technology scanning

Sustainable Design Strategies

This category highlights a variety of technologies and land use orientation ideas which contribute to improved design efficiency, particularly as related to energy efficiency and sustainability.

Design/Layout

The Design/Layout category lists ideas and technologies that involve design and orientation. Low energy architecture and community design cover ideas that change the dynamics of heat gain in groupings of homes or communities. Software and information technology are also included in this category, which contributes to more efficient design capability.

Urban Micro-Climate/Urban Geometry

Urban Micro-Climate (the effect of a cluster of homes on each individual home) is often neglected in many urban designs. For example, in hot, dry climates, the compact cluster of homes generate a large, thermal mass attenuating the ambient conditions around each home, making each home's air conditioner work harder and longer.

Proper street orientation and layout of homes can have considerable effect on the shading, which affects the urban micro-climate and environmental performance of the homes. Building heights, proximity, and street width influence the heat generation characteristics of the street surfaces and surrounding grounds in the local urban micro-climate.

- North/South street orientation can result in street shading between 40 percent and 80 percent (dependent on latitude);
- Street orientation of NW/SE can only manage shading between 30 percent and 50 percent of the street area throughout the year; and
- East/West Street orientation can only achieve 30 percent street shading.

In addition to street orientation, urban layout affects energy use. The following are some good and poor examples of layout and its impact on energy use:

- Inner tier suburb streets with very mature trees provide added shading and reduced energy costs to each home in the area;
- New developments, often built in farm fields or large tracts of open land, are some of the worst "heat sinks" and continue to be for 10 to 20 years, assuming trees are planted;
- Concrete streets reflect more heat back into the atmosphere; asphalt streets absorb and store more heat. However, because of first cost, more asphalt streets and driveways are put in than concrete;
- Wide streets that are poorly shaded generate added heat for the homes around them versus narrower streets, oriented and properly shaded;
- Parkways (separated by grass or landscaped islands) are also more effective than wide streets at giving off less heat;
- Water near and adjacent to street surfaces also reduces the amount of heat given off to surrounding homes;
- The position of the home in proximity to the street also can influence heat gain. Homes close to the street in tightly packed neighborhoods leave little room for wind to dissipate heat, leaving heat to be absorbed by surrounding homes; and
- Cul-de-sacs also have large asphalt surface areas and can have tight housing configurations, which absorb heat from the street surface.

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Technology Scanning

One of PATH's major research support services is PATH Technology Scanning. *Technology Scanning* tells us about technology developments in other industries, from other nations, from federal laboratories, and from other building sectors. PATH looks for breakthroughs in other industries that could be transferred and applied to housing. *Technology Scanning*—published by the U.S. Department of Housing and Urban Development/PATH and prepared by the NAHB Research Center, Inc.—are updated as technology developments dictate. The Research Center works to unite technology developers from outside of residential construction with manufacturers in the residential housing sector.

This issue of *Technology Scanning* is one in a series. Each issue in the series falls into one of the following categories:

- *Design and Internet Tools*
- *Safety*
- *Surfaces and Interior Finishes*
- *Building Envelope Technologies*
- *Electrical*
- *Plumbing*
- *Heating, Ventilating and Air Conditioning*
- *Energy/Power Systems Generation*
- *Basic Materials*
- *Information Technology*
- *Sustainable Design Strategies*
- *Materials Recycling and Reuse*
- *Thermal and Moisture Protection*
- *Indoor Environmental Quality*

Call the ToolBase Hotline at 800-898-2842 for information about other available *Technology Scanning* issues. Or, log onto pathnet.org and www.toolbase.org.

