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Garden City, Megacity: Rethinking Cities for the Age of Global Warming | 花园型超大城市：全球变暖时代背景下反思城市

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Alina Yeo has been associated with WOHA for the past 12 years. She first joined WOHA as an intern in 2002 before returning permanently upon completion of her Master of Architecture in 2005 from the National University of Singapore and was made Associate in October 2014. Yeo's portfolio with WOHA encompasses design and project management, including institutional and high-rise condominiums. She was instrumental in the design of the School of the Arts, has authored numerous published papers and leads in many of WOHA's design competitions, monographic exhibitions, research work and building contract matters.

在过去的12年中，Alina Yeo一直服务于WOHA。在2002年初次加入WOHA时，她还是一名实习生。2005年，在获得新加坡国立大学的建筑学硕士学位之后，她立即重返WOHA，并于2014年10月成为合伙人。Alina Yeo在WOHA的工作包含设计和项目管理，如机构和高层公寓。她在新加坡艺术学院的设计中发挥了重要作用，已撰写并发表了多篇论文，曾主持过WOHA的众多设计竞赛、专题展览、研究和建筑合同事宜等工作。

Abstract | 摘要

This paper proposes an alternative to the continuing implementation of unsustainable 20th century urban planning models. By using WOHA's mini-city projects and proposals as prototypes – energy-efficient vertical landscapes with sky villages and sky parks – the paper presents a compelling manifesto for densely settled, yet comprehensively green, and ultimately self-sufficient, cities of the future. The author responds to the alarming urban crisis that now threatens all large cities around the globe, and urges the universal reinstatement of a mutually beneficial coexistence between human beings and the natural environment. WOHA's projects prioritize the re-creation of ecosystems, and have also reintegrated public space and civic culture within the increasingly unpleasant urban fabric of our overcrowded cities. WOHA's scalable prototypes offer a radical model for megacity planning: not just for the newly massive cities of Asia, but for other such cities around the world.

Keywords: Architecture, Climate, Green Walls, Sky Garden, Skybridges and Sustainability

这篇文章提出与一直以来实行的可持续的20世纪城市规划模型不同的另一种方式。以WOHA建筑事务所的迷你城市项目和方案——有空中村落和空中花园的高效节能垂直景观为原型，这篇文章展示了对高密度居住，以及全方位绿化、本质上的自持、未来城市的有力宣言。作者回应了现在威胁着全球所有大城市的令人担忧的城市危机，并倡导回溯普世的人与自然环境互利共存的状态。WOHA建筑事务所的项目将生态系统的再造放在首位，也在城市肌理变得越来越不适宜的过度拥挤的城市里将公共空间和市民文化重新融合。WOHA建筑事务所的可塑原型为巨型城市规划提供了激进的模式：不仅对新的大规模亚洲城市适用，也对全球范围里这样的城市适用。

关键词：建筑、气候、绿墙、空中花园、空中天桥、可持续性

Introduction

Cities are growing at a phenomenal rate, with the number of megacities in the world having more than tripled in the past 25 years. The rush toward urbanization is expected to continue, with population and land-use growth projected to add 2.5 billion people to the world's urban population by 2050, 90 percent of which would be concentrated in Asia and Africa. Caught in an unprecedented growth spurt, these cities are undergoing an "urban puberty" phase and are rapidly outgrowing their infrastructure. Contributing about 70 percent of the world's carbon emissions, cities are causing an escalating rise in global temperatures that will lead to inevitable crisis if governments, urban planners and architects fail to urgently rethink the way that cities are planned.

Since 2001, the authors have designed and built a series of prototypes as part of a process of urban re-evaluation, adopting the Asian megacity as an ideal testing ground for new urban typologies and architectural strategies. Re-imagining the early 20th Century Garden

引言

城市正以惊人的速度发展——在过去的25年中，全球大城市的数量已经增长了三倍多。随着人口的增长和城市用地的增加，城市化热潮预计将一直持续下去。到2050年，全球城市人口预计将增加25亿，其中亚洲和非洲占90%。这种史无前例的增长将使这些城市经历“城市青春期”，扩张速度要高于基础设施的开发速度。在全球二氧化碳排放中，约有70%来自城市地区。如果政府机构、城市规划者和建筑师们对城市的规划方式不再予以考虑，因城市发展而导致的全球气候急剧上升将不可避免地给人类带来危机。

自2001年以来，我们将亚洲大城市作为新的城市类别和建筑策略的理想测试范本，设计并打造了一系列原型，作为城市重新评估过程的一部分。我们对20世纪初的花园城市进行了重构，认为兼具社交生活与可持续性的高密度垂直21世纪超大城市是唯一的解决途径。“花园型超大城市”以一系列“宏观建筑风格，微观城市风格”策略为基础，从根本上加强土地利用率，增加绿色空间，并全面考量特定气候环境

City, The authors propose that a multi-layered, high-density, high-amenity 21st Century Mega City that is dense and vertical, yet sociable and sustainable, is the only way forward. The "Garden City Mega City" is built on a series of "Macro-Architecture Micro-Urbanism" strategies that radically intensify land use, multiply green space, and integrate climate-specific solutions to reduce the environmental impact of cities and improve the quality of life for people.

