Implementing Green Roof Projects at the Local Level

U.S. EPA Heat Island Reduction
and
U.S. EPA Local Climate and Energy
Webcast
June 8, 2010

EPA

Webcast Agenda

- Overview - U.S. EPA Heat Island Reduction Program, U.S. EPA Climate and Energy Program, Green Roofs and Webcast Logistics
  - Neelam R. Patel, U.S. EPA
- Energy Performance of Green Roofs: The Role of the Roof in Affecting Building Energy and the Urban Atmospheric Environment
  - David Sailor, Portland State University
- Green Roofs: Stormwater Management and Urban Heat Island Mitigation
  - Jason Berner, U.S. EPA
- Green Roofs Incentives and Partnerships
  - Sara Loveland, DC Greenworks
- Chicago's Green Roof Initiative
  - Michael Berkshire, City of Chicago
- Q and A Session

GoTo Webinar Software Logistics

- You will be muted throughout this webcast to minimize background noise. You'll be able to submit questions and comments in writing.

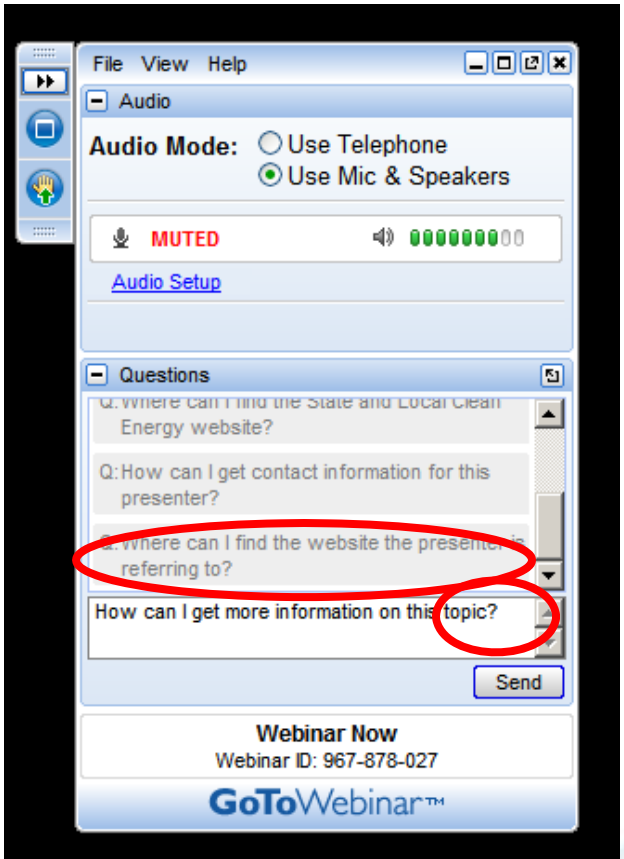
- Today's session will be recorded and will be made available for download in a few weeks at:
  - All files:
    - http://www.epa.gov/hiri/resources/webcasts.htm
    - http://www.epa.gov/statelocalclimate/web-podcasts/local-webcasts-by-date.html
  - Podcasts:
    - http://www.epa.gov/statelocalclimate/web-podcasts/index.html

- Throughout the webcast, if you have problems, please contact Lauren Pederson at LPederson@icfi.com

Questions (GoTo Meeting)

If you have a question, submit through the question pane.

We will compile these questions, and ask them during the Q&A session. Please include the name of the presenter who should answer your question.



