Cool Roofs for a Warming Planet

Energy Coordinating Agency CRRC Meeting 2014

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

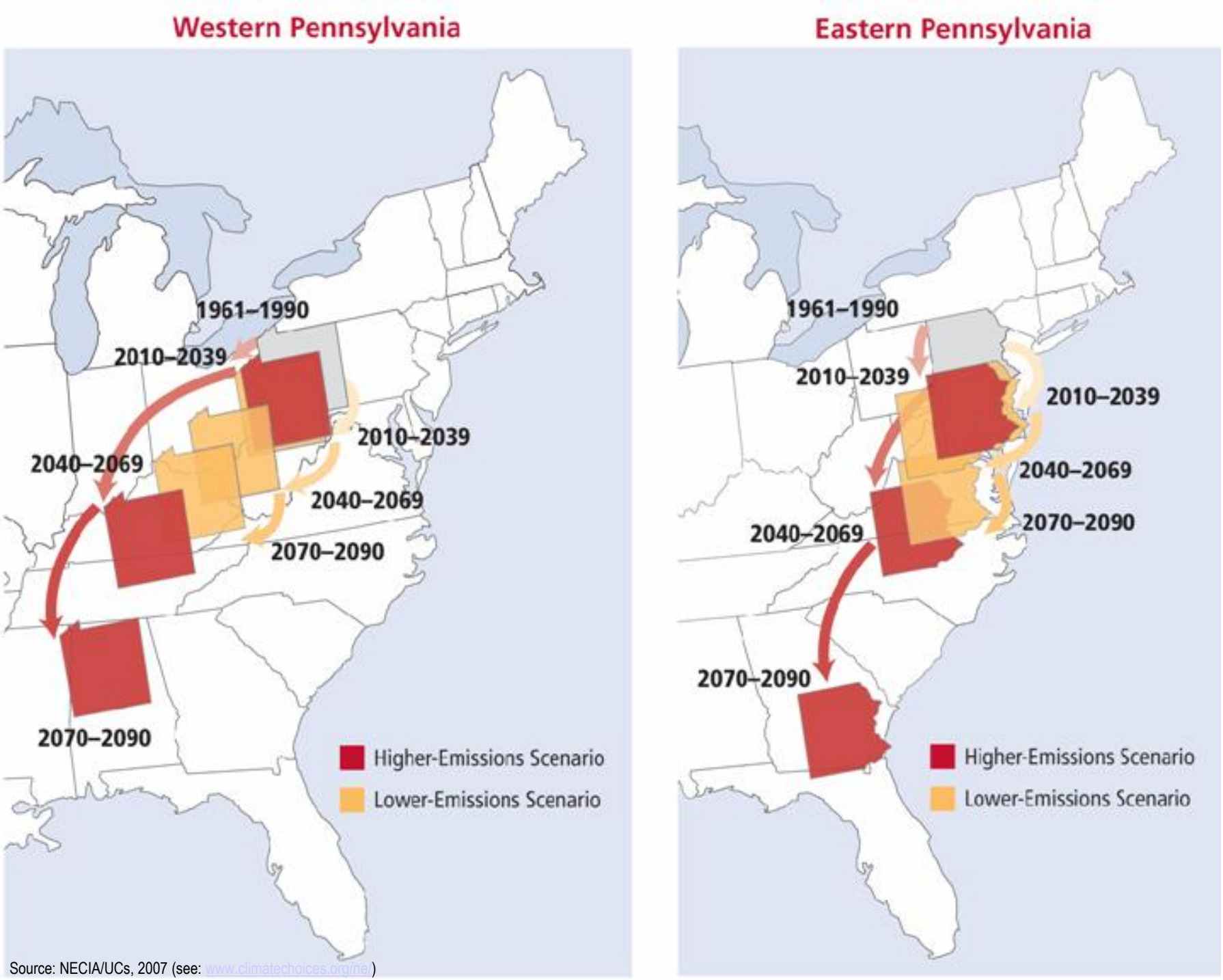
2002 = 29 deaths

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

