Talking Building Green with Dr. Melissa Belic

What kind of engineer are you?
I’m a civil and environmental engineer, but I really do work in sustainable engineering. I’m most interested in the build environment and understanding the environmental impacts of the build environment. And I’m also specifically interested in better understanding and quantifying some of the environmental issues associated with our healthcare system.

You do work in sustainable engineering. What is a project you worked on that involves sustainability?
I worked with a team to design the Phipps Center for Sustainable Landscapes. Our team used an integrated design process. During the integrated design process, you bring everyone together who has a stake in the building, and you come up with different designs. This is a new way to design, construct, and operate buildings. The integrated design process takes longer because there are lots of people involved, but the outcome of the design is very high.

For the Phipps Center for Sustainable Landscapes, there was a big elevation difference where we were building. So we had to work to understand the different topography of the area. And we had to understand how we could use the topography of the site to enhance, or make the design better. For example, we had to ask, could we use and take advantage of existing wind to help provide passive ventilation of the building. Or how could we use the topography of the site to gather storm water to use for non-potable purposes, like flushing toilets.

The build environment includes spaces created or changed by humans. Some examples are buildings, water supply, and energy production as well as green spaces such as parks and community gardens.

Quantity is the amount or number of something. Quantify is to measure the quantity.

Living in Pittsburgh, you have probably noticed all the hills, or changes in elevation. These are examples of physical features or the topography of the land.
What is passive ventilation?
When we are in a space, we want fresh air to come in. Normally, that's done with fans. Fans help push the air through. Passive ventilation often uses something called the chimney effect. In Pittsburgh, the temperature 15 or 20 feet below ground is about 55 degrees (Fahrenheit). Hot air rises (because it is less dense than cooler air). As the hot air rises, it draws in and is replaced by cooler air, in this case the 55 degree air. But you have to give the air a path in order to move. So we created a path for the air. Now the space has natural air flow, and it's a cooler temperature.

So your job is to figure out how the system works naturally and then give it a way to work?
Right. That’s a good way to think about it.

In the chimney effect, the different temperatures of the air cause a natural flow of air to be pushed through a space.

What’s another problem you faced when you were working on the Center for Sustainable Landscape design?
Well, we needed everyone’s input on different renewable energy solutions for the site. For example, we had to ask questions like “How many photovoltaic (or solar) cells do we need?” and “Do we have enough space to install the number of photovoltaic (or solar) panels to produce enough electricity to operate the new facility?”

So a really important part of figuring out how many solar panels are needed is to first figure out how much energy is required to run your building. A part of figuring out how many solar panels we needed was to create a building that used as little energy as possible. That’s what happened for the Center for Sustainable Landscapes. So we did calculations and used different energy models to figure out what the daily energy use would be. Then we were able to figure out the number of solar panels we would need. There are lots of

Can solar panels work in cloudy weather?
different kinds of calculators on the Internet to figure out how many solar panels you need. The biggest thing to think about is the efficiency of the solar panels, and that can vary significantly. Then you have to think about how that fits in with the general weather pattern of where your project is located.

So really you have to understand a variety of factors to solve the problems. You have to understand the science of the solar panels, but you also have to think about the weather and the amount of space you have and the amount of energy the building uses. So lots of things to think about!

Right, and you also have to think about the materials being used. For example, the Center for Sustainable Landscapes project was trying to design a net zero energy building and to work under multiple green building rating systems. One green building rating system was called the Living Building Challenge. With the Living Building Challenge, there are requirements for net zero energy with no combustion. That’s why we were really limited to solar panels, wind, and geothermal for energy. Another important element of the Living Building Challenge is called “red list items.” Red list items are a list of materials that you can’t install in your building because they have been known to have negative health impacts on individuals or to have negative environmental impacts, or both. This really promotes the reuse of different materials so we don’t use as many new materials in the build environment. One of the ways we reused materials was by contacting local barns in the area to find wood. The entire façade, or outside surface, of the Center for Sustainable Landscapes is composed of reused barn wood.

With net zero energy, you are producing enough energy onsite to completely run and maintain your building. So you aren’t taking in extra energy from city power plants. Net zero energy is measured on an annual, or yearly, basis. The same thing is true for net zero water. But water is a little bit different because there are different laws for the use of potable water on site. Phipps has their own water treatment center, but the local authority won’t let them use it for potable purposes. So instead they use the treated water for their very delicate orchids. Which I think is awesome! So they can use the water for things like toilets, but they can’t use the water for anything that would be ingested, like water fountains or food preparation.

