

Gensler

**DESIGN**

UPDATE

# SHANGHAI TOWER

**Now under construction,**  
the Gensler-designed Shanghai  
Tower will be the 2nd tallest  
building in the world when it  
opens in 2014.



This tower is symbolic of a nation whose future is filled with limitless opportunities.

—Mr. Qingwei Kong, President of the Shanghai Tower Construction & Development Co., Ltd.



# SHANGHAI RISING

Shanghai Tower will anchor the city's Lujiazui district, which has emerged as one of East Asia's leading financial centers. Designed by a local team of Gensler architects to embody Shanghai's rich culture, the 632-meter-high mixed-use building will complete the city's super-highrise precinct. It is the most forward-looking of the three towers symbolizing Shanghai's past, present, and future. The new tower takes inspiration from Shanghai's tradition of parks and neighborhoods. Its curved façade and spiraling form symbolize the dynamic emergence of modern China. By incorporating sustainable best practices, Shanghai Tower is at the forefront of a new generation of super-highrise towers, achieving the highest level of performance and offering unprecedented community access.

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Construction moves ahead as the technical complexities of the tower's structure, glass enclosure, and mechanical systems are skillfully managed.

# FROM THE GROUND UP

Gensler's vision for Shanghai Tower has taken tangible form after completion of the immense foundation. Soil conditions in Shanghai—a clay-based mixture typical of a river delta—meant supporting the tower on 831 reinforced concrete bore piles sunk deep into the ground. For three days, a small army of workers assembled to complete the marathon, 60-hour continuous concrete pour. When the job was finished, more than 61,000 cubic meters of concrete had been used to create the six-meter-thick mat foundation.

The tower's scale and complexity have created so many "firsts" for China's construction industry that more than 100 expert panels have been established to analyze

every aspect of the design. Workers are busy building form for the concrete core and erecting the gigantic composite supercolumns—measuring 5 x 4 meters at the base and reinforced with steel plates that weigh 145 metric tons each—that will provide structural support for the tower. To carry the load of the transparent glass skin, Gensler designed an innovative curtain wall that is suspended from the mechanical floors above and stabilized by a system of hoop rings and struts. And the strategic division of the tower into nine vertical zones will supply the lifeblood of the building's heating, cooling, water, and power throughout with less energy and at lower cost.

Workers positioned rebar and poured the mat foundation in March 2010. They affixed steel for the supercolumns through the summer and, by October, the structural core was taking shape.



# 61k

cubic meters of concrete in the mat foundation slab

total floor area, in square meters

**521k**

weight of in metric tons

**1,200**

number of structural piles in entire project

**2,000**

number of elevators

**106**



Shanghai Tower completes Asia's first super-highrise precinct, the centerpiece of the city's international financial district. The three mixed-use towers are interconnected, served by Shanghai Metro, and accessible from across the city.

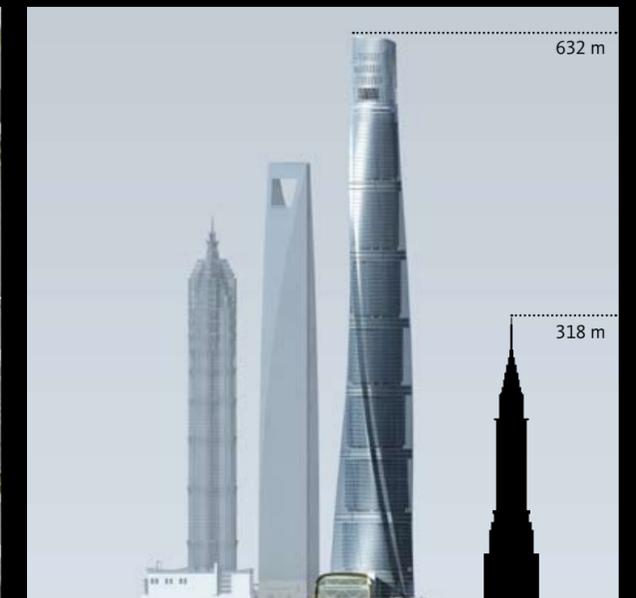
# A UNIFIED SKYLINE

The Lujiazui zone in Shanghai has gone from farmland to financial center in two decades, resulting in a skyline and architectural landscape that need a unifying landmark. With a rounded triangular footprint derived both from the bend in the nearby Huangpu River and from its relationship to the Jin Mao Tower and the Shanghai World Financial Center, Shanghai Tower will stand as a beacon and a signature icon for the city of Shanghai. At the same time, it completes the precinct's harmonious trio of buildings and gives the

precinct its defining silhouette in the sky. The spiraling form of the tower rotates as it rises, signifying the emergence of China as a global financial power. "This tower is symbolic of a nation whose future is filled with limitless opportunities," said Mr. Qingwei Kong, President of the Shanghai Tower Construction & Development Co., Ltd., a consortium made up of a government-based developer, a public landowner, and a construction group.

