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NJARNG Sustainability Newsletter

In collaboration with Rowan University

Clean Cut Quarterly

Insulation

Learn about the evolution of insulation.
Story on page 1.

Rain Garden

Discover how rain gardens can improve sustainability on page 4.

Radiant

Read how radiant floor heating systems are becoming more innovative and efficient.
Details on page 7.

Get an inside look at Rowan University students performing energy and water audits at Fort Dix Story on page 6.

The Evolution of Insulation

By: Anthony Alliegro, Payton Keblis, and Kieran Murphy

Insulation Types

Insulation comes in many variations each with its own strengths and weaknesses. Some are less expensive than others, while others may be higher quality. Insulation aids in decreasing heat entering from outside when it's hot and keeps heat inside the building when the temperature outside is cold. "Insulation is rated by its R-value. R-value measures how resistant types of insulation are based on the type, thickness, and density of the insulation material." Spray Foam Insulation is commonly found in attics, basements, and doorways. It serves the purpose of adding extra protection in hard-to-reach spots to seal any water or air leaks. Blanket Insulation is a DIY-friendly type that is very affordable and reliable. This type can be very irritating when touched or rubbed against the skin. Foam Board insulation is a rigid board and gets installed in between the studs of walls. It's great for limiting heat conduction through walls. Concrete Block insulation is a newer type of insulation that works by sealing air gaps in between foam insulation to cover the cracks. Concrete insulation helps to maintain constant temperature control indoors and improves energy efficiency. However, it is difficult to install and requires the skills of a professional.

Insulation

Blow- In Insulation is very easy to install and is DIY-friendly. This works by blowing bits of fiberglass fiber or cellulose over walls and floors to cover any cracks, and gaps, and fill holes. It's important to wear goggles, long sleeves, masks, and gloves when installing because, like the blanket insulation, it is very irritating when it touches the skin.

'Insulation' continued on page 2

Recent Innovations

Companies and research institutions have taken a look at insulation and ways to improve its efficiency and environmental impact. One such institution, Oak Ridge National Laboratory (ORNL), has been experimenting with a nontoxic thermoplastic foam, as recently as 2023. This foam is made up of small "hollow glass spheres and expandable polymer microspheres." The hollow glass spheres are what separate the hot and cold air from each other while the polymer microspheres are what makes it an expandable foam. The foam performs similar to the typical fiberglass insulation found in most homes. However, it performs better at fire prevention and actually trapping the heat inside of the building. It is also environmentally friendly and lends itself to being favored by projects that specifically look for products that want green materials. The biggest advantage of this method of insulation is that it is non-toxic. Typically, when insulation is installed it requires an excessive amount of PPE. That is not the case with this foam.

ORNL Researchers

Unfortunately, there is not a lot of innovation in the field of insulation since 1% of the industry's budget goes toward R&D. The Department of Energy funds the research conducted by the ORNL, which is good since the cutting-edge of this technology has been proven to be costly. ORNL is hoping that the funding will increase so that they can make a more affordable option for the industry that will benefit the efficiency of buildings and the environment.

Sustainable Approach

Recently, there has been an uptick in sustainable insulation in commercial buildings as the impact of mainstream insulations on the environment is becoming more apparent. A sustainable approach provides a building with less exposure to toxins such as formaldehyde, isocyanates, and some flame retardants. Sustainable insulation is made up of recycled content and is a replenishable resource. The production of this insulation also emits less greenhouse gas emissions as compared to mainstream insulation production. Many are hesitant to make the switch due to a preconception that sustainability costs more. You can see this everyday, such as the cost of organic produce being higher at the store. With this insulation, it is cheaper to produce when compared to the other types because it is made from recycled materials. Long-term, commercial building owners as a whole would save $9.6 billion dollars, which equates to $2,100 per building. Normal insulation is not biodegradable, so there comes a problem when it is

