Green Design

From Theory to Practice

The Jerusalem Seminar in Architecture

Lecture: Mr. Nadav Malin

Mr. Matty Kones: Welcome to this session, I'm Matty Kones, an architect from Israel, and before presenting our distinguished guest Nadav Malin from the United States I would like to say some words. Besides the beautiful lectures we have seen I would like to remind something that the famous architect Edmond Ezriel (inaudible) has done lately- the architecture 2030 challenge that we architects should work more on green architecture in some way in order to save the world. Because the question is whether we're going to reduce significantly the green house gases by 2030, otherwise all kinds of climatic disasters will occur including flooding of extended, extensive areas in the world with millions, hundreds of millions of people having to move in other places. So, all of us, we are here, who have to develop more awareness about the principles of green architecture that once upon a time was a good architecture. Now we have more romantic maybe title like "green architecture" and be continuously aware of what's happening in the field and apply that in our projects. One of the topics that's very hard still to find a solution is the case of materials. In Israel, where I work on green architecture, I find it rather hard to find all kinds of materials, especially in Israel, insulation and stuff, etc, and going down now to our colleague here, we're going to see how some very positive initiatives by Nadav Malin has brought about a whole system of awareness development, and also a source for finding green materials. So, I'm very proud and happy to present our next speaker, Mr. Nadav Malin. (Applause) Some words about him. OK. He's the Vice President Editorial Director of BuildingGreen, LLC and Editor of Environmental Building News, and also Executive Editor of Macro Green (inaudible) Constructions GreenSource Magazine, and Co-Editor of the Green Spec Product Directory. And the rest you can read yourselves. These are some examples of what our colleague has brought and is distributing in the States for those that are connected with the whole system of this green information system. Thank you. (Applause)

