

# 深圳国际能源大厦

## Shenzhen International Energy Mansion

客户 Shenzhen Energy Company

建筑设计 BIG

合作设计 Arup, Transsolar

项目负责人 Bjarke Ingels

项目经理 Andreas Klok Pedersen

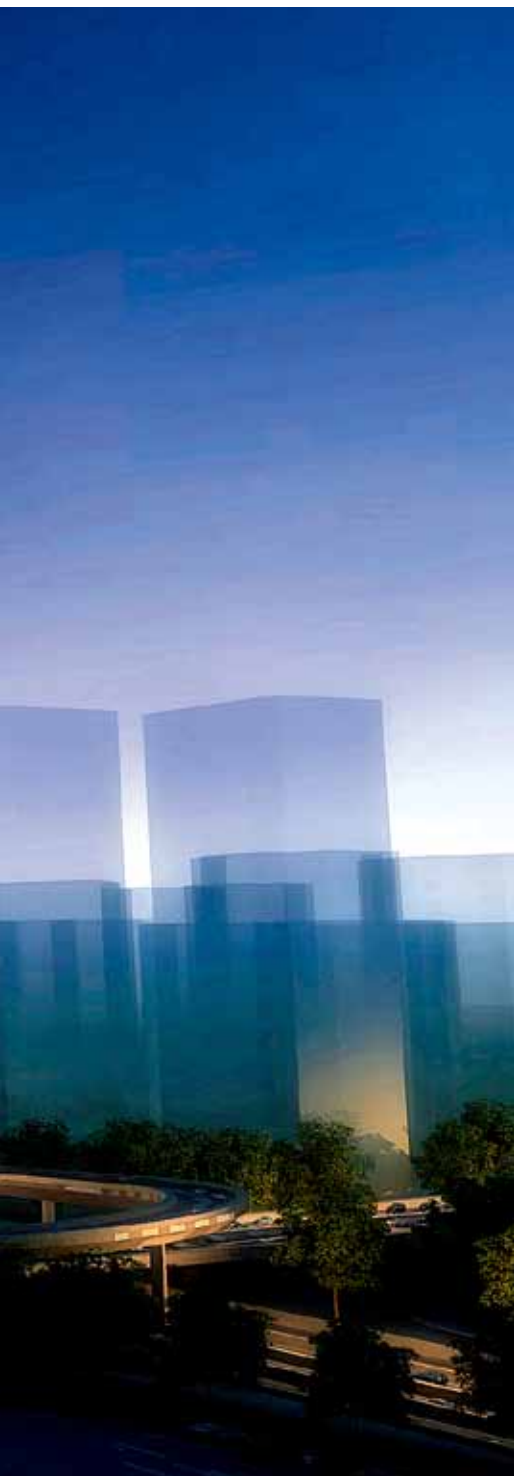
设计团队 Cat Huang, Alex Cozman, Fan Zhang, Kiana Sheng, Flavien L., Stanislaw

规模 96 000m<sup>2</sup>

类型 设计竞赛一等奖

编校 朱晓琳

深圳能源大厦成为深圳新市区中心的标志性建筑，也是深圳能源公司展示企业愿景及价值的窗口。我们所提议的设计将在着重建筑的生态可持续性的同时，关注社会及经济可持续性。我们的目标是建造一幢实用、高效布局的楼宇，并采用可持续的立面，通过被动及主动途径减少建筑的能源消耗。设计将采用灵活且高效的楼层方案，建筑内外将设有多处特定区域，以打造舒适的工作环境，并构成独特的建筑特征。



设计概念的演进

## 设计的演进

熔岩在慢速冷却过程中形成垂直岩柱的天然几何作用，构成了由玄武岩组成的曲线形墙面。棕榈叶在适应外部环境的过程中形成了其层叠结构。棕榈表面的包围式曲线使棕榈变得更加轻盈，并具有一定的结构柔韧性和灵活性。与此同时，棕榈叶中央的凹处形成自然的排水渠道。形似灯笼的折纸结构设计灵感来自于自然界不断演进的植物。传统的梯田式稻田景观是人们为满足居住与食物生产需求而逐渐形成的自然景观。