'Insulation' continued on page 3

time to dispose of it. Since sustainable insulation is organically sourced, it breaks down easier when it is time to get rid of and replace it. According to the Syneffex website, Nuclear facilities around the US are searching for surface protection from mold, lead abatement, and energy saving solutions. Nansulate™ GP was used by Wolf Creek Nuclear Facility in Kansas for insulation and surface protection over the concrete walls of a cabinet room. The coating reduces heat transfer as well as provides resistance to moisture, mold, and UV degradation. More examples of sustainable insulation and other sustainable building approaches can be accessed through the Syneffex website. DMAVA works with the Environmental Management Bureau (EMB) to implement strategies to become more sustainable and work towards protecting the environment. Among this companionship is the National Guard's commitment to excellence following these four pillars: compliance, pollution prevention, conservation, and restoration. By making the switch to sustainable insulation, DMAVA would comply with these pillars and reduce its carbon footprint greatly.

Planting Rain Gardens to Sow Sustainability

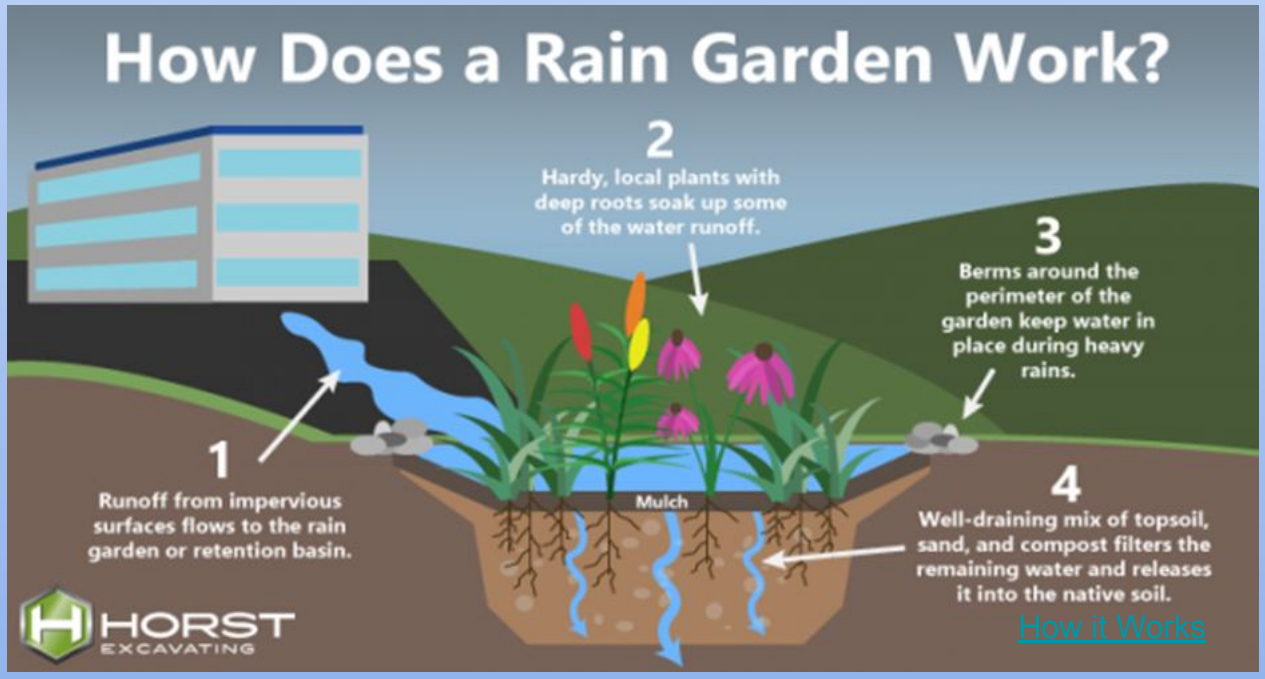
By: William Johnson

Garden

Planting rain gardens on New Jersey National Guard sites can mitigate stormwater problems and reduce flooding that is negatively affecting the foundational integrity of buildings. Rain gardens are designed landscape depressions that trap and absorb rainwater runoff.. Runoff is a destructive force that carries pollutants such as fertilizers, excrement, waste, pesticides, and trash. Runoff strains our environment and is a major contributor to degrading our atmosphere. As intense storms overflow drains and splash across land, water consumes and carries everything in its path. These excessive nutrients, sedimentation, and chemical contaminants are carried back to rivers and streams, where they create erosion and harm the aquatic habitat.

