



## Mitigating the Heat Island Effect



Neelam R. Patel  
U.S. EPA Heat Island Reduction Program

State of California Action Team:  
Public Health Working Group Meeting  
April 20, 2010

## Outline

- Heat Island Effect Overview
  - Impacts
  - Heat Island Mitigation Connections to Other Programs
  - Mitigation Strategies
- Heat Island Implementation Activities
  - Local-level Implementation
  - EPA Sustainable Skylines Initiative Grant Program
  - California Cool Communities Program (LBNL, CEC, CARB)
- U.S. EPA Heat Island Reduction Program
- Upcoming Meetings Related to Heat Islands
- EPA's Next Steps – Needs Assessment Pilot Project, Dave Mills, Stratus Consulting




## 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**

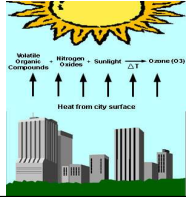


- Reduced vegetation
- Materials used to build urban infrastructure
- Urban geometry

## 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](http://www.epa.gov/heatisland/about/heatguidebook)

## Heat Island Connections with other Programs

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

- 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)
- 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/hit/resources/sof/famartgrwth/heatislands.pdf](http://www.epa.gov/hit/resources/sof/famartgrwth/heatislands.pdf)
  - > Brownfields Redevelopment
  - > Green Building activities



## Mitigation Strategies

Communities can take action to reduce urban heat islands using four key 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






## 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

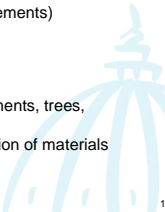

EPA Pavement Activities:

- 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





## Heat Island Mitigation – Scales for Implementation

- Individual building
  - Roofs (green and reflective)
  - Vegetation (shade trees and more)
- Community/Neighborhood
  - Street design (e.g., vegetation, pavements)
  - Open vegetated land use
- City/Regional
  - All mitigation strategies (e.g., pavements, trees, vegetation, roofing)
  - Integrate into land use plans, selection of materials

## 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



## Messages to Heat Island Community




**Topics of Interest to Scientific Community**


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

**Activities for Programmatic and Policy Community**


<p><b>Voluntary Efforts</b></p> <ul style="list-style-type: none"> <li>Urban Forestry Programs</li> <li>Demonstration Projects (i.e., LBE)</li> <li>Weatherization</li> <li>Outreach and Education Programs</li> <li>Awards</li> </ul>	<p><b>Policy Efforts</b></p> <ul style="list-style-type: none"> <li>Procurement</li> <li>Resolutions</li> <li>Tree and Landscaping Ordinances</li> <li>Comprehensive Plans and Design Guidelines</li> <li>Zoning Codes</li> <li>Green Building Standards</li> <li>Building Codes</li> <li>Air Quality Requirements</li> </ul>
--	---




## Key Program Features





- Website**, features include user-friendly format, updated content, calendar of events, heat islands in the news, updated database, **Science Corner**
- 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**, [www.epa.gov/heatislands/resources/webcasts.htm](http://www.epa.gov/heatislands/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**, [www.epa.gov/hiri/admin/listserv.htm](http://www.epa.gov/hiri/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](http://yosemite.epa.gov/gw/statepolicyactions.nsf/webpages/HIRI_Initiatives.html)

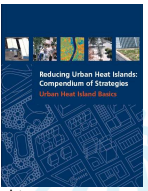



## Compendium




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](http://www.epa.gov/heatislands/resources/compendium.htm)




## Webcasts



- EPA holds free, national, routine heat island webcasts.
- Stakeholders from around the country inform each other of their urban heat island-related work.
- Scientists, practitioners, industry representatives, and government officials and staff all participate.
- Webcasts cover topics such as:
  - Measuring and Modeling Urban Heat Islands
  - Heat Island Impacts (e.g., air, water quality)
  - Mitigation (e.g., strategies, technologies, activities)

[www.epa.gov/heatisland/resources/webcasts.htm](http://www.epa.gov/heatisland/resources/webcasts.htm)