Layering Cities

Over the last two centuries – as towns became cities and cities became megacities – land has been taken for granted, as an infinite horizontal site for building, farming and mining. The combined effects of land exploitation, exploding megacity populations, rapid urbanization and economic growth have led to the degradation of land quality and quantity, the depletion of non-renewable energy sources, and the rise of global warming. Land scarcity is also reflected in the competition to meet the conflicting needs of a city, resulting in high land costs and stark trade-offs between various land uses.

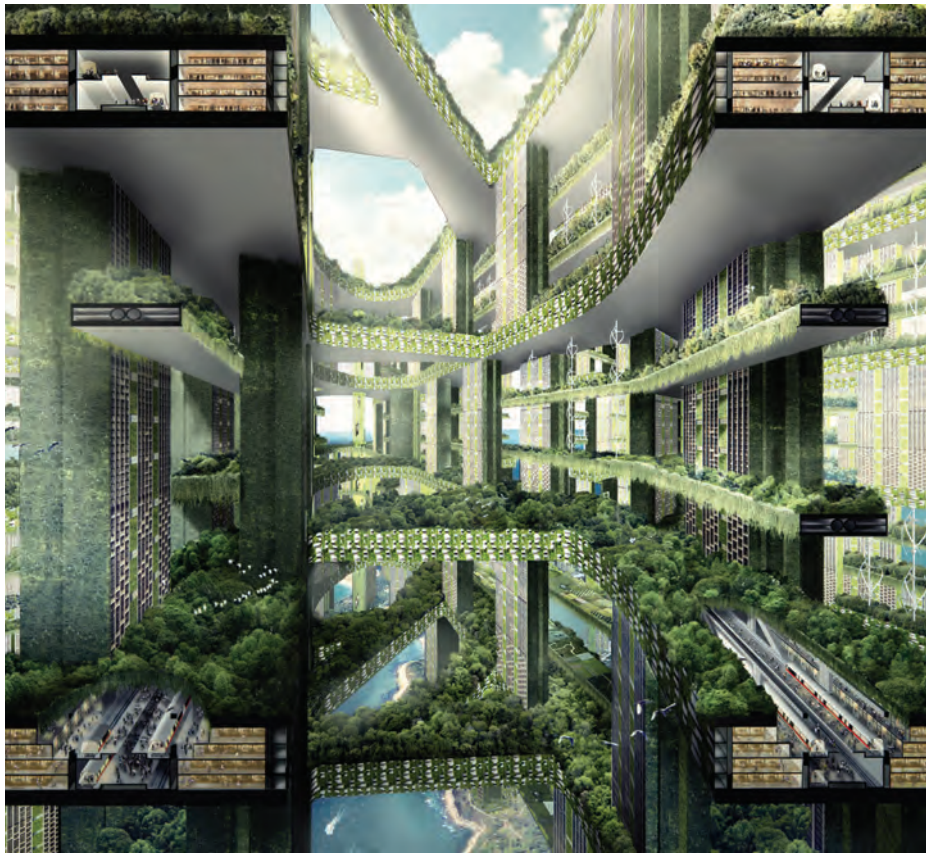

Figure 2. The layered approach introduces multiple ground levels of various functions at strategic horizons in the sky (Source: WOHA)
图2. 该分层法引入了整体布置的空中地平线上功能各异的“多样地表面”（来源：WOHA）

