Large Scale Urban Developments in Austria – Challenges and Opportunities Based on Two Case Study Examples

D Österreicher¹* and M Treberspurg²

¹ Department of Landscape, Spatial and Infrastructure Sciences, Institute of Spatial Planning, Environmental Planning and Land Rearrangement, University of Natural Resources and Life Sciences, 1190 Vienna, Austria
² Treberspurg & Partner Architekten, 1140 Vienna, Austria, martin.treberspurg@treberspurg.at

doris.oesterreicher@boku.ac.at

Abstract. As urban densification is on the rise and the population of cities are increasing, strategies for eco-friendly urban development plans are needed in order to ensure the long-term sustainable growth of our cities. Quality of life and socio-economic considerations are in this context equally important as environmental factors such as energy efficiency, resilience and a future proof mobility concept. Especially large scale urban developments require long-term planning as the actual implementation phase can take decades for completion and advances in technology can significantly change over time. However these developments offer the unique opportunity for research and innovation, as accompanying studies can support the projects throughout the whole life cycle ranging from planning to implementation and monitoring during operation. To discuss the challenges and opportunities of large scale urban development projects, two Austrian case studies, that differ in time, scale and overall context have been selected: The solarCity Linz in the county of Upper Austria and the Aspern Seestadt in the City of Vienna.

1. Background

With population in cities on the rise, resilient solutions are needed to address the requirements for housing and associated infrastructure in the growing cities. In Austria, the demographic conditions are increasingly changing over time, due to higher immigration rates in the last decades. With 7.5M inhabitants in the 1970s, the country has increased to over 8.74 in 2016. The city of Vienna has in this period achieved the highest growth and is with over 1.8M by far the largest city in Austria. Linz, the capital of Upper Austria is with 200.000 people the third largest city after Graz with just under 250.000 [1]. For Vienna the prognosis show that the capital of Austria will reach the mark of 2 million inhabitants by 2027 [2].

Whilst cities are complex, historically grown entities, large-scale development areas within the cities boundaries are often on the outskirts with a lesser culturally burdened context. If existing districts are not part of the development, then the connection and integration to the surrounding neighbourhoods are the biggest challenges in terms of an urban-morphological approach. The opportunities in new urban developments however lie in the fact that a clean slate can be planned and an innate sustainable approach can be considered.
Whilst the two exemplar case studies, which are discussed in this paper are inherently different in terms of their time of design and implementation, scale and overall context, both initial designs consider energy and resource related factors equally important as well-being and socio-economic indicators in their underlying philosophy. In both projects the early masterplan already included these highly relevant aspects, which resulted in a building-morphological design that is based on the districts context and relevant influencing parameters such as climate and orientation.

For the development of a sustainable energy and transport infrastructure, the urban morphology, such as orientation, height, density as well as a functional mix form the basic underlying principles. The adequate solar orientation is not just relevant for wanted solar gains, but also for the health and well-being of the occupants due to the physiological and psychological effects of the direct solar radiation. Considering the often lengthy implementation phases, the developments must also be flexible and adaptive to new technological advances as well as resilient to changes in climate, culture or socio-economic requirements over time. If the city is equipped with appropriate control and adaptation mechanisms then disturbances can be absorbed with a higher tolerance. A resilient city has the intrinsic ability to change and adapt over time. From an energy perspective, a high degree of decentralisation and the utilisation of the built environment as energy producers are important in order to increasingly utilise renewable energy systems. Load shifting and building to grid concepts must be implemented on a larger scale so that buildings can function as flexible storage systems in an adaptive smart city context. Similarly the transport infrastructure must allow a high degree of modal split moving to a non-fossil based and highly flexible infrastructure whilst considering the mobility and ability of all inhabitants.

One of the greatest challenges lies in the planning with foresight and the detailed implementation. Inter- and cross-disciplinary approaches are needed in order to arrive at a true sustainable design, which is resilient, future-proof and liveable. Coordination and cooperation between the multitudes of stakeholders such as planners, researchers, city administration, the construction and energy industry as well as inhabitants and relevant local organisations is highly important in order for a truly sustainable project to achieve its ambitious goals.

