also at the construction and facility use stage. Successful interdisciplinary cooperation hinges on effective project organization and management of all processes. Especially critical is the timely consultation with the appropriate experts and the active involvement of the end-users.

Non-Exhaustive List of Involved Stakeholders

KOBRA **Owner / Client |** Kobra Team d.o.o. | www.kobra.si

Designer	Petra Spaic, BS Arch	**Architecture & interior design**	Andrej Ržišnik, BS Arch
Structural Design	Robert Premrov, BSCE	**Architect / Associate Building Physics & Sound Insulation**	Aleš Hajnrihar, BS Arch
Electrical Installations	Mag. Gregor Bavdaž, MSEE	**HVAC:**	Bojan Mehle, BSME, Andrej Pureber, BSME
		Protim Ržišnik Perc ARHITEKTI IN INŽENIRJI	**Architects & Engineers** https://www.protim.si/

External Experts

Fire Safety: Mag. Aleš Drnovšek, BSEE | Environmental Impact Assessment: Alenka Markun, BS Chem
PV-Sytem: David Furlan, Electrician

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Acknowledgements

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- The Kobra Team for their kind permission to use photographs, their logo as well as for contributing information to the case study text.

Selected References

- https://www.buildup.eu/en/practices/publications/gb-id-award-2014-commendation-plus-energy-business-building-kobra-slovenia
- https://www.protim.si/index.php?t=projects&id=12478&l=en

Local Demographic, Political & Climate-Related Information

Address: Levičnikova cesta 2, Šentjernej 8310, Slovenia

Approximate Geographic Coordinates [Google | EPSG:4326 – WGS 84]: 45°50'52.9"N 15°20'19.1"E

Local Government: Municipality of Sentjernej

Population: 7,107 [2018, Municipality]
Total Area Administered: 96 km²
Municipal Budget: EUR 8.619.792,35 [2021]
Website of the Municipality: https://www.sentjernej.si/

Climatic Zone [Köppen]: Dfb - Warm summer continental or hemiboreal climates

Image 4 | Building Floor Plan Ground Level

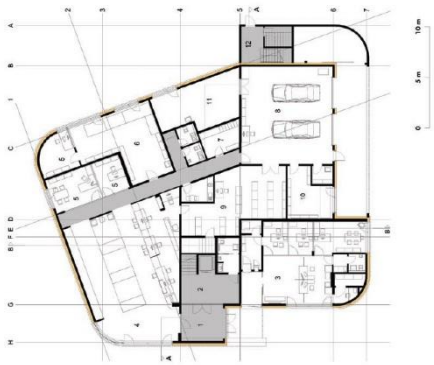

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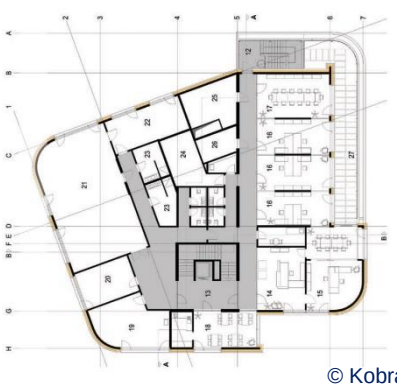
Image 5 | Building Floor Plan 1st Floor



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