



## The Quest for Zero-Energy Buildings That Work

Takenaka Corporation's proven commitment to the environment makes the company a leader in 'green' buildings

At the Paris Climate Conference (COP21\*) in December 2015, Japan submitted Intended Nationally Determined Contributions (INDCs) targeting a 40% reduction of domestic greenhouse gas emissions in business and other sectors. The world is now closely watching how Japan, a global eco-technology leader, will achieve this ambitious goal.

A zero-energy building (ZEB) is a building with zero net energy consumption, that is, the total amount of energy it consumes on an annual basis is roughly equal to the amount of renewable energy, such as geothermal or solar energy, that it creates on site. Already the focus of intense media attention in various industry circles, ZEB technologies are expected to revolutionize energy-saving practices in existing buildings and in society, at large.

Takenaka Corporation, a leader among Japan's 'super general contractors' with a proud 400-year history and a proven commitment to environmental issues, put the ZEB theory into practice when it completed the renovation of its own Higashi Kanto Office building in March 2016. As one of the earliest projects in Japan to transform an existing structure into a fully operational ZEB, the renovation created an industry sensation. Managing Officer Joji Kurumado, who directed the project, talks about Takenaka Corporation's commitment to ZEB and its vision for the future.

\* The 21st yearly session of the Conference of the Parties (COP) to the United Nations Framework Convention of Climate Change (UNFCCC)





**Left:**  
**Joji Kurumado,**  
**Managing Officer**

**Right:**  
**Tokyo Main Office, completed**  
**in 2004, is a milestone in**  
**Takenaka Corporation's quest**  
**for a fully operational ZEB.**



## “Connecting People With Nature”

In 1971, when Japan was riding a tide of euphoria of high economic growth, Takenaka Corporation unveiled an unexpected slogan: “Green Design.” The slogan expressed the company’s resolute commitment to environmental sustainability and the greening of architectural design and construction. Even then, it was clear to Takenaka that an era driven by economic growth and efficiency was over, and a new era focused on ecology had begun. I was a new hire at the time and, to be honest, did not fully grasp the progressive spirit of the slogan. It just looked a little strange to me. But, since then, the company has steadfastly adhered to and reinforced its environment-friendly policies. In 1992, Takenaka created its own Global Environmental Charter. In 2004, we promoted the concept of ‘Sustainable Works.’ And in 2010, guided by the spirit of our original slogan, we drew up an environmental strategy through to the year 2050 based on a new slogan: “Connecting People With Nature.” We are passionate about contributing to both the environment and society through our corporate initiatives and projects, as evinced in the recent renovation of Higashi Kanto Office as a ZEB.

## From ZEB-Ready to ZEB Reality

A building is considered ZEB-ready if it consumes less than 50% of the energy consumed by a conventional building. Takenaka Corporation has completed an impressive range of ZEB-ready projects, including the New Ohi Office Building of the Dai-ichi Life Insurance Company, Limited, as well as the company’s Iino Building in central Tokyo. Meanwhile, Takenaka Corporation’s Tokyo Main Office, established in 2004, continues to implement technologies in its ongoing evolution towards becoming a real, fully operational ZEB. This pioneering project achieved the highest ‘Superior’ (S) rating from Japan’s Comprehensive Assessment System for Built Environment Efficiency (CASBEE). Our Higashi Kanto Office — a real, fully operational ZEB — is the culmination of the expertise gained, and the portfolio of energy-saving technologies developed, over the course of these key projects.

When Higashi Kanto Office was constructed in 2003, it was just another conventional office building. Nobody imagined then that it would be reincarnated one day as an actual, functioning ZEB. But when you try to help a building generate more renewable energy than the amount of energy it consumes, you come to understand the true challenge of ZEBs. It is not simply a matter of installing large solar panels on a rooftop since there is rarely the space or budget for these. So, how to realize a ZEB? As it turned out, Takenaka’s own office renovation project gave us a prime opportunity to explore ways to achieve a real, working ZEB — with implications far beyond the actual building itself. After all, zero CO<sub>2</sub> emissions aren’t just the goal of the construction industry. They are the goal of society as a whole.

## 4 Steps to a Fully Operational ZEB

### Redefining the Concept of Comfort

For years, Takenaka had designed office spaces in line with the well-established concept of the ‘Universal Office’ featuring uniform temperature, humidity, and desk lighting. For example, in summer, room temperature would typically be set at 26°C and 55% humidity to ensure an agreeable level of comfort at every desk throughout the day. But is ‘universal’ really the best standard for measuring everyday comfort? At Takenaka, we felt we had to push the envelope further. This is why we made sure that our renovated Higashi Kanto Office building offered not just maximal comfort but also easy adjustability — and minimal energy consumption.

For example, by using desiccant air-conditioning and radiant cooling systems to control ambient temperature and humidity, we can open the windows at any time without compromising comfort. The fresh air might bring tantalizing aromas of lunch being prepared at a neighboring school, or the happy chorus of children heading home after classes, or the songs of birds above the playground — all of which have pleasant associations that other, conventional offices cannot provide. Such genial office environments can totally change our work styles for the better.





### Realizing Super Energy Conservation

Energy-saving measures are among Takenaka Corporation's core competencies. Drawing on a wide range of technologies, as described below, we aim to meet our clients' diverse energy-saving needs, which is only to be expected. Our mission in this regard is simply to continue to develop and provide new solutions to counter any emerging energy challenges.

