UHI Collaborative Meeting II

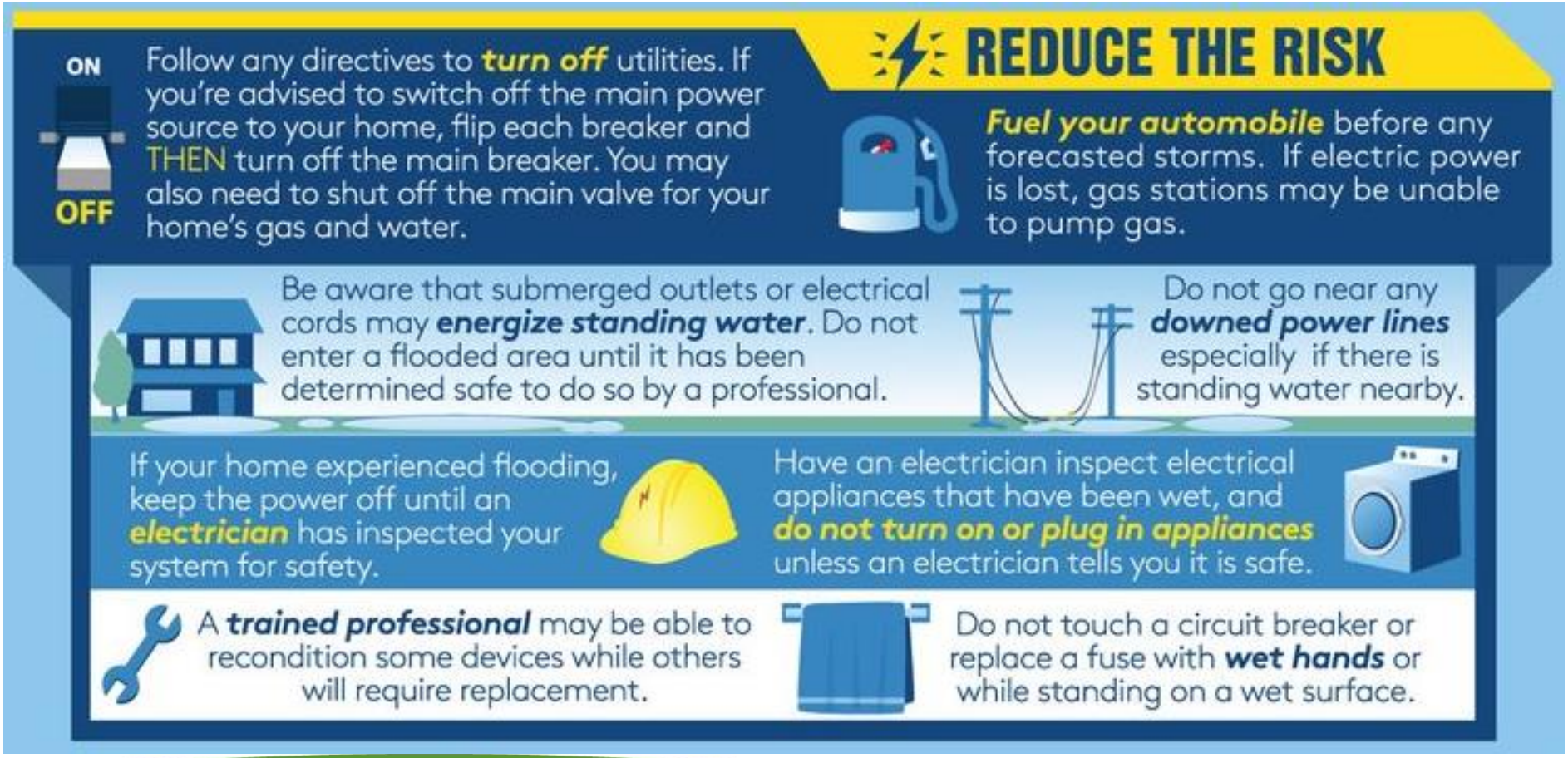
June 25, 2019

Meeting Agenda

- Introductions
- Safety Tip
- Urban Tree Canopy

  (BTG, Arbor Day Foundation & KCP&L)
- Global Cool Cities Alliance – Kurt Shickman
- UMKC – Dr. Sun Fengpeng & Kyle Reed
- Discussion and Questions
- Wrap-up