▼ Shanghai Tower's footprint was reduced to make more room for green spaces, pedestrian paths, and entryways to the tower, creating a public space for respite and social interaction.

▼ Shanghai Tower, at 632 meters, is a 121-story "vertical city" comprising office space as well as dining, shopping, hospitality, and entertainment destinations. The Chrysler Building is shown for scale.



With integrated design and technology, Shanghai Tower embodies a new understanding of the super-highrise building and its place in the 21st-century city.

# INNOVATION TAKES THE PRIZE

Gensler won the Shanghai Tower project in an invited multi-stage competition among leading international architects. What secured the win were the tower's design and performance, and Gensler's commitment to China. To refine the tower's shape, Gensler's team used a series of wind tunnel tests to simulate the region's greatest natural force, the typhoon. Results produced a structure and shape that reduce wind loads by 24 percent—ultimately yielding a savings of \$58 million in construction costs. A simple structure, public spaces within the double façade, and sky gardens based on Shanghai's traditional open courtyards will make Shanghai Tower an unrivaled asset for the Lujiazui district.

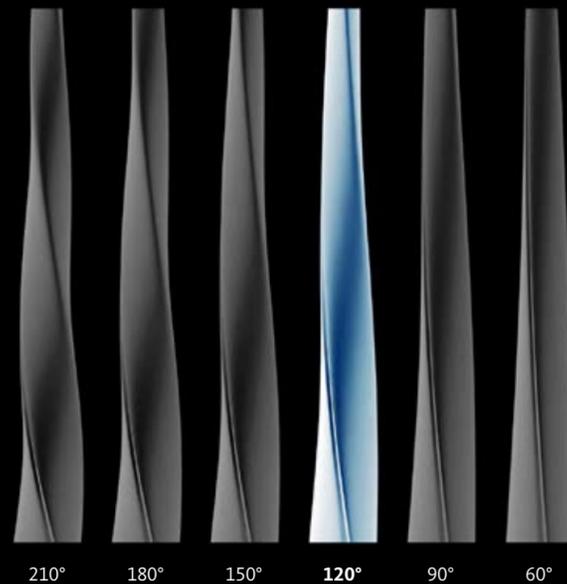
▼ A 16-meter-tall scale model of the tower passed a shake table test simulating earthquakes measuring up to 7.5 on the Richter scale.



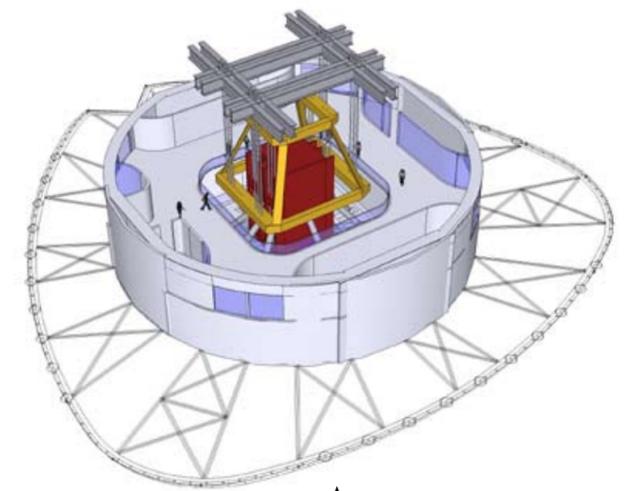
## Shaped to reduce wind loads

Gensler's design team anticipated that three important design strategies—the asymmetry of the tower's form, its tapering profile, and rounded corners—would allow the building to withstand typhoon wind forces common to Shanghai. Using wind tunnel tests, Gensler and structural engineer Thornton Tomasetti refined the tower's form, ultimately reducing building wind loads by 24 percent. The result is a simpler and lighter structure with unprecedented transparency and a 32 percent reduction of costly materials.

