
THE FUTURE IS GREEN—A CONVERSATION BETWEEN TWO GERMAN ARCHITECTS IN SYDNEY

Steffen Lehmann¹ and Christoph Ingenhoven²

INTRODUCTION

Since the foundation of his practice *Ingenhoven Architekten* in 1985, **Christoph Ingenhoven** (born 1960, as the son of an architect) has been an advocate of sustainable design and low-energy architecture. He is considered Germany's most successful architect of his generation and a leader in the application of sustainable design concepts using an ecological approach. Main themes that stand at the centre are future work environments, ecology, mobility, and urban landscapes. Conceptual strategies and realization of innovative solutions, an integrated approach, and dedication to optimize and implement it on all levels, is visible. It is obvious that Ingenhoven is influenced by the work of other modern German architects, such as Egon Eiermann, Frei Otto, Thomas Herzog, and Guenther Behnisch, people who understood so well the relationship and tension between architecture and engineering.

Christoph Ingenhoven is involved in projects all over the world and is increasingly involved in the design of major buildings in Australia. After winning the design competition for a new high-rise tower in Sydney's central business district in 2006, his new "Space" high-rise office tower (to be completed in 2011; ground breaking was in May 2009), and his recent involvement with the urban and architectural design of the Barangaroo waterfront development, brings him to Australia on a regular basis. The Australian city will gain a prominent addition to its skyline with this new (6-star Green Star rated) office tower on Bligh Street.

Other major works include:

- The RWE Tower, a cylindrical high rise headquarters in Essen, for one of the biggest energy suppliers in Europe, which Ingenhoven designed in 1991 and completed in 1997, was one of the first ecologically orientated high-rise buildings that—with its double façade technology—allows each floor to be naturally ventilated.
- The Lufthansa Headquarters at Frankfurt Airport completed in 2006, which requires only one-third of the energy of a conventional office building.
- The new Main Station in Stuttgart, to be built over the next ten years, which was awarded the Gold Global Holcim Award in 2006 for its sustainable design. As a carbon-free and zero energy railway station, it will require no heating, cooling, or mechanical ventilation (described as "the 21st century underground version of a 19th century railway cathedral"; Walsh 2008).

Steffen Lehmann (SL)

Christoph, at the beginning I would like to talk with you about the challenges of designing sustainability at an urban scale—let's say for the Barangaroo waterfront development in Sydney, but also more generally. I feel we have moved on from the scale of the individual building or from the sophisticated façade solution, to a broader scale that deals with the entire city. Discussing sustainability on the scale of districts and neighbourhoods, rather than on the eco-façade scale, means that we can focus on potential strategies that you might bring to Sydney projects in the light of the huge challenges we are facing. For instance: How can we best address the broader requirements for the necessary transformation of cities and their energy landscape?

Christoph Ingenhoven (CI)

Public space, and the city as a whole, are always much more important than a single building. If we

¹German architect, **Steffen Lehmann** (Steffen.Lehmann@newcastle.edu.au), who holds the Chair at the University of Newcastle (NSW) and the UNESCO Chair in Sustainable Urban Design for Asia and the Pacific, met with ²Christoph Ingenhoven (www.ingenhovenundpartner.de) in Sydney, in May 2009, to discuss the future of green design. Here are excerpts from their conversation.

FIGURE 1. Conversation between Christoph Ingenhoven and Steffen Lehmann (photos: Cida de Aragon, 2009).



think about sustainability as a necessity, it's still very complex but not impossible, to build city districts entirely without CO₂ emissions and zero waste to landfill. Mixed-use is hereby one of the most important aspects, because it is a prerequisite for achieving social sustainability. For example, at the new university campus in Dublin, which we are currently planning, we are incorporating a series of existing buildings in the master plan. New campus structures will have large sophisticated roof shells with building-integrated photovoltaic panels and wind turbines. These buildings will provide more energy than the campus will need to operate.

SL

What exactly is your involvement with the Barangaroo waterfront development in Sydney?

