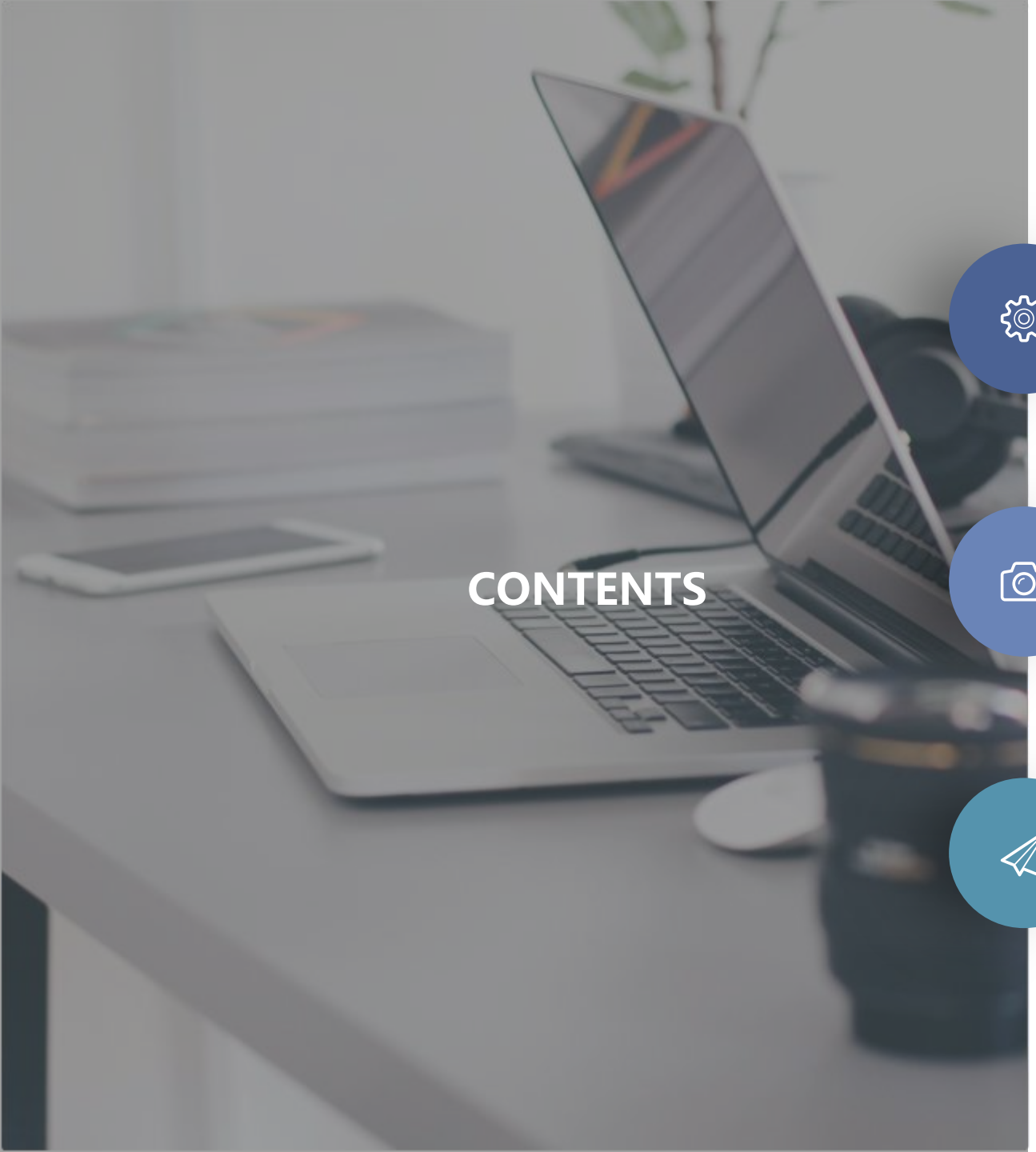
Exploration of Implementation Path and Practice of Near Zero Carbon Communities in Shanghai

QU YAN
Scientific Technology Development Branch of Arcplus Group PLC

2024.12.18



CONTENTS

PART 01

Definition of Near Zero Carbon Community

PART 02

Implementation path of near zero carbon community

PART 03

Near zero carbon community practice case

01 Definition of Near Zero Carbon Community

Definition of Near Zero Carbon Community

Currently, there is no unified national standard for near zero carbon communities in China, but Shanghai has been exploring this concept for years, and a national standard is forthcoming. Two aspects of consensus have been reached:

- Community carbon emissions must be significantly reduced and can approach near-zero through various means, with carbon neutrality achievable via carbon offset measures.
- The scope of carbon accounting for communities must at least include buildings, transportation, municipal operations, and carbon sequestration.

Content	**Shanghai Low-Carbon Demonstration Creation Work Plan** 2021.8	**National Standard "Zero Carbon Building Technical Standard“** *(under development)*
Carbon Emission Requirements	**Low-Carbon Community**: Low-Carbon Community: The community's per capita carbon emission intensity must be below the citywide average or reduced by over 10% from the baseline (new communities require a reduction of over 20%). **Near Zero Carbon Emission Community**: The per capita carbon emission intensity of the community should reach an advanced citywide level or be reduced by more than 40% compared to the baseline.	**Near-Zero Carbon Zone**: The carbon reduction rate must be at least 60%, or the per capita carbon emissions must meet specified limits based on the region and type. **Zero-Carbon Zone**: Building on the criteria for near-zero carbon zones, the remaining carbon emissions must be offset through carbon trading or green power trading, ensuring net carbon emissions are no greater than zero.
Scope of Carbon Emission Accounting	Buildings, Transportation, Municipal Street Lighting, Carbon Sequestration	Buildings, Transportation, Municipal Services (Waste Management, Water Supply and Drainage, Lighting), Renewable Energy, Carbon Sequestration

