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GREEN ROOF AS A SAVING TECHNOLOGY AND CREATOR OF MICROCLIMATE

У цьому документі підкреслюється важливість економії енергії за рахунок оптимального вибору рослинності, яку використовуватимуть для зелених дахів.

Місто Кошице розташоване у східній частині Словаччини, на річці Горнад в Кошицькому басейні. Кошице має ознаки як вологого континентального клімату, так і океанського клімату, оскільки місто знаходиться в північній помірній зоні. Місто має чотири районні сезони. Випадання опадів характеризується невеликою зміною протягом року, в основновному опади випадають протягом літа і лише деякі – в зимовий період.

Сьогодні зміни клімату активно обговорюють у всьому світі. Ми кожен день маємо справу зі зміною рельєфу країни, зміною типу природної поверхні Землі на бетон, бітум і водонепроникні поверхні.

Екологічна будівля в Кошице має зелений дах на верхівці будівлі. Мета статті – дослідити температуру поверхні покрівлі для трьох різних типів трави зеленого даху. Той факт, що різний вибір рослинності впливає на зниження температури зеленого даху, може бути дуже цікавим з погляду мікроурбанізму та мікроклімату. Основною ідеєю цієї статті є зниження температури на поверхні покрівлі для заощадження енергії та отримання води.

Ключові слова: інша рослинність, зелений дах, температура під листям, енергозбереження.

This paper highlights the importance of energy savings in terms of the best choice of vegetation used on green roofs.

Kosice city is located in eastern Slovakia. Košice is situated on the Hornád River in the Košice Basin. Kosice has a borderline humid continental climate and oceanic climate as the city lies in the north temperate zone. The city has four district seasons. Precipitation has a little variation throughout the year with abundance precipitation that falls during summer and only few during winter.

These days, change of climate is very discussed issue all over the world. Changing the topography of the country, changing the type of the surface, putting away nature, replacing it with concrete, bitumen and impervious surfaces are things we have to deal with almost every day.

Ecopoint buidling in Kosice has a green roof on one top of the building. Aim of this article is to present three different measurements of temperatures under three different types of foliage of this green roof. The fact that different choice of vegetation has an effect on lowering the temperature of green roof might be very interesting in terms of microurbanism and microclimate. Reducing temperature may cause also other savings like energy or water retention, what is the main idea of this article.

Key words: different vegetation, green roof, temperature under foliage, energy saving.

Introduction. The object with the green roof where the experiment started is situated in Košice city in Slovakia, Magnezitárska 2/C, 04013. Name of the building is EcoPoint Office Center Košice, one of the

mottos of this building is “Where ecology meets economy”. The EcoPoint project has been awarded with Silver DGNB Pre-certificate. That certificate is awarded based on assessment of authorized experts of ÖGNI. EcoPoint is thus the first project of a building in Slovakia that has been awarded with the pre-certificate. It guarantees to the investor, but especially to tenants, that principles of sustainable construction will be adhered to [1]. The building is using active technologies. Heating and cooling using activation of the concrete core in ceilings, using heat pumps will provide environmental comfort without air-conditioning. Another qualities of this project are: possibility of natural airing through opening windows, fire and evacuation radio, air ventilation system in all offices provide fresh, thermally treated air, clear height of offices, double flooring, antistatic carpets, adequate natural light, connection to public data and telecommunication networks, video monitoring system for building protection, high-speed elevators, access to the parking lot and all floors protected by a security card system etc.

Green roof used for the experiment. The green roof is the roof of fifth floor. It is accessible from open space offices situated on this floor. Orientation of the roof is to the north, west and south. After leaving the interior of the building and entering the roof, on the surrounding parts of this terrace is a green roof with three types of sedum, in the middle, there is an artificial pavement made of concrete blocks. The use of this area is free for the workers of the building and for the employees renting offices. Between the green roof and the roof guard, there is a dilatation area of stones.

Fig. 1. Places for sensors under three different sedums

The roof construction and all its layers are described in Table 1. Spots, where the sensors are placed under the sedums are pictured on Fig. 1. As can be easily notable from the pictures, main idea of this article is explained here, the sensors are placed under three different plants.

Table 1

The green roof construction

vegetation	-
medium	100 mm
filter fabric	-
water holding drainage layer DEKDREN L 60	60 mm
filter membrane TYPAR SF	-
waterproof PVC foil SIKAPLAN SGmA	1,5mm
filter fabric PP 300g/m2	-
thermal insulation ROOFMATE SL-A	40 mm
thermal insulation	160 mm
vapour barrier ISOROOF PLUS	-
interpenetration paint SBS	-
Bearing construction	250 mm

Sensors that were places under the vegetation. The sensors before placing on the green roof under the sedums have been for one day in the same place in the interior. This step was made to adjust the sensors and record first measurements. As it was assumed, there were little differences between all 6 sensors. Recorded temperatures can be found in Table 2. In future, while making conclusions, these anomalies will help to adjust the measurements of all the sensors H01 H02 H03 H04 H05 H06.

