

# Green it Forward

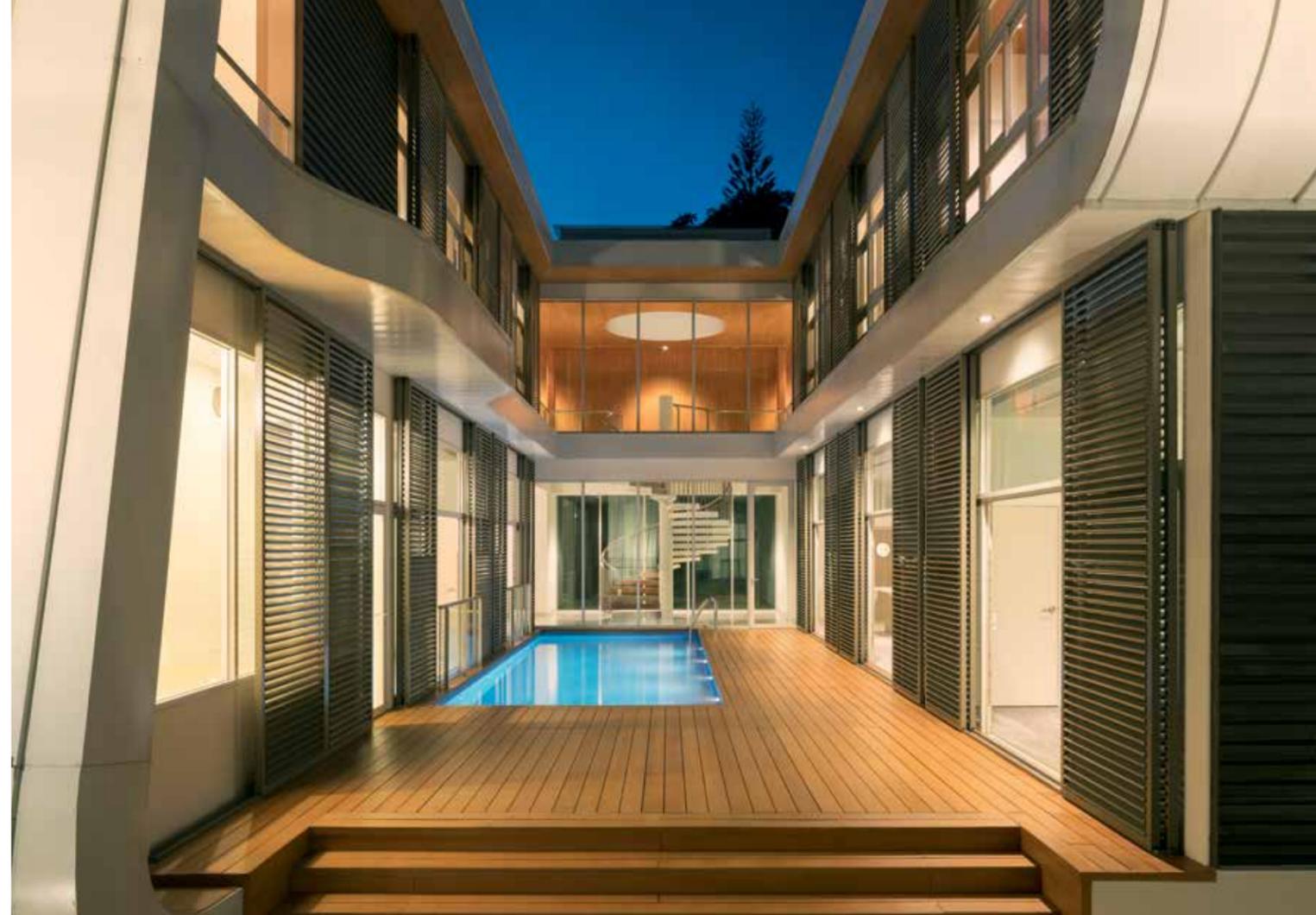
Moving beyond merely reducing pollution, technology is helping give back to nature