Definition of Near Zero Carbon Community

Since 2014, Shanghai has been developing low-carbon (near-zero carbon) communities. To date, four batches have been completed, totaling 55 low-carbon communities. Through years of exploration, a comprehensive set of control indicator systems for low-carbon (near-zero carbon) communities has been established, including carbon emission intensity control, management measures, awareness campaigns, and public participation

Primary Indicators	Secondary Indicators
Mandatory Items (100 points)	
Carbon Emission Intensity	Benchmarking and reduction rate of CO_2 intensity in the community.
Low-Carbon Practices Across Sectors	Proportion of green travel, adoption of energy- and water-saving appliances, retrofitting existing buildings for energy efficiency, public EV charging stations, renewable energy streetlights, rooftop solar utilization, non-traditional water use, waste segregation (compliance, wet waste recycling, recyclables ratio), and community greening.
Operations Management	Conduct community carbon inventories, establish carbon emission accounting systems, and implement carbon emission management frameworks
Low-Carbon Lifestyles	Low-carbon facilities and initiatives, including education, household creation, recycling programs, living guides, community canteens, smart service platforms, and carbon benefit programs
Bonus Items (20 points)	
Innovative Features	Explore innovative community-specific approaches in low-carbon technology application, atmosphere creation, and practical implementation models

02 Implementation path of near zero carbon community

Implementation path of near zero carbon community

Promoting the construction of near-zero carbon communities, primarily focusing on improving energy efficiency, energy transition, environmental response, enhanced perception, and the overall co-building and sharing of the community, which represents the "**5E**" path to low-carbon community development

Environment

- Climate change mitigation
- Biodiversity preservation

Energy

- Energy transition
- Renewable energy

Emotion

- Cultural identity
- Perceptible low-carbon features

Efficiency

- Low-carbon buildings
- Low-carbon transportation
- Resource recycling

Evolvement

- Intelligent Surveillance iterative Enhancement
- A virtuous circle of public participation

Implementation path of near zero carbon community

Efficiency

Low-carbon buildings
Low-carbon transportation
Resource recycling

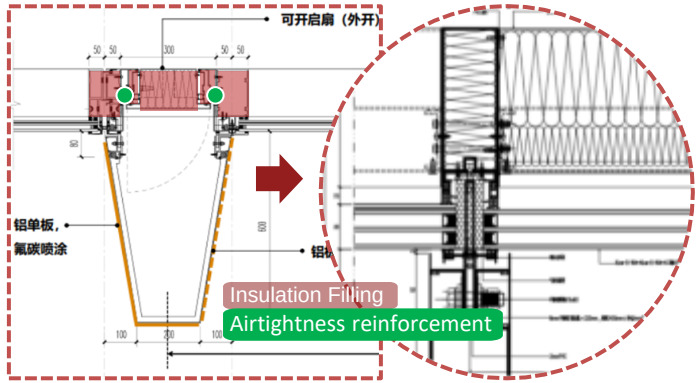
- **Low-carbon buildings**
- Buildings are the main contributor to carbon emissions in communities, accounting for 60-70% of total emissions.
- **For new developments**: Green building strategies, ultra-low energy, near-zero energy, and zero-carbon designs can significantly reduce carbon emissions.
- In addition to reducing operational emissions, controlling embodied carbon is crucial for new developments.
- **For existing communities**: Focus on reducing operational energy consumption through smart lighting control and optimizing public facilities, alongside retrofitting public and residential buildings for energy efficiency

Implementation path of near zero carbon community

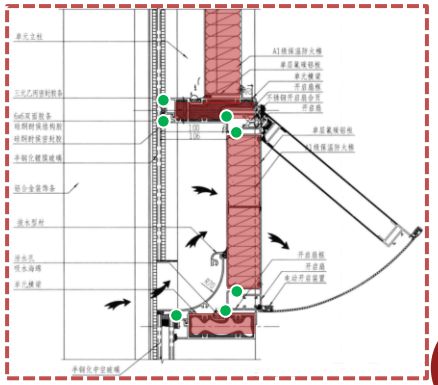
Efficiency

Low-carbon buildings
Low-carbon transportation
Resource recycling

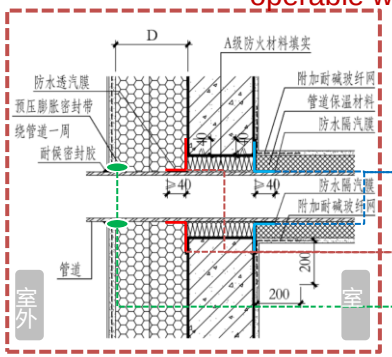
- **Low-carbon buildings**



Enhancing building operational efficiency to reduce lifecycle carbon emissions



Thermal bridges and airtightness treatment measures for curtain wall mullions, transoms, and operable windows



Waterproof vapor barrier membrane

Waterproof breathable membrane

Pre-compressed expansion joint sealant

High-performance insulation method

1 Embodied carbon emissions control

- Building renovation and reuse
- Optimization of construction management
- Traceability of green building materials
- Use of local materials
- Reuse of waste materials

2 Green Building, Ultra-low/near-zero energy building

- Energy-efficient building layout
- Passive energy-saving through daylighting and ventilation
- Thermal performance of envelope
- Thermal bridge and airtightness treatment
- High-efficiency energy-saving systems
- Renewable energy utilization

3 Efficient energy operation

Commissioning
Energy management

Real-time adjustment

Implementation path of near zero carbon community

Efficiency

Low-carbon buildings

Low-carbon transportation

Resource recycling

- **Low-carbon transportation**

Low-carbon emission traffic management

- Restrictions on high-pollution vehicles
- Congestion charges for diesel vehicles during peak hours
- Installation of pollutant and particulate matter monitoring points, integrated with smart traffic systems
- Electronic license plate monitoring with smart recognition and differentiated electronic tolling

Pollution Restriction

Differentiated Charging

Pollution Monitoring

Electronic Recognition

Differentiated parking

Differentiated parking policies for public parking lots:

- Set different parking fees by time period and area, with higher charges during peak hours and in core functional zones for private cars, encouraging the use of public transportation.
- For park-and-ride facilities, offer parking fee reductions or discounts with a valid public transport ticket from the same day, promoting the use of public transport.