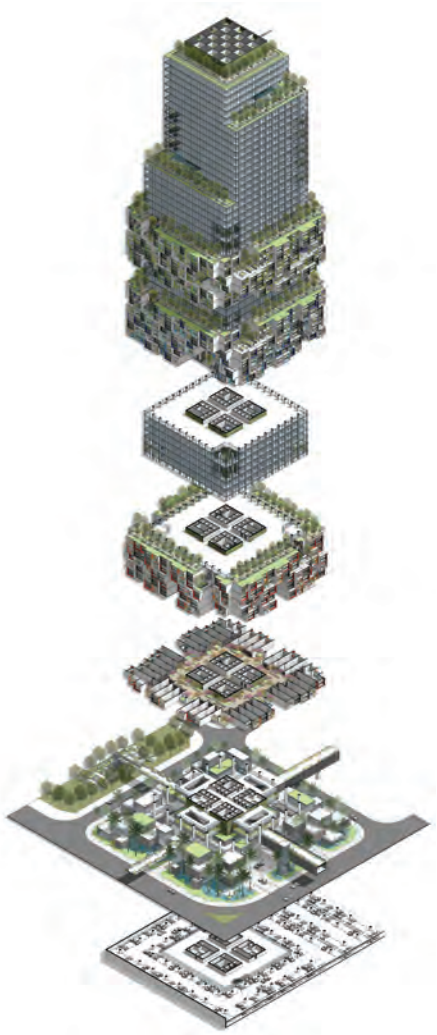

Figure 1. Axonometric diagram of the Layered City (Source: WOHA)
图1. 分层城市轴测图（来源：WOHA）

The authors propose visualizing a city in terms of layers – as a three-dimensional matrix, rather than as a two-dimensional grid (Figure 1). This calls for innovative land use solutions that involve a re-planning of cities – vertically, not horizontally. On top of reclaiming, restoring, and re-energizing our existing land, new land must be created. The use of land needs to be intensified by layering urban (and rural) environments – residential, recreational, commercial, agricultural, and infrastructural – above and below the existing ground level of the city.

These strategies for "Layering Cities" aim at offering a good quality of life for people by creating highly dense urban environments that are also highly vibrant, humane and resilient in the sustainable long term. The layered approach introduces "Multiple Ground Levels" of various functions at strategic horizons in the sky (Figure 2). This achieves "High-Density, High-Amenity" developments where civic, community and green spaces are multiplied over the same limited land area. Complementary programs of the right proportions are also integrated into vertical, mixed-use "Cities within Cities" that generate a 24/7 live-work-play vibrancy. To ensure human-scaled "Domesticated Structures," the authors' designs take references from the surrounding

下的解决方案，从而减少城市对环境的影响，改善人们生活质量。

分层城市

在过去的两个世纪，随着城镇成为城市，城市成为特大城市，土地理所当然地被认为是建筑、农业和矿业完美的水平用地。土地开发、大城市人口爆炸、快速城市化和经济增长的联合效应导致土地质量和数量退化、不可再生能源耗竭、全球变暖加剧等问题。土地稀缺也反映在为了满足城市冲突性需求而产生的竞争上，进而导致土地成本高昂，而且必须明确地权衡土地的各种用途。

我们认为，应从分层的角度看待城市——它是一个三维矩阵，而非二维网格（图1）。这就要求我们采用创新的土地利用方案，包括重新对城市进行垂直而非水平规划。除了返还、恢复并加强利用现有土地，还必须开发出新的用地。土地的利用必须通过将城市（和农村）环境（住宅、休闲、商业、农业、基础设施用地）分层的方式，在城市现有地表面的基础上进行加强。

“分层城市”策略旨在通过创建极为活跃、极其人性化、适应性强的高密度城市环境，为人们提供良好的生活品质，实现长期可持续发展。这种分层方法引入了空中战略地平线上功能各异的“多地表面”

Figure 3 Sky streets and parks recreate the proportions of neighborhood streetscapes at height (Source: WOHA)
图3. 空中街道和公园在高度上对街区街景的比例进行了重构 （来源：WOHA）

district and incorporate external spaces (e.g., "Sky Streets/Parks") into the high-rise, recreating the proportions of neighborhood streetscapes (Figure 3).

To further foster a sense of identity and belonging, concepts of neighborhood and community that are specific to the unique culture and context of the project are first studied, and then translated into the contemporary high-rise as a system of "Sky Villages."

"Layering Cities" also necessitates innovating the way in which both architecture and infrastructure/urbanism are combined in large-scale, radical yet synergistic ways. This "Both-And" concept requires a strategic rethinking of building typologies, with considerations for energy production, water rights, air rights and biodiversity indices to support self-sufficient townships and natural ecosystems in our cities. The traditional "bar graph" skyline, for instance, is picturesque but problematic. It gives visual interest at a distance, but the ground level can be very repetitive. The varied heights of buildings also overshadow each other, presenting a self-shading problem that is a disaster for solar collection in cities. To overcome this, the authors propose an "Inverted Skyline" (Figure 4), which creates opportunities for installing large-scale solar energy farms on the roof, while eliminating the current problems of low solar efficiency yields due to overshadowing, thus making 100-percent zero energy developments possible (Figure 5).