## Heat Events Guidebook

- Helps officials plan for and respond to excessive heat events in different urban areas
  - Health impacts and risk sources of excessive heat events (EHE)
  - Summary of current EHE notification and response programs
  - Recommendations for notification and response programs

<http://www.epa.gov/heatisland/resources/compendium.htm>



EPA

## Heat Island Funding in 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 will:
  - 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-program/heat-island-local-showcase.htm](http://www.epa.gov/cleanenergy/energy-program/heat-island-local-showcase.htm)
- Next Solicitation will open in early summer 2010

EPA

## Cool Communities Program California-based Initiative

**Objective:**  
Provide technical assistance to California communities for development of "cool community" programs that save energy, reduce emission of greenhouse gases, and improve the urban environment.

**Background:**

- Funded by California Air Resources Board (CARB) & California Energy Commission (CEC)
- Implemented by Lawrence Berkeley National Lab (LBNL)
- Global Warming Solutions Act of 2006 (AB 32)
  - Caps greenhouse gas emissions
  - CARB prepare plans to achieve objectives
- "Cool Communities" identified as a voluntary early action program
  - Estimate cool community measures reduce GHG emissions by 4 MMT CO2 e/y

EPA

## Cool Communities Program Pavement Training Task

### Cool Pavement Trainings

**Goals**

- Create training courses for building and public works professionals on the needs, benefits and options for cool community practices, such as the selection of cool paving materials.

**Dates**

- Trainings and materials completed August 2010

**Contact**

- Haley Gilbert – Senior Research Associate, Heat Island Group  
[HEGilbert@lbl.gov](mailto:HEGilbert@lbl.gov)  
510/486-7325

**Deliverables/Activities**

- Create training courses
- Conduct train-the-trainers
- Create supplemental instructional materials

EPA

## Upcoming Meetings

**Upcoming Meetings,**  
[www.epa.gov/heatisland/resources/calendar](http://www.epa.gov/heatisland/resources/calendar)

- Urban Environmental Pollution 2010 Conference, June 20–23, [www.uep2010.com](http://www.uep2010.com)
- AMS Symposium on the Urban Environment, August 2–6, 2010, <http://ams.confex.com/ams>
- TRB Subcommittee on Pavements and the Urban Environment, January 2010, [www.TRB.org](http://www.TRB.org) or contact Kamil Kaloush at [kaloush@asu.edu](mailto:kaloush@asu.edu)

EPA

## What is the Needs Assessment Project?

- Driving question:
  - "What information/tools do cities need to develop and implement EHE programs?"
- Motivation:
  - U.S. EHEs are, on average, the leading source of natural hazard-related mortality
  - EHE-attributable health impacts are avoidable
    - Risks and responses well known

EPA

## Needs Assessment Update



- Representative U.S. cities (9) interviewed
- Ranked options for information/tools still being provided to EPA
- Some results to date:
  - Variation in programs' structure is reflected in their rankings
  - Consistent interest in easing exchange of EHE information (e.g., website, webinars)
  - Programs find integrating climate change into planning is difficult



25

## Contact Info



**Neelam R. Patel**, [patel.neelam-r@epa.gov](mailto:patel.neelam-r@epa.gov), 202-343-9384  
U.S. EPA National Heat Island Program Manager  
**Kathy Diehl**, EPA Region 9 Heat Island Coordinator, [diehl.kathy@epa.gov](mailto:diehl.kathy@epa.gov), 415-972-3996  
EPA Heat Island Website: [www.epa.gov/heatislands](http://www.epa.gov/heatislands)  
U.S. EPA Heat Island Listserv sign-up: [www.epa.gov/hiri/admin/listserv.htm](http://www.epa.gov/hiri/admin/listserv.htm)

**Jason Samenow**, [samenow.jason@epa.gov](mailto:samenow.jason@epa.gov), 202-343-9327  
EPA Headquarters Climate Change and Heat Health Expert

**Dave Mills**, [DMills@stratusconsulting.com](mailto:DMills@stratusconsulting.com)  
Stratus Consulting, Contractor to EPA on Heat Health

