Green giant

Lighthouse tower with low-carbon footprint Dubai, UAE

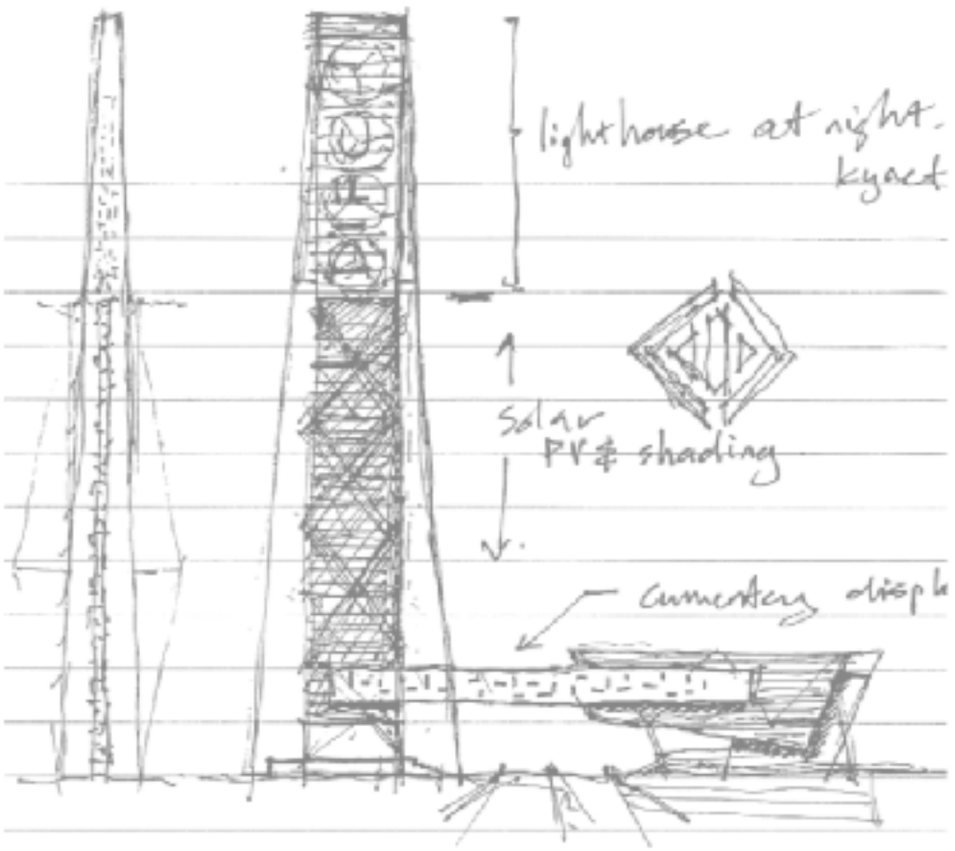
Regional competition **Holcim Awards Bronze 2008 Africa Middle East;**
jury appraisal page 96

Thanks to visionary projects such as the DIFC Lighthouse Tower and recently-implemented strong environmental regulations, the emirate of Dubai is set to be a beacon for sustainable construction. Currently under construction, the elegant skyscraper is expected to more than halve its total energy consumption and reduce water consumption by 35% compared to its peers.

When architect Shaun Killa left his October 2006 meeting with new client, the Dubai International Finance Center (DIFC), he knew he would spend the weekend working. The brief was simple: to design a 90,000 square meter office tower that symbolizes DIFC as the centre for finance between Europe and Asia, to create an iconic beacon in a city that already had many ambitious projects, and that they needed the concept design within the week. In those few days, Shaun Killa came up with a design for a skyscraper which would not only set new standards for Dubai, but create new benchmarks for low energy high-rise buildings within the region and beyond.

Towers, towers, towers

"The idea for the lighthouse came to me the moment I left the meeting," the architect says. In the car, he drew a quick sketch on notepaper. Comparing that design with the



Everything clear – after the first meeting with the clients, Shaun Killa was ready to design their Lighthouse Tower.