Safety Tip: Water and Electricity



Urban Tree Canopy – Event 1 Update

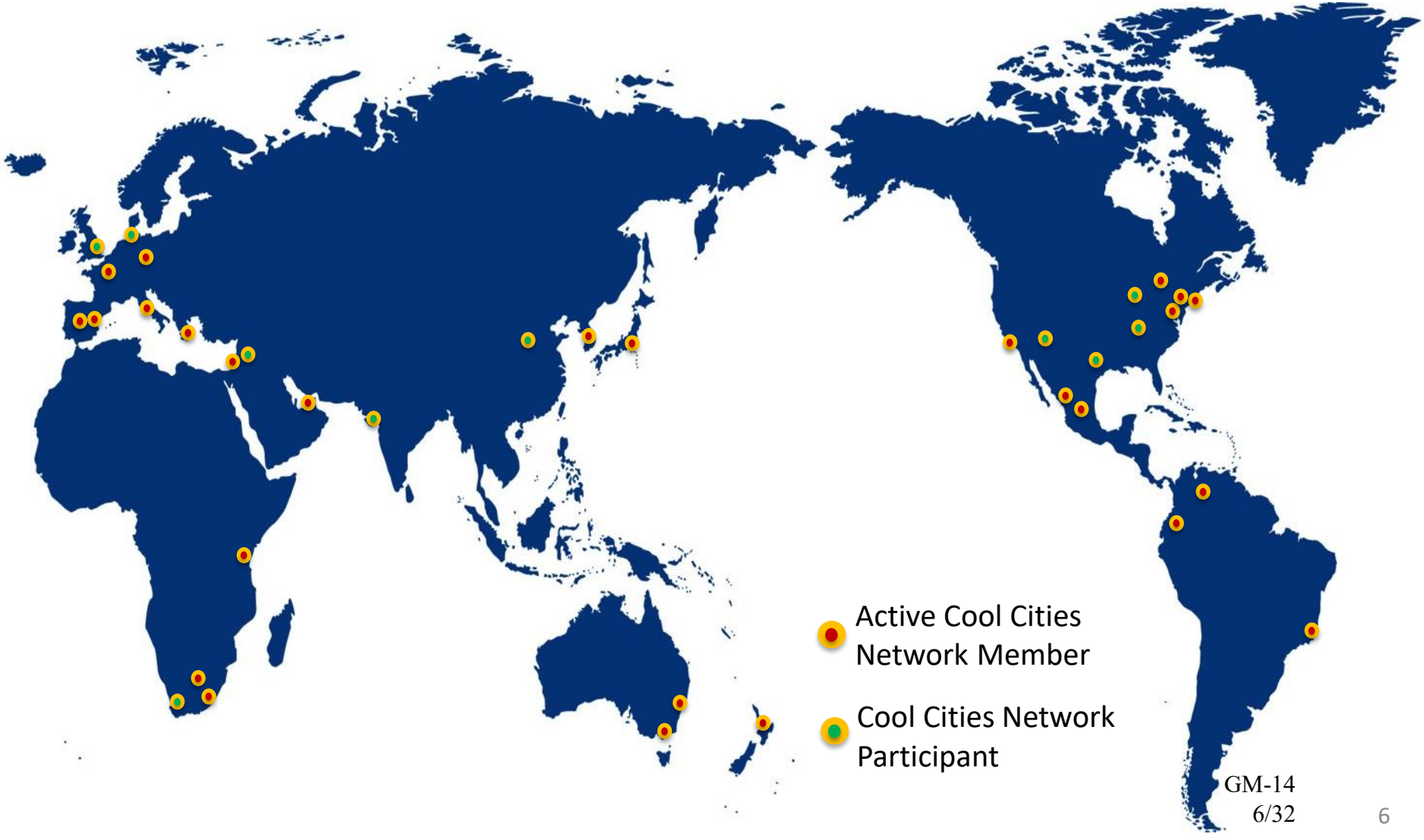
What Cities are Doing to Cool Off

Presentation to the Kansas City UHI Collaborative

Kurt Shickman

June 25, 2019

Cool Cities Network Members



A selection of GCCA initiatives

Quantifying the value of cool roofs.

Up to 20% energy savings, on average

Reduced heat wave deaths from small increases in reflectivity and vegetation

2-4°C indoor air temperature reductions

Equivalent of taking 50% of all vehicles off the road for 20 years

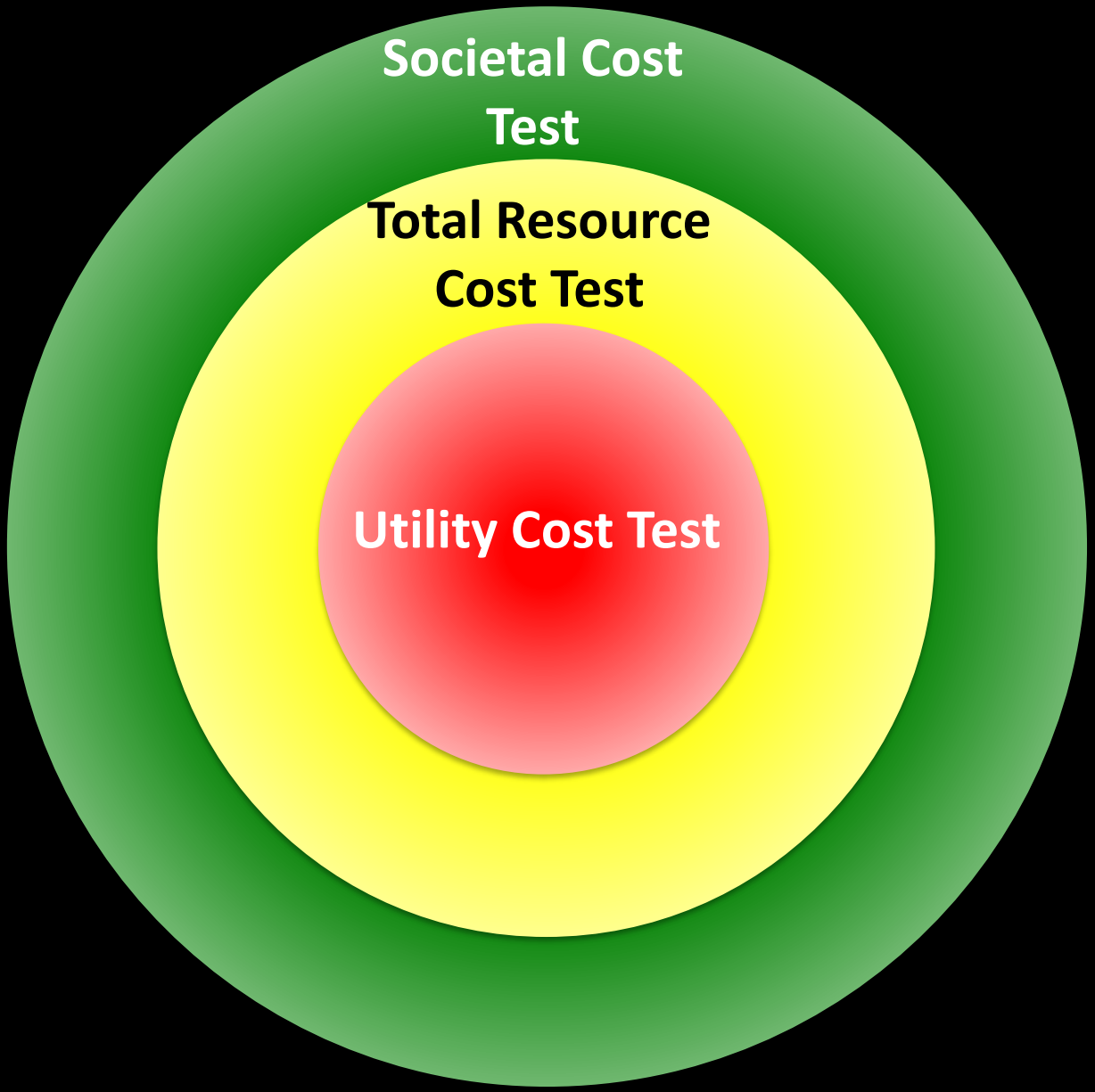
Reduced ER visits, less direct and indirect heat health challenges

Peak demand reductions, improved transmission efficiency

Efficiency gains and lower temperatures reduce ozone

Cool surfaces deliver benefits worth 12x their cost

Cooling benefits to utilities



1. Avoided energy cost
2. Peak demand reduction
3. Grid reliability
4. Lower energy trans/distro costs

5. Energy price suppression
6. Low-income impacts

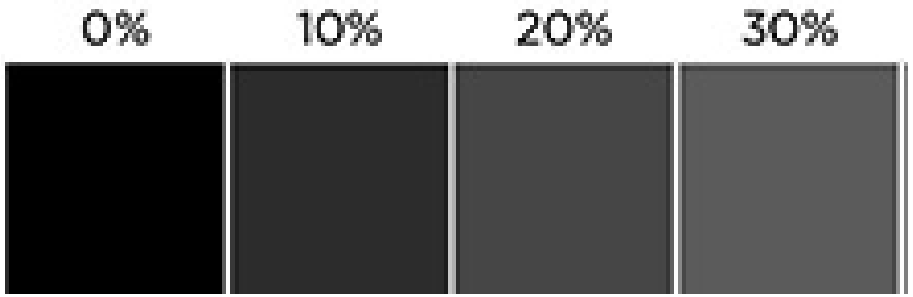
7. Water impacts
8. Air quality impacts
9. Health
10. Other

Lower the temperature, save lives

Cool roofs, implemented at scale*, reduced average temperatures during heat waves by **1.5C** in both Boston and Chicago.

Equivalent to cancelling 70% of Chicago's average UHI and all of Boston's average UHI.

Modeled reductions in mortality during heat waves of **8 – 9%** in Boston and **3 – 10%** in Chicago – the equivalent of saving up to 300 lives over the next decade.



