



## Hanging Gardens: The Jakob factory in Saigon

**Three structures, all multi-storey and with green facades, are grouped as a new unit around an inner courtyard. In order to minimize energy consumption, Jakob relies on an energy-reducing construction principle of naturally ventilated rooms and green facades for the new factory building in Vietnam. Stainless steel wire ropes and nets from the company's own production are used.**

### Background

With the increasing awareness of sustainable building, pioneering examples of green facades are now emerging in major cities and other residential areas around the world. These green facades absorb CO<sup>2</sup>, bind dust and air pollutants, dampen noise and reduce energy requirements through shading and water evaporation. In comparison, there is a great deal of untapped potential in construction projects for industrial buildings. Located in large industrial areas, fully air-conditioned factories and production halls still consume a lot of energy today.

The region north of Saigon, Vietnam's financial center and largest metropolis, is one such industrial area. Since Vietnam's economic reform in 1986, the country has experienced rapid growth, especially in the production of goods. Industrial parks have sprung up on the outskirts of the city

with tremendous speed. Many of the factories located here are fully enclosed and air-conditioned, resulting in high energy costs. The buildings and the associated streets, courtyards and parking lots partially seal soils and prevent the runoff of rainwater.

### Initial situation

In 2003 Jakob Rope Systems started the production of its wire rope nets in Saigon in contract manufacturing. In 2008, the first own factory was put into operation, which quickly reached its spatial limits as the company grew. With plans to build a second production facility, the company decided to take a different path and respond to the environmental impact of industrial development with a design that would set new standards for the field of industrial architecture.

The main challenge was to develop a design that is suitable for a climate with an average temperature of around 27 degrees Celsius and high humidity. Furthermore, the high demand for electrical energy for cooling the production rooms was to be reduced as far as possible.

### Solution

On behalf of Jakob, the architects of the Swiss firm rolli-marchini, together with the Vietnam-based architects of G8A,

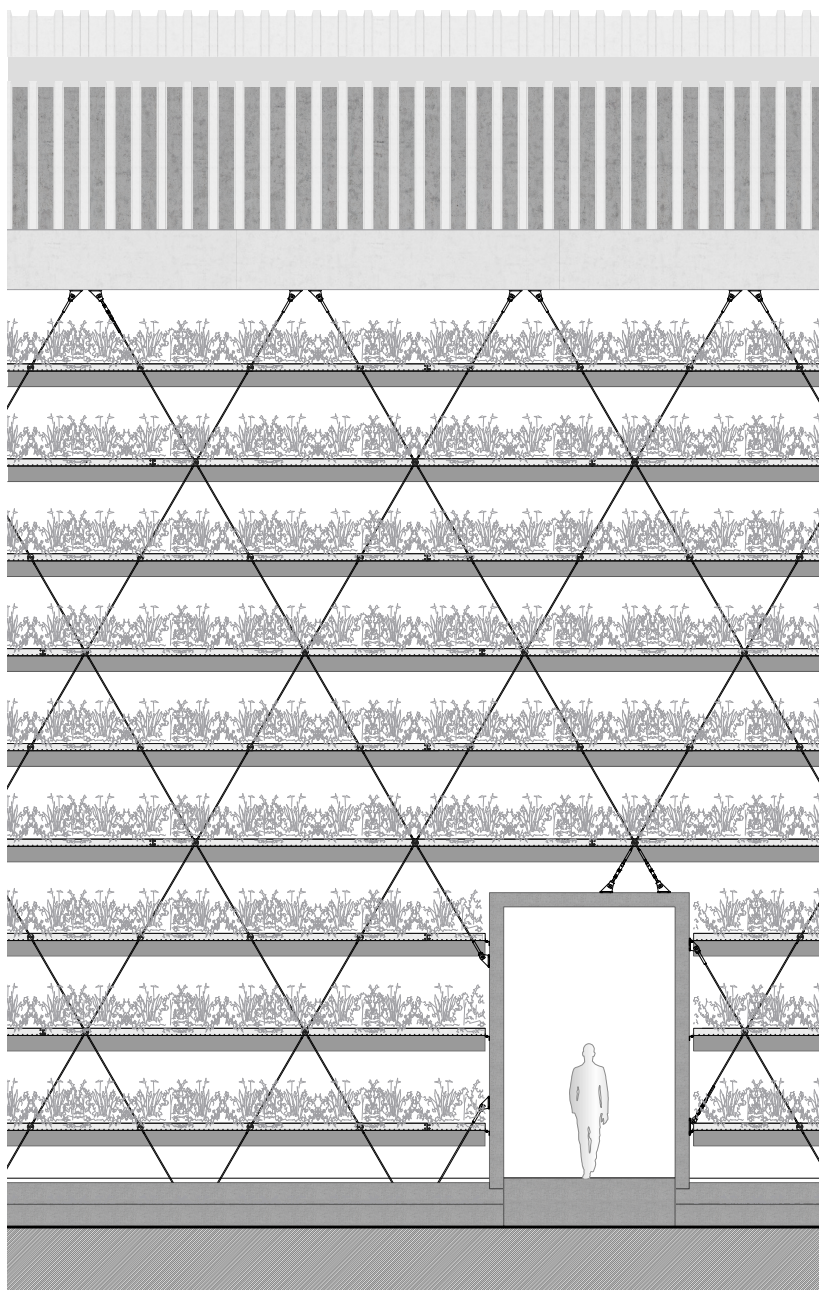
developed a concept to meet these challenges with a combination of modern materials and local traditional building techniques.