Peak Hour Charges

Private Car Fees

Park-and-Ride Discounts

Encouraging the use of new energy vehicles

- Provide sufficient charging stations and parking spaces to encourage the use of new energy vehicles.
- Offer charging fee discounts for new energy vehicles, with discounts of up to 20%.
- Set up rental stations for new energy vehicles.
- Provide subsidies for the construction of charging stations and implement related policies.

EV

Parking Discounts

Rental Stations

Charging Station Subsidies

Incentives for ped and bike system

- Optimize and improve the comfort of pedestrian and cycling infrastructure to encourage green travel.
- Implement a "carbon credit" system, allowing individuals to exchange carbon credits for recharge amounts or gifts as an incentive for using pedestrian and bicycle systems.

Green Travel

Low-carbon Points

Points Redemption

Implementation path of near zero carbon community

Efficiency

Low-carbon buildings
Low-carbon transportation
Resource recycling

- **Resource recycling**

固体废弃物


建筑/装修垃圾


生活垃圾


腐败物/湿垃圾


污泥污水

变废为宝

建筑废弃再生

建筑废弃物资源化处理为再生建材

实现**建筑垃圾资源化利用率≥50%**

- ☑ 可循环材料应用比例≥15%
- ☑ 利废建材应用比例≥30%
- ☑ 就地取材搭建景观构筑物

生活废弃回用

生活垃圾分类回收、再利用生成雕塑

实现**生活垃圾资源化利用率≥45%**

- ☑ 垃圾分类收集设施景观化
- ☑ 引入湿垃圾就地处理系统
- ☑ 垃圾收集与碳积分挂钩

绿地废弃造景

林地落叶等用于生态堆肥、生态造景

实现**生物质垃圾资源化利用率100%**

- ☑ 就地取材搭建景观构筑物
- ☑ 场地垃圾进行堆山造景
- ☑ 生物质收集与堆肥再加工

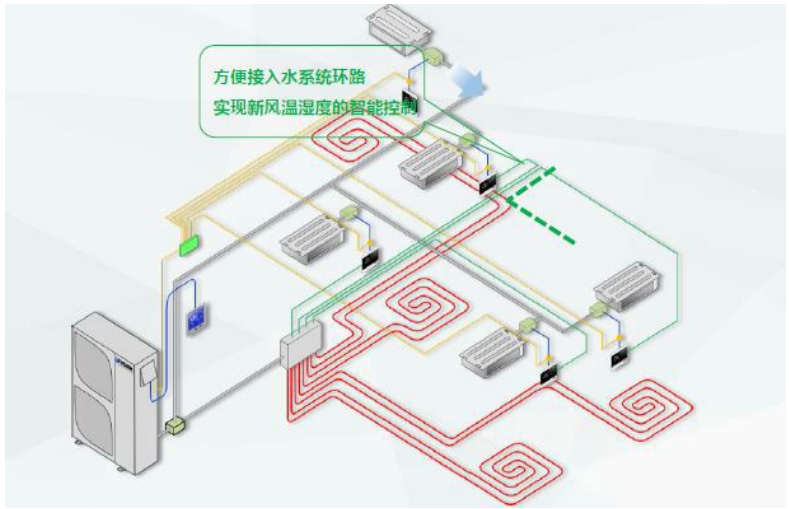
Implementation path of near zero carbon community

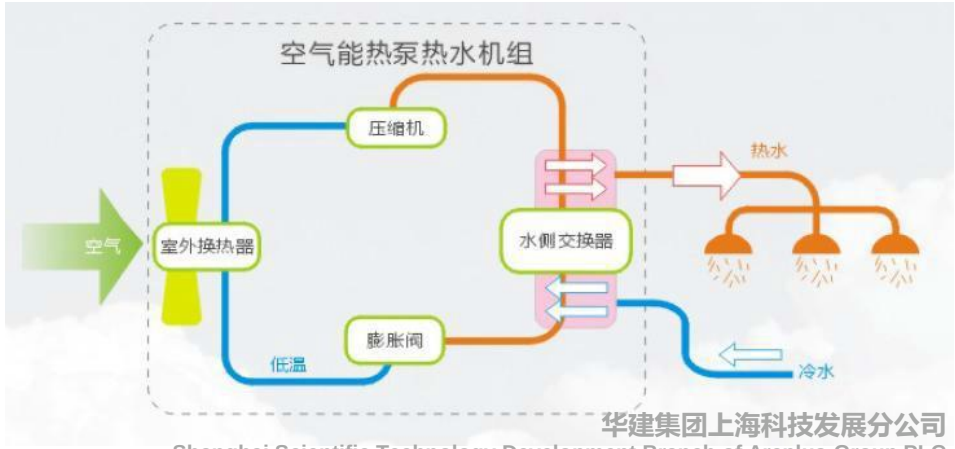
Energy Transition

Energy

Renewable Energy

- Energy Transition
  - Increase the electrification ratio of buildings, which is crucial for future carbon reduction
  - For new communities, limit the energy sources for heating and hot water; for existing communities, enhance the promotion of electrification and recommend efficient products.
  - Recommended heating sources include electric-driven heat pump systems, promoting air-source heat pump water heating systems, and even advocating for all-electric kitchens.