**Combustion** is the process of burning materials.
Earlier you said that you wanted to align the solar panels with how much energy was being used. And you said you were creating a building that used the lowest amount of energy possible, which is a different viewpoint than to make sure you have all of the energy that you want to use. How did you get to the point where you were using the lowest amount of energy possible?

One of the ways we were able to reduce the amount of electrical energy being used was to have the building allow as much natural light to come into the space as possible. This lowered the amount of electrical light needed to light the space. We also added in features called **light shelves**, so basically that allows the natural light to be reflected and bounced and to go back farther into the building. Also, we painted the walls white. You’ll see white walls in a lot of green buildings. The color of the walls makes a difference of how much light is reflected. So a white wall helps you use less electricity because you’re getting more out of the light you are using.

**So it’s thinking about the materials you are using and then getting the most out of your materials.**

Right. And you should also think about the process. One really important thing about designing green buildings is that a lot of it is thinking about and putting together a process. Instead of designing or operating a building where people don’t talk to each other, like the electricians don’t know the needs of the different people in the building, a lot of it is bringing people together to put the different processes together in a sustainable manner. That’s a part I think is really important.

**Why should we care about having green buildings?**

Buildings use more energy than both cars and industry. Buildings are a huge user of energy in the United States. And that’s pretty common internationally in developed countries. If we are going to try to tackle our energy consumption, we have to look at the biggest energy consumer. Really understanding why green buildings are important helps us as a country reduce the total amount of energy we use. But also, on a personal level, we spend 90% of our time in buildings. Our health is really linked to the time we spend indoors. So promoting and developing a space that’s nice and healthy is important for an improved quality of life.
So what can I do?
If you live in a house, you probably already know a lot of the energy issues in your house.

You mean like I probably already know that heat is going out through a large gap in the bottom of the door because I can feel the cold air?
Yeah. So it’s really the courage and time to act. So if you have a suspicion about an energy issue, you are probably right, and you should probably try to fix it. The other thing is that there are so many resources that are available to residents that they don’t take advantage of. For example, Duquesne Light does a free energy audit online. They send you a free kit, valued at $50, if you put in your account number. And that can ultimately help you reduce the energy use in your home. Also thinking about the improvements you make in your home. So, for example, the types of blinds you install can be more energy efficient. So thinking about things like that in your decision process can be significant.

What can I do if I’m a kid?
Try not be such a consumer. One of the biggest things to understand is that all of the things that you want are from resources. And sometimes those resources are harmful to people and the environment. Like plastics, some of them give off harmful gases. The other thing is connecting with food. Like to think about where food comes from. I think that connection is really important. But other than that, it’s things that you’ve probably heard like recycling and turning off your lights and taking shorter showers, turning off the facet, composting with your family, creating a garden, and all those fun things.

Want more information on energy efficiency? Hunt through this site!
www.pittsburghpa.gov/green/energyefficiency.htm

Are you a customer of Duquesne Light? Interested in doing an energy audit?
www.duquesnelight.com/WattChoices/Home/EnergyAudit.cfm

Not a Duquesne Light customer? Try out this site.
www.energystar.gov/?c=home_improvement.hm_improvement_audits

Want to learn more about composting?
aggie-horticulture.tamu.edu/kindergarden/kidscompost/compostingforkids.pdf
On a school level, are there ways for students and teachers to make a classroom “green” even if they can’t immediately make the entire school green?

Yeah, there are different resources out there for greening the classroom. One of the programs I love because I feel like it brings a lot of different concepts together is the idea of students having their own greenhouse and figuring out what kinds of plants they want to have in the greenhouse and grow. And then taking the plants into individual classrooms because certain plants can help to purify the air.

I’ve heard plants also have the potential to reduce stress and violence. It’s so interesting how things in the environment have the ability to change how we feel.

Yeah, and most of the design decisions are not new decisions. We’re just redoing things. Like people hear about green roofs, and they’re like, “Oh, my gosh, what’s a green roof?” But if you look at old English cottages, they all have green roofs. So its really recognizing that in many ways, this is not new.

Interested in creating a garden or greenhouse?
Here are some tips from Phipps Conservatory.
phipps.conservatory.org/project-green-heart/green-heart-resources/tips-for-sustainable-gardening.aspx

What is a green roof?
science.howstuffworks.com/environmental/green-science/green-rooftop.htm