



Avi Friedman

**Innovative Apartment Buildings. New Directions in Sustainable Design**

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Current design of apartment buildings is facing challenges of philosophy and form. Past approaches no longer sustain new demands and require innovative thinking. The need for a new outlook is propelled by fundamental changes that touch upon environmental, economic, cultural and social aspects that led to the writing of this book.

The depletion of non-renewable natural resources and climate change are a few of the environmental challenges that prompted designers to reconsider conceptual approaches in favour of ones that promote a better suitability between buildings and their environments. Concepts that minimize the building's carbon footprint, passive solar gain, net-zero structures and water harvesting system are some of the contemporary strategies that architects and builders are integrating into their thought processes and design.

Increasing costs of material, labour, land and infrastructure have posed economic challenges with affordability being paramount among them. The need to do with less brings about concepts that include adaptable dwellings, and smaller-sized yet quality-designed housing. Social challenges are also drawing attention. As the »baby-boom« generation plans now for retirement, housing an elderly population will take priority. Walkable communities, aging in place, live-work residences, and multigenerational living are some of the concepts considered.

The book offers information on contemporary design concepts and illustrates them with plans and photographs of outstanding international examples.

Avi Friedman received his Bachelor's degree in architecture and town planning from the Israel Institute of Technology, his Master's degree from McGill University, and his Doctorate from the University of Montréal. He co-founded the Affordable Homes Program at the McGill School of Architecture where he teaches. He also holds an Honorary Professor position in Lancaster University in the U.K. Avi is known for his housing innovation and is the author of 18 books. He is the principal of Avi Friedman Consultants Inc. and the recipient of numerous awards including the Life Time Achievement Award from Sustainable Buildings Canada and the World Habitat Award. In 2000 he was selected by *Wallpaper* magazine as one of ten people from around the world »most likely to change the way we live«.

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Menges



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# Innovative Apartment Buildings New Directions in Sustainable Design



High Park, San Pedro Garza García, Mexico (see pp. 74–77).

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**Innovative Apartment Buildings**  
**New Directions in Sustainable Design**

**Edition Axel Menges**

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Avi Friedman



Sonnenhof, Jena, Germany (see pp. 56–59).

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## The evolution of and current trends in apartment-building design

In many nations a »perfect storm« of social factors has led policy makers, designers and builders to rethink the planning of communities and the design of dwellings. The overarching motive that underlines these initiatives is a need to establish a built environment with small ecological and carbon footprints. Apartment buildings suit this ideological framework well since by the nature of their design more inhabitants reside in one place. Whereas the concept of many households living in a single multi-level structure dates back centuries, this building's form has evolved to respond to emerging realities. An historical chronology of some of these factors as well as contemporary trends and their effect on the design and construction of apartment buildings are described in this chapter.

A study of urban forms demonstrates that apartment buildings were built primarily in cities. The rationale for building tall structures and placing a number of units on top of each other was rooted primarily in a lack of land, which was often imposed by defence walls. Whereas in cities the wealthy commonly resided in townhouses or palaces, the lower classes rented units in crowded apartment buildings. The remains of such places can be seen in Ostia Antica, ancient Rome's port city. For example a building called Insulea stood five to six stories tall with several Cenaculas windowless units, each containing one or two rooms that measured 20 m<sup>2</sup> (215 sq. ft.) on each floor. The structure had poor sanitary facilities and ground floor shops facing highly traveled streets. Other civilizations, most notably the Egyptians, also constructed apartment buildings to house urban dwellers.

However it can generally be argued that in the centuries that followed, at least in the western world, apartment buildings were not the primary dwelling type. During the Middle Ages urban dwellers resided primarily in townhouses or lived in the home of the upper class family that they served. After London's Great Fire of 1666, a series of building acts brought uniformity into their construction and they were classified into several categories based on their width and height. Also, various regulations introduced improvements to the manner in which they were constructed to make them safer.

In Paris by the end of the nineteenth century the popularity of apartment buildings rose as a result of urban transformation after the redevelopment by Baron Georges-Eugène Haussmann when land for the building of townhouses became prohibitively expensive. Another reason was the urban settings that saw apartment buildings constructed along newly created tree-lined boulevards. The structures boasted palatial façades and offered generously sized rooms, which made them attractive to upper classes. The success of Parisian apartment building as a housing form for upper classes spread to other European hubs like Berlin and Vienna.