同样地，为了向工作人员提供功能灵活且具备足够照明的的工作区域，具有高效性的摩天大楼也应运而生。然而到目前为止，普通摩天大楼的设计只是提供了空气调节及照明，却忽略了环境影响或能源短缺情况。

新型的可持续摩天大楼需要在保留灵活程度、日光、视野、密集程度以及可用性的同时，不断尝试新的因素，例如将自然光线最大化与日光照射最小化相结合，从而大幅度减小机动制冷的需求。

设计建议将深圳能源大厦建造为首个新型可持续性办公大楼，充分利用建筑与日光、空气、湿度以及风速等外部因素。利用这些资源打造建筑内部良好的舒适性和品质。深圳能源大厦将从传统的摩天大楼中脱颖而出，完成一项顺应自然的设计蜕变。

## 针对当地气候优化建筑几何设计

深圳的热带气候特征需要全新的办公楼设计方案。我们面临的挑战是如何在一个热带气候条件下创建舒适的工作环境，同时减少能源消耗。传统型现代办公楼被广泛应用于全球各地，其优势包括切合实际的楼层规划以及经济型结构系统。但是在热带气候条件下，玻璃幕墙立面往往会导致用于空气调节的大量能源消耗，涂层窗户的使用也使视野受到一定影响。我们建议大楼的设计应基于高效出色的楼层方



#### 1. Volume

The project site is located at the south gate of the political, cultural and business centre of Shenzhen, north-east of the crossing of Binhai Road and Jintian Road. A podium and two towers of 200 and 100 meters define the maximum building envelope.



#### 2. Traffic

The site is located directly at the crossing point of two main infrastructures. Towards west a highway bridge passes by the building. Cars access the building from the back.



#### 3. Pedestrians

Pedestrians access the building from surrounding sidewalks. A pedestrian tunnel connects the site to the convention center. This pedestrian access leads directly to the main lobby of the building. In each end of the site will be access to the commercial areas.



#### 4. Skyline

The towers are a part of a planned height profile for the central area of Shenzhen. By keeping the height of the towers to 200 and 100 meters, they will form together with the neighbouring towers a continuous curved skyline marking the center of Shenzhen.



#### 5. Green

Green spots for recreation are surrounding the site in the dense forest of towers. By utilizing all roofs of the building volume as green parks, the building site can stay green even when fully developed.



#### 6. Sun

The site is located directly facing east and west. In the morning and evening there is a low sun on the east and west facades. During mid-day the sun is in a steep angle on the smaller south facing facades.



#### 7. Wind

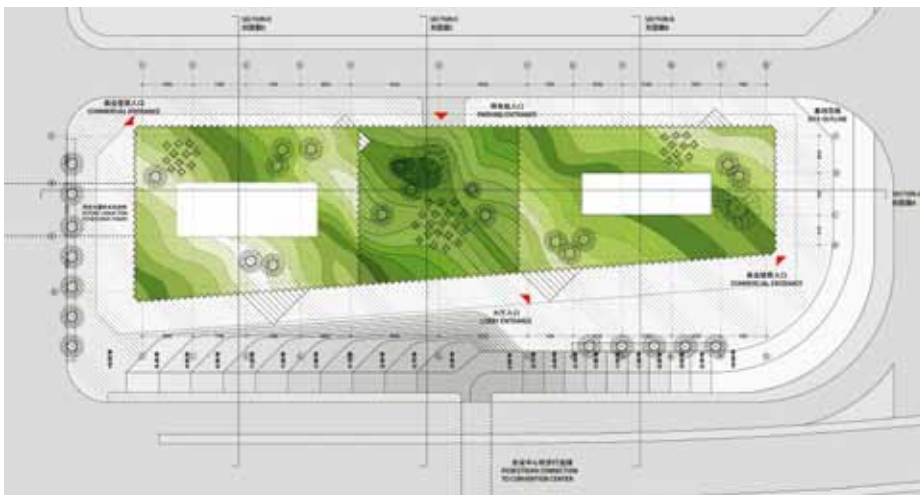
The wind is coming predominantly from the east and west directions, creating need for wind protection on the outdoor spaces on the roofs.