Implementation path of near zero carbon community

Energy Transition

Energy

Renewable Energy

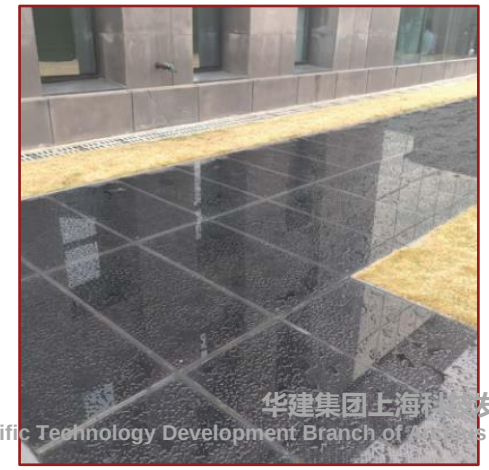
- **Renewable energy utilization**

Encouraging the use of renewable energy in the community

- Setting up solar water heating systems in buildings with hot water demand, such as residences, elderly facilities, kindergartens and restaurants.

- Arrange photovoltaic panels on the roofs of buildings, and set up integrated application pilots of photovoltaic frames, photovoltaic facades, photovoltaic floors, etc., which can be locally combined with the functional needs.

- When necessary, PV power can be allocated and consumed within the community through energy storage and microgrids.



Implementation path of near zero carbon community

Environment

Climate change mitigation

Biodiversity preservation

Climate-Responsive Ecological Design

- With the ongoing trend of global warming, extreme weather events, such as flooding and high temperatures, are becoming more frequent.
- Communities should also consider addressing extreme weather by creating an ecologically resilient environment system.

Meteorological Disasters

- High Temperature
- Drought
- Heavy Rain
- Typhoon
- Strong Wind
- Hailstorm
- Thunderstorm
- Cold Wave

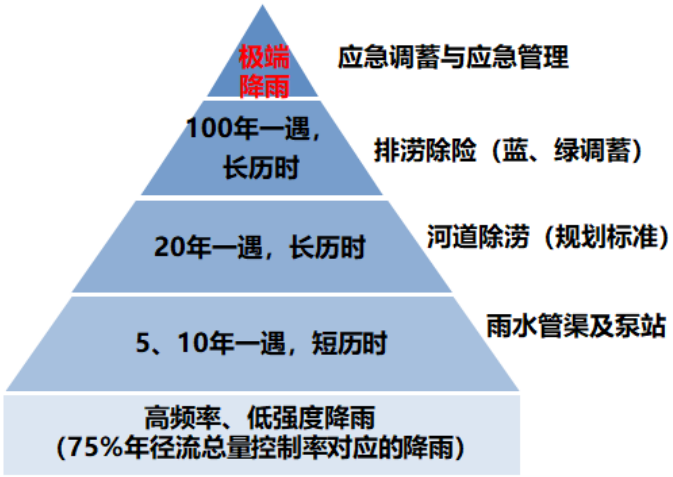
Ecological resilience systems
Transformative power
Resilience
Redundancy
Adaptability
Robustness
Versatility

- Stormwater infiltration system and recycling system
- Ecological resilience builds stormwater safety patterns

- Wind and Typhoon Information Forecasting System
- Building Wind Protection Measures
- Urban Cooling System

- Green and Healthy Building Thermal Insulation and Moisture Control System
- Municipal and building lightning protection and grounding system

生态韧性雨洪安全体系



Implementation path of near zero carbon community

Environment

Climate change mitigation

Biodiversity preservation

- **Design Strategies for Heat Mitigation:**

Strategies for Heat Mitigation:

1.Increased Tree Canopy

Develop green infrastructure through street trees, green spaces, green roofs, and green walls to achieve cooling via vegetation.

2.Cooling Materials

Recommend using surface materials with improved reflectivity, emissivity, and permeability to lower urban temperatures.

3.Water Features and Mist Systems

Utilize natural water bodies as a cooling source, using environmental heat for evaporation to reduce air temperatures.

