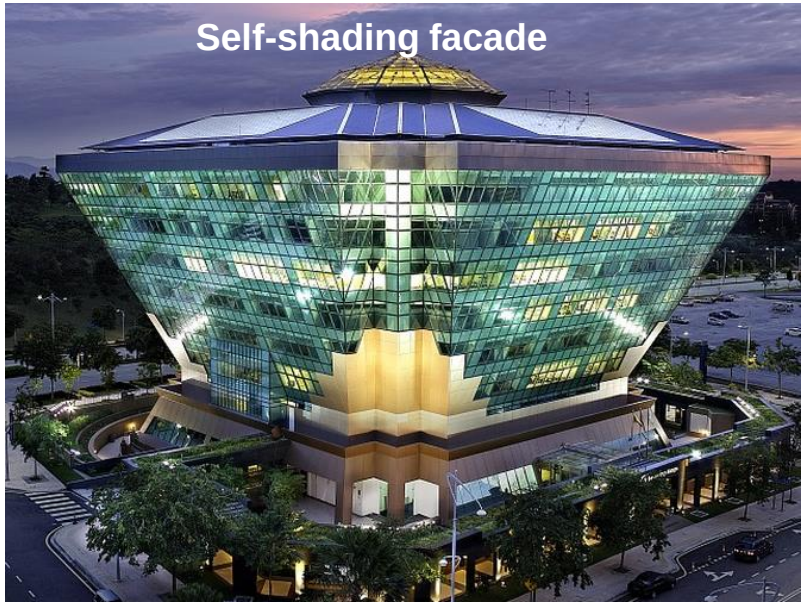
High Performing Buildings

where Going Green was Not an Afterthought



vs

By : Gregers Reimann

Managing Director

IEN Consultants Sdn Bhd | Energy Efficient & Green Building Consultancy

www.ien.com.my | gregers@ien.com.my | +60122755630

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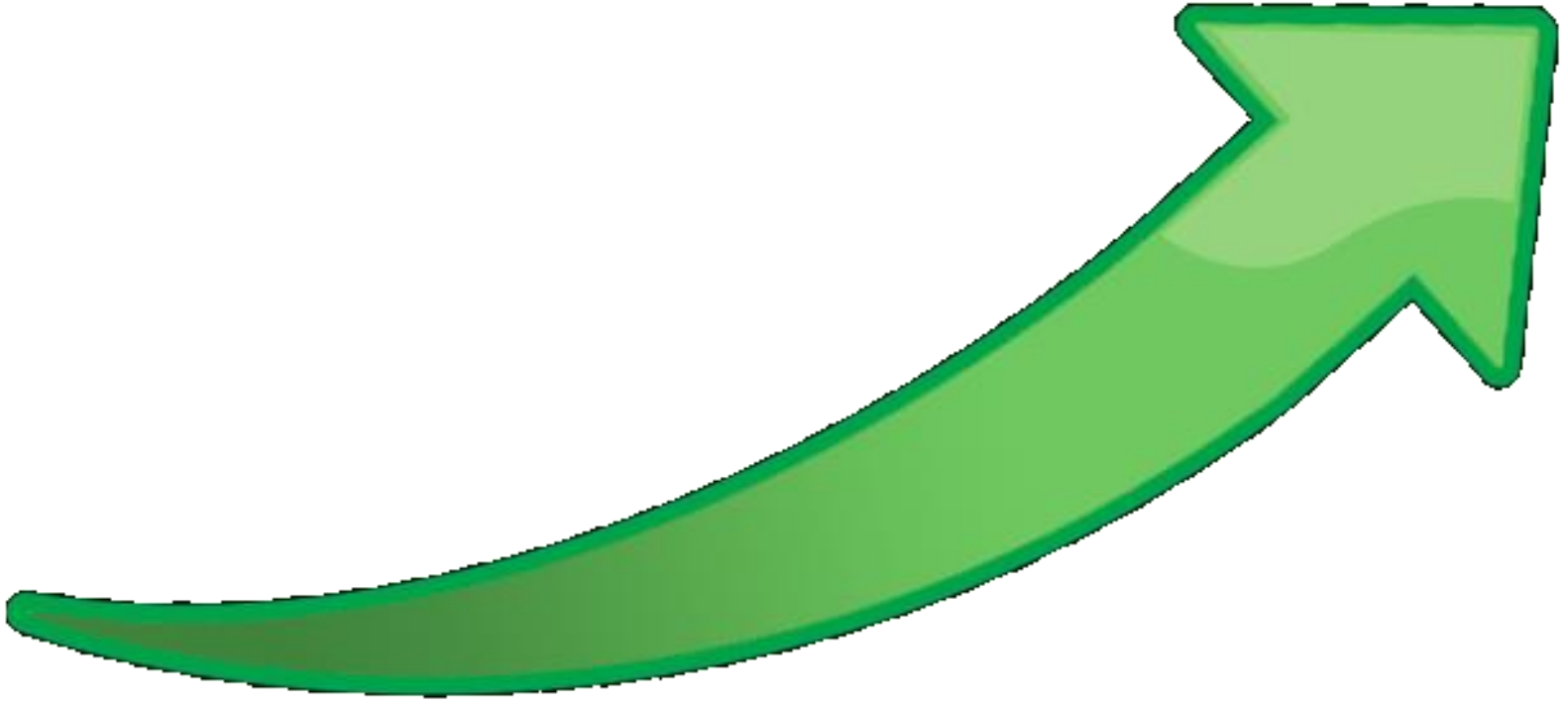
Increasing Awareness
of client about High Performance Buildings



No idea

Wrong idea

Request for green building certification

Request for building performance

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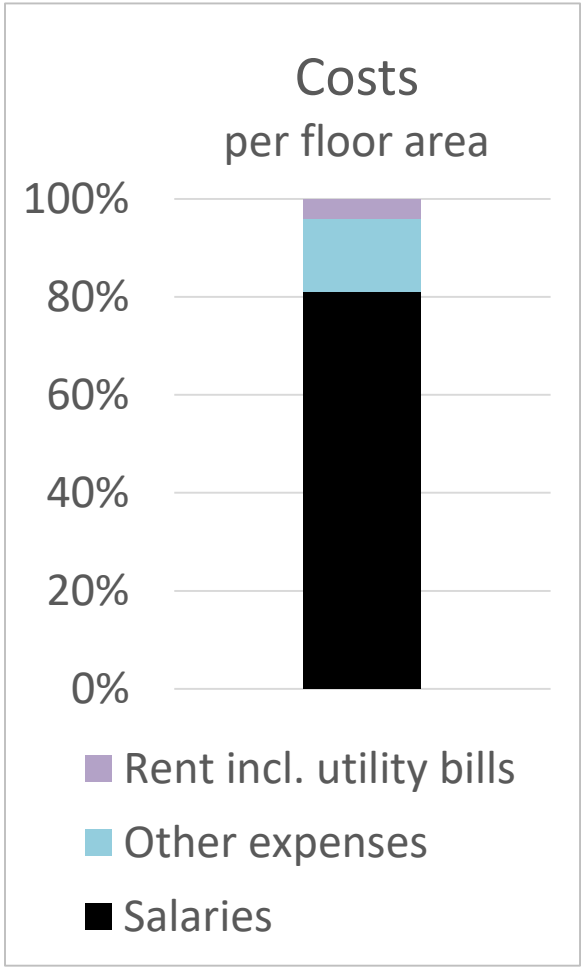
“Wrong idea”