Across the Atlantic apartment buildings were introduced in American cities, most notably in New York. It became a housing alternative to the townhouse which formerly housed middle and



1. Ruins of apartment buildings in Ostia Antica near Rome, Italy. A building called Insulea stood five to six stories tall with several Cenaculas windowless units, each containing one or two rooms that measured 20 m<sup>2</sup> (215 sq. ft.).

upper class families. The design of the building was influenced by the French prototype noted above. Luxury apartments had doormen, spacious and elegant lobbies, grand staircase and often a clerk's office. The Stuyvesant Building which was designed by Richard Morris Hunt, a Paris-trained American architect, had such features. At first, the building did not gain much popularity with renters due the lack of privacy that the townhouse offered. However this changed with time. The layout of each unit featured several rooms off a long corridor which to some degree limited the unit's internal flexibility. The top attic units contained several studio apartments that often attracted artists. Following the market's acceptance of the Stuyvesant Apartment similarly styled buildings were constructed in other highly populated American cities.

Perhaps the one of the most intriguing aspects of apartment building design was that with some modification it could house upper, middle and lower classes. Both in Europe and America the building housed migrants that flocked from the countryside to cities during the Industrial Revolution in search of employment, and in later years immigrants who arrive from other countries. The living conditions in buildings that housed lower classes were in most cases horrific, with entire families often residing in a single room with poor ventilation, no running water and appalling sanitary conditions, a breeding ground for widespread disease. Some apartment buildings were constructed as tenements in proximity to manufacturing plants by factory owners. These were small units in which large families congregated and where bathrooms were public.

The poor living conditions of the masses initiated calls for social reform. Some reformers drew schemes that offered urban planning solutions and designs featuring apartment buildings such as Ebenezer Howard's Garden City in England. Two other earliest reformers were Robert Owen and Charles Fourier of England and France, respectively. In an attempt to alleviate the misery of urban dwellers, both envisioned an ideal city form that would remove the working class from the existing cluttered cities to new developments, structured around a single industry and agriculture. Owen's city, proposed in 1816, was New Lanark, where, in a repeatable square module approximately 1,200 people could reside. Housing enclosed a common space. Communal and recreational buildings were located in the public square, while allotment gardens were placed behind the houses. Though industry was pushed to the periphery of such a development, it should be noted that Owen was a leading industrialist in England, and he therefore provided for a close living relationship to the places of work and for the retention of industry by private interests. In fact, Owen's model town could be considered a benevolent dictatorship, as he specified not only the town form but also the hygienic and virtuous manner in which inhabitants should live.

Fourier created a socialist version of roughly the same type of development. Influenced by the French Revolution and desiring to remove the unemployed from the harsh city environment, he proposed the relocation of society into »phalanxes«. These were single buildings that could house up to 1,600 people in private apartments. Each phalanstery had centralized communal amenities and was situated on a plot of approximately 2,023 hectares (5,000 acres) of land that residents were expected to cultivate, thereby ensuring self-sustenance. Though the socialist foundation of such a design was never realized, the palatial treatment of the architecture was realized at Guise, France.

The realization that poor living conditions put entire cities at risk led to political reform that altered the lives of lower classes and the design of apartment buildings. In 1902 the »Housing Act« was introduced in the Netherlands. The act made it possible to acquire government funds for the development of social housing. The initiative saw dramatic improvements in the type of buildings constructed but more so, the active interest and participation of the state in the well-being of the population. Apartment estates were built by socialist-led city governments or by private investors who took advantage of the grants offered. Having a measure of control over the finances also implied a measure of control over the design. Regulation about the number of units to be served by each stairwell, size of rooms and the amount of light to enter each dwelling were some of the guidelines that were put in place.

Several housing schemes were built in Europe along these ideology and principles. Karl Marx Hof was designed by Karl Ehn and built in Vienna in 1926 with a denser, more urban form surrounding an interior courtyard. The project ran almost a kilometer long and was made of rectilinear blocks four stories tall and approximately 11 m (36 ft.) deep. The scheme had a total of 1,382 mostly small dwellings with one or two bedrooms, a kitchen and bathroom overlooking either the street or the courtyard.