Optional Feedback
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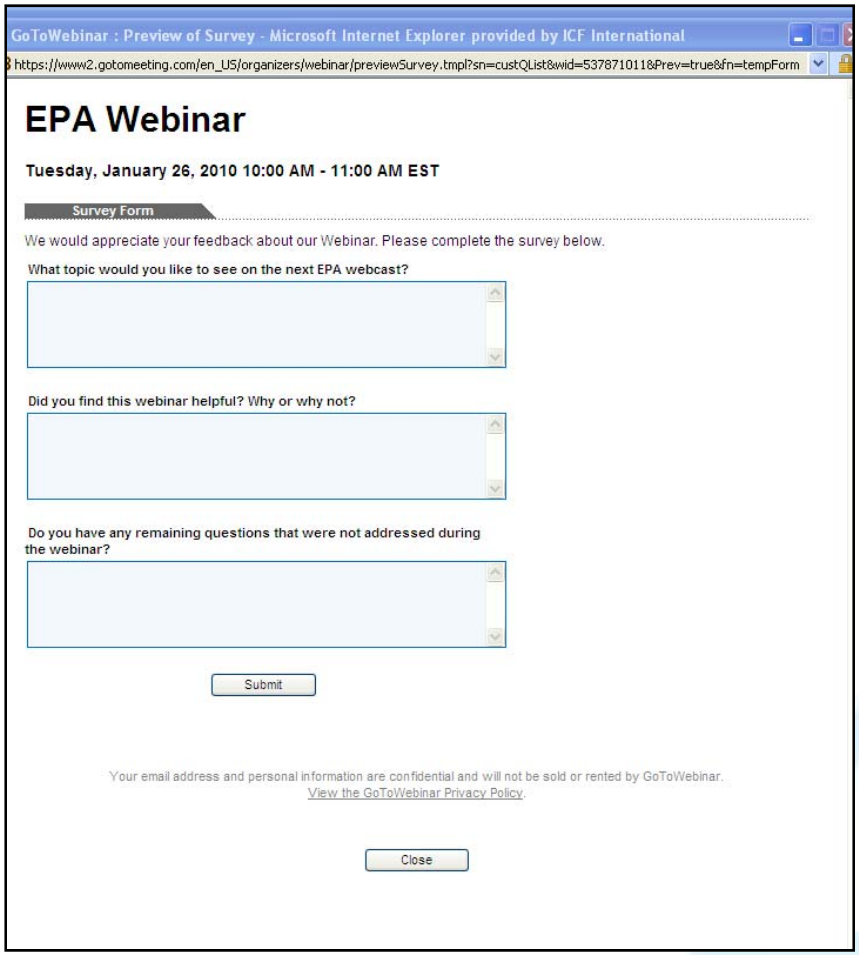
A pop-up window will appear once you exit GoTo Meeting. If you have feedback, please respond to the optional questions in the designated areas.



U.S. EPA
Heat Island Reduction Program and
U.S. EPA Climate and Energy Program

Webcast:

Implementing Green Roofs at the Local Level

June 8, 2010

Neelam R. Patel, Heat Island Program Manager

Outline

- Heat Island Effect Overview
- Introduction to Green Roofs
- Heat Island Implementation
  - Local-level Implementation
  - Funding Opportunity: Climate Showcase Communities Grant Program
- U.S. EPA Heat Island Reduction Program
- U.S. EPA Local Climate and Energy Program
- Appendix A - Heat Island Mitigation Strategies
- Appendix B – Local Climate and Energy Program Resources

Heat Island Effect Overview

Definition

- Micro-scale temperature differences between urban and rural areas
- Urban areas can be 9 – 27 ° F higher than rural areas

Formation

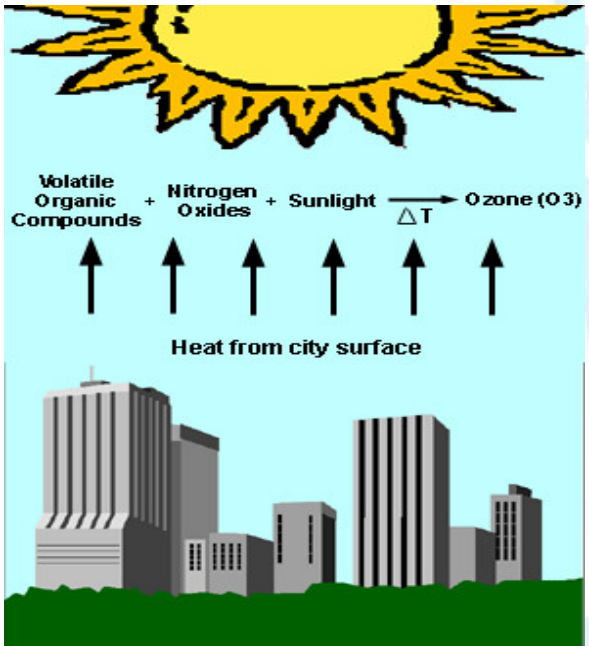
- Reduced vegetation
- Materials used to build urban infrastructure
- Urban geometry

Energy and Air Quality Impacts

Impacts

- **Increased energy use**
  - 5 – 10 % of electricity demand is to cool heat islands effects
  - Longer peak periods; pressure on E grid; brownouts, blackouts

- **Air quality and greenhouse gas (GHG) emissions**
  - Increased GHG emissions
  - Increased air pollution
  - Ozone formation

