# Unexpected New Directions for the Future of Green Building

Eric Schiff:

Okay, let's begin. Welcome to this research and technology forum, the Syracuse Center of Excellence and Environmental and Energy Systems. I'm Eric Schiff, interim executive director of the Center. Today we're very pleased to have a presentation and discussion with Ian Shapiro and Nina Sharifi. Our occasion is the publication of the second edition of the book Green Building Illustrated which Ian created with Francis Ching, whom I believe is in the audience today.

Eric Schiff:

Ian was educated as a mechanical engineer at McGill University in Montreal and then Columbia University in New York. He worked at Carrier Corporation for several years, specializing in heat pumps, which is one of the topics he'll be addressing today. In 1989, he left Carrier and founded a company, Taitem Engineering. In case any of our listeners don't know the story, Taitem is an acronym for Technology As If The Earth Mattered. The company has thrived and passed into its fourth decade recently. Their portfolio of projects is remarkable in its breadth and also in its support for sustainable and healthy buildings. Somehow, Ian has also found time to teach and to write several well-regarded books, in particular the two editions of Green Building Illustrated and a monograph on energy audits and improvements in commercial buildings. If we were together in an auditorium today, there'd be a table in the back where I'd insist that you purchase a book and then get Ian to sign it. So now I'll just encourage you to purchase a copy online if you haven't done it already, and then try to get him to sign it in post-pandemic times.

Eric Schiff:

Ian's partner in today's forum is Nina Sharifi, a professor in Syracuse University School of Architecture. Nina's background includes degrees from Rensselaer Polytechnic Institute, and University of Texas, and a previous faculty appointment at RPI. In addition to her teaching, her work involves the development of reconfigurable environmental systems and renewable materials for buildings, as well as simulation and visualization tools for architects and inventors.

Eric Schiff:

So welcome, Ian and Nina, to our forum, and I'll now pass the electronic baton to our presenters.

Nina Sharifi:

Thank you, Eric, for that kind introduction. I want to also extend a warm welcome to all of the attendees. We talked about this being a bit of a less formal, less rigid kind of conversation than the typical CoE events, as we imagine that many of you are probably participating from your homes, with all of the attendant distractions therein and because it is a more casual conversation, we had talked about it and I think mutually agreed, and this was started by Ian, that we would welcome and encourage hard questions towards the end. So as we wrap up, I think there's a level of camaraderie in the presence of colleagues and a certain implicit trust that we should challenge each other in order to improve and I agree. So I think difficult questions as we wrap up and start to take questions from you all I think would be appreciated. So with that, I suppose we'll begin.

Nina Sharifi:

So first of all, Ian, you've worked on this project with Francis Ching, who is, myself and any of the architects that I know, this is a person whose name has appeared on our bookshelves and who is quite

iconic to us. So you've worked together now quite a bit, so can I ask how the two of you met and came to work together on this project?

Ian Shapiro:

Sure, sure. Thank you, Nina, for hosting this. I'm very excited to be working with Nina on a research project of hers as well, and thank you to Syracuse CoE for hosting this.

Ian Shapiro:

So it's kind of a long story. It goes back quite a few years. I'm not an architect, I'm a mechanical engineering and in high school I took a class in technical drawing and it's like a vocational training class. I enjoyed it so much and I would come out of class feeling so calm. It was something transcendental about drawing. We were doing purely technical drawing and engineering drawing but all in pencil. I loved to draw and then I went to engineering school. We again, still not computer graphics so it was pencil drawing. Then I chanced in a used book store, I'll show you, I chanced on a book. These are the two editions of Green Building Illustrated over six years. But I chanced on a used book by Frank Ching. It was either The Word bookstore in Montreal, because I studied in Canada as I was finishing college, because it was the Strand Bookstore in Manhattan.

Ian Shapiro:

So I came across this book and I picked it up and Frank had written it just a few years before and it was in fact a collection of teaching notes that he turned into a book and I was entranced by this book. It was so beautiful and I used it to teach myself some more sketching and what I loved about it was the clarity and there were these simple instructions. Like when you have two lines that meet, make sure that they meet well, that you don't leave a little space between them. There were ways of turning your pencil to get sharp lines and there was advice about how to show people in architectural renderings, with advice that people should be in relaxed poses because if people are relaxed in the drawings, then the viewer will be relaxed. This book was just transformational for me. I loved this book. So we're talking early 1980s.

Ian Shapiro:

Time goes by. I work in Syracuse for Carrier. I started Taitem when our oldest daughter was born, and then in 2004, someone told me that they were looking at Cornell in the Architecture School for somebody to fill in, to teach environmental controls and green buildings, and LEED had just started and we were already doing LEED work. So I applied for this adjunct position and taught a course. Then that kind of helped me to come with clarity with some ideas about ... my thoughts about green building design.

