Raising the Roof
Vegetation above us could be very cool

BY MARGO PIERCE

In Greater Cincinnati, summer is snug alert season. But it doesn't have to be.

While car manufacturers tout protests about manufacturing more fuel-efficient vehicles and politicians debate senators about the merits of alternative fuels and damaging what's left of our unpaved eco-system with oil drilling, a revolutionary approach to addressing environmental issues has been growing overhead.

One economically viable and ecologically responsible alternative isn't just reducing pollution but is also feeding the poor, lowering energy bills and making concrete jungles a more pleasant place to work and live. It's called "green roofs."

Unlike the traditional roof garden of potted plants scattered around a gravel-covered roof with a picnic table and some asparagus, a green roof is a roof top covered with plants, which takes the place of standard roofing material such as shingles, according to Virginia Russell, associate professor of landscape architecture and leadership in energy and design (LEED) at the University of Cincinnati.

"An extensive green roof is 100 percent vegetation," she says. "At the other end is intensive that's more like a roof garden. When you say "roof garden" to me, that means people. You might have walkways, you might have benches, you might have lighting. You're going to have things that make people comfortable and safe that take up space that might have been given over to vegetation."

Alpine Cincinnati

The user-friendly green roof has different requirements and benefits. What they have in common is a waterproof membrane that covers the roof, with "growing medium" on top of that. Russell doesn't recommend shoveling dirt from the back yard onto the top of the garage to start your herb garden.

"Bad idea," she says. "Don't try this at home. A lot of (growing medium) is actually engineered soil."

Depending on the plants chosen, the soil will be a mixture of organic matter, lava or pumice rock or extruded clay that creates a lightweight yet porous foundation in which plants will grow. The bugs, fungus and disease that Uplift from the air, in addition to a lot of pollution, can also help provide moisture, if not all, this will need, resulting in gapping into stormwater.

Green roofs also have the potential to provide a tax break, as well as benefits for people living in a city, known as "cool cities." A reduced number of urban and commuting buses, grid initiatives, such as plant rich streets, create cooler temperatures on the hottest days, and provide a thin layer that dampens the level of noise, particularly helpful in a airport with heavy traffic. This installation can lower the cost of a roof up to 80 percent, as it is exposed to future, destructive UV rays.

A green roof is just to sustainable design, says Stoughton, a third-year student at UC.

"Sustainable design is to design with the environment in mind. He says," the "fun factor" is a plus. Mark Sauer, in his third year teaching, says, "It provides people the environment and a place to put a garden, otherwise, he says."

At the University of Cincinnati's Niehoff Studio, visitors study presentations on green roofs and sustainable design in Over-the-Rhine.

Russell notes Over-the-Rhine provides a unique opportunity to apply green building principles, including green roofs, in an urban, historical district.

Both students and faculty in Russell's class designing affordable green housing in Over-the-Rhine. Other cities use motions to grow vegetables that can help feed low income residents, just one example of how an entire community can benefit from creating new green space.

Before a single roof can be planted, the structural integrity of any building — existing or in design — must be evaluated, so that the weight of the green roof can be sustained over time. Working with a qualified green roof provider to identify the purpose of the green space and desirable plants will dictate the weight of the garden and essential support.

Potential issues such as leakage and maintenance also impact the selection of materials and green roof layout. No longer source, green roof retailers now provide consumers a variety of choices, including asphalt that help accurately adjust loads.

Russell suggests businesses and homeowners ask for references of three similar projects before signing contracts and verifying standards are in place. These are key issues that can help ensure a successful installation.
Working with the Hamilton County Planning Partnership - Local Alliance for Nature and Development (LAND), the US Green Building Council, and the Over-The-Rhine Housing Network, students researched and illustrated sustainable building techniques applicable to inner city buildings and sites. Again, this studio project is inspired by and facilitates sustainable development advocacy that is being led by active community partners.

With a focus on sustainable affordable housing solutions and eco-village concepts for districts within OTR, students presented their work to the general public and community partners on 6/2/06. This end of quarter event was complemented with a panel on sustainable development led by Cincinnati City Councilman Chris Bortz, who spoke on his pending city policy resolutions for sustainable construction requirements for municipal, commercial, and residential buildings, Steve Evans of Green City Builders, a proponent of eco-housing, and Jim Schenk of the environmental advocacy organization IMAGO, discussed urban eco-village concepts.
Mark Sauer: Sustainable Block

Sustainability and green design are found in two ways in this project; cohousing inspired site design and affordable house construction. Common facilities, residential management, shared open space, remote parking, and a non-heirarchical participatory process are some of the characteristics of a cohousing situation that this development embodies. Residents are required to participate in the cohousing community by maintaining their properties, preparing common meals, and working in the eco-garden, green house, and bike shop.

Social/Cultural...
embrace. By creating a site that not only retains the historical aspects of its surroundings but also brings a modern style of design, we strive to bring new life back into Over-The-Rhine. The cohousing lifestyle brings a new sense of community within a larger neighborhood.