4.Shading Systems

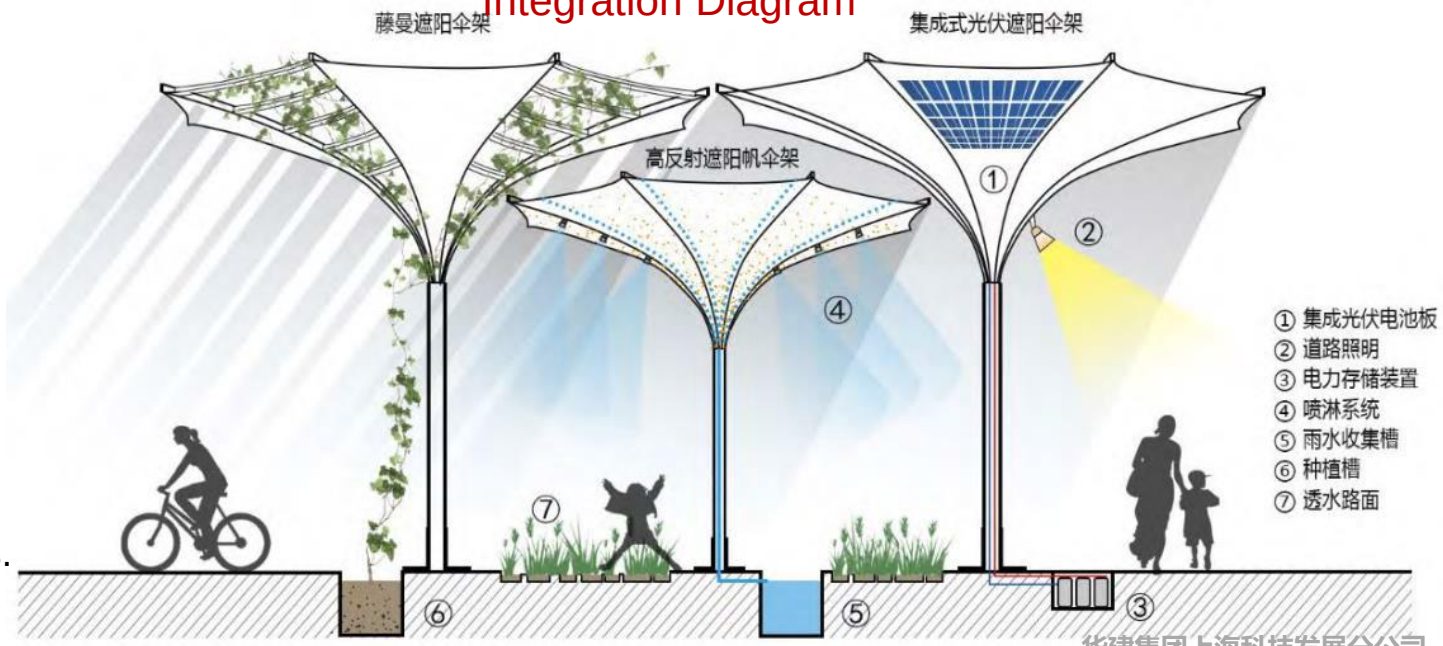
Natural shading is provided by trees or vines, while artificial shading includes awnings, temporary covers, and umbrellas.

5.Ventilation Corridors

Establish corridors to enhance natural airflow and ventilation

Diverse Water Features for Cooling System

Photovoltaic Power Generation and Shading Cooling Integration Diagram



Reference: "Urban Cooling Strategy Guide" by the City of Sydney, Australia》

Implementation path of near zero carbon community

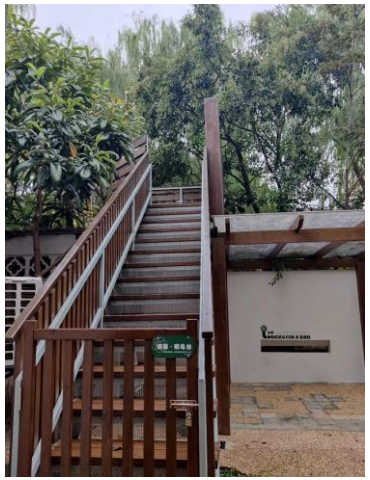
Environment

Climate change mitigation

Biodiversity preservation

Provide diverse habitats through environmental creation

- Use native plants
- Eliminate invasive plants
- Enrich plant communities (trees, shrubs, and grasses)
- Reduce the use of pesticides and fertilizers
- Provide supplemental food, water, or shelter for urban wildlife



Implementation path of near zero carbon community

Cultural identity

Emotion

Perceptible low-carbon features

Through the creation of community style, space, environment and atmosphere, to create a sense of identity and value at the spiritual and psychological levels of the community

Macro Cultural
Perception Cultural heritage
Cultural Characteristics
Traditional Materials

Neutral community belonging
Spatial richness
Spatial Recognition
Natural environment integration

Micro Home Atmosphere
Home atmosphere creation
ndividual aesthetic experience
Pro-life interiors

Implementation path of near zero carbon community

Emotion

Cultural identity

Perceptible low-carbon features

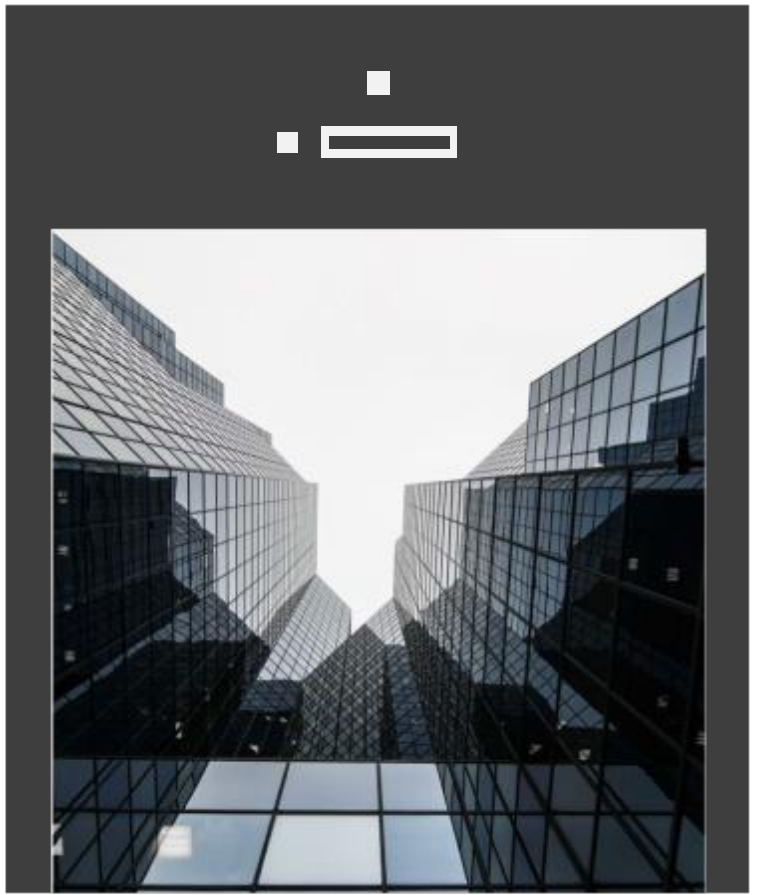
Real-time monitoring and intelligent self-control based on the realization of sensible and participatory