A project similar in nature was Berlin's Britz Hufeisensiedlung which was designed by Bruno Taut in 1925. It was developed as part of a program to provide much needed housing for workers. Taut's idea was a combination of Ebenezer Howard's Garden City and simple functional plan-

2. A view of Robert Owen's New Lanark Community in Scotland.
3. Karl Marx Hof was built in Vienna in 1926 with a denser urban form surrounding an inner courtyard.
4. Habitat 67 in Montreal attempted to challenge the traditional rectangular apartment block's form.



ning. The 1,000 unit project had two building types, one of which was a three storey apartment building. The units had living space with loggias or balconies on the garden side and access landing and staircases on the opposite side. Several large scale similar housing schemes were built in Europe at the time. By the nature of their design they popularized apartment buildings and established a sense of community and ownership that has stood the test of time.

The next era in apartment building innovation took place after World War II. The reconstruction effort of many European cities and the need to house waves of immigrants and clear poor pre-war districts in America sparked modernization initiatives. Many of the projects were highly monotonous, but among them there those that set the tone for future projects. Such a project was Le Corbusier's Unite d'Habitation in Marseille, France. It embodied the architect's own writing and theories and the modernist ideas and vision of how should the inhabitants live. The 18-storey block had 337 apartments of 23 different types. The reduced personal space was replaced with communal living area to support family life. Bedrooms and private spaces were minimized to make more room for kitchen and living areas. Most of the long units enjoyed cross ventilation and views from two façades.

The design of post-World War II East European apartment buildings on the other hand lacked stylistic and architectural diversity. The projects embodied socialist realism with large rectangular structures framing public spaces. Planning initiatives saw entire communities designed based on American Clarence Arthur Perry's neighborhood unit principles with a school as the defining yardstick and apartment buildings facing wide boulevards. Such principles were embedded in the Nowa Huta near Krakow, Poland, a new town for 200,000 inhabitants that was built in the 1950's.

Concerns about a lack of personalization in apartment building design led to calls for giving inhabitants greater choice and say in shaping their dwellings. John Habraken, a Dutch architect, devised a system to assist with such initiative. The essence of Habraken's theory is that the role of the community and the role of the individual in housing are distinct. When we confuse or fail to separate them, the result is the perfect barracks of mass housing. The basic expression of the theory is seen as a dual form of construction, in which supports are permanent, long life, multi-storey artificial land providing utilities and communal services. The dwelling within the supports is formed of what Habraken calls detachable units (e.g. external walls, bathrooms, kitchens, partitions) which should be available to occupants, eventually through normal marketing channels but until then as products of individual manufacturers.

A project that used Habraken's theory to offer maximum choice and scope for participation by users was in Hollabrunn, Austria. The design, a government initiated project, fully applied the hierarchical principle by separating between the structure and the infill. Concrete structures of column and slab were used in a module of 510 by 960 cm (200 by 378 in), and a tartan grid 10 by 20 cm (4 by 7.8 in) was used for the interior arrangement of material and spaces. The inherent openness of the support structure was utilized quite efficiently by the users while achieving floor plans that responded to their needs. A review of the plans and façade demonstrates the uniqueness of each.

Another architect whose ideological departure was also based on a desire to break away from the ubiquitous rectangular apartment block was Moshe Safdie. In Habitat that was built for the 1967 world exhibition in Montreal, he explored the application of modern technology and especially mass production. Laid in a striking fashion, concrete boxes measuring 11.7 m long by 5.3 m wide and 3 m high (38.5 by 17.5 by 10 ft.) incorporated a one piece moulded fiberglass bathroom unit. Despite the fact that the idea was never replicated in another location, it was a unique and creative demonstration of alternative arrangement of units in an apartment building.

The decades that followed World War II saw the introduction of several projects that like Habitat attempted to challenge the traditional rectangular apartment block's form. The 1964 circular Marina City Tower in Chicago by architect Bertrand Goldberg explored new high density living form. The 1971 Nagakin Capsule Tower by Kisho Kurokawa in Tokyo followed the ideology of the Japanese Metabolist Group. The building had pods attached to a core that housed stairs and elevators. Ricardo Bofill's 1974 Walden 7 in Barcelona introduced a new kind of urban living where the units could accommodate offices and shops faced open areas.