The Problem

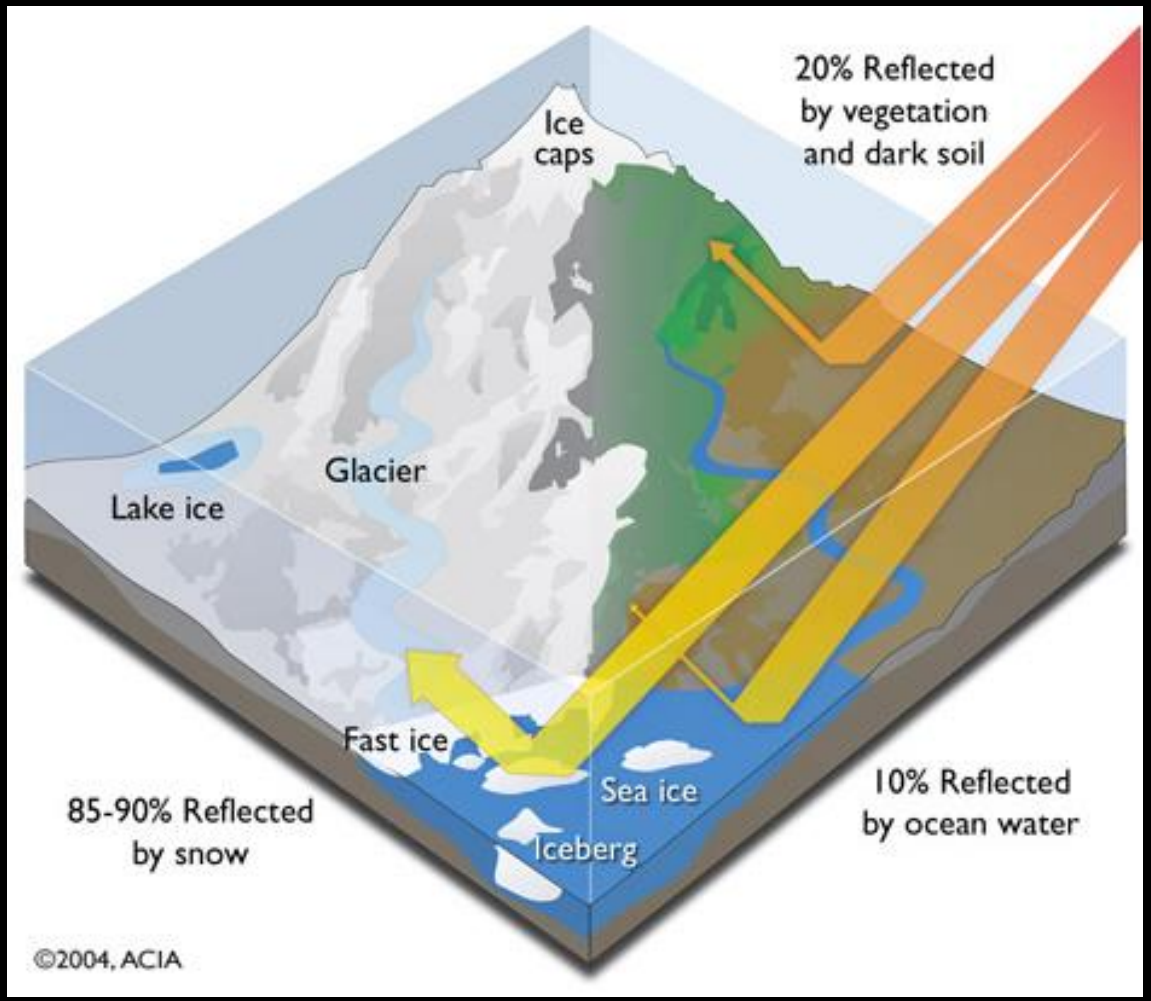
is compounded by the Urban Heat Island

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



Source: NECIA/UCs, 2007 (see: www.climatechoices.org/ne)