#### 8. Visibility

The buildings prominent location on the main entrance axis to Shenzhen the Binhai Road makes it a visible landmark both for cars entering and leaving Shenzhen.

### 城市环境分析



### 总平面

案，外观则应根据当地气候条件进行具体的设计及优化。根据我们的研究与实验，仅通过建筑立面外层的改革，就能够显著提高建筑的可持续性。

### 气候环境

根据Köppen-Geiger气候划分模式，深圳属于潮湿型亚热带气候，较多月份内湿度较高。由于毗邻赤道，太阳照射角度可高达90°，全年每日太阳移动几乎为东西向直接移动。要在这样的气候条件下获得舒适的工作环境，办公楼应具备以下两个条件：防止太阳光线直接照射的遮阳装置以及室内空气除湿措施。

### 城市环境

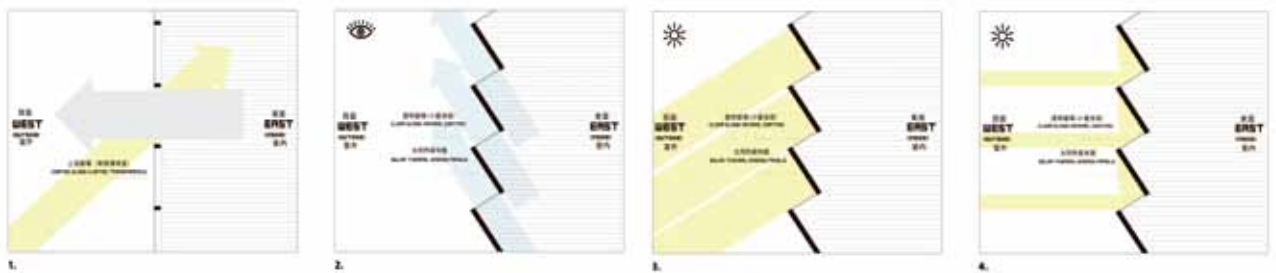
(1) 项目概况：项目基地处于深圳政治、文化及商业中心

The tropical climate of Shenzhen calls for a new approach to designing office buildings. How can we create comfortable working spaces in a tropical climate while reducing our energy consumption? The construction principle of the typical modern office tower is replicated all over the world. It has the advantage of a practical floor plan, and economical structural system. But in tropical conditions the glazed curtain wall facades normally result in high energy consumption for air conditioning and poor views through coated windows. To achieve a comfortable working environment in these conditions an office building would especially need two things: Shading from direct exposure to sunlight, and dehumidification of interior air.

We are proposing a tower based on an efficient and well-proven floor plan, enclosed in a skin specifically modified and optimized for the local climate. We propose to enhance the sustainable performance of the building drastically by only focusing on its envelope, the façade.

### Design evolution

The rippled walls of basalt rocks have evolved naturally from the geometric behavior of lava cooling at very slow speeds into vertical compounds of rocky