On the 63rd floor will be the Visitor's Center – the backdrop to its permanent exhibitions on sustainability will be the impressive view of rotating wind turbines.

final building plans of today is amazing – Shaun Killa had not only recorded his vision for the project, but its final realization. The 39-year-old architect is one of the leading tall building designers in the world. He is responsible for many iconic structures on the Dubai skyline – including the Al Mas, Millennium, 21st Century, and Chelsea Tower. They are all between 250 and 360 meters high, and all are new – no wonder that Shaun Killa has called only Dubai "home" for the past ten years.

Wind turbines on a world stage

Having studied at the University of Cape Town and worked on many large projects in his native South Africa, Shaun Killa left the country in 1998 with the UK as his destination. En route he stopped-over in Dubai to visit a friend. It turned out to be a long stopover. As design director of Atkins Dubai, he is part of one of the largest architectural firms in the world. To date, his most celebrated tall building is not located in Dubai but in the nearby Kingdom of Bahrain.

The Bahrain World Trade Center is the first building in the world with its own integrated wind power station. The twin 240-meter-tall towers are connected by three turbines – each with a diameter of 29 meters – generating some 15 to 25 percent of the complex's energy needs. For the first time, Shaun Killa was able to link his passion for tall towers with his interest in sustainable solutions in a more than visible way. He also demonstrated that a tall building with a low-carbon footprint could generate worldwide attention and set a precedent for future sustainable towers.

Lighthouse for sustainable construction

Interpreting the client's brief as a "lighthouse" sends a strong message about its intent. "The building needs to be visible – both physically in height, and metaphorically as a leader. Its narrow plan creates incredible day lighting – therefore lighthouse – and it is a strong symbol for what the Finance Center stands for," the architect says. "The Lighthouse Tower presents itself as a beacon for sustainable construction in the region. As a prototype, it demonstrates we can consider energy-efficiency at the center of architecture and, without compromising comfort or aesthetics."

According to Shaun Killa, it is usual for individual technical systems to be added after the concept design has been completed, but with the Lighthouse Tower, we reviewed and questioned each element

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as if it were part of an organism to create a truly holistic design where everything works together, interdependently."

The Lighthouse Tower is tall and slim, a geometric shape sculpted by sunlight and wind. The high-tech structure is 400 meters tall comprising of 64 floors – predominantly office space, with the top floor dedicated to a viewing deck and resource centre for sustainable design for the region. The façade is inspired by the traditional mashrabiya screens of the region, the traditional carved lattice shutters which form a decorative screen between inside and outside to protect against the harsh heat and light.

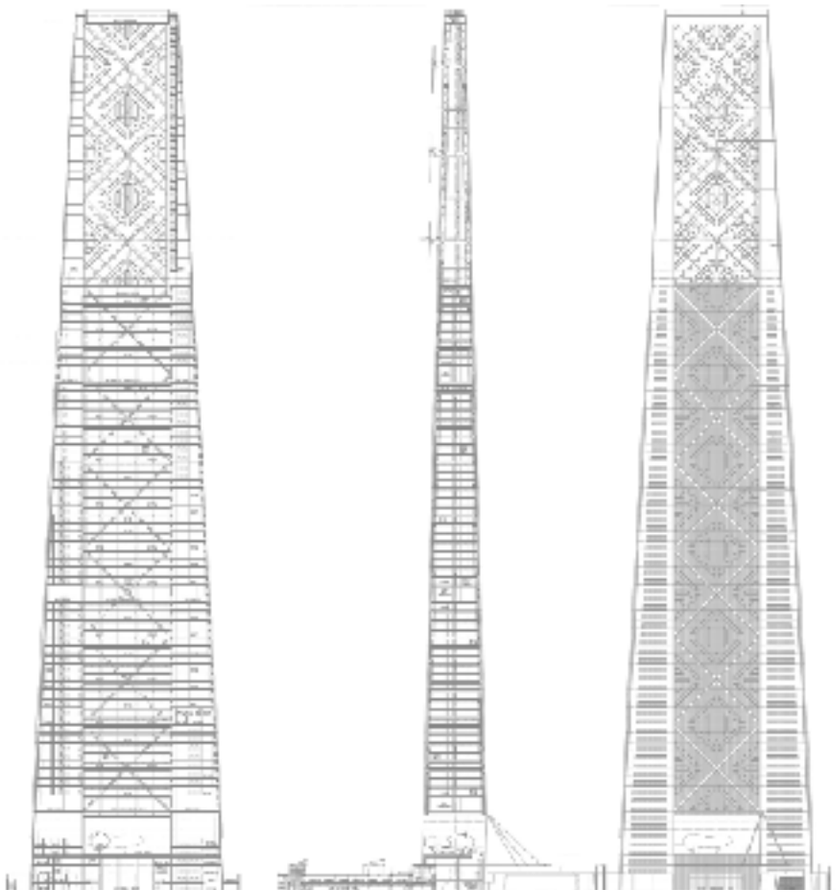
In the case of the Lighthouse Tower, the mashrabiya design is based on repetitions of the DIFC logo creating an elegant pattern that take cognizance of the building's context and the region's past.