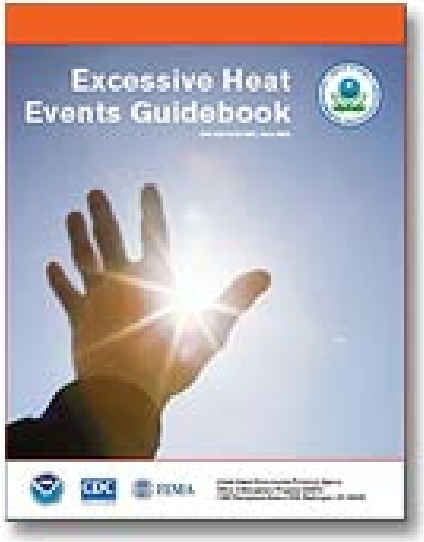


More Impacts

Impacts *cont'd*

- **Water Quality**
  - Warmer water runoff = ecological shock in waterways
  - Increased water runoff = more pollutants in waterways

- **Human Health**
  - Respiratory difficulties
  - Heat cramps
  - Heat exhaustion
  - Non-fatal heat stroke/sun stroke
  - Heat related mortality



www.epa.gov/heatisland/about/heatguidebook

Mitigation Strategies

See Appendix A

Communities can take action to reduce urban heat islands using four main strategies.

- Trees and Vegetation
- **Green Roofs,** http://www.epa.gov/heatisland/mitigation/greenroofs.htm
- Cool Roofs
- Cool Pavements

Green Roofs vs. Cool Roofs

Different options for different motivations – each has different costs and performance implications

Green Roofs

- Initial costs are higher (costs depend on type of green roof)
- Selected by those interested in additional environmental benefits, i.e., stormwater management, natural habitat, green space

Cool Roofs

- Minimal incremental cost (compared to conventional equivalents)
- Selected by those focused primarily on energy savings or reducing peak energy demand

For more information, see the Green Roofs chapter in the Reducing Urban Heat Island Compendium: http://www.epa.gov/heatisland/resources/pdf/GreenRoofsCompendium.pdf

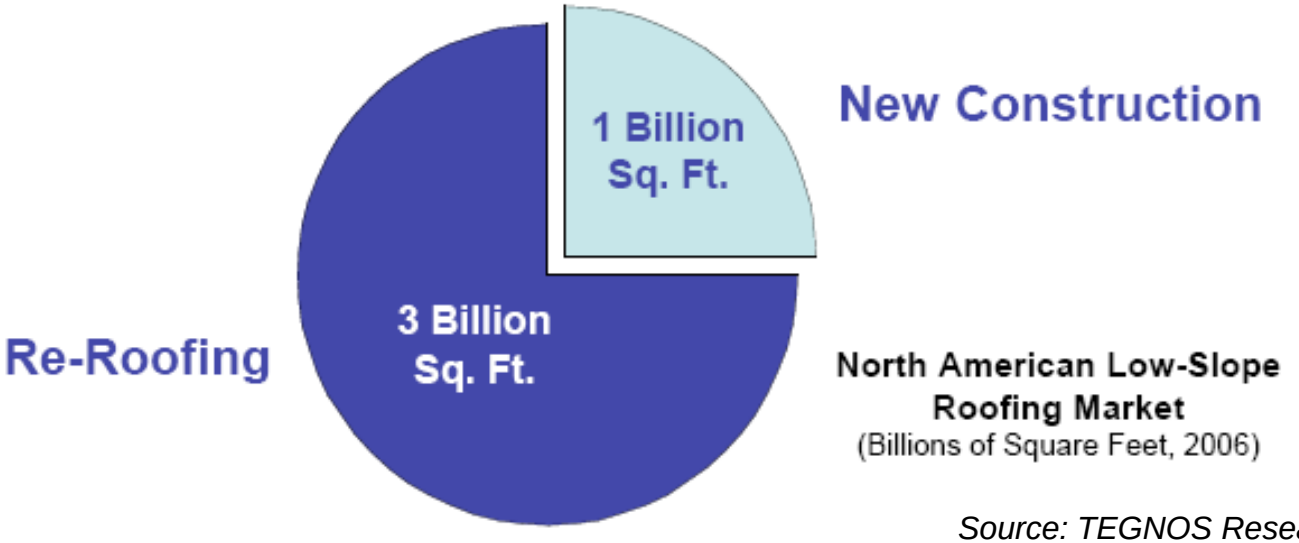
What is a Green Roof?

A “green” roof is a roof partially or completely covered with plants and soil or other growing medium.