The 1980s witnessed several attempts to offer new stylistic exterior ideas. The Atlantis Condominium in Miami, Florida by Architectonica had a Post-Modern expression. To a simple rectangular shape, the architects introduced playful interventions such as red triangle roof, yellow triangle balconies and a »sky court« to create a unique sculptural effect. Another notable project of the same era was the Byker Wall project in Newcastle-upon-Tyne, UK by Ralph Erskine and Vernon Garacie & Associates. Built as a long wall that sheltered behind it two-storey wood-frame single-

## Biscornet apartment building, Paris, France

Design: [BP] Architectures Jean Bocabeille et Ignacio Prego, 2011

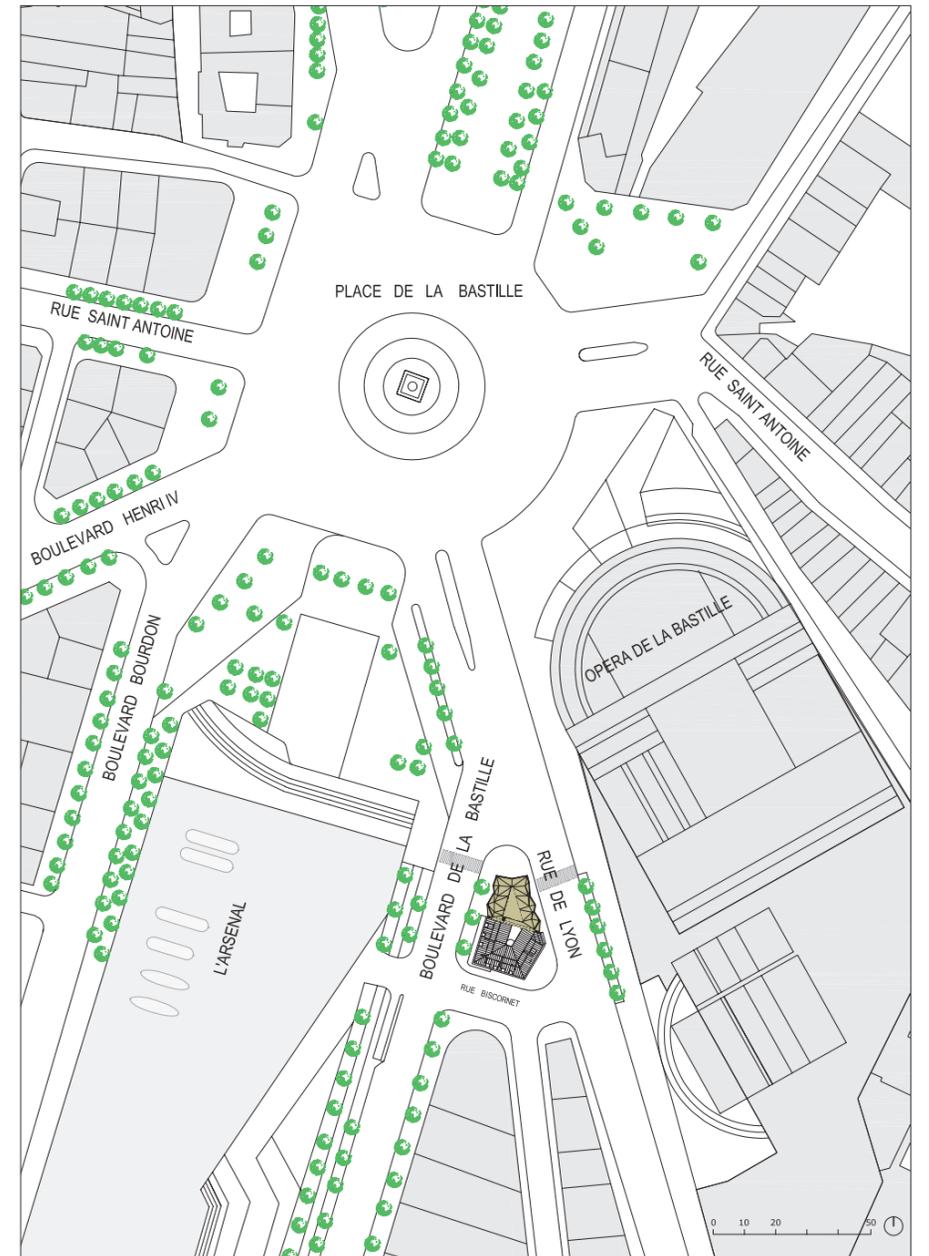
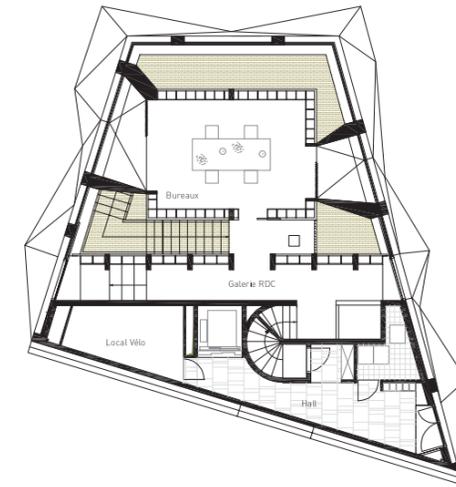
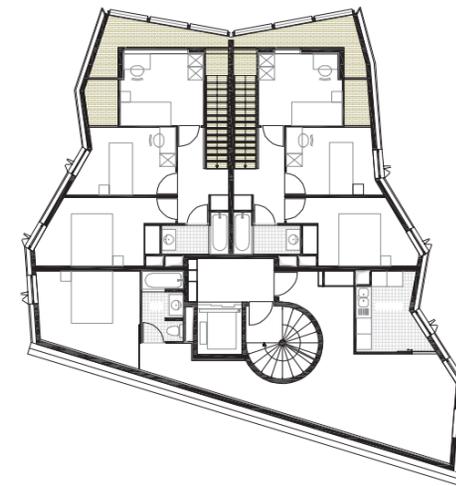
The Biscornet apartment building in Paris has an attractive design that fit well in the urban fabric. The project is located near a canal, while also offering a view towards the nearby Gare de Lyon business district and has a footprint of approximately 1,609 m<sup>2</sup> (17,319 sq. ft.).

