



Universität für Bodenkultur Wien
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Green up your City

Study on façade greening and roof greening in
subsidised housing in Vienna

Summary



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Climate change adaptation as a challenge for subsidised housing in Vienna

The urban climate in Vienna is changing noticeably. The heat is increasing and is affecting people's health. Heat periods are becoming more frequent and last longer. 14 of the 20 warmest years in Austria since the beginning of the measurements in the middle of the 18th century have been recorded in the past years since 2000.¹ Vienna's inner city reported a new record of 42 tropical nights in 2018 (air temperature does not fall below 20 °C).² The climate scenarios for Vienna expect further temperature increases in the future. Summer droughts and heavy rainfall events are also expected to increase. Cities and the housing sector in Europe and around the world are preparing for these changes and are trying to mitigate the consequences for the society.

Vienna and its population are especially affected by these developments. Climate change is accompanied by an intensive urban growth, which increases the urban heat island effect (higher temperatures in the city compared to the surrounding area). The build-up of currently undeveloped areas – mainly areas in agricultural use or abandoned traffic areas – as well as inner-city densification lead to the loss of green spaces. At the same time, the trend towards denser and higher construction methods reduces the amount of green and open spaces on the plot.

Various research projects prove that urban green infrastructure is an important tool to mitigate the effects of climate change. Nature-based solutions such as green walls and green roofs provide ecosystem services which help to reduce the heat burden and support the rainwater management. In addition, they support air purification, increase biodiversity, promote physical and mental well-being and have positive effects on the urban design quality.

However, the lack of space, high property prices and land use conflicts in urban areas limit the possibility of implementing urban green infrastructure. Green roofs and green walls do not require any additional space and create green spaces in a further dimension. Although green roofs and green walls cannot completely replace residential green spaces, parks and other public green spaces, they are a valuable addition to urban greenery. Many examples and successfully implemented green walls and green roofs show their positive effects. They help to cool the building's surrounding and the interior, improve rainwater retention, increase biodiversity and contribute to the living quality.

¹ ZAMG (2018): <https://www.zamg.ac.at/cms/de/klima/news/2018-wird-eines-der-waermsten-jahre-seit-messbeginn>.

² Pfurtscheller, F. (2018): Rückblick auf den Sommer 2018. UBIMET. Online unter: <https://wetter.tv/de/news/rueckblick-auf-den-sommer-2018> (Zugriff am 19.12.2018).

Adapting to climate change and ensuring a high quality of living while the urban density increases is an important goal for Vienna's urban development policy. The subsidised housing sector plays a key role in this.

Aims and content of the research project

The research project "Green up your City" analysed the feasibility of the construction of green roofs and green walls in subsidised housing in Vienna and developed strategic recommendations for a stronger implementation of roof and façade greening in the subsidised housing sector.

The research questions were:

- How is the greening of roofs and façades currently implemented in subsidised housing in Vienna?
- What are the success factors supporting the implementation of green roofs and green walls?
- Which positive effects do green roofs and green walls provide for the residents?
- How can the greening of roofs and façades in subsidised housing in Vienna be promoted?

To answer these questions, a mixed-method approach was used, in which qualitative and quantitative, social-scientific and planning methods were combined. The methods included the collection of good practice examples and their evaluation, qualitative guideline-based expert interviews, desktop research and literature review.

Green roofs and façades and their ecosystem services

Green roofs and façades have positive effects on different levels. The building itself, the residents, the buildings surrounding and the urban area benefit from the greenery and its diverse ecosystem services. The term ecosystem services describes all benefits that humans obtain from ecosystems. They provide material goods, psychological benefits, human health and well-being. Four different kinds of services can be identified: (1) regulating services, (2) socio-cultural services, (3) provisioning services and (4) supporting services.³

Green roofs and green walls provide mainly regulating and socio-cultural services. Regulating services cover all services that result from the regulation of ecosystem processes. They include, for example, temperature regulation, air purification and the

³ Millennium Ecosystem Assessment (2005): Ecosystems and Human Well-being: Synthesis.

<http://www.millenniumassessment.org/documents/document.356.aspx.pdf>.

TEEB – The Economics of Ecosystems and Biodiversity (2010): The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations. Edited by Pushpam Kumar. London and Washington: Earthscan.

regulation of the water balance. Socio-cultural services describe all non-material services ecosystems provide to humans, such as recreation, aesthetics, spiritual experiences, ethical values, social relations or cultural identity. The provisioning services of green roofs and façades cover mainly fruits and vegetables grown in rooftop gardens. Supporting services like soil formation, nutrient cycles or pollination are the basis for the existence of ecosystems.