Planting Cities

The relentless tide of rapid urbanization has also caused green, open and civic spaces to shrink at an unprecedented rate, while chronic traffic congestion, vehicular and industrial pollution further compound the city's environmental condition. Cities have

Figure 4. The "Inverted Skyline" (Source: WOHA)
图4. "反转天际线"（来源：WOHA）

（图2）。这样就能够打造出"高密度、高舒适度"住宅区，在有限的土地上大大增加居民、社区和绿色空间。适当比例的辅助项目也可以与垂直的多功能"城中城"融为一体，使其能够在全天都富有生活–工作–休闲的活力。为了确保构造出符合人类尺度的"家居结构"，我们的设计会以周边地区环境作为参考，将外部空间（如空中街道/空中花园）与高层建筑进行整合，重新构建社区街景的比例（图3）。

为了进一步强化认同感和归属感，我们首先研究了契合该项目独特文化与语境的街区社区概念，然后将其转化为现代化高层建筑，形成一个"空中村落"。

"分层城市"也需要变革：建筑风格和基础设施/都市生活设施都要通过大规模采用激进但协调一致的方式整合。这种"兼容并蓄"的理念要求我们对建筑类别进行战略性反思，考虑能源生产、水权、空气权和生物多样性指数，对城市中的自给自足型区域和自然生态系统予以支持。例如，传统的柱状天际线虽景致优美，但问题重

Figure 5. An "Inverted Skyline" creates the potential to cover cities in PV panels (Source: WOHA)
图5. 凭借"反转天际线"，城市被太阳能电池板覆盖成为可能（来源：WOHA）

Figure 6. "Topographic Architecture" transforms megastructures into landforms for hosting landscape, creating an inhabited topography (Source: WOHA)
图6. "地形建筑"将超级建筑转化为展现地貌的景观，从而打造宜居地形（来源：WOHA）

Figure 7. In "Tropical Community Spaces," buildings provide shelter for mass activities (Source: WOHA)
图7. 在热带社区空间，建筑物为大规模活动提供庇护（来源：WOHA）

become harsh concrete jungles, with hard surfaces directly contributing to the urban heat island effect. Citizens are also leading increasingly insular lives, with minimal contact with nature. The authors' strategies for "Planting Cities" aim at re-introducing biophilic design into buildings. This not only improves human well-being/comfort and environmental quality, but also restores biodiversity into the city and keeps the natural balance of ecosystems and wildlife habitats.

"Screens of Green" incorporated into building facades create a strong identity for the development, while providing visual relief for neighbors and the public. Serving as environmental filters, they provide shade, cut out glare and dust, reduce heat, improve air quality and dampen traffic noise. Focusing on the human experience of nature, "Topographic Architecture" transforms megastructures into landforms for hosting landscape, creating an inhabited topography that generates psychological comfort for building occupants and passers-by alike (Figure 6).

In view of the limited access to sunlight within dense cities, gardens on ground can actually be at a disadvantage, as compared to gardens elevated within buildings that receive more light. The authors propose "Sky Gardens" that thrive in densely settled tropical cities, taking advantage of the climate and the degree of sunlight, while strategically relating to the building's context, orientation, proportions, structure and circulation zones. Publicly accessible "Sky Parks" incorporated at strategic "New Ground Levels," on the other hand, compensate for the lack of ground level parks and serve as civic gifts.

Breathing Cities

The archetypal Modernist model for high-rise buildings was originally devised for the cold climate cities of the US. The towers were engineered to maximize the ratio of a building's volume to its surface area, and were wrapped in glass envelopes in which inhabitants were kept comfortable mechanically. Regardless of appropriateness to local conditions, these glossy, hermetically sealed towers have been replicated across the globe, consuming about 40% of the world's energy, without any real reinvention of the basic typology to suit the changing times and local climate.

The authors' strategies for "Breathing Cities" call for a return to first principles, with the aim of creating sensible climatic designs that achieve thermal comfort without the need to rely solely on mechanical systems. Vernacular and passive responses to climate are adapted into the tropical high-rise form and translated into contemporary technologies. By opening up internal spaces to the climate and nature, buildings can "breathe" again.

Shade, shelter and breeze being vital to the usability of the civic/public spaces in the tropics, the authors' approach is to create "Tropical Community Spaces" by leveraging the building form and footprint to serve as urban umbrellas over gathering areas (Figure 7). These are placed strategically in the path of linear "Horizontal Breezeways" that work in combination with wind deflectors to draw breezes and bring natural daylight through the development. "Vertical Breezeways," on the other hand, are designed as continuous internal voids within towers and work on the principle of the hot stack effect, drawing cool air into communal areas as the warm air rises.