***At scale = an increase in avg. roof SR of 0.25**

IN PRESS – ASTM International Ninth Symposium on Roofing Research and Standards Development

Laurence Kalkstein,[1] Frank Klink,[2] Kurt Shickman,[3] Sarah Schneider,[4] Mischa Egolf,[4] and David Sailor[5]

The Potential Impact of Cool Roof Technologies Upon Heat Wave Meteorology and Human Health in Boston and Chicago

Heat is a serious challenge for Kansas City

SUMMER HEAT IN

Kansas City

UP TO

28.0° HOTTER IN THE CITY THAN IN NEARBY RURAL AREAS

AVERAGE

4.6° CITY SUMMERS ARE HOTTER THAN IN RURAL AREAS

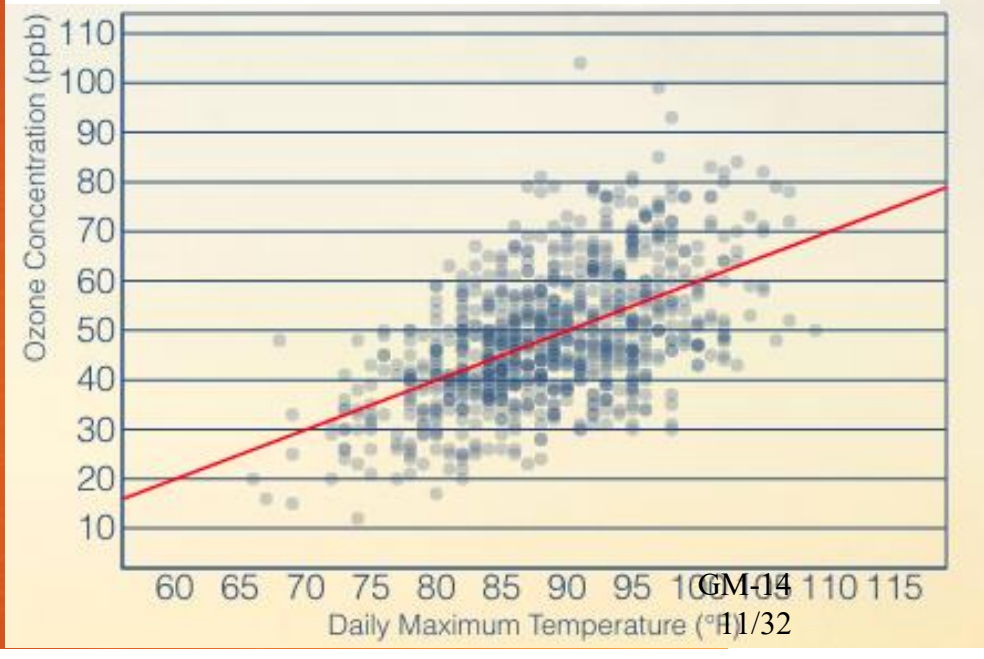
20 MORE DAYS ABOVE 90° F EACH YEAR, THAN RURAL AREAS

No.7 BIGGEST DIFFERENCE BETWEEN URBAN AND RURAL TEMPERATURES

(out of 60 Cities)

Source: Climate Central

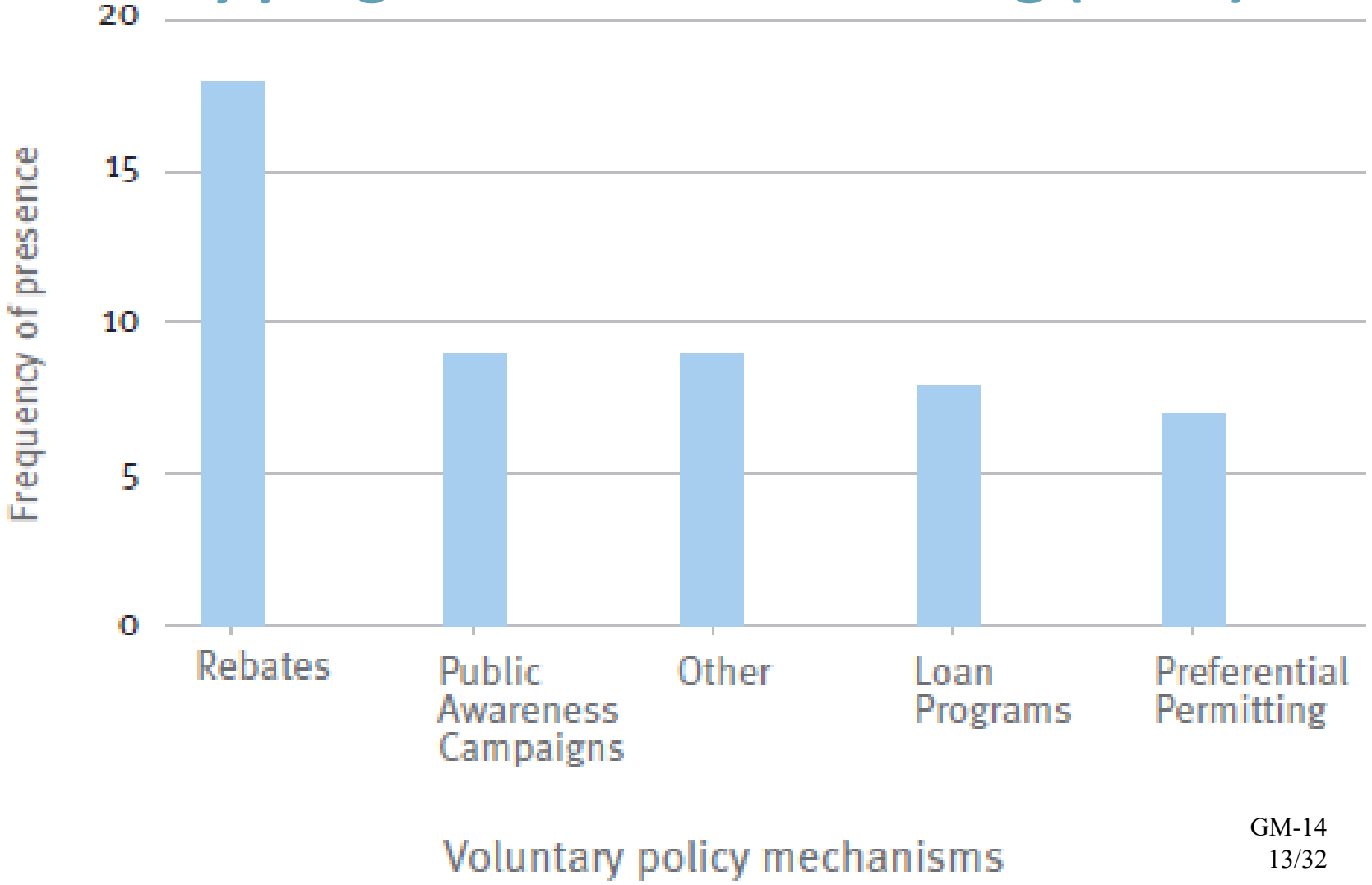
Ozone Concentrations and Max Temps: Kansas City