Table 2

The state of the sensors H01-H06 on 31.07.2015 at 11:30

Date	Time	Sensor	Temperature, °C
29.07.2015	15:00	H01	25,8
29.07.2015	15:00	H02	30,0
29.07.2015	15:00	H03	25,9
29.07.2015	15:00	H04	26,5
29.07.2015	15:00	H05	25,8
29.07.2015	15:00	H06	26,2

For the final research report, measured temperatures were adjusted to the sensor H01 and H05, because only these two sensors measured on 29.07.2015 at 15:00 same temperatures.

Plants. Three significant plants of this roof used for an experiment are: Sedum Diffusum 'Potosinum', Sedum Kamtschaticum and Sedum Spurium 'Voodoo'. Diffusum 'Potosinum' described in Table 3 has significant yellow/green color, Sedum Kamtschaticum described in Table 4 is vivid green and Sedum Spurium 'Voodoo' described in Table 5 has significant burgundy color.

Table 3

Sedum Diffusum 'Potosinum' [2]

Plant type	Perennial, Cactus / Succulent, Groundcover
Height x Spread	15 x 30 cm
Soil needs:	Average, Well-Drained, Rich, Rocky, Sandy/Gritty
Water needs:	Regular, Occasional, Low, Drought Tolerant
Sun exposure:	Sun, Part Sun
Special situation:	Pollution Tolerant
Flowers:	Yellow
Foliage:	Evergreen, Silver / Gray / Blue
Wildlife:	Bees, Butterflies
Flowering time:	Summer

Table 4

Sedum Kamtschaticum [3]

Plant type	Cactus / Succulent, Groundcover
Height x Spread	10-15 x 30-60 cm
Soil needs:	Well-Drained, Sandy/Gritty
Water needs:	Regular, Occasional, Drought Tolerant
Sun exposure:	Sun
Special situation:	-
Flowers:	Orange
Foliage:	Green
Wildlife:	Bees
Flowering time:	Summer

Table 5

Sedum Spurium 'Voodoo' [4]

Plant type	Perennial, Cactus / Succulent, Groundcover
Height x Spread	10-15 x 45 cm
Soil needs:	Well-Drained, Sandy/Gritty
Water needs:	Occasional, Drought Tolerant
Sun exposure:	Sun
Special situation:	-
Flowers:	Pink, Red
Foliage:	Evergreen, Burgundy / Maroon
Wildlife:	Butterflies, Deer Resistant
Flowering time:	Summer

Tempertature differences. Change of temperature under three different sedums was recorded. The data was recorded between 30.07.2015 and 06.09.2015 in 30 min interval. The change can be seen on Fig. 2, Fig. 3, Fig. 4. Vertical lines (Y axis) of the graph represent 24 h interval of records, horizontal lines (X axis) represent temperatures.

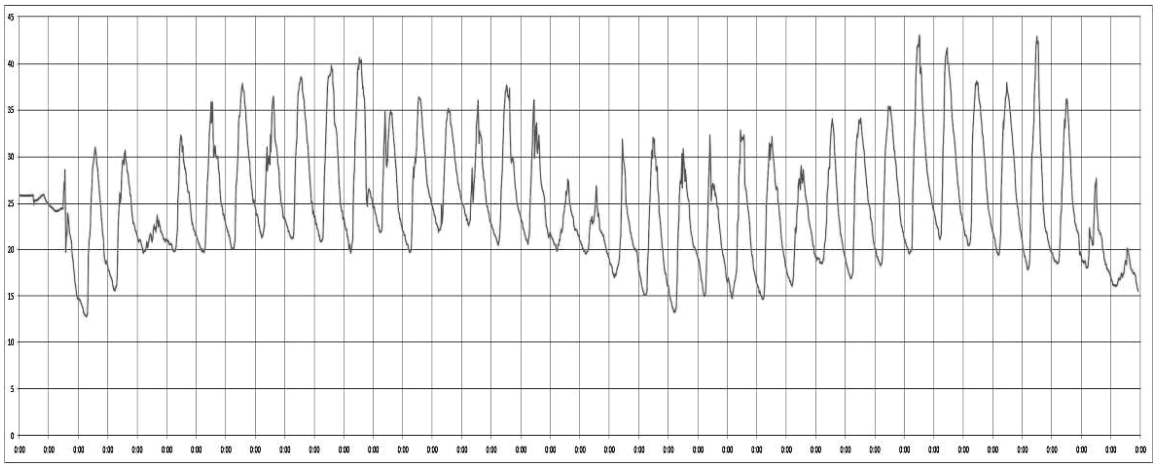

Fig. 2. Change of temperature under Sedum Diffusum 'Potosinum'