Types of Green Roofs

- *Extensive* (plant heights between 2’ and 3’ and soil is less then 6” deep)
  - Very little maintenance: once a year weeding and fertilizer spreading
- *Intensive* (plant heights between 3’ and 15’ and soil is at least 1’ deep)
  - Heavy maintenance: irrigation, fertilizer feeding, etc. (typical backyard garden)

Green Roofing Market



Source: TEGNOS Research, Inc. 2008

- 3 billion SF of commercial roofs are retrofitted annually
  - *This surpasses new commercial roof building constructing by a factor of 3!*
- Retrofitting a small percent of this roof area as green roofs would lead to a significant number of green roof installations in the US
- Green roofs are a cost effective strategy to achieve LEED credits or public recognition
- Incentive programs could encourage hesitant building owners to take advantage of these benefits

Green Roofs

- **Benefits**
  - Increases real estate value
  - Amenity space for building occupants (intensive-type only)
  - Decreases energy consumption
  - Evaporative cooling
  - Filter CO_2 and air pollutants
  - Increase roof's lifespan
  - Habitat for plants, insects, and animals in an urban setting
  - Reduce
    - Heat island effect
    - Total stormwater runoff—up to 75% of stormwater is retained
    - Rate of stormwater runoff

- **Disadvantages**
  - Structural improvements may be required before installation
  - Making repairs under the soil and plants is difficult and expensive
  - The majority cannot tolerate foot traffic

Roof Types

- **Flat Roofs**
  - Most common roof types, including many office buildings
  - Easy design and construction
- **Shallow Slope Roofs**
  - Slopes less than 4:12
  - Can support green roofs with few structural modifications
- **Steep Slope Roofs**
  - Slopes greater than 4:12
  - Difficult to build and design due to the high potential for erosion on the steep surface
  - New technologies are making this more feasible
- **Green Walls**
  - Emerging trend in design, not as mature as green roofs

Setting up a Green Roof

1. Installing drainage
2. Layering the roof
3. Placing soil media
4. Selecting plants
5. Planting the items
6. Maintaining the plants