Cartoon of a real conversation I had
when explaining my job as Building Energy Efficiency Consultant

The Star newspaper, Malaysia, 16 August 2013

The Highest Operating Cost of Buildings is Salaries



Figures for IEN Consultants (Malaysia)

The average Malaysian worker has:

UNPRODUCTIVE

66 days per year!

Amount of time that average Malaysian worker is either absent or suffering from presenteeism

NB. The UK figure is only 30 days per year

HIGH PERFORMING BUILDINGS MUST:

Provide occupants with a healthy, conducive and stimulating environment that enhances well-being and productivity

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Case study

High Performance Factory building in Penang:

PARAMIT – FACTORY IN THE FOREST

(MALAYSIA, 2016)

Architect: Design Unit
Green Building Consultant: IEN Consultants

The Client wanted a High Performance Building

with he defined as having good air quality, daylit, views to the outside and energy efficient, because he knew it would be a good investment

Interestingly, the client first identified the Green Building Consultant, who was then asked to recommend the architect.

Paramit – factory in the forest
Project performance: Measured 40% energy savings. High occupant satisfaction. More info:
http://ien.com.my/projects/paramit.html

Nominee for
"Best New Building of the World 2018"
RIBA International Prize

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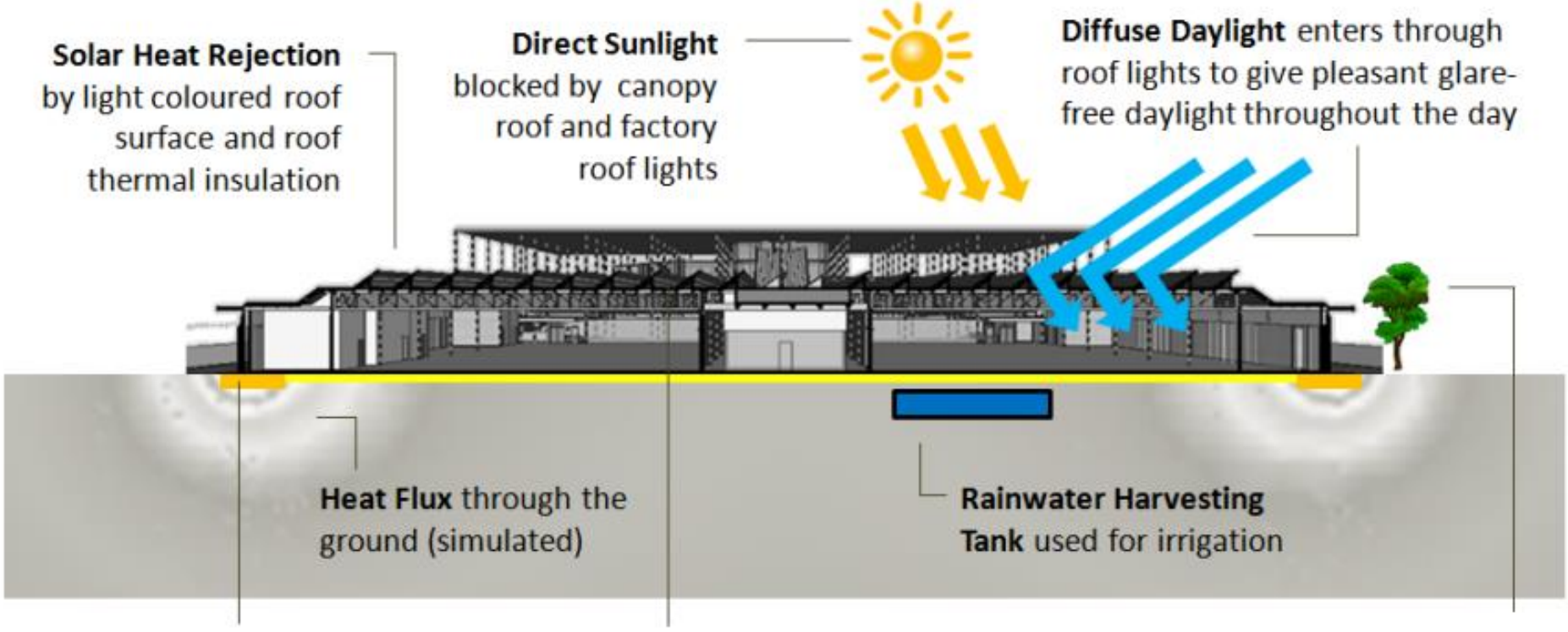
Passive Design Features

