SUSTAINABILITY BEYOND LEED: INTEGRATING PERFORMATIVE DELIGHT IN THE BUILT ENVIRONMENT

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LEED (Leadership in Energy and Environmental Design) and similar benchmarking systems have become a standard method for evaluating sustainability in buildings over the last 10 years. Simultaneously, sustainable design has become standard practice in many countries. Meanwhile, the U.S. Energy Information Administration continues to report that buildings are responsible for almost 50% (46.9%) of American CO2 emissions. In addition to energy-related issues, there are many other aspects, such as a healthy environment and other aspects of indoor environmental quality, which are of relevance for a "truly sustainable" building. After more than a decade of considering sustainability in building design, it is appropriate to evaluate the results and—if necessary—reconsider or recalibrate the existing rating systems.

In the western world, buildings consume and pollute significantly more than the entire transportation sector. It is clear that our buildings consume far more energy than they need, and it is our responsibility to contribute to a reduction of this imbalance. However, simply building an energy-efficient building does not make it sustainable. We must consider many other factors, such as the embodied energy in the building, the comfort of occupants and the lifespan of the building.

All of these factors are connected. A sustainable building must be a place people want to be, which is shaped by key factors such as human comfort, health, and the strong aesthetic architectural feel of the place. In creating such a desirable space, the lifespan of the building increases, and the impact of the embodied energy decreases. The amount of energy spent to create the products used in the construction of the building can range

from 10% to 25% of what is required for building operation, depending primarily on it's lifetime and excluding the further impact of the resource extraction associated with building products. Buildings and their poor design are key contributors to carbon emissions and must be addressed.

This reality has led the European Union to require that all buildings built after 2020 must achieve net zero energy, while the entire building sector must reduce carbon emissions by 90% by 2050. Unfortunately, we have designed only a handful of buildings that achieve carbon neutrality, especially in a dense urban context. We currently lack the skills, technology and incentive to do this effectively. Meeting this mandate requires significant changes to the accepted norm and incredible innovation. The level of innovation required suggests more than incremental improvements to current practice. The Flatiron Building in New York was one of the first steel high-rise structures, but it looks like a masonry building. It took architects several decades to explore the design potential and opportunities of steel structure. This is comparable to our current status of sustainability, leading to the clear question: how will we get there? Many standards have been proposed by both government and non-governmental agencies to evaluate and incentivize sustainable buildings. LEED is by far the most recognized and pervasive example. However, if we continue down the path of equating sustainable design with only a LEED score, then sustainable design is destined to become a short-lived early 21st century phenomenon. In order to truly succeed, sustainability has to trigger massive innovation.

Looking at LEED, we recognize that it is essentially a prescriptive system based on current construction practices. In simplified terms, LEED is a system in which a list of sustainable features is provided to a building designer and the features that the building fulfills are checked off, the more features that are incorporated, the higher the overall rating. This approach doesn't truly challenge standard construction methods, nor is it an absolute metric for sustainability. A prescriptive approach is inherently based on the current state of building design and therefore only creates incentives for marginal improvements. For example, the LEED system implies that fly-ash in concrete is good because it reduces the carbon footprint of the concrete (embodied energy) through the use of recycled material. It does not, however, establish a goal for reducing embodied energy in general. Such a goal would encourage architects and engineers to rethink the building structure beyond using recycled material. There are many more examples like this, which lead to the ultimate conclusion that prescriptive tools such as LEED do not boost innovation.

Manitoba Hydro Place designed by KPMB.
Image courtesy of Gerry Kopelew.

LEED has created momentum for sustainable design. The system has been incredibly successful and has led to the improvement of thousands of buildings. The LEED checklist is providing guidance for a sustainable building design, with the drawback that it does not boost innova-

French School—Lycée Charles de Gaulle, Damascus, Syria, designed by Ateliers Lion, Paris (Design Architect), Dagher, Hanna & Partners architects sarl, Beirut (Architect of Record), Barbanel Liban S.A. Antélias, Beirut (MEP), GEC Ingénierie, Paris (Civil Engineering); and Transsolar, Stuttgart (ClimateEngineering). Image courtesy of Adria Goula.