1- Drainage

2- Layering the Roof

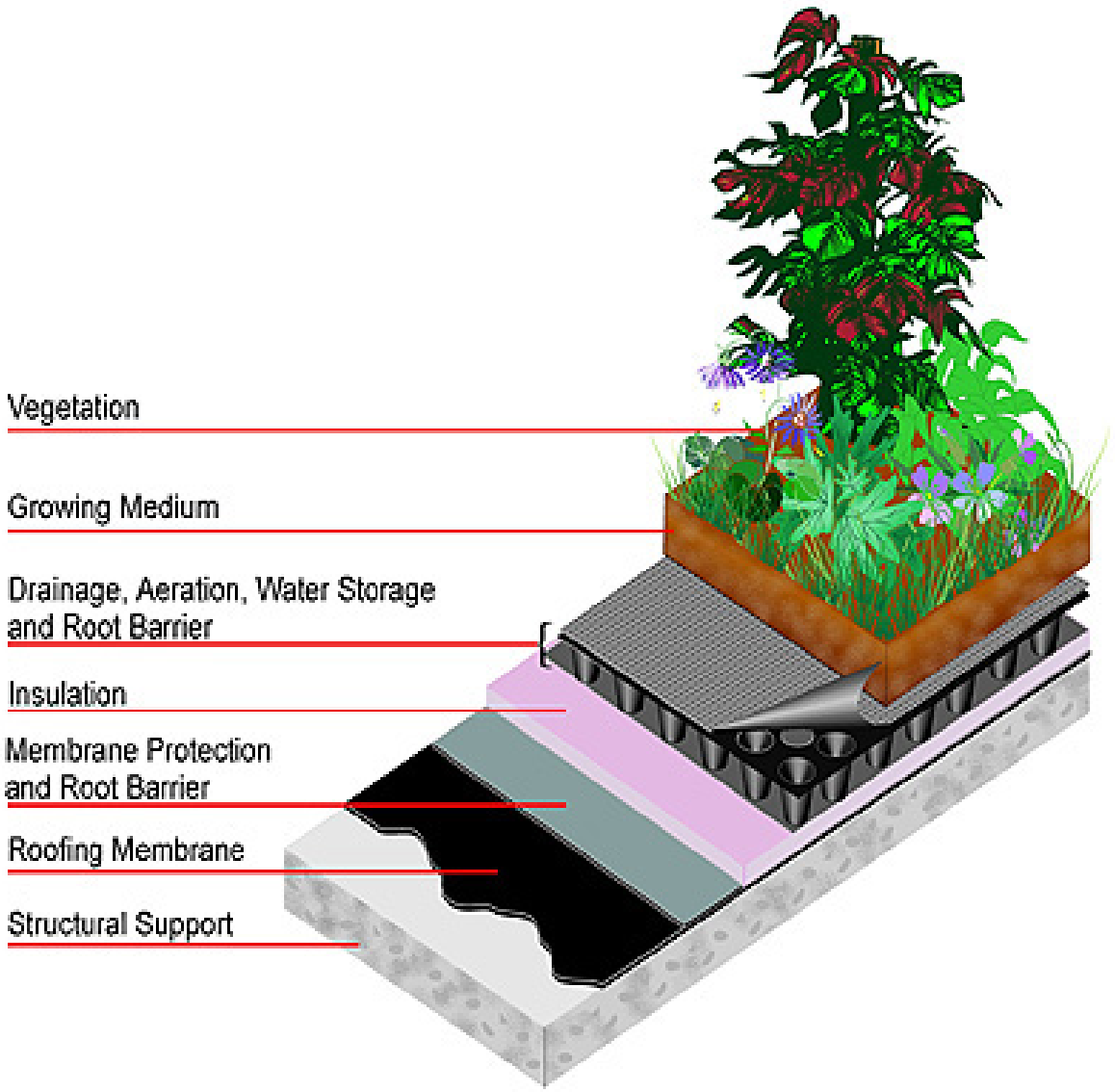
3- Soil Media

4- Sedum Plugs

5- Planting

6- Mature Green Roof

Setting up a Green Roof



Using Native Plant Species

- When designing green roofs, using native plant types is a smart strategy for several reasons:
  - Native plants support the local ecology which was disturbed when the building was constructed
  - Native plants are accustomed to the regional climactic conditions and pests, therefore less water, pesticides, and fertilizers are needed to sustain the green roof
  - Native plants cost less to maintain because they have evolved to survive in their region without human support or intervention
- By using local plants, the local ecology can be supported and the green roof can be built and maintained with a smaller budget

Heat Island Reduction Implementation Activities

Urban Heat Island Mitigation and LEED™

U.S. Green Building Council's Rating System
Leadership in Energy and Environmental Design (LEED™)

LEED Rating System

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovation & Design Process

1st LEED Platinum in AZ:
The Arizona Biodesign Institute at ASU

For more information: www.usgbc.org

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Implementation at the Local Level Activities

Part of climate, energy, sustainability, air quality, water, adaptation, or building efforts

- Voluntary Efforts
- Policy Efforts
- Example of Funding Opportunity

Heat Island Reduction - Voluntary Efforts

- Demonstration Projects
- Incentive Programs
- Urban Forestry Programs
- Weatherization
- Outreach and Education
- Awards

Heat Island Reduction - Policy Efforts

- Procurement
- Resolutions
- Tree and Landscape Ordinances
- Comprehensive Plans and Design Guidelines
- Zoning Codes
- Green Building Programs and Standards
- Building Codes
- Air Quality Requirements

Heat Island Funding - Climate Showcase Communities Grant

- $10M Competitive grant to assist local communities in pursuing their own climate change initiatives
- Goal is to achieve documentable, replicable GHG reductions from a range of activities- includes Heat Island Management
- Program supports local governments to:
  - Foster collaborative partnership between communities and with the Federal government
  - Ensure federal investments spur local innovation and produce concrete results
  - Promote transfer of best practices among localities
  - Identify strategies to overcome institutional barriers to local governments achieving energy use and GHG reductions
- First round of grantees will be awarded in February 2010
  www.epa.gov/cleanenergy/energy-programs/state-and-local/showcase.html
- **Request for Proposals OPEN NOW!!**
  - **Submissions due July 26, 4:00pm Eastern**

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U.S. EPA Heat Island Reduction Program

Program Objective

- Communicate policy, programmatic developments, and scientific, technological advancements to heat island community

Program Community

- Policymakers, program designers and program implementers
- Researchers/academia
- Industry, developers of new technology
- General public (e.g., K-12 students and teachers, coaches)
- Media

Topics of Interest to Heat Island Community

- Heat island science, modeling, and measurement
- Innovative mitigation technologies in areas such as cool pavements, cool roofs, green roofs, and trees and vegetation

Heat Island Connections with other Programs

Part of climate, energy, sustainability, air quality, water, adaptation, land use planning or building efforts