Mr. Nadav Malin: Good afternoon, and thank you very much for inviting me to come speak here. It's quite an honor to be part of this event, and I hope I have some interesting things to share with you. So I've titled this talk, "Materials for Green Buildings" and not "Green Building Materials" and as Matty just mentioned, I'm an editor and writer and so word choices are intentional, most of the time. And I think there's an important difference between those two and I'll talk about that a little bit. There's also kind of a puzzle or a little quiz here which is what is the material in the picture in front of you? I don't know if anyone would have a guess about that, but we'll get to the answer a little bit later on. So I'm going to go over this idea of climate change and of course the primary driver for the climate change that we're observing now is increased carbon dioxide in the atmosphere. So, I'm going to talk about materials and how they interact with that, with that carbon cycle. And from that, lead into a broader study of what's called environmental life cycle assessment, and then using that information to make choices in terms of the materials that you use, things that you look for. I understand many people here are familiar with the LEED rating system. It's really, in the United States, very much driving the debate and setting the tone and the language for a lot of the green building that's happening, for better or worse, depending on who you speak with. But I'll talk a little bit about how materials work in that framework. And then some efforts to go beyond LEED, in terms of materials, and how it's addressed. And finally, we'll look at certification programs for products and some guidance that's out there on materials. The context for all of this really is that materials in themselves, the choice of materials, is not typically the biggest driver in terms of the overall environmental impacts of a building. So, it's really materials and the choices in the way they manifest or express the building but also the way the materials and the products you choose affect how the building will perform in terms of its operations. So that's, just, keeping that, you'll see, I'll come back to that because it's an important distinction. And that's really a key part of why "materials for green buildings" is different than "green materials". You can choose green products or green materials and make a not very green building. Conversely, you can make a pretty green building without choosing any green products or materials. You put the two together, you have the best of both worlds. But it's important to keep that distinction, separate in my mind. So, kind of looking at the whole picture, and I have to credit a Norwegian, Bjorn Berge (inaudible) for this graphic which I love. It really points out that materials are part of a complete cycle, where everything kind of begins and ends to the extent that a cycle has a beginning and an ending, with the earth. And so, there's a whole process of extracting and refining materials and products into, from the earth. As they go through there's often secondary refining, till you get to the point where you have the products, the things you can actually specify, design within your buildings. Eventually, you get around to the point where you have a building. And at that point, the materials are serving their purpose, they're functioning. And then, at a certain point, either the building is no longer needed, or it's no longer serving a purpose or the particular products or materials are replaced and they become waste. And typically they return to the earth. Now if you have infrastructure, if you have systems in place, they might not return directly to the earth, they might be recycled, back into this loop, or they're even a shorter form of recycling is just reusing the material, so you bypass that extra manufacturing step you're able to extract a product or a material from one place and reuse it in another. And each time you eliminate a step in the process, you reduce the environmental impacts associated with that. So, if we look at this whole cycle, and now we have several cycles built into this, we see that there's actually energy in carbon associated with each of these steps along the way energy going into the process, and carbon emissions usually associated with that energy use coming out. I apologize for the characters being a little jumbled there, but you get the picture. There's energy, every step of the way, there's energy going in and usually with energy going in, it means there's carbon emissions coming out, because almost all of our energy sources, except for the very few that are renewably powered, are associated with carbon emissions. So, if we focus just on those processes for a minute, and then we can look at each step along the way, back to what I said earlier, the use phase, the time that the building is in use, that the materials are actually associated with the operations of the building, is typically the most important, in terms of energy going in, and carbon emissions associated with that building. So, first and foremost, when we choose products and materials, it's important to think about how they are going to affect the building operationally and how are we going to try to minimize at least the use of nonrenewable energy. I have to be careful how I talk about energy because I have Steve Strong sitting here right in front of me. And as the Photovoltaics leader, he can actually provide energy that doesn't have carbon associated with it, carbon emissions. The refining process is probably second on the list, it depends on the material you're looking at, in terms of significance, for energy going in and carbon coming out. And it’s important to know that even recycling is not energy free, is not emissions free. And in fact, you have to look at that fairly closely. Sometimes, the process of recycling a material can actually be worse environmentally than extracting and making something new. It’s not a given. We shouldn't take it as a given that recycling is always better, especially if you have a very widely distributed product and you’re spending a lot of energy in transportation, collecting it from many places. Those impacts can build up to the point where it’s no longer an environmental net gain. So, it’s important to look at all these things fairly comprehensively. So, as we think about materials from the point of view of the carbon cycle, a lot of the materials that we use have some connection to plants-are plant based in some way-or at least are originally that way. And plants of course, they extract carbon dioxide from the atmosphere, and they bind it up in their cellular structure. And that's how we get wood and other natural fibers. If those plants are left alone for thousands or hundreds of thousands of years, eventually they become fossilized, and turn into the fossil fuels that we're now burning through very quickly, as Mr. Behnisch pointed out last nightm many, many times more quickly than they're being restored. And so, and then as we burn those fossil fuels or as those natural fibers are composted, that carbon dioxide is rereleased into the atmosphere. So, we can take those products, the wood for example, out of that cycle, in a sense and use it in a building, and then in effect we've sequestered that carbon for a period of time. We’ve protected it from being returned to the atmosphere for as long as it’s in use. And so that's a pretty good thing, from the point of view of the carbon balance. Otherwise, we can take some of the carbons that has become fossilized in the ground, and take it out, and burn it. And of course, that's one of the key problems that we have right now. And then, because then as we do that, it gets returned to the atmosphere and it's contributing to the problem we have. Now there's another way though, which more and more we use that fossilized carbon-and that's to make plastics, right? Petrochemicals. And so in effect, petrochemicals are another way of sequestering carbon. Now, of course, there's a lot of energy that goes into manufacturing those petrochemicals as well, so again, you have to look at the whole picture to really understand whether it's a net gain or not. But, there is, in plastics, a certain amount of sequestered carbon. And, I believe it was a Russian scientist who, looking at the chemical makeup of oil, said, "Oh my gosh, this is such amazing stuff, how could we possibly burn it? This is really the basis for a miraculous chemistry that we could do all kinds of amazing things with". So, hopefully, we can continue to find better uses for oil than burning it. There's another way that materials relate to the carbon cycle, and that's through the oceans. And so there's also… just as there's carbon in the atmosphere, there's carbon in the oceans. And in fact, one of the things we're discovering now is that as carbon dioxide is increasing in concentration in the atmosphere, it's also increasing in concentration in the oceans, and that's causing problems for marine life. But one of the things that happens with carbon in the oceans is that animals that grow, that have hard shells, use that carbon to make their shells, and that's what eventually becomes limestone. And limestone is what we then turn into cement to make concrete. So you have shells from marine organisms turned into limestone and then fired in a concrete kiln at very high [1]temperatures to make concrete. So, course concrete being a primary building material of ours, it's important to recognize that it's also an enormous contributor to global emissions of carbon dioxide. And, estimates are typically 5-7% of human generated carbon dioxide emissions are associated with concrete and with cement, and it's interesting to note that there's actually two ways in which carbon dioxide is emitted in the manufacturing of cement. One is what we're looking at right here, that when you cook, in a sense, fire the limestone, at very high temperatures, up to nearly two thousand degrees Celsius, in a cement kiln, that very process, the way you convert limestone into cement, is by driving off carbon dioxide. That's the chemical change that happens. So you get a release of carbon dioxide from the chemical change and then you also get carbon dioxide emitted from the fuels that are used to generate all that heat, whether it's different fuels in different settings-it might be coal or oil or natural gas or other things, but those also release carbon dioxide. Globally, the estimates are about one ton of carbon dioxide for each ton of cement produced. So, it's really an opportunity to look at how can we both create cement more efficiently and use it more efficiently, or use other materials to reduce those emissions. So, looking now, stepping away from materials for a minute, to look more broadly at climate change and greenhouse gases in the atmosphere, there are really two primary vectors or ways in which society is responding to climate change, right? There's adaptation-we change where we live, how we live, to deal with the fact that our climate is changing. And then there's mitigation. We take measures, as hopefully many of us here are trying to do, to reduce the climate change itself and the effects of climate change. And you can do each of those individually, as you see here. Conventional construction is doing neither, right? It's going along as if climate change doesn't exist or as if it isn't a problem. We can go the adaptation route of raising our buildings near the coast, or moving away from the coast so that we're not going to be subject to rising sea levels. Or we can go the mitigation route by itself, which is trying to reduce emissions directly, but in fact, probably the smartest thing to do is a combination of both, and that's what robust green buildings really are doing, is they're both reducing emissions, but they're also, by being well insulated, by being more efficient, they're protecting us from the effects of increased climate change. And my colleague Alex Wilson has coined this term "passive survivability" as a term for buildings that are designed to survive through different interruptions in power supply, in fuel