重。从远处看，它能给人以视觉享受，但地表面可能千篇一律。不同高度的建筑也会互相遮蔽，并引发自我遮蔽问题，这对城市太阳能的采集不啻是一场灾难。为了克服这一缺陷，我们提出了"反转天际线"（图4）概念，在屋顶上建造大型太阳能农场，解决当前因遮蔽而产生的太阳能利用率低的问题，进而建造100%零耗能住宅区（图5）。

种植城市

快速城市化的无情浪潮也造成了绿色、开放和公民空间以前所未有的速度萎缩，而长期交通拥堵、车辆和工业污染更进一步恶化了城市环境。城市已经成为粗粝的水泥丛林，坚硬的表面直接导致了城市热岛效应。此外，由于与大自然的接触减少，居民生活也日益孤立。我们的"种植城市"策略旨在重新将亲生物设计引入建筑中。这不仅能够改善人类健康/舒适度和环境质量，还可以恢复城市的生物多样性，保持生态系统和野生动物栖息地的自然平衡。

与建筑外墙融为一体的"绿色外墙"让住宅区显得别具一格，同时为居民和公众提供视觉上的放松与享受。作为环境过滤器，它们还能够提供荫凉，减少眩光、灰尘和热量，改善空气质量，并降低交通噪声。"地形建筑"强调人类的自然体验，可将超级建筑转化为展现地貌的景观，创建令建筑居住者和路人都能获得心理安慰的宜居地形（图6）。

鉴于高密度城市的采光条件有限，与建筑内采光条件更佳的花园相比，地面花园实际上可能会处于劣势。因此，我们建议在人口密度大的热带城市大力建造"空中花园"，充分利用气候和光照条件，并巧妙

Figure 8. Skyville @ Dawson was designed as a "Breezeway Tower," an open-lattice megastructure that dynamically interacts with its environment (Source: Patrick Bingham-Hall)
图8. Skyville @ Dawson被设计成“有顶通道高楼”，即可与环境动态的格栅开放式超级建筑 （来源：Patrick Bingham-Hall）

Figure 9. The Oasia Tower has a "Breezeway Atrium" at the top and its exoskeleton offers an alternative to full glazing (Source: Patrick Bingham-Hall)
图9. Oasia大厦的顶部有一个“有顶过道中庭”，其支撑框架取代了全玻璃结构（来源：Patrick Bingham-Hall）

To facilitate good thermal comfort at grade, buildings are configured and shaped to direct breezes to the porous community ground plane below, creating "Breezeway Courtyards."

Instead of compact, solid and monolithic buildings, "Breezeway Towers" are designed as open-lattice megastructures that dynamically interact with their environment (Figure 8). "One Unit Thick" designs further enable the incorporation of windows on all sides, maximizing cross-ventilation, natural daylight and views through the units. Within densely built-up areas in the city center, well-ventilated "Breezeway Atriums" are carved out of high-rise towers, offering an alternative to fully glazed, air-conditioned skyscrapers. This creates dynamic internal views, which frame, soften and mediate the surrounding dense urban fabric (Figure 9).

Rating Cities

The strategies presented here must be assessed within a larger picture, with holistic planning of the city being the priority.

地与建筑的背景、方位、比例、架构和环流区关联起来。另一方面，与战略性“新型地表面”融为一体并向公众开放的“空中公园”可弥补地表面公园的缺失，并成为馈赠给市民的“礼物”。

呼吸城市

高层建筑的现代主义原型模型最初是为美国气候寒冷地区的城市设计的。这种设计风格最大限度地增加了建筑体积与表面积的比例，并在周围使用玻璃幕墙，通过机械方式让住户保持舒适。无论当地条件是否合适，这类经过密封保护处理的大楼已经复制到了全球各地。它们消耗了全球约40%的能源，但从未对其基本类型进行真正的改造，以适应时代变化和当地气候。

我们希望通过采用“呼吸城市”策略回归本原，旨在打造能够达到热舒适的合理气候设计，而无需仅仅依靠机械系统。对气候的本地化和被动式响应需适应于热带高层建筑形式，并转化成现代技术。通过向气候和自然开放内部空间，让建筑再次“呼吸”。

在热带地区，遮阳处、遮盖物和微风对市民/公共空间的可用性至关重要，我们采用的办法是利用建筑形式和空间创建“热带社区空间”，并将其用作聚集区的城市雨伞（图7）。它们被巧妙地放置于呈线性的“水平有顶过道”上，并与导风板共同作用，将微风导入，使整个住宅区均有自然采光。而大楼内的“垂直有顶过道”被设计成连续的内部空洞，并根据热烟囱效应原理工作——当温热的空气上升时，可引导清凉的空气进入公共领域。为了在同一平面达到良好的热舒适度，建筑物被配置和塑造成能够将微风引导至下方的多孔社区接地表面的样式，以此打造“有顶过道庭院”。