幕墙设计

南区的门户位置，位于滨海路及金田路路口的东北方向。一座裙房以及200m和100m高的两座塔楼构成其最大的建筑围护结构。

(2) 交通：项目基地坐落于两大主要基础设施的交汇处，西面高架桥位于建筑一侧，汽车可以从后部方位驶入建筑区。

(3) 人行区域：从周围的人行道前往建筑的区域为行人区域。人行隧道将基地与会议中心连通起来，人行通道直接通往建筑大堂，从基地各处可通往商业区。

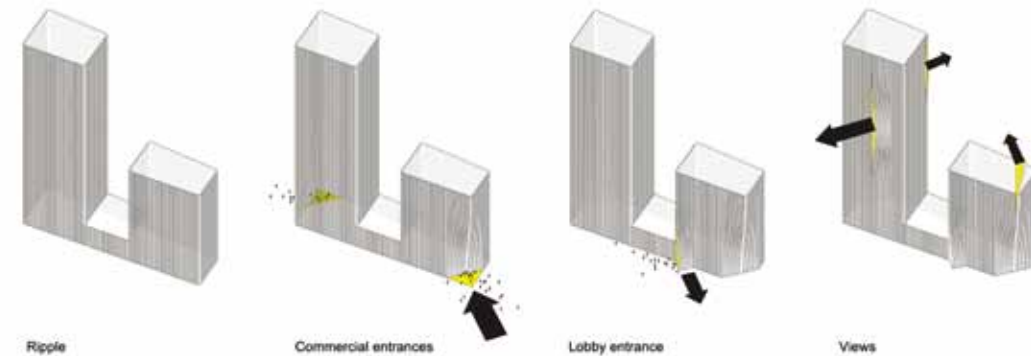
(4) 天际线：能源大楼是深圳中心区域规划建筑轮廓的组成部分，200m和100m的大楼与毗邻的楼宇共同构成美妙蜿蜒的天际线，成为深圳中心的标志性建筑。

(5) 绿化：基地周边的密集建筑群中设有绿色休闲区域。建筑屋顶将被设计为绿色花园，使全面开发后的建筑基地仍能

columns. The folded structure of a palm leaf has evolved by adapting to the requirements of the exterior environment. The folded ripples in the surface of the palm provide a light sheet of material with structural rigidity and flexibility. The chlorophyll exploits sunlight to create energy through photosynthesis. The vanes along the ripples channel water to the extremities of the structure. The origami like structure of a paper lamp is designed inspired by the ingenuity observed in naturally evolved plants. The traditional stepped landscapes of rice paddies have evolved by man adapting the natural landscape to meet their needs for inhabitation and food production.

In the same way the skyscraper has evolved as an economically efficient way to provide flexible, functional and well illuminated work spaces for dense populations of professionals. It has however evolved at a time when air conditioning and electric lighting were merely seen as modern solutions to modern demand, with no thought of the environmental consequences or energy shortage.

Today the skyscraper needs to evolve into a new sustainable species. It must retain its highly evolved qualities such as flexibility, daylight, view, density and



特定区域的设计分析

保持较高的绿化率。

（6）日光：建筑基地面向东部及西部，早晨与晚上东西立面接受的日光照射较少，正午时分日光垂直照射在南部立面上。

（7）风向：风向主要为东向风及西向风，屋顶室外区域应采用防风措施。

（8）视觉效果：建筑位于深圳市滨海路的主要入口中轴线上，可将其作为出入深圳交通的地标性建筑。

### 功能布局

建筑项目的主要内容包括办公楼、商业裙楼以及地下车库。办公楼分为两大部分：深圳能源公司总部区域和可租用的办公区域。裙楼包括大堂、会议中心、酒吧以及展览区。能源公司总部位于大楼顶部，可享有最佳视野效果。其它办公楼层均可租用。该项目要求使用大量传统方案，而会议室、经理人俱乐部及员工设施等特别区域将打造独特的视觉效果。

### 幕墙设计

在深圳能源大厦的幕墙设计中，考虑到传统的幕墙玻璃立面

general usability, while evolving new and untested attributes such as ways of combining maximum daylight exposure with minimal sunshine exposure or integrated ways of limiting the need for cooling.

We propose to make the Shenzhen Energy Mansion the first specimen of a new species of office buildings that exploit the buildings interface with the external elements - sun, daylight, air humidity, wind - as a source to create a maximum comfort and quality inside.