▼ Many options were studied, but wind tunnel tests pinpointed a 120-degree rotation as optimal for minimizing wind loads.



▲ Landscaped atriums are located at regular intervals throughout the building.



▲ Tuned-mass damper minimizes building movement.

## Benefits of the double skin

The innovative design incorporates two independent curtain walls—the outer skin is cam-shaped in plan, the inner one is circular. The space between them forms atriums that will house landscaped public gardens at regular intervals throughout the building. These sky gardens will improve air quality, create visual connections between the city and the tower's interiors, and provide a place where building users can interact and mingle.

▼ The landscaped sky lobbies will be social and retail hubs for each neighborhood within the building.



▼ The outer skin gradually narrows at each floor level, giving the glass tower an elegant tapered profile, while a V-notch in the curtain wall accentuates the spiraling geometry.

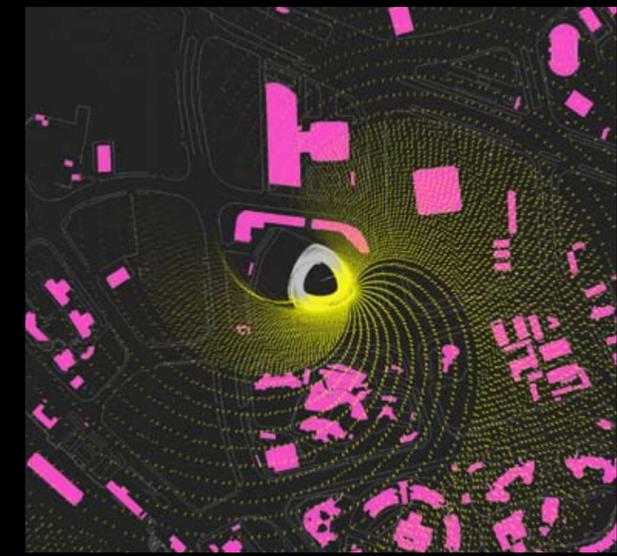


**Minimizing reflection and glare**

Concerns over light pollution had significant impact on the design of the outer curtain wall. Building codes in China's urban districts are highly sensitive to the impact of sunlight reflecting off glass façades toward surrounding buildings. Two curtain-wall schemes—"staggered" and "smooth"—were studied extensively. The tests revealed that a staggered skin made of glass panels set vertically was far superior to a smooth skin of angled glass, which would reflect much more light onto neighboring buildings.

▲ The outer curtain-wall design incorporates metal shelves at each floor level, producing the preferred staggered configuration.

▼ Light reflectance off the curtain wall was modeled using Ecotect software, which showed that the "staggered" curtain-wall design was much more desirable.



**A fast-tracked super-highrise tower**

The simplicity of Shanghai Tower's structure is a response to many challenges: a windy climate, an active earthquake zone, and clay-based soils. The heart of the structural system is a concrete core. The core acts in concert with an outrigger and supercolumn system, with double-belt trusses that support the base of each vertical neighborhood. This makes for an easier and faster construction process—a significant cost savings for the client.

▲ This series of drawings illustrates the layering of structure, composite floors, inner skin, and exterior curtain wall.

▼ The simplified mega-frame proved to be an economical approach to construction.

- Core
- Double-belt truss
- Outrigger
- Beam
- Supercolumn





Shanghai is a city of vibrant neighborhoods. As it positions itself for a future of rich opportunities, it is redefining the way community happens.

# CREATING THE VERTICAL CITY

With its emphasis on public space and its shops, restaurants, and other urban amenities strategically located at the floors with public atriums, Shanghai Tower envisions a new way of inhabiting super-tall towers. Each of the building's neighborhoods rises from a "sky lobby" at its base—a light-filled garden atrium that creates a sense of community and supports daily life. The sky lobbies serve much as plazas and squares do, bringing people together throughout the day. Each one harkens back to the city's historic open courtyards, which combine indoors and outdoors in a landscaped setting.

The entire tower will have an inside-outside transparency and is the only super-highrise building wrapped in public spaces and sky gardens. Each neighborhood is dedicated to a primary use, but is enriched by complementary amenities and services. The upper floors will house hotels, cultural venues, and an observation deck with sweeping views of the Shanghai skyline and the landscape of the city. Central floors will house office space. A six-story retail podium concentrates shopping and dining near the base. And the ground floor will serve as an "urban market," connecting people to each other, to nearby services, and to Shanghai's Metro.