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choices - buildings that can actually ride through longer periods of time without requiring the constant input of energy. And that's part of that both mitigation and adaptation strategy. So, looking at this idea of robust green buildings and what that means, part of what it means is that we have to now look beyond carbon and carbon emissions and see that it's really just one piece of a broader array of things that with green buildings we can address. And so what you're seeing here is a presentation of the relative importance of a whole range of different environmental impacts, environmental areas of concern and everyone would have their own view of how to prioritize these-their relative importance. There's nothing sacred about this one-it was just one group of people and what they came up with in analyzing this problem - but you can see carbon dioxide and climate change is clearly the most significant, but it's only about a quarter of the whole picture. If you look at all of the environmental impacts of concern, there's a whole bunch of other ones that we're looking at as well, and all of those are part of this idea of what contributes to a real approach to green building. And so, to look at all of that, we look at this practice of environmental life cycle assessment. And so, with environmental life cycle assessment, what we're doing is we're following the life cycle, just as in that first graphic, all the way through, and saying what are the inputs, and what are the emissions at every step of the way? What's happening at every step o f the way? And then what are the environmental impacts of those inputs and emissions through the life cycle of the product? And there are scientists that have been working to quantify and create databases so that you can actually look at this and choose products based on some quantitative analysis of those combined emissions. So if we look at the first step of raw material extraction, typically you have impacts on the ecosystem. Here you have a mine, and of course whatever wildlife, whatever plants and animals were living there in the area of that mine-their ecosystem has been destroyed. So, it's a very drastic impact typically in a fairly contained area. So it's localized but absolute. So you have strong ecosystem impacts and you have energy use and energy emissions associated with that mining. In the manufacturing process of course, it's going to vary. A lot of different processes have different emissions, but again, energy use typically, and then pollution from the energy use but also from different aspects of the manufacturing are the types of impacts you see there. All along the way, you have transportation. Transportation is a huge source of pollutants: both greenhouse gases and other kinds of pollutants-one of the biggest-when you do this analysis, you find that one of the biggest sources of cancer causing emissions-particulates-is from burning diesel fuel in trucks, and so the biggest source of impacts there. And here you see that of course the different ways of transporting materials provide…are more or less efficient in terms of the amount of energy it takes to move stuff. And so, to the extent that you can use ships or rail instead of trucks, you're using less energy per quantity. So these very simple, as we'll see with LEED in a little while, sometimes you get this very simple analysis that says well if it's closer, it's better. In fact, it's not always the case, if you're moving it by ship, you can bring it further and have less impact sometimes than by truck. During the construction process itself, it's really not so much about the products and materials themselves, but about what you're doing in the process that releases the emission. But there are a few things, a few choices you can make, if you switch your construction equipment to burning a biodiesel, you're helping reduce emissions and offset carbon. And then there are erosion control systems that are more biodegradable and natural. And then we get to again, really the significant part which is the products in use in the building. Right? Now, we have the building, and the building is using energy, and the occupants are using energy and they're using water. And so all of those things over time are going to dwarf the impacts of the materials going in the building, depending on the type of building it is and what it's being used for. It may take 3-5 years. It may take 10 or 15 years before the operational impacts become larger than the embodied energy or the original impacts of making the building. But, I show a picture here of a glazed curtain-wall system because we're seeing more and more that this type of building is really the most difficult to make a green, a sustainable structure. Really, a glass system is difficult to insulate well and it absorbs energy, and so the operational impacts of all-glass buildings are typically much higher than one with a more nuanced and varied façade. And so, more and more, we're getting feedback for example, in magazines, when we show these all-glass buildings as green buildings we get more and more feedback saying, "Wait a minute. What are you showing there? You have got to watch out for that." That's important feedback for us to have and then reflect back and say, architects like to think that they can do these all-glass buildings and make them green. And actually they can, but the length you have to go to to make that work is really pretty extreme. So, finally the end of life-at the end of the life of the building- you have materials coming out of service, and in this case, with this building here in the picture, is one that was made almost entirely from salvaged materials. So, it's made from products and materials that were previously used, that were there on the site and they designed the building to be made from those products. And so now you have a combination of the products, materials you choose to use and how you use them, how you build them, how you build with them that affects how easy it will be to reuse them again later on. So it's a combination of design and material choices. And so I guess the main message here is that designers often say, "We can't get green materials." Well, to a certain extent, you don't have to. A lot of this is really more about the intelligence, the wisdom that you bring to the process and how you use materials is probably more important than what materials you use. But really, ideally, the two go together. So, this environmental life-cycle assessment that I mentioned, we show it as a simple cycle, but in fact if you think about any one product or material, it doesn't just… it's not just one thing, it's many things usually coming together to make a product. And so you have a whole complicated network of processes and ingredients with steps along the way. So these databases that try to track all of this, through the inputs and outputs at every step, can become quite complicated. And then you have another step, because once you've quantified the inputs and the outputs at every step of the way, you still have to then figure out, well what is the environmental impact? What are the actual concerns associated with those inputs and outputs? Maybe I'm using something that's very plentiful, it's not a problem, then it's not really an environmental concern. Or maybe I'm using something that is hazardous or that's going to result in hazardous pollution. And then I need to watch out for it. So there's this next phase called impact assessment, where you look at all of those, that inventory of resources going in and emissions coming out, and you have to quantify the impacts of each of those. So, in the example here, looking at global warming, or climate change as an impact category, you have different emissions that contribute to that. There's carbon dioxide, but also methane, nitrous