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GREENRE BUILD

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Reimagining the **Workplace After COVID-19**

Paramit Factory: **Award-Winning Factory in the Forest**

Insight: **Malaysia's Commercial Green Buildings**

Factory in the Forest

By: Gregers Reimann, IEN Consultants Sdn Bhd

"Wow, is this a resort?!" the taxi driver exclaimed when pulling into the Paramit electronics factory at Batu Kawan science park in Penang. The extensive greenery, the gravity-defying architecture and the grand horizontal louver roof clearly had mesmerized the taxi driver in this otherwise soulless industrial area. His reaction is quite typical of first-time visitors. Equally impressive is the fact, that this is a high-performing green factory with 40% measured energy savings compared to the old factory, also in Penang.

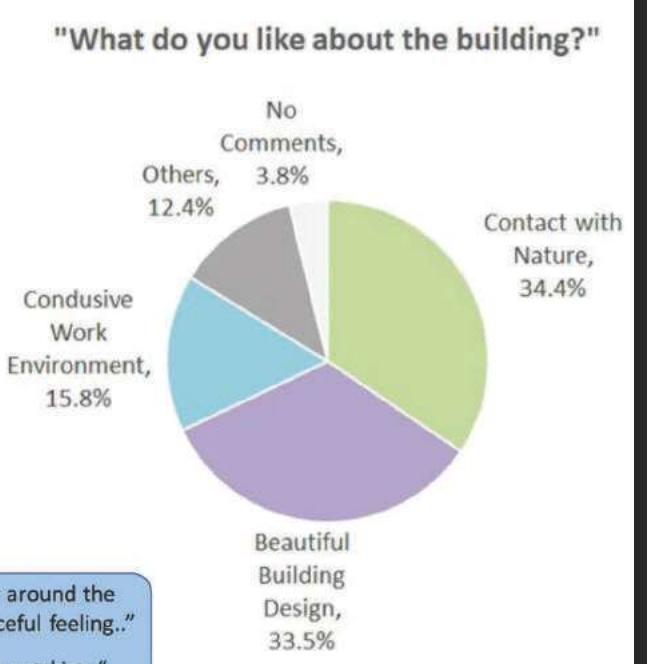
Sustainability was an integral part of the design process from the very beginning, thanks to the client's vision of a high-performing building. In fact, the client first consulted with the environmental design consultants to help put together the design brief and to help identifying what architects to invite for the design competition. The environmental performance of the building was prioritised and underpinned the design process, instead of just being an afterthought.

RIGHT:
Author (left) and colleagues visiting the completed Paramit factory project (Photo by Khim Bok)

The cardinal sustainable design principles were energy efficiency, water efficiency, daylighting and biophilia – the fundamental human need for a connection to Nature. The vision was to create daylit work environments with view to Nature for all employees throughout the 11,600m^2 factory and 1,450m^2 office spaces. The client knew that he wanted a factory with a conducive and healthy work-environment, not just because it is the right thing to do on a Human level, but also because it gives healthier and more productive employees – and increases staff retention. In other words, it is also a good business decision.

Occupant satisfaction

An anonymous post-occupancy survey (141 respondents) found that 90% of the staff preferred the new factory over the old factory. When asked the open-ended question "What do you like about the building?", the three most common responses were the contact with Nature (34.4%), the beautiful building design (33.5%), and the conducive working environment (15.8%). One staff even called the factory her "Second home". Generally speaking, the feedback has been very positive from staff and visitors alike.



90%

Prefer new factory to old factory

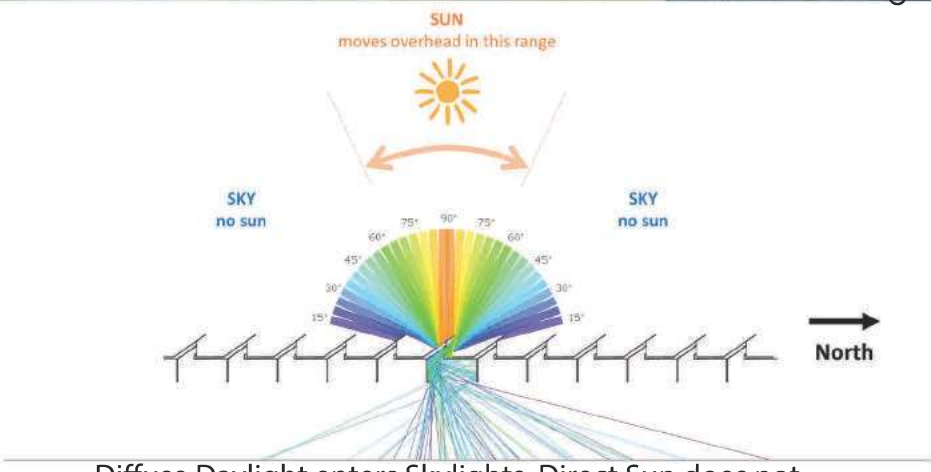
"Its the best place i worked.. The greenery around the factory is simply amazing.. It give us a peaceful feeling.."