“有顶过道高楼”被设计成可与环境动态互动的格栅开放式超级建筑（图8），而非紧凑、立体的庞大建筑。凭借“一单元厚”的设计，窗户可以随意安装在任一墙面，从而最大限度地在各单元之间实现空气对流，增加自然光和景观。在市中心人口密集地区，可在高楼内辟出通风良好的“有顶过道中庭”，为全玻璃墙面、空调调节温度的摩天大楼提供了又一替代方案。这可以打造出动态的内景，为周围的高密度城市结构制定框架，并对其进行柔化和调节（图9）。

PROTOTYPOLOGY

Skyville@Dawson 2007

COMPLETED 2015 – SINGAPORE

- Twelve forty-seven storey **Breezeway Towers** are placed on a triple diamond-shaped plan, which facilitates ventilation and sunlight penetration, and enables views from every apartment.
- **Vertical Breezeways** utilise thermal displacement to generate cooling upward airflow between the towers.
- Twelve **Sky Villages**, each comprising eighty apartments, are layered within **Breezeway Atria**, cooled and ventilated by **Horizontal Breezeways**.
- **Multiple Ground Levels**, eleven floors apart, provide locations for **Sky Gardens** and **Tropical Community Spaces**, and maintain human scale in a **Domesticated Megastructure.**
- A **Sky Park** on the roof, and extensive public parkland at ground level, form part of a **High-Density High-Amenity** urban environment.
- Each apartment is **One Unit Thick**, in order to enable cross-ventilation, increase exposure to daylight, and provide a wider outlook.

Green Plot Ratio		**110%**
Community Plot Ratio		**140%**
Civic Generosity Index		**100%**
Ecosystem Contribution Index		**40%**
Self-Sufficiency Index	Energy	**44%**
	Food	**0%**
	Water	**60%**

Figure 10. City rating as applied to Skyville @ Dawson(Source: WOHA)
图10. 应用于Skyville @ Dawson 的城市评估（来源：WOHA）

Twentieth-century cities were planned as collections of segregated components, which were measured in terms of their economic productivity. The value of buildings was assessed only by capital cost efficiency – building plot ratios, net-to-gross floor values, and surface-to-volume ratios – rather than their overall contribution to the city as components within a self-sufficient system. Twenty-first-century cities, on the other hand, must be about people and integration, with buildings assessed in terms of their contribution to social and environmental sustainability, as well as their economic viability. To gauge this, the authors have devised a social and ecological rating system for all city buildings, conducted on behalf of a city's residents, rather than its property developers (Figure 10).

"Green Plot Ratio" measures the amount of landscaped surfaces within a building over its site area, with the aim of reintroducing biodiversity and green relief into the city. "Community Plot Ratio," on the other hand, measures the total amount of community space within a building over its site area, with the aim of encouraging social gathering and human interaction at various scales.

评估城市

本文提到的这些策略必须在一个更大的框架内进行评估，因为必须优先考虑城市的整体规划。在过去的20世纪，城市被规划为在经济生产率方面可以衡量的分离元素的集合。建筑物的价值只是通过资本成本效率（包括建筑用地比率、净毛地面价值和表面积与体积比）进行评估，而不是它们作为自给自足系统中的元素对城市的整体贡献。21世纪的城市必须关注人和一体化，建筑物的评估依据必须是其对社会和环境的可持续发展以及它们的经济可行性。为了从这一方面对其进行衡量，我们会从城市居民而不是地产开发商的利益出发，为所有城市建筑设计一个社会和生态评价体系（图10）。

“绿色容积率”用于衡量建筑物内景观表面积与其占地面积之间的比率，旨在将生物多样性和绿色慰藉再次引入城市。“社区容积率”用于衡量建筑物内的社区空间与其占地面积的总比例。为了衡量建筑物对城市公共生活的鼓励和促进作用，我们确立了“市民慷慨指数”。该指数会褒奖那些从视觉，或者空间上为城市带来回馈，营造出良好邻里关系的建筑。“生态系统贡献指数”认可采用“城市生态学”方法来支持城市野生动植物繁育的行为，该指数衡量的是建筑物在多大程度上对城市生态系统提供了有益补充。为了打造能够彻底实现可持续发展的建筑和城市，我们设立的城市评价体系对“自给自足指数”予以高度重视，该指数衡量的是建筑物提供自身所需能源、食物和用水的能力。

自给自足型城市

作为2009年国际工业设计联合会世界设计大会的参与者，WHOA率先成立了垂直工作室，为新加坡探索2050年的理想化自给自足型城市。2014年，我们的想法逐渐成型，并以其为雅加达北部新城总体规划建议制订了切实可行的确切蓝图。