CI

We have been invited to be part of a large international team, with JPW and landscape architect Peter Walker, Leighton Properties, MIRVAC and Macquarie Bank, and we are competing here with the team of Richard Rogers. I see the Barangaroo project as Sydney's last chance to significantly expand and transform its CBD through genuinely mixed-use sustainable strategies. Sydney will need to keep up with changes to stay competitive with other cities such as Singapore or Shanghai. At the same time, Sydney needs a very good, long-term plan which improves its sustainability performance. The city must continue to evolve in order to remain competitive, by integrating density in commercial and liv-

ing spaces, bringing people back to live in the city centre. Efficient public transport will play a major role in this transformation process. For Barangaroo, we developed the idea of "energy islands", where much of the required energy is generated locally on-site, or at least as nearby as possible, using solar-PV and wind turbines along the harbour. The idea of autonomous energy production with small units on-site is very interesting, and we also propose to reuse an existing wharf building that is already there. Our concept for Barangaroo hopes to extend the CBD by improving and complementing the setting, and reduce the energy needed for this new district by having the right volume, exposure, façade and, of course, by having the right systems in place. A better life-cycle and potential reuse, allowing for changes of structures in future, means more flexibility. Barangaroo is Sydney's great chance to be one of the sustainable 21st century cities.

SL

A lot of your design work is research-led and based on in-house knowledge that you have built up from one project to the next, an aspect not dissimilar to the practices of Norman Foster or Renzo Piano, where we can find technologically focused details, with a constantly expanding knowledge base that is nurtured inside the office, for instance in the fields of prefabrication and façade technology. One project builds on the previous one. Given that you are now involved in projects from Osaka to Sydney to Luxemburg, how do you feel about exporting this German know-how globally?

CI

It seems to me natural to export this know-how. I think German architecture has been very committed to green buildings for a long time, and this has presumably something to do with what others call “German angst”, which could also be described as being scared about the environmental pollution and destruction, health issues, and security problems, which we can see everywhere today. This development started around 25 years ago, but it is more than just a question of technology or detail—it has grown to a unique approach and attitude. I do not think it is possible to export the solution, but it is possible to bring a philosophical approach and commitment to another place, never the solution as such. The final solution emerges from climatic considerations and the local contextual circumstances, which in every project need to be carefully analyzed at the beginning.

SL

Sustainable design is always about holistic approaches, about seeing things systemically and with regard to all the connections—and implications—of what we do, exploring and understanding the variety of solutions that are usually available to any problem. You frequently use large glass panels to achieve transparency in your designs, even in hot and humid climates such as Singapore or Osaka. Wouldn't it be more helpful to use prefabricated concrete panels to reduce the amount of heat gain? There are many ways to avoid heat gain. One is by choosing appropriate materials and surfaces, but a glass tower might lack thermal mass. I know that you do not use glass wherever you build, but there is clearly a desire to build transparency, similar to the early modernists. Where does this urge come from?

CI

This desire for transparency has to do with the human experience. Humans used to live constantly outside before we started to settle, and for me, this has something to do with an instinctive wish to live outdoors, directly experiencing the change of seasons and sunlight. Yes, transparency is difficult to achieve, because it's a question of energy saving too, but even in a building like the Osaka tower, if you calculate the amount of glass, it's less than 50 per-

cent, because you have the metal cladding and core areas which are closed. We are always restricted by orientation and views, trying to keep out the steep summer sun with sophisticated sun shading devices. For instance, at the Bligh Street tower, the naturally-ventilated atrium is completely oriented to the south, shielded from the sun. To ensure energy-efficiency, we provide a double-skin façade with efficient sun shading in the space between. I don't want to be ideological about the question of materials and transparency. We have done wooden façades and brick façades. For instance, the university building in Duesseldorf is nearly closed on the colder façade; only the sunny side is open, using passive design principles, and wide cantilevering roofs keep the summer sun away. The traditional house, with verandahs around them, is actually quite transparent, too. If you think of the traditional examples in Singapore, these provide flexible envelopes.