oxide, and other gases that are part of climate change. So, these life-cycle databases have to account for all that as well, to quantify the different contributions of those different ingredients to each impact category. So, moving from that to, ok, all of that gets very complicated. There's a lot to think about there, and it's really, at a certain point, better left to scientists. It's not something designers are going to do. So what are some simple things you can think about as you start to make choices in your design practice? One of the most useful things we've seen is that you really want to think differently about different types of materials, when you're thinking about your structure: the foundation, the structure, the really massive elements that make up the mass of the building. At that point, because you're using so much, the low impact nature of it is really important. That's where we talk about concrete and reducing the impacts of the cement or the steel. But you also want it to be very durable because you want it to last a long time. You don't want typically that building to be replaced, unless it's designed as a temporary building. So it's important to consider what is the planned service life? What is your plan for this building? And choose materials accordingly. It doesn't make sense to put very durable materials in a building that's going to be replaced quickly. And then you move to the interior finishes. Well at least in commercial buildings, interior finishes are often replaced much more frequently. In the United States, we say, for example, carpets are typically replaced every 7-12 years. So it doesn't make sense to invest in a tremendously durable carpet. What you want is a low-impact carpet that's easy to replace and recycle. And then with the enclosure, with the actual shell of the building, this is what's going to provide your thermal barrier, it's going to insulate, and also protection against moisture, both from outside with rain but also condensation, from humidity in the building moving out. And so, there, it's really the performance of that enclosure that matters most, because if that fails, it can start to cause failures throughout the entire building system. So there you really want to look at the performance of the products first and only after that then you can look at, well, what are the impacts of those products? How durable, how efficient are they? And then when you get into anything that uses energy, again, lighting, mechanical systems, all of that, it's the efficiency of those systems of course that should be the primary concern. And what they're made of and how they're made is a secondary concern. So, keeping those priorities straight is important as we think this through. So here's the answer to the quiz from the opening slide. This was an environmental education center in Pennsylvania where the architects discovered these… basically, a junkyard of old tires on the site. And they said, "Well we could use those old tires as cladding on the building." And so if you recall from that first building, it's actually quite attractive. They took old tires, they got volunteers to collect those tires, cut them up, and turn them into siding for the main entrance of the building. And quite effective choice of material there-it's not only low impact, but actually restoring. In restoring the site, they actually found the material that they could use. So, a very clever choice there. So, as designers, what are you looking for? From a survey of designers at a large firm in the United States, they found this order of priorities. And of course, we want everything we want to use to be sexy and appealing first and foremost. But, I think it's pretty encouraging that for this large firm, meeting the environmental criteria is right up there on the list. It's a very high priority for them. They're constantly striving for how to find products, materials that can do that. And so, a lot of these designers are working on commercial interiors. This is an office for an environmental NGO in the United States and so everything in this office was really designed to be as environmental as possible. The wood flooring is made from salvaged wood, out of old buildings. The wood in the furniture is made from environmentally certified forests. All the finishes, the paints, the coatings, are all very low-emitting paints and coatings. Envision Design is the designer on that. So, moving from that into LEED grading system and how we look at materials and LEED, LEED is a rating system for buildings, right, not for products, not for materials, and it rates buildings based on how many points the buildings earn in these six categories. So, materials and resources are one of those six categories, but in fact the products and materials, as I've been saying all along, the choices that you make in terms of materials, are going to affect energy use, they're going to affect water use, going to affect a lot of other things throughout the building. So the impacts of the material choices are not limited to that one section. But, focusing on that section, the particular areas that LEED focuses on, first of all, there's building reuse. If you reuse an existing building, and we're hearing more and more about that, because we've got all these existing buildings that really need to be renovated and made more efficient as we continue to use them. There's a tremendous infrastructure there, a valuable infrastructure there that's available for reuse. So there's points available for reusing that infrastructure and renewing an existing building instead of tearing it down and building a new one. And then there's points for construction waste management on the construction site, both from anything that gets taken down but also as new materials are brought in, anything that becomes waste, how can you manage that most effectively? How can you reuse it or recycle it instead of having it become landfill, go to a landfill or be incinerated as waste? And then resource reuse is about using salvaged or reused materials, recycled content. We talked about recycling, so in order to be able to recycle things, there has to be a market for that product, there has to be something that's going to use that recycled content and so LEED encourages the use of materials with recycled content. And the local and regional materials is about finding things that are within the region. In the United States we draw a very big circle, it's 500 miles, about 1100-1200 kilometers, so it's a very big region that we work with. But there are also a lot of efforts to narrow that down further. And of course LEED doesn't look at how you transport the product. A lot of people say that it should but it's adding another level of complexity that the creators of LEED felt the market wasn't quite ready for. So, that's likely to be in a future stage. And then rapidly renewable materials, materials that can be replaced on a short cycle, like natural fibers. And certified wood is really looking at forest management practices. How can we ensure that the wood we use is coming from a well-managed forest where the habitat and the ecosystems are not being destroyed in the process of extracting that wood? There are also a number of points very directly related to material choices in the indoor environmental quality section where we look primarily at what are the indoor emissions. What kind of chemicals are coming off of these products? And how might they affect the occupants? And so things like adhesives and sealants and paints- all these things that might release chemicals to the indoor environment. We want to try to minimize those releases. Over time LEED is getting more sophisticated in terms of how it analyzes those products or what kind of products it looks for in that area and how you make sure you choose the ones that are best for the environment, for the indoor environment.

