A Whole Systems Approach to Sustainablity

by Peter Gisolfi, AIA, ASLA, LEED AP

Sustainability is an ecological term that has become commonplace in our vocabulary. We understand that various natural ecosystems, when left in their natural state, are self-sustaining. In this context, self-sustaining means that plants and animals and the climate are in balance, and that the same environment will evolve and sustain itself over many years, as long as there is no major intervention by an outside force.

When we refer to sustainability in an academic setting, we are talking about an environmental system in which a building or a campus can sustain itself. What does this mean? This article will address four types of sustainability that can apply to academic buildings and campuses.

- Environmental sustainability is the classification that most mimics nature. By reducing carbon emissions through renewable fuel sources, we can reduce environmental degradation; by planting campuses with native trees, shrubs, groundcover, and grasses, we can reduce the use of fertilizers and pesticides that pollute our streams and watersheds.
- In an academic setting, economic sustainability identifies the strategies that use resources in a manner that allows the institution to continue to function responsibly and productively over a long period.

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- Operational sustainability seeks to reduce environmental impact, lower operating costs and increase workplace safety.
- Student activism refers to the power that students have to influence change. Student awareness of environmental issues can impact the present generation and generations to come.

Let us look carefully at these four approaches to sustainability in academic settings.

ENVIRONMENTAL SUSTAINABILITY MIMICS NATURE

When we speak of environmental sustainability, we could be referring to one small parcel of land, or to a large segment of the natural environment, such as the watershed associated with a major river. For example, we might consider the environmental sustainability of the Hudson River Valley or the Delaware River Valley. On the other hand, environmental sustainability might be limited to the environment of a single academic building or an academic campus (the landscape and the buildings).

Academic buildings, especially those that are situated on campuses, have the potential to be self-sustaining to a significant extent, or even completely self-sustaining. Buildings consume energy, but we can collect and use energy that is available from the sun, from the movement of water or wind, and from geothermal sources. In essence, we are looking at heating, cooling, and providing electricity for a campus. It is possible to produce onsite all the energy that the buildings will consume. We could then say that these buildings are environmentally self-sustaining.

Sustainable buildings are constructed with regionally available natural materials that are not harmful to the buildings' occupants. Building codes have been evolving toward prohibiting the use of materials that can be dangerous to the occupants.

ENVIRONMENTAL SUSTAINABILITY

Also refers to outdoor space — the campus on which the buildings are situated. The guiding principle is that the academic landscape should resemble the natural landscape to the greatest possible extent. Obviously, parking lots and playing fields are never going to be natural landscapes, but it is possible to mitigate the negative effects of these components. Parking lots can be designed with no runoff from their surfaces, and stormwater can be filtered, detained and gradually reintroduced into the soil. Playing fields can be designed with no negative stormwater consequences. The challenge comes from the use of chemical fertilizers or possibly from the negative aspects of synthetic turf. Some building codes are addressing these issues by prohibiting stormwater runoff from the site, and requiring the planting of natural vegetation.

In the broader view of the campus landscape, the resemblance to nature can be quantified and measured in terms of stormwater effects and in terms of the amount of photosynthesis that occurs. The campus resembles a suburban landscape, and most suburban landscapes can be designed to mimic the natural landscape.

ECONOMIC SUSTAINABILITY VS. THE NATURAL ENVIRONMENT

Economic sustainability is a term that entered the lexicon in 1987 with the publication of the Brundtland Report, from the United Nations World Commission on Environment and Development. The report attempts to marry two disparate ideas: sustainability that is patterned after nature, and the exchange of goods and services that foster economic development. As countries continue to advance economically, they strain the ability of the natural environment to absorb the negative impacts of this economic growth. Economic sustainability imagines a future in which the economies of the world can continue to grow without adversely affecting the natural environment. This may be difficult to accomplish.

When we consider the idea of economic sustainability in terms of an academic institution, we tend to think of the sources of funds that support the academic endeavor. A public school might receive money from taxpayers and, with that money, the school would maintain its buildings and sites, pay the staff, and purchase fuel and electricity.

It would be in the interest of such an institution to invest in simple initiatives, such as insulating the building and using low-energy lighting to save energy and reduce its carbon footprint. These institutions are at the smaller end. At the larger end are private institutions with the endowments and tuitions that help them thrive. They should invest in high efficiency

building envelopes, geothermal heating and cooling, solar collectors, wind turbines and other sustainable initiatives that reduce environmental impact

OPERATIONAL SUSTAINABILITY RELATES TO EFFICIENCY

Operational sustainability in an academic setting can apply to a single building or a series of buildings on a campus. The issue at hand is how the sites and buildings can be operated in the most efficient manner possible. On the energy front, the ultimate goal is to not purchase energy from the utility companies. Electricity can be produced on campus through solar collectors and windmills; in addition, significant amounts of energy can be saved by harnessing the latent heat and coolness of the ground to help heat and cool the buildings.

The pathway to operational sustainability is relatively straightforward, but will require time and significant investments. By implementing the following key points among other strategies, zero energy buildings and campuses are possible.