SL

So the double-skin façade is a modern interpretation of the traditional verandah? That's quite a poetic way to look at it.

CI

Maybe it's more like the modern interpretation of a multi-layered window. I remember I was very impressed as a kid when I visited, with my father, an old house on Lake Geneva, an area which has a mild climate. An old villa there had shutters outside the window for security reasons, then the window itself, which they called a “winter window”, had an inner window, and in-between these two wooden framed windows was an inside shutter for glare control. In addition, they had two different layers of curtains on the inside—one translucent and one for blacking-out. So, they ended up with six layers.

SL

And you have only three!

CI

Exactly! **(laughs)** But you see the technology is quite old. You can find it in vernacular architecture in the Alps, for instance at old farmhouses. These frequently have so-called “winter glasses”, and they just put these in as is necessary.

SL

I want to talk with you about the question of density in urban design, and the idea of high rise. Does the notion of “green high-rise tower” actually exist, and can a high rise ever be truly green?

CI

They have to be green! In future there will be no modern city without high rise. Many German cities are shrinking as population is in decline; they don't need high rise buildings. But globally, Asian cities are rapidly growing, and we find there they have hundreds, even thousands, of high rise buildings for working and living—just think of Hong Kong. We need high-rise towers on the global scale. So, why shouldn't we develop better high-rise models? The denser city is certainly the better city, but this doesn't depend on high rise. Take, for example, Houston in the U.S., which has high rise but an appalling low overall density. It depends on the whole city scale. Sydney has an extremely low density and is one of the biggest energy consumers per capita. On the opposite side, the city of Copenhagen, which has no high-rise at all, is one of the best cities in terms of energy efficiency. What does this all tell us? It's not about high-rise, but about other elements; for instance the extensive use of the automobile has become a major problem, and it is essential to understand the need for more public transport and mixed-use neighbourhoods. Even in the European context, a single person commuting every morning and evening alone in a car uses more energy than a four-person family in a house. Sustainable urban design depends on the right mix of uses, the right densities, and efficient public transport. We can reduce the energy consumption of a city by combining living and working, and by reducing the distances in between and therefore reducing traffic.

SL

But all buildings you design are large mono-functional “machines”. For instance, the Lufthansa Headquarters is a huge complex—and I know the brief has asked for this. Are there any new mixed-use typologies that are emerging? In this regard, what is, then, the future of Asian cities that are currently experiencing rapid urbanization?

CI

The city needs to be planned in a way that reduces dependence on the automobile. The land use in the city and public transport needs to be intensified. We need to upgrade on all levels, from new bus-based routes, to light rail networks and cycle paths, if we seriously want to enhance mass transit. Of course, it's still very difficult to do a real mixed-use high rise typology. The bigger a single building is, the more difficult and unsafe it becomes. To be honest, the better solution might be to have office high rises and residential towers side-by-side, not mixed in one building. Structure and service-wise it's really difficult to do an environmentally sustainable project for both users. I would like to be realistic, it's not about a single piece of architecture, it's about the city's overall structure and intensification of use.

SL

Barcelona has been looked at as a robust model, where walking is very pleasant and well supported by a memorable public space network. However, Barcelona has about double the population density per square kilometer compared to Sydney. We don't build new cities from scratch. So, what should we do with the existing cities and existing building stock? And what should we do with the suburbs? A lot of new research indicates that compact 4- to 6-storey buildings are more likely to deliver social and environmental sustainability. For instance, Thomas Herzog has noted that if there is a blackout, a 30-storey building is dysfunctional, but a 5-storey building can still be used.

CI

We need to increase the density, compactness, and intensity in the suburbs too, maybe even give some of it back to nature by demolishing inefficient suburbs. The city is about being able to deal with technology on many levels. A smaller grain of decisions and function is much better than large complexes. I agree that we need a clear step towards compactness.

SL

Many planners predict that the suburb is an outdated model and urban sprawl will soon outrun and stop by itself, as no one wants to live in isolated, far-out houses anymore.