Contrary to other apartment buildings near the city center, the architects wanted the design to embody some of the common traits to Parisian architecture. At the same time, they also sought out to design a building that would comply with the strict energy code imposed by the city. The building sits in the intersection of two streets with views of Place de la Bastille. Consequently, designers opted to suggest a façade made entirely of windows to maximize views onto the Place. However, these windows are far from ordinary. If one looks closely, the entire façade is composed of horizontal segments of glass shutters. These shutters are operated by the occupants which lets them control the amount of sunlight that penetrates in. In addition, the glass used for these shutters contains an amber tint, which offers additional protection from sunlight, as well as privacy when the shutters are closed. When all the window shutters are closed, people walking along Rue de Lyon see an entirely unified glass façade.

In regard to materials, the use of iron, aluminum, concrete, and glass helped the structure fit nicely into the urban fabric. Also, the choice of materials employed on the other façades consists of side blocks clad in golden aluminum panels, whose angular relief meant to create a unique effect when light shines on them. Throughout the entire building, the window frames are composed of exuberant colors: pink, mauve and orange that are quite visible along both street side façades. They are also conveniently embedded in the glass window shutter façade. Furthermore, when the window shutters are open, flashes of these eccentric pink, mauve and orange colors can be seen.

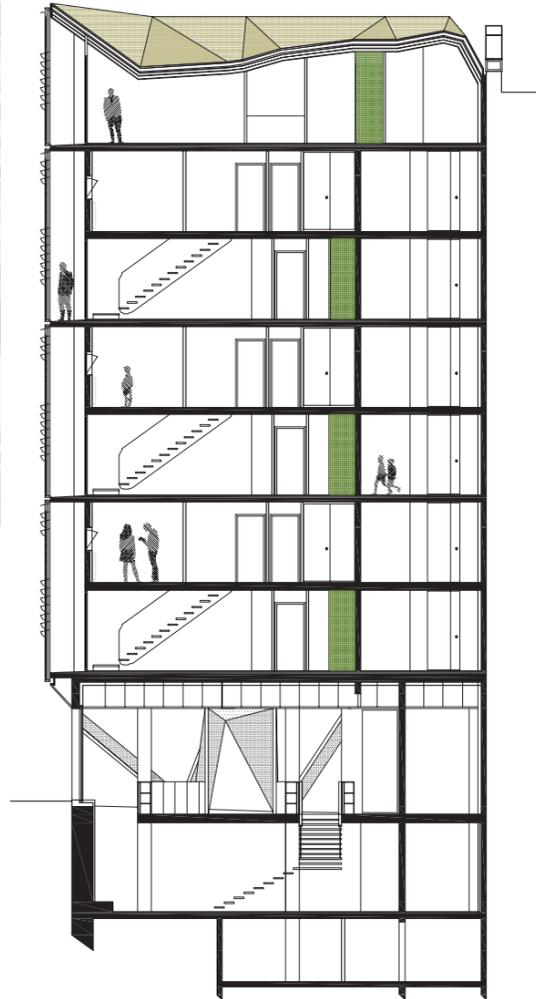
Through the use of particular materials and shapes, the designers were able to fulfill their goal and design an apartment building, which responds appropriately to its trapezoidal plot of land. In addition, they created a magnificent structure, which considers energy efficiency and whose building materials exercise an intriguing relationship with sun and night lights.

1. Street view. The building sits at the intersection of two streets with views of Place de la Bastille.
- 2, 3. Floor plans (residential floors, top) and a floor used as office space on another level, bottom).
4. The site plan shows the proximity of the building to Opera de la Bastille.





5. Side view showing the shutters which let the occupants control the amount of sunlight that penetrates into the apartment.
6. Section showing above and underground floor levels.
7. One of the units' interiors showing work, living and kitchen spaces.



## BedZed Community, Sutton (London), UK

Design: ZED Factory, 2002

The BedZed Community is one of the first projects in the UK to include apartment buildings with net-zero energy strategies that consume roughly as much power as they produce.