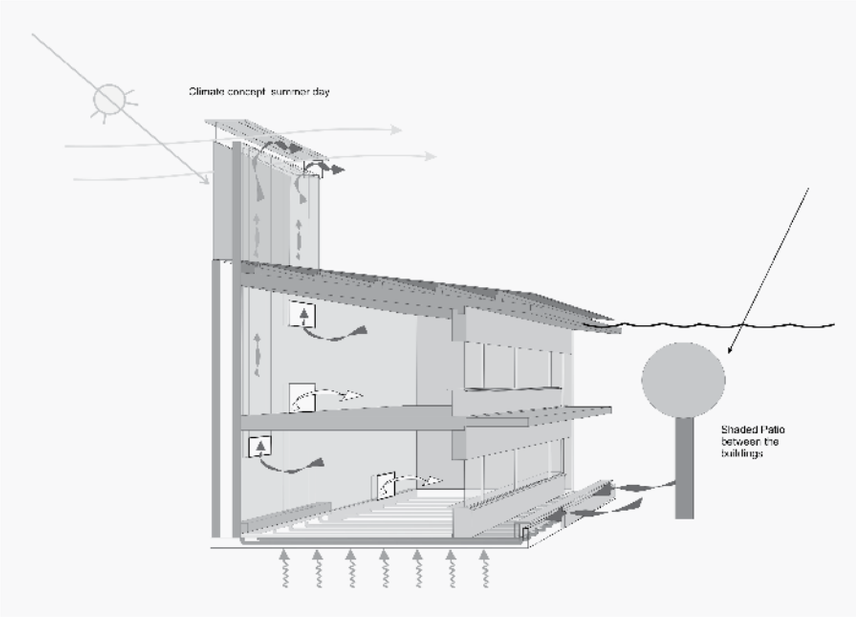
tion beyond current practices, nor can it ever include "design excellence," which is essential for the lifetime of a building. This raises the question of whether LEED can potentially be improved in order to avoid or minimize these disadvantages.

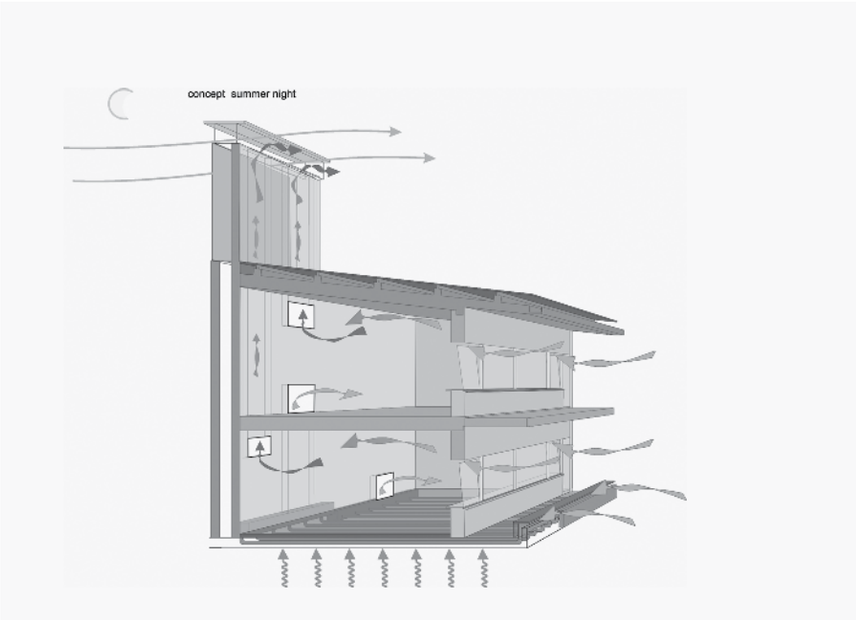
WHAT'S HOLDING LEED BACK?