Ian Shapiro:

I started outlining this book and over a few years, I started drafting the book. When the time came to publish the book, I had no idea whatsoever how to publish a book, so I was asking around and somebody said, "You know, this really needs to be illustrated," and I sat on a weekend thinking to myself, "How do I find an illustrator?" I'm not a good enough illustrator. "What kind of drawings would I like?" I said, "Well, the kind of drawings I would like are the ones that I saw years before in Frank Ching's book." I said, "Well, I wonder where Frank Chin is," so I googled him. We had Google already, and I found Frank had just retired from University of Washington. At that juncture, I found that in the intervening years, he had authored a remarkable series of books, remarkable. I looked through his

books, and the more I looked, the more I realized that my early impressions were right on. Frank is just a remarkable illustrator, but beyond that he's a remarkable writer and is able to convey ideas so creatively, so creatively.

Ian Shapiro:

So architects know of Frank but I'm very excited for people in my field, engineers, energy consultants, policy people who are now working in green buildings and in climate change to become familiar with his work because I think we can all learn from them. Books like Building Construction Illustrated, which had details on construction. Visual Dictionary of Architecture which has thousands, thousands of architectural details and definitions, and many, many more books.

Ian Shapiro:

That's the story of, and it was a weekend back in maybe 2012. I found Frank had retired, his email address was there, and I reached out to him and he very graciously said that his editor had been thinking about trying to do a book on green buildings and so I was in the right place at the right time and he was responsive and supportive and that's the genesis of the book.

Ian Shapiro:

We wrote the first book in 2014. It's been translated into Chinese and Korean, Spanish as many of Frank's books have been translated. The field is changing so fast, even in the last six years. We are now seeing net zero buildings widespread. We're seeing the cost of solar has come down. We're seeing the emergence of heat pumps. LED lighting. There's so many changes so fast that we thought the time was already right for a second edition. That's how it came to be.

Ian Shapiro:

Oh, I think I had a ... there's a sketch, almost 40 years old. That's the house I grew up in, from Frank's books and the things I learned. It's crude, but this is how far back I go in my relationship with Frank's work.

Nina Sharifi:

It's really wonderful and honestly, Ian, it's a great story but I couldn't agree more. There's an accessibility and a clarity to his drawings and annotations that is so important and really fundamental in what teach young aspiring architects that has to be conveyed to the client, right, and to others to convince and I still have those books on my bookshelf and I know many others who do and we still refer to them so I think that kind of enduring relevance is a testament to the work.

Ian Shapiro:

Do you have a favorite, Nina, yourself?

Nina Sharifi:

Don't ask me to pick. I enjoy them. That's the other thing. You enjoy looking through books like this. They're not ... again, they lend a kind of clarity to the way you communicate a drawing and the way that you communicate an idea that can apply across different kinds of work and so I think, yeah, they continue to be relevant even as we move into almost a completely digital age. I don't even know if all

schools still really even teach hand drawing. I know we do at Syracuse, but I don't know if all schools even teach hand drawing anymore to new students.

Ian Shapiro:

For anyone who misses hand drawings, I can recommend his blog. He has a wonderful blog called Seeing, Drawing and Thinking and he is doing urban sketching, sketches of buildings in the Seattle area but also overseas. You can see these wonderful hand sketches. Our book was digitally produced. It was digital drawings and still remarkably clear.

Nina Sharifi:

Mm-hmm (affirmative).

Ian Shapiro:

Did you say you don't teach hand drawing anywhere?

Nina Sharifi:

I think we do, but I know that there are universities that have ceased to do so and I think the way in which those lessons are learned, especially as students are first coming into architecture school, is really critical to the way that they learn how to think.

Nina Sharifi:

So I want to move on a little bit into the discussion in green buildings and there has been, I think, in green building discourse a focus and I would say a good deal even of controversy about how we heat and cool buildings, and it's really become a topic that is seen more frequently now, I think, than ever before and it's one that you address in your book and so I want to move a little bit into that topic and maybe talk for a few minutes about heating systems. So this question of will central heating systems be replaced ultimately by having heat pumps in every room, so I wonder if you might talk about that a little bit?

Ian Shapiro:

Well, the current trend is just ... the consensus is unanimous that we need to stop using fossil fuels to heat our buildings and in the original book six years ago, we were still talking about condensing boilers and condensing furnaces. In the new addition, we talk about fossil fuels strictly in an historical context. So high performance new buildings, green buildings, are almost universally already some form of heat pump. To give it context, try and share my screen again. Still getting used to all of these controls. The new edition has some case studies, most of which are ... I think maybe all of which are heat pumps. Maybe one district heating bio fuel. Some of you may recognize top left is Alfandre Architecture's office. That's Rick Alfandre who's been very active in the Upstate Green Building Council.