One of the interesting things that's going in- that pie chart that I showed earlier, with the prioritization of the impact categories-well that was adapted for the update of LEED for 2009. They said, "Well, if greenhouse gases and climate change is the most important thing, we have to take another look at how we're assigning points in LEED to make sure that it reflects those priorities." So, what you see here is a change from the current version of LEED, or the version that was current up until, actually it's still current right now. In about a month or so, it'll be switching over to the new version for 2009 and you can see that LEED is in fact now putting more of an emphasis, in terms of the points, on energy, on water conservation. And by virtue of that, because we're emphasizing energy and water more, we're actually emphasizing materials and the indoor environment a little bit less. And so that's this constant weighting, this constant reprioritization that's going on as you look at what do we care the most about? How are we going to focus on the things that matter the most?

So that's really where things are at with materials within LEED, and LEED, you may be familiar, has four levels of certification. There's LEED certified, silver, gold, and platinum. We also have people in particular, in the Pacific Northwest, the Cascadia region of Oregon, Washington State, and British Columbia that have introduced the system called Living Building, or the Living Building Challenge, which really tries to look way beyond LEED at what would the ideal green building be? You know, set aside, LEED was really targeted at, what is the market ready for? What can be achieved given the way people are thinking about things, the way they're doing things now, and how can we push the market to the next step? With the Living Building Challenge, it was much more of a question of forget all of that, where do we want to go? What is the ultimate goal? So there's this Living Building level of performance that is based around, instead of points, there are no points in that system; it's 16 requirements. They're all required. And the requirements are zero energy, zero net energy use- the building must generate as much energy as it uses. Zero net water use-it must collect its own water and recycle its own water within the site, and on and on. It's things like that. You're not allowed to build on a new previously undeveloped site. You can only build on previously developed sites. So we'll take a look at what that means for materials, just from one aspect. But then, they also acknowledge within the Living Building Challenge that even that is not the ultimate end because we have a lot of places on earth; that it's not enough to just sustain their current state, they actually require restoration. They need to be renewed and restored. So there's a whole other level that is still being explored. What would it mean to take a site and actually restore it to a state - not a state in the sense of stasis, because really a living thriving ecosystem is not static. It has to be dynamic; it has to be growing and changing. This is where it starts to get more complicated. What would that mean for buildings? How can a building be an active participant and a supporting participant in a changing, thriving, growing ecosystem and social system? All of that has to work together. And so, that's really I think the next cutting edge beyond Living Buildings, and we're starting to move there at least in thought as well. But a lot of opportunity for that. So, one of the material requirements within the Living Building Challenge is this idea that there's a red list, and your building should contain the products in your building and the materials should contain none of these problematic chemicals. Now, they also acknowledge that given today's economy, that's actually not possible. So there's a number of what they call temporary exceptions. So, in practice, you're still not reaching the ideal goal yet, but the principle is that they've taken the opposite approach. Instead of LEED starting where a conventional practice is and stepping out from there, here they've defined the ultimate goal and then are sort of easing back from that in order to try to define what might actually be achievable by people who really want to stretch to the cutting edge. So some of these things are really already not a problem. Chlorofluorocarbons -we're already not using those in new buildings. Halogenated flame retardants-these are like brominated flame retardants-these are associated now with toxic, what are called, the acronym in the US is PBT's (Persistent Bioacccumulative Toxins). So these are the kind of toxins that last a long time, and they bioaccumulate; they accumulate through the food chain, so that as you get higher in the food chain, they're concentrating more. Of course the classic example historically is pesticides like DDT. But in fact we're finding that there are chemicals that are produced accidentally through the manufacturing of other products or by-products of the use of some of these things that behave like DDT in the environment. So we're trying to phase out the use of things like that: lead and mercury or heavy metals that are highly toxic. And then you run into dilemmas. For example, mercury, very problematic, very toxic, but fluorescent lighting depends on mercury. Right, mercury is an integral part of that. So, within living buildings, and elsewhere, we're sort of excited about the arrival of LED lighting which is just beginning to get to the point as those of you who heard Stefan Behnisch last night describe - he's got projects where he's able to use it now, across the board, and in fact not use fluorescents. From a materials point of view, from a toxic releases point of view, that's a very exciting step. Because if you sacrifice efficiency, if you say, well we don't want to use mercury, so we should use traditional incandescent lamps, that are actually not helping the problem at all, because when you burn coal, you also release mercury into the atmosphere. So, in effect, by avoiding fluorescent lamps, you would be releasing more mercury, unless you can get LED or some other kind of lighting that's as efficient as the fluorescents. So, that's part of this ongoing calculation about when is it time to say fluorescents are no longer needed, we have other ways of achieving adequate or even better quality of light and at the same efficiency. So, we're looking at things like mercury.