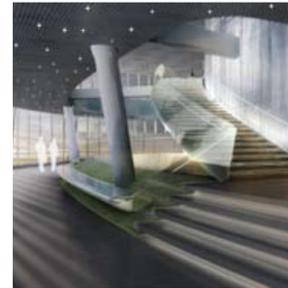
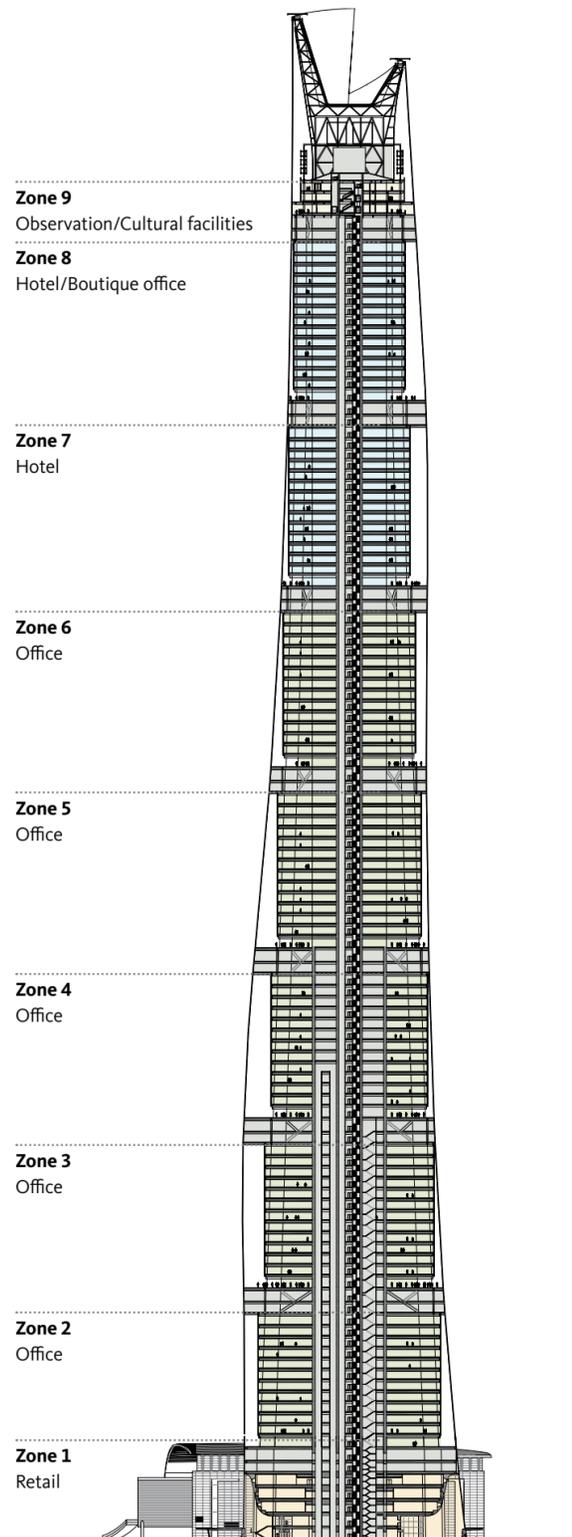
◀ This conceptual image shows how the innovative hub-and-spoke supports for the outer curtain wall create courtyards that serve each of the vertical zones.

▼ Office levels will be served by a separate lobby that streamlines pedestrian circulation into the building and allows quick access to elevators.



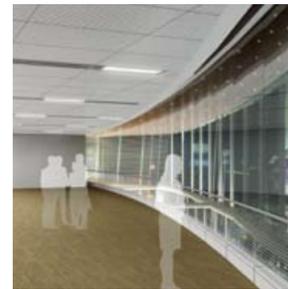
## SELF-CONTAINED CITY

Shanghai Tower is a city within a city comprising nine vertical zones, each 12 to 15 stories high. Each zone is encircled by public space within the double-skin façade. Within each neighborhood, a mix of uses caters to the daily needs of occupants. Separate elevators shuttle people among zones, and below-grade parking links via walkways to the nearby super-highrise towers.



### ◀ Observation level

The highest of the nine zones houses public amenities: gourmet restaurants, an exhibition center, and enclosed and open observation decks served by the tallest single-lift elevator in the world.



