RENEWABLE ENERGIES AS THE BASIS FOR THE FUTURE OF SUSTAINABLE URBAN PLANNING: THE CASE OF BUBNY-ZÁTORY*

The intensified focus on renewable energy sources after 2022, triggered by geopolitical changes and efforts to achieve energy independence, is leading to a fundamental transformation of spatial planning and the appearance of settlements and the landscape. Households and municipalities are increasingly investing in technologies such as solar panels and heat pumps, thereby supporting decentralized energy and community solutions. At the same time, this transformation raises new questions about the future of the landscape after coal mining, as well as the place of nuclear energy in a mixed energy policy. The article focuses on the groundbreaking urban development project Bubny-Zátory in Prague, which is one of the first climate-neutral urban districts in the Czech Republic, with an emphasis on energy efficiency, sustainable mobility, and modern technologies.

A New World of Clean Energy

The energy sector is shifting towards clean, safe, and accessible sources – solar, wind, water, and geothermal energy. Thanks to technological advances, production is becoming decentralized: every building or community can become an energy producer.

According to Daniš [1, pp. 42–48], solar and wind energy will make up 75–90% of the future energy mix, supplemented by other renewable sources depending on local conditions. Primary energy consumption will require a 3.5–5-fold increase in electricity production, supported by two-way flow in decentralized networks. It should be noted that nuclear energy does not produce CO_2 during production, but it is not renewable. Its construction takes more than ten years, the costs are high, and the long-term storage of waste remains a problem. Nevertheless, in terms of safety, it is comparable to solar and wind energy.

The interconnection of energy networks within Europe will allow energy to flow where it is needed. Most of the time, there is wind or sunshine somewhere, so individual locations will be largely self-sufficient, reducing overall energy demand. This system will also work on a larger scale: when the wind blows in the North Sea, cheap energy can flow to southern Europe, and vice versa – when the sun shines in Spain, Italy, or Greece, energy can travel north. However, this requires new networks to enable such exchanges [1].

Community Energy and Eco-neighborhoods

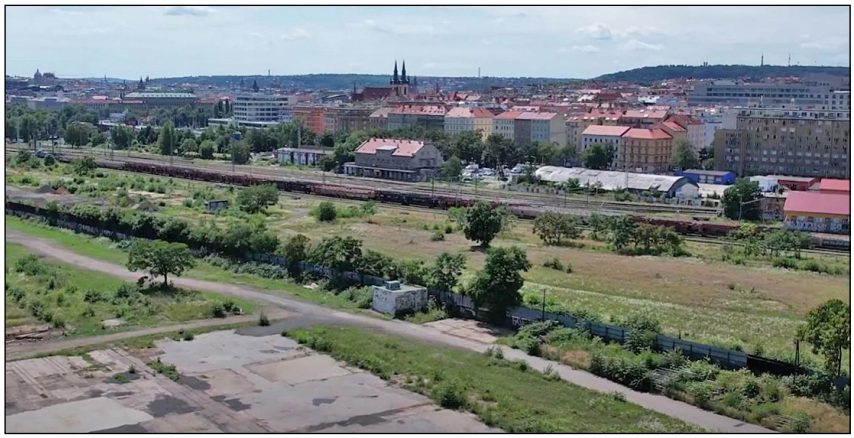
A community approach allows renewable resources to be shared between households, municipalities, and city districts. Joint energy production and distribution enables more efficient consumption management and better control of the supply fluctuations typical of renewable resources [4].

Success depends on cooperation between developers, local governments, and residents, with the development of local industries such as eco-design, organic farming, and waste processing [5, pp. 78–80]. Some cities promote environmentally friendly behavior among residents through practical guides that describe specific measures related to greenery, sustainable mobility, energy efficiency, and water and waste management. These materials, tailored to specific residential areas, explain, for example, how solar water heaters work, the importance of sunshades, the quality of thermal insulation, and the selection of vegetation for green spaces with regard to local conditions. Ecological habits are most effectively reinforced in a group. According to environmental psychologist José Palma Oliveira from the University of Lisbon, sustainable lifestyles are formed and reinforced by the group – they are supported, recognized, and socially accepted [5, p. 53].

Energy sources	**Study 2021** [2]	**Study 2024** [3]
Nuclear energy	–	13,6–49,0
Lignite	10,38–15,34	15,1–25,7
Hard coal	11,03–20,04	17,3–29,3
Natural gas	7,79–13,06	10,9–18,1
Water		
Onshore wind energy	3,94–8,29	4,3–9,2
Offshore wind energy	7,23–12,13	5,5–10,3
Biomass	7,22–17,26	11,5–23,5
Small photovoltaic system	5,81–11,01	6,3–14,4
Large-scale photovoltaic power plant	3,12–5,7	4,1–6,9

Comparison of current average energy prices for electricity generation in new power plants in euro cents per kilowatt hour by type (source: fraunhofer.de [2], fraunhofer.de [3])

* Slovenský překlad článku je uveřejněn na webových stránkách časopisu.



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Brownfield Bubny-Zátory

Visualization of the Bubny-Zátory study [11]

Urban situation of the area [11]

BedZED – Sustainable Techniques in Practice

One example is the London neighborhood of BedZED (Beddington Zero Energy Development), which has reduced its ecological footprint by 50% and its heating requirements by 80% thanks to functional planning and efficient use of space [5, p. 80]. BedZED is one of the first attempts at an energy-neutral urban neighborhood.