PASSIVE DESIGN: **Designing with the Climate**



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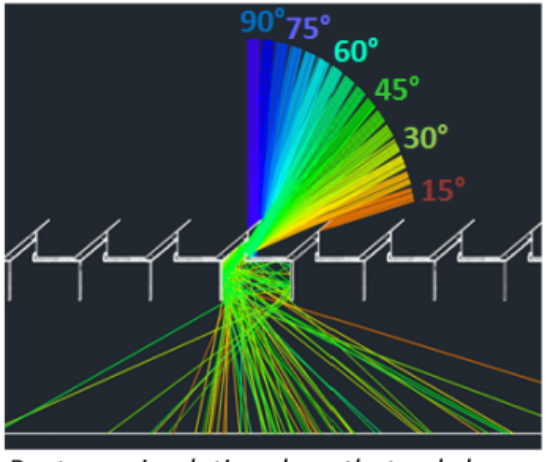
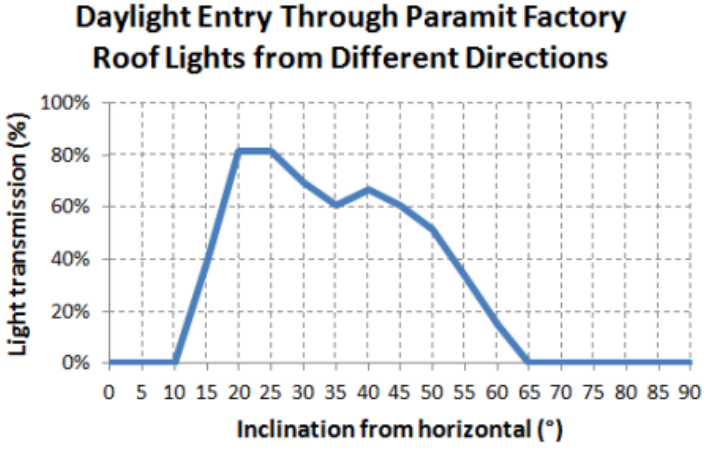
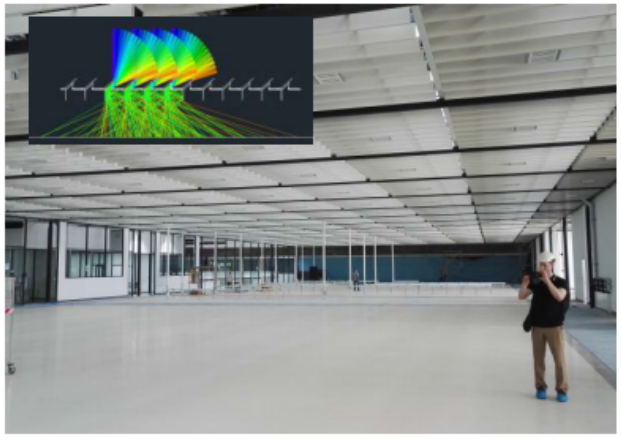
Designed for 100% Glare-free Daylight

SKYLIGHTS for FACTORY

The factory skylights were designed to rely on diffuse daylight from the sky, and not on direct sun light. The factory is located 5.3° North of the equator, and factory site is oriented in a near perfect East-West orientation. In order to minimise direct sunlight entry, the skylights were aligned with the factory and pointed North with a slight 22.5° angle to the West as dictated by the site. An internal deflector panel was added to diffuse any direct sunlight entering the skylights during certain times of the year.





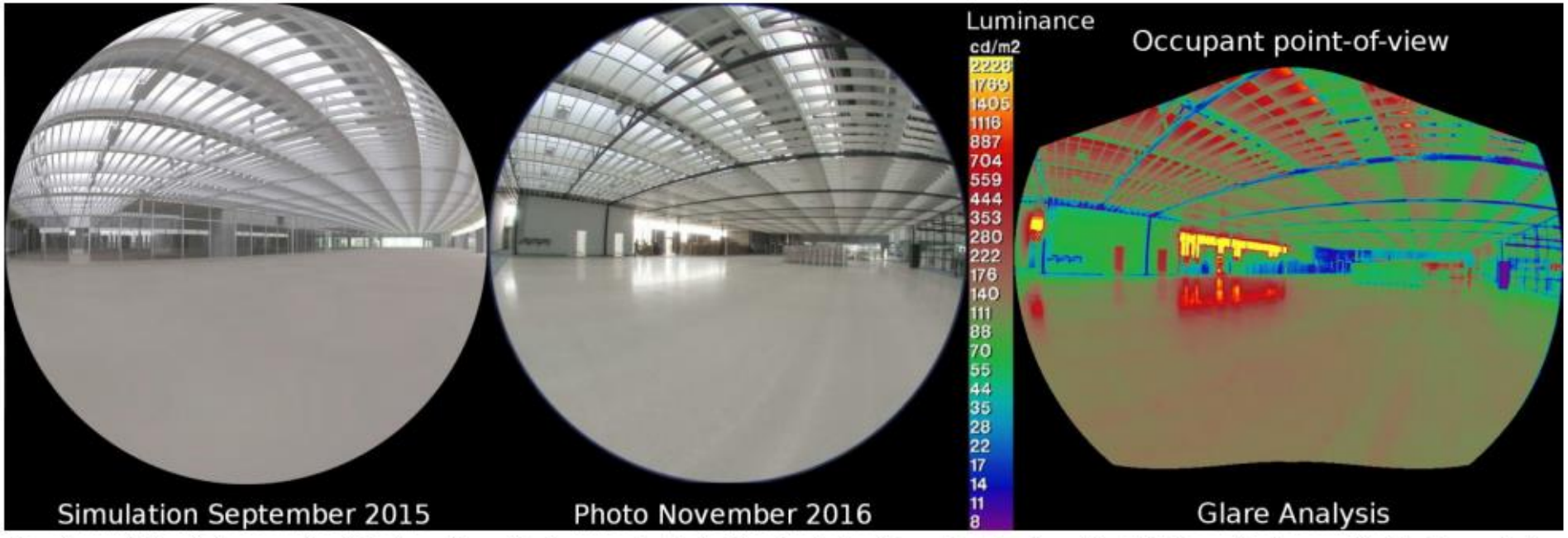


Raytrace simulation show that only low angle light (15-60° from horizontal) enters the roof light. Simulation and software by IEN Consultants

Design Simulation = Photo

DAYLIGHT without GLARE

Extensive annual hour-by-hour daylight simulations were undertaken to evaluate the daylight and glare levels. The skylight design was optimised, for example by moving them closer to each other, in order to achieve an evenly day-lit work environment without glare. The simulations and daylight measurements show that the factory floor achieves a daylight factor of 0.7-1.0%, with a measured lux level of 600-700 lux around 2 pm.



Good correlation between simulated results and subsequent photo. Tropical glare formula, developed by IEN Consultants, applied to the project.