Ian Shapiro:

So the question becomes we're getting rid of fossil fuels, and what form will the heat pumps take and heat pumps come in different shapes and sizes. So here's a graphic from the book and at the bottom we show different types of heat pumps from most efficient at the top, which are ground source heat pumps, and then moving through mini-split, multi-split. Those are air source heat pumps. Then larger, we call them VRF, variable refrigerant flow heat pumps. Rooftop heat pumps, and then at the highest

energy use currently, are what we call package terminal heat pumps which were developed in upstate heat pumps. And heat pumps and Carrier and so many other companies in central New York and all over Syracuse have played a critical role in development of heat pump technology.

Ian Shapiro:

Across the top we have different building types from single family, multifamily/hotel, often multistory but not always. Single story commercial, that's our common retail, and then multistory commercial, and we think to a high rise office building. We see that different heat pumps can be used in different building types with some challenges.

Ian Shapiro:

Ground source heat pumps, you need access to wells, so to do a ground source heat pump in a dense urban setting, lets say in Manhattan, it's probably not going to happen. Then we go to the next on the list, the small minis and multis which are so efficient. We can't really rely on those for a high rise building, so then we go to an air source VRF heat pumps and there's a question of trying to find the heat pump for the right application. There is an important emergence of small, room by room heat pumps and they take different shapes and sizes. One of them is the package terminal heat pump so you will recognize this as the one that's below the window in a motel or a hotel. Well, these devices are not that efficient today. They have a reputation of being noisy, because you can hear the compressor, and they have a reputation for introducing air leakage into the building so there's all kinds of issues around them. So currently, I don't recommend them and they don't operate in cold climates.

Ian Shapiro:

But things are changing fast and there is one small manufacturer with support from NYSERDA in New York State that's working on a cold climate heat pump. Well, if that thing succeeds, we will be able to slash the construction cost of heat pumps in half, easily. Retrofits will be much, much easier and retrofits in buildings that already have PTAC heat pumps, many multifamily buildings in New York City, many hotels around the country, can be readily retrofitted and people are queuing off this and we're starting to see variations on this.

Ian Shapiro:

There's currently in development, there's room air conditioners, window air conditioners, that are heat pumps that could well be cold climate. There's an Italian heat pump we're testing in our office. It's wall hung and you cut two holes through the wall, so the entire device is indoors. Cut two holes through the wall and you're able to serve the outdoor heat exchanger that way. We're seeing work happening, and I am positive that from a point of view of comfort, control, room by room control, construction costs, that this might be the wave of the future which is just a room by room appliance. Something you could indeed pick up at Lowe's or Home Depot and don't need a mechanic to connect refrigerant lines.

Ian Shapiro:

So my question for you, Nina, is how does that work architecturally? I think this is going to happen, but I wonder how architects will respond to things hanging off the wall and doors. Let me stop this and so there I can. That's my question for you. How do ... I guess it's a broad question. How do architects relate to grills on the outside of buildings and things hanging in doors?

Nina Sharifi:

Yeah, it's interesting. First of all, I would say that there is no monolithic response from ... we don't get together as a conclave and determine what our response will be. You get a range of responses, I think, from enthusiastic and determined to find a way to ensure that the aesthetic merges with the existing architectural intent, right, as you see with some of the PTAC systems that are installed in some of these Manhattan retrofits where we see a very clean, very crisp, beautiful PTAC that sings with the exterior historic façade, right, and of course there are costs associated with that that can be quite significant as we start to multiply those across all of the multifamily retrofits that are upon us in the next twenty years, in New York State in particular.

Nina Sharifi:

I think there .. first of all, it depends, right? It depends on the typology. It depends on the site, as you were saying with things like ground source heat pumps. It's very difficult to say with certainty as it with guided pieces of advice, guidelines like you've got to insulate under your slab. It's very difficult to do that in retrofit and sometimes it's not done, and sometimes we trench around and insulate around the exterior of the foundation.

Nina Sharifi:

I think it's a question of typology. It's a question of accessibility. With heat pumps, we have to have access to the outside and so there's a question of how architecturally does that change the programmatic organization of space? How does that get addressed in a refit, where we have, of course, buildings that were constructed post-war in New York City that are these very large, floor plate buildings but which also guarantee or ensure access to the outside, because you have to have that, at least a window. But the whole apartment, in the case of multistory, multifamily residential, the whole apartment might not ... all the rooms might not have access to the outside, so we've got to kind of think about what is that context and how do we convey comfort?