The project used several innovative solutions:

- Biomass and gas – in addition to gas boilers, a biomass boiler was installed.
- Winter gardens – two-story glassed-in spaces in front of each apartment function as a passive heating and cooling system.
- Wind chimneys – roof chimneys oriented according to the wind provide natural ventilation with heat exchange.
- Decarbonization of the structure – the use of lightweight prefabricated concrete slabs, granulated blast furnace slag (GGBS) blocks, recycled steel, and local bricks has significantly reduced the embodied carbon.
- Photovoltaic panels – positioned to allow daylight into the conservatories while providing shade and reducing overheating in summer.

In addition to energy measures, the neighborhood offered community services (nursery, café, gardens, playground) to minimize car use. Although the original vision of a self-sufficient „village" was not fully realized, BedZED became an important reference point for sustainable urban projects and inspired further developments in green architecture [6].

Bubny-Zátory as One of the First Climate-neutral Districts in the Czech Republic Supplied from Renewable Energy Sources

The 110-hectare **Bubny-Zátory** transformation area in Prague's Holešovice district is set to become the first district in Prague to be energy independent from gas and coal. Heat and cooling will be obtained from renewable sources – specifically from recycled wastewater

Map of heat supply from the Energocentrum in Bubeneč [8]

energy. The plan is to use heat and cooling from the Energy Center, which is to be built next to the wastewater treatment plant in Bubeneč. Heat will be produced from wastewater using high-capacity pumps [7].

An available study of the technical infrastructure, published in 2022 at [8], examined two alternatives for heat supply – a conventional connection to the central system and a new low-emission variant using the aforementioned Energy Center. The study also includes a proposal for the route of the main pipeline leading to the collector at Hlávkov Bridge, which would allow the ecological system to be extended to central Prague. In addition to energy, the study focuses on the coordination of technical infrastructure and securing space for planting urban greenery. The preliminary investment costs were estimated at CZK 2.3 billion, with co-financing from developers. In the future, the energy center could supply heat and cooling not only to the entire Bubny-Zátory district, but also to the wider city center, including the planned philharmonic hall near the Vltavská metro station [8].

Discussions about the construction have been going on for decades, and a building freeze is in effect in the area [9]. Currently, the area around the large railway station is difficult to navigate and prevents the natural connection of two lively districts – Letná and Holešovice. In addition to the challenging traffic situation, the process is also complicated by the division of the area among several owners [10].

In order to harmonize the intentions of individual owners with the needs of the city, Prague commissioned a detailed territorial study. Its authors are the architectural firms Pelčák a partner architekti and Thomas Müller Ivan Reimann Architekten [10]. At the beginning of 2025, the construction of a new northern entrance hall (vestibule) for the Vltavská metro station was approved. This infrastructure will be key to connecting the future district with public transport [12]. Magistrat plans to approve a change to the zoning plan in the near future, which will allow construction to begin [9].

The project to use thermal energy from wastewater is unique on an international scale (technically, it is not a renewable energy source, but rather an increase in energy efficiency). Wastewater utilization is also used in Denmark and Sweden, for example [7].

In addition to its innovative energy concept, the project is also unique in other aspects:

- The new Bubny–Zátory district will provide homes for up to 25,000 residents in 11,000 apartments. Its size makes it one of the largest transformation areas in Prague – a former industrial zone with a freight station and warehouses is gradually being transformed into a modern urban structure [10].
- This is a brownfield transformation in close proximity to the historic city center (the only area closer to the center than this is the Masaryk Railway Station) [11].
- The new district will have excellent transport links – it will be connected to the metro, trams, pedestrian and cycle routes, as well as the railway, which will become even more important thanks to the modernization of

the Prague–Kladno line and the new connection between the city center and Václav Havel Airport [11].

- The project promotes short distances and plans to create high-quality civic amenities – kindergartens and elementary schools, cultural facilities, a shopping center, and a new town hall for the Prague 7 district.
- A 6-hectare central park will be created in the center of the area as the green „heart" of the new district, providing opportunities for sports and recreation while connecting the Vltava riverbank with the Výstaviště exhibition grounds and Stromovka Park [9].
- The project makes effective use of the economic potential and consists of a compact block structure of buildings. The main residential part will be located in the southern half of the area, with a height of approximately 6 to 8 floors. In the northern part of the area, the apartments will be complemented by administrative buildings, which in some locations may reach 18 to 21 stories. From an urban planning perspective, the area will be functionally divided – administrative buildings will be located along the main roads (e.g., Argentinska Street), while residential areas will be concentrated in the quieter inner part. A total of approximately 29,000 new jobs are expected to be created.
- The project includes significant cultural elements that give it a strong international context, such as the new Vltava Philharmonic Hall (the first symphony concert hall in Prague in the last hundred years) and the Memorial of Silence, commemorating the tragic history of the Bubny railway station during the Holocaust [13].
- New squares will be created in the vicinity of the Bubny and Holešovice stations, while the historic buildings of the railway station, waterworks, and power plant will be preserved.

Conclusions

The Bubny-Zátory project represents an innovative approach to urban development that emphasizes the use of renewable energy sources and the goal of climate neutrality without dependence on gas or coal. This project demonstrates the importance of comprehensive spatial planning that integrates technical infrastructure, green energy supply, and urban greenery, while also offering a long-term sustainable vision for development. Bubny-Zátory is thus setting a new standard for future brownfield development projects, with a focus on quality of life, energy efficiency, and community solutions. This project also serves as inspiration for other cities facing the challenges of the climate crisis and geopolitical changes and seeking ways to transform their urban areas in a sustainable manner.

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