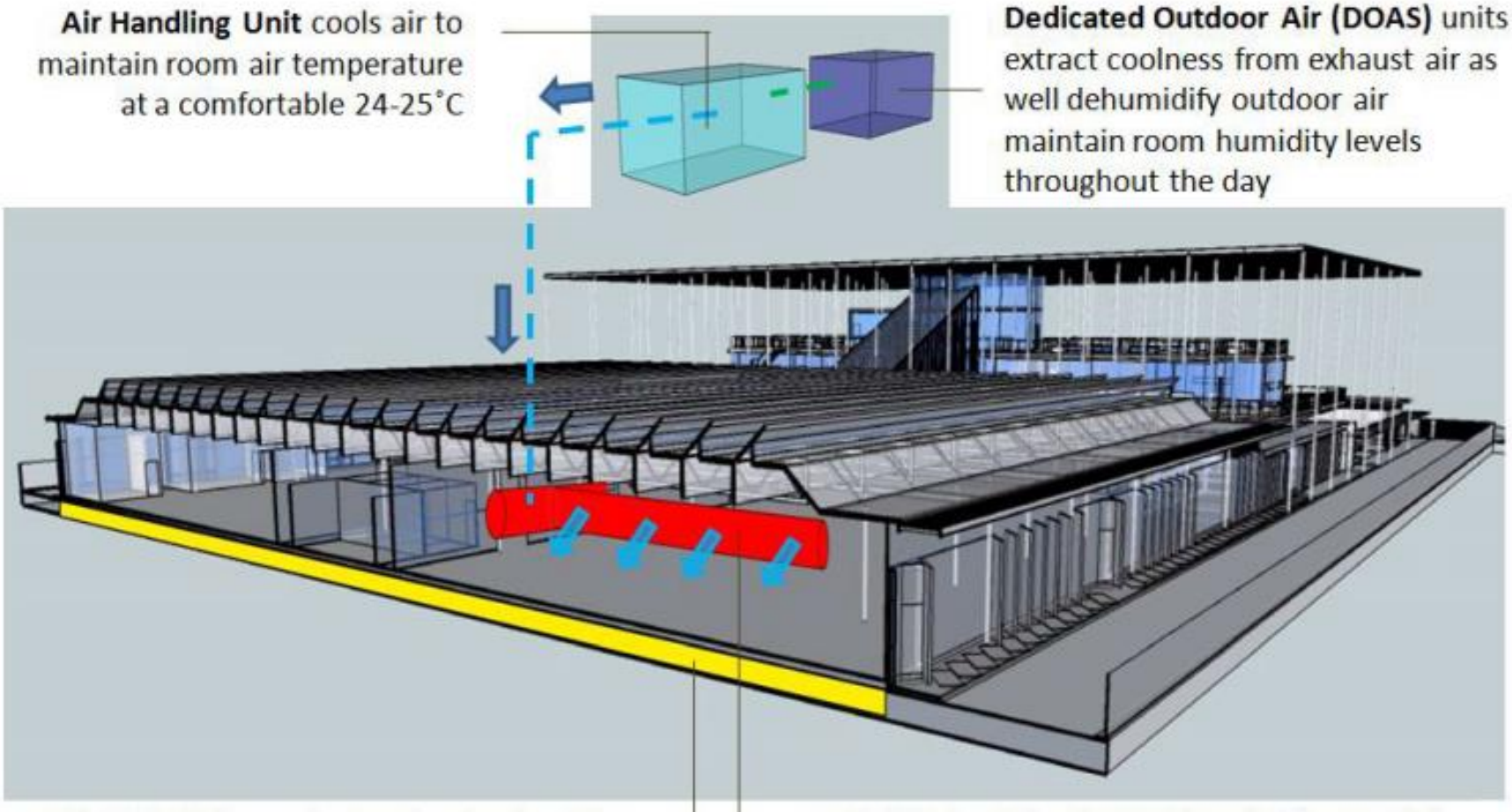
Active Design Features

ACTIVE DESIGN:

Innovative Cooling System for Production Area

Air Handling Unit cools air to maintain room air temperature at a comfortable 24-25˚C

Dedicated Outdoor Air (DOAS) units extract coolness from exhaust air as well dehumidify outdoor air maintain room humidity levels throughout the day



Cool Floor Slab - Cool water is circulated in embedded pipes within the floor to keep the floor continuously at a cool **20-22˚C**

Cylindrical Fabric Air Supply Ducting provides even air distribution minimizing cool spots, hot spots as well as draft below air grilles

Energy Efficient Floor Slab Cooling

Chiller COP of 10. Supply water temperature 17°C

Photo by Lin Ho

65 km of pipes in floor

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View to Extensive Greenery

Shaded Green Roofs

usable during office hours

Canteen with outdoor section

Inside the factory (old factory)

Almost everybody has: **No view out & No daylight**

Inside the factory (new factory)

Almost everybody has: **View out & Daylight**

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90% of Occupants prefer the New Factory to the Old Factory

Repies to anonymous survey question **"What do you like about the building?"**:

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

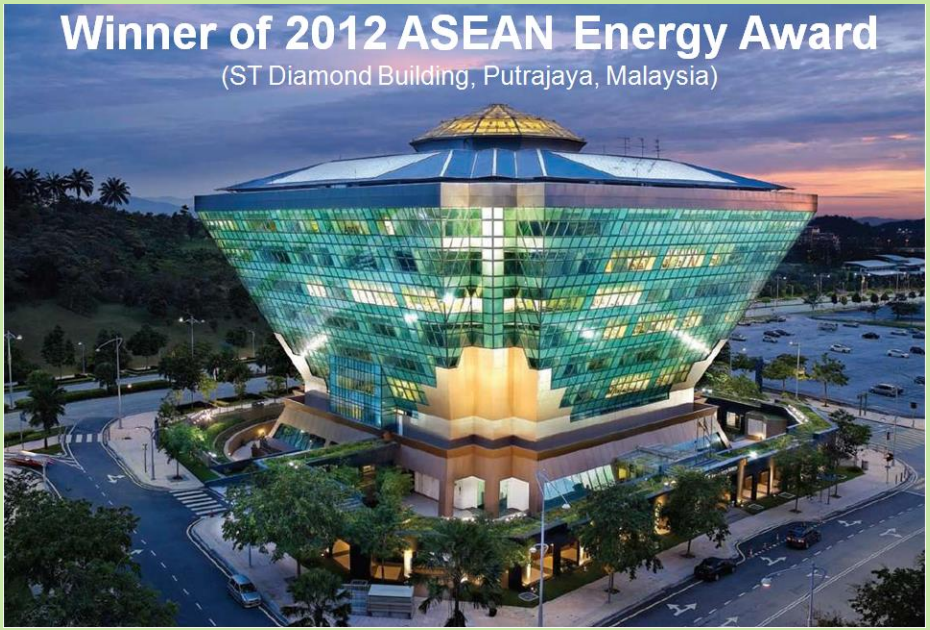
2) Very green, light and healthy

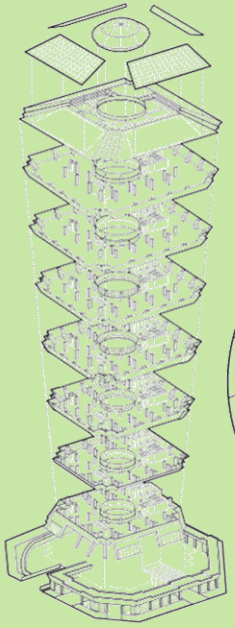
3) Give a balance and serene feel (able to reduce stress). Work place = 2nd HOME

4) I like the environment of this building that have been surround by tress. Comfortable. Outstanding from others building.