CI

This will require a shift in public thinking. At the moment, most of us live in the suburbs, which are still growing into the landscape, consuming precious landscape and agricultural land. But I agree, the ineffectiveness of low-density suburbs makes it an outdated model. Several developers, who used to develop suburbs, are now talking to us about inner-city residential buildings and ways to make their products green. To communicate good green design and to convince the client is not the problem. You can always explain things. The main problem is that the public is not yet really behind it. There is a lot of public desire for sustainable architecture, but I often find that people are not really interested.

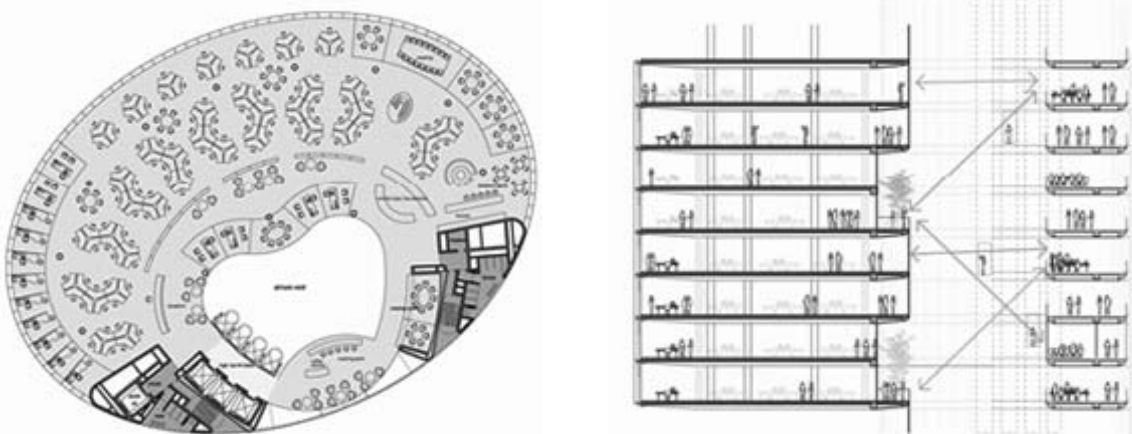
SL

It seems today, a building's sustainability rating correlates to its letability and therefore to its value on the real estate market. I would like to talk about the new tower in Bligh Street, a building hailed as a benchmark building in integrative environmental design and construction in Australia, even before it's completed. It's an elliptical tower, similar to Harry Seidler's cylindrical "Australia Square" tower from 1961, which, in fact, is just next door. How can you ensure it is truly a new generation of green high-rise, without knowing the tenants and their fit-out plans?

CI

The Bligh Street tower—also known as “Space”—will feature a transparent elliptical shape, with 29 storeys and is around 140 metres high. It has a range of progressive environmental design features, including a double skin façade with potential for natural ventilation, an atrium, and a range of energy and water initiatives. Our work is based on innovative and holistic solutions in terms of energy, sun shading, and thermal comfort. The use of regenerative energies and resources, like geothermal energy and rainwater, plays an important role in all our building concepts, and so does the intensive integration of daylight, as well as natural cross-ventilation. With a minimum consumption of energy and resources we aim for the highest degree of user comfort. Our first eco-high rise was the RWE Tower in Essen, 25 years ago, which was all about the building's envelope. Since then, we have done over 40 buildings with dual glass skin façades, and the technology has greatly evolved over this time. The Bligh Street tower will be the first high-rise to receive a 6-Star certificate on the Green Star rating system. This tower will be equipped with a real double-skin façade and will be ventilated by an atrium stretching the whole height of the tower. 50 percent of the ventilation will be provided by the double-skin façade. The building will capture great gap views to Circular Quay, and there is a whole range of things

FIGURE 2-3. “Space”, a new green high rise in Sydney's central business district, under construction (2009–11); architect: Christoph Ingenhoven. Plan and section.



we have introduced that will make the project work well. For instance, the façade will allow us to have a 100 percent shading solution and glare protection, with perforated internally adjustable blinds within the 600mm double-skin cavity. The sun protection is very efficient, while maintaining the views, so we can use non-tinted glass on the outer skin. This makes the building extremely transparent and will offer the user a different experience. The ventilated outer skin is made of clear glass, which will ensure a highly transparent building.