Problem: Global Warming is lowering Earth's Albedo

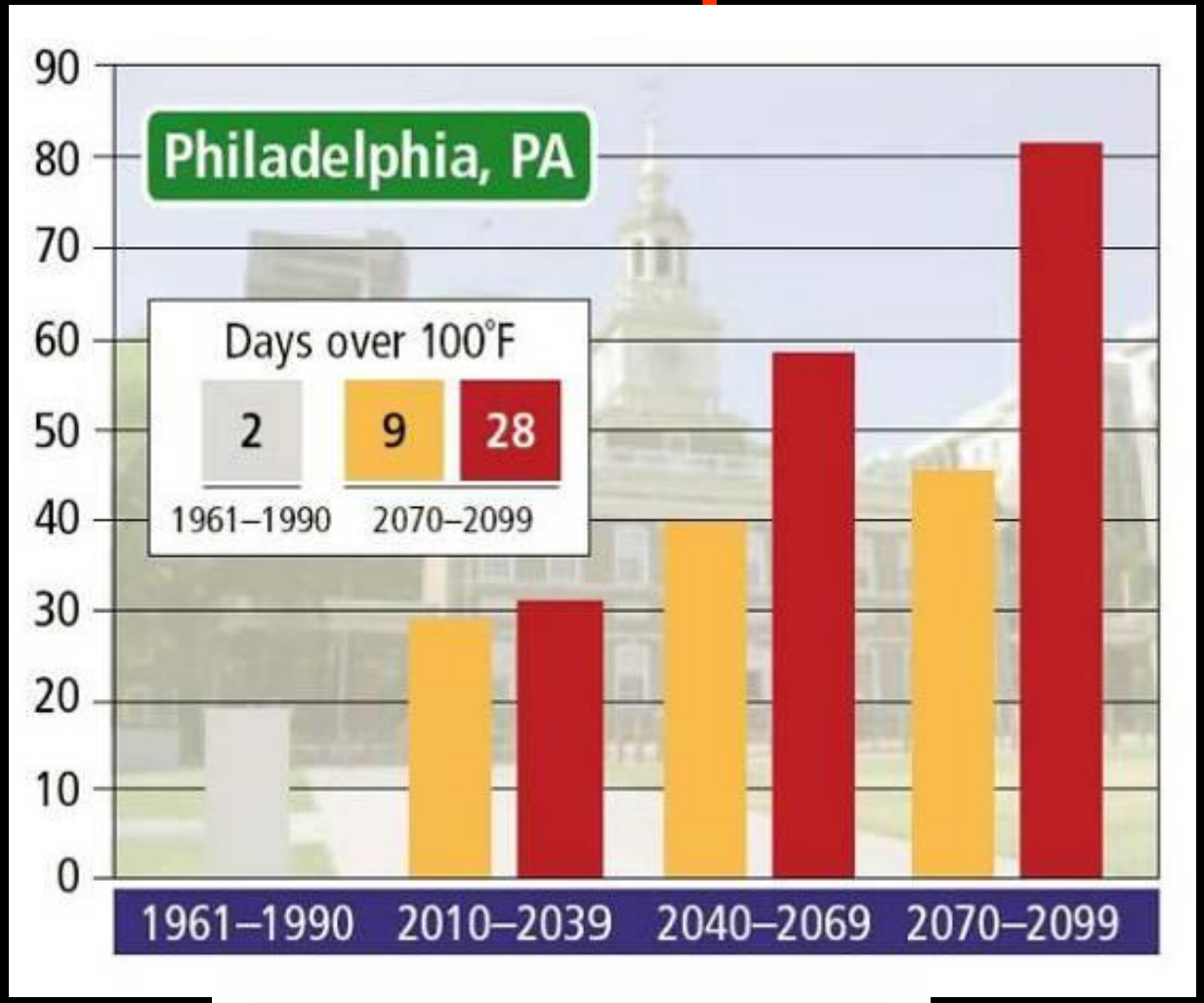


AP Photo/Michael Dwyer

Impacts on Human Health

- Extreme Heat
- Air Quality
- Pollen, Allergens
- Vector-borne disease

Increases in Extreme Heat in Philadelphia



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:

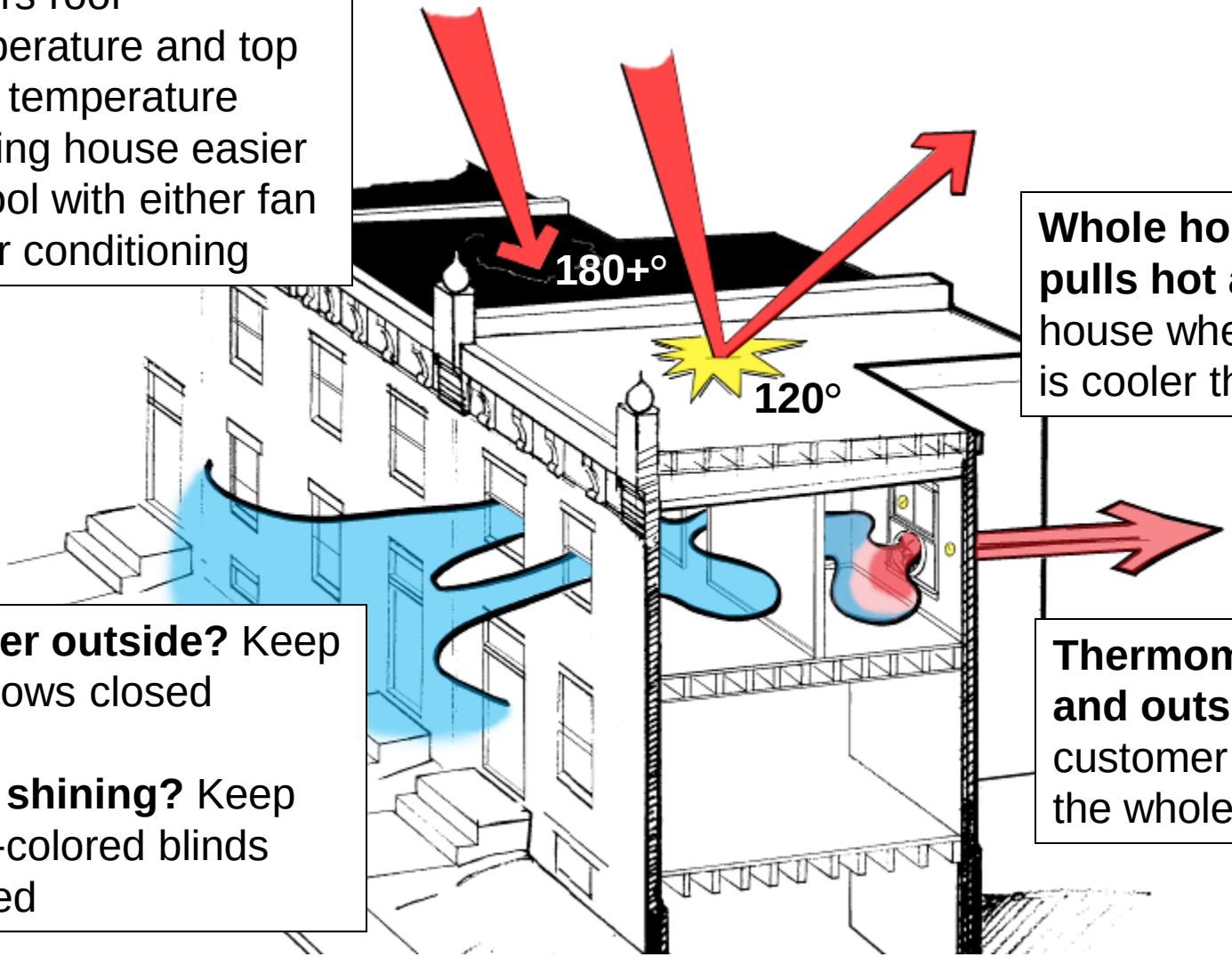
1)**Significant problem:**
Roof radiant temp.
(~50- 80° F difference)

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

2)**Other problem:**
Wall Temperature

Cooling Strategy

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



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

Hotter outside? Keep windows closed

Sun shining? Keep light-colored blinds closed

Thermometers inside and outside tell the customer when to use the whole house fan

Feedback for Customer:

Outside thermometer

Whole house fan

Customer monitors indoor and outdoor temperature differences to know when to use the whole house fan