### ◀ Offices

Zones 2 through 6 are comprised of high-performance offices, all of which are filled with natural light and connect to the atriums with expansive views of the city.



### ◀ Sky lobbies

Each office zone rises from a sky lobby at its base—a light-filled garden atrium that fosters community and supports daily life. Shops and restaurants in each lobby lower the demand for trips to the ground level, which saves energy.



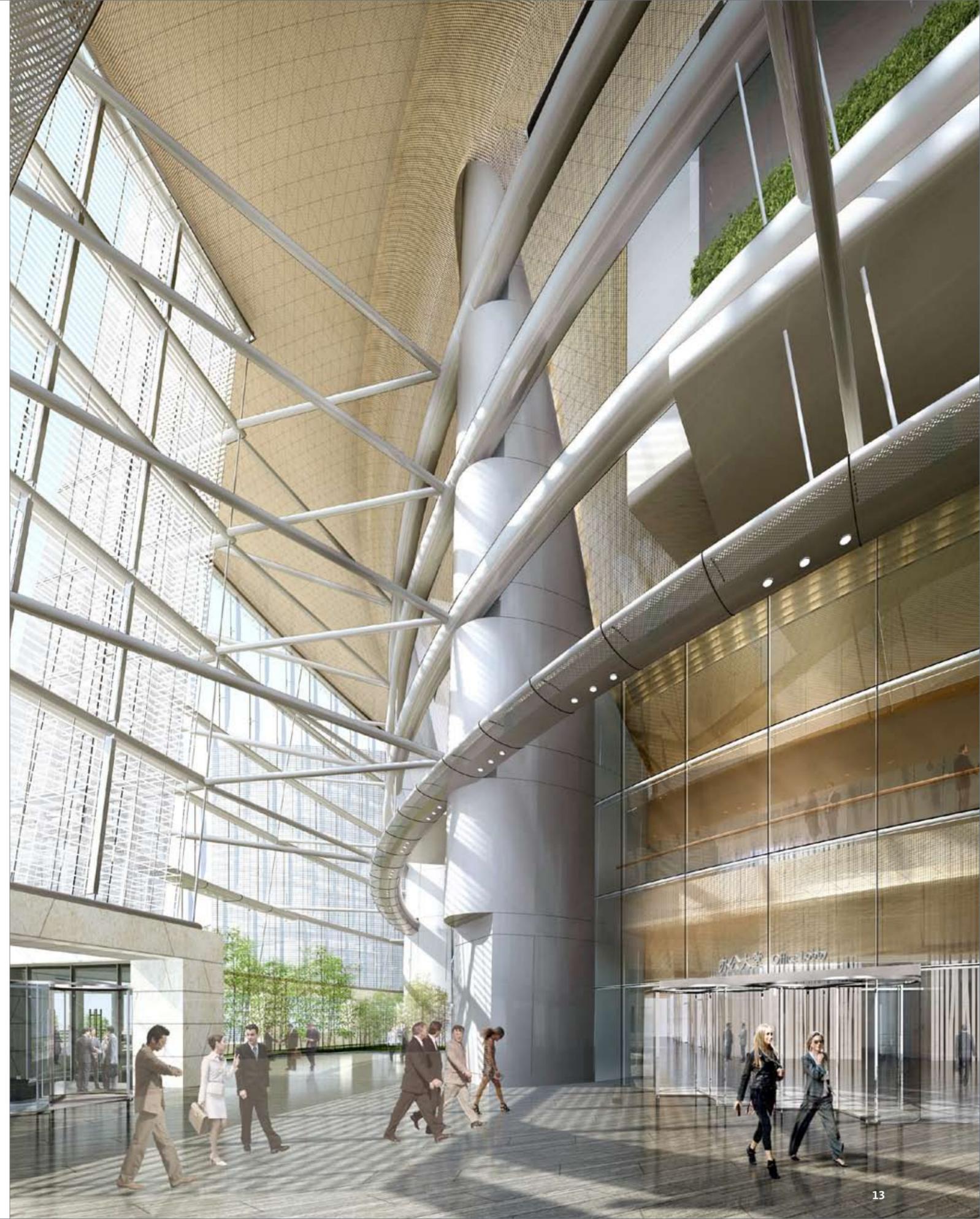
### ◀ Retail podium

Zone 1 is the base-level retail podium of luxury boutiques, high-end dining destinations, cafes, and lounges. The hotels' conference, banquet, and spa facilities also occupy space in the six-story podium.