Nina Sharifi:

This question that keeps popping up is radiation, convection, conduction? Do we employ kind of hydronic loops? Do we employ radiant heating and cooling? Do we think about a combination, a combinatory approach of systems where we have possibly some of the ... you mentioned in your book, which I found very interesting, the resurgence of popularity of steam systems, steam-based systems, in newer projects and so I think there's a question there of what can we learn from our history of heating and cooling technologies thus far? How have we managed to trap harmful bacteria and fungi that make people sick with condensation and how does duct work get cleaned or not cleaned? What are the maintenance and operational implications of something like a VRF?

Nina Sharifi:

So I think it's a question of not only aesthetic preference and kind of the construction logic and the spatial logics that we have to work with, but now architects are faced with this question of life cycle, and overall what ... do we want to include refrigerants? Do we think about ... obviously we're moving away from fossil fuels and towards electrification but how do we achieve that with the kind of combinatory approach, potentially.

Nina Sharifi:

Then the other innovation that I think is really interesting to consider in this context is the area of sensing and controls and building management systems. I think it's a question of how fine grain do we

want the technology to be that heats and cools, but also how fine grain is the kind of sensing or controls network? Do we have it in an office where we have individual preferences that get programmed in and if so, how would we control that? Does it continue in the future to be typologically divided where we have single family homes that are heated and cooled in a different way than high rise office buildings?

Ian Shapiro:

I'm hearing micro flexibility and there's many other criteria that we're going to use. That's helpful. That's helpful. I also don't think that there's a kind of a monolithic thing happening. There has been this historic trend in the U.S. to prefer duct work.

Nina Sharifi:

Mm-hmm (affirmative).

Ian Shapiro:

In contrast to overseas, and it's possible that's going to end. It's not without challenges. We still need to somehow get ventilation into buildings and does that come with a wall hung little heat pump? Do you do the ventilation with it or not? I think there's a big unanswered question.

Ian Shapiro:

There's also opportunities here for talking about an appliance. There's opportunities for start ups. The big heating manufacturers are fifty, a hundred years old and I'm seeing some activity in this area that's like twenty year olds and twenty five year olds who are calling me from Silicon Val lye and they've got an idea for a heat pump. I'm seeing an energy that's kind of exciting, so it just is.

Nina Sharifi:

It is. It is. Yeah, and we're seeing the level of interactivity that people want to have with their environmental control systems and the interest of this new generation, and we're seeing it in our students as well. They're incredibly aware of these issues. It's no longer for them a fringe issue. It's very central to the way that they think about energy and buildings and systems. We've got now ... I think it's also interesting where we're seeing an increase and a sophistication of knowledge and the level of knowledge that we have about things like fluid dynamics and thermodynamics in architecture and buildings. It's a relatively young field. We didn't have access to a great deal of really thorough understanding about that and the experts who really study those things very closely in their wind tunnels and their labs their knowledge is increasing and deepening from their perspective and then from the generalist's perspective, the architect, it's unrealistic that we will gain an equivalent depth of understanding. However, what we are getting is access to more tools with that knowledge, at least at it applies to buildings, I think starting to be embedded within it.

Nina Sharifi:

So now I think we're approaching tools where architects can punch in criteria, building criteria, design criteria, performance criteria and start to gain better understanding of what really needs to be done thermodynamically to satisfy comfort criteria. Is it that we cool with less cold temperatures? Is it that we heat with less hot temperatures? We could be warm instead of heat. There are all of these different aspects of the technology and the way that we apply it that I think are starting to become really interesting.

Ian Shapiro:

Yeah. The last thing I want to mention, this Italian wall hung unit. It's entirely interior and we were testing it in our office. I turned it on and I couldn't hear the compressor. You were talking about thermodynamics. Historically, we've had these PTACs keeping us awake at night in a hotel, and this is a wall hung unit that compressor's inches from my face and I couldn't hear it.

Nina Sharifi:

Amazing.

Ian Shapiro:

There are new tools for controlling noise and controlling sound. It's exciting.

Nina Sharifi:

It is. So it's interesting, I want to kind of move into this question of typology and heating and cooling and what the typology has to do with the way that space is laid. You contend in your book that this idea of surface area and space efficiency is really critical and could potentially help to reduce energy and construction costs. I think there's a question of how do we maximize this as a metric while retaining the character of external features?

Ian Shapiro:

So in the book we introduce a new metric called shape efficiency. In the first edition, we had defined a metric called area ratio which is very simply the surface area of the building divided by the floor area. Floor area is something we're interested in. We pay for a rental space by floor area. We buy buildings, we cost buildings out by floor area. The floor area is the thing we're using, but from a heat transfer perspective, what's really important is the surface area. That's where we lose heat in the winter, that's where we gain heat in the summer. In the first book, we defined the area ratio as simply the surface area divided by the floor area and in this book we take it one step further and we define a building shape efficiency. I will ... I can't tell if I'm still sharing. Can you see my screen here?