"The beauty of the natural, de-stress while working "

Passive Design

Reducing the energy consumption always starts by reducing the energy demand though a climate responsive building design. Passive design strategies included a huge sunshade canopy over roof gardens, skylights allowing natural diffused light across the factory floor, concrete fins shielding against the low east and west sun and of course the 'forest' to provide shade to the building and recreation space for building users – the forest reintroduced indigenous trees to this site.

For the office block, the canopy louver roof was designed to provide effective solar protection from 2 pm onwards, i.e. during the hottest part of the day, while allowing streaks of sunlight through during the cooler morning hours. Pleasant diffuse evenly distributed daylighting for the entire factory production hall was ensured by North facing saw-tooth skylights.

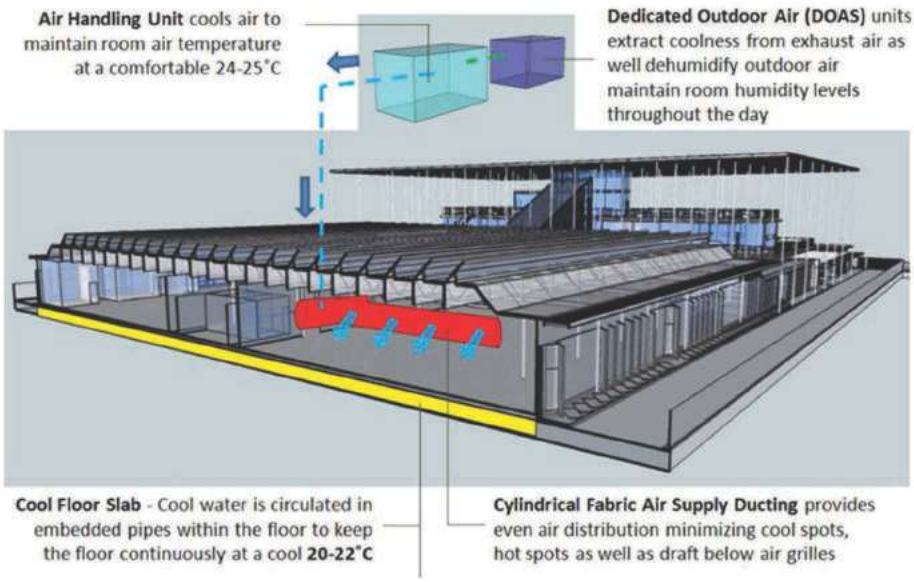


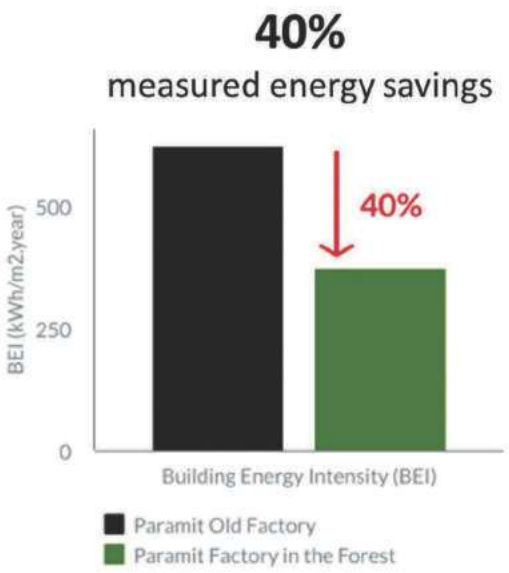
Diffuse Daylight enters Skylights. Direct Sun does not

Active Design

The factory production requires high humidity control and must be fully air-conditioned 24-hours. After accurately establishing the heat load and exhaust rates of the manufacturing plant, detailed energy simulations were undertaken that enabled down-sizing the cooling system by a factor 2.3, thereby saving USD1.2 million in CAPEX.

The factory has two cooling systems, namely an innovative and highly energy efficient radiant floor cooling system that delivers 1/3 of the cooling as well as an energy efficient air-conditioning system delivering the remaining 2/3 of the cooling.



