



Sustainable Design: Time for a Reset?

By John L. Pierson, P.E. and Julie Anne Geyer

It's been over half a century now since aspirations for an environmentally responsible, *sustainable* infrastructure became a dominant factor in the design and construction of commercial, public sector and residential buildings. Since the green movement's impetus, i.e., the energy crisis of the 1970s – our industry has seen a number of “green” building fads come and go.

A 2010 ASRHAE¹ report identified three major pitfalls that have led to green building failures:

- Disregarding the principles of building science
- Failing to take into account the context and conditions of a particular project
- Deploying materials inappropriately for no other reason than that they have met certain ecological criteria

According to architect Rick Avon, AIA, CPHC, RESET Air AP, whose design firm, Avon Design Group, LLC of Pittsburgh, focuses on high performance buildings, today's green building successes happen when owners and their design teams:

- Choose the right materials
- Detail them properly
- Install and then maintain them in full compliance with each manufacturer's specifications

After 50+ years of trial and error, how close are we to ensuring our buildings are adequately protecting the environment? Rick Avon suggests that we may be looking at the wrong paradigm and that it might be helpful to change our perspective. He explains, “The way our design group pictures it, we look at the individual person and the first ring around them is their health, and then the second ring is their environment. Early adopters were looking at the environment while ignoring its context. If you take care of the person and their health, then what you need to do to care for them properly is to save the environment.”

This article will look at how today's architects, material manufacturers and design engineers are going back to the most fundamental principles of building science to ensure equitable building solutions that prioritize the health and welfare of a building's occupants and its surrounding communities.

High Performance Buildings Demand Predictable Outcomes

If we expect our buildings to facilitate the health and safety of their occupants, as well as that of near-by communities, ongoing measurement and verification are critical. Predicting outcomes no longer depends solely upon field-based observations or paper-based warranties. Rick Avon suggests, “Now we can generate a model so we can predict how [the building] is going to perform. Decisions are based on models and metrics.”

Avon's firm looks to Passive House, a voluntary standard for measuring energy use, which can be used for new construction as well as rebuilds, and which gives architects “the freedom to design the building to meet those metrics.”

Thoroughly researching the short and longer term benefits of emerging technologies is critical to successful outcomes. Too often supposedly “green” solutions fail to take into full consideration the energy consumption related to their production and to their eventual removal and replacement when systems prematurely fail. The long-term service life of a building system should be an essential factor in evaluating the environmental impact of any building envelope solution. Successful deployment of authentically green solutions is only possible when such materials are used appropriately.

Building envelopes with predictable performance outcomes require that building owners and their design and construction collaborators thoughtfully evaluate the cradle-to-grave consequences of each material decision.

¹ [“Why Do Green Building Enclosures Fail and What Can Be Done about It?”](#) Guylaine Desmarais, Richard Trempe, and Mario Gonçalves, PEng; ASHRAE, 2010

Relevant Standards

There are now a number of building industry standards, most notably Environmental Product Declaration (EPD), which focuses on environmental impact, and Health Product Declaration (HPD), which focuses on human health impact of specific materials, being used to authenticate various factors relevant to sustainable design. Since building envelopes integrate numerous products that can only be properly evaluated in a system context, such standards have their limitations.

Nevertheless, EPD and HPD are valuable tools to assist the design community's building system evaluation and selection on those factors most critical to sustainable design.

Longevity

It has often been said that longevity is the ultimate form of sustainability; indeed the very word comes from the Latin word *sustinere*, meaning to continue, to endure. Avon reports, "A longer life cycle is beneficial for two reasons. One is for cost – you are not replacing every few years. Two, in a world focused on carbon reduction, you don't want to be discarding materials and replacing them with frequency. Dollars spent on long-lived products is money well spent. Why would you want to produce a material nine times, when you can get the same lifespan from a product produced only once?"

According to Avon, "Enclosing the building to stop the elements from entering is a milestone. This affords a chance to dry out anything that did take on water. Every time you open the building to the elements the same risk of water infiltration and damage are factors. To avoid those problems, you want materials and systems that last."