本次设计遭遇的挑战是，要将21万人安置在一块长满次生林、面积为730公顷的土地上，而且建筑物的高度上限为60米。为了在热带地区打造“森林生态城镇”，并保留一半以上的现有绿色景观，我们将该地块的水平土地使用分配与其自给自足型城市原型的分层结构进行了整合（图11）。

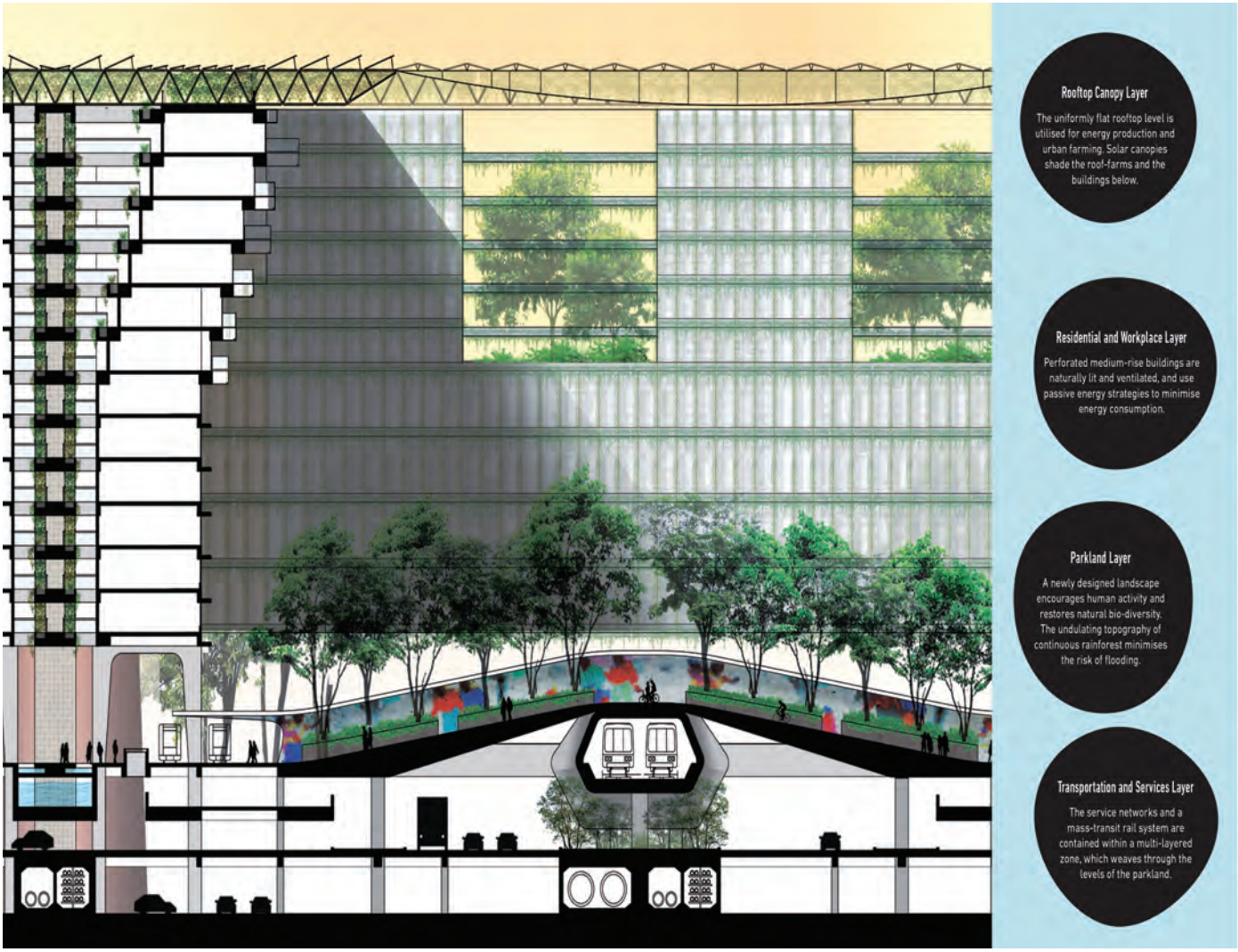

Figure 11. The four-layer "Self-Sufficient City" (Source: WOHA)
图11. 分为四层的“自给自足型城市”（来源：WOHA）

To measure the extent to which a building encourages and facilitates the public life of a city, the authors devised a "Civic Generosity Index." This rewards buildings that exhibit good neighborliness in the way they gift the city visually or spatially. The adoption of "urban ecological" approaches to support wildlife within cities is also recognized under an "Ecosystem Contribution Index," which measures the degree to which a building supplements a city's ecosystem. Aiming for fully sustainable buildings and cities, the city rating system gives high priority to a "Self-Sufficiency Index" that measures a building's capacity to provide its own energy, food and water.

