

DRAFT FINAL



A strategy to cost-effectively reduce global CO₂e emissions by 10–15%, cool cities by 3°C/5°F—and deliver large environmental justice, health, and resilience benefits

www.smartsurfacescoalition.org

The Opportunity

30 leading organizations with an integrated and complete strategy to cost-effectively reduce global CO2e emissions by 10–15%, cool cities by 3°C/5°F—and deliver large environmental justice, health and resilience benefits

Reduce CO2e by
10%-15%



Deliver Large Environmental
Justice Benefits



Cool Cities by 5°F &
decrease risk



Save Billions & Strengthen
Local Economies



Create Jobs



Improve Health

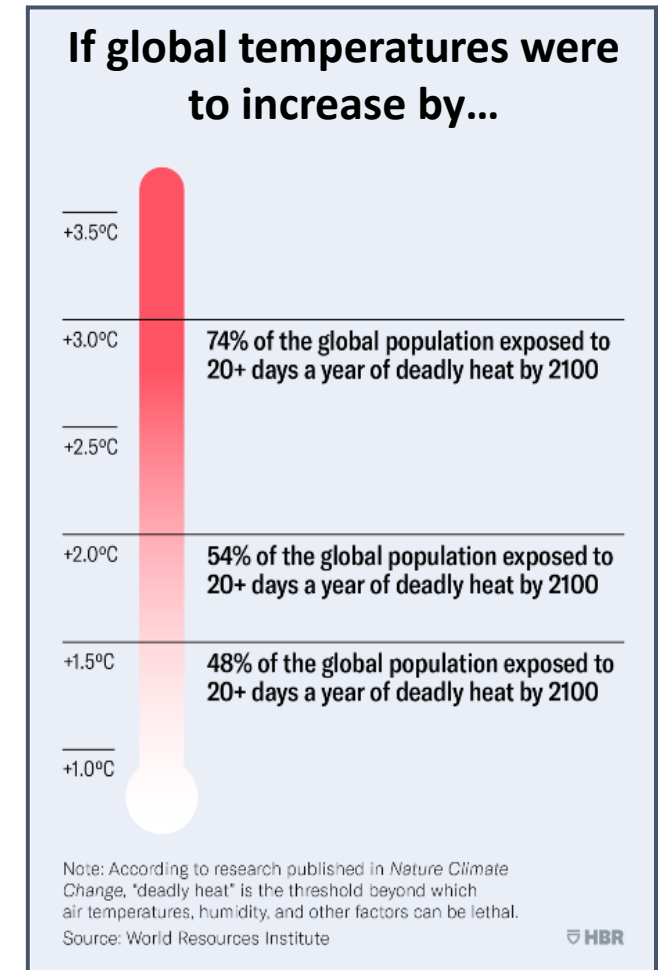
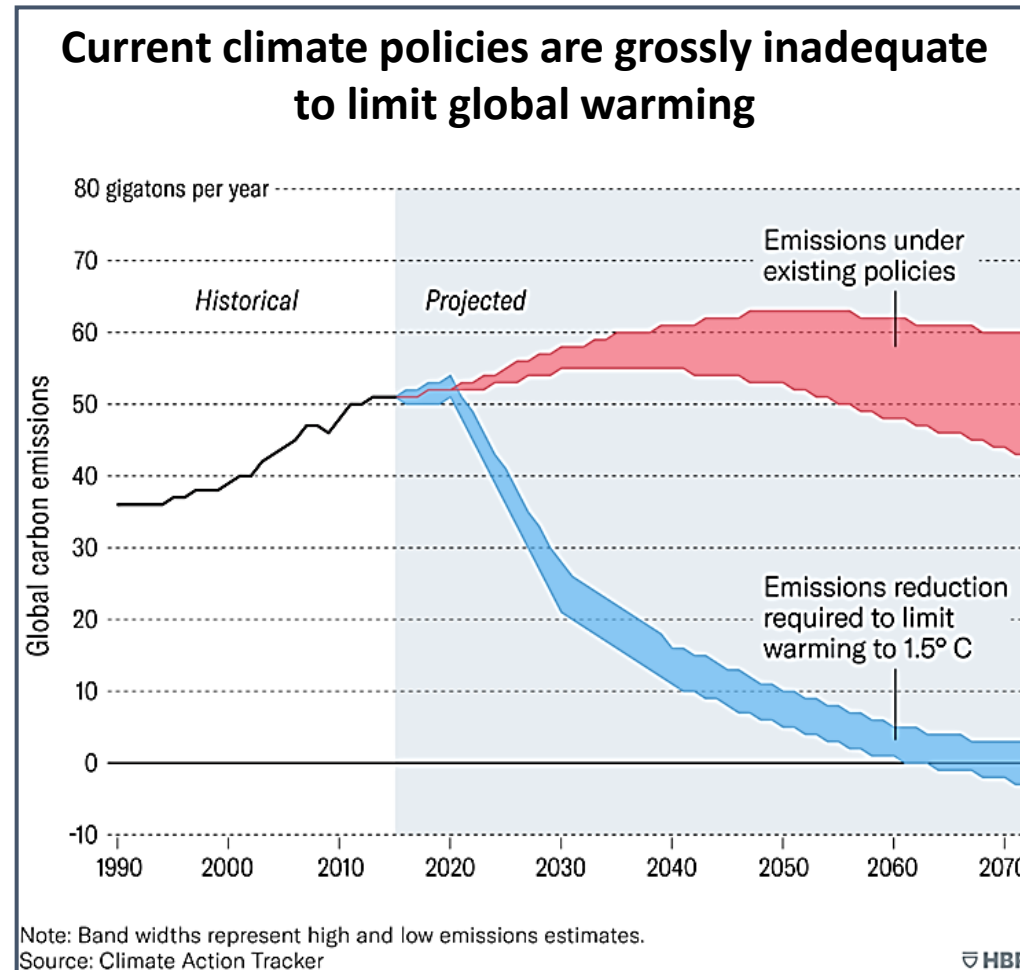


