

# 韩国产业联合会总部大厦，南韩，首尔市

## Head Office of the Federation of Korean Industries, Seoul, South Korea

**建筑设计** Adrian Smith + Gordon Gill 建筑设计事务所

**资料提供** Adrian Smith + Gordon Gill 建筑设计事务所

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高度为240多米的韩国产业联合会总部大厦新楼为韩国首尔市的天际线增添了一个新的制高点。2009年，美国Adrian Smith + Gordon Gill建筑设计事务所在一个国际设计竞赛中赢得了该设计，工程于2010年9月破土动工，预期2013年建成。

业主的意愿是与首尔市中心占主导地位的方正规整的建筑特征环境相融合，而Adrian Smith + Gordon Gill的目标则是创造一个更多地体现高效能，而不只是表面雄伟的形象设计。当然，建筑的美观永远是重要的。叠加的结果就是设计一座具有创新意义的和有可持续发展的外墙系统的高效能办公楼。大楼表面具有扭转角度的墙板和不规则布置的空中花园，为城市的天际线增添了一个令人印象深刻的建筑形象。同时塔楼的尖角和相连裙房的柔和曲线之间形成强烈的对比，增加了视觉上的趣味感。

这一高水准可持续发展的项目用专有的先进技术外墙代表了韩国的一些主要公司，如三星、LG和现代汽车等。外墙的设计可以降低建筑室内的冷热负荷，并与西南及西北外墙窗间墙板的光电板相结合，可接受到大量直射阳光从而收集能量。

韩国产业联合会总部大厦拥有美丽的花园休闲空间、充足的阳

At more than 240 meters, the new Head Office of the Federation of Korean Industries will be a major new addition to the skyline of Seoul, Korea. Adrian Smith + Gordon Gill Architecture won an international competition to design the tower in 2009. The project broke ground in September 2010 and is scheduled to be completed in 2013.

In keeping with the client's desire for a building that was contextual to the predominantly orthogonal architecture of downtown Seoul, AS+GG's goal with the Head Office of the Federation of Korean Industries (FKI) was not to create a structure whose iconic status depends on its form. Instead, the aim was to produce a design whose uniqueness related more to high performance than to its visual identity. At the same time, as always, aesthetics matter. The result is a high-performing office building with one of the world's most innovative and sustainable exterior wall systems, whose angled panels and irregularly placed skygardens also happen to create a strong architectural presence on the city skyline. The visual interest of the complex is enhanced by the striking contrast between the tower's sharp angles and the softly molded curves of the connected podium building.

This highly sustainable project will feature an innovative exterior wall designed specifically for FKI, which represents major Korean companies such as Samsung, LG and Hyundai Motors. The wall is designed to help reduce the internal heating and cooling loads of the tower and collect energy by integrating photovoltaic panels into the spandrel areas of the southwest and northwest





总平面



建筑底层环境



位于50层的中庭



屋顶花园剖视图

光以及与之相邻的汝矣岛公园、汉江和不寻常的城市优美景色。裙楼柔和的曲线抵消了塔楼棱角分明的线条，它包含宴会厅、中央餐厅及会议中心。

项目由Adrian Smith + Gordon Gill与结构工程公司Thornton Tomasetti、机电设备工程公司Environmental Systems Design以及韩国昌乔建筑师合作设计。

在设计过程中，设计团队必须在以下三个主要方面进行权衡：1）能量的产生和效率；2）人的舒适程度；3）对城市的各个地方在视觉上产生的影响。通过广泛的环境分析和一个比例为1/4的外墙系统模型的研究，设计团队得出以下结论：从产生最大的能量和遮阳效果，以及使用者可以享受到周围城市环境、相邻公园的优美景色的综合角度来看，设置15°角的可见玻璃是最好的决定。

