The Problem

Extreme heat waves create life threatening conditions, especially for low-income elderly and disabled persons who cannot afford air conditioning.

Philadelphia has many summers with “killer” heat waves:

- 1993 = 118 deaths
- 1995 = 61 deaths
- 1999 = 67 deaths
- 2002 = 29 deaths

ECA’s Cool Homes and Philadelphia Health Department . . .
The Problem

is compounded by the Urban Heat Island

Brick row homes with black asphalt roofs absorb 95% of the sun’s heat and can literally become brick ovens.
Western Pennsylvania

1961–1990

1961–1990
2010–2039
2040–2069
2040–2069
2070–2090
2070–2090

Eastern Pennsylvania

1961–1990

1961–1990
2010–2039
2040–2069
2040–2069
2070–2090
2070–2090

Source: NECIA/UCs, 2007 (see: www.climatechoices.org/ne/)
Problem: Global Warming is lowering Earth’s Albedo
Impacts on Human Health

• Extreme Heat
• Air Quality
• Pollen, Allergens
• Vector-borne disease
Increases in Extreme Heat in Philadelphia

![Graph showing increases in days over 100°F in Philadelphia from 1961-1990, 2010-2039, 2040-2069, and 2070-2099 with and without higher emissions]
A better choice: **Cool White**

White roofs are typically 50 – 80 degrees cooler than black on hot summer days.
The Solution = Cool Homes
Affordable Cooling Program

Goals:
Reduce indoor air temperature to comfortable levels without increasing the occupants’ energy bills
Maximize passive cooling and ventilation
Minimize air conditioning

Methods:
White roof coating
R-38 insulation and Attic air sealing
Window mounted whole house fan
Cooling strategy
Basic conservation treatments
Benefits of Cool Roofs Program

- Reduced health risk to occupants
- Lower energy bills for cooling
- Fewer utility delinquencies, terminations
- Extended roof life
- Less roofing material in landfills
- Reduced urban heat island effect
- Increase Earth’s Albedo: Slow Climate Change
Program Treatments
White, acrylic elastomeric roof coatings
R-38 Roof insulation and air sealing
Window mounted whole house fan
Baseload electric conservation treatments
Weatherization and other referrals

Personal Cooling Strategy
Correct use of a whole house fan
Restore function of windows
Window security, screens and shades
Monitoring Cool Homes comes in different shapes and sizes

Research

Feedback

Evaluation
1) Significant problem: Roof radiant temp. (~50-80°F difference)

Unshaded windows
Un-shaded streets (10-40°F difference)

2) Other problem: Wall Temperature
Cooling Strategy

**White roof coat**
lowers roof
temperature and top
top floor temperature
making house easier
to cool with either fan
or air conditioning

**Hotter outside?** Keep
windows closed

**Sun shining?** Keep
light-colored blinds
closed

**Whole house fan pulls hot air** out of the
house when outside air
is cooler than inside air

**Thermometers inside and outside** tell the
customer when to use
the whole house fan
Feedback for Customer:

Customer monitors indoor and outdoor temperature differences to know when to use the whole house fan.
ECA Evaluation Results

- 5 degrees F cooler at ceiling height (avg)
- 5 degrees F cooler than ambient (maximum)
- 2 degrees F cooler from fans at night (avg)
- Energy Savings Year Round
- More than 20% reduction in cooling load if the home were centrally air conditioned
- Higher comfort levels
- Greater roof durability and longevity
Data Logging:

Measuring temperature and humidity

Top front bedroom
First floor
Outside
Tracking the Effects

HOUSE #6 TRACKS HOTTER:
in the pre-treatment phase.

REFLECTING HEAT: During the day of white roof treatment, house #6 (thin line) never reaches as high as #8 does.

HOUSE #8 TRACKS COOLER:
but parallel to #6.

RELEASING HEAT:
The first evening, house #6 continues to cool off even after #8 has bottomed out, then consistently tracks cooler than the untreated house #8.

REALITY CHECK:
Temperatures return to their pre-treatment relationships immediately after #8 gets the white roof coat.

Tracking the effects of white roof coating on two identical homes
Temperature Differences
Between Ceiling and Air in house #6

White roof coat eliminates the roof/ceiling as a source of additional heat gain.
Heat Gain from Attic to Bedroom
American Society for Testing and Materials (ASTM)

**Elastomeric Coating Standards**

(ASTM D6083-97)

Specification includes:

Adhesion (ASTM C794)
Elongation- Initial (ASTM D2370)
Elongation-Weathered 1000 hours (ASTM D2370)
Fungi Resistance (ASTM G21)
Low Temperature Flexibility (ASTM D522)
Permeance (ASTM D1653)
Tear Resistance (ASTM D624)
Viscosity (ASTM D2196)
Volume Solids (ASTM D2197)

**Energy STAR Reflectance**
Industry Support

Rohm & Haas
- Training & Technical Assistance
- Product Donations
- Equipment Donations
- Coolest Block Contest in Bridesburg

Dow
- Coolest Block Contest Citywide
White Roof Coating can Repair Bad Roof Conditions
And Split Seams
Holes are Patched
Clogged Drains Repaired
Polyester Fabric is Applied
Where needed then roof is . . .
Finish Coat

Primer

1st Coat
Sun Glasses Anyone?
Repairs Must Be Done Right
12 Months a Year
Rain Wash-off

White roof coating needs some attention to detail
Attic Insulation Works with White Roof Coating
Roof Hole for Insulation
Cool Block in Bridesburg
Temperature Logging
Both indoors and outdoors
Evaluation of Cool Block

Black roofs super-heat homes and add to the urban heat island effect

Measure temperatures on treated and untreated blocks
Difference in Outdoor Temperature

Between a white and black roofed block

1° difference as the air temperature reaches 100°

Difference in the temperature decreases to .15° at 65°

Then back up to .5° at 35°
The Choice is Clear
Philadelphia Legislation

• All Commercial Roofs are required to be cool or green as of 2011

• Municipal Level
  – Home Performance Programs can include cool roofs
  – Financing includes cool roofs
Market Transformation

- South Philly seen from Google Earth: a sea of black roofs steadily turning white.
Liz Robinson
Executive Director
Energy Coordinating Agency
106 West Clearfield Street
Philadelphia, PA 19133
Phone: (215) 609-1033
lizr@ecasavesenergy.org
www.ecasavesenergy.org