Above  
Singapore National Library has a skybridge on every floor, a naturally ventilated atrium, landscaped sky courts and a viewing point called The Pod  
Below  
Singapore Science Research Centre Solaris contains 8,000 square metres of landscaping  
Right page  
The B House modular design increases the speed and efficiency of construction by fifty per cent compared to similar sized residential buildings



An often-overlooked fact is that humans spend ninety per cent of their time indoors. So it's no surprise that worldwide, the use of buildings consumes forty per cent of the world's energy and contributes to thirty per cent of urban emissions. This startling truth casts "green" building construction and design as the largest potential for global energy savings. In Asia, the greening effort has moved beyond good intentions to permanent commitments. Its need for immediate and impactful solutions has prompted a pan-Asian trend of blending innovative design technologies with infrastructure to produce positive effects on the environment.



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In many industrialised nations, the presence of fertile soil, clean air and potable water are no longer certainties of reality. All too aware of this crisis and known for having some of the world's most densely populated and polluted urban areas, many Asian countries have begun to respond accordingly. A recent report listed four Asian cities in the top ten of global cities which are putting forth initiatives to create more green infrastructure: Singapore, Shanghai, Tokyo and Hong Kong. These cities are well on their way to establishing a system of supportive policies that reduce energy usage and foster healthy and sustainable urban environments.

Today, Singapore is head and shoulders above the rest when it comes to preserving the environment. Committed to greening eighty per cent of their existing infrastructure by 2030 (as of 2014, the city was at forty-eight per cent), it is at the forefront of greening initiatives and ambitions.

Singapore's recently enacted building standards have been strict enough to produce quantifiable, positive results. In fact, the paradigm is shifting: designers, developers, architects and owners worldwide are becoming aware of the social and economic benefits inherent in building green.

As Singapore is demonstrating, zero-carbon technologies have the ability to produce efficient

heating and cooling systems that experience a forty per cent decrease in energy use as well as innovative conservation methods that provide a thirty per cent reduction in water waste. More contact with plants, natural light and scenic views provide social benefits like enhanced health, well-being and comfort. These elements also increase human productivity in office environments by fifteen per cent and encourage shoppers to spend more time (and money) in retail and commercial environments.

In early 2016, Singapore-based sustainable design firm Pomeroy Studios completed B House, their first operational carbon-negative home. While a typical family of five is estimated to consume 12,500 kWh per year, B House will only consume approximately 8,000 kWh. Its solar panels are expected to generate 16,720 kWh, effectively creating a structure that acts as a power station with the ability to generate surplus energy that could potentially be fed back into the grid for income generation.

Green innovation is showing up in the public sector too. Architect-cum-ecologist Dr Kenneth Yeang, who designed the Singapore National Library, also created an award-winning design for Solaris, the Singapore Science Research Centre.

TECHNOLOGY



Left  
At Alila Villas Uluwatu luxury eco resort, all main spaces are designed for natural cross ventilation and are oriented to catch local sea breezes  
Below  
To avoid damaging the local environment, salt-water pools are used instead of chlorine



The latter, a former military base, has managed a thirty-six per cent decrease in energy consumption by integrating landscape into the building's façade. Committed to creating living systems out of buildings, Dr Yeang designed a ramp containing 8,000 square metres of landscape along a 1.5-kilometre "linear park" that connects the basement to a roof garden. This uninterrupted space allows plants and animals to move freely, enhancing local biodiversity as well as providing a creative environment for the occupants.

While Singapore has certainly outpaced the rest of the continent, green technology is thriving in other areas of Asia. The Alila Villas Uluwatu luxury eco-resort was founded on the idea that luxury does not have to mean excessive consumption. Located on the

Indonesian island of Bali, it utilises a series of low-tech water conservation solutions that are suitable for a developing country. Rainwater is collected and recycled through retention pods and sewage and wastewater are recycled into a grey water system for watering plants and flushing toilets.