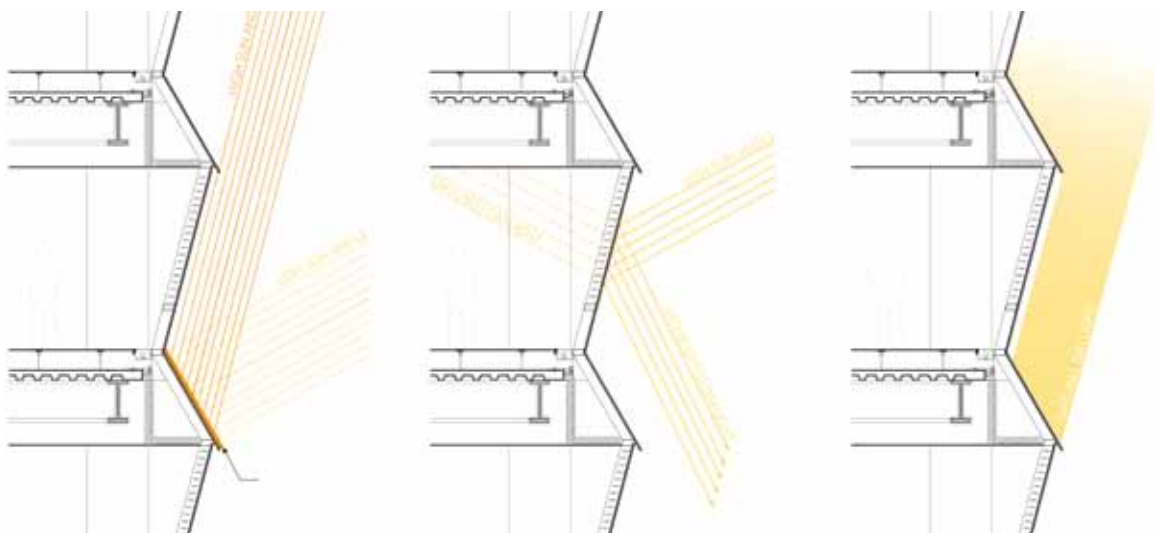
facades, which receive a significant amount of direct sunlight per day.

The tower also features restful garden spaces, abundant access to natural light and remarkable views of neighboring Yeouido Park, the Han River and the city. Offsetting the angular lines of the tower is the softly molded sculptural podium building, which includes a banquet hall, a central restaurant and a conference center.

AS+GG collaborated on the project with the engineering firms Thornton Tomasetti and Environmental Systems Design, as well as the local firm Chang-Jo Architects.

During the design process, the team had to balance three key concerns: (1) energy generation and efficiency, (2) human comfort and (3) the visual impact of the tower as seen from throughout the city. Through extensive environmental analysis and the construction of a 1/4-scale mockup of the exterior wall system, the team determined that the 15-degree angle of the vision glass produced optimum results in terms of energy generation and shading while allowing building occupants impressive views of the surrounding cityscape and the





立面幕墙系统分析



中庭幕墙系统



屋顶太阳能光伏板

远距离观看建筑时，外墙较为平淡。设计团队希望从全市的各处都能看到此建筑物的立体造型，且至少不小于 $15^{\circ}$  角的范围。而业主担心建筑的使用者站在靠近外墙边时可能会产生向外倾倒的感觉，亦或外墙可见玻璃的阴影或反射可能出现意料之外的问题。设计团队通过大量的试验和模型研究打消了业主的这些顾虑。

由于采用了向上 $30^{\circ}$  角朝太阳倾斜的窗间墙板使能量的收集最大化，并产生足够的动力以帮助维持整个建筑的核心筒和办公空间的电力供电系统。窗间墙板下的可见玻璃向下呈 $15^{\circ}$  角朝地面倾斜，使得直射阳光的辐射和眩光降至最低。窗间墙板和可见玻璃交错的布置方式创造了一个动态的、波澜起伏的建筑立面，它既是基于环境设计的发展和进步，又有引人注目的视觉效果，将为首尔市的建筑天际线增添优美的一笔。

设计团队将立面比喻为“手风琴”，相比于双层外墙在造价上有着极大的优势，这同时也是设计团队探索出的结论。

设计团队与业主利用首尔市鼓励建设者使用可再生能源的计划来增加外墙系统的经济效益。光伏建筑一体化设计可产生本建筑所需能量的3%，但是这些能量将以韩国产业联合会总部大厦从

adjacent park.

The design team also wanted the building to “read” architecturally as three-dimensional from throughout Seoul; at less than a  $15^{\circ}$ -degree angle, the exterior wall appeared flat from a distance. The client, however, was concerned that building users standing near the wall might experience a sensation of falling forward, or that the wall might generate problems with shadows or reflections on the vision glass. Extensive testing and the mockup allayed those concerns. By angling the spandrel panels 30 degrees upward toward the sun, the design team maximized the amount of energy collected, generating enough power to help maintain the electrical systems throughout the tower core and the office space. Just below the spandrel panels, the vision panels are angled 15 degrees downward toward the ground, minimizing the amount of direct sun radiation and glare. Together, the alternating spandrel and vision panels create a dynamically rippled facade that is both environmentally progressive and visually striking, giving the tower a unique architectural presence on the Seoul skyline.

The “accordion” exterior wall, as the design team came to call it, had the advantage of being far more cost-efficient than a double climate wall, which the team also explored.