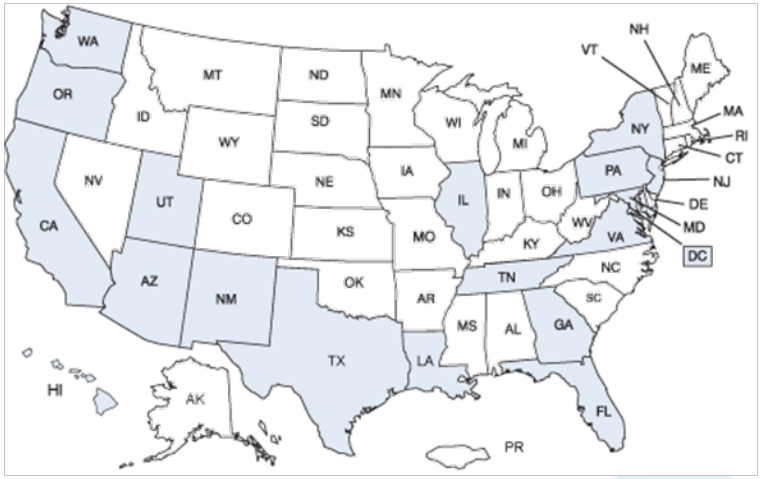
- Fold heat island messages into other programs to promote **multiple benefits** of mitigation strategies
  - Stormwater and Green Infrastructure Programs
  - Landscape and Construction Materials
  - Smart Growth and Land Use, www.epa.gov/hiri/resources/pdf/smartgrowthheatislands.pdf
  - Brownfields Redevelopment
  - Green Building activities
  - Economic Development activities (e.g., jobs, increased real estate values)
  - Public Health programs and Emergency Response Plans
- Link to climate adaptation issues
  - Promote mitigation strategies to address heat health, energy conservation, and climate mitigation for local, regional and state programs
  - Use mitigation strategies to support actions for extreme weather (high rainfall, heat)

Key Program Features

- **Web site**, features include user-friendly format, updated content
  - Calendar of events
  - Heat islands in the News
  - Science Corner
    http://www.epa.gov/heatisland/
- **Database**, "Where You Live"
  - Provides info on more than 75 local and statewide initiatives to reduce heat islands and achieve related benefits *(more on upcoming slide)*
- **Compendium** of Strategies: Reducing Urban Heat Islands
  - Document describes the causes and impacts of summertime urban heat islands and promotes strategies for lowering temperatures *(more on upcoming slide)*
- **Webcasts**, http://www.epa.gov/heatisland/resources/webcasts.htm
  - Routine online meetings for our diverse program audience spotlighting local/regional urban heat island programs, new scientific findings, and upcoming meetings
- **Listserve**, http://www.epa.gov/heatisland/admin/listserv.htm
  - Disseminates info to heat island community, e.g., funding opportunities, conference call for papers, webcasts, and more

Database

- Actions listed in the database are some efforts underway to cool communities while saving energy, reducing greenhouse gas emissions and improving air quality
- Each entry in the database includes a description of the activity, its current status, and a link to a website (if available) for more information.
- The database can be searched by:
  - Clicking on U.S. map (diagram on right)
  - State and locality
  - Initiative Type
  - Strategy



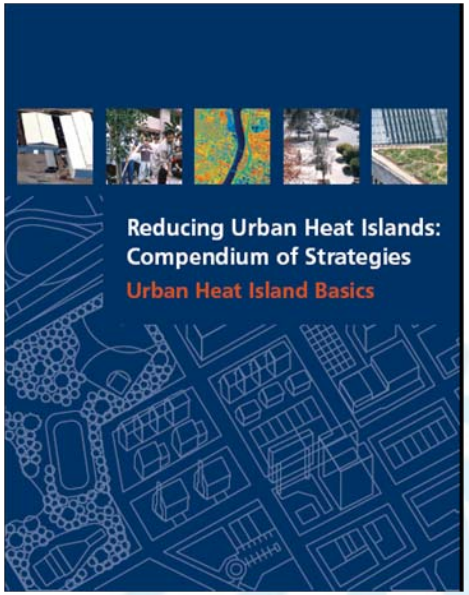
- If you are aware of heat island initiatives, please submit through our website.

http://yosemite.epa.gov/gw/statepolicyactions.nsf/webpages/HIRI_Initiatives.html

Compendium

Reducing Urban Heat Islands: Compendium of Strategies

- Provides an overview of latest science, mitigation strategies, case studies, and recommendations for additional resources
- Chapters
  - Heat Island Basics
  - Trees and Vegetation
  - Green Roofs
  - Cool Roofs
  - Cool Pavements
  - Heat Island Reduction Activities



www.epa.gov/heatislands/resources/compendium.htm
www.epa.gov/heatisland/mitigation/greenroofs.htm

U.S. EPA Local Climate and Energy Program

Assist localities (e.g., tribal governments, regional governments, municipalities and small communities) to:

- Reduce greenhouse gas emissions while achieving their sustainability goals
- Identify and work with expert partners and programs
- Understand, integrate, and maximize multiple benefits (e.g., energy savings, cost savings, public health benefits, economic growth, securing local energy) in planning and designing programs

http://www.epa.gov/statelocalclimate/local/index.html

Local Climate and Energy Program Approach

Multiple Benefits Framework for Climate - Clean Energy

- **Local Governments can achieve:**
  - Air quality improvements
  - Greenhouse gas emission reductions
  - Energy security and reliability
  - Economic development
  - Public health
  - Quality of life