Telemetry and Management

- 用水远传计量、分类分级统计
- 管网漏损检测分析管理
- 用能远传计量、分类分级统计
- 能源管理系统监测分析管理

Real-Time Monitoring and Control

- 水质在线监测
- 空气质量实时监测与显示系统
- 自然采光区域照明自动调节



Intelligent Services

- 家电控制、照明智能控制、环境智能监测、建筑设备自动控制等
- 远程监控
- 接入智慧城市

Customization

- 根据不同需求个性化定制空间
- 基于个性化空间需求定制运行模式
- 实现统一风貌与性能标准下空间风格与运行模式的百花齐放

Implementation path of near zero carbon community

Evolvement

Intelligent Surveillance iterative Enhancement

A virtuous circle of public participation

Intelligent operation and maintenance: Responding to the needs of “carbon reduction, consumption reduction, comfort” and other aspects, realize multi-energy complementary coordination, energy saving, carbon reduction and intelligent operation and maintenance management through digital means.

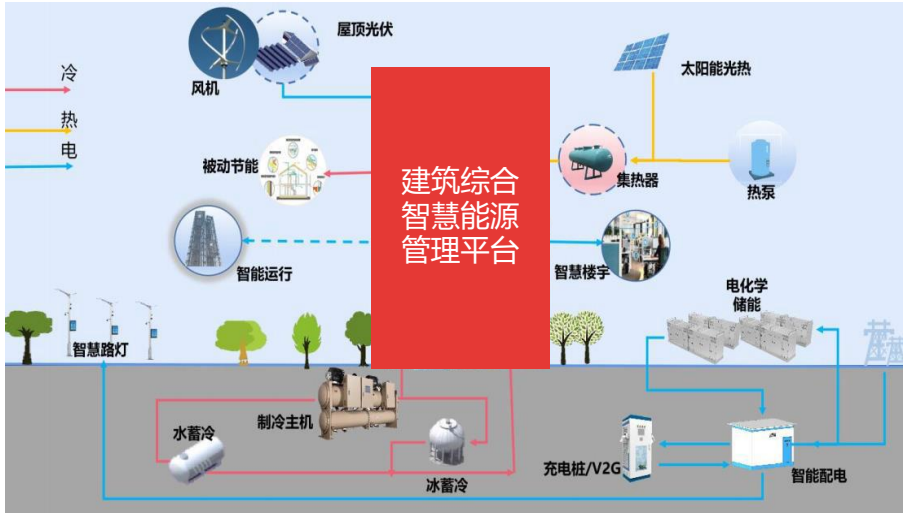
- **Microgrid scheduling**: Realize optimal scheduling of the optical storage direct flexible system and the conventional AC power system, and provide the ability to participate in the demand-side response of the power market and peak shaving and valley filling in the future
- **Carbon Emission Management:** Tapping the potential by monitoring carbon reduction and renewable energy generation, providing improvement strategies for energy efficiency and operation optimization, and enhancing the ability of carbon reduction.

Energy Internet Platform Based on IoT Technology, Enabling Real-time Data Collection and Unified Management of Renewable Energy, Energy Storage, Cooling Supply, etc.

Coordination of electricity, heat, and cooling in a multi-energy complementary system, providing multi-objective optimization scheduling strategies for operational cost and low-carbon emissions, to improve the overall energy operation efficiency of the system

Real-time monitoring of building energy use and efficiency, with full transparency in carbon footprint tracking, to uncover energy-saving potential and support low-carbon economic operations.

Real-time energy use, consumption, and carbon emission information is shared with the public through displays and mobile devices, while encouraging community participation in low-carbon and carbon-reduction actions through carbon-inclusive activities and point systems.



Implementation path of near zero carbon community

Evolvement

Intelligent Surveillance iterative Enhancement

A virtuous circle of public participation

- **Carbon-inclusive carbon reduction with nationwide participation.**

Establish a carbon management platform to integrate behavioral carbon reduction into the carbon emission management system. Implement a public carbon reduction points policy to encourage widespread voluntary participation, fostering a positive low-carbon cycle.

03 Near zero carbon community practice case

Near zero carbon community practice case

Explore the prominent expression of cutting-edge technologies and the high-density application of mature technologies.

The technology applications are both innovative and topical, while also being practical and durable, ensuring long-term operational sustainability.

7个 功能业态

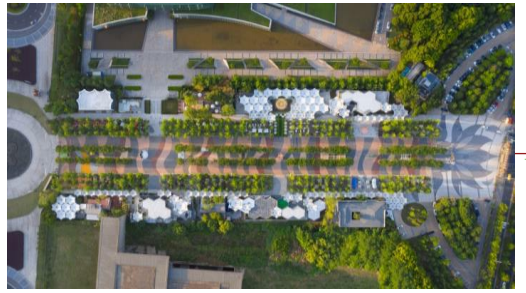
示范区	集成示范+低碳感知 低碳集成样板
幼儿园	近零碳排+童趣活力 近零能耗建筑
住宅	超低能耗+健康舒适 超低能耗建筑
自持办公	低碳高效+品质适配 绿色三星建筑
可售办公	气候响应+灵活适变 绿色二星建筑
公寓	经济适用+安心宜居 绿色二星建筑
店屋	生态体验+交互共享 绿色二星建筑