'Rain gardens' continued on page 4

When rain gardens are strategically placed, water is channeled from parking lots, sidewalks, roofs, and lawns. Experts estimate these drainage systems can soak up 30% more water than typical grass. The water filters through the soil and eventually returns to local rivers or streams. More intricate rain gardens are called bioretention cells and have drainage systems that filter out contaminants, pollutants, and sedimentation from stormwater runoff.. Rain gardens are an invaluable barrier to protecting the water quality in the community. The gardens will also protect the foundation of buildings by reducing flooding, in turn, decreasing maintenance costs and extending the life of the structure. Yiwei Huang, an assistant professor of landscape architecture at Purdue University believes that "These types of gardens are a way for all of us to critically think about how we treat water and make use of it versus making it the enemy. They can solve an urban problem in a sustainable way."



There are a few factors that are considered when deciding where to place a rain garden. First, identify problem spots where flooding naturally occurs. Then redirect water away from the foundation by grading the soil downstream, about 10 feet away from the building. The goal should be to have the downspouts in the direction you are channeling the water. After choosing the ideal spot for the rain garden you must decide the size of the garden and how many gardens to install. Variables to account for are the roof size and slope, yard slope, number of downspouts, and soil density. The rain garden should have an area about 20% the size of the roof or pavement draining into it. Finally, choose plants that are conducive to the environment and can sustain being wet for long periods. Shrubs, perennials, and native wildflowers are suitable options that can stand up to the surrounding conditions.

'Rain gardens' continued on page 5

By working together to implement water-smart strategies we can lessen the impact of runoff at N.J. Army National Guard facilities and the surrounding communities. By enacting green projects, we can reduce puddling around building foundations, improve the quality of life, and protect the health of our local and regional water supply.

Rowan University's Sustainable Facilities Center Leads Energy and Water Audits at Fort Dix

By: Jason Muermann

Rowan University's Sustainable Facilities Center's (SFC) engineering students recently conducted building energy and water audits at the New Jersey Army National Guard's (NJARNG) Fort Dix Joint Force Headquarters 3650 (JFHQ) and Joint Training and Training Development Center 3601 (JT2DC) in October 2023. This work is conducted to align with energy consumption goals established by the New Jersey Department of Military and Veterans Affairs (NJDMAVA) as part of the Clean-Cut Campaign. The campaign sets a clear goal to reduce its energy use per square foot by 2.5% annually, for a total of 25% by the end of the fiscal year 2025, compared to the fiscal year 2015 baseline, as well as providing a safe and healthy work environment for building occupants. These targets are founded on a combination of federal, state, and departmental requirements and objectives.

From left, Amna Abdeen, Emma Benkovic, Gus Van Walsen, Owen Power, Jordan Jeffers, Jason Muermann, Natalie Greene, and Edward Coyle, pose in front of the Fort Dix JFHQ 3650 at the conclusion of the building energy and water audit.

'Audits' continued on page 6

By conducting further data analysis, which involves monitoring historical energy consumption and reviewing notes documented during the on-site assessments, the engineering students are actively engaged in providing recommendations to reduce building energy usage and enhance overall building efficiency. These recommendations include the implementation of temperature setbacks during the building's unoccupied hours, roof replacement, incorporation of occupancy sensors, application of window film, delamping, transition to LED interior lighting, adoption of solar water heating technology, installation of ground-mounted solar panel arrays, and various other strategies.

From left, Thomas Torney, Brian Scala, Jason Muermann, Rajorn Elliott, Gus Van Walsen, Sarah Remick, and Lesley Perez, pose in front of a military vehicle during the building energy and water audit at the Fort Dix Battle Lab 3601.