Low-carbon, high potential

An expert team was assembled to work on the concept. As well as Atkins' own team, other specialists from around the world were consulted. The plan was for the Lighthouse Tower, among the ten tallest office towers in the world, to be the one with the smallest environmental footprint.

Hundreds of assessments were undertaken, numerous ideas considered, discounted or adopted. Hong Kong Polytechnic worked on the air-cooling system, the Welsh School of Architecture developed concepts for air-quality and the façade energy modeling. The numbers are impressive – the context-responsive design optimizes passive cooling and lighting with projected savings of 65% in total energy consumption and 35% in water consumption compared to Dubai standard practices. Another accolade is

Once complete, the DIFC Lighthouse Tower will be one of the ten tallest buildings in the world.



that the Lighthouse is to be the tallest building in the world to receive LEED Platinum status, the highest rating in the Green Building Council program. Harnessing wind energy, as he had done in Bahrain, is a major element of Shaun Killa's low-carbon concept. Three horizontal axis turbines, each 29 meters in diameter, are being considered for the upper portion of the tower.

"In Dubai, the wind is a fairly constant," he says. The turbines are aligned to catch the breezes that blow in from the north-westerly onshore sea breeze, producing between 700 and 900 megawatt hours of energy, some 6% of the building's energy needs. Another 3-4% is produced by the 6,000 photovoltaic units in the façade's spandrel panels. The project successfully demonstrates how renewable energy

No compromise was needed between comfort and aesthetics.

systems can be incorporated into architectural design.

Don't reinvent the wheel!

The commitment to energy- and water-efficiency in the Lighthouse Tower can be found in many of the project details. The intelligent design includes 16 double-decker regenerative breaking elevators where their descending motion produces 30% of the energy required for a simultaneous ascending elevator. Ventilation systems recover heat and cooling. Sensors ensure lighting is only used when required though motion and solar sensors. The less artificial light, the less heat build-up and by including chilled ceilings, the Lighthouse Tower also reduces its cooling load by more than 45%. The most energy-efficient mechanical systems are used – whether variable motors and pumps or CO_2-demand-driven ventilators for car parking. Building control systems, where every device has an IP address, are all monitored in symphony to reduce the energy consumption of each element of the building.

Water consumption is minimized with the use of efficient fittings and appliances. "Often we install systems in our offices to test manufacturers' claims before using them in our projects," Shaun Killa explains. "We don't need to reinvent the wheel – most of these devices are available on the market however they are simply not well known." The building is specified to have waterless urinals, dual flush toilets, flow restrictors on taps, grey water recycling, condensate collection from chilling units – to name a few of the water-saving measures.

Rethink in the Emirates

Most of these decisions came a long time after that first presentation of the light-house sketches. Shaun Killa remembers explaining his sustainable ideas to the clients, their excitement and immediate acceptance of the concept – "they understood the enormous potential of this project as being a leading example of more sustainable buildings within the

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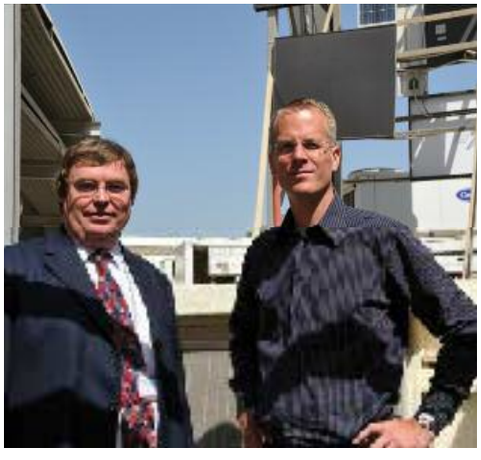
At the Dubai International Finance Center the foundations of the Lighthouse Tower are being dug.