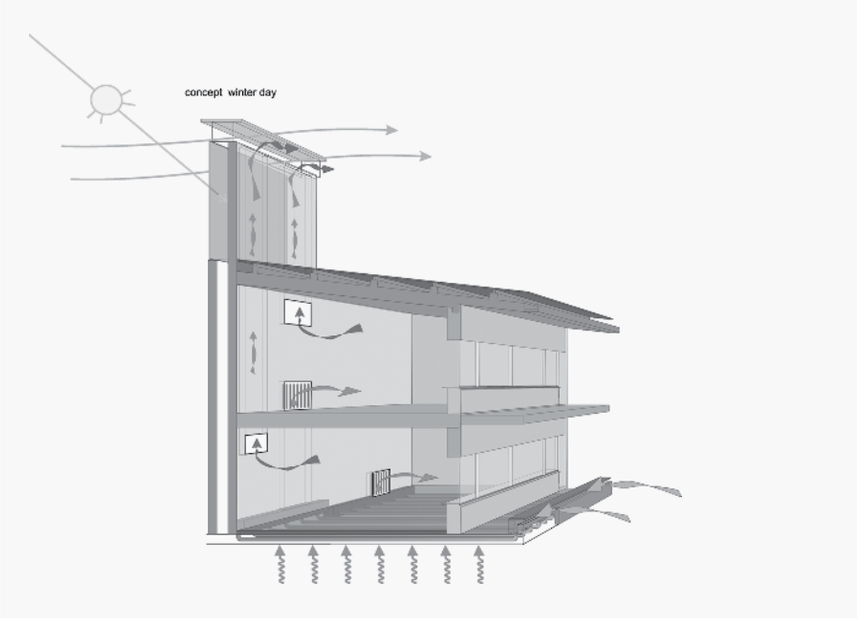
No building certification has developed as much recognition or momentum in the last ten years as LEED. The straightforward checklist, which allows not only architects, but also developers, clients and the public to quickly understand and demand certain features, has undoubtedly played a key role in its quick diffusion. This has led to a broad acceptance and a greater-than-market-average growth in LEED certified buildings. Even during economic recession, the number of certified buildings and spaces has continued to grow by over 50% per year, showing the confidence that clients and developers have in the program. This branding has also led to recognition worldwide of LEED and what it stands for: green buildings and a greener world. This is unquestionably a great story of success.

Unfortunately, LEED is not the silver bullet for energy-efficient sustainable buildings. Despite the incredible growth, the energy improvements of certified buildings are under question. A paper by Newsham, Mancini and Birt[1] examines in depth whether LEED buildings actually perform better than non-certified buildings. While it appeared that some do, it also became clear that at least 25% of the buildings studied were less efficient than their non-certified counterparts. No correlation was found between the number of LEED energy points and the overall performance of the building. Nor was there strong statistical evidence to show anything more than an average 10% improvement on the current norm. Consequently, in the last ten years, LEED's exponential growth, the actual progress of the North American building industry in sustainability has been relatively small. According to statistics from the Green Building Market and Impact Report, a total of 8 million tons of CO2 savings per year are achieved due to LEED buildings. This is equal to less than 0.003% of the total building contribution to CO2 annually in the U.S. This "improvement" in efficiency is far too small to address the challenges

1 Newsham, G. R.; Mancini, S.; Birt, B, Do LEED-certified buildings save energy? Yes, but …published in *Energy and Buildings*, 41, (8), pp. 897-905, DOI: 10.1016/j.enbuild.2009.03.014 or in the Internet: http://www.nrc-cnrc.gc.ca/obj/irc/doc/pubs/nrcc51142.pdf.







ahead. Yet LEED is still recognized as the best available standard for green building certification. This paper is only one of many studies with varied conclusions on the effectiveness of LEED, which, in sum, lead us to ask why the massive popularity of LEED is not translating into more meaningful performance improvements.

The largest factor for the underperformance of LEED seems to be the checklist nature of the standard versus setting measurable performance goals. In essence, by modeling the energy consumption during the design process, LEED buildings are not required to prove that the buildings meet the goals post-construction. Yet all buildings come with people, and people are unpredictable. If the building does not consider how people will act in a space and how the space can adapt to their needs, the actual energy costs can greatly exceed the modeled assumptions.