低碳技术浓度

Actively explore innovative applications of mature technologies to achieve the organic integration of low-

近零碳社区实践案例

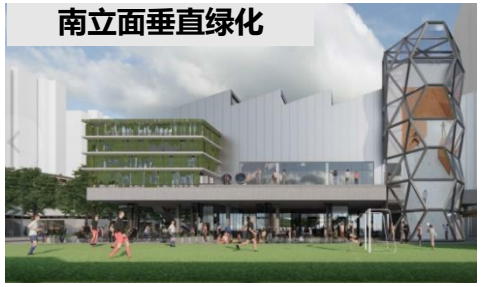
Nature-friendly green ecological environment design



- **城市绿廊**

良好的通风廊道将绿化的清新空气带入室内，改善人流密集区的气候环境

- **立面垂直绿化**

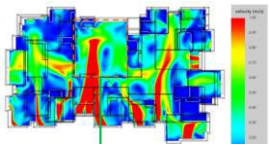


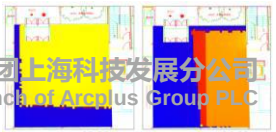
- **种植屋面、露台绿化**

- **架空层/庭院等灰空间引入风、光与绿化**

- **绿中庭+植物方舟**

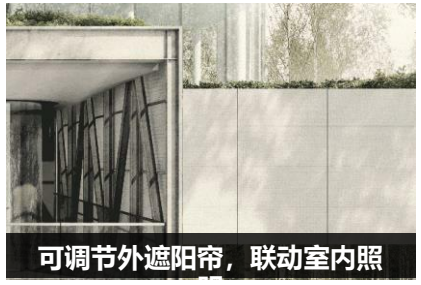
结合商业空间设置大榕树，营造适宜植物自然生长的环境，从林下到树稍创造不同自然体验植物方舟选择珍稀且本土生长的植物，修复本地生态系统，将上海本土原生植物带回家





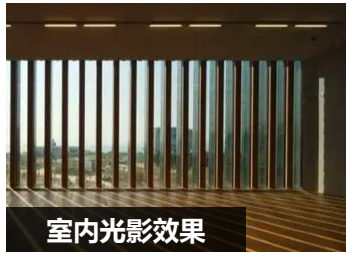
Perceptible energy-saving and comfortable passive design.

- 可变围护结构营造室内舒适光影环境、通风环境



可调节外遮阳帘，联动室内照

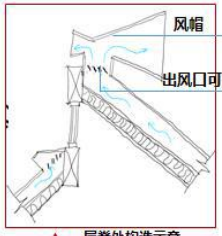
根据光线自动调节开合的遮



室内光影效果

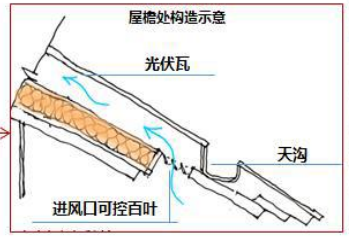
- 双层通风屋面+风帽拔风打造保温隔热屋面

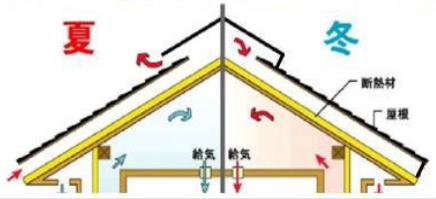
双层可控通风屋面



两层屋面之间空腔层高度250~300mm，在檐口与屋脊处设置通长通风口，以百叶控制开闭

屋脊处构造示意





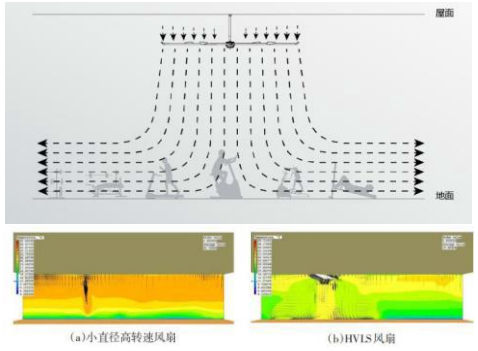
冬季百叶关闭，形成保暖夹层

- 冬季时，形成封闭式内循环屋面体系。
- 内部空气层在阳光的照射下温度升高，形成一个温室，阻止室内热量的外扩

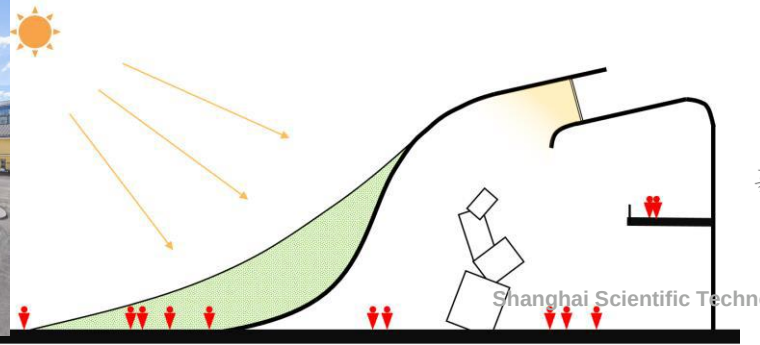
夏季百叶打开，形成通风+遮阳

- 夏季时，对下层屋面形成遮阳
- 同时形成敞开呼吸式屋面，带走通道内的热量，降低屋面表面温度

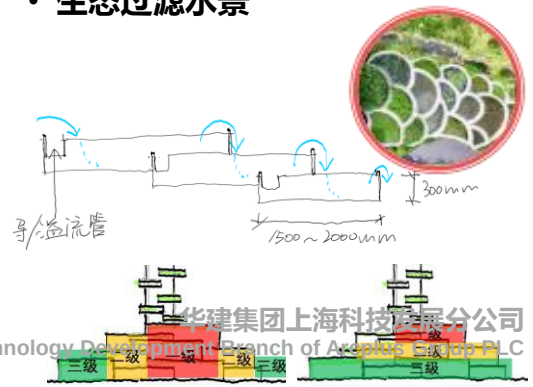
- 吊扇通风降温



- 潜望镜防眩光天窗



- 生态过滤水景



Near zero carbon community practice case

Pilot application of photovoltaic storage direct current (PV-Storage DC) technology