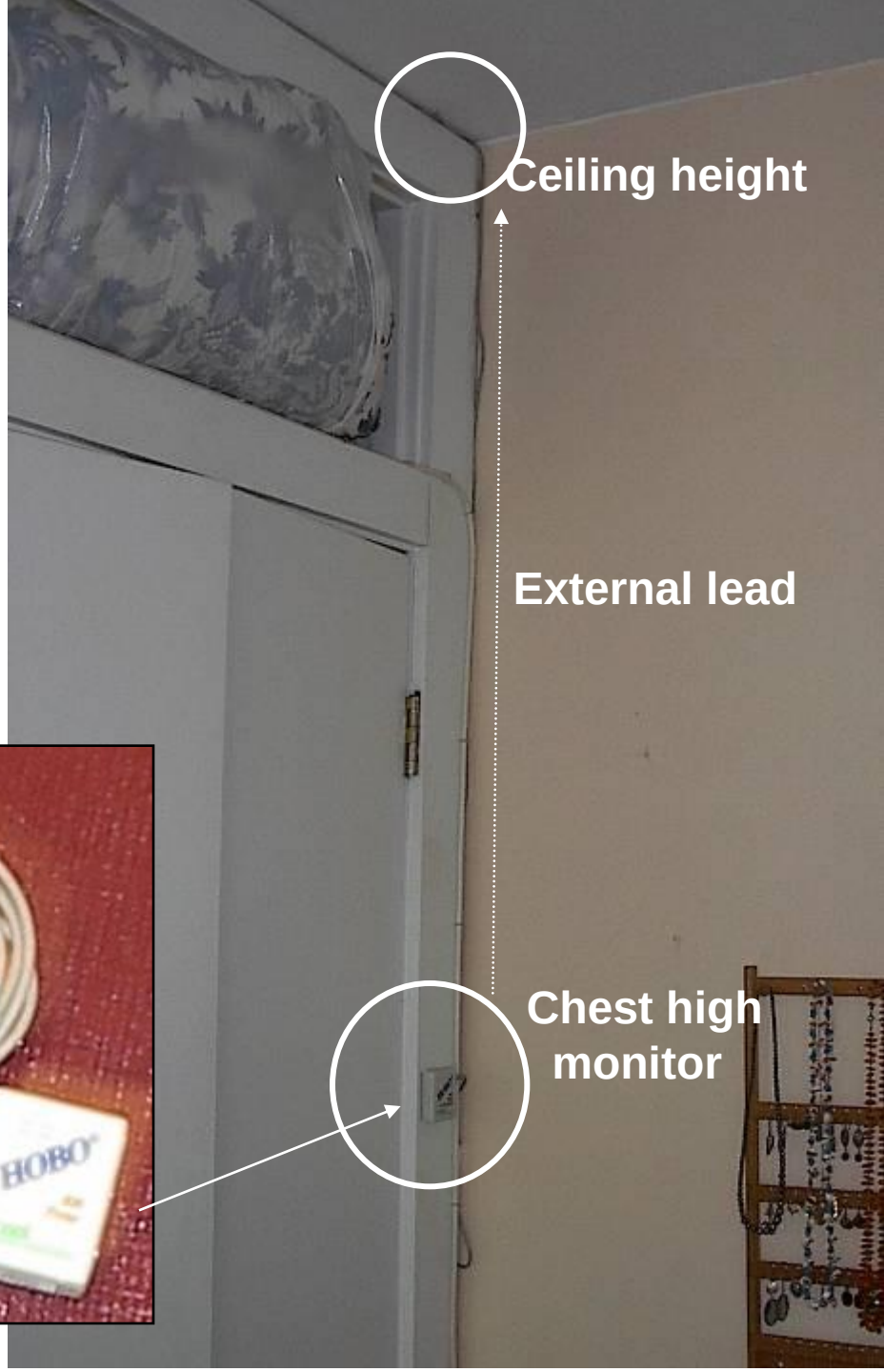
ECA Evaluation Results

- 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

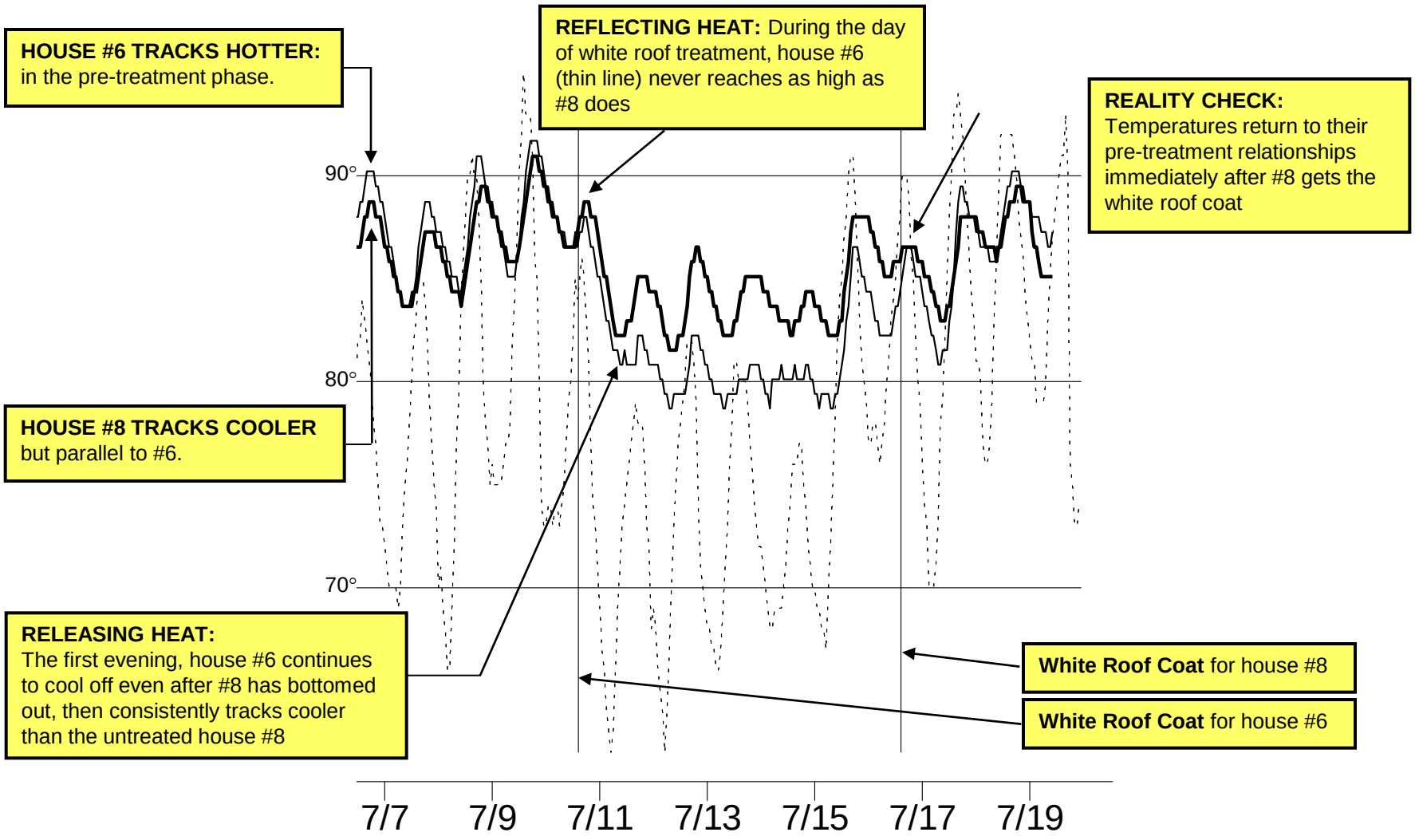
Data Logging:

Measuring temperature and humidity

Top front bedroom
First floor
Outside



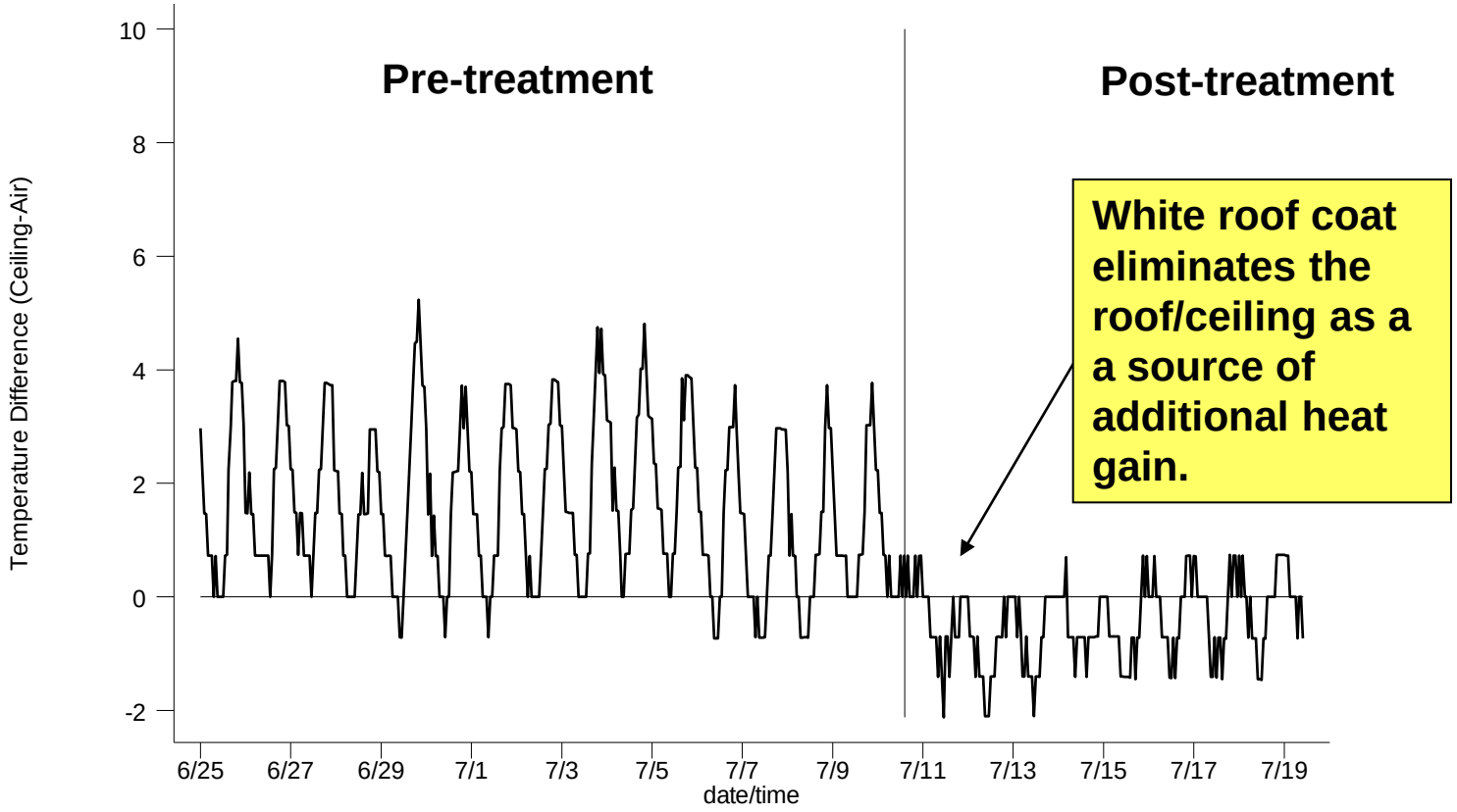
Tracking the Effects



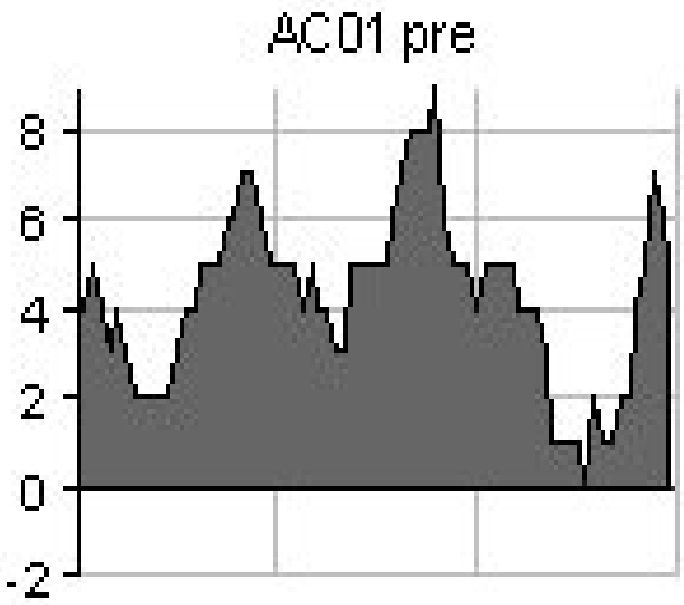
Tracking the effects of white roof coating on two identical homes

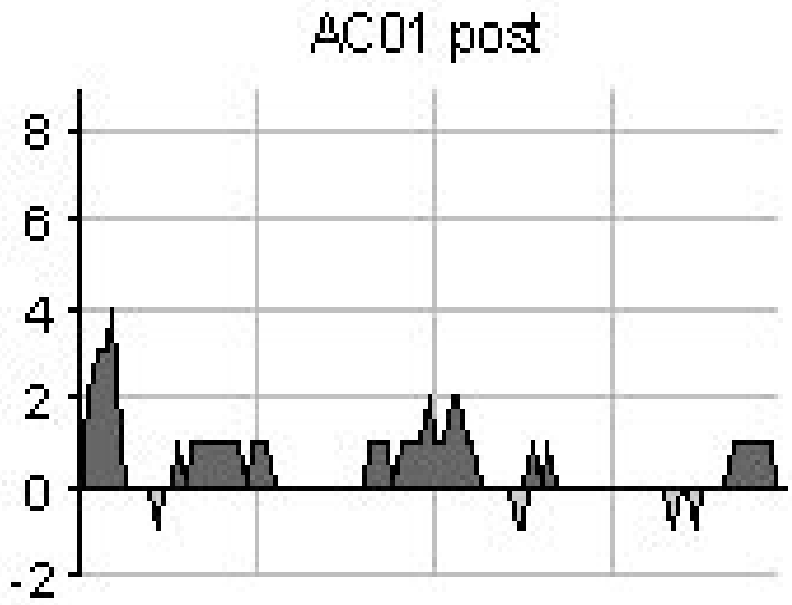
Temperature Differences

Between Ceiling and Air in house #6



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

RetroFit PHILLY

Coolest Block Contest


White Roof Coating can
Repair Bad Roof Conditions


Like Ponding


No Maintenance


And Split Seams


Holes are Patched
WARNING
AVISO
Children can fall into bucket and drown. Keep children away from bucket with even a small amount of liquid.
Los niños corren peligro de caerse dentro del balde y ahogarse. Mantener a los niños lejos de los baldes, incluso cuando sólo tengan una pequeña cantidad de líquido.

Clogged Drains Repaired


Polyester Fabric is Applied
Where needed then roof is . . .