Another drawback of the system is that it is not as climate-specific as it should be. Although climate-specific energy modeling is required to achieve LEED standards, rarely is this modeling done until after the design development stage. Consequently, climate is rarely considered in the early design process. When you consider how different traditional houses in Boston are from those built in New Mexico, it seems ludicrous that we now aim to design buildings in exactly the same way for both climates. We need to be developing the practice of understanding how we can shape buildings in order to use the local wind conditions for natural ventilation, or to optimize the use of daylight, or how we can orient and shape the building to take advantage of the sun and minimize cooling demand. We should use daily humidity and temperature swings (when they exist) to help determine our overall cooling and heating strategies. This is just the surface of climate-responsive design, which provides the potential to minimize energy consumption by maximizing the quality of the built environment at the same time. It will be impossible to get to the "Massive Change"[2] necessary by expecting people to suffer. How can one prescriptive program account for the different climates and cultures that exist in the USA, let alone in the world?

(above) Manitoba Hydro Place, Winnipeg, designed by KPMB.

(left) In the French school in Damascus the aim was to avoid any mechanical cooling and ventilation within a hot desert climate. During daytime solar chimneys draw outside intake air naturally from irrigated and shaded courtyards through miniature earthducts into the individual classrooms. During nighttime the thermal mass of the chimney releases heat stored during the day and continues to draw air through the now open windows and the earthducts. Cool night air flushes the classrooms, cooling down the thermal mass and providing radiant comfort for the following day.

One of the natures of metric-based systems such as LEED is that they incentivize only quantifiable components. As long as it is measurable, such systems perform their tasks admirably, allowing the authorities to weigh the key components more heavily. Yet there are aspects that are too difficult to measure that are key elements to sustainable buildings such as comfort, beauty and happiness. Certifications can be dangerous because of the temptation to chase credits as the budget tightens, the pressure increases just to meet the standard, and results in simply capturing the "low-hanging fruit." By focusing only on the metrics, we lose the bigger picture, reduce our creativity and forget to exercise the innovation that makes us unique.

A less prescriptive system based solely on measurable performance goals would naturally be much more complex. Would a complex system be as successful as a more simple, prescriptive system? The USGBC recognized all these issues and integrated many more performance-based metrics in the current draft of LEED 2012 than in previous LEED systems versions. The second public review period for this draft has just ended.