The two case studies both show a different approach, however they each succeed in their own way in bringing new ideas on large-scale urban developments into implementation with environmental, economical and social sustainability in mind.

2. solarCity Linz Pichling

In the 1990s the city of Linz was in urgent demand for additional housing due to the imbalance between available jobs and local population. On the one hand, the inner city was already densely populated and on the other hand, there was not enough land available within the city boundaries for non-profit housing developers. A solution was needed to decrease the urban sprawl of single-family units located around the urban centres, increasing traffic and associated pollution in the area. At that time, the number of people looking for an affordable apartment in Linz was estimated over 10,000 [3].

The lakeside area of Linz-Pichling offered a unique opportunity to provide the much needed housing development areas in close proximity to the city centre and with a good public transport connection. Close to nearby steel factories, the land was previously not regarded as suitable for housing due to high emission rates. However in the beginning of the 1990s advanced filter technologies resulted in a significant improvement of the air quality, a fact that was also supported by measurements and an independent study. Since the planning area of Linz-Pichling lies in an ecologically sensitive area in close proximity to wetland and lakes, the aim of the planning was on a – at that time visionary – eco-friendly and sustainable urban development. The concept of the solarCity was the underlying principle in addressing this goal. Adequate orientation resulting in a high degree of solar gains by means of passive design due to orientation and spacing of the housing units was a key aspect to ensure economically feasible and highly liveable social housing units [4]. The objective was thus on achieving the ambitious goals by means of an appropriate architecture, rather than by the implementation of costly technology. In addition to energy efficiency measures, aspects related to low-
impact materials, landscape planning and family friendly infrastructure were implemented. An advanced wastewater treatment system [5] completed the holistic approach.

The well-known architect Roland Rainer initially developed the original masterplan in 1992. Within a large EU-project, planning firms around Foster and Partners, Richard Rogers Partnership, Herzog + Partner and Renzo Piano Building Workshop joined the design team. These high-profile architectural firms subsequently formed together with the energy technology planner Norbert Kaiser the working team “READ group” [3]. In 1995 the initial four non-profit social housing developers where complemented by eight more additional developers over the remainder of the area. Martin Treberspurg won in 1996 with his architectural firm Treberspurg & Partner Architects the second phase of the international urban planning competition. The new district comprised of 93 residential units with mostly low-energy and passive houses. The design was focused on the exploitation of passive design measures: a southern orientation in radial concentric patterns from the centre of the development as well as compact building forms highlights the signature design of the urban planning. The mobility concept foresaw that no building has to be more than 300m from the tram stop connected to the city centre of Linz [4].

During the following years additional units were built within subsequent planning and landscape competitions. Up to 2005 the solarCity Linz Pichling was completed with 1298 housing units from twelve different non-profit social housing developers within 36 hectares. One of the key goals was to implement a European Model of sustainable urban expansion [3], [6].

The project was analysed by several studies prior, during and after implementation, which also highlights the novelty of the urban development approach. One of the studies carried out by
Treberspurg & Partner Architects also focused besides technology related aspects on the interaction between people, technology and costs in the area of social housing [3]. One of the key publications of this large-scale development process is the book "solarCity Linz Pichling sustainable urban development" with Martin Treberspurg and the city of Linz as publishers [4].

3. Seestadt Aspern
The city of Vienna is growing at a steady rate, reaching close to 2M inhabitants by the mid 2020s [2]. To address the rise in population, the city has identified ten target areas for urban planning with the Seestadt Aspern being one of the key zones for long-term development [7]. In 2007 the land use plans have been adopted for the area and a competition for the masterplan has been carried out with the Swedish architectural company Tovatt becoming the winner of the original setting [8].