The Shenzhen Energy Mansion will appear as a subtle mutation of the classic skyscraper - a natural evolution rather than a desperate revolution.

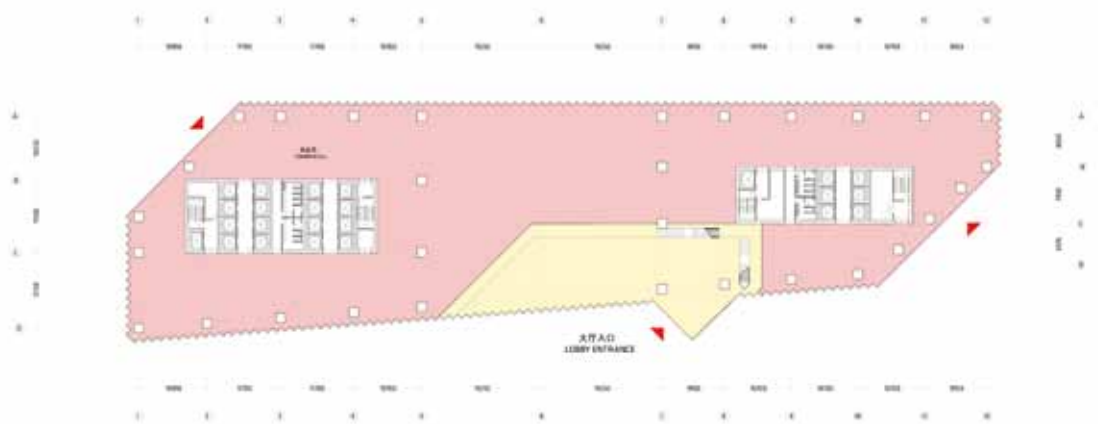
### Urban Context

1. Volume—The project site is located at the south gate of the political, cultural and business centre of Shen-zhen, north-east of the crossing of Binhai Road and Jintian Road. A podium and two towers of 200 and 100 meters define the maximum build-ing envelope.

2. Traffic—The site is located directly at the crossing point of two main infrastructures. Towards west a high-way bridge passes by the building. Cars access the building from the back.

3. Pedestrians—Pedestrians access the building from surrounding sidewalks. A pedestrian tunnel connects the site to the convention center. This pedestrian access leads directly to the main lobby of the building. In each end of the site will be access to the commercial areas.

4. Skyline—The towers are a part of a planned height profile for the central area of Shenzhen. By keeping the height of the towers to 200 and 100 meters, they will form together with the neighboring towers a continuous curved



一层平面

的绝缘隔热性能较低，办公楼常常因阳光直射而受热过度，而使用涂层窗户又使视野晦暗不清，且空气调节需要消耗大量能源费用，我们针对立面采用包围式结构，建筑将出现包围及开放区域。包围区域可确保立面获得高度绝缘隔热效果，遮挡太阳光的直射。室外包围区域将装配太阳能面板，在为空调作用提供能源的同时也为工作区域提供除湿作用。经包围的墙面能使人们在某个角度欣赏到玻璃窗外的美景，内部面板之间太阳光的反射也提供了充分的散射光线，以达到明亮的工作环境。

窗户采用平角设计，当日光从东部或西部直接照射时，大部分的太阳光线将通过玻璃发生反射。反射的光线提高了太阳能面板的能效，太阳能面板将帮助减少超过60%的建筑能源消耗。

### 特定区域

波纹——经包围的立面在建筑表面产生涟漪效果，两幢简单设计的大楼将采用这一经典外观。立面几何设计采用相同的角度，立面采用相对简单的变形模式。几何设计的各种变化将为入口、视野或特定项目提供独特的元素。

skyline marking the center of Shenzhen.

5. Green—Green spots for recreation are surrounding the site in the dense forest of towers. By utilizing all roofs of the building volume as green parks, the building site can stay green even when fully developed.