### ◀▶ Ground-floor lobbies

Both the office tower and the hotel/conference center functions will be accessed through separate, dedicated lobbies rendered at a scale fitting to the tower.



Shanghai Tower's six-level retail podium—showcasing forms and materials that resonate with traditional Chinese culture—will be the ultimate destination for shopping and large-scale gatherings.

# WORLD-CLASS RETAIL

Both gateway and connector, the Shanghai Tower retail podium will be a world-class destination for shoppers, office workers, and hotel guests in the Lujiazui district. Clad in luminous cast-glass tiles, the distinctive podium offers a luxury retail and leisure experience that incorporates a mix of premium brands, one-of-a-kind specialty retailers, and high-concept dining. Strategically placed entrances from the tower, street, and underground transit station funnel pedestrians into active public spaces connected by a network of concourses, escalators, stairs, and balconies.

The retail complex is comprised of two distinct zones—two levels below grade and four above—whose clarity of organization makes for easy navigation. Most people will enter from the subway into a lower-level concourse that functions like a marketplace. The podium's upper four levels house luxury retailers whose products and services represent the most exclusive brands in the world. Slicing through both zones is a five-story atrium with an expansive glass façade that opens toward the city, filling the shops with natural light, enhancing the visibility of luxury tenants, and establishing an important connection between inside and out.

▼ The glazed west end of the podium and the rooftop terrace signal the location of the conference center that adjoins the retail floors.

▶ The podium design creates a unique shopping and dining experience through the consistent use of contemporary forms and materials that are rooted in place, drawing their inspiration from Chinese tradition.





Shanghai Tower's entry-level retail podium welcomes visitors with an approachable and transparent gateway to the tower's mix of neighborhoods, and serves as the super-highrise precinct's transit-served destination for shopping and gathering. The circular sunken garden in the foreground provides access to the podium's lower levels and to elevators serving the top-level observation area.



As a global leader in sustainable design, Gensler designed Shanghai Tower to incorporate green strategies that will long demonstrate the city's commitment to an environmentally responsible future.

# SUSTAINABLE TOWER

Shanghai Tower will be one of the most sustainably advanced tall buildings in the world—designed to achieve both LEED® Gold certification and a China Green Building Three Star rating. The sustainability of the tower grows out of Gensler's integrated approach to its design, using simulation studies to optimize overall building performance. Wind tunnel testing of the tapered, asymmetrical tower focused on defining the optimal shape of the exterior skin and showed that reducing wind load makes for a lighter, more efficient structure that conserves natural resources.

A central aspect of the design is the transparent, second skin that wraps the entire building. The ventilated atriums it encloses conserve energy by modulating the temperature within the void. The space acts as a buffer between inside and outside, warming up the cool outside air in winter and dissipating heat from the building interior in the summer. Mechanical equipment is spaced strategically in each zone of the building to provide optimal flexibility, reduce operating costs, and conserve energy. As Gensler's founder, Arthur Gensler, told *The International Business Times*, "We hope Shanghai Tower inspires new ideas about what sustainable tall buildings can be. We've lined the perimeter of the tower, top to bottom, with public spaces, and we've integrated strategic environmental thinking into every move."

◀ The tower's topmost levels will house rows of vertically aligned wind turbines and a spiraling parapet that is integral to a rainwater collection system.

Shanghai Tower is targeted to reduce water consumption by:

**40%**

Shanghai Tower is targeted to reduce energy use by:

**21%**

## GREEN STRATEGIES

Sustainable design is at the core of Shanghai Tower's development. To achieve the LEED Gold and China Three Star ratings, Gensler incorporated many strategies that will generate a positive environmental impact. The foundation of this approach is state-of-the-art water resource management practices and high-efficiency building systems. A full 33 percent of the site is green space, with landscaping that breathes fresh air into the city and shades paved areas that radiate heat. Locally sourced materials with high-recycled content are being used when available. And the building's heating and cooling systems will tap the power of geothermal technology to deliver energy from fluids maintained at the earth's constant temperature.