With a development area of 240 hectares, which is equivalent to the city’s first historic district, the Seestadt Aspern is one of Europe’s largest urban development areas. On a former runway for military airplanes in the 22nd district on the east side of the Danube, the development should comprise of housing for 20,000 people and as many workplaces and should be completed until 2028. The district is planned to be truly multifunctional with a mix of apartments, offices and commercial as well as scientific, research, health and educational spaces as well as areas devoted to religion. In the middle of the plot the five-acre lake marks the centre of the Seestadt Aspern and also gives the project its name.

Environmental compatibility and sustainability already play a key role during construction. Generous, interconnected green and open spaces and the proximity to the Donau-Auen National Park as well as a high-quality infrastructure ensure a new quality of urban living and working. 50 % of the space is reserved for public spaces, streets and squares. Almost 25 % of this is attributable to green spaces in and around the new district [8]. One of the key challenges is however the distance to the city
centre: with 10km to the 1st district, a good public transport connection is key in ensuring that people avoid using cars to travel to and from the city. In 2013 the underground line U2 has been extended to serve the district with two stations, one along the periphery on the north and another close to the lake in the centre [9]. This means, that a rapid public transport system was already in place, when the first inhabitants moved into their flats. There are a limited number of parking spaces available on the streets, garages are built underground with equal access distance to public transport and a car parking space. Mobility concepts such as e-bikes, car sharing and shared freight bicycles are concepts that are being explored and monitored.

The Seestadt was conceived as an urban lab of the Smart City Vienna, a place where intelligent ideas, concepts and technologies can be tested out [8]. Whilst the city administration implemented the development agency Aspern 3420[10] to coordinate all aspects of the development and facilitation of the whole area, the city also participated in the set up of a research entity, the Aspern Smart City Research (ASCR), which is funded by the city of Vienna, the Wien Energie and Wiener Netze, which are the main energy providers of the city, Siemens and the Vienna Business Agency. This highlights, that the city has understood, that this large-scale urban development provides a unique opportunity to test, implement and monitor new system and technologies over a longer period of time. The ASCR in particular focuses on the aspects of Smart Building, Smart Grid, Smart User and Smart ICT and uses the development area, together with national and international industry and research partners, as a living research facility for these topics [11]. Long before the first units were built, a collaborative research project already explored the relevant sustainability aspects on such large-scale urban developments on the example of the Seestadt Aspern. It identified at a very early stage a series of factors that influence the quality of sustainability of the project. The requirements ranged from urban morphology, mobility and resource consumptions to the needed quality assessments and provided key recommendations for the further planning and implementation stages [12]. During the following years, a series of research projects, studies and reports have been concluded on the diverse topics the Seestadt Aspern encompasses. From the characterisation of the sustainability concept in the Seestadt [13], to the district heating functionalities [14] and the Smart Building [15] and Smart Grid related research topics ranges the scope of publications [16] to name just a few. It highlights that this is much more than a state of the art urban development project but an opportunity to advance the research in this context in a highly cross-disciplinary way.

As of 2018 around a quarter of the overall site has been developed on the south and south-west side of the lake. Approximately 6800 people live in 3000 flats and 2000 people already work in the Seestadt. A series of offices, commercial entities, service-providers research and educational facilities have already opened [9].

4. Discussion
Whilst the two case studies are intrinsically different given their time horizon (starting in 1992 for the solarCity Linz with completion in 2005 and 2007–2028 for Aspern Seestadt), their context and especially their scale (36 hectares vs 240 hectares) they also have a series of characteristics in common: Both are large scale urban developments in relation to their respective overall city sizes. And – most importantly – both were conceived with a vision to provide a sustainable, future-proof and resilient urban development with an extremely high quality of life ambition. The various sectors that are considered as interconnected parts of a smart city – such as buildings, energy, mobility, industry and urban planning – were planned in a highly cross- and interdisciplinary way. Whilst the solarCity Linz focuses more on urban morphology to exploit passive measures, the Seestadt Aspern focuses more on the functional mix, high density and interconnectivity from a Smart Building and Smart Grid perspective. In this sense both the solarCity Linz as well as the Seestadt Aspern are unique in their setting and also serve as best practice examples beyond their city limits.
References