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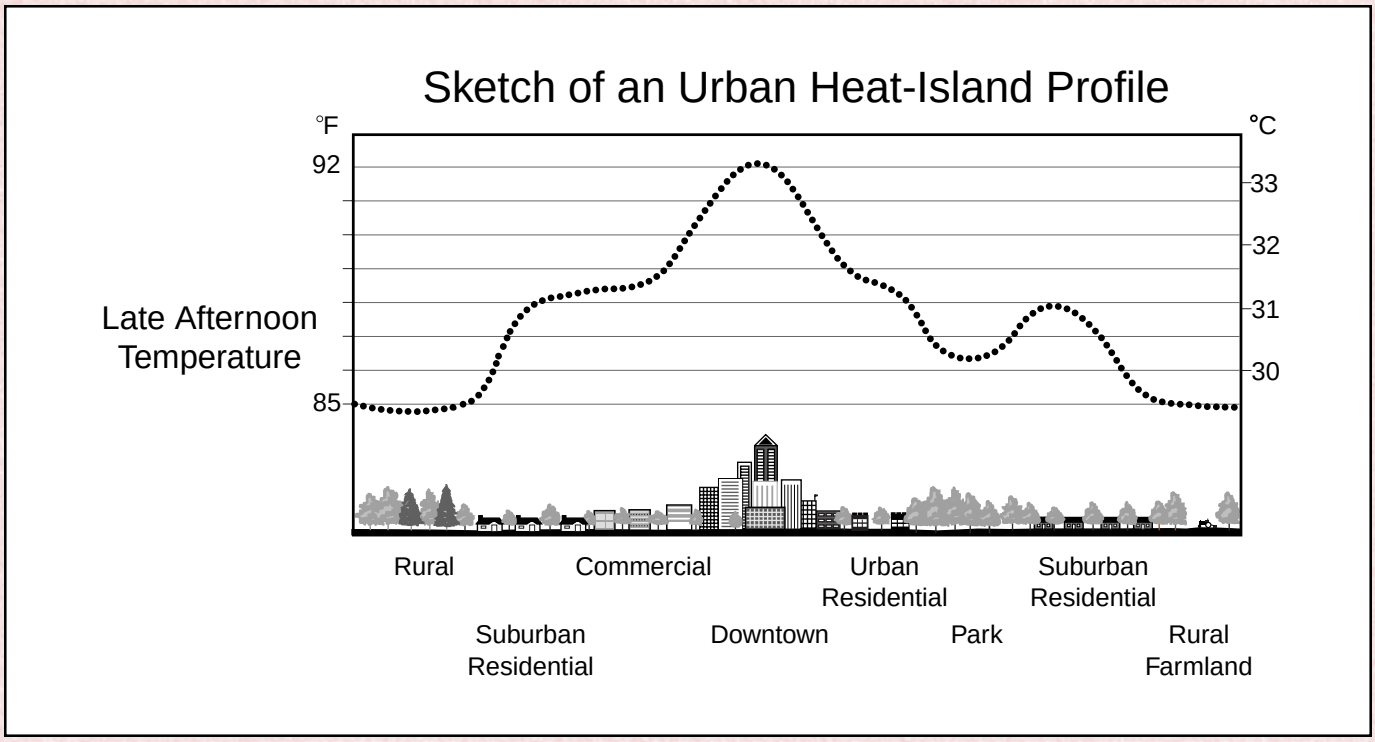

Courtesy: Lawrence Berkeley National Laboratory

Lawrence Berkeley National Laboratory's Environmental Energy Division is working on a project which uses light (cooler) surfaces and specific trees strategically placed to reduce the effects of urban heat islands on cooling loads.

Reducing Urban Heat Islands through Design

Lawrence Berkeley National Laboratory's Environmental Energy Division is working on a project which uses light (cooler) surfaces and specific trees strategically placed to reduce the effects of urban heat islands on cooling loads. Urban heat islands increase the cooling loads on surrounding areas and accelerate formation of urban smog. The research examines solar reflectivity of building materials and paving materials, and uses computer modeling of climate and air quality to see the effects of large-scale changes in solar reflectivity.

Several demonstration buildings and landscapes are located in San Jose, Sacramento, Gilroy, and Downy, California. The next stage of the project will use the information learned to date to work with roofing manufacturers to develop cooler materials, paving companies to look at next generation paving materials, and with municipalities to offer incentives to use the new materials and landscape strategies. They also have begun to draft roof reflectivity standards and codes. (Project ref LBNL-7)

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City of Tomorrow, Malmo, Sweden

The City of Tomorrow in Malmo, Sweden, is being built to include a Sustainable Housing Expo and permanent living. It will be the largest of its kind. The city of Tomorrow (Bo01) aims to stimulate debate on architecture, technology, construction, and living that will contribute to international R&D in the housing sector, and that will spread knowledge on future homes to many people.

Malmo is taking the first coordinated step towards development of a sustainable city. This will be a long-term initiative, with a number of future additional elements that make it the expected world leader in dense, urban, sustainable development and a model for other projects around the globe.

Over 800 living units (apartments) and homes of the future will be on display during and after construction in 2001, in the largest housing exhibition of the modern era. Bo01, with around 50 homes, is specifically designed to demonstrate new thinking and new technologies around sustainable practices. The housing area exhibit will include different types of sustainable buildings with regard to energy, building materials, waste treatment, IT solutions, and green issues.