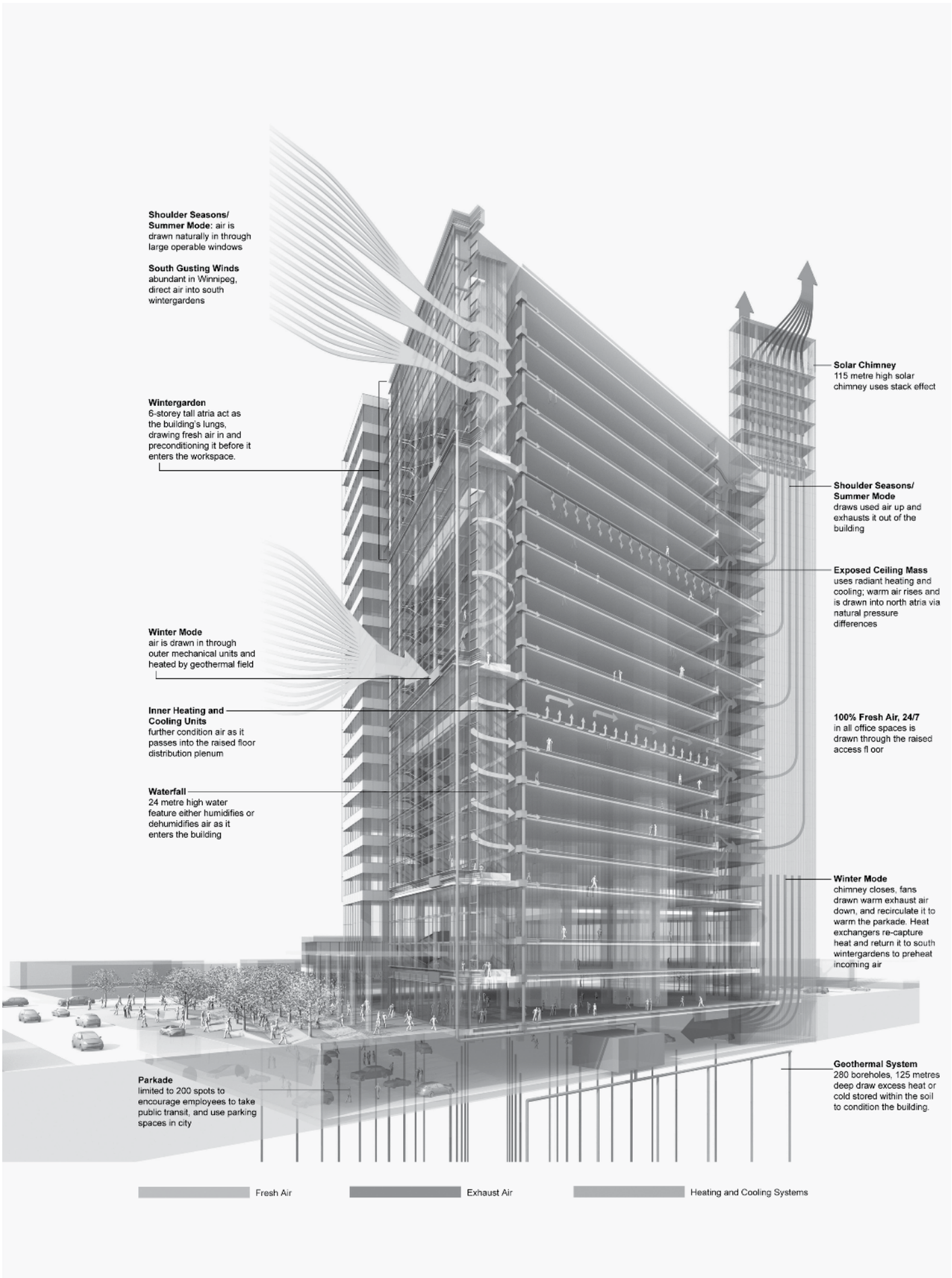
The new draft includes new categories for "Integrative Process" and "Performance" that require tighter owner engagement and formalize the requirement for reporting energy use back to the USGBC (previously added ad-hoc to the existing rating system). Material performance goals are based on a Life-Cycle-Assessment (LCA). Many of the common criticisms of LEED are addressed, representing a major and brave step forward.

There is no doubt that the metrics considered by LEED are valuable; however, they are not all-inclusive and do not recognize the intangibles of integrative thought that are essential in sustainable building design. A building must be designed in a holistic and integrative manner that recognizes interactions between the different key components of a building such as the local environment, the cultural context, the climate, the aesthetic architectural qualities and the possible synergies for energy, air and water inside and outside the building. Ignoring the intangibles and the synergies, we design buildings that are insensitive to the climate and perform below their potential. We create buildings that are fragmented. We know that buildings can be more than the sum of their parts, providing comfort, inspiring happiness, and reducing their environmental impact far beyond the current levels of LEED. The question is whether a generic rating system can ensure a good building. We must recognize that LEED and other rating systems cannot replace a smart, passionate design team!

When setting up a framework for the design process of Manitoba Hydro Place[3], the design team—which included the client—sought to identify what would be needed for the building to be a truly sustainable building. Very early in the process, the client decided that they liked the

2 Bruce Mau with Jennifer Leonard and the Institute without Boundaries, © 2004 Phaidon Press Limited (ISBN 0 7148 4401 2).

3 Manitoba Hydro Place, Winnipeg, designed by KPMB, Toronto (Design Architect), Smith Carter, Winnipeg (Architect of Record), Prairie Architects Inc, Winnipeg (Advocate Architect), Crosier Kilgour, Winnipeg and Yolles, Toronto (Structural Engineer), Earthtech, Calgary/Edmonton (MEP), PCL (Construction Manager); Transsolar, Stuttgart (Climate Engineer).