Rooms that can be opened up to 60 percent with sliding elements are arranged under large roofs that protect against sun and rain. This ensures natural ventilation. In addition, simple fans support a constant air flow that lowers the perceived temperature in the buildings by several degrees. However, due to the high facades, this approach alone was not sufficient to provide complete heat and rain protection. This problem is solved in a complementary way by “hanging gardens” made of planters suspended from stainless steel wire ropes and nets. The green walls not only shade the interior spaces and filter pollutants from the air, they also lower the building temperature through evaporation.

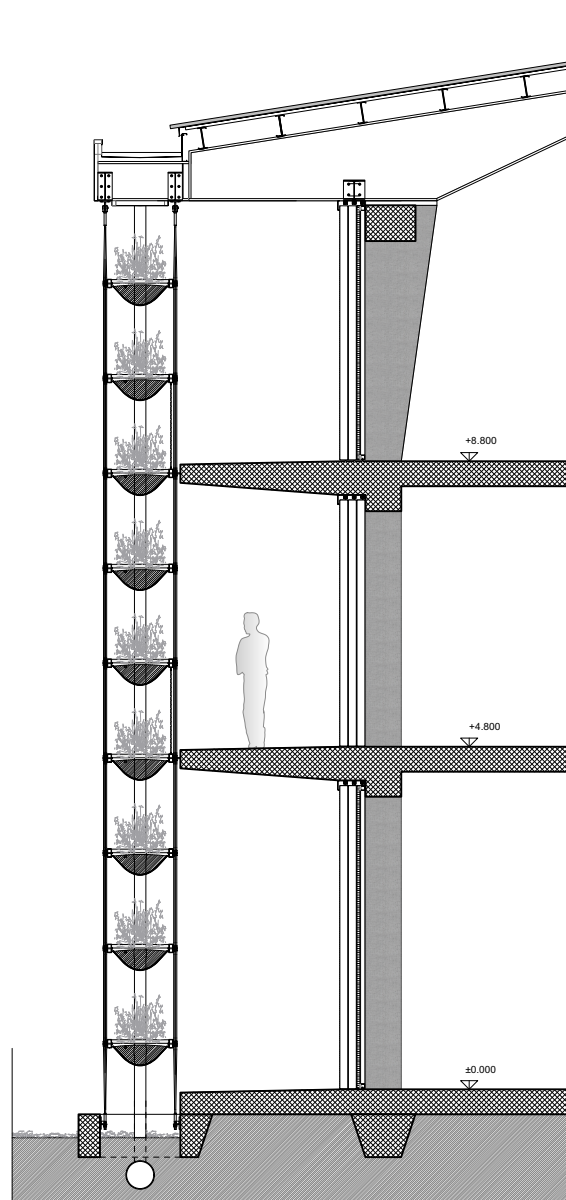
The vegetation of the green walls grows in planters that extend along the entire length of the buildings' facades. Over six kilometers of diagonally running stainless steel wire ropes support up to nine levels of planters. The 16-millimeter-thick rope tension members transfer the loads to the steel roof beams at the top and to the floor slabs at the bottom. The planters themselves consist of a base frame of rectangular sections and a waterproof layer held in place by Webnet rope nets. All structural components are made of type 316 stainless steel, which offers great durability against corrosion. In addition to the structural elements, the green facade contains a fully automatic irrigation and fertilization system.

Buildings that are greened and ventilated in this way reduce energy costs and emissions. Where the buildings are not open to the outside, mobile sliding walls made of

**Facade view**



**Facade section**





translucent polycarbonate allow sunlight to penetrate. The use of natural light for the interiors further reduces the factory's electricity requirements.