5) The beauty of the natural, de-stress while working

Case study





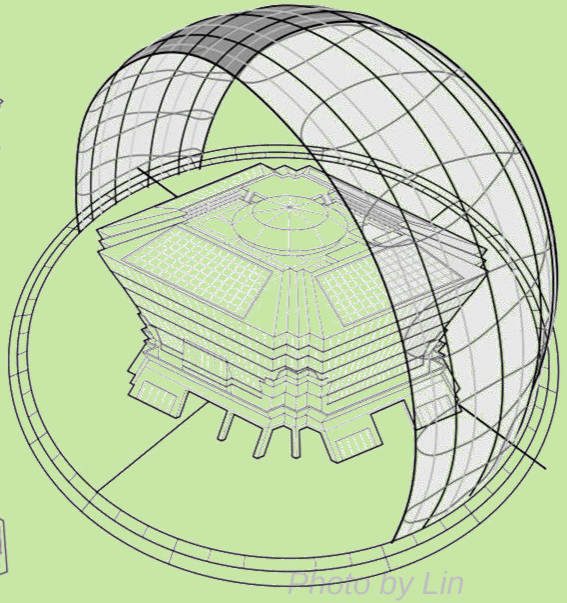


Photo by Lin Ho

Energy Efficient Office case study

DIAMOND BUILDING

(SURUHANGJAYA TENAGA, 2010)

Architects: Soontorn Boonyatikarn (Thailand) and NR Architect (Malaysia)
Energy efficiency and sustainability: IEN Consultants

Mechanical & Electrical: Primetech Engineers
Contractor: Putra Perdana Construction
Client: Malaysian Energy Commission

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Similar design with vernacular buildings

Examples and Initiatives

Malaysia and Denmark's, commitment to the field of

Green Energy in Architecture

as well as in cooperation and capacity building within the field, can be illustrated by the mutually beneficial involvement of IEN Consultants with the development of this field in Malaysia over the years. IEN Consultants was originally a proprietorship established by a Danish Chief Technical Advisor involved in the identification of energy projects in Malaysia. When the company took on the LEO Building projects it gained recognition in Malaysia and IEN Consultants managed to build up a team of consultants, most of them Malaysian, who with their experience on the LEO Building, became known further afield. This helped gain further commissions on such projects as the Green Tech Building and what has become known as The Diamond Building in Putrajaya.

"Green Buildings" are perceived to be expensive, both because of the costs of employing the expertise necessary to develop and refine the building and system designs, and because of the relatively high capital costs of green technology items. It takes time for reduced operating costs, which come with reduced energy usage, to counterbalance the increased capital investment and this has been a significant brake on development worldwide. However, given that approximately 40% of worldwide carbon emissions come from buildings, it is clear that the there is a need for the "greening" of buildings to make a significant contribution to carbon reductions.

As a result much effort has gone into the dissemination of green ideas to the Malaysian building industry, including the idea that the advantages of reduction of whole life costs of buildings as opposed to just capital costs are worthwhile. The fact that some "green" input to building design in Malaysia has moved from a subsidised base, using for example Danish funding for the LEO Building and European Union funding for the Green tech Office Building, to a fully Malaysia funded base in the case of the so-called "Diamond Building" indicates some success in changing attitudes to operating costs vs capital costs ascribed to "Green Buildings".

Improved energy efficiency is already recognised by the Malaysian government to be more important than mere certification under the Green Building Index (GBI) scheme. That scheme therefore carries tax and stamp duty benefits to encourage the real application of green ideas in the design and operation of buildings.

Beyond this, IEN Consultants is now involved with a UNDP funded project, with the Ministry of Works, to promote low carbon buildings in Malaysia. It is hoped, amongst other things that it will lead to a building code by 2015 specifying much lower carbon footprints even than the LEO Building or the Diamond Building.

Modern sunshade
Diamond Building in festive season lighting

Traditional sunshade
Rungus Longhouse, Sabah

Another major area of involvement was in

Capacity Building for Malaysian Industry and Academia in EE Building design.

The objective of the scheme, which was implemented by the Ministry of Energy, Communications and Multimedia (now Ministry of Energy, Green Technology and Water), was to develop capacity in the optimisation of energy efficient building design. This was done through training sessions, seminars, specific analysis of existing buildings and design development of new buildings. A key partner in this endeavour was the Public Works Department (JKR) and there was close cooperation with Schools Division and Healthcare Division, so the lessons learned were comprehensive, and the dissemination of the results widespread.

The project produced reports outlining design strategies for new buildings, making lessons learned from the LEO Building described above available to practitioners and academics across Malaysia. The project also produced reports on "Energy Efficiency Promotion: Lessons Learned and Future Activities", and undertook an evaluation of JKR design standards.

The project certainly raised awareness and improved the country's knowledge base regarding energy efficiency in buildings and made recommendations to Ministry of Energy, Green Technology and Water and JKR to set up demonstration offices, a very successful example of which was in Wisma Damansara.

Examples and Initiatives

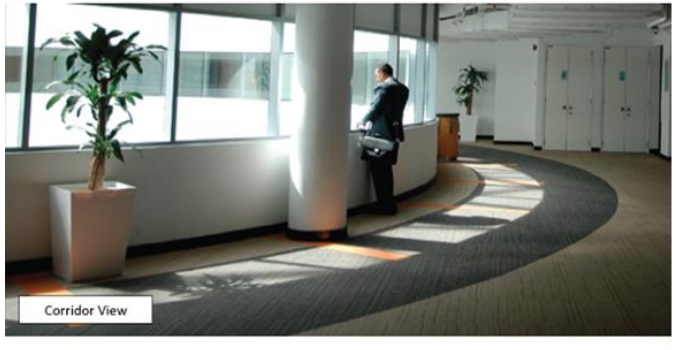
Result of many SIMULATIONS

Result of many GENERATIONS

Screendump from the book "The Co-operation" by DANIDA

1/3 Energy Consumption

3 year payback time



Key Data

Gross Floor Are: 14,000sqm

Year of Completion: 2010

Building Energy Intensity: 69kWh/m2*year

Total Construction Cost: RM60mil

Additional EE Cost: 3.2%

Payback Period: **< 3years**

IRR: 34% (based on 7year Lease Term)