[1] Statistik Austria, Bevölkerung, Bevölkerungsstand- und Veränderung; https://statistik.gv.at/web_de/statistiken/menschen_und_gesellschaft/bevoelkerung/bevoelkerungsstand_und_veraenderung/111433.html (accessed 12.05.2019)

[2] Wien in Zahlen, Bevölkerungsprognose 2018, Magistrat der Stadt Wien Magistratsabteilung 23 – Wirtschaft, Arbeit und Statistik, https://www.wien.gv.at/statistik/pdf/bev-prog-2018.pdf (accessed 12.05.2019)

[3] Treberspurg M, Österreicher D and Ertl-Balga U 2018 Einblick / Ausblick: 14 Jahre Ressourcenorientiertes Bauen an der BOKU, Von der Forschung in die Praxis (Klein Publishing, Wien) ISBN 978-3-903015-11-1

[4] Treberspurg M and Stadt Linz 2008 Solar City Linz Pichling (Springer-Verlag / Wien) DOI: https://doi.org/10.1007/978-3-211-69293-6 Print ISBN 978-3-211-30562-1

[5] Starkl M, Ornetzeder M, Binner E, Holubar P, Pollak M, Dorminger M, Mascher F, Fuerhacker M and Haberl R 2007 An integrated assessment of options for rural wastewater management in Austria Wat. Sci. Tech. 56 105–13 doi:10.2166/wst.2007.562

[6] Stadt Linz, Stadtleben, Stadtentwicklung, Stadtplanung/Bau, https://www.linz.at/stadtentwicklung/solarcity.php (accessed 12.05.2019)

[7] Stadt Wien, Stadtentwicklung, Projekte, Zielgebiete der stadtentwicklung, https://www.wien.gv.at/stadtentwicklung/projekte/zielgebiete/ (accessed 12.05.2019)

[8] Stadt Wien, Stadtentwicklung, Projekte, Das Projekt – asperm Seestadt; https://www.wien.gv.at/stadtentwicklung/projekte/asperm-seestadt/projekt/index.html; (accessed 12.05.2019)

[9] Facts and Figures about asperm Seestadt, October 2018, https://www.asperm-seestadt.at/jart/prj3/asperm/data/downloads/181004_asperm_Seestadt_Facts_Figures_EN.pdf (accessed 12.05.2019)

[10] Wien 3420 AG https://www.asperm-seestadt.at/ueber_uns/wien_3420_ag, (accessed 12.05.2019)

[11] Asperm Smart City Research, https://www.ascr.at (accessed 12.05.2019)

[12] Hageneder C et al 2010 Wegweiser für eine zukunftsfähige Stadt- und Siedlungsentwicklung, Nachhaltige ressourcenschonende Seestadt Asperm, Juli 2010, ÖGUT https://www.oegut.at/downloads/pdf/wegweiser_stadtentwicklung.pdf, (accessed 12.05.2019)

[13] Biedron ska J 2018 The application of innovative energy-efficient technologies in the sustainable model of a housing estate – seestadt Asperm in Vienna Architecture Civil Engineering Environment 11 15–22 doi:10.21307/acee-2018-002.

[14] Kofinger M, Basciotti D, Schmidt R R, Meissner E, Doczekal C and Giovannini A 2016 Low temperature district heating in Austria: Energetic, ecologic and economic comparison of four case studies. Energy 110 95-104 doi:10.1016/j.energy.2015.12.103.

[15] Litzlbauer M, Schuster A, Einfalt A and Fasthuber D 2016 Gridfriendly flexibility management in future energy systems Elektrotechnik Und Informationstechnik 133 362–70 doi:10.1007/s00502-016-0443-5.

[16] Zehetbauer P, Stifler M, Rao B V 2018 Phase preserving profile generation from measurement data by clustering and performance analysis: a tool for network planning and operation Computer Science-Research and Development 33 145–55 doi:10.1007/s00450-017-0381-4