region." In Dubai, embracing energy efficiency and renewable energy is only a recent development. The emirate's energy needs continue to grow by 15% each year. The UAE's per capita CO_2 emissions are second only to Qatar's. This is acknowledged by government authorities who last year introduced tough environmental regulations for all new buildings. Two years ago, the Emirates Green Building Council was established and Richard Smith, technical director at Atkins, is its vice-president.



Technical director, Richard Smith (left), and design director, Shaun Killa, of Atkins Dubai.

The fact that Dubai is eager to position itself as a regional pioneer in sustainable construction is in no small part due to its friendly rivalry with Abu Dhabi. In the capital of the UAE, the Norman Foster-designed Masdar is being built – pitched as the first CO_2-neutral city in the world. Meanwhile, Dubai is building a metro – in cooperation with Atkins – to address the challenging public transport problems in the city. "The Lighthouse Tower came at just the right time," Shaun Killa believes, "we are at the threshold of change and have hopefully helped to guide the way to a more sustainable urban environment."

Sustainable investment

Yet an industry as successful as the building industry in Dubai needs time to change. As always the biggest challenge is commercial. "We must prove that sustainability pays." DIFC Lighthouse Tower rises to this challenge. The total extra cost for all sustainability initiatives, including the integrated renewables is recouped in less than eight years. The experience of Bahrain shows that tenants are prepared to pay a premium to rent space in a tower with a sustainability focus. "They are attracted by the building's green image, and these greater returns readily surpass the additional capital expenditure for environmental measures."

An experiment guaranteed to function

The Lighthouse Tower completes its sustainability credentials with social criteria. Outdoor spaces will be landscaped

A test-run on the roof

WS Atkins PLC is a multinational engineering and design consultancy. Established by Sir William Atkins in 1938, it is the largest multidisciplinary consulting firm in Europe and one of the largest design companies in the world. Atkins not only builds sustainably, but conducts sustainable design research – for example, in Dubai. On the roof of its office are banks of solar cells. "We lack a lot of data about solar cell performance in Middle Eastern conditions," Atkins' design director Shaun Killa (pictured left) explains. "We can't go to our clients and say: these solar cells cost X million, when we don't know how much energy they will finally produce in this climate." As a result, the firm tests the operation of various manufacturers' products, under various conditions.

Questions are asked, data is collected: for example, does a vertical panel produce more energy than a horizontal one that is cleaned every six months? "We've put together this knowledge, and even managed to discount some myths in the meantime – such as, under certain conditions, solar cells on a northern façade can produce more energy than on a southern façade." Atkins pitches itself as a firm which delivers workable solutions for a carbon critical economy – even the roof of the Dubai office is involved in their quest.

"Planet, Project, People – for me, that means architecture in the 21st century." **Shaun Killa (pictured above)**

as public parkland. Shady trees will ensure the spaces are comfortable to use for far more of the year than is normal for Dubai.

Lighthouse Tower will also educate people about sustainability. The Visitor's Center on the 64th floor will house permanent exhibitions on sustainability themes, and an observation deck on the roof –at a height equivalent to the 94rd floor. The project has the potential to redefine how tall towers should be built in the future. "As an example of sustainable construction, it is a highly technical innovative solution that will be a resounding success."

Setting the standard

Despite concerns about the impact of the global financial crisis on this project, Shaun Killa remains optimistic. Foundations are being dug and the piling is almost complete. Construction is set for the next two and a half years. "A lot can happen in that time," he says. "In Bahrain, the first six floors were built before we got the go-ahead for the turbines."

The Lighthouse Tower is a beacon for sustainable construction. "There is nothing like it, anywhere in the world. We have integrated so many different sustainability measures into a single project – it will set the standard for years to come."

For the past 80 or so years, skyscrapers have been built in more or less the same way. Now change has come, and radically. "Planet, Project, People – for me, that means architecture in the 21st century."

The team examined the efficiency of solar cells under different conditions.