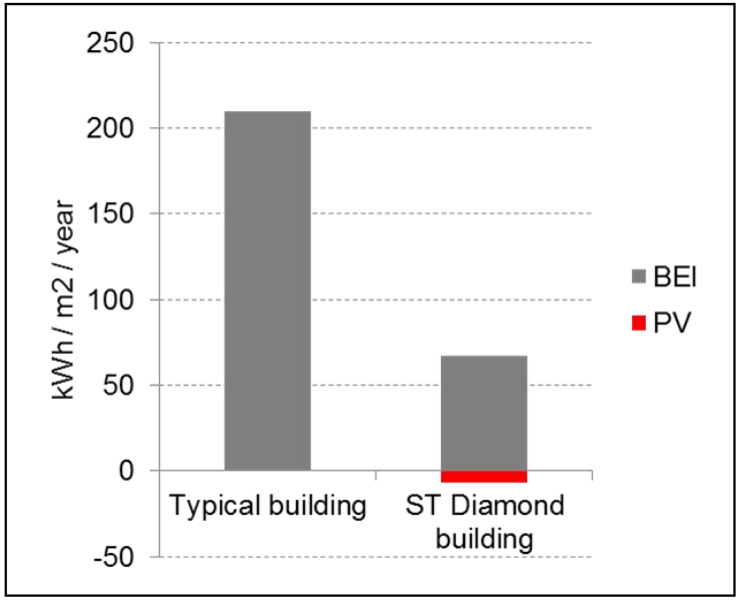
GBI **Platinum**

Green Mark **Platinum**

AWARDS

2012 ASEAN energy award **Winner** &

2013 ASHRAE Technology Award (2nd place)



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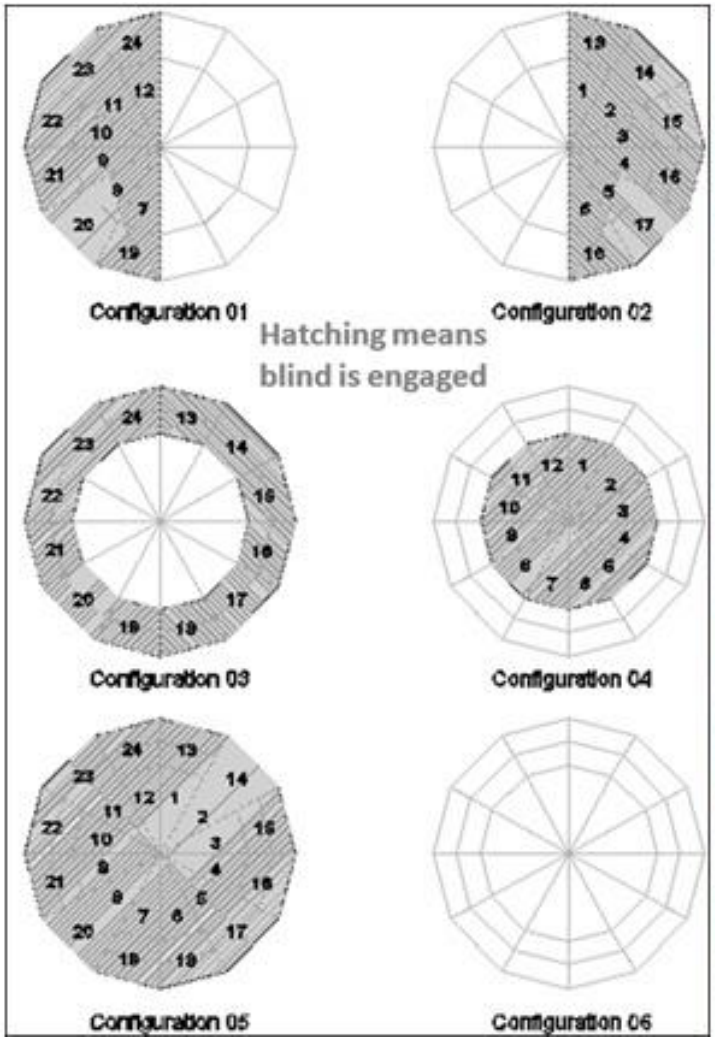
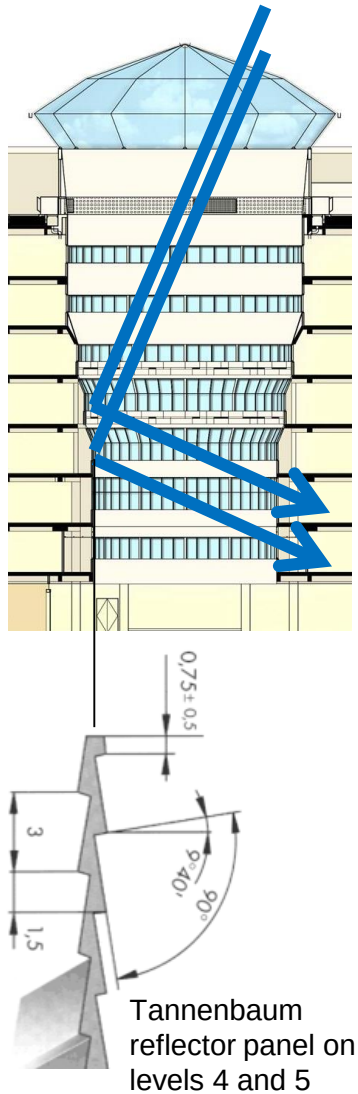




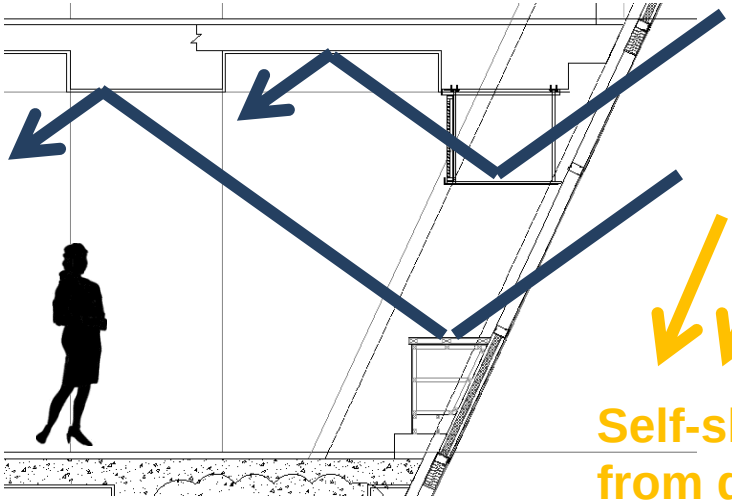
Tannenbaum reflector panel on levels 4 and 5

Atrium Daylight Design

The atrium has been carefully designed optimize daylight utilization for each floor employing the combination of the following three strategies:

1. Automated blind with six different configuration to maintain the appropriate daylighting levels at all times. The blinds with 30% light transmittance are adjusted every 15 minutes and follow a three different control strategies for morning, mid-day and evening
2. The windows size becomes larger deeper into the atrium to cater for lower daylight levels
3. A band of Tannenbaum reflector panels are applied to 4th and 5th floor to deflect daylight across the atrium to 1st and 2nd floor where daylight levels are the lowest. The 'christmas tree' profile reflectors have an inclination of 10° and reflect about 85% of the light in semi-diffuse manner, hence, avoiding visual glare issues for the building occupants.

