The Brno District at Špitálka To Be Interlaced with Smart Technologies

Jiří DŘÍNOVSKÝ

Brno University of Technology, Technická 12, 616 00 Brno, Czechia

drino@vut.cz

In a few years, the revitalized district at Špitálka is going to offer a trail in the clouds with a unique view of Brno, community gardens, sports grounds, flats and commercial premises. The project of reconstruction of unused buildings of the Brno heating plant has not only been discussed for several years, but an intensive work has been being done on an implementation.

In 2020, the Era Atelier prepared a territorial study, which was followed by an urban-architectural concept of the area development. That way, the so-called Master plan from the Atelier A8000 was created. "Thanks to the Master plan we have a clearly defined vision of the site, the future function of both existing and planned buildings. We would like to keep the genius loci of the location: the cooling tower, the two-aisle industrial hall and the archive of the heating plant" explains the locality manager **Yuliya Ostrenko.** The existing buildings are going to be revitalized and equipped with new technologies.

When developing the district, promising smart technologies should play the key role. At present, the technological equipment is necessary to be planned, the implementation process has to be conceived, and the sustainability of operations should be ensured.

Brno in the Role of a Follower

The project **RE: Špitálka** - as the new district construction plan is called - has become the part of the European RUGGEDISED project in 2016. RUGGEDISED is an acronym for the project name - *Rotterdam, Umea and Glasgow: Generating Exemplar Districts in Sustainable Energy Deployment*. RUGGEDISED received the support under the call Smart and Sustainable Cities of the HORIZON 2020 program. The RUGGEDISED consortium consists of 34 partners from eight European countries - cities, companies, universities and research centers. In tandem with the city where it is located, Brno University of Technology (BUT) also contributes to the project.

In RUGGEDISED, the so-called pilot cities (or "lighthouse cities") play the dominant role. These cities should not only implement their smart solutions but also pass on their experience to the so-called follower cities ("followers"). Now, the role of pilot cities is played by Glasgow in Scotland, Umeå in Sweden and Rotterdam in the Netherlands while the group of followers consists of Parma in Italy, Gdańsk in Poland and Brno in the Czech Republic.

Examples of implemented smart solutions include intelligent heating and heat supply, thermal energy storage, smart public lighting and electro-mobility support. The

well-known Ahoy Center in Rotterdam, from which the finals of the Eurovision Song Contest were broadcast in 2021, is an interesting example of such smart realizations.

Assessing Smart Solutions

The city of Brno, in cooperation with BUT, assesses smart pilot solutions within the project and tries to apply them to the development of Špitálka. As a part of the assessment process, a series of expert round-tables brought together academic and private sector experts to discuss possible solutions for the smart district. These days, the so-called *White Book* is being processed to unify the urban-architectural concept of the Master plan with relevant outputs from expert round-tables. The construction of a smart district at Špitálka should test the particular solutions in real life.

The expert round-tables were focused on key areas such as production, efficient distribution and storage of electric power, water management, heat and cold supply, connectivity, computing and data services, shared economy, security and recycling. The full energy self-sufficiency of the district and approximately 15% energy savings in the operation of completed buildings (compared to current standards) are the ambition of the project.

Particular smart solutions, which include rainwater management, the use of waste heat from bakeries and data centers, and the construction of electricity and heat storage facilities, should contribute to achieving this goal. As an example, the use of a low-temperature heating system connected to the return branch of the heat pipe can be given. Waste heat from nearby bakeries and data centers belong to other sources by which the heat management can contribute to the maximum energy self-sufficiency of Špitálka.

Moreover, a cooling supply with a peak output of 2.0 MW must also be taken into account. Together with the supply of 1.5 MW of the thermal energy for heating, the refrigeration power represents a significant amount of energy to be obtained from external and autonomous energy sources. The use of the already mentioned return heating water, the production of heat or cold by absorption heat pumps, the exploitation of excess heat produced by the heating plant or the use of the waste air heat with the redistribution among particular buildings seems to be promising solutions.

Energy in Main Role

A comprehensive approach to the energy management that does not reject any clever idea can be illustrated by a discussion of the use of thermal energy from wastewater, sidewalks and roads. No matter there is a number of similar options, all potential approaches need to be carefully assessed and only those solutions that are meaningful and competitive can be selected for implementation. At present, the assessment is at the stage of feasibility studies and economic return analyzes.

Although the above approaches to energy recovery often represent smaller energy sources, their stability over time is acceptable. Combining stable partial sources into a complex entity can then play a significant role in supplying the district with heat. Potential fluctuations in the demand for thermal energy can be covered by the heating plant.

The use of underground accumulators to store the heat in summer months and cold in winter is another interesting approach. These accumulators are intended to increase the efficiency of heat management throughout the district.

The buildings themselves should help to maximize the energy self-sufficiency as well. "We assume that the thermal-technical design of buildings will exceed today's standards for about 15%," the ambitious goal is commented by **Dr. Jiří Pospíšil**, the head of the expert round-table focused on the *Thermal Grid*.

Generating and delivering electricity is even a bigger challenge. The required power input of the new Špitálka quarter is estimated to be up to 2 MW. The obvious first choice is clean green energy from renewable sources produced on site. However, the usual location of photovoltaic panels on rooftops is used here for recreational purposes such as the trail in the clouds and community gardens on the roofs of the three existing buildings and six new ones. For this reason, photovoltaic panels are planned to be placed on the southern facades of the buildings, which will be sufficiently exposed to sunlight.

Of course, modern urban neighborhoods must also prioritize clean and quiet transport, creating favorable conditions for electromobility. At Špitálka, numerous parking sites with slow charging wall-boxes will be reserved for residents, while fast charging stations will be designated for employees and visitors. Along with other activities, the charging of electric vehicles will further burden the energy balance of Špitálka. Naturally, the smart district will need to be equipped with a system of buffered battery storages that will be charged in times of surplus electricity and will be able to meet peak electricity demand in times of shortage.

An essential part of the equipment of a modern urban district is also smart lighting, the intensity and spectral composition of which is flexibly controlled according to current needs, taking into account energy savings and the lighting comfort of residents and visitors. A similar urban lighting system is already being tested as part of the RUGGEDISED project in Glasgow in Scotland.

Recycling, or Upcycling?

Although some interesting original buildings will be preserved and modernized, the construction of the new urban quarter will undoubtedly be preceded by extensive demolition of unnecessary buildings. Of the large amount of waste generated, some can certainly be used on site. In order to optimize all processes, the problem of efficient sorting and subsequent appropriate use of construction waste on the one hand, and the disposal of unusable residues on the other, is already being intensively discussed in the planning phase.

The above issues are not the only areas addressed by the RUGGEDISED project. In this paper, only selected topics are mentioned to illustrate the varied and diverse content of the RUGEDDISED project. The realization of the smart district at Špitálka is a complex and broadly conceived project.

The ambition of the City of Brno is to successfully implement the smart Špitálka. Špitálka will offer not only a unique view of Brno from the athletics track between the roof gardens, but also valuable practical experience that Brno will be able to share in future projects as one of the pilot cities.

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