Economic...
efficiency. Connection with Findlay Market through the eco garden and green house provides a way not only to actively participate in the cohousing community, but the existing neighborhood as well. Through required participation, by cohousing residents, in the eco garden and bike shop, learning opportunities are created for the broader community.

Environmental...
sensitivity. Using LEED strategies in new construction as well as the site design, we can minimize the impact of development. Placement of design elements, such as houses and park spaces provides maximum efficiency and resourcefulness.
John Stoughton: Can Sustainable Rehab Housing Really be Affordable?

Assuming a $100/SF construction cost, the total value of this rehab project is $195,500. I concluded that the total amount of financing needed to make this project happen is $23,500. Although all numbers in my calculations were approximate, this relatively low number is very encouraging. Sources of financing are plentiful because the project is in a Historical District and is implementing sustainable design. Tax credits and other incentives for building in this area should make this project a reality.

The Trombe Wall is the most visually significant feature of this house. The system maximizes passive heat gain in situations where south facing glazing is not possible. A south-facing wall is coated with a dark material. A layer of glass is placed no more than 6 inches from the wall. The sun’s heat will be trapped within the small space between the building and the glass. It takes hours for this heat to transfer from the exterior through the mass of masonry to the interior. The masonry wall can be sized to intentionally allow the heat to enter the interior during the night. Additional vents within the system allow direct warm air into the coolest spaces in the house. Average temperatures are about 20 degrees cooler at night than during the day, so heating the space in the cooler night time using a passive system is an easy way to ensure the building will not cool down too much in the winter months. Exterior shading can be applied to the Trombe Wall during the summer months to ensure the space will not over heat in the summer. This passive heat gain system is especially intriguing in an urban environment such as Over-the-Rhine where masonry structures with an existing window pattern are prevalent.

The Stack Effect is created on the southwestern corner of the building to promote passive heat gain, passive cooling, and natural ventilation within the duplex space. This area is an open, unobstructed double height space with no confining walls. As heat enters the space it will rise and be distributed within the home. Strategically placed operable windows assist in directing the air throughout the building. An additional benefit to this space are the incredible views of downtown Cincinnati unique to this area of OTR.

Roof Gardens exhibit many beneficial qualities which can be exploited in the urban environment. These roof spaces provide a much needed private green space for the resident. Views and privacy are luxuries in urban environments. Both can be found on the roof garden of this building. Stormwater runoff is collected on the roof and used below on the community gardens. The insulative properties of a roof garden are especially beneficial in the cooler winter months, and the landscaped vegetation helps protect the roof from direct sunlight in the summer months.

Other Sustainable Features Less visible sustainable strategies are also employed within the building. Ceiling fans operated by solar panels located on the roof garden are a great way of cooling the 10’ tall spaces within the units. The cool basement air is used to supplement a central air system putting less strain on energy costs during the summer months. This air system is integrated into the core utilities wall where the plumbing fixtures are located. Vertical spaces such as this utility wall and the community staircase are testaments to the urban typology.
The Crankshaft Block will be centered around a public green space, the Community Commons. The new commons will not only be much more aesthetically pleasing, but also serve as a gathering place for neighbors. A pergola connects the historic buildings while the open grass is used for block parties and family recreation. Rehabilitation on surrounding buildings will place an emphasis on opening their facades to the commons, daylighting, and a gorgeous view of Cincinnati’s skyline.

The Plan

**Sustainable Concepts**

- **Heating**
  - A green roof insulates the ceiling, a Trombe Wall stores and releases heat and is shaded from summer sun

- **Ventilation/Lighting**
  - Operable clerestories pull air through each unit and provide daylighting while shading summer sun

- **Water Retention**
  - The upper green roof supplies water to a cistern which can be used to water gardens on the lower green roof

**BASEMENT LEVEL**

- Features
  - Large storage areas
  - Truck access

- Sustainability
  - EPA required clean-up
  - Gray water recycling tanks
  - Solar batteries
  - On-Demand water heaters
  - Geothermal Furnace

**GROUND LEVEL**

- Features
  - Parking & storage
  - Separate unit entrances
  - Retail display windows
  - Large retail space

- Sustainability
  - Added South glazing
  - Grouped utilities
  - Flexible floor plans
  - Two business incubators
  - Lighting controls

**UPPER LEVEL**

- Features
  - Two four bedroom units
  - City view
  - Outdoor patio for each unit

- Sustainability
  - Green roof - patio & gardens
  - Ceiling Fans
  - Open floor plans
  - Added West & South Glazing
  - Grouped Utilities
  - Modular Rooms
  - Windows spaced to maximize daylight

**ROOF**

- Sustainability
  - Green roof
  - Clerestories for each unit
  - Photovoltaic Panels
  - Water retention
  - Sun shades

**LOCATED** in the southeast corner of Over the Rhine and just north of the Business District, the Crankshaft Block will become a diverse and healthy place to live, as well as a model of sustainability for urban neighborhoods economically, environmentally, and socially.