Reduce Pollution



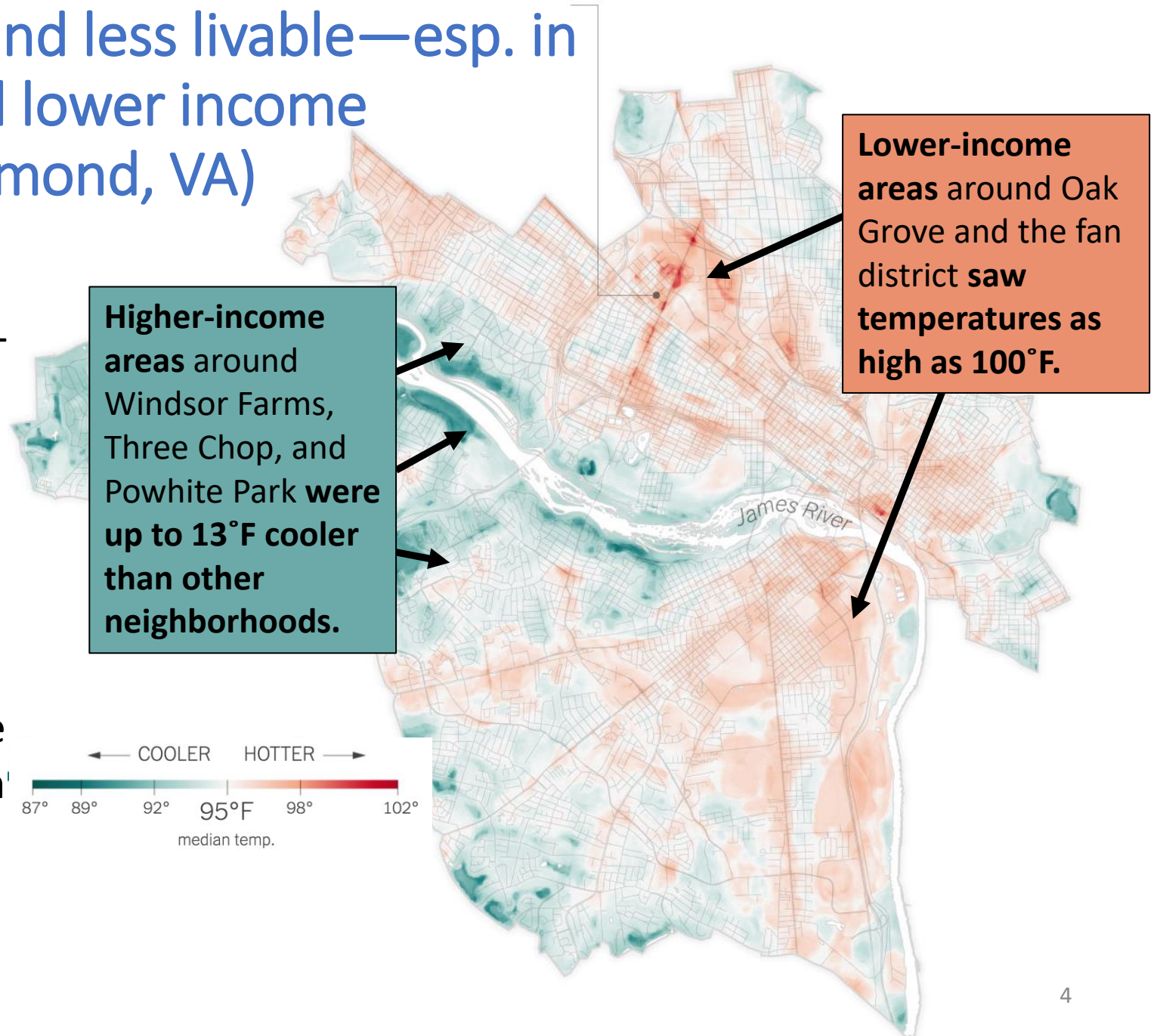
Broad, transformative policies must be implemented now if we are to limit the worst effects of climate change