### Reshaping Work Styles in a Green Environment

Ideally, an office is a place not just for day-to-day business activities, such as deskwork and meetings, but an open forum where innovative ideas are incubated, encouraged and shared. Our task, therefore, is to provide office workers with an environment that suits their individual work styles.

At the same time, we have to continually reduce energy consumption. Take task-ambient lighting, for example. By strategically darkening surrounding areas while spotlighting task areas, we can minimize distraction and aid concentration. Likewise, opening the windows during meetings can suddenly refresh and inspire participants. So when we say we are "reshaping work styles," we mean we are working to achieve a green environment to further enhance individual productivity.

### Ensuring Continuous Operation

The Great East Japan Earthquake in 2011 caused power shortages in cities all across Japan. Elevators at most residential and commercial buildings stopped in their tracks, leaving people trapped inside. For office buildings in this earthquake-prone

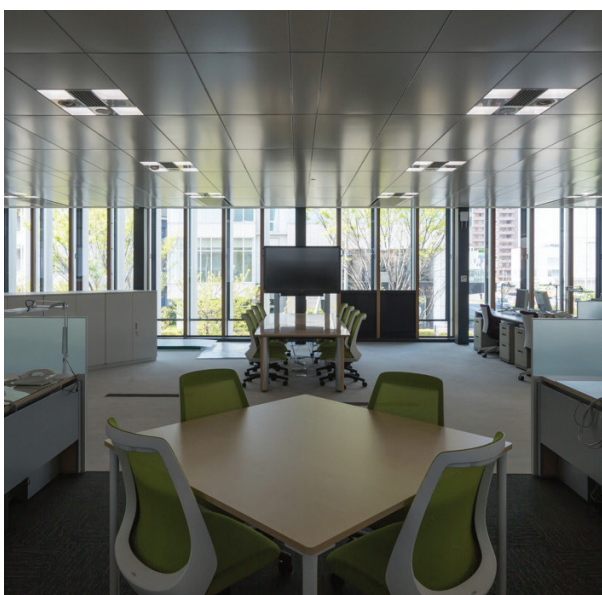
country, it is crucial to ensure continuous operation even during emergencies. Higashi Kanto Office can maintain full functionality without any external power supply for 3 days in winter, 6 days in summer and 7 days in the interim seasons.

### Next-generation Technologies

Higashi Kanto Office features a range of next-generation technologies that are already contributing to the greening of other conventional office buildings.

(1) Desiccant air-conditioning: When the humidity is low, the air feels cooler even at the same ambient temperature. Higashi Kanto Office is equipped with a desiccant air-conditioning system that dehumidifies and cools the air. The system has become steadily more compact to allow for easy ceiling installation in conventional offices. (2) Radiant cooling panel system: By circulating water across the ceiling, the radiant cooling panel system achieves efficient cooling. The circulating water is kept between 18°C to 21°C

using geothermal technology. Unlike conventional air-conditioning units that only cool the air inside closed rooms, a radiant cooling system works even with the windows open and without electricity. (3) Smartphone operation: To maximize personal comfort in the office, we implemented a system whereby every staff member can control airflow using his or her own smartphone. The work environment can thus be finely adjusted to one's own preferences.



**Higashi Kanto Office provides a diversified environment to fit individual work styles.**

Photo by Shinkenichiku-sha



(4) AppleWatch® operation: In an industry breakthrough, Takenaka introduced a control system that can recognize data on an AppleWatch® and adjust the office environment accordingly. The wearable device stores the worker's wellness data, such as cardiac rate and level of physical activity. When the office's built-in smart wellness control system picks up the wearer's thermal comfort indicators and location data, it automatically adjusts the lighting and room temperature to provide optimal comfort.

## A Long-term Vision for a Changing Society

Different clients have different expectations of ZEBs, depending on whether they prioritize workplace productivity or lower running costs or higher resale value. But after discussing these priorities in detail, we usually come away with a firm grasp of our client's objectives. At that point, we already have a very good idea of the technologies that will be needed for the ZEB and how these will be applied. Occasionally, the client will ask for a different solution altogether. Our approach to ZEB doesn't end with a varied menu of solutions — on the contrary, this is just our starting point.

Redefining a client's concept of comfort is like asking a person to give up deep, long-held beliefs. We can only bring about such a fundamental change of heart if we have a relationship based on total, mutual trust. Therefore, we need to continually ask ourselves whether the ideas that we propose are such that we can expect our clients to give up the beliefs they had held up till now. This is the road we must be prepared to take if we are to win our clients' trust and understanding.

A newly constructed office building usually lasts for half a century. In 50 years' time, if we reach our current goals, the world may be carbon-free, and there may be a completely different set of goals for us to aim for. At Takenaka Corporation, we believe that the buildings we construct today must keep evolving to meet those distant, elusive goals. We cannot afford to wait years to see what challenges will emerge for ourselves, or our clients, or society in general. Now is the time to identify potential problems and take appropriate action. This is the mission we must undertake together with our clients.

A showcase of fully operational ZEBs:

(From top) The New Ohi Office Building of the Dai-ichi Life Insurance Company, Limited, 2012; Meiji Yasuda Life New Toyochō Building, 2011; and Iino Building, 2014.



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