Regulating and socio-cultural services of green roofs and green façades increase the living quality and contribute to the well-being and satisfaction of the residents

The positive impacts of urban green infrastructure as a nature-based solution to deal with the challenges of climate change and increasing urban densification are not only scientifically proven, but are also becoming increasingly important for the residents. Green spaces contribute to the quality of life in many respects: they provide a contrast to the built environment, provide recreational opportunities, improve mental and physical health and enable social contacts.

Temperature regulation through shading and evapotranspiration is one of the most important benefits of green roofs and green walls.

They also support the insulation of the building and protect the façade and the roof's sealing system by lower temperature fluctuations. Green roofs make an important contribution to the rainwater management. Extensive roof greenings are able to retain more than 60% of the rainwater. This leads to a reduction of the water runoff. Through their dust-filtering and particulate-binding potential, green roofs and façades contribute to the improvement of air quality. Noise reduction through vegetation, i.e. sound insulation through reflection and absorption, is another positive effect.⁴

In addition to the regulating services, green roofs and green walls provide socio-cultural benefits for the residents. Buildings with green roofs and green façades are aesthetically pleasing, have high recreational effects and are becoming increasingly popular. Green roofs and green walls can provide a learning environment and increase the awareness of nature – especially for children and adolescents. The housing situation is one of the most important factors for human health. Green roofs and green façades increase the psychological well-being and reduce stress – even for people who only watch the greenery. Accessible and usable green spaces are places of social encounters. They provide opportunities for social

⁴ Hop, M.E.C.M. & Hiemstra, J.A. (2013): Contribution of Green Roofs and Green Walls to Ecosystem Services of Urban Green. In: Van Huylbroeck, J. et al. (Eds.), Proceedings II International Symposium on Woody Ornamentals of the Temperate Zone. ISHS Acta Horticulturae 990: 475-480.

Pfoser, N., Jenner, N., Henrich, J., Heusinger, J. & Weber, S. (2013): Gebäude Begrünung: Energie Potenziale und Wechselwirkungen. Interdisziplinärer Leitfaden als Planungshilfe zur Nutzung energetischer, klimatischer und gestalterischer Potenziale sowie zu den Wechselwirkungen von Gebäude, Bauwerksbegrünung und Gebäudeumfeld. Abschlussbericht August 2013.

interaction and empowerment. Community gardens and rooftop gardens connect generations and cultures. Increased social well-being has in turn positive effects on mental and physical health.⁵

The implementation of green roofs and green façades in subsidised housing in Vienna

From the construction of the first municipal residential buildings onwards, there has been a tradition of establishing housing-related green spaces in subsidised housing in Vienna. Starting with the construction of Metzleinstaler Hof (1919-1920), Vienna implemented a comprehensive social housing programme. It was characterised by the aim to provide sufficient living space for Vienna's inhabitants and, at the same time, to improve the living quality in the city. Vienna's social housing policy was based on the rule that buildings are only allowed to cover 50% of the total site (compared to 85% in the period of promoterism "Gründerzeit"). The generous courtyards that were created due to this regulation provided plenty of green space and children's playgrounds for the residents as well as for the neighbourhood. The building of the Karl Marx Hof, for example, only covered 23% of the total site area.⁶ The overall goal was to provide sufficient light, fresh air and open spaces for the residents and Vienna's citizens.

The urban planning conditions in Vienna and the requirements for residential buildings have of course changed since then. Urban density ensures the reduction of land consumption and helps to plan efficient social and technical infrastructures. In order to reduce land consumption in urban development projects, there is a new trend towards denser and higher construction methods. However, increasing urban density goes hand in hand with the reduction of green spaces.

The research project analysed about 90 examples of subsidised residential buildings in Vienna, which are characterised by different building typologies, different age and different subsidy models. The large number of examples shows that green roofs and green façades have already been successfully implemented in many cases. A lot of examples are "classical" municipal residential buildings and buildings that have been developed by housing associations, supported by different instruments of housing subsidies. The first subsidised residential buildings with green roofs and green walls were constructed in the period between

⁵ Naturkapital Deutschland – TEEB DE (2016): Ökosystemleistungen in der Stadt – Gesundheit schützen und Lebensqualität erhöhen. Hrsg. von Ingo Kowarik, Robert Bartz und Miriam Brenck. Technische Universität Berlin, Helmholtz-Zentrum für Umweltforschung – UFZ. Berlin, Leipzig.