The multi-storey design of the factory buildings saves space on the floor area. Instead of the usual horizontal distribution of the factory on a single-storey floor plan, the architects have arranged the required work areas one above the other. As a result, the Jakob factory site includes a three-story production building, an administration building, and a covered storage and parking area. In the master plan, the architects have also envisaged structural extension stages using the same energy-reducing construction principle, in order to be able to create further production rooms if required.

In the center of the site is a spacious courtyard. Grass-covered and tree-covered planting islands accentuate the courtyard. The walkways between the islands are covered with gravel so that excess water can seep away. This arrangement provides employees with a park-like recreation area with shady trees, sports equipment, volleyball and table tennis courts.

### Outlook

The green facade of the factory not only fulfils its functional character for the Jakob Rope Systems manufacturing site,

### Technical details facade

#### Components facade

**Total area plant trough facade:** 4250 qm

**Rope:** Jakob 6 × 19 + WC Ø 16 mm, AISI 316, clevis with turnbuckle, swaged external thread end

**Clamps / Deflection points:** AISI 316

**Anchoring components:** Structural steel S355

**Plant container frame:** RHS-50 × 100 × 2.5, AISI 316, total about 6 km

#### Frame plant containers

**Cross braces:** SHS 50 × 3, AISI 316

**Plant pot holder:** 20261-0150-080 with hook, 3000 m<sup>2</sup>

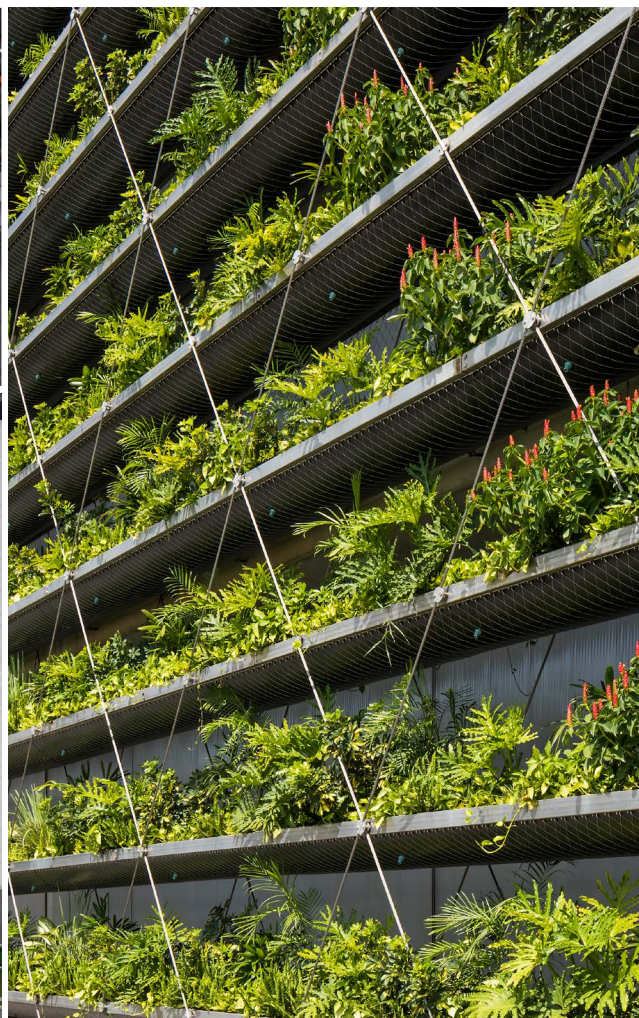
**Earth beam:** Webnet, rope diameter Ø 1,5 mm, Mesh aperture 80 mm, with hooks on railing (Ø 10 mm)