Nina Sharifi:

I don't.

Ian Shapiro:

Sharing.

Nina Sharifi:

You have to reshare it.

Ian Shapiro:

I might call out to Kerrie to see if she needs to let me share my screen. That's all right. So we define a shape efficiency and the thing about building's shape is that if you can increase your shape efficiency ... it's a metric where it's zero to a hundred and a hundred is a good shape efficiency and zero is very poor. If you can increase your shape efficiency by 10% you will likely reduce your heating energy use and your carbon emissions by 10%. We show case studies in the book of buildings and we show their shape efficiencies. It's an easy metric to calculate. We show buildings that have a 50% shape efficiency and we

show buildings like Rick Alfandre's office that has 100% shape efficiency and it's a beautiful looking building but the overall shape is such that you can't make it much more efficient. It doesn't have cantilevers. It doesn't have exposed floors or jogs. It's got great proportions and it's got character, but its shape efficiency is high.

Ian Shapiro:

The other thing about shape efficiency is that it reduces energy use but it also reduces construction costs. So historically we've thought about anything we need to do to reduce energy use or carbon emissions, we need to pay money for. We need to add insulation. We need to put in a high efficiency heating system. We need to put in more expensive lighting. Well, this is counterintuitive. This will reduce energy use and reduce construction costs. When I have floated this idea at times, the response I get is one where people get nervous, like, "What are you going to do to our buildings? Are you going to make us live in concrete bunkers or something?"

Ian Shapiro:

We are floating this as a tool, a tool in your toolbox where if you have flexibility with your building design, calculate your shape efficiency. If your shape efficiency's 30%, there are things you can do to reduce construction costs and reduce carbon emissions. Still, I'm kind of a little nervous about how people responded.

Ian Shapiro:

Has anyone come to you, Nina, and said, "If you simplify your building shapes?" Is this a topic of discussion in the architectural studio already or does it feel like something new?

Nina Sharifi:

You know, it's funny that you use this word new. It's funny. I talk to my students about this through the lens of studying, learning lessons from historical and vernacular architecture and these principles of kind of surface area to volume and controlling that prior to the advent of the Industrial Revolution and all of these heating and cooling systems that we have now to regulate interior space, going back thousands of years in some cases, from ... you go to Southeast Asia and you see these amazing vernacular, kind of thatched roofs and you can see over time how the height of that roof and the size of that opening at the top changed and they didn't have a RF on staff, right? They didn't have the calculations or necessarily the quantitative understanding of what was happening but they learned over time by trial and error how these things could change to increase air flow sufficiently to exhaust cooking smoke or exhaust heat. You look at kind of the dome shape of the kind of ice block structures or you look at the yurt, the Mongolian yurt, that cylindrical structure with the kind of point at the top.

Nina Sharifi:

So these ideas of controlling the surface area to improve habitability in the kind of broadest way of expressing it, it's been around for such a long time and I think at a certain point, we trended towards deeper floor plate buildings and toward mechanical controls and lighting and HVAC et cetera and moved away from this idea, at least in some of the kind of Western industrialized context, so if we're talking about New York State for example or the United States, I think there are challenges there. There are lessons that we could learn from that without sacrificing our design intent and I think without this kind of binary of is the metric driving my design or is my design incorporating the metric? I don't think this is binary and I would challenge some of my colleagues to think about in a little bit of a different way.

Nina Sharifi:

As you're saying, I think the phrasing of the tool within the toolbox is a great way to express it. It's yet another piece of feedback that you can get and decide how you want to incorporate that and if it doesn't disrupt the intention of the architecture or if there is a benefit from plate preference to material availability to trying to achieve LEED or net zero certification, there are all of these quantitative and qualitative criteria and considerations, so if it satisfies one or more I think there has to be a way for us to incorporate it in the toolbox. It's such a fundamental, physical fact that I think that it's something that could very reasonably be incorporated.

Ian Shapiro:

That's exciting. Again, the kind of funny dynamics we've seen often is building designs that are conceptualized in early schematic design with renderings and then shown to the owner. Owner likes them, says, "Go ahead." Shown to the planning board, planning board approves them, and the energy team, or the green design team, gets involved and starts asking about shape and other things and it's too late because the planning board approved it. That speaks to the benefits of integrated design and [crosstalk 00:41:20] earlier.

Ian Shapiro:

I want to be respectful of time and Eric and Kerrie said make sure that people have a chance to ask questions.

Nina Sharifi:

Yes. How are we on time, Eric and Carrie?

Ian Shapiro:

I'm seeing 2:42, so I'll let you direct it.

Nina Sharifi:

Okay. I think Kerrie and Eric, feel free to interrupt.

Kerrie Marshall:

You can go on to daylighting. Let's give it a few more minutes and then let's move on to questions.