The project showcases eight apartment buildings, most of which are three stories tall. The location, positioning and shape of the buildings function in parallel with the energy-efficiency and production concepts and site's chosen density. The mixed-used BedZed community includes public, private and semi-private spaces. Each unit has access to a private green space or outdoor area. The planning concept seeks to promote social interaction by creating common areas and public outdoor spaces. Modest bridges cross over public pathways to connect residential units, office spaces and roof terraces.

One of the unique aspects of BedZed is its car-free living. Since the design includes mixed-use buildings, amenities such as kindergarten, fitness center, and offices are all available on site making car ownership redundant. Frequent public transit and bicycle routes offer various methods of commuting the short distances to amenities. In addition, an on-site electric charging station for cars is available, with the capability of charging forty cars at any given time.

The community area covers 12,000 m<sup>2</sup> (129,166 sq. ft.) and integrates different housing styles, including townhouses, two floor (maisonette) and one/two room apartments units. Moreover, the plan layout of the apartments also reflects the energy concept of the community. Interior layout of each module consists of three sections: double-glazed, full-storey patio rooms that serve as thermal buffers located along the southeastern perimeter. This segment is partially shaded by horizontal glazing with integrated solar cells. Other rooms like living and office spaces are located along a northwestern axis, to receive ambient daylight from the north. On the other hand, living rooms are kept warm through southern exposure to sun. The south façade, is almost entirely fenestrated with triple glazed, argon-filled thermal wood frame windows. During construction the architects were environmentally conscientious about choosing building materials. Therefore they selected materials with low embodied energy that were sourced locally to avoid excessive transport.

Energy-efficiency was a key design focus which was reflected in most decisions. Materials such as exposed concrete walls, ceilings, and ceramic tiles floors have a high thermal mass and retain heat. Also, the ventilation system, with a heat recovery ratio of 70 percent, along with an airtight envelope minimized heat loss. Along the roof, the colorful and aesthetically pleasing wind cowls serve as the ventilation system's air intake. Within the apartments, water-saving plumbing fixtures and energy efficient lighting are used to reduce hot water demands and save electricity. BedZed's omnipresent use of photovoltaic cells, which cover an area of 777 m<sup>2</sup> (8,363 sq. ft.), satisfy 15 percent of the community's total power consumption. A state of the art woodchip-fired combined heat and power (CHP) system produces the remainder of the necessary heat and electricity required for the project. The average electricity consumption for the community is 34 kWh/m<sup>2</sup> a while households in the same district were recorded using 48kWh/m<sup>2</sup> a.