Schlößer, S.A. (2003): Zur Akzeptanz von Fassadenbegrünung: Meinungsbilder Kölner Bürger – eine Bevölkerungsbefragung. Dissertation an der Universität zu Köln.

⁶ Eigner, P., Matis, H. & Resch, A. (1999): Sozialer Wohnbau in Wien. Eine historische Bestandsaufnahme. In: Verein für Geschichte der Stadt Wien (Hrsg.), Jahrbuch des Vereins für die Geschichte der Stadt Wien 1999. Wien, S. 49-100.

the First and the Second World War. Significantly more examples were built since 1990 and especially during the last decade. In addition, a lot of green roofs and green walls were constructed on existing buildings during the last two decades, as part of a subsidised building renovation programme. The 90 examples are distributed throughout the city. Most of them can be found in the largest districts of Vienna: Favoriten, Floridsdorf, Donaustadt and Liesing, due to the fact that most urban development areas are located there.

An analysis of the different types of green roofs and green façades shows that all greening types can technically be implemented on all analysed housing types. A further result of the analysis is that green roofs and green walls are realised within all different housing subsidy models in Vienna.

Strategies to promote green roofs and green façades as an instrument to adapt to climate change and to improve the living quality in subsidised housing

Vienna has successfully positioned itself as a city that combines urban density with a high living quality. Vienna's social housing programme has made a significant contribution to this. Since 60% of Vienna's inhabitants live in subsidised houses or in municipal residential buildings, the subsidised housing sector plays an important role in the city's adaptation to climate change and counteracting the loss of green spaces due to urban densification.

Socially disadvantaged and low-income groups are especially affected by the consequences of climate change because of poorer living conditions. Elderly people and people with reduced mobility (children, people with chronic illnesses) – who are particularly affected by heat stress – are dependent on healthy, green living environments. Urban greenery is not equally distributed within the city. Especially dense and socially disadvantaged neighbourhoods are usually facing a lack of green spaces. The implementation of green roofs and green walls in subsidised housing is important in order to avoid "green gentrification". Studies show that green spaces increase property values and price out vulnerable residents. Since the rents are capped in subsidised housing, "green gentrification" can be prevented. Thus, climate change adaptation through greening roofs and façades in subsidised housing supports social justice.

Besides the integration of climate protection measures (e.g. thermal restoration, renewal of heating systems, etc.), the aim should also be to link climate change adaptation measures to Vienna's subsidised housing program. Climate policy is not only environmental policy. It has to be integrated into all political fields.

A stronger implementation of green roofs and green façades into the subsidised housing sector requires both – a legal obligation and financial support. A stronger integration of green roofs and green walls into the strategies of Vienna's subsidised housing programme as well

as a stronger integration into the various subsidy models and into the quality criteria for subsidised housing are necessary to support a broad implementation.

Green roofs and green walls provide a variety of services for the residents. In contrast to "grey" infrastructure, "green" infrastructure has values that go beyond its primary function. Besides cooling the environment through evapotranspiration, green roofs and green walls increase biodiversity and contribute to the physical and psychological health and well-being of the residents. Because of these multiple benefits and various positive effects of urban green infrastructure, green roofs and green façades are an efficient and effective adaptation measure to climate change and a powerful way to ensure the high living quality in subsidised housing.

Properly constructed roof and façade greenings are a cost-efficient measure to adapt to climate change. They prevent "mismatches" like using the car to travel to cooler places or purchasing air conditioning systems. Heat protection or rainwater management measures which at first glance may seem cost-intensive are actually reducing future costs. Taking no actions today means higher costs for adaptation measures in the future. Future-oriented planning means solving the conflict between cheap investments and climate-resilient solutions. That can only succeed if life cycle costs and additional hidden costs for residents (air conditioning, energy consumption) are taken into account.

The necessity of climate change adaptation as well as the challenge of increasing loss of green space as a consequence of the city's growth and its densification once again offers Vienna the opportunity to further expand its internationally recognised pioneer position in the subsidised housing sector. The City of Vienna can use its role model and expertise in climate-resilient and green-oriented urban development to improve the acceptance of green roofs and green walls within the population and to position itself towards other cities world-wide.