Life Cycle Assessment is a critical factor in sustainable design. Today's select high-performance metal roof and cladding systems are designed for a 40+ year lifespan and are 100 percent recyclable when their service life has ended. In the roofing arena, a high-performance thermoset polyurethane-modified membrane is available with a life expectancy more than double the 17-year typical service life of conventional roofing materials. There are environmentally responsible restoration materials that can add as much as 20 years of life to an existing roof, vastly reducing the millions of tons of construction and demolition debris that ends up in landfills annually.

Avon believes that early on there was a misconception that you had to spend too much green to be green. In his experience, both the commercial and public sectors are doing well at overcoming short-term cost variances and striving to make the green products more price competitive. "We have weeded our product libraries of products that are not contributing to authentically healthy buildings."

Human Health

What does it mean to start the design process with the health of building users and its surrounding inhabitants in mind? According to Avon, that process looks like this:

1. What does each individual product contain and what is the context for its placement? For example, something that might be considered hazardous inside a room may pose no health threat at all when embedded in the building envelope.
2. What is the cost-to-benefit ratio in relation to the purpose of the building, i.e., what level of longevity is appropriate and what degree of maintenance is acceptable to the building owner?
3. How safe and how costly is the installation process? What hazards are involved that could adversely affect the installers as well as other job-site or building occupants?
4. How quickly will the performance attributes of mission-critical but invisible components, most notably insulation, decline?
5. At the end of the project, will the resulting aesthetic live up to the wellness objectives of the occupants and the surrounding community, and will that aesthetic sustain over time?

Education Never Stops

Avon believes the pandemic has played a major role in raising public awareness of the health benefits of truly sustainable building solutions. Threats of contagion, coupled with concerns over climate change, have raised the design community's awareness of the inequities that exist for urban communities that lack adequate tree cover and suffer disproportionately from urban heat island effect. The many illnesses related to poor air quality and inadequate storm water management have been well documented by the EPA³.

He comments, “[Our customers] are not looking to put a plaque on their walls applauding their greenness. They want solutions that are proven to work...Garland⁴ has a metal panel line for exteriors. Some metal manufacturers stop at the panel and do not look at the substrate, the need for vapor barriers and adequate insulation. We want to work with manufacturers that are well-educated to the entire system. Companies that are willing to help educate us and make sure that the materials we are specifying are being applied properly...When we work with Garland, they are doing things the way we would recommend.”

According to Avon, Garland’s ability to provide comprehensive, fully integrated building envelope solutions, including on-site inspections during installs, combined with its many educational opportunities, have made it a dependable resource. He believes it is not enough to choose a supplier that provides a quality system. What is needed is to partner with suppliers that “come alongside you to make sure their systems last; a supplier who understands that systems only last when they are installed properly.”

Even before short-lived materials fail, they are gradually losing their ability to perform as specified. When the right materials are used for the right application and are installed and maintained per the manufacturer’s specifications, the customer’s desired outcomes will be achieved. That requires manufacturers who are willing not only to inspect their installations but to educate end users to the maintenance required to maintain warranted performance.

Conclusion

The construction industry has come a long way since the start of its quest for sustainable building envelope solutions. From low VOC and cool roof coatings that significantly reduce energy consumption to purposeful deployment of bio-based materials and system solutions designed to optimize interior air quality – building owners and the design community have never before had such a wide range of sustainable options.

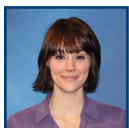
With the increasing adoption of stringent third-party standards, it has become far easier to avoid the pitfalls related to premature trend-chasing product releases. Our industry is on the cusp of a new era in which sustainable design and building functionality have become indelibly intertwined for the health and welfare of our planet and its inhabitants.

³ [“Climate Change and Heat Islands”](#), U.S. Environmental Protection Agency

⁴ [The Garland Company, Inc.](#), a leading U.S.-based manufacturer and distributor of high-performance solutions for the building envelope



John L. Pierson, Jr., P.E., has more than 20 years experience in the construction industry and is a frequent presenter of seminars and AIA-accredited classes on building science and code compliance. In his current role as Director of Engineering for The Garland Company, Inc., John supervises a staff of in-house engineers who provide a full range of services for high-performance building-envelope solutions.



A graduate of The Ohio State University with a B.S. in chemistry, Julie Anne Geyer began her career at Garland in 2013 as a research and development chemist and now serves as the company’s R&D Manager. She is an active member of ASTM (American Society for Testing and Materials) and serves on the Technical Committee for AMAP (Association of Modified Asphalt Producers).