- No new construction needed
- Diverse neighborhood, keeps current residents in affordable housing and introduces newcomers
- Amazing views of the Cincinnati skyline
- Within walking distance of schools, markets, restaurants, churches, parks, and entertainment
- Easily accessible by automobile, foot, and public transportation
- To keep Cincinnati beautiful this site needs to be rehabilitated immediately

**Evan Blake Henderson: Turning Don’s Crankshaft Green**
Nate Morgan: Shining Some Light on the Subject

DESIGN OVERVIEW: The main goal of this 1600 sf design is to incorporate every aspect of daylight into the house. Whether it is used to passively heat the space, increase the health of the occupants or by even allowing light through large amounts of glazing which also provide opportunities for outdoor views.

Passive Heating
- NATURAL LIGHT - southern exposure to make the best use of heating effect of solar energy from the sun on the glass.
- SUPER INSULATION - double, or thicker insulation of walls, floors, and roof to store warmth during the winter months throughout the day and to release the heat stored at night.
- TRIPLE GLAZED WINDOWS - on southern side, stops heat from leaking from the building in the winter, and prevents heat to penetrate the building in the summer months.
- SUPER WINDOWS (R8 VALUE) - on north side, actually collect more heat during the day than they lose during the whole 24 hour period.
- GREEN ROOF - designed to keep heat in during the winter months due to its increase depth and good insulating materials.

Passive Cooling
- SHADING - shading of glazing with deciduous vegetation to shade the glass in the hot summer months, yet lose their leaves in the winter to allow sunlight to penetrate the building. Or using horizontal louvers to shade the surface of the glass and not allow all of the sunlight to penetrate the building when heating is not desired.
- SUPER INSULATION - double, or thicker insulation of walls, floors, and roof to keep cool air from escaping the house during the summer months.

Active Systems
- PHOTOVOLTAIC PANELS - (3’ x 5’) technique to transition solar energy into electricity, through panels that collect sunlight, to power heating and cooling systems.
- GREY WATER SYSTEM - collecting water from roof, filtered before use and stored in tanks within the building to be used for flushing toilets and irrigation.

Cross Ventilation
- STACK EFFECT - using a double height atrium space to pull hot air up and out of building.
**Green at a Glance**
- Rehabilitation
- Recycled Building Materials
- Southern Solar Heat Gain
- Day lighting
- Cross Ventilation
- Green Roofs
- PV Cells
- Stormwater Collection
- Grey Water System
- Geo-exchange Heat Pumps
- Energy Star Appliances
- Individual Gardens
- On Demand Water Heaters
- Bike Racks

**BUILDING FEATURES**
The building I chose for rehabilitation used to be single occupancy but because there isn’t a market for residences that large in the area I broke it down into a duplex. The first floor and basement consist of a 3 bedroom unit with an open floorplan in the living areas. The second and third floor is a slightly smaller 2 bedroom unit.

**SUSTAINABILITY FEATURES**
The site I chose for rehabilitation has a perfect orientation to take advantage of southern sun for passive heating in colder months. The majority of the windows are located on the southern edge to take advantage of daylighting and winter heat gain. The open park to the southern edge of the property allows for winds to be able to reach the building and be used for cross ventilation to cool the building in warmer months by passing through the open floor plans. Storm water runoff cisterns located at the base of the building will collect water to then be pumped inside and used as a grey water system to flush toilets. Geo-exchange heat pumps will be buried in the ground and provide additional space conditioning.
Is it feasible to design and build affordable and sustainable housing in Over-the-Rhine, and if so, how might the community as a whole benefit from this change?

Sarah Major: 
Renewal by Design in OTR

THE PROBLEMS: Poverty, Crime, Poor Education, Poor Health & Nutrition, Vacant & Condemned Buildings, Inevitable Redevelopment, Community Displacement, Environmental Deterioration, Pollution and low Quality of Life.

THE PURPOSE: The purpose of the community space is to promote and facilitate lifestyles that foster well-being in individuals, their community, and their environment. The provisions of the community space must be the result of united effort on a daily basis among neighbors, thus improving the community via their awareness of each other, their children, and all their commonalities, such as the socioeconomic goals they share.

THE DESIGN is for a renovation of an existing apartment building into a community space, and the addition of a greenhouse connector between the building and eco-garden.

SETTING & STRATEGY The south-facing slope of the site and building roof are highly conducive to the implementation of sustainable strategies in solar orientation and thermal protection. These strategies are the most obvious... but just the beginning.

A. Buildings & Land Development - 1/3 of America’s total energy supply is consumed by buildings, a majority of which is wasted by inefficient design. Land use influences 1/3 of all vehicular transportation. From these two categories alone, it is easy to see that small changes in design and land use zoning laws can change the future of our ability to protect our natural habitat.

B. Community Economic Development and Natural Capitalism - By now most communities realize that short-term fixes, development at any cost and unchecked environmental risk are not the answers to economic development and renewal. The best way to achieve an exceptional advantage in business and the creation of wealth and positive social change, is environmental change.

C. Energy Use & Supply - Strategy - Target the biggest energy saving opportunities first. In lighting, fan and pump systems, 70% to 90-% of energy can be saved. In heating, cooling, appliances and equipment, 60% of energy use can be saved. In other words, green design equals green in your pocket.

D. Water Use & Supply - "Soft Path" for Water - Technologies and management systems that provide the same or better services with less water.