Concerned about the declining trend in the number of farmers and the future of sustainable food production, the Pasona Group headquarters in downtown Tokyo recently renovated an office building into an urban farm with 200 species of crops that are grown, harvested, prepared and served in the employee cafeteria. Through utilisation of both hydroponic and soil-based farming, crops and office workers share a common space: fruit trees are used as partitions for



Above left  
Pasona employees are asked to participate in maintenance of plants alongside agricultural specialists to build teamwork  
Above right  
Plantations are equipped with metal halide, HEFL, fluorescent and LED lamps and an automatic irrigation system  
Left  
Pasona HQ renovated a fifty-year-old building in downtown Tokyo to integrate urban farming facilities within the building



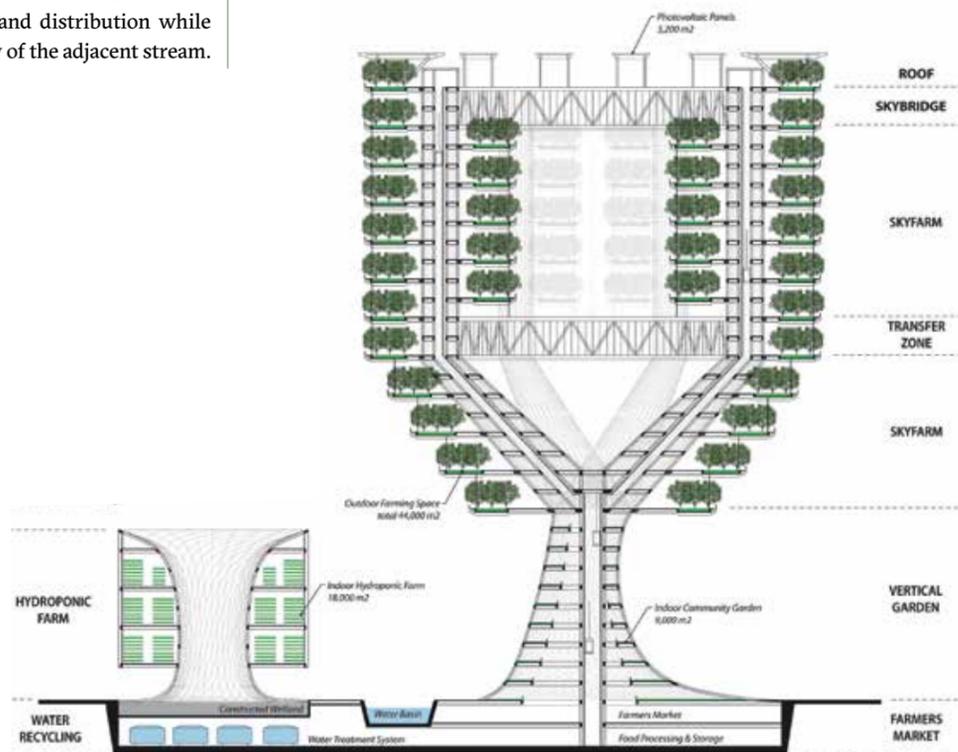
meeting spaces, bean sprouts are grown under benches and tomato vines are suspended above conference tables. This “zero food mileage” model is achieved with an intelligent climate control system that monitors humidity, temperature and breeze to balance human comfort during office hours and optimise crop growth after hours.

Taking a step further into this concept is Skyfarm, a proposal for a tree-like building that would function as a mini ecosystem within the densely populated area of downtown Seoul. It plans to operate as a net-zero facility, using only renewable energy produced by solar panels and wind turbines. The vertical farm would support local food production and distribution while also improving the water quality of the adjacent stream.

At the heart of each of these projects is an idea most accurately stated by Dr Yeang, designer of the Singapore Science Research Centre: “Green architecture has to be a living system. Otherwise it becomes estranged from nature.” By critically analysing local ecology and using technology to become part of the environment instead of just building on top of it, positive emissions can replace negative ones and fresh food, clear air, water and contentment can once and for all become part of daily life in a large metropolis.