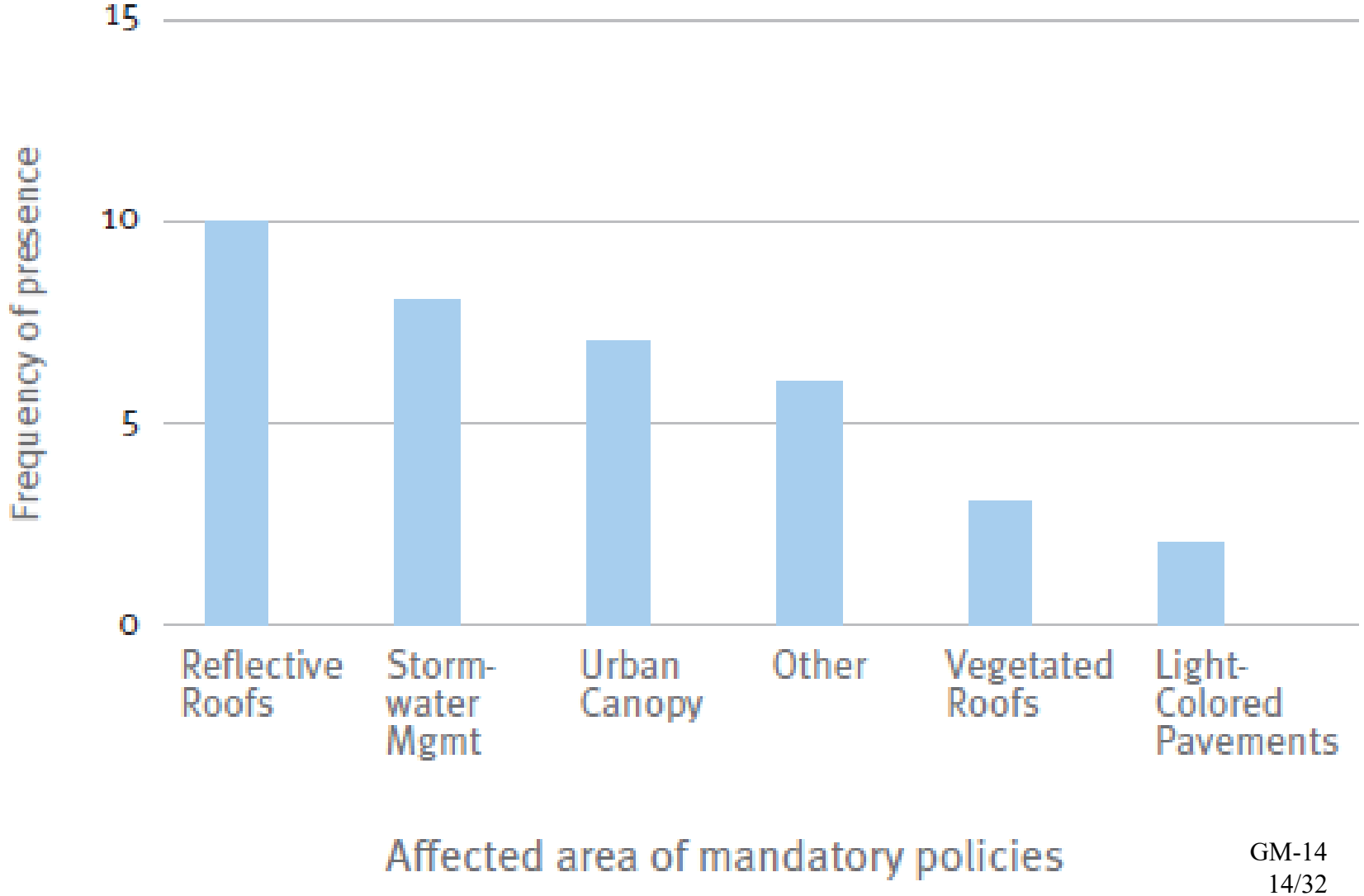
How are cities implementing urban cooling?

A few examples…

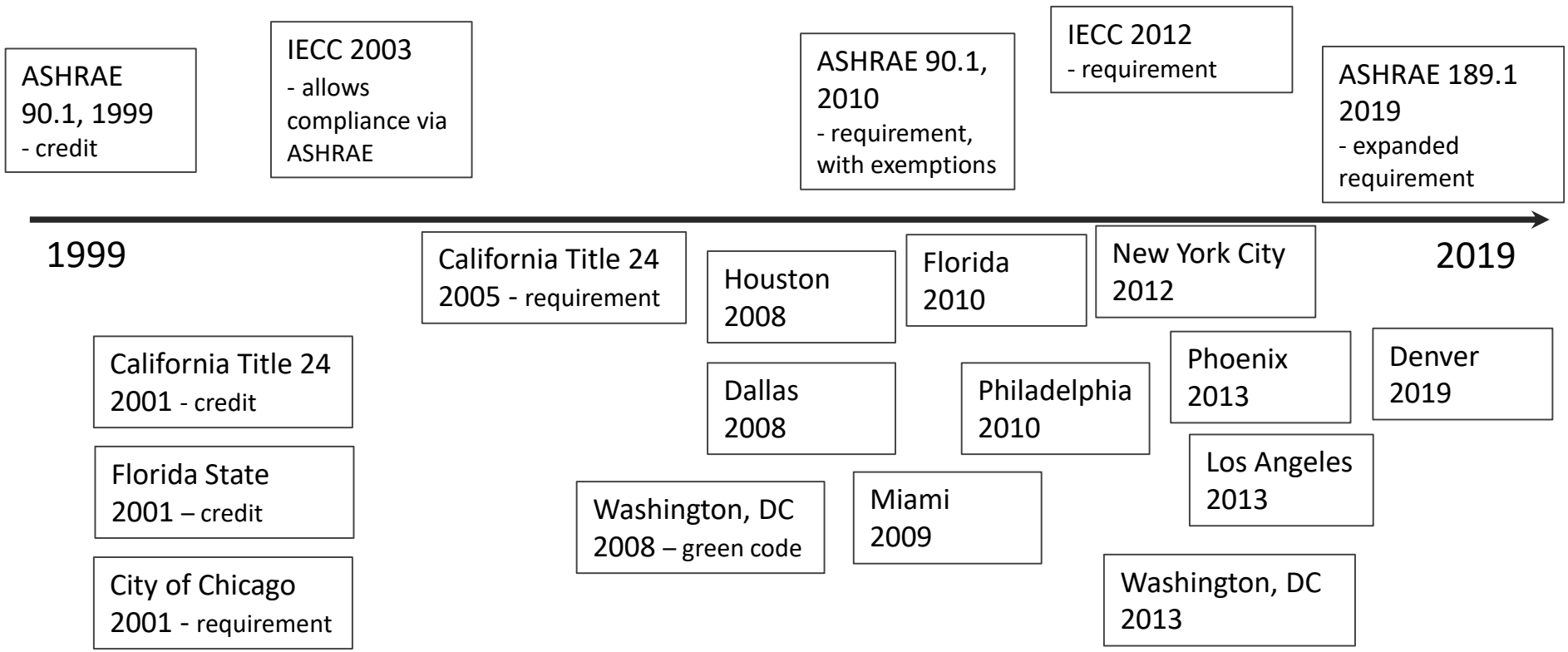
Voluntary programs for urban cooling (n=26)



Requirements supporting urban cooling (n=26)



Cool roof requirements in the U.S.