The design team also worked with the client to increase the cost-effectiveness of the exterior wall system by taking full advantage of an incentives program by the City of Seoul that encourages builders to pursue energy generation from renewable sources. The BIPV on FKI generates about 3 percent of the





鸟瞰图

首尔电力网买价（大约5cents / (kW·h)）的10倍价卖给该电力网（大约50cents / (kW·h)）。与单独使用光伏太阳能相比，韩国产业联合会总部大厦的光伏建筑一体化设计对土地没有产生任何不良影响。这样，本大厦的外墙系统从各个方面来看都成就了一个双赢的局面。

韩国产业联合会总部大厦的主要目标之一是通过在建筑屋面和外墙系统上实现一体化的光伏电板设计，以充分利用现场产生的能源。光电板与建筑在屋顶及东南面和西南面14层以上的外墙结合成一体，这些地方可以实现最大的阳光照射和最少的相邻建筑造成的阴影。屋顶上的光电板设置角度是一个专门的研究课题。在相对不受限制的地方，光电板一般是向上呈30°角的方向设置。但是在本建筑有限的屋顶面积上，设计团队决定采用10°角，容许以较小的间距安装更多的光伏发电板，从而减少板与板之间产生的阴影，并为建筑生产更多的太阳能。

另一个独特的设计是雕塑型裙房建筑的外墙，连续的弧形玻璃表面巧妙地塑造出这一复杂的几何形体的裙房外表面。为了降低建设造价，设计团队在裙房的倾斜面采用了平面玻璃体系代替特别的弧形玻璃。可见玻璃板具有3个不同的图案区，塑造了自上而下由重到轻的效果。为了减少玻璃的使用（减少吸收太阳的热量），在建筑的东端采用了竖向窄窗金属墙板系统。窄长缝的部分是窗，同时在建筑结构的顶部是百叶窗式排气系统。

韩国产业联合会总部大厦对于公共性的解读也是令人关注的。场地具有卓越的地理位置，位于首尔市主要的交通大道上，并且面对市内最主要的公园之一。既与地面环境相结合，又为使用者和来访者取得最大的利益。裙房建筑的西端面对汝矣岛公园，采用了大片的玻璃幕墙；在它的下面，阳光充足、使用方便的下沉式绿化广场使零售商业和餐厅变得更为开阔。排列成行的树木有助于界定塔楼和裙房的边界，并在二者之间形成一个过渡地带。塔楼的车行上下接客处有一个简单的玻璃雨篷保护使用者和来访者不受雨淋，同时它也是外墙体系中一个花费不多但又使得建筑更为壮观和挺拔向上的组成部分。此外，一个优美典雅的水景也使得建筑的公共绿化更加尽善尽美。

building's energy needs, but that energy will be sold to the Seoul power grid at about 10 times the price (about 50 cents per kWh) of the energy which FKI buys from the grid (about 5 cents per kWh). At the same time, the FKI BIPV has zero environmental impact in terms of land use, as opposed to building a PV solar field. In this way, the FKI exterior wall system achieves a win-win scenario for all parties.

One of the key goals of the Federation of Korean Industries project was to take full advantage of the opportunities for on-site energy generation via building-integrated photovoltaics on the roof and exterior wall system. Photovoltaic panels are incorporated in the southeast and southwest facades of the tower above Level 14 (areas which had the greatest solar exposure and the least amount of shadowing by neighboring buildings) as well as on the roof. The angle of the PV panel placement on the roof was a subject of particular study. In a relatively unconfined space, PVs would normally be angled upward at 30 degrees. Within the limited area of the FKI roof, however, the design team determined that a 10-degree angle allowed for more panels to be installed closer together, minimizing the effect of the panels casting shadows on each other and ultimately producing more solar energy for the building.

Another unique aspect of the design is the exterior wall system for the sculpted podium structure. The continually curving glass surface of the podium is subtly molded, resulting in complex geometries of the skin. To make the wall more cost-effective to construct, the design team devised a system in which flat glass panels, rather than uniquely formed curved panels, could be used to cover the sloping sides of the podium. The glass vision panels feature three zones of frit patterning that provides a shading effect, with the heaviest frit at the top of the wall; the frit pattern grows lighter and more transparent as it descends. To reduce the amount of glass (and therefore solar heat gain), a metal panel with slots covers the top and east-facing end of the building. The slots provide windows and, on the top of the structure, louvered exhaust systems.

Finally, FKI's addressing of the public realm is also notable. Because of FKI's prominent site on one of Seoul's main thoroughfares and across from one of its key public parks, it was important for the design team to allow the building to meet the ground intelligently and with maximum benefit to occupants and visitors. The west end of the podium features a vast vision glass panels that opens up onto Yeoido Park; just below, retail and restaurant functions are rendered more open and light-filled and user-friendly with a landscaped below-grade green plaza. Rows of flowering trees help define the perimeters of tower and podium as well as create a green buffer between the two. At the tower drop-off, building occupants and visitors will be protected by the elements by a simple glass canopy, which will also afford spectacular upward views of the exterior wall system. An elegant water feature completes the building's pleasant public greeting.