A 1.5°C global heating cap **cannot be met without reduced urban warming globally**—and the most viable way to achieve substantial reductions in warming is through city-wide adoption of Smart Surfaces



Cities are getting hotter and less livable—esp. in communities of color and lower income neighborhoods (e.g. Richmond, VA)

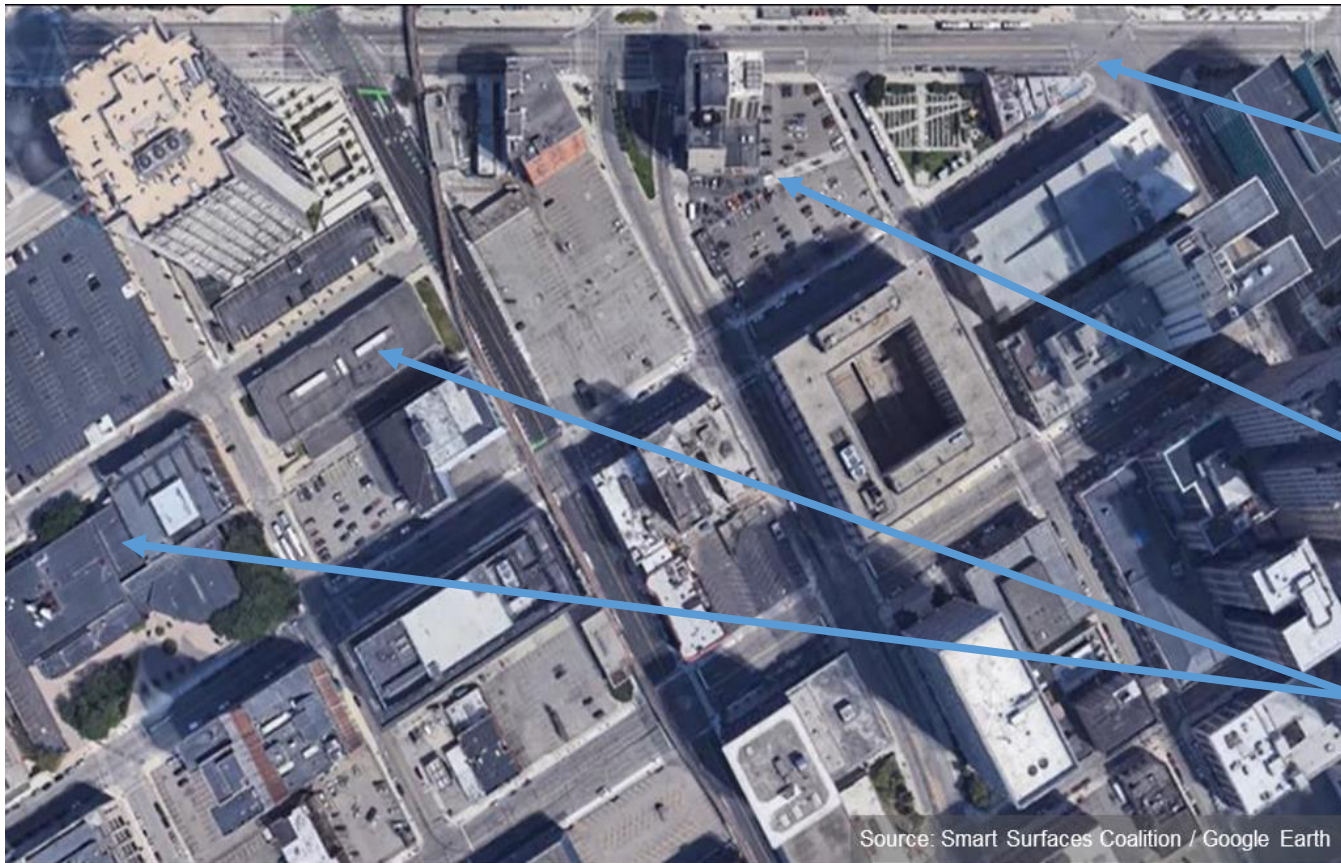
- Lower-income and BIPOC neighborhoods are commonly 8–12°F hotter in summer than higher-income neighborhoods largely due to dark roads, parking lots and roofs, and few trees
- Smart Surfaces is the most viable strategy to redress excess heat in BIPOC neighborhoods