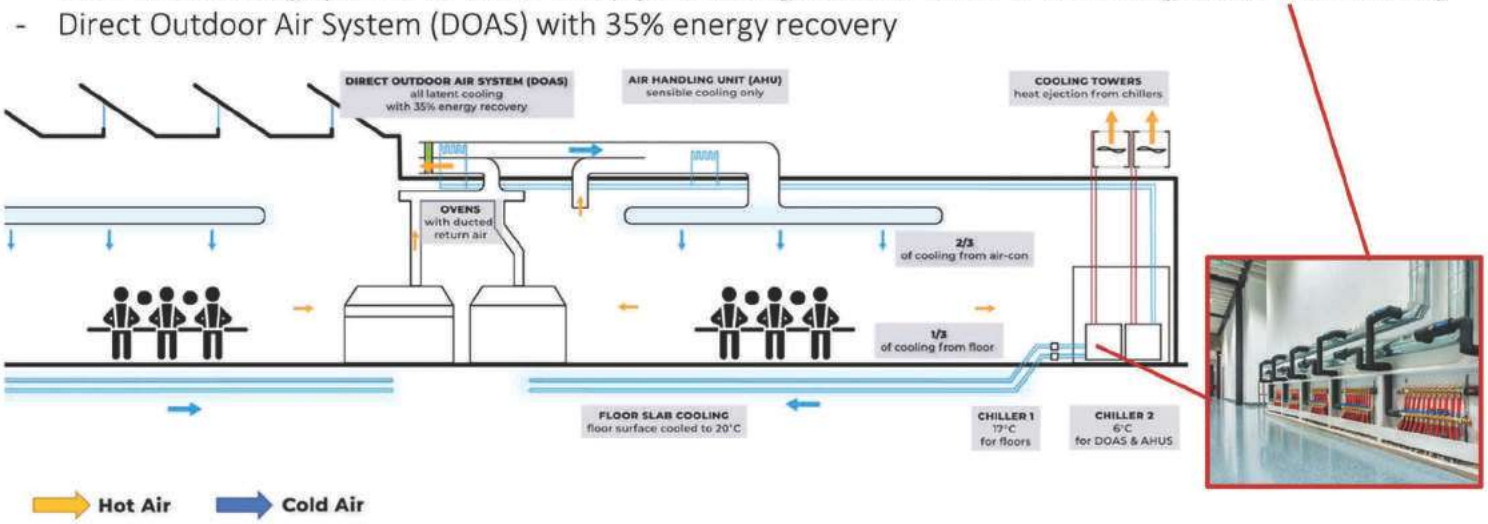


The radiant floor system works by embedding 65 km of PEX pipes in the concrete slabs throughout the factory. By cooling down the slabs to about 21°C, this structural element of the factory doubles up as part of the cooling system and allows the magnetic bearing chiller to operate at a significantly higher efficient (COP of 9.7) with a chilled water supply temperature of 17°C in comparison to a standard centrifugal chiller (COP of 5.6) with a chilled water supply temperature of 7°C.

Dedicated outdoor air supply (DOAS) units were installed with energy recovery units, hereby saving 35% from the exhaust air. Energy efficient and dimmable LED adjust to the daylight levels. These and other systems are controlled by an extensive, flexible and user-friendly Building Management System (BMS). Measured energy saving reductions of 40% have been achieved compared to the old factory, by comparing 1 year of electricity bills of the old and the new factory.

Innovative Cooling Systems

- Floor slab cooling system, 65 km of PEX pipes cooling the floor to 21°C delivering 1/3 of total cooling
- Direct Outdoor Air System (DOAS) with 35% energy recovery



Water Savings

To alleviate flood risk from the tropical rainstorms, the building has an 800m³ storm water retention tank as well as a 400m³ rainwater harvesting tank. For year 2019, 61% of the rainwater harvested from the big factory roof a was used for irrigation, reducing the potable water consumption by 7.1 million liters of water, or 26% of the overall consumption.

Recognition

The project has won numerous green building awards, a testament to its genuine environmental design despite not undergoing any formal green building certification. Key awards include winning the 2020 WorldGBC Asia Pacific Leadership in Green Building Awards (commercial building), and being nominated for the 2019 Aga Khan Award as well as long-listed for the 2018 RIBA International Prize.

LEFT:
Lush greeneries cascading from factory platform down to carpark offers touch of human-nature connection.

Key project info:

Year of completion: *2016*
Project scale: *13,000 m²*
Client: *Paramit Malaysia Sdn Bhd*
Architect: *Design Unit Sdn Bhd*
ESD Consultant: *IEN Consultants Sdn Bhd*

3-minute design video:
https://youtu.be/fl3WMYAt55E

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Gregers Reimann specializes in energy efficient and green building design with excellent indoor environment. His green building consultancy pursues innovative and integrated design solutions bridging the gap between architects and engineers. In addition to green building consultancy, Gregers regularly contributes to green building articles and frequently lectures at universities.

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