**Horizontal supports:** Rope Ø 10 mm (glued in with composite mortar), total around 190 pieces

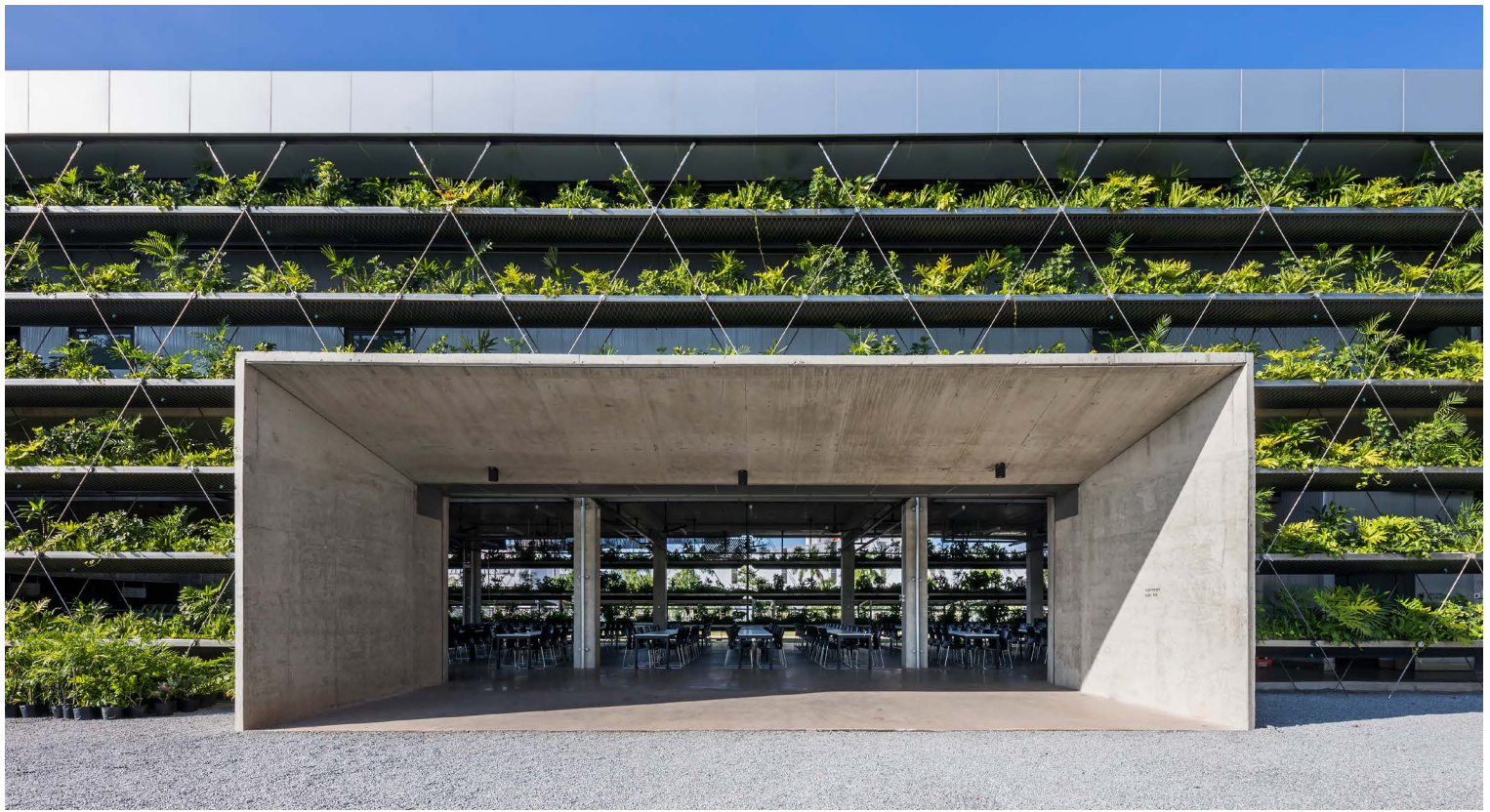
**Vertical fall protection:** Webnet 20261-0150-080 with hooks, total around 500 m<sup>2</sup>

**Loads plant container filling:** 3 kN/m<sup>2</sup>

**Through reduced dynamic pressure:** 0,3 kN/m<sup>2</sup>







it also becomes an inspirational impulse for other companies. It shows a way to “open up” for natural ventilation and drainage and for better working conditions with less ecological impact. The use of natural ventilation using stainless steel cable systems and green facades provides an example of sustainable architecture. The design of this project could trigger further developments both in Vietnam and worldwide.

### **Construction process**

1. Installation of ropes, installation under specific prestressing force ( $P_0 = 15 \text{ kN}$ )
2. Mounting frame plant containers
3. Mounting horizontal supports
4. Mounting Webnet
5. Attachment of membrane, drainage layer, soil with plants
6. Retensioning of wire rope tension members
7. Installation of irrigation system, connection work for drainage

By 2022, the existing photovoltaic system will be expanded to include previously unoccupied roof and site areas. The entire plant will then produce around 1 million kilowatt hours of electricity per year. In future, it will cover the majority of the energy requirements at the production site. Jakob Rope Systems also continuing the sustainable architecture at the Vietnamese site in terms of power supply.

Location: Saigon, Vietnam

Completion: 2020

Client: Jakob Saigon Ltd.

Architecture: rollimarchini AG Architekten, G8A architects

Dimensioning + planning of green facade: Jakob Rope Systems

Design: Trung Hau Corporation

Photos: Hiroyuki Oki