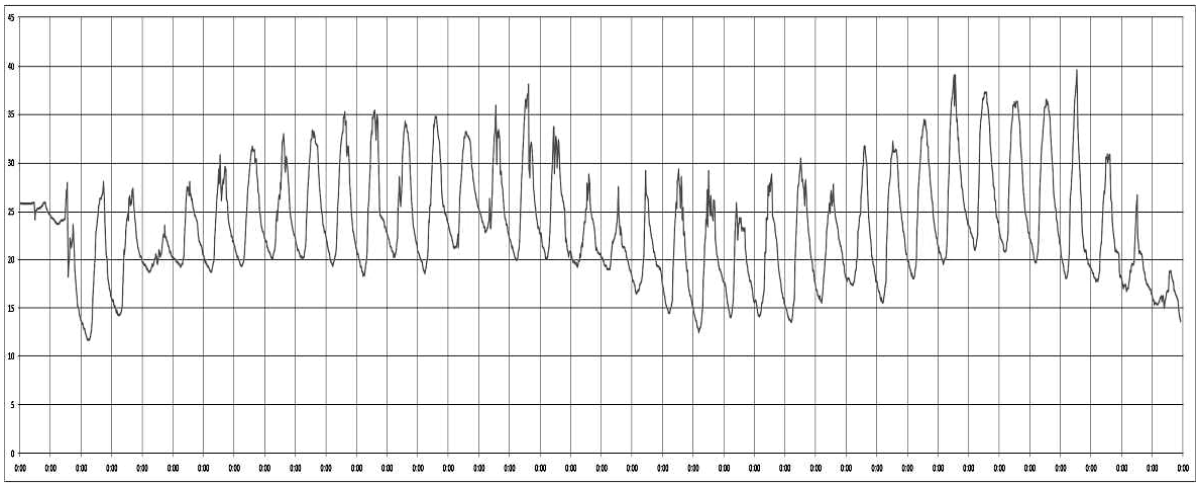

Fig. 3. Change of temperature under Sedum Kamtschaticum

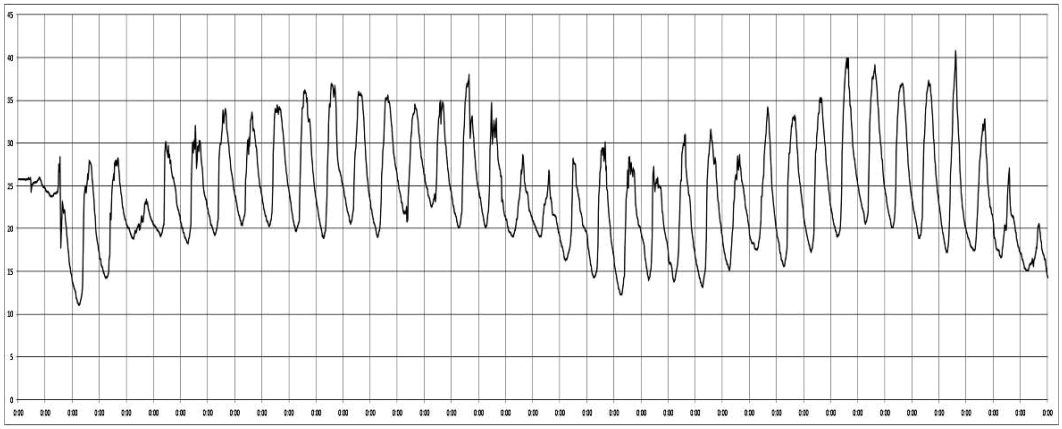

Fig. 4. Change of temperature under Sedum Spurium 'Voodoo'

Fig. 5 shows that the biggest differences in temperatures are under Sedum Diffusum 'Potosinum. The smallest differences in temperatures are under Sedum Kamtschaticum.

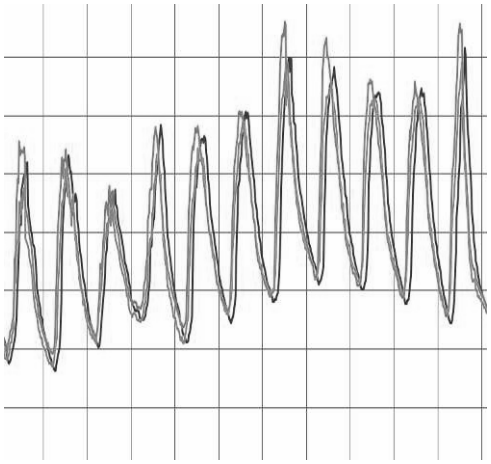

Fig. 5. Comparison of change of temepratures

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Conclusion. As it can be seen on the Fig. 2, 3, 4 and 5, different vegetation has different qualities in term of lowering temperature. According to this study, next steps will be focused on this measurement following the research in terms of lowering temperature, therefore focusing on layers and their ability to keep water, thus energy savings.

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