Rebates and financing for cool roofs

St. Louis:

Set the PACE St. Louis. *Financing for low-sloped roofs with 0.65 SR, or steep-sloped roofs with 0.25 SR.*

Toronto:

Eco-Roof Incentive. *Eligible green roof projects receive $75 per sq meter. Cool roof projects receive $2-$5 per sq meter.*

Washington DC: leading by example

Comprehensive CBA

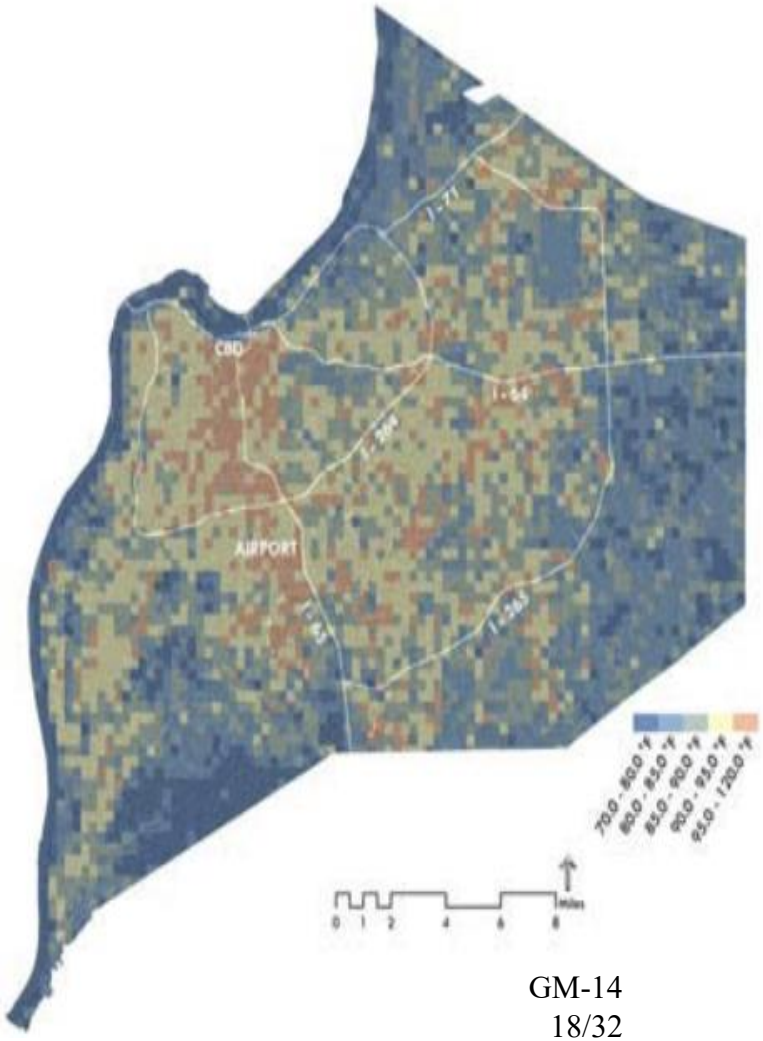
Evaluate	Plan	Implement
Roof Condition Score	Prioritization	Total: 11M ft² low-slope
Remaining Roof Life	Capital Planning	As of Feb 2016:
		167,000m² Reflective
Economics		35,000m² Green
		12MW Solar

Net Economic Benefit (over 40 Years) of Sustainable Municipal Roofs in Washington DC (~11M ft²)

Comparison to Standard Dark Roofs	Reflective Roof	Vegetated Roof	Standard Roof with Solar PV (PPA)
Costs	$5,580,000	$203,000,000	$0
Benefits	$52,100,000	$528,000,000	$294,000,000
Net Total	$46,500,000	$335,000,000	$294,000,000
Internal Rate of Return	58%	11%`	N/A
Simple Payback	2 years	11 years	N/A
Benefit to Cost Ratio	6.62	2.65	N/A
Net Present Value per m²	$46.07	$401.08	$908.90

Louisville: Impact research to target implementation

- 2-year technical study to assess urban warming and mitigation impacts at a resolution of 500m.
- 8 months of public workshops and policy development
- Targeted rebates for cool and green roofs based on high heat vulnerability.



San Antonio: “Under 1 Roof”

City program to replaces steep slope roofs with lighter shingles on homes of income-qualified residents

Expanded from a $200,000 pilot to a program with a 2019 budget of $4.25M ($1M from philanthropic sources).

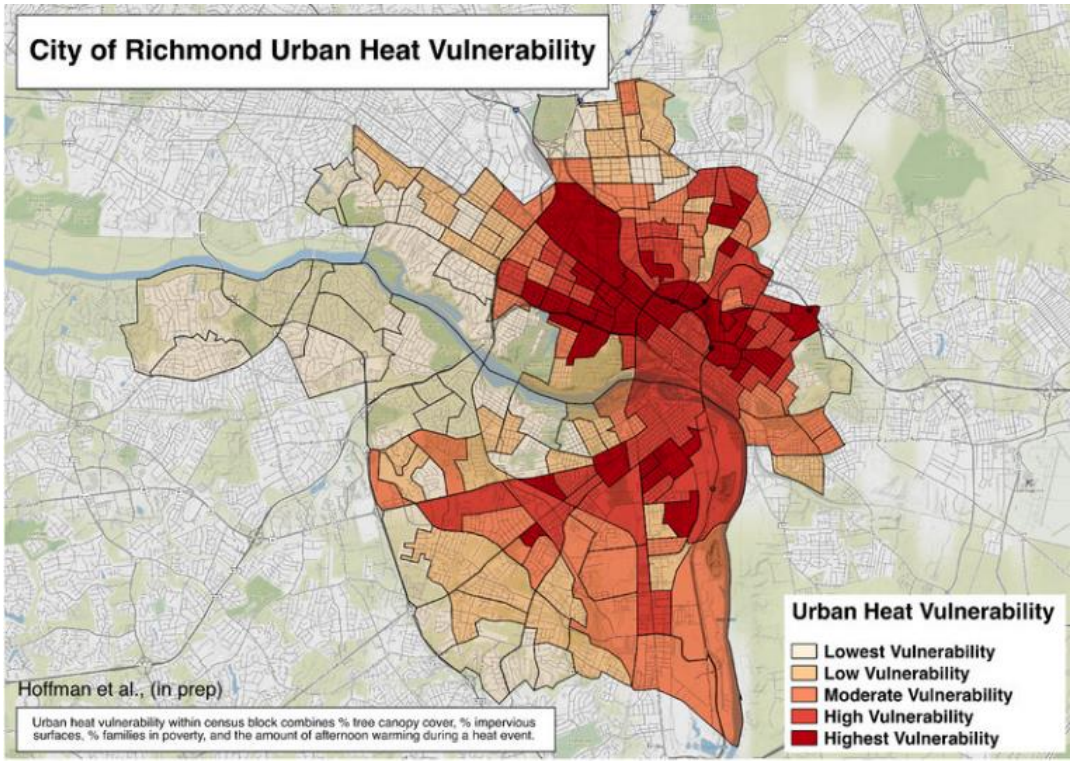
Attic temps down 23F with average annual energy savings of $1200 per house.