Radiant floor heating and slab-on-grade heat loss reduction products

By: Nicholas Gentile and Jason Muermann

Recent technological advancements have enabled radiant floor heating systems to emerge as a practical alternative for space heating, specifically in commercial buildings. These systems (as shown in Figure 1), including air-heat radiant, electric radiant, and hydronic radiant floors, distribute heat directly to the floor or panels in the wall or ceiling, using infrared radiation akin to the warmth felt from a hot stove. In contrast to

'Radiant flooring' Continued on Page 7

conventional heating systems, radiant floor heating offers a host of advantages. These include uniform heat distribution, heightened comfort, discreet piping, quiet operation, energy efficiency, sustained warmth, compatibility with various flooring materials, minimal maintenance requirements, and potential health benefits. The evolving landscape of technological innovation continues to enhance the appeal and effectiveness of radiant floor heating in modern building environments. First, air-heat radiant flooring systems are less commonly selected for building installations as they circulate hot air through the floors. The limited thermal mass of air, which hinders the retention of substantial heat, typically renders this option the less cost effective choice among radiant flooring systems.

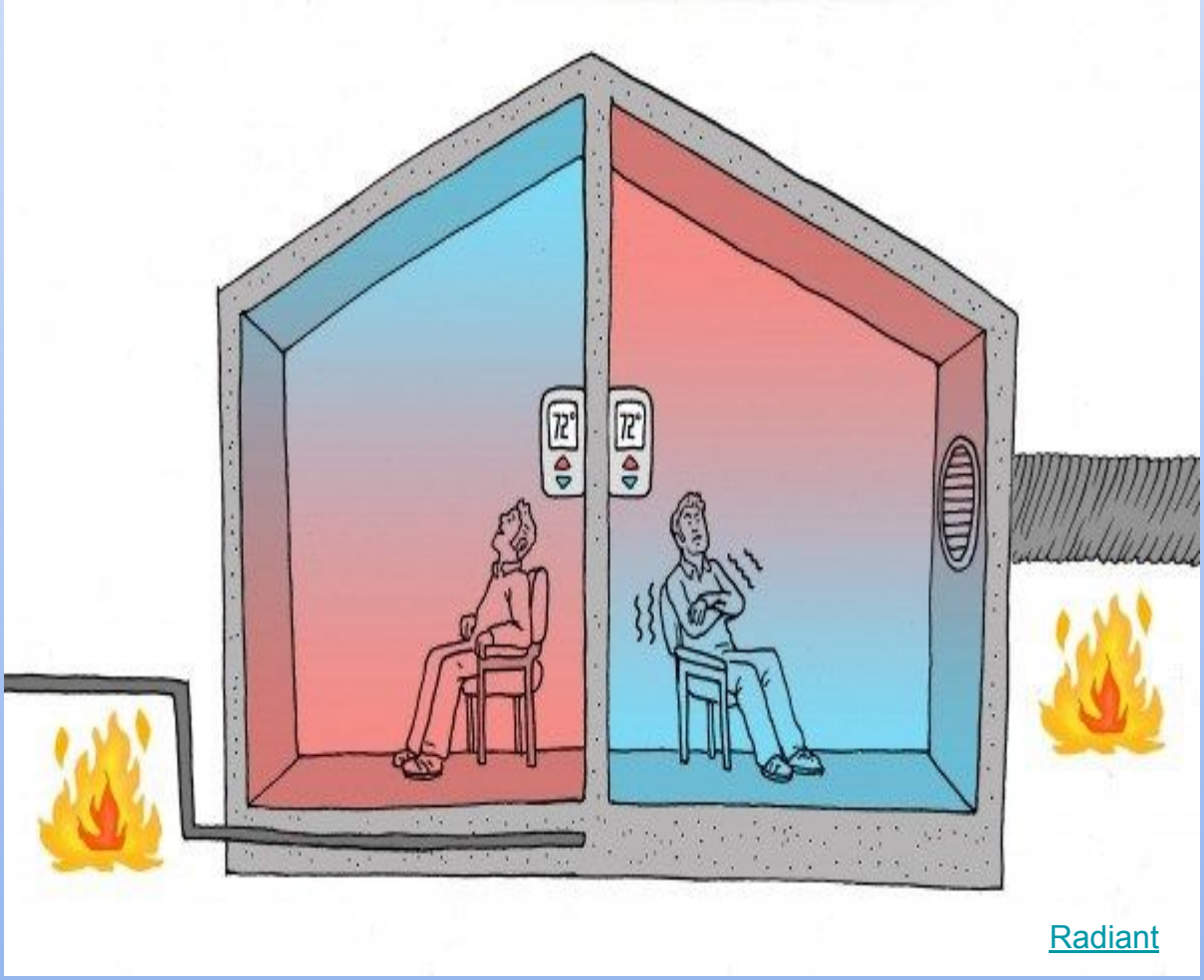
Flooring

Next, electric radiant floors represent an alternative, utilizing electric cables integrated into the floor. These systems are favored for their discreteness, quietness, and ability to retain heat over prolonged periods. However, these systems are difficult to install or renovate, have high installation costs ($10-$12 per square foot for materials), and high operating costs due to their dependence on electricity. Electric radiant floors are chosen for buildings when the system incorporates a substantial thermal mass, like thick concrete, and the electric utility company offers time-of-use rates, featuring lower electricity rates at specific times of the day.

Moving on, hydronic radiant floors emerge as the favorable option, employing a system where water is circulated from a boiler through tubing positioned beneath the flooring. These systems boast reduced maintenance needs, increased energy efficiency, equitable heat distribution, comfort, an extended lifespan ranging from 40 to 50

'Radiant flooring' continued on page 8

years, and the ability to incorporate zoning. Despite these advantages, it is worth noting that they come with elevated installation costs, ranging from $6 to $20 for materials and labor per square foot, and necessitate a greater amount of space for installation.