The European Village (formally open in August '01) will be a demonstration of houses that reflect national characteristics of 16 countries adapted to Sweden's climate and building conditions. These houses will be built using environmentally sustainable methods. As of May, eight countries had begun construction. Among the countries showcasing their best will be Sweden, Germany, Denmark, Hungary, Czech Republic, Greece, Slovenia, Lativa, and Lithuania. During construction, those from building related fields are invited to view the construction practices and technology only visible during construction. Once construction is finished, the Village will be open to the general public (August '01).

Examples of specific countries' housing applications:

► ***Norway***: 3 levels or longitudinal zones (services, living, and solar) built on a strict planning module to avoid waste; construction is easily dismantled for future recycling; designed and built for 25 percent energy reduction over the norm in Norway; uses a rainwater collection system and solar collection and regulation practices.

► ***Sweden:*** ecologically adapted for a long lifespan; low maintenance; recyclable materials; energy management with high direct sunlight; limited number of and low emitting materials; prepped for future deconstruction and recycling; IT for effective operation.

► ***Lithuania:*** heating and hot water via connection to local heating grid; rainwater usage and air recuperation systems; natural building materials like clay and wood; PV incorporated into the design.

Beyond housing, the City of Tomorrow will showcase public transportation, electric hybrid vehicles, urban planning methods and practices, IT for the environment, biodiversity, and 100 percent locally renewable energy. Sun, wind, and water will be the forms of energy production, together with energy from refuse and sewage generated in the district. Electricity will be generated by wind power and photovoltaic cells.

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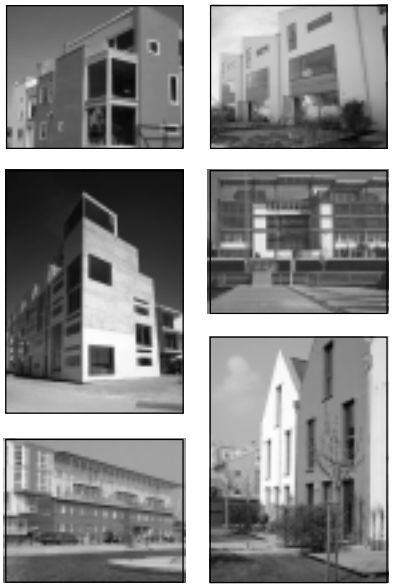

Courtesy: Bo01

Shown above are six of the buildings being constructed as part of the City of Tomorrow.

Low Energy, Sustainable Architecture & Community Design

Low energy architecture looks at concepts and new thinking in regards to landscaping, street and site layout, with respect to the sun and surrounding buildings. Also outlined in this section are materials or surfaces, which reduce the effects of architecture and infrastructure on heat gain.

The City of Tomorrow (Bo01) aims to stimulate debate on architecture, technology, construction, and living that will contribute to international R&D in the housing sector.

Courtesy: Bo01

Sustainable Urban Housing In China

Demonstration projects were highlighted at the Sustain2001 Conference. These are being planned in Beijing, Shanghai, and Shenzhen, China as part of a joint effort by MIT and Tsinghua University. Three years of pre-planning and criteria development have gone into the effort to date, with construction starting in year 4 (late 2001). This demonstration will showcase the exploration of design, technology, and implementation of environmentally responsive urban housing.

Areas of special focus are site orientations and design integration with natural cooling properties, mechanical systems advancements, envelope/ enclosure thermal comfort, and visual comfort. Promising technologies and systems will be incorporated into the project.

The collaborative includes the following:

- MIT Department of Architecture, U.S.;
- University of Tokyo Industrial Sciences, Japan;
- Tsinghua University and Tongji University, China; and
- Institute of Solar Energy Resource, Air & Climate Group, Switzerland.

Sponsors and funding include:

- Kann-Rassmussen Foundation (Velux –founder); and
- Alliance for Global Sustainability.

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Courtesy: Bo01

Over 800 housing units will be on display in 2001.

The City of Tomorrow takes a big step forward towards the development of a sustainable city.

Technologies for Sustainable Buildings

Sustainability in this instance means "meeting the needs of the present without compromising the ability of future generations to meet their needs." Sustainable buildings are characterized over their period of use by:

- Consuming minimal energy and water use;
- Efficiently using environmentally benign material and energy;
- Minimizing direct and indirect waste;
- Integration with surrounding environment;
- Sustainable urban transportation system;
- Safety for workers and occupants; and
- Healthy to live in for users.

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