Self-Sufficient City

As part of the Icsid World Design Congress 2009, WOHA spearheaded a vertical studio to explore an idealistic self-sufficient city for Singapore in 2050. In 2014, the authors evolved these ideas, and produced a tangible and buildable blueprint for a new town master-plan proposal in northern Jakarta.

The design challenge was to house 210,000 people on a 730-hectare site that is overgrown with secondary rainforest and constrained by a 60-meter building height control limit. To create a tropical "eco-town-in-a-forest," which would retain over half of the existing green landscape, the authors integrated the site's horizontal land-use allocations with the stratification of their Self-Sufficient City prototype (Figure 11).

That stratification consists of four layers: a "Transportation and Services Layer" that contains all service networks and vehicles; a "Parkland Layer" beneath buildings that comprises "Tropical Community Spaces" for public functions and social interaction; a "Residential and Workplace Layer" organized into a series of "Breezeway Courtyards/ Towers" with cross-ventilated "One-Unit-Thick" apartments; and a "Rooftop Canopy Layer" that is both protective and productive, providing shade and shelter as well as solar energy and food harvested from "Sky Field" crops.

The new town was planned to be totally self-sufficient in terms of energy production, water

该分层结构包括四层：涵盖所有服务网络和车辆的“运输和服务层”、建筑物下方的“公共用地层”（包括用于公共功能和社交互动的“热带社区空间”）、通过一系列“有顶过道庭院/高楼”串联起来的，由通风良好的“一单元厚”公寓组成的“住宅和工作场所层”，以及一个兼有保护作用与生产功能的“屋顶树冠层”。“屋顶树冠层”既可以提供遮阳处和遮盖物，又能供应太阳能和从“空中田野”庄稼中收获的食物。

根据规划，新城在能源生产、供水、废物处理和粮食生产方面完全可以自给自足，同时最大限度地降低对现有植物和动物的影响。高效的被动式设计，加上安装在屋顶树冠层超过3平方千米的太阳能电池板，能够使这座新城实现净零能耗运作。所有建筑屋顶均采用“反转天际线”，并限制在同一高度，从而确保不会因为遮蔽而导致能量损失。

总体规划优先考虑了行人与四通八达的活动路径的连通性。除了有轨电车和自行车外，公共用地层将禁止其他车辆通行。这样一来，“热带社区空间”和公共花园就可以在安全、无污染的环境下遍地开花。设计中对地形也会进行塑造，提供丰富多

supply, waste disposal, and food production, while having the minimal possible impact on existing flora and fauna. Effective passive design in combination with more than 3 square kilometers of photovoltaic panels installed on the Rooftop Canopy Layer would enable the town to operate with net zero-energy consumption. Adopting an "Inverted Skyline" typology, all building rooftops were capped at the same height, ensuring that no energy losses occurred from over-shadowing.

The master plan prioritized pedestrian connectivity with well-connected mobility paths. Apart from trams and bicycles, the Parkland Layer would be vehicle-free, so that "Tropical Community Spaces" and public gardens could thrive in a safe and unpolluted environment. The terrain would be sculpted to provide a diverse topographic landscape, with terraced knolls overlooking forest glades and the waterways of the town's reservoir. "Sky Streets" on "Multiple Ground Levels" in the Residential and Workplace Layer would link a series of "Sky Villages", so that residents can interact and form community bonds within their own aerial neighborhoods. "Sky Parks" would share space with the urban farmland on the rooftops, so that recreational areas have a view, and form part of a cheerful and productive village lifestyle.

The authors' concept of a Self-Sufficient City is not a romantic utopian ideal. It is a realistic vision for our urban future, with a blueprint for sustainable development and a progressive philosophy for a dense and vertical, yet sociable and sustainable 21st-Century Garden City Megacity.

彩的地形地貌，比如可以俯瞰城市森林空地和新城水库水道的梯田。在住宅区和工作场所层，“多地表面”上的“空中街道”将众多“空中村落”互相连通，这样居民便可以在自己的空中社区进行互动，并形成社区纽带。“空中公园”将与屋顶上的城市农田共用空间，因此可以在休闲区饱览风光，并成为气氛活跃、高效多产乡村生活方式的一部分。

我们的自给自足型城市这一概念并不是浪漫的乌托邦理想，而是我们对城市未来的现实愿景，是实现可持续性发展的蓝图，也是打造兼具社交生活和可持续性的高密度垂直21世纪“花园型超大城市”的前进理念。