- Assess current energy utilization and set phased goals for reduction.
- Employ alternative strategies, such as solar power, wind power, and geothermal systems.
- Design building mechanical systems so that buildings hibernate and use little energy while they are not occupied. (Most academic buildings are in use only 40 to 50 hours a week, but the buildings are heated and cooled 168 hours a week.)
- Introduce fresh air into spaces only when they are occupied.
- Switch to low-energy lighting.
- Use effective mechanical system controls to reduce energy consumption.
- Find ways to use less water.
- Reduce the workload for the maintenance staff by keeping the landscape more natural.
- Develop a plan to reduce energy consumption, and update it frequently.

Creative solutions can emerge that favor well-being in instructional spaces, and inspire a choreographed sense of community in the school building and in the adjacent outdoor spaces.

At the Hackley School in Tarrytown, New York, a 1903 stone building was reconstructed. Heating and cooling is done by a geothermal system, drilled into bedrock. The transformed and expanded building, which has doubled in size, uses approximately 10 to 15 percent of the energy of the original building.

STUDENT ACTIVISM CALLS FOR STEWARDSHIP OF THE ENVIRONMENT

Student activism relates to what students and staff might be able to learn by observing and monitoring how a sustainable building and a sustainable campus function. The negative human influence on the natural environment has grown geometrically in only the last couple of centuries. It seems there are no limits to the size and destructiveness of the human population. We have recognized, belatedly, that environmental stewardship is a critical issue.

Student activism related to environmental stewardship can be effective only if students have been educated about these issues. They could urge the institution to make more rapid progress if they understood the long-term benefits of sustainability. A building or a campus can be a learning tool for students if there are measureable results that can be observed and improved.

The challenge for this generation of students is how to work for the sustainability of the planet. Perhaps good places to start are in their own school buildings and school communities. The buildings and campuses could be learning tools that deepen their understanding of these world-threatening issues, and inspire the changes that are necessary.

SUSTAINABLE REMEDIES ARE WITHIN REACH

Sustainability is a multifaceted subject. It is not surprising that the idea is difficult to define and understand. Nevertheless, the players within the education community have the opportunity to influence the sustainability of their physical settings. If they collaborate effectively, we could see significant change and improvement.

Sustainable remedies are within reach, but disagreement about the metrics continues to be a stumbling block. For example, it is common practice for an academic institution to construct a new "low energy" building. The new building uses less energy per square foot than a typical building, but is still, in total, adding energy consumption to the institution. Instead of constructing a new energy-efficient building, why not modify an existing building so that it becomes energy efficient? Or, instead of calculating energy use per building, why not calculate energy use per student? These debates might stimulate discussions of environmental awareness at academic institutions.

If you imagine that all the environmental damage is recent, I remind you that our forebears 2,000 years ago were raising similar issues. The Roman essayist Pliny the Elder (23 to 79 AD) bemoaned the destructive influence that human beings have on the natural environment. In his Naturalis Historia, one of the first naturalist encyclopedias, he wrote, "…in regard to nature's elements, we have no gratitude… She is flung into the sea or dug away to allow us to let in the channels. Water, iron, wood, fire, stone, growing crops are employed to torture her at all hours, and much more to make her minister to our luxuries and our sustenance."

Pliny was worried when the world population was only 300 million. Never could he have imagined the danger we face now.

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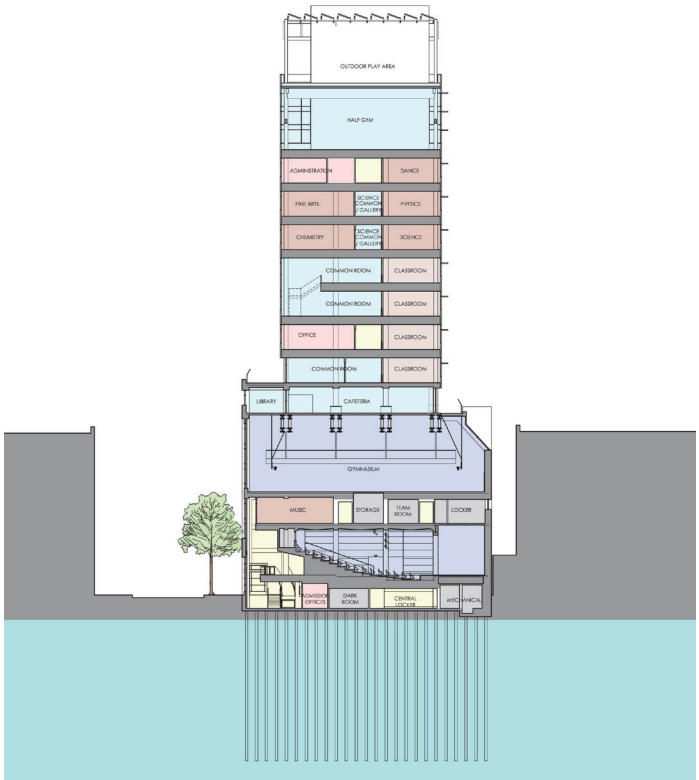

Trevor Day School in New York City is linked to the subsurface in an unusual way. Three hundred sixty poured concrete "energy piles" support the building and are the backbone of a geothermal system that heats and cools this new school. The system will be enhanced in the future by solar collectors mounted above the rooftop playground.