

Spruce Up! Using Green Roofs and Green Spaces to Alleviate Heat Islands

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Webcast Questions and Answers

How much experience is out there installing green roofs in hurricane-prone regions? What are the special considerations that must be accounted for in those climates?

Steven Peck: There are standards for roofing materials that are well established in hurricane-prone areas. Some jurisdictions like South Florida have specific requirements that pertain to green roofs, but there are a lots of different techniques and there's an American National Standards Institute (ANSI) standard for wind uplift. If you Google "ANSI standard," we developed it, it's with the Single Ply Roofing Industry. We developed and actually just recently updated a wind uplift standard that has a whole bunch of measures that can be undertaken to reduce any threat of green roofs being torn off buildings.

Having said that there's a lot of talk about that, but there's very little evidence to show green roofs flying off. In fact, the evidence that does exist demonstrates that green roofs outperform traditional roofing systems during hurricanes, not the other way around.

In the Kansas City case study how were the increased public health benefits linked to green roofs? Explain a little bit more about how that link was made. Is it possible that there are other benefits?

Robyn DeYoung: When there are energy savings, we plug that into our tool AVERT – the [AVoided Emissions geneRation Tool](#). That's able to specify which power plants in the Kansas City region would lower their generation and then lower their emissions. Based on the location of the power plant and the emission reductions in those different counties, we put that into our program model and COBRA – the [CO-Benefits Risk Assessment health impacts screening and mapping tool](#). That has a built-in reduced form air quality model. When you lower the emissions in these counties, it takes that and determines how the air quality has improved. Then it looks at what the population is where the air quality has improved and it monetizes what health benefits are. It actually has the dollars associated with less asthma exacerbation.

COBRA is able to look at the dollar value of fewer hospital visits or fewer sick days of the dollar value for the location where there are emission reductions and improved air quality. It shows how the health benefits accrue.

What other unrelated urban factors (more electric cars, greener public transit, other forms of green infrastructure, etc.) could confound the increased benefits calculated in the Kansas City green roofs case study?

Robyn DeYoung: Maybe there are other policies out there; this study does not look at those factors. This is one green roof analysis; however, you can do a more comprehensive analysis if you wanted to. If you knew that there were more electric cars, then COBRA has the ability for you to lower the emissions in the transportation sector. You can look at industrial sector, too. So if you have that information, you could do a combined analysis that shows how the health benefits are increasing from other sectors of the economy. We just have the power sector for the case study.

Are there any other examples similar to Denver where green roof projects were developed that involve participation of citizens - cases where professional technical stakeholders and citizens have met and agreed on a final program or project?

Steven Peck: I'm not aware of any other citizen-led ballot initiatives around green roofs anywhere in North America. I'm not aware of it. I think it's unique.

Victoria Ludwig: What I've seen is that other cities usually do involve the citizens. Maybe the citizens do not initiate the program or put something on the ballot, but when a city is developing a policy for a green roof incentive program, they do have usually public listening sessions, and task forces or citizen advisory groups.

What part of the process the city went through is most replicable - things that weren't specific to the Denver context or the Colorado legal framework? What could other cities really take and run with based on the lessons that you learned?

Katrina Managan: I think the most replicable part of our process is this concept of laying out the goal and then asking your stakeholders how to reach that goal. In our process the goal was to honor the vote and make sure that we delivered as much or more benefits for voters as the original ordinance and the original proponents intended. The rest of the community did not care very much how we reached that goal. A lot of technical experts in the real estate sector and green building sector did care a lot though about how we reach that goal and they wanted to make sure we reach the goal in a way that actually works for all buildings in Denver. They wanted to ensure the end results was not disproportionately burdensome on one sector over another. I think if you set the goal, no matter what goal it is that you want to achieve, and then you ask a group of smart stakeholders how to reach that goal, they can help you find that path. We ended up having four goals and four benefit areas defined from that original ordinance. The four for this project were urban heat island, adding greenspace to our city, stormwater management benefits, and greenhouse gas emission reductions.

Could a similar analysis be done for other cities in the U.S. the same way that you did for Kansas City?

Robyn DeYoung: I definitely think that this analysis could be done in any city in the United States. Alaska and Hawaii would be tough because the [AVoided Emissions geneRation Tool](#) doesn't have data in Alaska and Hawaii. In the contiguous United States you can enter any of 100 cities in the [Green Roof Energy Calculator](#). If you're not one of those one hundred cities, you could use a city nearby as a proxy because it's based on the weather data that is available and it's probably very similar even if you're not in that metropolitan area. I would say, "yes."

Katrina Managan: I would just note we did a lot of analysis to figure out and quantify the benefits of the original Green Roof and Solar Ordinance and our findings were actually quite different from what Robyn presented. I don't think the methodologies are all totally settled on these things. So if someone on the phone is doing that sort of analysis, I am happy to share what we did. We hired a third party, Stantec, as a contractor to quantify all the benefits of the original ordinance for us and land all the costs that also all the benefits and so and we have some different conclusions actually. So I'm just happy to share if anyone's trying to do that.

Robyn DeYoung: What we've developed uses freely available tools, it doesn't have all the costs and benefits available. It's one place (Kansas City) and there are probably many other ways to do it; it's not the only way. I really encourage people to investigate what makes sense for them. They might need more comprehensive analysis. They might want different information in terms of outputs. It just depends on the stakeholders need, so very good point.

Katrina Managan: The big difference is that we found the green roofs and cool roofs have similar urban heat island benefits; we found that the color of the roof doesn't affect energy consumption in the building very much. New buildings have R-30 insulation, so the roofing doesn't actually lower energy consumption much in the building, according to all the analysis we did. I'm not sure all of that's perfectly settled.

Please provide a link to the Denver green building ordinance.

Katrina Managan: [Denver's Green Buildings Ordinance](#).

Does the 29 inches of stormwater retention referenced for the Kansas City study include just green roofs?

Robyn DeYoung: By 2020, green roofs in Kansas City, Missouri could retain 29 inches of annual stormwater runoff if building developers and parking garage owners continue to install green roofs at the current growth rate. Read the full analysis online: [Estimating the Environmental Effects of Green Roofs: A Case Study in Kansas City, Missouri](#).

In Denver, what's the threshold for existing buildings to need to install green roofs?

Katrina Managan: All existing buildings over 25,000 square feet have to have a cool roof when they replace their roofs. Plus, they have to have one of the following compliance options:

- 1) A new green roof or green space. For existing buildings, green area has to be equivalent to 2 percent of the gross floor area of the building or 18 percent of the total roof area or the available roof space. There's also an option to pay the city to install offsite green on behalf of the building, or
- 2) On-site renewable energy, or
- 3) Leadership in Energy and Environmental Design (LEED) Silver certification, or
- 4) Enrollment in the [Energy Program](#) administered by Denver's Department of Public Health and Environment.

For the Kansas City Case Study do you evaluate the green roof induced effect on the heat island?



Robyn DeYoung: For the case study heat flux is an output of the [Green Roof Energy Calculator](#). The heat flux calculations are based on the green roof input data and associated lower temperature of individual roofs and buildings. The calculator's outputs are not intended to be scaled up for estimating wider-scale heat island temperature reductions – that would require an atmospheric modeling component.

You can find out more information on the heat flux calculations by going directly to the Green Roof Energy Calculator and following the link to [learn more about how the calculator works](#). In the documentation it discusses how sensible and latent flux estimates come from the Department of Energy's [EnergyPlus model](#).