Source: CPS Energy

Richmond: citizen science & community engagement

- Richmond Urban Heat Island Collective – public/community/scientific partnership.

- Throwing Shade in RVA - An initiative of the Science Museum of Virginia and Groundworks.
  - Citizen science
  - Effective youth engagement through hands-on science



Reflections from "Smart Surfaces" Interviews

Interviews with:

Boulder, CO
Las Cruces, NM
Los Angeles County, CA
Louisville, KY
Newark, NJ
Reno, NV
Richmond, VA
Tempe, AZ
Washington, DC

1. How do "smart surfaces" currently fit into your city's strategy, planning, and implementation efforts?

2. What have been the key challenges to progress on heat mitigation?

3. What would be a useful set of resources/activities to reduce those challenges?

Reflections from "Smart Surfaces" Interviews

1. Progress on urban cooling is opportunistic, not systemic. There are no "Departments of Heat"

2. Heat is rarely a driving policy force but is often buried in other goals.

3. Cities want help avoiding the echo chamber. Cities want to grow the cohort of people in various agencies that understand and incorporate heat into their planning, targets, and budgets (particularly public works, capital planning/procurement, emergency services, and health).

4. Nearly every city interviewed described how valuable academic/scientific partnerships were for both data and analysis they can provide but also the credibility.

New Tool Preview

Evaluating the solar reflectance of urban surfaces in Kansas City

Cities are seeking a way to meaningfully measure progress on heat mitigation

There is currently no cost-effective, easily repeatable way to measure urban surface changes.

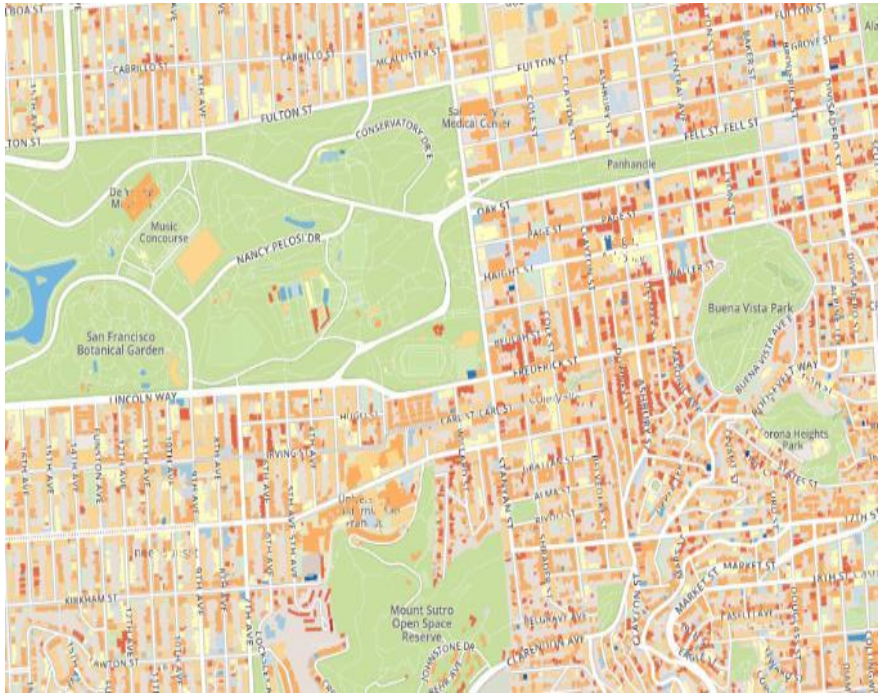
The lack of concrete measurability slows the adoption of urban heat mitigation policies, despite the clear need.

Cities are seeking a scientifically sound way to target heat policy to maximize the effectiveness of limited budgets.

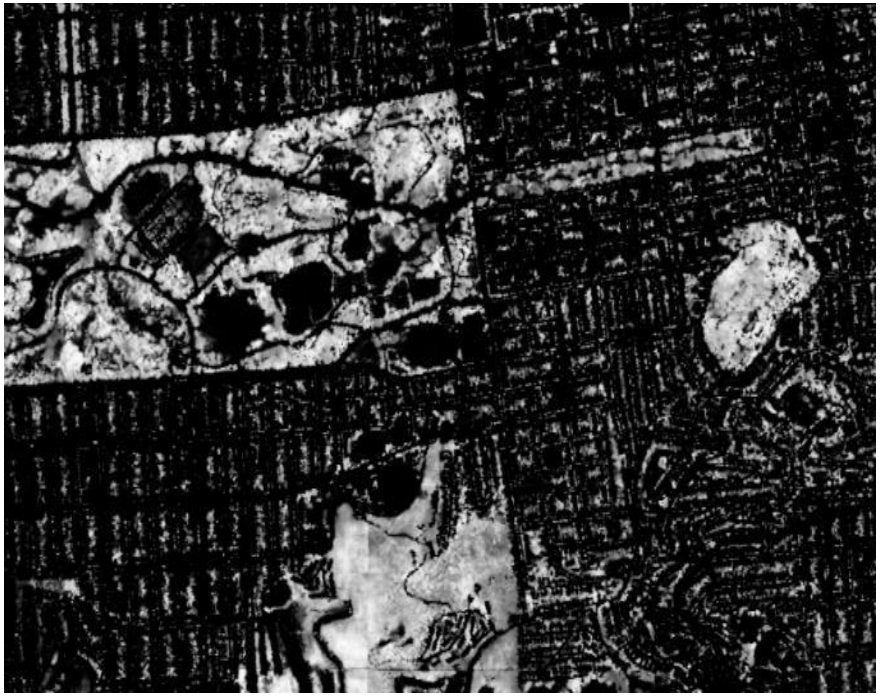
The First Globally scalable AI methods to quantify Surface reflectivity & Tree Canopy

- High spatial-resolution data on top 2 urban heat mitigation measures – reflectivity and trees
- Resulting datasets both already available for California at ≤ 1m resolution
- Data not previously applied together
- In principle, both methods globally scalable at low cost (pending imagery access and training data)