The Current City Norm:

Dark, impervious hot surfaces with few trees and little green space

Current solution: More air conditioners > hotter cities > more air conditioners > hotter cities



Dark and impervious roads:

- Absorb and re-radiate heat
- Increase rain runoff and flooding
- Increase smog
- Heat cities

Dark and impervious parking lots:

- Increase urban heat
- Increase rain runoff and flooding
- Increase smog

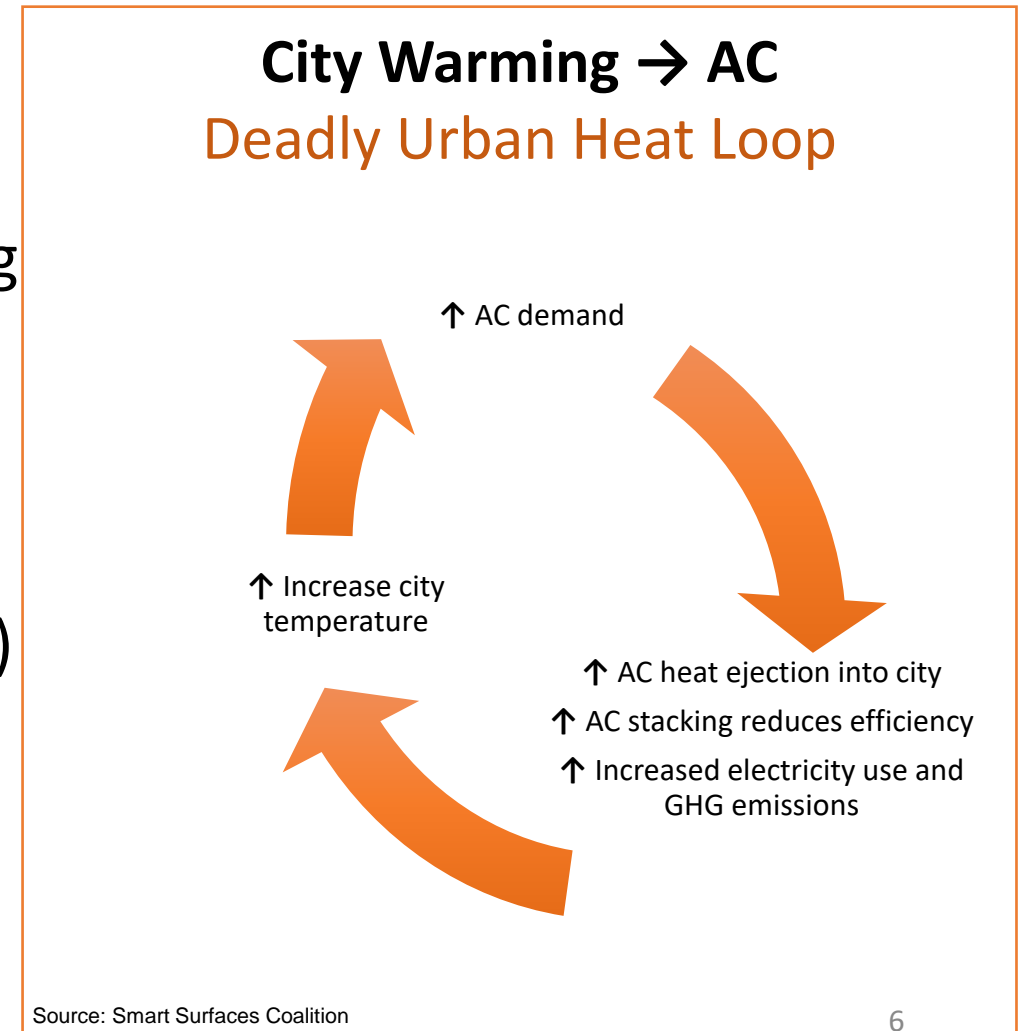
Dark roofs:

- Increase urban heat
- Heat up buildings, increasing electricity use for air conditioning

Source: Smart Surfaces Coalition / Google Earth

Expanding AC is not the answer to urban heating—it actually makes climate change much worse

- Business-as-usual: roughly tripling air conditioning units from 1.9 billion today to 5.5 billion by 2050, increasing global warming by 0.5°C from increased power use alone
- Air conditioners eject heat into streets and can heat cities by 1°C
- Stacked AC units (e.g. in apartment buildings) sharply cut efficiency and increase AC use
- AC units leak greenhouse gas refrigerants (e.g. HFCs), accelerating global warming



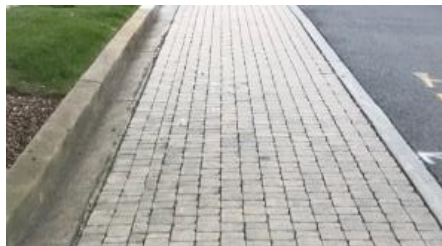
Smart Surfaces manage sun and rain to slow climate change, cut heat, cut costs and increase livability and equity



Reflective roofs reflect most sunlight and heat, much of which exits the atmosphere, slowing global warming



Green roofs reduce building energy use, clean the air, and absorb and clean water



Porous pavements allow rain to recharge ground-water – and reduce pollution, mold, stormwater runoff, and flood risk



Solar PV converts sunshine into electricity and can provide shading, for buildings, sidewalks, and other public areas



Trees reduce temperature, provide shade, clean air of pollutants, reduce flooding risk, and sequester carbon



Reflective roads and highways slow climate change by reflecting light and heat, reduce city temperature, and cut costs



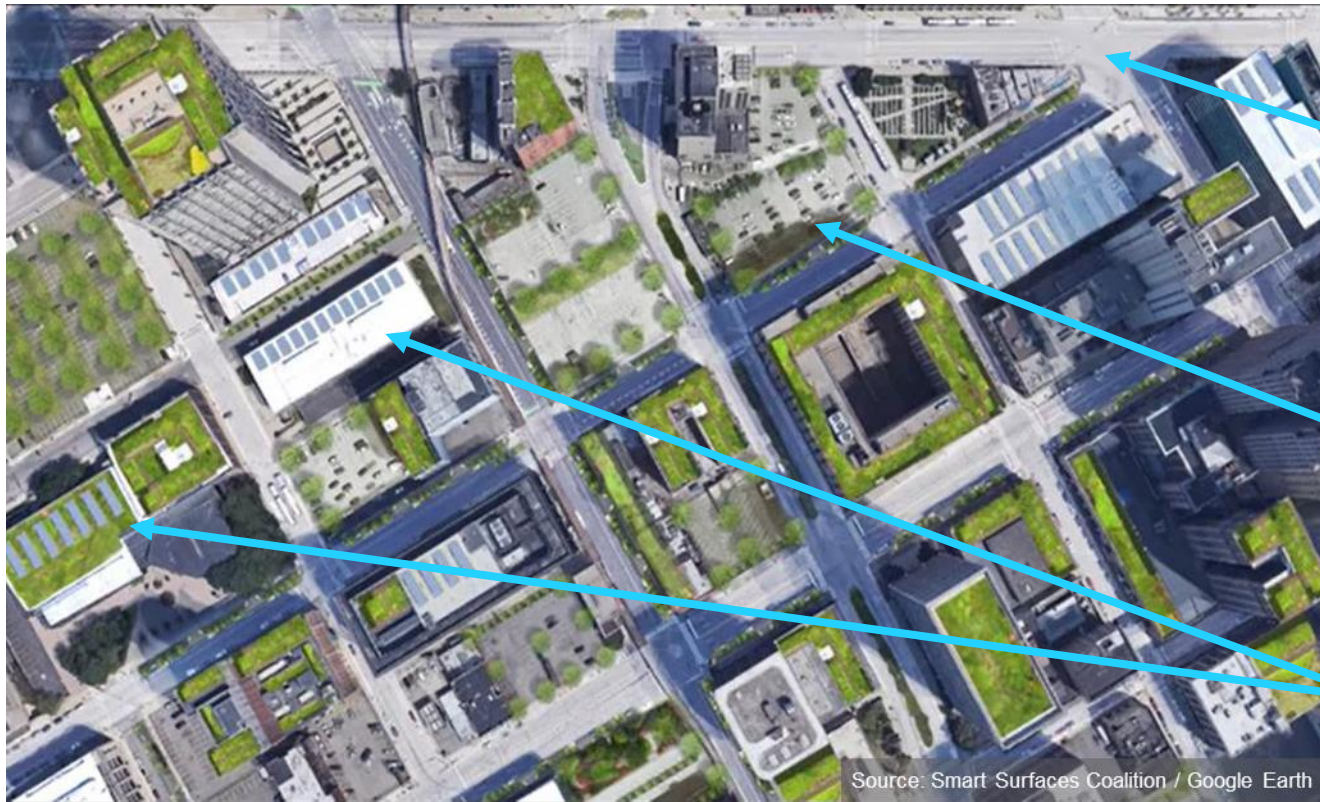
Combined solutions such as solar PV on green roofs increase clean power production, while reducing flooding and water costs