Clean Energy: Energy Efficiency, Renewable Energy, Clean Distributed Generation

http://www.epa.gov/statelocalclimate/local/getting-started.html

Local Climate and Energy Program Resources

See Appendix B

- Web site, www.epa.gov/statelocalclimate
- Webcasts and Other Training Opportunities, http://www.epa.gov/statelocalclimate/web-podcasts/local-webcasts-by-date.html
  - Next Webcast – Transportation Control Measures will be held in late June; date TBD
- Economic Recovery Resources for Energy Efficiency and Renewable Energy, http://www.epa.gov/statelocalclimate/econ-recovery/index.html
- Climate Showcase Communities Grant, http://www.epa.gov/statelocalclimate/local/showcase/index.html
- Local Climate and Energy Strategy Guides, http://www.epa.gov/slclimat/resources/strategy-guides.html

Local Climate and Energy Webcasts Widget & iTunes

- **Webcast Widget**
  - Can be added to your website
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  - Copy the code from our website and paste it into the source code for your webpage: http://www.epa.gov/statelocalclimate/widgets/downloadwidgets.html#local

- **iTunes Channel**
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U.S. EPA Contact Info

Heat Island Program

- Neelam R. Patel, patel.neelam-r@epa.gov,
  U.S. EPA National Heat Island Program Manager
- Web site: www.epa.gov/heatislands
- EPA Heat Island Listserv sign-up: www.epa.gov/hiri/admin/listserv.htm

Local Climate and Energy Program

- Contacts:
  - Andrea Denny, denny.andrea@epa.gov
  - Neelam R. Patel, patel.neelam-r@epa.gov
  - Emma Zinsmeister, zinsmeister.emma@epa.gov
- Web site: http://www.epa.gov/statelocalclimate/local/index.html
- Climate and Energy Listserv sign-up:
  http://www.epa.gov/statelocalclimate/listservs/index.html#a01

Appendix A and B

Appendix A -

Heat Island Mitigation Strategies

Appendix B -

U.S. EPA Climate and Energy Program Resources

Heat Island Mitigation Strategies

Appendix A

Appendix A: Heat Island Mitigation Strategies

Communities can take action to reduce urban heat islands using four main strategies.

- Trees and Vegetation
- Green Roofs
- Cool Roofs
- Cool Pavements

Mitigation Strategy: Trees and Vegetation

- Most U.S. communities have opportunities to increase the use of trees and vegetation in their land cover to reap multiple benefits.

- Strategically planting trees maximizes energy savings and reduce GHG emissions (among other things).

  - Buildings
  - Parking lots
  - Streets

Mitigation Strategy: Green Roofs

- Decrease heat island impacts by shading roof surfaces and through evapotranspiration
- Can save energy both in the summer and winter; energy savings depend on local conditions and building circumstances
- Can be installed on a wide range of buildings, from industrial facilities to private residences

Green Roof Types

- **Extensive** - 2-inch covering of hardy groundcover
- **Intensive** - complex as a fully accessible park complete with trees

Mitigation Strategy: Cool Roofs

- Cool roofing products are made of highly reflective and emissive materials that can remain approximately 50 to 60°F (28-33°C) cooler than traditional materials during peak summer weather.

Cool Roof Types

- Low-sloped roofs
  - Coatings
  - Single ply membrane
- Steep-sloped roofs
  - Asphalt shingles
  - Metal roofing
  - Tiles
  - Shakes

Green Roofs vs. Cool Roofs

Different options for different motivations – each has different costs and performance implications

Green Roofs

- Initial costs are higher (costs depend on type of green roof)
- Selected by those interested in additional environmental benefits, i.e., stormwater management, natural habitat, green space

Cool Roofs

- Minimal incremental cost (compared to conventional equivalents)
- Selected by those focused primarily on energy savings or reducing peak energy demand

Mitigation Strategy: Cool Pavements

- Materials range from established to emerging technologies
- Tend to store less heat and have lower surface temperatures compared with conventional products
- Do not have standards or an official definition like cool roofs

EPA Pavement Activities:

- Hosted Cool Pavements workshop in 2005, helped identify future research areas
- Created the Transportation Research Board Subcommittee Meeting: Pavements and the Urban Climate, encourages further pavement research

U.S. EPA Local Climate and Energy Program Resources

Appendix B

Appendix B: U.S. EPA Local Climate and Energy Program Resources

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- Local Climate and Energy Strategy Guides, http://www.epa.gov/slclimat/resources/strategy-guides.html

State and Local Climate and Energy Website – Released Feb 16

Provides State and Local governments with:

- **Information to develop comprehensive** climate strategies
- **Background on climate change topics**
- **Information to** develop and implement climate mitigation policies and programs
- **Links to a wide array of** tools, guidance documents**, webcasts, podcasts, and other technical assistance resources**
- Examples and case studies

http://www.epa.gov/statelocalclimate/index.html

Webcasts and Training

- Local Climate and Energy Webcast Series
  - Held monthly, announced via our listserv and website
  - Each call features local government case studies and speakers
  - View past webcasts at:
    - All files: www.epa.gov/statelocalclimate/web-podcasts/local-webcasts-by-date
    - Podcasts: www.epa.gov/statelocalclimate/web-podcasts
- Next Webcast – Transportation Control Measures will be held in late June; date TBD
- Additional Webcast Opportunities
  - ENERGY STAR Training Center http://energystar.gov/training
  - State Climate and Energy Technical Forum http://www.epa.gov/statelocalclimate/web-podcasts/forum-by-date.html
  - DOE Technical Assistance Project for State and Local Officials http://www1.eere.energy.gov/wip/assistance.html
  - Information on other EPA Clean Energy webcasts is available at:
    - http://www.epa.gov/statelocalclimate/web-podcasts/index.html
    - http://www.epa.gov/statelocalclimate/events/index.html

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EPA ARRA Resources for Energy Efficiency and Renewable Energy Projects

State and Local Climate and Energy Economic Recovery Resources Website

www.epa.gov/statelocalclimate/econ-recovery

Funding Opportunities within ARRA 2009:

- Document: American Recovery and Reinvestment Act of 2009: A Guide to Renewable Energy and Energy Efficiency Opportunities for Local and Tribal Governments

EPA Programs and Resources:

- Document: ARRA 2009: State and Local Guide to U.S. EPA Climate and Energy Program Resources

Project Ideas and Implementation Support Resources:

- **Toolkits** - Rapid Deployment Energy Efficiency (RDEE)
- **Documents** – Clean Energy Funds, EECBG drop-in text samples, Local Clean Energy Strategy Guides, Energy Star products for Shovel-ready projects
- **Webcasts** – Local climate and energy webcast series, Energy STAR building benchmarking webcasts, other Energy STAR webcasts

Resource Guide: State & Local Guide to U.S. EPA Climate and Energy Program Resources

- Provides overview of EPA clean energy programs that can help expand or develop clean energy initiatives

- Each program description includes:
  - Basic information and contact details
  - Potential target audiences
  - Highlights of tools and resources
  - Suggestions of possible actions

- EPA programs are organized into six categories:
  - Buildings
  - Industry
  - Electric power and renewable energy
  - Transportation
  - Energy education
  - Policy, planning, and energy security

www.epa.gov/statelocalclimate/documents/pdf/slb_guide_to_program_resources.pdf

Climate Showcase Communities Grant

- Competitive grant for local and tribal governments
- Goal: Showcase documentable, replicable GHG reductions that build community capacity and address multiple benefits
- First 20 Showcase Communities announced Feb 25, 2010
- Second round of funding opened on June 8, 2010
  - $10 million for 20-30 projects

http://www.epa.gov/statelocalclimate/local/showcase

Climate Showcase Communities
Local Climate and Energy Program

Climate Showcase Grant Framework

- Demonstrate integrated and sustainable community approaches that achieve large reductions in GHG emissions and additional co-benefits (Air Quality, Jobs, etc.)
  - Planning through implementation (including financing, technical assistance, policy development, training, and partnerships)
  - Major emission sources -- buildings, transportation, public services
  - Robust Measurement and Reporting

- Build networks and peer exchange to share approaches
  - Spur additional climate action
  - Support comprehensive and integrated GHG management that creates jobs
  - Offer forums for training and peer exchange
    - Regular webcasts for grantees
    - Annual Workshops

EPA

Climate Showcase Communities
Local Climate and Energy Program

Local Climate and Energy Strategy Guides

- Covers Multiple Strategies in Five Areas
  - Energy Efficiency, Energy Supply, Transportation, Community Planning and Design, Solid Waste and Materials Management
  - For each strategy, outlines: benefits, measures, key participants, mechanisms for implementation, costs, funding, interaction with federal, regional, and state programs, case studies, and resources/references
- Nine Draft Guides Currently Available
  - Energy Efficiency in Affordable Housing
  - Green Power Procurement
  - Energy Efficient Product Procurement
  - On-site Renewables
  - Combined Heat and Power
  - Landfill Gas to Energy
  - Energy Efficiency in Municipal Operations
  - Energy Efficiency in K-12 Schools
  - Smart Growth
- Upcoming Guides
  - Transportation Control Measures
  - Efficient Fleets
  - Reducing Urban Heat Islands

http://www.epa.gov/statelocalclimate/resources/strategy-guides.html