"Albedo Map" – LBNL/USC



"DL Trees" – Descartes Labs



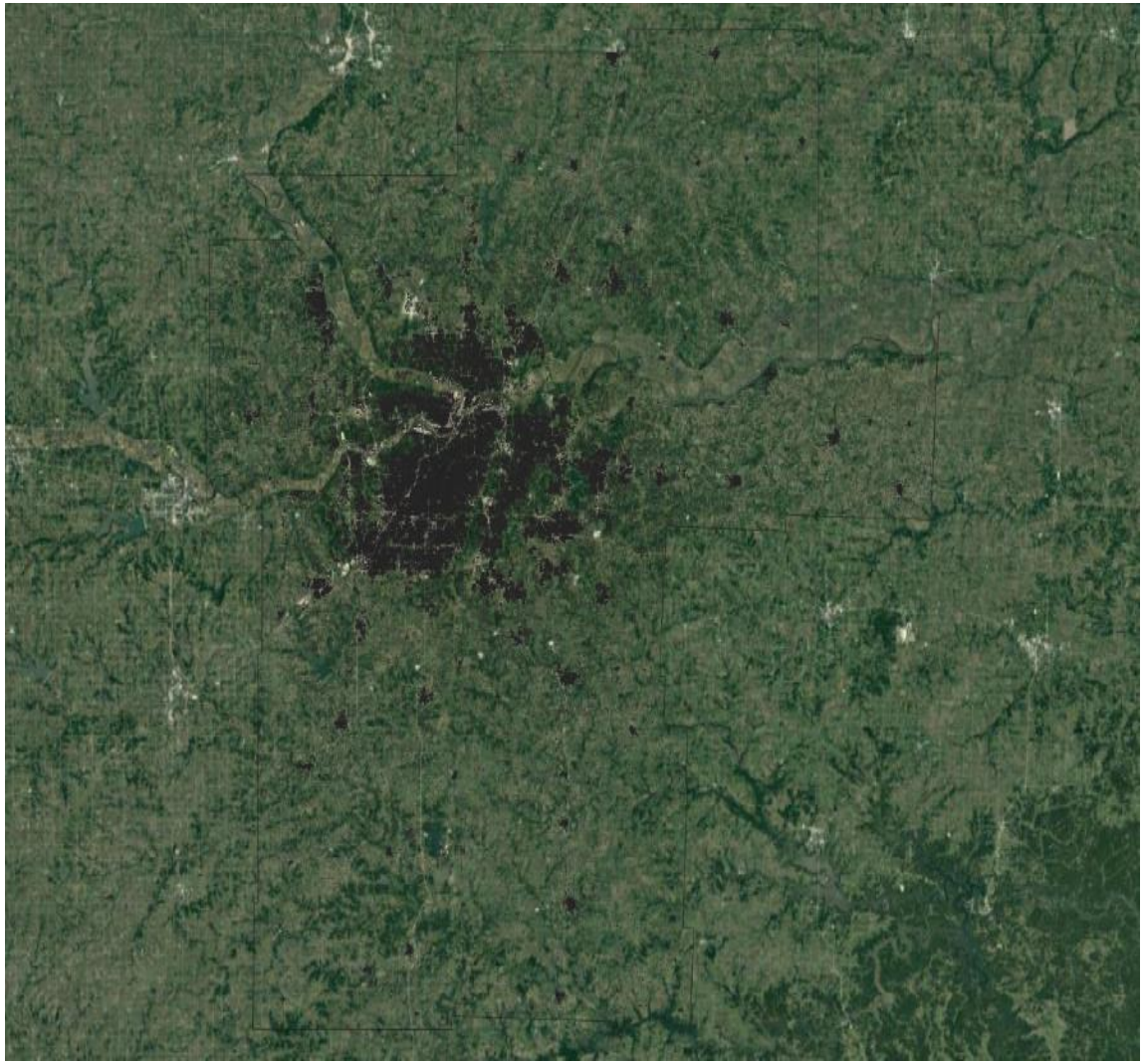
Golden Gate Park and surrounding neighborhoods, San Francisco

A Transformational improvement in Data-Driven URBAN Heat Mitigation

- Enabling quantitative:
  - Baselining
  - Target setting
  - Scenario planning and cost-benefit analysis
  - Geographic targeting
  - Progress measurement

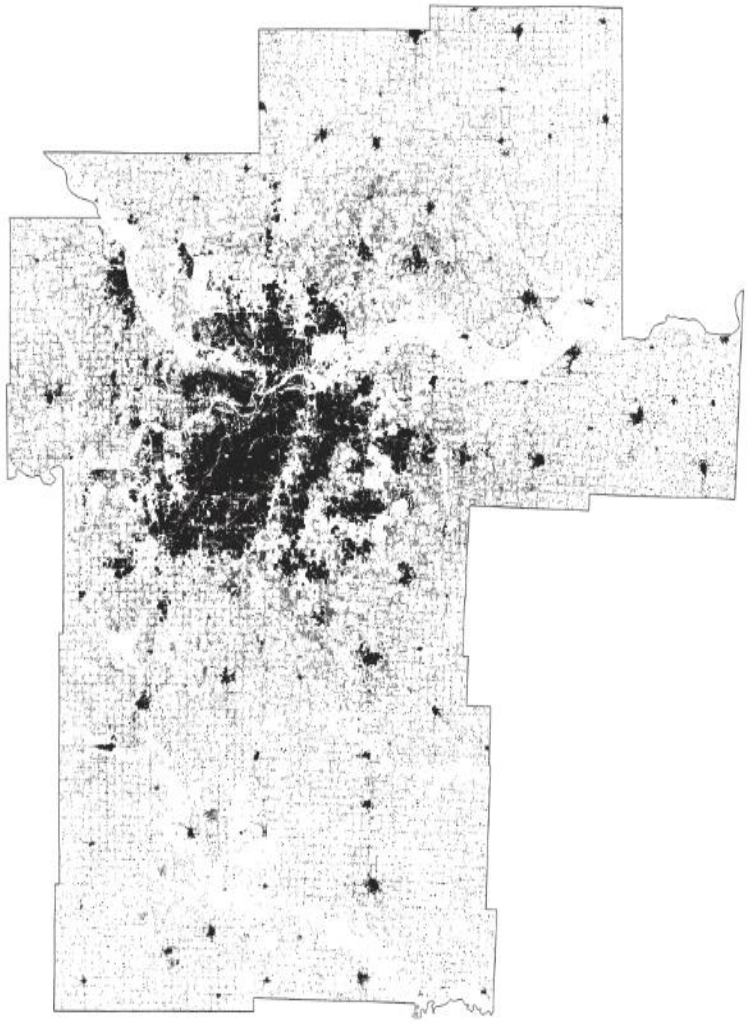
Hypothetical tool mock-up: overlay of trees, reflectivity and social vulnerability index (SVI). Darker areas are more vulnerable to heat.