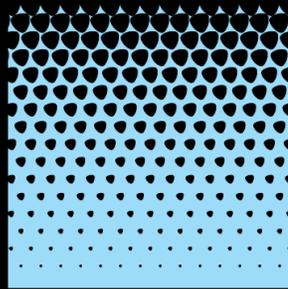
Shanghai Tower's sustainable strategies will reduce the building's carbon footprint by:

# 34,000

metric tons per yr



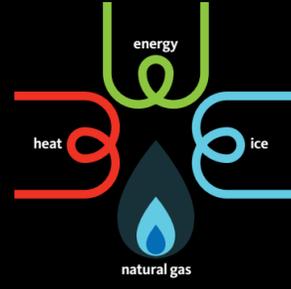
**Daylighting**  
The continuous glass skin admits the maximum amount of daylight into the atriums, reducing the need for artificial lighting. Floor-to-ceiling glass in the office and hotel floors yields similar benefits to those spaces.



**Sun-shading**  
To reduce heating and cooling loads, both the inner and outer curtain walls will have a spectrally selective low-E coating. Fritted glass on the outer wall provides additional sun-shading, aided by horizontal ledges at each floor level that will block high summer sun.



**Building controls**  
Shanghai Tower incorporates intelligent building controls that lower energy costs by monitoring and adjusting systems such as lighting, heating, cooling, ventilation, and self-generated power. Lighting controls alone will save more than \$556,000 each year in energy.



**Cogeneration system**  
The 2,200-kW natural gas-fired cogeneration system provides electricity and heat energy to the low zone areas. In addition to providing site-generated power, the system produces 640 tons of refrigeration during the cooling season and heat during the winter months.



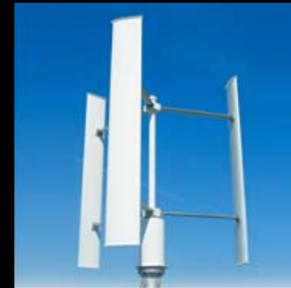
**Regional materials**  
The team seeks out building materials that are harvested and manufactured within an 800-kilometer radius of the site. Local sourcing of products is sustainable because it reduces transportation-related environmental impacts and boosts local economies.



**Building envelope**  
The building's two curtain walls create atriums that act like an insulating blanket, reducing energy costs. Used indoor air is circulated through each atrium to temper the space, keeping the sun's heat out in summer and the building's heat in during winter.



**Landscaping**  
One-third of the site will be dedicated green space, with extensive planting to lessen the heat island effect of paved areas. Efficient irrigation systems, combined with plant materials requiring low watering, reduce overall water consumption.



**Wind turbines**  
In keeping with the client's desire to demonstrate cutting-edge technologies, wind turbines at the top of the building will power the exterior lighting for the building and some of the park areas. The turbines will produce an estimated 54,000 kWh/year in renewable energy.