Carbon-sequestering concrete can be carbon-neutral or even carbon-negative (sequestering), and is a major emerging carbon sequestration strategy

Smart Surfaces must become the city design norm

Reflective, porous and green surfaces, trees, and rooftop solar PV: a very cost-effective solution set for slowing climate change and achieving cooler, healthier, and more resilient cities



Source: Smart Surfaces Coalition / Google Earth

Reflective and porous roads:

- Reduce heat absorption and ambient temperature
- Porous roads reduce stormwater runoff and flooding risks

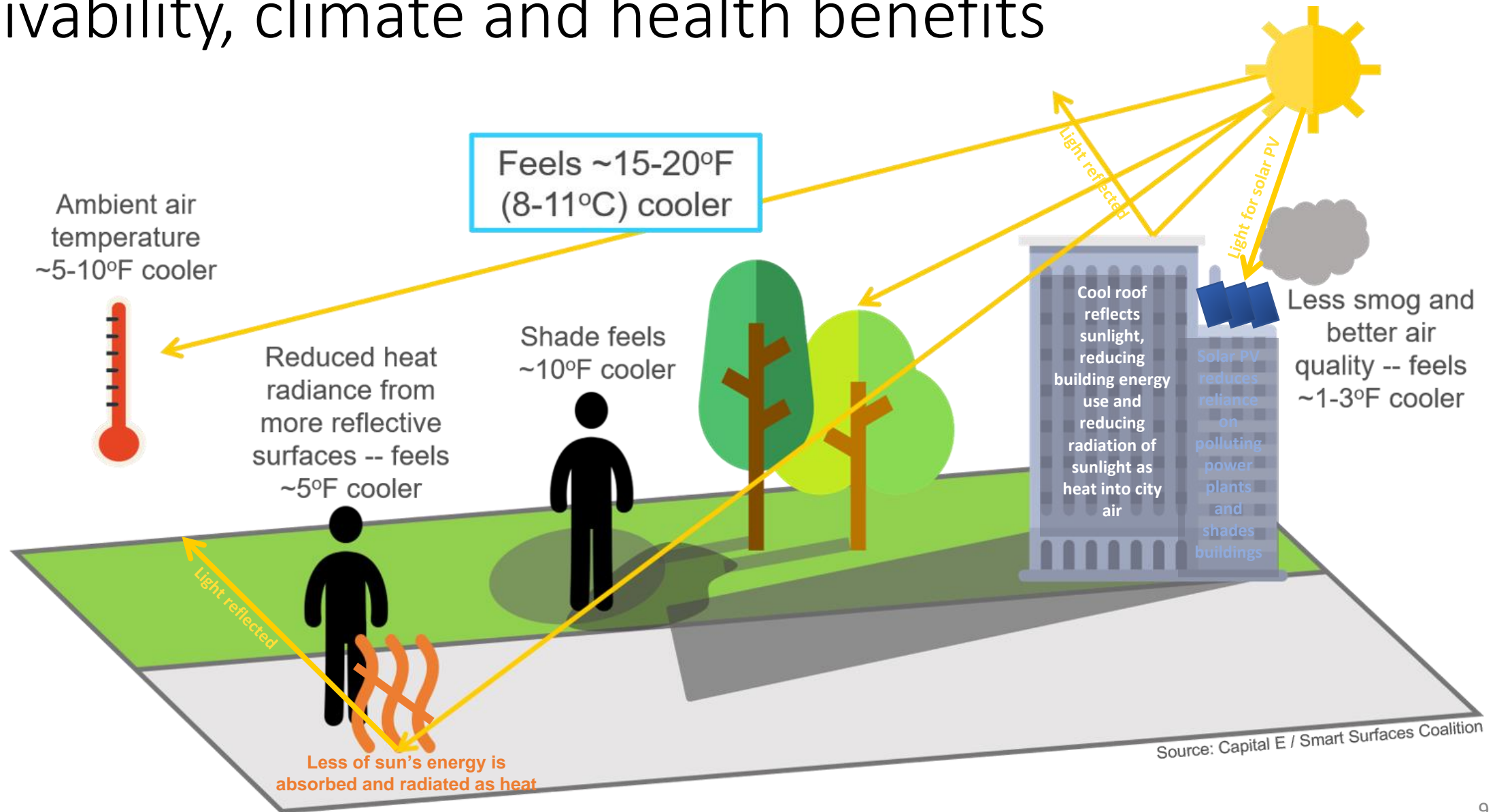
Porous, reflective parking lots with trees:

- Reduces temperature and increases comfort
- Provide shading and stormwater management

Reflective, green, and PV-covered roofs:

- Reduce building and city temperature
- Reduce runoff
- Generate clean, renewable energy

Combining Smart Surfaces delivers large cooling, livability, climate and health benefits



Changing City Surfacing Decision Making

Today



Governments and foundations spend hundreds of millions of dollars to pilot and promote single solutions such as urban trees or porous or reflective surfaces.

But...cities are *still* getting hotter and more polluted, and are losing tree canopy...why?

City infrastructure decisions are made by **city departments** that **lack the expertise, authority or tools to quantify and understand most benefits** including city heat, air and water quality, human health, equity, employment, livability, city bond rating and climate impacts.



With Smart Surfaces

For cities to adopt reflective, porous and green surfaces, trees, and solar PV at scale requires that overall costs and benefits be fully quantified and included in design decisions.



How does the Smart Surfaces Coalition do this?



Organize surface solutions in a single framework to enable city-wide analysis and adoption



Provide data and tools for cities to quantify full costs and benefits of surface options, model city adoption scenarios allowing informed surface design decisions

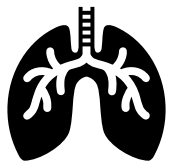


Directly support cities through integrated training, guidance, analysis, and funding through a Coalition of leading organizations that cities already trust

Smart Surfaces are critical to achieving environmental justice, especially for children and the elderly



Heat – Due to greater body surface to volume ratios, children are more susceptible to heat stress and mortality. Extreme heat also prevents outdoor exercise, increasing the risks of diabetes and obesity, and hurting cognitive development (see [study](#) on link between heat and children’s health, and [study](#) on childhood learning and heat)



Outdoor air quality – Children face increased risks from poor air quality because their lungs are still in development, and children are more active and spend more time outdoors. Chronic exposure to ozone and particulate pollution reduce lung growth, increase asthma, and increase respiratory infections ([American Lung Association studies](#))



Mold – Flooding causes mold in millions of homes each year. Chronic or acute exposure to mold worsens respiratory health and can cause permanent neurological damage in young children (see [study](#) showing link between cognitive development and mold exposure)



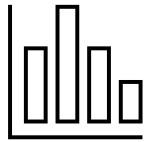
Quality of life – Greener, cooler neighborhoods and streets enable kids to spend more time outside, fostering a sense of community, well being and belonging

SSC has built a powerful online cost-benefit analytic tool so cities can make “smarter” surface decisions (case example below: Baltimore)