Nina Sharifi:

Okay. Sounds great. Yeah, I think this is a really important topic to visit because, again, it's so fundamentally tied into the way that we think about passive design principles and what we kind of hold as kind of passive design principles, how to leverage, as you talk about in your book, orientation, proportion sizing, et cetera and so I think the question about LEDs and the thermal loss of excessive glazing as we've kind of crescendoed into this trend of really maximizing glazing. So how does this, as you say, you posit it as sunsetting potentially a favorite green building strategy, so are the days of daylighting over?

Ian Shapiro:

Well, I don't want to be too dramatic. I think that change that has come about with LED lighting is transformational and it's been accompanied with lighting controls, mainly motion sensors, that are

much more reliable and LED lighting is more easily controlled. So we see outdoor lighting that as you kind of approach it, it ramps up quickly but it doesn't just come on. It ramps up slowly and then as you leave the area it fades. The immediate impact is huge. The reduction in energy use for artificial lighting, in many instances it's 80%, 90%. We are talking about a fraction of the electricity. That has a spillover impact on daylight harvesting, which is the use of natural light in buildings to reduce energy use.

Ian Shapiro:

I think we are very close to the point at which daylight harvesting doesn't make sense for energy conservation. That is totally separate from the issue of natural light, our connection to natural light outdoors which is really an issue of biophilia, our love of nature and views. Our views out the window to see if it's snowing, which it is here in Ithaca, if it's raining, if the sky is blue, to see trees. Those connections are vital, but the evolution of daylight harvesting, and in the last few years we've found that the best daylight harvesting is placing it high on the wall or clear stories or monitor, skylights, all this stuff that's way up high that has nothing to do with views and I think that the daylight harvesting as an energy conservation measure is about to go away and we need to recognize that.

Ian Shapiro:

The exciting part of it is now we can focus on glazing for its other purposes. Glazing for a connection to the outdoors and I think we don't know what that glazing needs to be. We have never studied it because we've been distracted by the daylight harvesting stuff and I'm declaring that over. The energy savings are so small or, in most instances, you're spending more energy because of the thermal losses through the glazing. So I think we need to put daylight harvesting behind us and I think we need to now think about what glazing we need for views, for natural light, and then operable windows for ventilation. I'm a big believer in operable windows. Those are the new focuses and it's almost like we're starting from scratch because I don't think ... in my review of the literature, there's just not much on what is the right amount of glazing and where should it be and it's the intersection of architecture, human behavior, psychology. That's where I think the future is with glazing. So just floating it out there as a bit of a challenge. So I think that-

Nina Sharifi:

Yeah, and I would agree that it's not only qualitative about human preference, biophilia. Look at for example the Lighting Research Center at RPI, at Rensselaer, what they're coming out with and the kind of abundance of evidence that's coming out supporting the influence of daylight on alertness in the workplace, the cognitive benefits of applying biophilic design principles, or biophilia design principles through design as well as providing fresh air to occupants. So we're seeing much more quantification, I think, of those effects and those benefits.

Nina Sharifi:

I think there's the question of what does the word optimize mean and how does that start to evolve in accordance with changing criteria? If we can almost perfectly simulate daylight and the effects of daylighting on occupants with LEDs, with sensing technologies, then what continues to be? Can we define what continues to be the benefit of a skylight? Yeah, and is it an opportunity for us to more holistically address the problem of, again, we're looking at retrofit at the deeper floor plate buildings. How do we bring in nature and are there ways to eliminate the kind of cultural force of glazing, especially in high rise buildings where you have clients that are just demanding more and more glazing

and these corner office kind of pecking orders, right? So you've got the executive with all the glazing and then everybody else is sort of in the bullpen, right?

Ian Shapiro:

And ultimately people deserve to have in their buildings what they want to have, but I still don't think we understand enough about how that connection is best made.

Ian Shapiro:

The BREEAM Standard is an English standard, a green building standard, and there they talk about glazing in regularly occupied space. They were talking offices, living rooms. That's where I think we need to focus. Kitchens. That's where we need to focus on glazing and I'm not sure we need fully glazed stairwells.

Eric Schiff:

All right. If we're going to have some time for questions, this has been a great conversation. I've been fascinated and enjoyed it greatly, but I'd like to leave a little time for questions and we've got some good ones. I'm pretty sure the first one is going to Ian. It's from Bill Chadwick, whom you probably overlapped with at some point, and he asks, "Room by room heat pumps from a big box store sounds like a non-network HVAC system that comes with its own set of tough issues to solve around ventilation and energy recovery," which isn't exactly a question, but I'll let you respond to his inquiry.

Ian Shapiro:

Well, first of all, Bill Chadwick and I carpooled to Carrier like in 1986.