And then the last one I'm going to touch on here, the bottom of the list, polyvinyl chloride or PVC. This is by far the most widely used plastic in buildings and Greenpeace has suggested that we should be phasing it out of our economy entirely, that PVC is associated with the emission of dioxins. The material itself, once it's manufactured, is very inert. It's not toxic to hold or to work with, but in the manufacturing and then ultimately in the disposal, there's the potential for releasing dioxins. There are a lot of nasty precursors, chemicals along the way in the manufacture of PVC. And so, there's a campaign within the environmental circles to phase it out and that's part of what living building's reflecting here. There's a strong pushback from the industry saying that actually PVC provides a lot of advantages in terms of making buildings more efficient. It's lightweight so we looked at the impacts of transportation. Well, if instead of PVC you're transporting something heavier, you might be increasing environmental impacts there. So, it's actually quite a complex conversation and I don't think we've quite gotten to the bottom of whether or not there might be some places where products like PVC might still have a place because of their advantages in terms of performance. But I guess the main message here is not that PVC is ok, because it's not; it's really problematic. The main point here is that you have to look at what you're using instead, because it might be worse. So it's not enough to say PVC is bad, we want to eliminate it. You have to pay careful attention to if you eliminate it, what are you going to use instead? And so this is where engaging the product manufacturers and encouraging them to find substitutes that are better-that you've actually researched and determined are better - and phasing it out in a more informed and intelligent way than just a blanket elimination without looking at the impacts of that.

So, another system that you may have heard of, looking at beyond LEED or differently from LEED, at materials is this cradle to cradle protocol. An architect and designer in the US named William McDonough, has, along with Michael Bernhard (inaudible), a chemist from