Sprayed


or Rolled


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

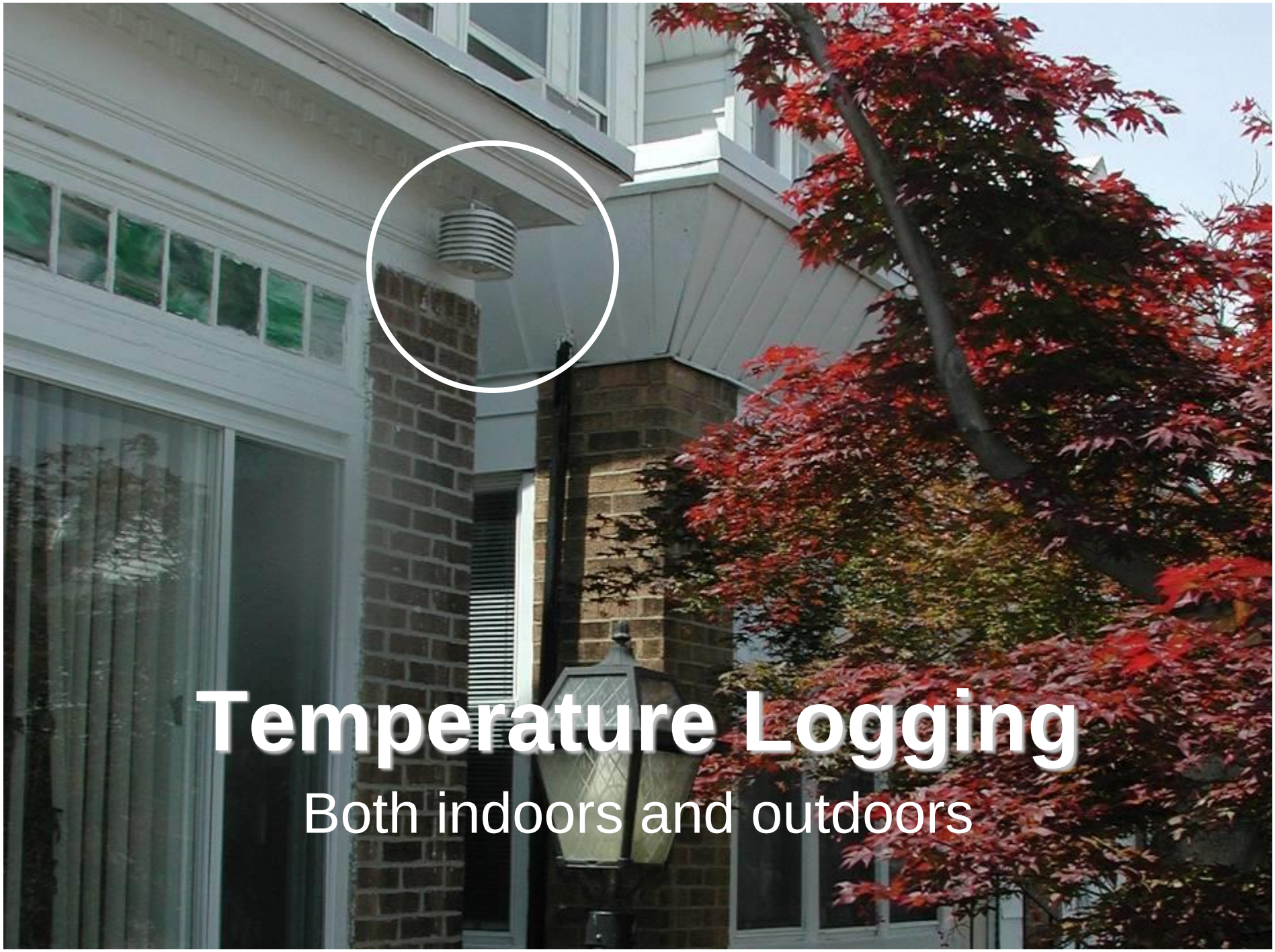

Attic Insulation Works
with White Roof Coating


Roof Hole for Insulation

Cool Block West Philly

Cool Block South Philly

Cool Block in Bridesburg

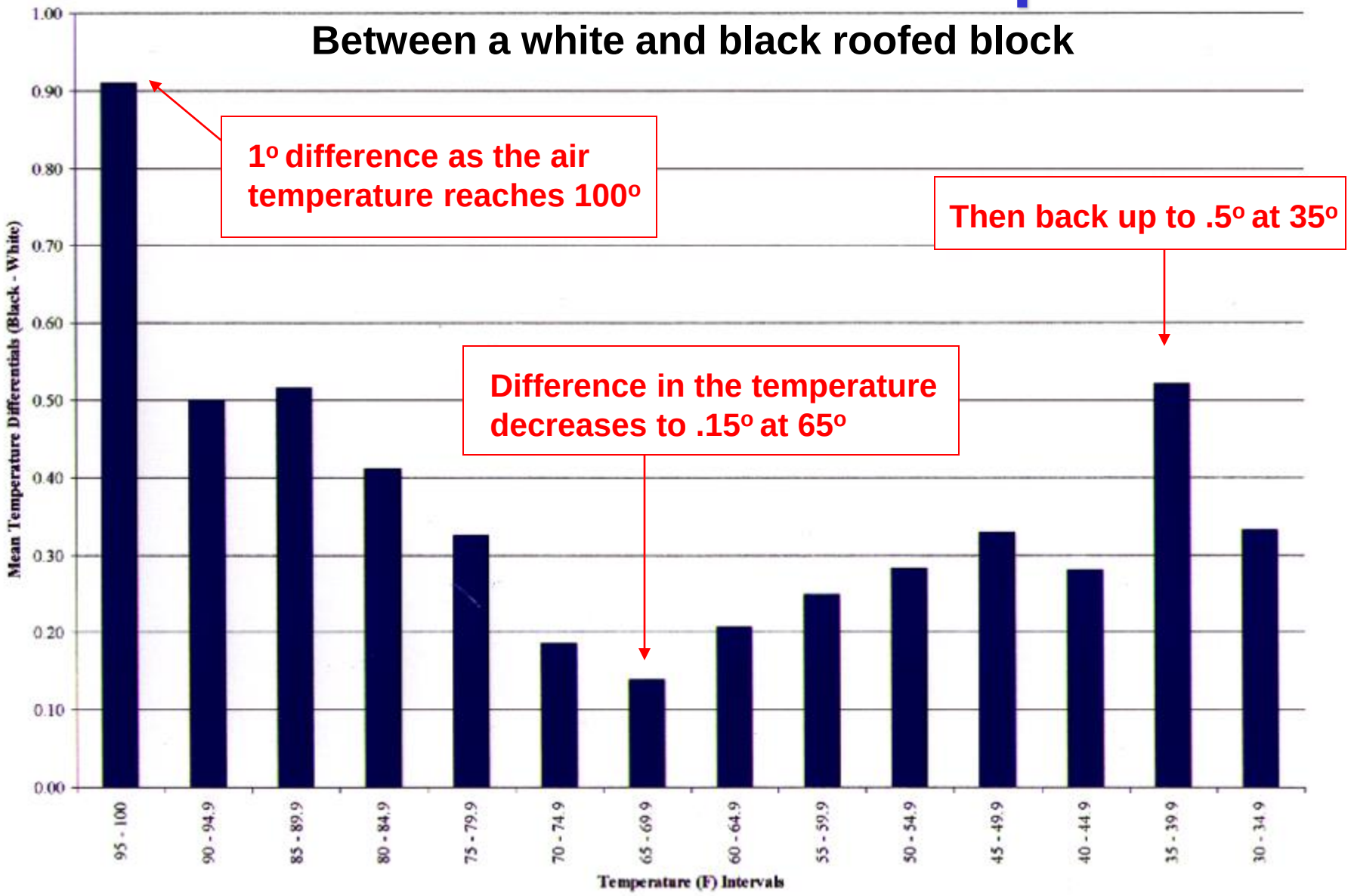

Temperature Logging
Both indoors and outdoors