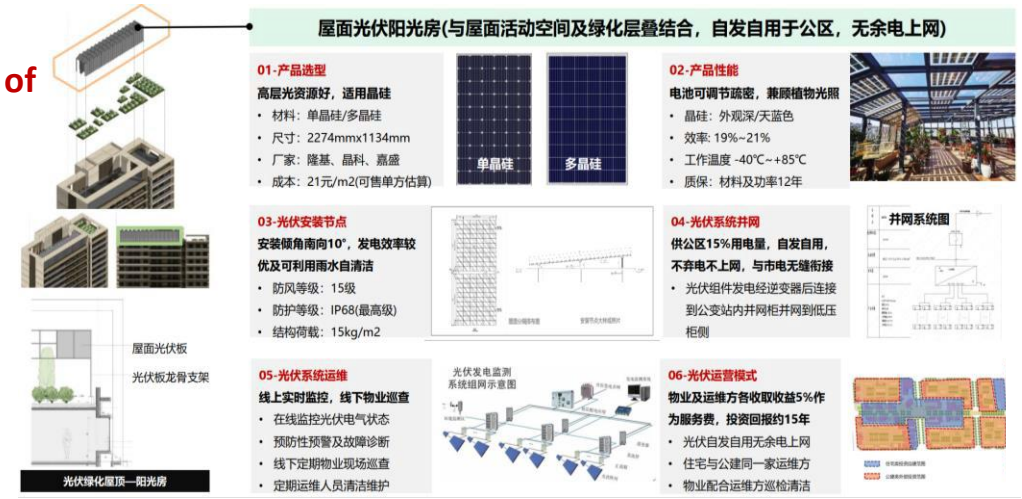
Applied in markets, exhibition halls, and sports venues

Pioneering Low-Carbon Technologies

The western district selects commercial buildings of no less than 5,000 m² for pilot demonstration

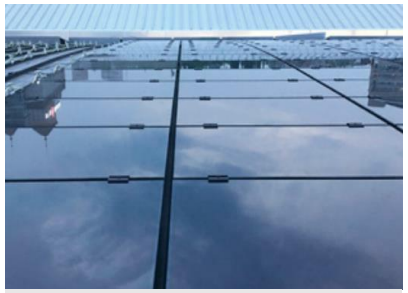
交直流混合供电系统示意图

Large-Scale Utilization of Renewable Energy



Photovoltaic BIPV Skywalk

Photovoltaic BIPV Greenhouse



Roof-mounted Photovoltaics

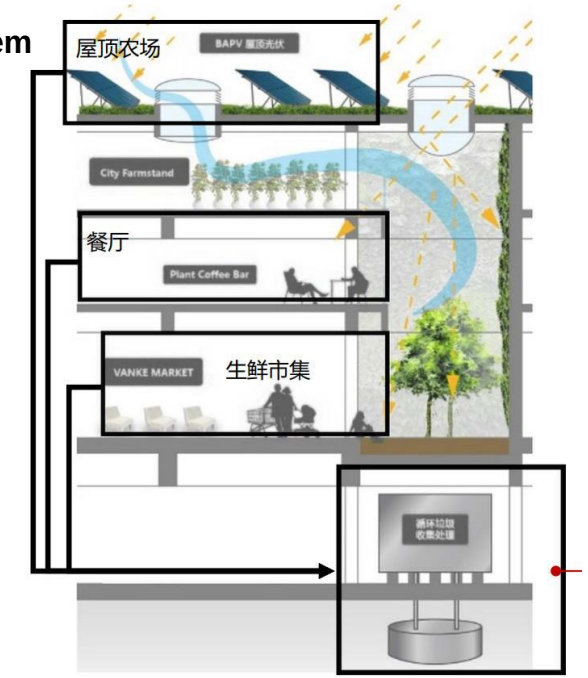
Facade Photovoltaic Supplement

Near zero carbon community practice case

Zero Waste Circular Wet Waste On-site Treatment

On-site Wet Waste Treatment System

By treating wet waste on-site, issues such as odor and appearance caused by transportation and piling are improved. This reduces the carbon emissions associated with waste collection and disposal. The waste residue is turned into plant fertilizer within the community, creating a "food cycle" experience for residents.



湿垃圾就地处理中心（结合地下一层垃圾房布置）

设备	日处理量	地库机房尺寸	荷载要求	水电要求
①	500kg	L:5m* W:3.5m* H:3.5m	1t/㎡	380V/30kW; 提供设备给水、排水接口

垃圾清运方式变化

现状：办公租户、餐饮商户 → 物业收集/自运 → 垃圾房 → 物业分类、称重、配合外运 → 生/熟 → 环卫清运

技术投用后：办公租户、餐饮商户 → 物业收集/自运 → 垃圾房 → 有机肥（社区景观自用）；商户与环卫公司签订合同，每桶收费50元；商户与物业/运营公司签订合同

成本：76元/㎡（单方建筑面积）

厂家：蒙克环保、洁鹿、壹柯、德瑾绿水（正推进初筛设备打样测试）

THANKS

Scientific Technology Development Branch of Arcplus Group PLC

2024.12.18