Eric Schiff:

I had a suspicion. Okay.

Ian Shapiro:

Bill is a dear old friend. So I think room by room, we're starting with multifamily, hotels, single family. It might come later to commercial office buildings, large spaces, retail. I think integrating ventilation is the big question and I'm not sure we will integrate ventilation. I think that there is a trend in green buildings to separate out ventilation and say, "It is a separate function. Don't mess with the heating system," because you end up making compromises.

Ian Shapiro:

I would suggest to Bill maybe appoint multiple small little guys above that drop ceiling in a Walmart. There may be a place for small modular little point source heating devices, heating appliances. I'm more thinking initially with multifamily lodging, single family.

Eric Schiff:

Okay. Well, that sounds like a good way to say hi to your old colleague. Let's see. I've got several more questions. We're going to run short of time so I'm going to skip through some of them. Let's do this one. "Maximum shape efficiency is probably a simple box, right? How do you make a large, multistory building interesting and how do you bring natural light into the interior," which touches on several of the points that you and Nina were making. I'll let you divide the time of it and try to respond.

Nina Sharifi:

Why don't you start, Ian, and then I'll ...

Ian Shapiro:

Um, there are many, many factors we can use for shape efficiency. There's an optimum number of stories. The maximum shape efficiency, 100% shape efficiency, is fairly simple. Ultimately, it's a cylinder, right, a cylinder so that teepee or that yurt. Maybe I'm wrong. It's not new. Maybe it's old. I'm not suggesting that buildings be cylindrical, but it's just so interesting when you see a McMansion, you see a house that is built with so much surface area and its shape efficiency I think in many cases could be below 40%. So maybe there is a discussion with the owner about if we don't have this wing out here that's over the lake and cantilevered, we could save you some on construction costs and you will have lower carbon emission.

Ian Shapiro:

It's just that kind of a discussion. It's not, "Are we going to make all buildings either cylindrical or cubic?" It's more of a discussion, but I'll turn it to Nina. It's an architectural question ultimately.

Nina Sharifi:

I think, Ian, I would agree that your mention of the way that we build in residential, in both multifamily and single family housing, it has to do with the ballooning of size and I think also with certain architectural features that have become commonplace, because there is a conception, whether it's a misconception or not, I won't say, that American buyers are interested in things like having 14 peaks on a house. So you go out and you look at these houses now and I'm not exaggerating. They go like this and they shift the volumes to make them seem less monumental right, and so it's this idea of breaking up the volume and communicating an idea about American housing that is desirable.

Nina Sharifi:

I would challenge that notion and say that maybe you could have ten peaks. So it's about kind of a bar or a slider where you say, "Okay, let's boost the shape efficiency. Let's improve upon, potentially, the surface area. It's a volume ... we don't need five thousand square feet. Maybe we can do with three thousand square feet or even less than that and still have a really great, well functioning design that achieves the ends, that achieves the objectives that you're trying to achieve with the design, but it does so through a different pathway while being able to realize these energy efficiency and material choice and construction logic performance aspects.

Eric Schiff:

Let me follow that up with a different person but a similar question, which reads, "What if we want to compare cases one with a higher shape efficiency but less resistant opaque construction materials, so low R value, compared to another case?" So the key thing is how do look at both shape efficiency as well as the construction materials that are involved in extending beyond the simple shape efficiency?

Ian Shapiro:

Ultimately that's why designing buildings is so exciting, because if it was a commodity, we would just buy it as a commodity, but everybody ... buildings are our biggest investments. In our whole life, we don't make any bigger investment than in our homes or in our commercial office buildings. It is the

biggest investment we make and we deserve to have the buildings of our dreams. The question is how we get there, but all along, affordability is key, and when we look at building's shape we're not only talking about construction cost, we're talking about the materials that go into making the building and the embodied energy that goes into making and transporting those material.

Ian Shapiro:

So here's another tool in the toolbox with which we can use fewer materials, and deliver the same end function but also deliver a dream and this is where I think there's this need for architects to step in and start going wild with the possibilities of making simpler shapes beautiful. I'm just not an architect. I don't know how to do that. They do. Architects have tools available in terms artistically, in terms of massing, in terms of texture, in terms of proportion. They understand the stuff, I know, way better than I do. So there's an invitation to play with these things and wrestle with them.

Nina Sharifi:

I think it's a yes/and. I would argue that my colleagues, right, Amber Bartosh and Elizabeth Krietemeyer, who are working with augmented and virtual reality software and interfaces who are able to visualize data as well as design and it's happening so fast, our ability to be able to kind of process these things and make decisions.

Nina Sharifi:

I would agree with Ian. It's a yes/and. It's not an either/or, something binary. It's how do these things all come together with the numerous considerations that go into design?