Germany, came up with this protocol, this system, that says that well, with population growth, with limited resources, we have a finite planet, and seemingly infinite demand for resources. We're going to have to find a way to start closing the loop, to use things more than once, and ideally, over and over, indefinitely. And they realized an interesting thing about this, which is that in order to do that, in order to reuse things over and over, you have to determine and separate things that are going to be recycled within ecosystems-through composting, through biological digestion-from things that are going to be recycled through a technical infrastructure, like metals, through industrial recycling. And as long as you keep those separate, then you have the potential to really reuse things over and over again many times. If you mix the two together, you end up with a mix that is actually very, very difficult to recycle and is almost always, if it is recycled, it's almost always downcycled - recycled to something of lesser value. So it's an interesting principle that in effect redefines a little bit how we think about products. One of the most common… for example clothing, a lot of clothing now is a mix, right, of cotton and polyester. And that becomes a problem because you can't recycle that, you can't compost that. When it's done you have to just dump it. And the other aspect of this system, they said well if we're going to be reusing this stuff over and over and over, we also have to keep anything toxic out of the system. So they have a fairly sophisticated screening process to make sure that they're not using anything toxic, they're not including any toxic ingredients in the manufacture. And even trace elements, they discovered in processing polyester, a heavy metal called antimony is used as a catalyst in the polymerization process. And trace amounts of that antimony stay in the polyester and then that might accumulate over time as a recycled polyester. So they were able to work with manufacturers and discover an alternative to that process using that catalyst in order to make a safer polyester. So that's part of the process that they're working on that's very exciting as well. But as a result of all of these different systems, all of these different ways of looking, we end up with kind of a cacophony of different programs and certification systems that are all claiming to tell us what is a green product. And these are just the ones in the United States. This doesn't even include the European Union, Eco-label and the various ones from Germany and from Norway and other places. So we've got in fact, at least in the US, a lot of very confused designers that are looking at all these labels, all these certifications programs, and trying to figure out what they should be looking for, what makes sense. And I think it will take a little while for this to sort itself out. There will eventually be a kind of a shake down and a consolidation into sort of an agreement about which labels are more meaningful and which ones people should look for. But, in the meantime, the most important thing to pay attention to is that some of these labels are not really comprehensive eco-labels - they’re just looking at a single attribute. They're just looking at one thing. For example, the ones labeled "emissions", those are just about indoor emissions from the products. So those labels are just telling you that the product has been tested and has been found to be low in chemical emissions to the indoor environment. That really doesn't tell you anything about whether it's a green product from the point of view of its manufacturer, from the point of view of its disposal, from the point of view of its impacts on operational energy used, any of those other things that we’ve been talking about. None of that comes into play; it's just about indoor emissions. So, it's useful - useful to have that label, and useful to know that - but important not to confuse that with a comprehensive eco-label. Similarly, we have forestry programs. So those are going to look at forest impacts. But again, they're not going to tell you about the manufacturing, they're not going to tell you about other impacts, and then water conservation, energy efficiency. We do have the multi-attribute systems, are the ones that are starting to try to look more comprehensively at the whole life cycle and find products that are better from an overall ecological point of view. Unfortunately, there's not going to be agreement on any one of those until we can get agreement on the priorities and what we care about. Some of these systems emphasize, like the cradle to cradle one there, emphasize this idea of closed-loop recycling. Others emphasize energy efficiency, reduced emissions in transportation, other things more. So, for example, the cradle to cradle program would not allow any products made with PVC. There are some other systems like the Sustainable Choice that in fact for carpet, the only carpet that can meet that product , maybe not the only one, but most of the carpet that can conform to that standard is actually made with a PVC backing because it's more recyclable, PVC backing is more recyclable. So you have these labels that are actually conflicting in terms of the recommendations that they end up providing. And that's part of what over time is getting worked out, but until it is, it's becoming more and more of a point of contention among people looking at these things. Let me step back a minute and talk about what is this whole certification about? So certification really is about putting someone between the product manufacturer and you as the designer or the builder, right, who's going to provide some sort of a third party, hopefully an independent third party scrutiny, review, to tell you, to help you determine whether or not the product meets certain standards. So, in order for certification to work, you have to have the standards, which is there between the manufacturer and the certifier. That's really the guideline; that's what the certifier is certifying for, and so when you look at a certification, you need to understand what is the standard it's being certified to. If it's just about indoor emissions, you don't want to confuse that with a standard that's looking at the whole life cycle. And then, from that, you end up with a label that can get put on the material or the product that tells you in fact it has been certified. So the whole system of certification is one you want to understand in order to make use of it and make sure that you're using it appropriately.