Kansas City Metro Building Footprints



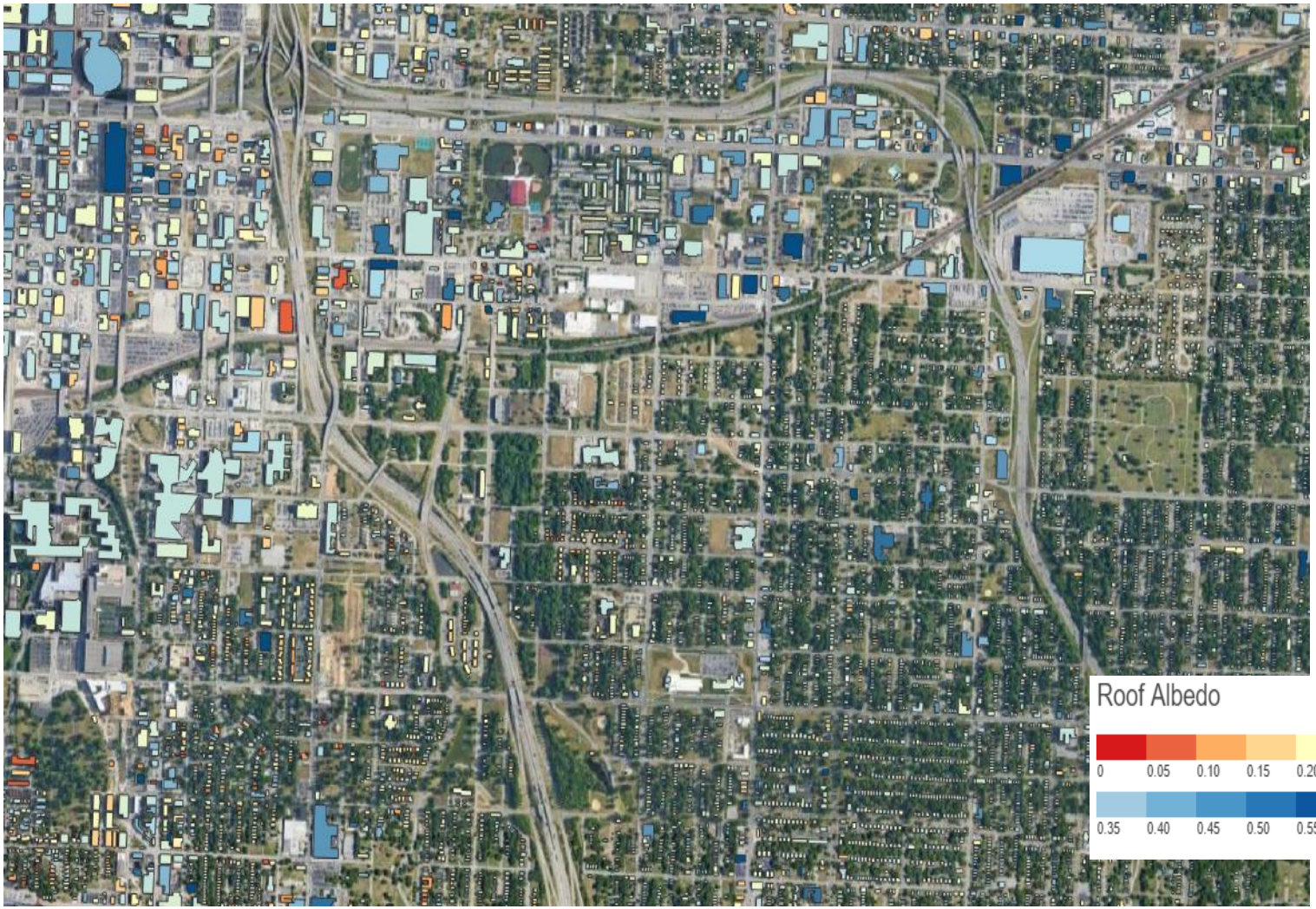
Source: Google Maps, US Census, Microsoft Building Footprints

Kansas City Metro Building Footprints

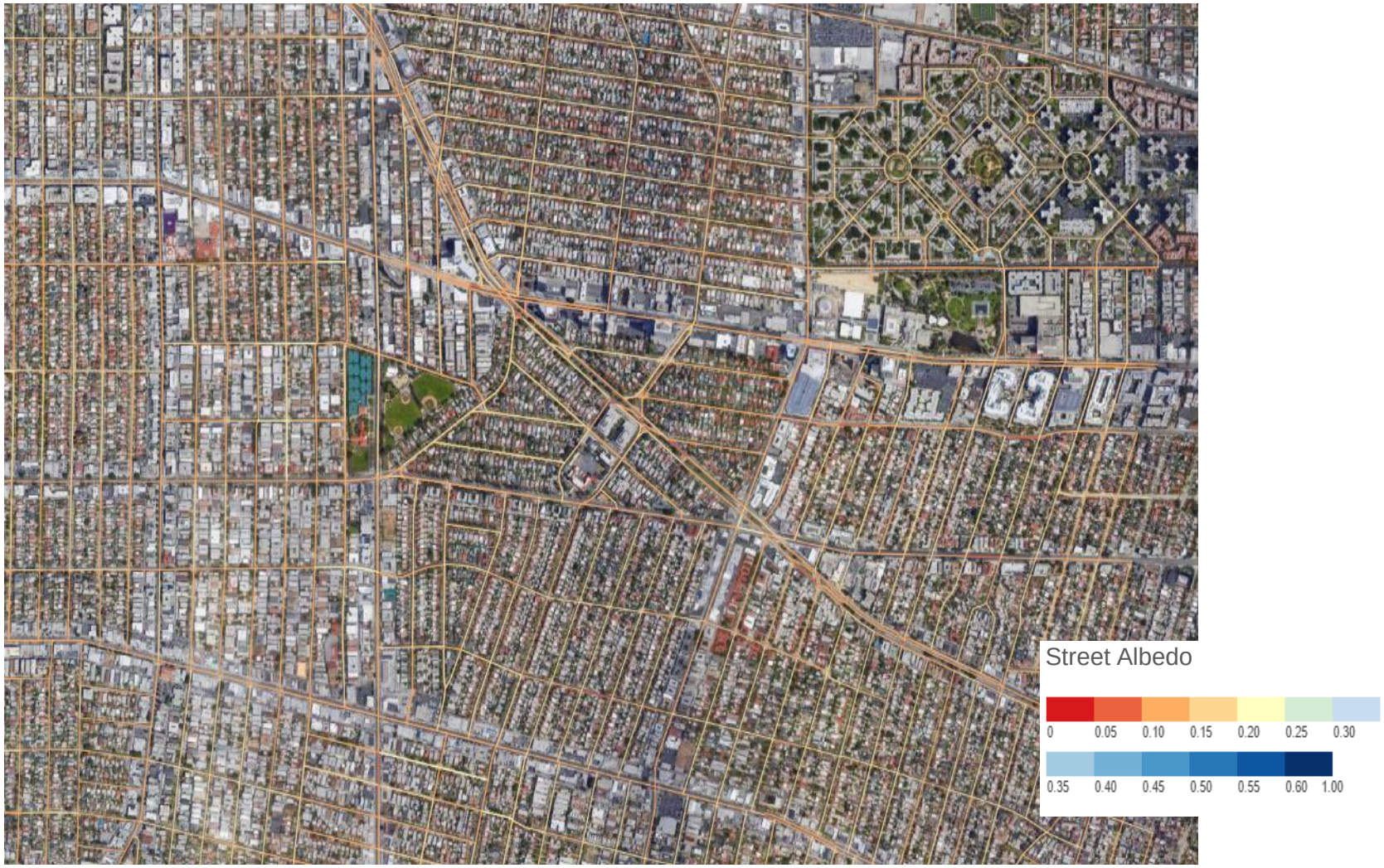


Source: US Census, Microsoft Building Footprints

every Roof in Kansas City Metro Area & its estimated Reflectivity



every Street in Los Angeles & its estimated Reflectivity



Thank You!

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