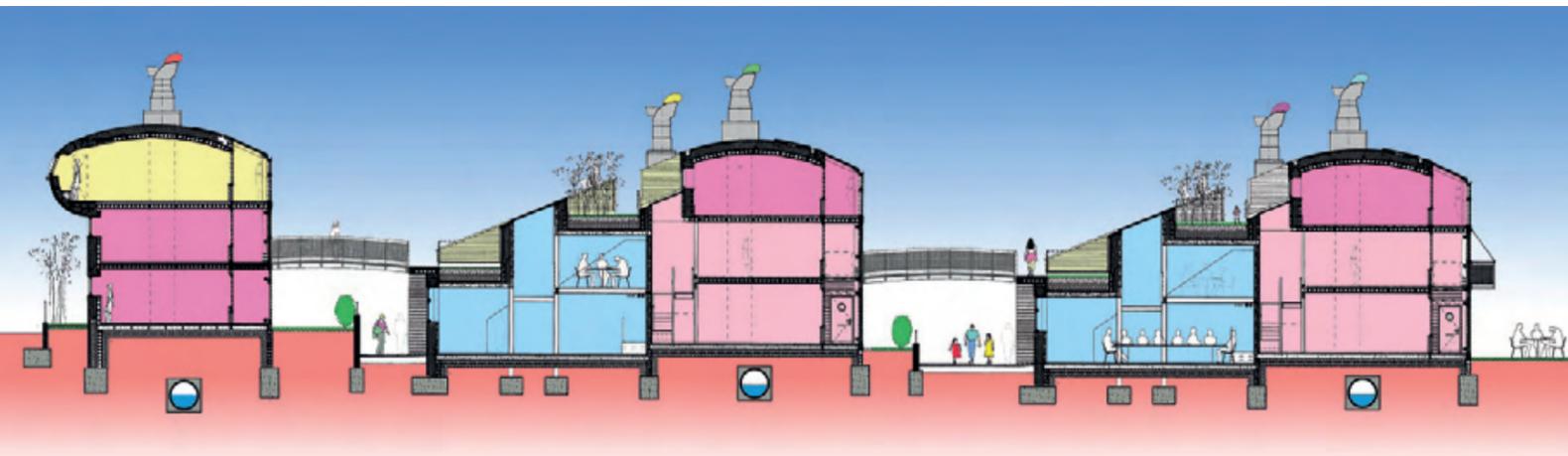
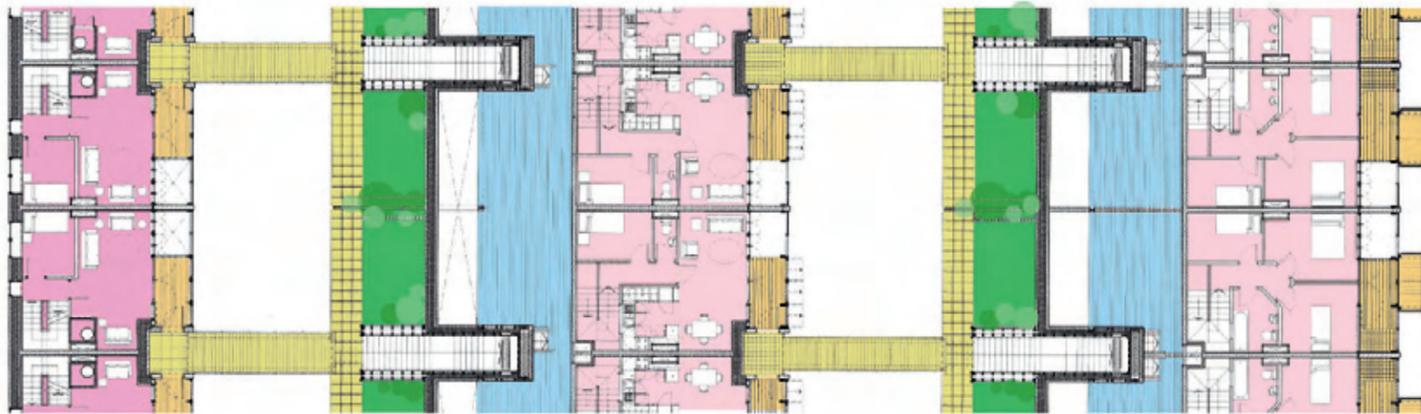
In sum, in addition to designing a visually attractive community, ZEDFactory satisfied zero-energy properties. Their objective was successfully achieved as demonstrated by energy consumption of 60 percent less than other residential buildings in the UK.