6. Sun—The site is located directly facing east and west. In the morning and evening there is a low sun on the east and west facades. During mid-day the sun is in a steep angle on the smaller south facing facades.

7. Wind—The wind is coming predominantly from the east and west directions, creating need for wind protection on the outdoor spaces on the roofs.

8. Visibility—The buildings prominent location on the main entrance axis to Shenzhen the Binhai Road makes it a visible landmark both for cars entering and leaving Shenzhen.

### Program

The main parts of the building program are offices, a commercial podium and a parking garage below grade. The office spaces are divided in two parts: The Shenzhen Energy Company headquarter areas, and the rentable office space. The podium houses the main lobbies, a conference center, cantinas and exhibition. The Energy Company Headquarter is placed in the top part of the high tower for best possible views. The remaining office floors are rentable spaces.

The program requires a large part of typical generic plans, as well as a series of special zones with special views for meeting rooms, executives clubs and staff facilities.



四层平面



三十一层平面

三十二层平面



剖面图



商业入口——建筑底部的墙面拉出朝向大堂区，将其与前部的广场连接起来，并将人行区域与会议中心连接起来。

大厅入口——建筑北部及南部的角落向内部推移，形成商业区的入口迎接区域。

视野——塔楼东部及西部立面的两处平滑变形处理可确保各个楼层的会议室、总监办公室或休息区都拥有更广阔的视野。在东南向，高楼顶部楼层采用拉开模式，确保经理人楼层及特定商务区拥有开阔的视野。

## 建筑与城市

从城市角度看，这个建筑将展现经典造型及有机模式。建筑包围式的幕墙可实现遮阳效果并确保舒适的室内气候。包围式设计可为办公室楼层和建筑附近的街道提供特定的位置及一定的空间。近距离下，立面上的曲线设计构成层叠小山的效果；夜晚时分，立面透明度的变化及一条条曲线可形成木质般的质地效果。

### Curtain wall

- 1.The traditional curtain wall glass façade has a low insulation level and leaves the offices overheated by the direct sunlight. This results in excessive energy consumption for air conditioning as well as the need for heavy glass coating that makes the view seem permanently dull and grey.
- 2.By folding the façade in an origami like structure we achieve a structure with closed and open parts. The closed parts are providing a high-insulation façade,

while blocking the direct sunlight. On the outside the closed parts are fitted with solar thermal heat panels that are powering the air conditioning and providing dehumidification for the working spaces.

3.The folded wall provides a free view through clear glass in one direction, and creates condition of plenty of diffused daylight by reflecting the direct sun between the interior panels.

4.Even when the sun comes directly from east or west, the main part of the solar rays are reflected off the glass due to the flat angle on the window. The reflected rays increase the efficiency of the solar thermal energy panels. The combination of minimal passive solar heating as well as active solar panels will reduce the building energy consumption with more than 60%.

### Specific modifications

1. Ripple—The folded façade creates a rippled skin around the building. A classical appearance on two simple volumes. The façade geometry follows always the same angles, allowing for a relatively simple type of deformations in the façade. A series of modifications of the geometry are creating special spaces for entrances, views or specific programs.

2. Commercial entrances—At the base a series of walls are pulled out to open up the main lobby, connecting it to the front plaza and the pedestrian connection to the convention center.

3. Lobby entrance—At the north and south end of the building the corners are pushed back to form welcoming entrance areas for the commercial areas.

4. Views—At the east and west facades of the tower two smooth deformations create spaces with extra good views on each floor, for meeting rooms, director offices or lounges.

Seen from the city the building will appear as a classical shape with an organic pattern. A folded curtain wall shading the building from the sun, and creating a comfortable interior climate. The folds are creating special niches and unique spaces inside the office floors as well as on street level around the building. Seen close-up the curves in the facade are forming terraced hills. At night time the changing transparency and the curved lines of the façade create an almost wood like texture.