Above  
The Skyfarm concept for downtown Seoul would support local food production and distribution

Right  
Inspired by the ecological system of giant trees, Skyfarm would improve the environment through air, water filtration and renewable energy production



## Interview

Dr. Ken Yeang, Eco-architect at T.R. Hamzah & Yeang

### What are the fundamentals that make a green building?

A green building is one that coexists and functions seamlessly and benignly within its natural environment. This means whatever has been built must physically and systemically biointegrate all its functions and processes (including the activities of its human inhabitants) with the natural environment, becoming an integral part of it and not being alienated or isolated from it. Its design must be nature-based to have an equilibrium of biotic (organic) constituents (e.g. landscaping) and well as abiotic (inorganic) constituents to form a living whole, much like an ecosystem in nature. Not only should it have no or minimal negative consequences on the natural environment; it should have positive impacts on and benefits for it. The built environment covers not just buildings but everything that humans make, such as bridges, highways, toys, refrigerators, clothing, food products, etc. Its processes are not just those in the urban realms - but in other societal aspects such as manufacturing, energy generation, etc.

### What are the current trends of that industry and how do you see them evolving in the future?

Current trends and approaches to green design at present are mostly engineering-driven. However we contend that this must be ‘cleantech’ with minimal embodied energy, meaning a green building needs to work with nature. The future generation of green design must focus on integrating with the ecology of the planet’s ecosystems and the biogeochemical cycles. Present-day environmental impairment is now so extensive that even if we halt all environmentally devastating acts (such as the emission of greenhouse gasses from burning fossil fuels, etc.), the consequences of our past action will affect us well into the future.

### What are the main challenges when building green?

We need to find ways to radically change society’s global socio-economic and production systems to do no harm to the natural environment. From nature’s viewpoint, it has not really noticed that there is any crisis. It is simply reacting to society’s acts upon it. If society does nothing and lets nature run its own course, eventually leading to the collapse of the ecological system, nature will recover and start all over again over several million years after the mass extinction of life. However this will mean the end of our present day human society, culture and civilisation. The survival of humanity lies in the hands of the present generation. The question then is how long will it be before our ecological design endeavours achieve positive outcomes that will save the planet. The hope here is that if we imminently and extensively implement ecological design, it would make a difference and buy us time to reduce, to halt and if successful, reverse the ecological collapse caused by present and past action already set into motion.

### What inspired you to take an ecological approach to architecture?

I started on my doctorate in ecological design and planning in 1971, which upon completion became my life’s agenda.

### As an eco-architect, how different is your approach compared to classic architects?

The difference between the ecological and conventional design approach is that nature is a crucial consideration in ecological design in addition to usual factors such as function and form. Ecological design is designing with the natural environment to biointegrate benignly with nature, not just physically and spatially but also systemically. I believe good design has to achieve the following goals: it must be functional and immensely beautiful; it must meet the usual criteria of governmental building and planning regulations while meeting budget and time constraints and the requirements for a high quality standard of construction; it must be green (ecologically effective) and it must give people who use the building immense pleasure in its use. I regard the latter to be the most important, but it should be done whilst meeting the former criteria. If we designers are able to achieve all of these, we will have done our job well.

### What would your dream green building look like? And what would be some of its characteristics?

My ideal green building would look like a living ‘constructed ecosystem,’ as a hybrid of the ‘human-made with the natural,’ perhaps as an ‘eco-cyborg.’

### If you could choose one civic building to green in every city, which would you choose and why?

I would not choose a building but the city’s major public realm (such as La Rambla in Barcelona, Trafalgar Square in London, Times Square in New York or Unter den Linden in Berlin, etc.). These places would be more effective in contributing to the happiness and well-being of the people of that city.

### What is an easy way to green a building most people overlook?

As mentioned above, we can start by putting an equivalent of biotic (organic) constituents (e.g. landscaping and greenery) in the building to counterbalance its currently overly abiotic (inorganic) content to form a living whole and to function like an ecosystem in nature. The building’s systems and processes are remade to have no or minimal negative consequences on the natural environment and even have net positive impacts and benefits on it. But even if we build the greenest buildings possible, this will not save the environment if people themselves do not change their attitudes towards nature. Our society’s institutions, habits, ethos, production, energy and systems of usage must all change.

### What is the most common feedback you receive for finished projects?

I usually get asked if the building could have been made greener had it not been for budget constraints.