Another tool that is generating some excitement in the United States is called this ferrous product-project, sorry-and ferrous is built around this participatory effort where users are going to… the idea is that they'll set up, they are setting up the framework and users will contribute the content, the information. But, they've got this beautiful presentation of the results. So, if they can get good data from the user community, they have a nice way of presenting the results. And what they've done is, they're looking at each product or material around a whole series of different areas of concern broken down into three main categories. There's the environment and resources, there's the social and community aspects, and then there's health and pollution aspects. And so you can look with this graph, you can look at a product, for example, in this case, it looks like it's performing very well on the social community aspect but not as well in terms of the environment and resources. So, just at a glance, you can get that picture, you can get that view. And so looking at each wedge, at each piece of this, of that graph, you can see they've defined the very best performance level – ten - is the ideal performance. That's all the way up to the green bar on the side and then down towards the center, you get poorer and poorer performance. And so in order to create that graphic, you have to have somebody scoring the product or material in each of these categories. So, it requires a large amount of data and a lot of information, and of course there will be a lot of debate around who's going to make that judgment. Who's going to say the quality, how a particular product performs in each of these areas? And some of it can be quantitative and data driven but much of it ends up being really a judgment call, a subjective judgment. And so that's where they're hoping that through getting enough people participating, there'll be kind of a community consensus around how these products rate. So, it's kind of an exciting initiative. We're waiting to see whether they can get enough participation to really make it work. Which brings us to what my company has been doing now for about ten years, which is, in effect, using that same kind of subjective assessment with our editorial team to screen products and materials and create a directory of green products that are available in the United States and Canada. We actually do have a few in the directory that are manufactured here in Israel. So, it's not true that there are none here, but I understand that most of the ones that are available in the US are not available here. And that is a problem that I think it will get solved as the demand grows as well - as there's more demand for these products. But we're not a certification program. We don't go and audit the manufacturing and scrutinize these companies the way a certification program would do. What we've done is we've screened a whole bunch of products and so we have about 2000 different listings in the directory and we do that based on the kind of principles that I've been talking about. We look at what information we're able to get about the whole life cycle about the product. We try to understand where the primary impacts would be in that life cycle and then we assess the performance against those. And we've developed some standards that we use to assess the performance against those impacts. And Matty was asking me earlier about the fact that our resources, our information, on our website is by subscription and we don't carry any ads. We don't take advertising on our website. And the reason we do that is so that this system will have some credibility. Because if we had companies paying us for advertising or for listings in the directory, you'd have no reason to trust that the judgments that we're making are meaningful. So, our model is that we make the judgments and then we rely on the users to pay a subscription fee to access the information, so that you know that there's not some sort of a bias in the selection process based on that manufacturing. So, that's the look at materials from the perspective of the United States at least.

At this point, I'd be glad to take any questions, comments you might have. It's hard to see out there, so stand up. You have a question?

Mr. Matty Kones: If you don't have any questions, I would like to ask something that we face sometimes working on different projects. There is a question? Please.

(Inaudible speaker)

Mr. Nadav Malin: Fees for, oh, to our resources? So the product directory is part of a website we call, BuildingGreen Suite, and the cost for that is $199 a year for an individual. And then we have reduced rates for universities and for firms to do as a whole group. It's all at buildinggreen.com and I have some literature here I'd be happy to share with you afterwards. Thank you for asking about that.

Mr. Matty Kones: Any more? OK. Some of the questions that we face now designing green projects and also the client sometimes questions them-for example to put polystyrene insulation which comes from oil, in order to save energy. So, is it correct or not?

Mr. Nadav Malin: Right. Great, so the question about whether you want to use a petrochemical based product like polystyrene to save energy and the tradeoff associated with that. So, at a certain point, that whole…that chart I showed, that graph I showed about the priorities, what I actually would recommend, is that at the beginning of a design process, you want to have a conversation with your client about their priorities. You want to understand how they're thinking about their building, how they're thinking about what they want their building to be-of course what you would do anyway- and then the environmental impacts associated with that project. And what's most important to them about that project? And for some clients, the idea, the building, the project, wants to be natural, made of natural materials and low tech and really feel like an organic building, then you would avoid using petrochemical products. For other clients, the priority might be really reducing the energy use. They don't mind using higher-tech or industrial materials to do that, and in that case, using something like polystyrene wouldn't be a problem. So, it really, there are certain aspects, and this is really a key one, whether you are going to use petrochemical-based products or try and stick with more natural products. Really, it's ultimately a value judgment. And the values really should come from you but also from your clients, and should be a reflection of what they want their building to say, what they want their building to express about what it means. Now, within the polystyrene world you have to be careful because some polystyrene is made with brominated flame retardants and that's a problem that you want to avoid if you can. But the polystyrene itself, as a plastic, is a relatively pure plastic; it doesn't have halogens, it doesn't have chlorine, or bromine or fluorine in it so it's not so toxic as plastics go. And it can save a lot of energy. So, generally, as I said earlier, operational energy being the most important thing, if it's ok with your client, I would say you should use it because you really want to save that energy.

Mr. Matty Kones: Thank you. Any more?

So, before we end, I would like to add a very important comment. I remember when first in 1988, the new insulation standards in Israel came into effect-1045-immediately afterwards many new companies were established that supplied insulation for buildings. This brings to the idea that in the time of recession that we face now, if we start retrofitting existing buildings, and besides building the new green buildings to save energy, first we could create millions of jobs all over the world, not only in Israel, and push the economy, save a lot of energy. Actually, I thought that the amount of money that they want, that is needed for the new power plant that they want to establish here, to be based on coal. All the world stops now coal fired power plants, here we debate about the need or not. But, by reducing the need for energy in the economy by 20% through retrofitting, we could save, investing part of the amount of the two billion dollars that is needed at least for a new power plant, to give that to people to retrofit existing buildings. And save a lot of energy and also reduce greenhouse gases. Now, think about it.

Mr. Nadav Malin: OK. Thank you very much.