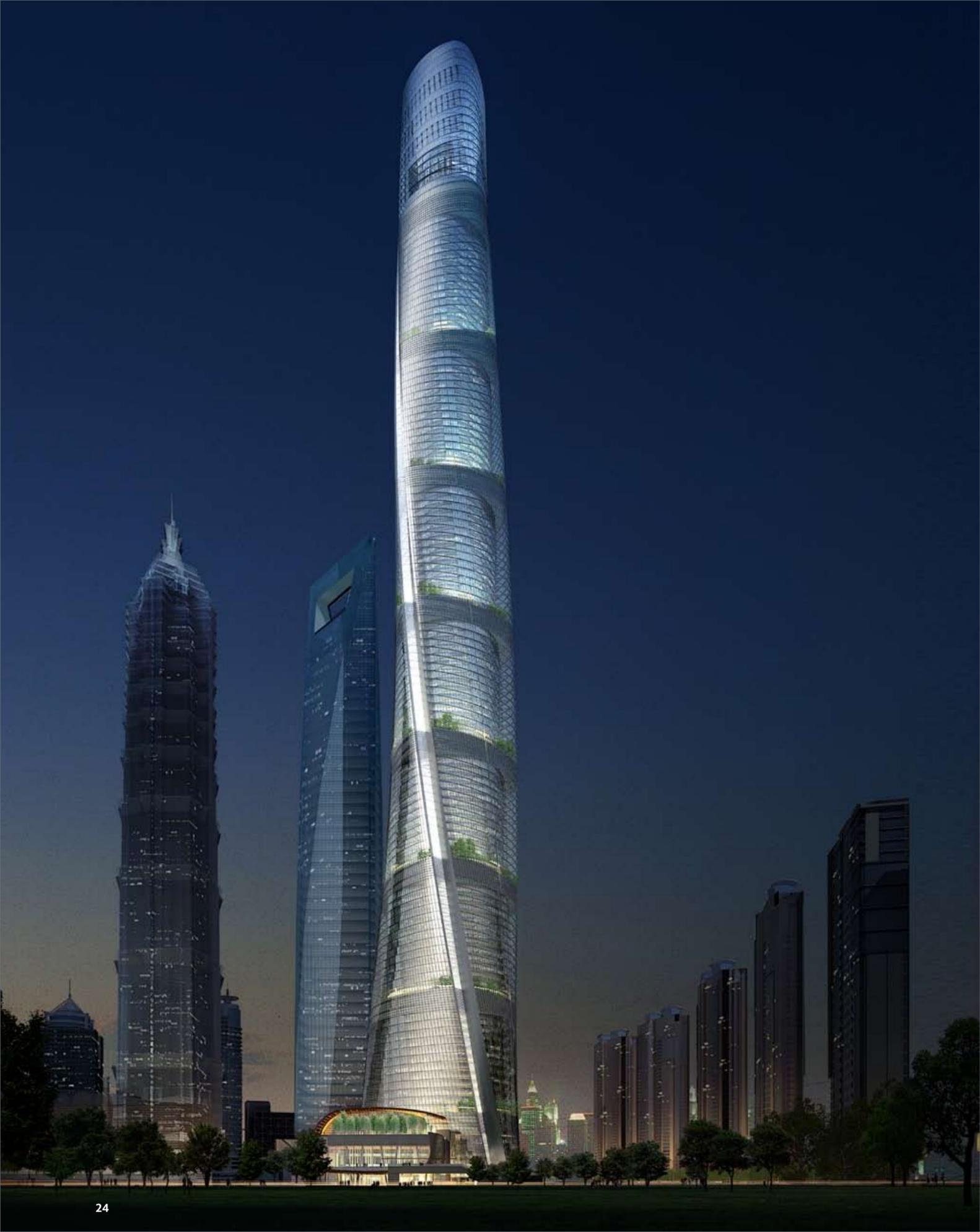
Rows of wind turbines integral to the curtain wall at the tower's upper levels will reduce energy consumption, while the funnel-shaped parapet channels rainwater into large collection tanks.



# SHANGHAI 2014

▲ Shanghai Tower's spiraling form captures the city's dynamic nature and its role as China's financial hub, yet fits harmoniously with its neighbors to anchor Asia's first super-highrise precinct.

At mid-century, Shanghai will be the gateway city of the world's leading economy. If each generation makes its mark on a metropolis, Shanghai Tower looks past this ambition to anticipate a future that is sustainable in every way—economically, socially, and environmentally.



## Project facts

### Site

Location: Lujiazui Finance and Trade Zone,  
Pudong district, Shanghai, China  
Area: 30,370 square meters

### Tower

Height: 632 meters  
Stories: 121 occupied floors  
Area: 380,000 square meters above grade  
141,000 square meters below grade  
Program: Office, luxury hotel, entertainment, retail,  
and cultural venues

### Podium

Height: 36.9 meters  
Stories: 5 stories above grade  
Area: 46,000 square meters  
Program: Luxury retail, bank, restaurant, conference,  
meeting, and banquet functions. Below-  
grade levels will house retail, 1,800 parking  
spaces, service, and MEP functions.

## Team information

### Owner, Developer, Contractor

Shanghai Tower Construction & Development Co., Ltd.

### Design Architect

Gensler

### Local Design Institute

Architectural Design & Research Institute  
of Tongji University

### Structural Engineer

Thornton Tomasetti

### MEP Engineer

Cosentini Associates

### Landscape Architect

SWA

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**1** million BTUs of net energy  
**1,760** gallons of wastewater  
**107** pounds of solid waste



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## Practice Areas

Aviation & Transportation  
Brand Design  
Commercial Office Buildings  
Consulting  
Education  
Financial Services Firms  
Headquarters  
Hospitality  
Mission Critical

Mixed Use & Entertainment  
Planning & Urban Design  
Product Design  
Professional Services Firms  
Retail  
Retail Centers  
Science & Technology  
Sports  
Workplace

## Locations

Abu Dhabi UAE	Dallas	Minneapolis	San Ramon
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