FACADE

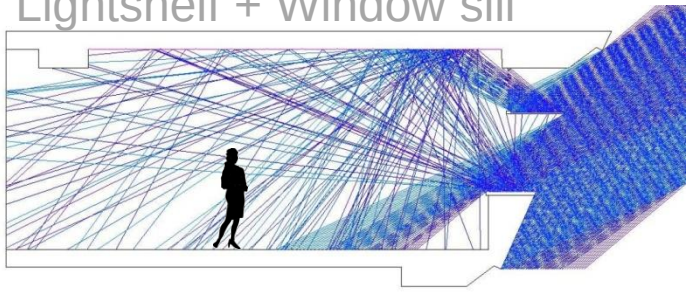


Diffuse light deflected into room by lightshelf and window sill

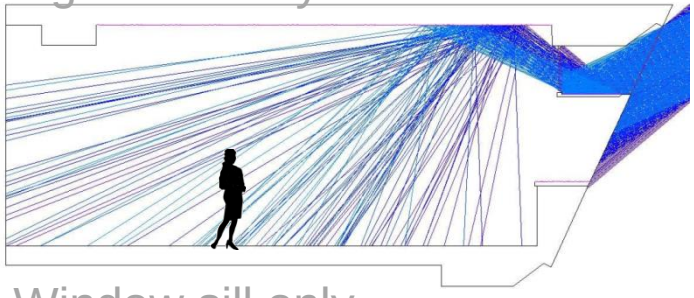
Self-shaded facade from direct sun

LIGHT REFLECTIONS FROM:

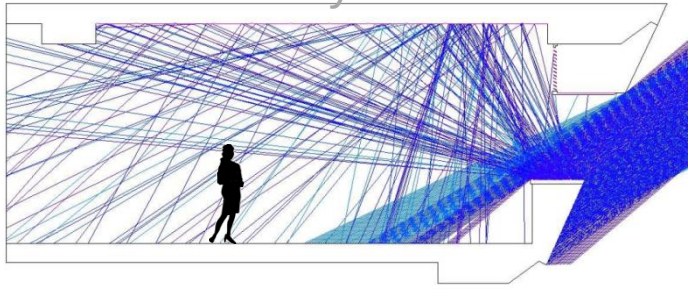
Lightshelf + Window sill



Lightshelf only



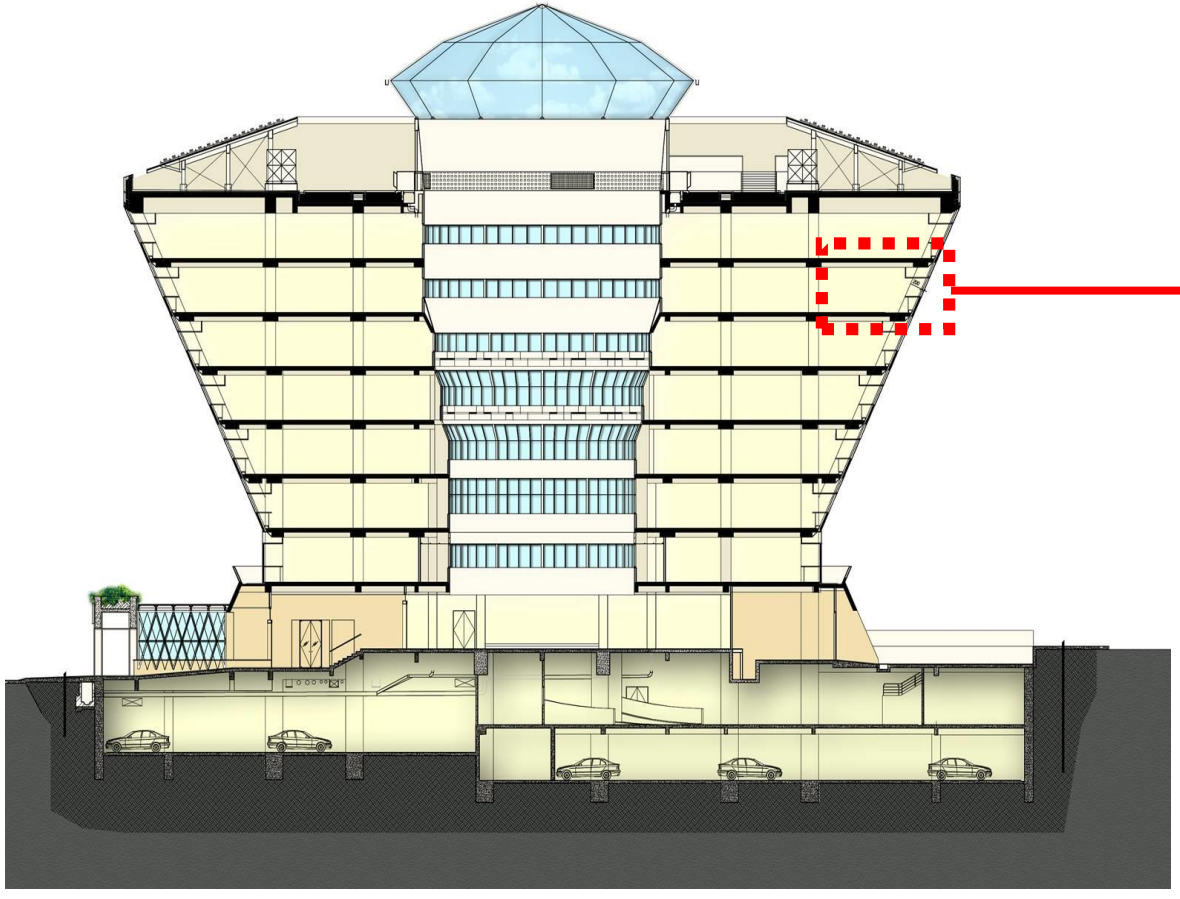
Window sill only



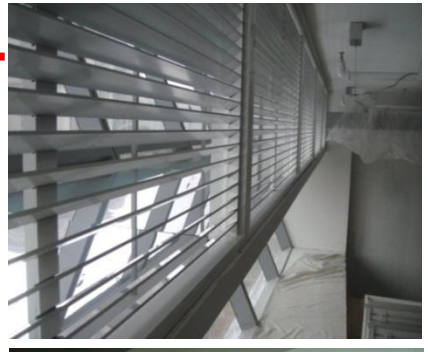
Façade Daylight Design

The building is 50% daylit. The façade daylighting system consists of a mirror lightshelf and a white painted window sill. Both deflect daylight onto the white ceiling for improved daylight distribution until 5 meters from the façade + 2 additional meters of corridor space. Installed office lighting is 8.4 W/m2, but 1-year measurements show consumption of only **0.9 W/m2** showing high reliance on daylighting