The treatment of water has also been made a priority: There's the on-site black-water treatment of 25,000 litres of sewage and recycling. In addition, we're tapping into the city sewer and will be treating another 75,000 litres a day and using the water for landscape features, such as the green walls in the ground floor plaza, and also for toilet flushing. In addition, there is a gas-fired co-generation plant in the basement, and solar tubes with absorption chillers are used for creating solar cooling. The tri-generation system uses gas and solar energy to generate cooling, heating, and electricity. 500 sqm of roof mounted solar panels will provide energy to directly power the absorption chiller. Solar cooling is a great new technology, invented in Germany. Free heating is provided by in-slab pipe work supplied with the heat that is normally rejected through the cooling towers. A hybrid air conditioning system consists of chilled beam cooling for the façade and a low temperature variable air volume (VAV) system for the central zones. Also in regard to construction methods, we will exceed the standards: The concrete which will be used contains a much higher percentage of recyclable materials than usual, site amenities are solar powered, and 90 percent of the rubble from demolition would be put back into the site.

SL

Interestingly, the tower has a compact single shape. Frei Otto, the pioneer of light building, used to say that the human eye perceives those shapes, which are the product of a successful natural evolution towards the most optimal form, as especially beautiful. You can be quoted by saying that "beauty is the logical consequence of necessity, logic, truthfulness, efficiency, simplicity, and minimalization" (Ingenhoven 2005). It seems to me that the building's

highly refined elliptical shape—a distorted circle in plan—deals well with the diagonal shift that occurs here in the main city grid, the angle of Bligh Street and the curve along Bent Street: In addition, the flattened shape maximizes harbour views from offices inside. I read that the tower's elliptical plan is 12 percent more efficient than a rectangular building in its façade-to-floor area ratio—so it also delivers economic efficiency.

It's interesting what you propose for the ground floor. The office floors are pushed up to provide an open public space on the ground floor, with the tower above. This publicly accessible urban undercroft will make it easier to relate to the street level and surrounding context, and allow more responsible city-making, I suppose.

CI

Exactly. Maximizing the view, while eliminating solar gain. The atrium is hereby another key element of the building and it allows natural light to penetrate deep into the floor plate. Ventilating through the atrium also means that the offices stay noise protected. It creates a social hub for office workers and has balconies that project into the atrium void to provide naturally ventilated break-out spaces, which is important when we think of the next generation workspace. What interests me first and foremost is how people will prefer to work in the next decade and how they envision an optimal work environment. Each floor in this tower will have balconies projecting into the atrium, creating social spaces and opportunities for interaction between tenancies. Sustainability has also a strong social component, and this part is about creating human public spaces and healthy working spaces.

SL

What are the other challenges with this project, for instance, the "unknown" user requirements?

CI

With rental office buildings there is often a disconnect with the end user of the offices, the unspecified tenant that will occupy the building. This has the disadvantage that we cannot communicate with the future users during the design phase, and need to make decisions based on assumptions. We try to

FIGURES 4–8. Images of the new green high rise in Sydney: “Space”, the first 6-star Green Star rated high rise tower, now under construction.



predict future tenant requirements and focus on indoor environmental qualities and energy-efficiency. Of course, the performance of the design is also dependent on the fit-out and how the tenants will operate the building. While the tower has the potential to be fully naturally ventilated, it depends on the final fit-out from the tenant. Much of the cooling will be provided passively, by activating the thermal mass of the concrete slab. If realized to a high standard, our double-glazed façade concept will allow

naturally ventilated floor space for high-rise offices, something that is possible even in extreme climatic conditions, like during summer in Sydney, when the temperature outside can reach 35 degrees Celsius.

SL

Christoph, thank you for the conversation.

Christoph Ingenhoven's web site:
www.ingenhovenundpartner.de