Evaluation of Cool Block

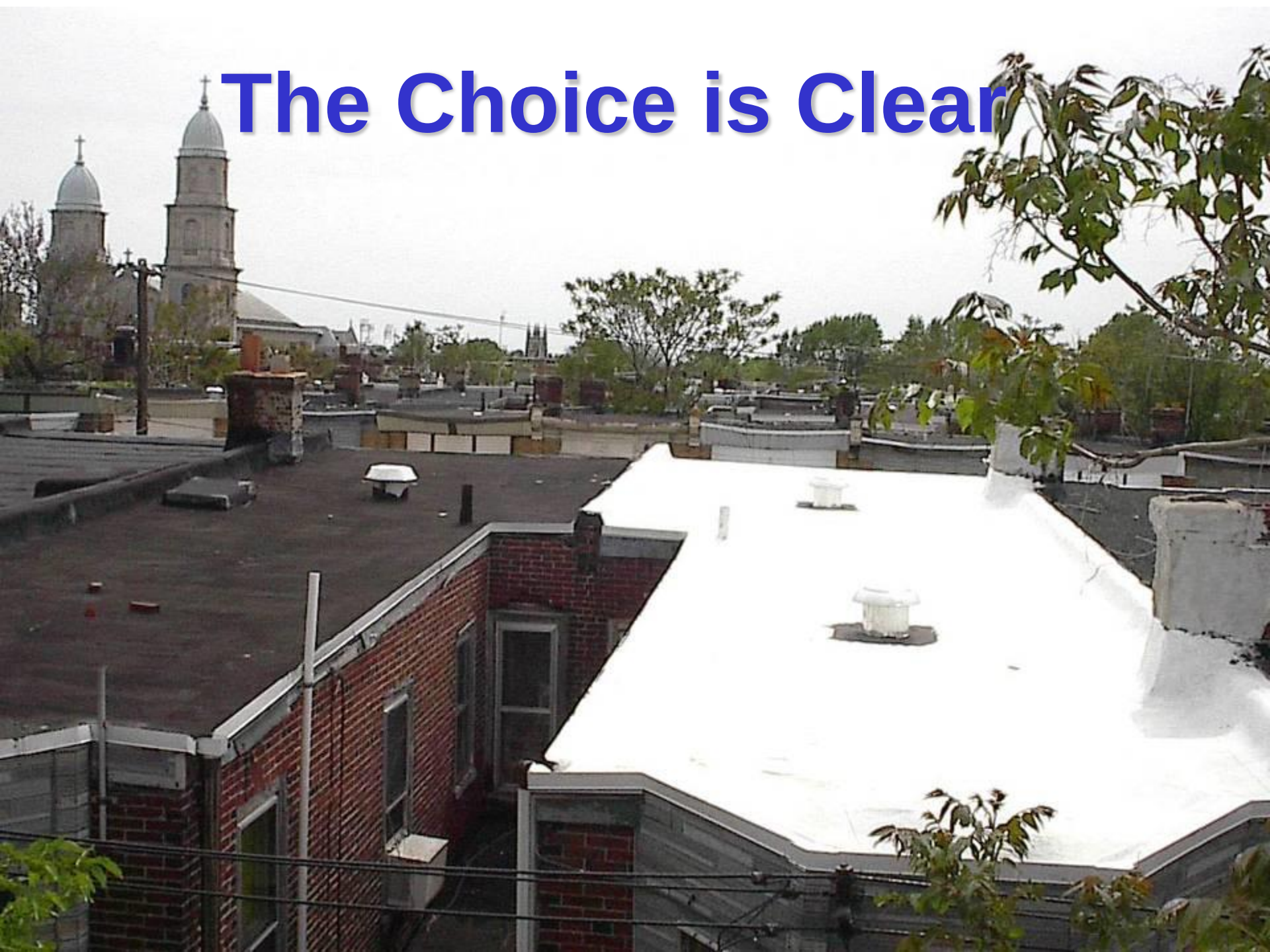
Black roofs super-heat homes and add to the urban heat island effect

Measure temperatures on treated and untreated blocks

Difference in Outdoor Temperature



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.

Cool Roofers

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