1. As demonstrated in the site plan, the location, positioning and shape of the buildings in BedZed coincide with the energy-efficiency and passive solar gain objectives of the designers.
2. The project showcases eight apartment buildings, most of which are three stories tall.





3. Modest bridges cross over public pathways to connect residential units, office spaces and roof terraces to one another.
4. Floor plans. The community integrates different housing types, including townhouses, two-floor (maisonette) and one/two-room apartment units.
5. Section. The interior layout of each module consists of double-glazed, full-storey patio rooms that serve as thermal buffers along the southeastern perimeter.
6. Along the roof, the colorful and aesthetically pleasing wind cowls serve as the ventilation system's air intake.



## High Park, San Pedro Garza García, Mexico

Design: rojkind arquitectos Michel Rojkind, 2014

The High Park apartment building includes 32 units with a floor area of 33,000 m<sup>2</sup> (355,209 sq. ft.) that stands ten storeys tall, and houses 3 penthouse units on its uppermost level.

Influenced by its close proximity to the majestic Sierra Madre Oriental Range, the designers' conceived this project to maximize views and help mitigate the region's extreme climactic conditions by having cross ventilation. As a result, the stale air in the building is constantly being replaced by fresh air. In addition, the cross ventilation aids in reducing the building's temperature without using mechanical means. The designers also chose to employ a thick envelop which protects the interior from the sun.

When designing High Park, the architects faced the challenge of integrating the building into the pedestrian realm as a way of «giving back» to the community. The chosen solution was to gradually recess the building and step it back to create an outdoor shaded space that can be enjoyed by all. Gerardo Salinas, one of the principal architects, explains that often times, apartment building architecture does not allow for the creation of public spaces. Rather, the entire site is developed and devised to optimize the square footage available for economic gain. To counter this notion, the designers took special care and reserved public spaces to be used by all.

The apartment building's staggered level arrangement does not only enhance the project's aesthetic appeal, it is also meant to counterbalance the effect of the strong sun. As a result, the floor plates shift in relation to one another creating a play of light and shadow, and the use of stone by a local craftsman on the façade allows the building to stay cooler as the sun moves across the horizon.

Multiple strict setback restrictions of the site resulted in private outdoor terraces for each apartment to enjoy. These outdoor spaces also capitalize on the panoramic views of the nearby Majestic Sierra Madre Oriental Range and adjacent mountains. Moreover, High Park consists of ten levels above ground, and three and a half levels of underground parking. The space is subdivided; the first two levels are reserved for commercial use, and the remaining eight are dedicated to luxury apartments. The eight residential levels also include amenities such as pool, gym and spa. Each apartment has a different area and configuration ranging from 250 m<sup>2</sup> (2691 sq. ft.) to 650 m<sup>2</sup> (6997 sq. ft.).

Essentially, the High Park development features meticulous design and green features which respond to its location. Rojkind arquitectos' designed a building, which does not only showcase a structure, but reserves public spaces for residents and visitors to enjoy.

1. Site plan (when designing High Park, the architects integrated the building into the pedestrian realm. As a result, the building steps back to create an outdoor shaded space that can be enjoyed by all).

2. The staggered level arrangement of the High Park apartment building not only enhances the project's aesthetic appeal, but it is also meant to counterbalance the effect of the strong sun.

3. The floors of High Park are subdivided; the first two levels are reserved for commercial use, and the remaining eight are dedicated to apartments as demonstrated in this section.

pp. 76, 77

4-7. Floor plans. The staggering of the floors in High Park and the integration of residential and commercial land uses coupled with the creation of a public space contributed to the success of this project.

8. The site of High Park was designed to optimize the area and leave public spaces for use by the public and the residents as demonstrated in this image.

9. The multiple strict setback restrictions of the site resulted in private outdoor terraces for each apartment as demonstrated in this night view.