Radiant

In summary, recent technological strides have positioned radiant floor heating systems, including air-heated radiant, electric radiant, and hydronic radiant floors, as a compelling alternative for efficient space heating in commercial buildings. These systems leverage innovative approaches to distribute heat directly, offering advantages such as uniform heat distribution, discreet design, quiet operation, increased efficiency, sustained warmth, flooring compatibility, minimal maintenance, and potential health benefits. While air-heat radiant flooring lags due to its less cost-effective nature, electric radiant floors are favored for their quietness and heat retention, despite challenges in installation and higher costs. Hydronic radiant floors stand out as the most popular choice with numerous benefits, although they come with higher installation costs and space requirements. The ongoing technological evolution continues to enhance the appeal and effectiveness of radiant floor heating in modern commercial building environments.

Meet the Authors

Anthony Alliegro, Payton Keblish, & Kieran Murphy

Facilities Management Clinic

Evolution of Insulation

Anthony is a junior majoring in Electrical and Computer Engineering. Anthony enjoys playing video games and watching football. He also works part-time for Rowan's Division of Information Resources & Technology (IRT). Anthony's career goal of mine is to eventually get my Master of Business Administration and do some sort of IRT, Construction, or Facility Management in the future.

Payton is junior studying Civil and Environmental Engineering. She spends her free time taking care of plants, going on hikes, and making jewelry. Payton's career goal is to help with the advancement towards a more sustainable future, potentially assuming a leadership role. Her primary focus is on environmental preservation and exploring ways to safeguard it.

Kieran is a junior in the Electrical and Computer Engineering program. He likes lifting, home improvement projects, and collecting pokemon cards. Kieran is exploring CAD and construction as career options, but exploring all opportunities.

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Nicholas is a junior in the Civil and Environmental Engineering program. His favorite hobbies are skiing, fishing, and Hockey. Nicholas intends to pursue as a career field or project engineer.

'Meet The Authors' continued on page 10

Meet the Authors

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Learn more about the Rowan University Sustainable Facilities Center **here** or scan our QR code!

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