Airflow diagram of Manitoba Hydro Place. Courtesy of Bryan Christie Design.

components of the LEED system but wanted to go beyond those requirements. For this reason, we set the goal of energy performance 60% better than required by the local energy code (MNECB: Model National Energy Code for Buildings). An office space would consume less than 100 kWh/m² per year (32 kBtu/sf) compared to the current best practice of 260 kWh/m² (83 kBtu/sf) and the current norm of 495 kWh/m² (157 kBtu/sf). The design team developed a charter which identified five primary goals for the building design, which included a healthy and inspiring workplace environment, energy efficiency, LEED, signature architecture and, of course, economics. The client and all team members signed this charter.

The climate in Winnipeg includes temperatures reaching -35°C (-31°F) in winter and up to +35°C (95°F), plus high humidity in summer. About 40% of the year, temperatures are below freezing, but Winnipeg also has more solar radiation than Milan, especially in wintertime. Studies showed that Winnipeg is the ideal climate for passive solar design. This climate, as well as other aspects such as daylight and natural ventilation, were an integral part in the development of the building shape. There was no pre-determined building form, no napkin sketch—the shape is a result of the integrated design process, considering all aspects in a holistic way (without a dogmatic focus on energy efficiency, either).

The building has been very successful and exceeded expectations:

- the measured energy consumption is about 65% below MNECB
- the building reached the predicted energy goals after two years of an extended commissioning and monitoring phase
- the building operates almost 40% of the time in natural ventilation mode
- staff absenteeism, headache complaints and similar issues are reduced since Manitoba Hydro relocated from their previous facilities
- occupants praise the exceptional air quality and daylight

As architects and engineers, we have to strive to design every project in such an integrated manner and achieve exceptional results, no matter the climate, program, budget or other constraints.

CONCLUSION

In conclusion, we recognize two different major challenges: first, greening the majority of new and existing buildings, and second, creating innovative buildings that become eye-openers and examples for future innovation. LEED provides invaluable support for the first category, whereas the second category can only be achieved by reconsidering the design process. In their roles as advocates, designers must convince their clients of an integrated design approach based on mutually agreed design goals—where LEED and other certification are one of several goals. Manitoba Hydro is a great building, but could be questionable if moved to another location. Thus, it is not the building which can be copied, but the process.

The integration of sustainability into architectural design is still in its infancy. Despite our complaints about the prescriptive nature of systems such as LEED, we need to admire the momentum created by LEED and other standards. We also have to see and admire that LEED has improved thousands of buildings and therefore has helped to create better environ-

ments for people. However, rating systems for sustainability such as LEED can only evaluate what is measurable and must be based on the current state-of-the-art building design. Therefore the system itself cannot encourage architects and engineers to rethink building design in a way that would lead to the massive change necessary. Architects and engineers are advocates for the client and in this role, it is our responsibility to inform clients in a way that triggers this level of change. Clients are concerned about the potential risk of innovation, but the need for change means there is now bigger risk in building an unsustainable 20th century dinosaur.

Meanwhile, sustainability provides an incredible opportunity for building design. Suddenly there is a "new" design challenge that is independent of the type or style of the building, but is entirely content-driven. We must reject the clichés of "form finding" such as "form follows function" or vice versa. Form development requires an open-minded process with multidisciplinary support.

The European Union established the goal that all buildings, old and new, have to be nearly carbon-neutral by 2050. Both this and other considerations, such as mobility and climate change, will significantly change the appearance and aesthetics of our buildings and cities faster than ever before. Architects must adopt this challenge; otherwise, architects will be left behind and further reduce their already very low market share. Solutions have to be an integral part of building and urban design in order to be successful—environmentally and aesthetically, but also socially. The required level of change and innovation can only be convincing if it provides a better environment.

> *At its core, integrative thinking is an art, not a formula or algorithm that can be followed routinely from start to finish.*
> *—Roger Martin*