Ian Shapiro:

I would suggest that we might even end up reducing our insulation. We might find out that the optimum in terms of embodied energy and life cycle energy, we may end up backing off slightly. I'm not advocating, but as our tools evolve and our analytical tools evolve, we may find out that the lowest life cycle energy cost is not R19 in the wall. It may be R17 or something.

Eric Schiff:

Okay. Well, we have a couple more questions. One is probably more for Ian and then the other goes back to human factors and a little bit less aesthetics. So one questions is, "As following your advice and many other people, we switched heating loads to electric in places like New York City, we're going to ..." let's see. "Our peak on the grid is going to be three times the current peak summer load which already browns out the grid, so curious on your thoughts what comes first? The distribution network or electrification?" That's a pretty technical question.

Ian Shapiro:

If you look at the load shape currently, New York State at least and most of the North, we are still summer peaking, so we have a long, long way to go electrifying before we'll even be winter. It'll come the time will come in our climate where we will be winter peaking. We have time. We have time ... it's not a lot of time, but we probably have five or ten years so we have some time to plan for it. I think we need to be working with energy storage and I think that is a focus of NYSERDA so that both electric storage and thermal storage. So one answer may be load flattening with energy storage, and I think we need to keep building. I'm a strong supporter of the Governor's wind initiatives offshore. We need to build 24/7 generating capacity.

Ian Shapiro:

Interestingly, the peak is going to end up begin about three or four, five AM in the morning because that's when the peak ... when the lights are out and people are sleeping. That's when the peak heating load is in midwinter. We have a few years and we need to use that time constructively to get ready for it.

Eric Schiff:

Well, this could be the subject of an entire hour easily of RNT forum, so we should probably let it go with those very interesting remarks. Let's see. It looks like one of the last questions refers to the Hesion Mahoney Group research, but I'll leave that alone, showing improved test scores for students and improved productivity in daylit spaces. So what are your thoughts about the approach to providing daylight in deep plate buildings where daylight may not penetrate? Skylights? Atria? Question mark? Your question.

Ian Shapiro:

Some of the best daylighting I've ever seen is skylights, by far. Kind of works best when you're on the top floor or if it's a single story building. I've seen some nice lighting tubes, at least getting you down two stories. I love daylight. I'm an amateur photography. I love daylight and the last thing I want to do is imply the end of daylight harvesting for energy conservation means we're going to start closing up windows. I'm not suggesting that. I think we're at the dawn of finding out what's the right amount of natural light to make people productive and I think I'm more productive with daylight. I don't know that we know the right placement and size and which spaces need more and which spaces ... I think we are at the dawn of understanding the role of natural light.

Nina Sharifi:

That's an important question and one that, again I'll refer whoever asked the question back to the research of the LRC, the Lighting Research Center. They're really deeply involved in this question of circadian entrainment and proper melatonin production in humans to induce proper sleep cycles and alertness during the day and cognitive performance during the day. I think that we're getting closer to, at least in theory, to an idea about LEDs and programmed, pre programmed lighting systems, interior lighting systems that mimic daylight.

Nina Sharifi:

However, there's still many kind of not necessarily yet quantitative aspects of that. One of the best office buildings I've ever worked in is Skidmore, Owings, & Merrill in Chicago. They have this ... it's an old building, it's an old kind of skyscraper with this incredible atrium that goes through the center of the building and it's very, very well daylit and it's got to be for Chicago, right, for those long, dark winters. I think there are light reflectors, there are light tunnels, there are all sorts of devices that can bring daylight in from the perimeter to create a geometry that will allow daylight in. I think it's going to be an approach in the field that occurs on many different fronts. I don't think there, again, kind of one answer to how we address that in retrofit. I think there will be multiple approaches and then in new construction we'll have a little bit more latitude to experiment with geometries and some of the new materials that material scientists are bringing to us for different degrees of daylighting and insulation and so forth.

Eric Schiff:

Okay. I think that's pretty much finishing the questions so I'll go ahead and draw this to a close by thinking Nina and Ian for a really stimulating hour of conversation and questions and congratulations on getting your second edition out and finished and published, Ian, and I hope many of our listeners will dip into it. I have just ordered my own copy on Amazon, so I'll be getting my own copy and make you sign it one of these days.

Eric Schiff:

So thank you to you and thanks to all of the listeners and to the people behind the scenes. Kerrie Marshall, Arik Palileo, Paul McCarthy. This RNT forum has been recorded and most of it will be available for perusal after the fact or there are people who couldn't attend but were very interested. Larry Davis, for example. Anyway, this is going to be available and we'll have a link out to all of the listeners as well as the participants so you can listen to it again or for the first time if you weren't here today.

Eric Schiff:

Thanks very much to you and to the audience.

Ian Shapiro:

Thanks-