Day-Lighting- Office



Mirror lightshelf



Fixed blinds for glare control

Daylight reflected onto ceiling

Floor Slab Cooling in Diamond Building

Floor slab cooling system embedded in RC slab

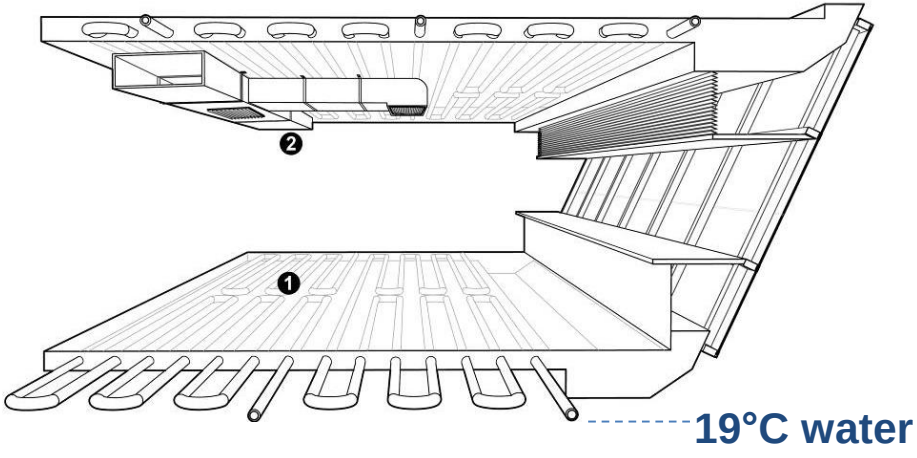
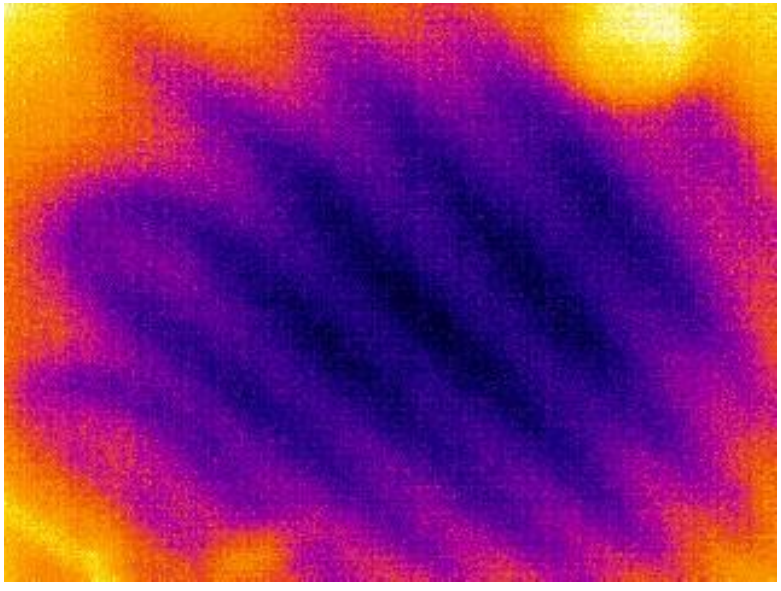
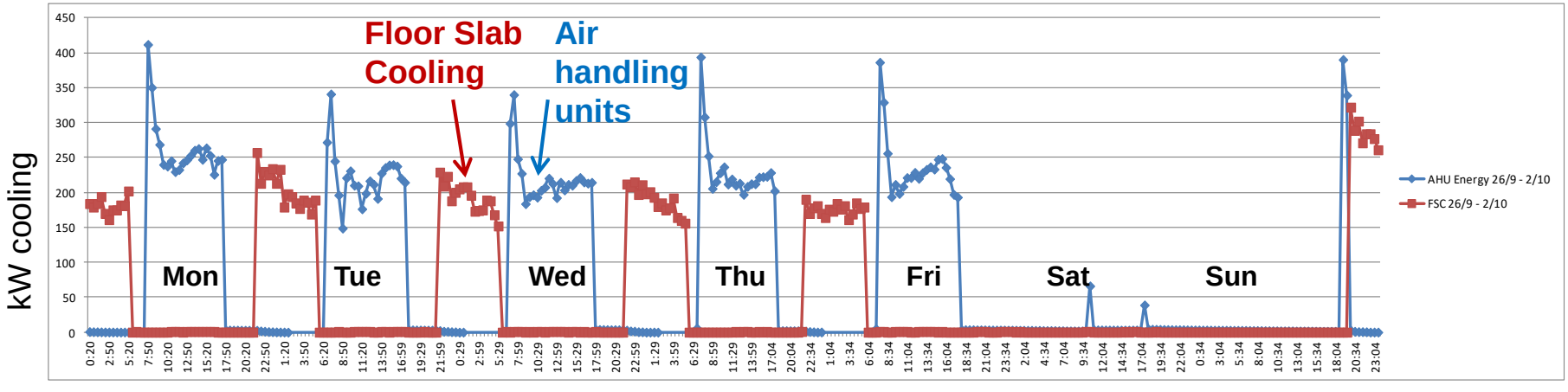


Illustration courtesy of:
Greening Asia – Emerging Principles for Sustainable Architecture.
Copyright: Nirmal Kishnani, 2012. Publisher: FuturArc



Thermographic image of floor slab cooling in ST Diamond
Picture courtesy of: PS Soong, Pureaire



Conclusions

after 20 years of green building consultancy in Malaysia

1. **Green Building Design should not be an afterthought**

2. **If done correctly, Green Buildings, can achieve:**
   - 50% energy savings or more
   - 60% water savings or more
   - 1-3% additional construction cost
   - 3 year payback (from utility bills)

3. **Main benefit of Green Buildings is to improve human well-being, health and productivity, which significantly will reduce the already attractive payback time.**

EECCHI office retrofit

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Thank you

Gregers Reimann
Managing Director
IEN Consultants Sdn Bhd | Energy Efficient & Green Building Consultancy
www.ien.com.my | gregers@ien.com.my | +60122755630

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