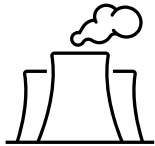
BALTIMORE: (20-YEAR ADOPTION SCENARIO, 30-YEAR ANALYSIS) CONSOLIDATED SUMMARY								
Smart Surface	Target	Costs (2020\$)	Benefits (2020\$)	NPV (2020\$, 2% Real Discount Rate)	Benefit:Cost Ratio (from 2020\$)	Employment (job yrs)	Peak Period Summer Temp Reduction Estimate ****	
Reflective (Cool) Roofs **	Low-slope roof area: 80% Steep-slope roof area: 20%	\$ (112,021,921)	\$ 861,699,715	\$ 540,883,629	7.69	1,904	2.41 °F	
Bioswale-managed Roof ****	Low-slope roof area: 20%	\$ (99,391,531)	\$ 549,322,190	\$ 301,406,117	5.53	1,391	not included	
Green Roofs	Low-slope roof area: 2%	\$ (81,248,064)	\$ 158,121,898	\$ 45,631,460	1.95	1,300	not included	
Solar PV*	Low-slope roof area: 40% Steep-slope roof area: 20%	\$ (474,275,239)	\$ 10,603,617,426	\$ 6,704,265,572	22.36	61,042	not included	
Reflective Parking**	Parking area: 50%	\$ (43,881,312)	\$ 102,805,859	\$ 43,212,786	2.34	746	0.52 °F	
Permeable Parking ***	Parking area: 5%	\$ 48,451,570	\$ 112,644,481	\$ 110,397,261	14.40		not included	
Bioswale-managed parking****	Parking area: 20%	\$ (99,898,491)	\$ 577,725,286	\$ 320,637,416	5.78	1,698	not included	
Reflective Roads**	Road area: 15%	\$ (9,519,821)	\$ 27,197,185	\$ 14,552,521	2.86	162	0.16 °F	
Permeable Sidewalks	Sidewalk area: 5%	\$ (49,027,682)	\$ 200,361,328	\$ 98,511,475	4.09	539	not included	
Trees ****	City land area: 40%	\$ (499,089,278)	\$ 1,330,110,900	\$ 559,553,468	2.67	9,982	1.21 °F	
5% Avoided Tourism Loss*			\$ 6,420,000,000	\$ 4,792,841,488		51,848		
TOTAL		\$ (1,419,901,769)	\$ 20,943,606,267	\$ 13,531,893,193	15 : 1	130,613	4.3 °F	
10% Avoided Tourism Loss			\$ 12,840,000,000	\$ 9,585,682,976		103,697		
Total with 10% Tourism Benefit		\$ (1,419,901,769)	\$ 27,363,606,267	\$ 18,324,734,681	19 : 1	182,461	4.3 °F	
20% Avoided Tourism Loss			\$ 25,680,000,000	\$ 19,171,365,952		207,394		
Total with 20% Tourism Benefit		\$ (1,419,901,769)	\$ 40,203,606,267	\$ 23,694,207,440	28 : 1	286,158	4.3 °F	

Scaling Smart Surfaces (2022-2025)

The Smart Surfaces Coalition is seeking \$65 million over 3 years to make Smart Surfaces the global urban design norm. This funding will directly result in:



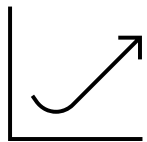
1,000 cities being provided the **data, training and tools** to understand and model city-wide Smart Surfaces adoption



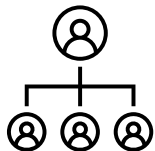
An **estimated 2 billion tons** of cumulative CO2 reduction equivalent by 2050—this \$65 million investment amounts to **~3¢ per ton** of CO2 emissions avoided



250 cities adopting Smart Surfaces, **locking in 5°F (3°C)** temperature reduction—with larger cooling, air quality, and resilience improvements in **lower-income and BIPOC neighborhoods**



Accelerated adoption of Smart Surfaces 10x, leading to another 10x scale up in the next phase, resulting in Smart Surfaces becoming the global city design norm later in this decade



Deeply engaged, coordinated leading national organizations and cities driving a rapid transition to Smart Surfaces, very strong base for accelerating expansion of Smart Surfaces beyond 2025

The \$65 million in proposed funding would be allocated as follows:

- **\$31 mil** (49%) awarded on competitive basis through SSC partners to hundreds of cities in to achieve Smart Surfaces adoption goals
- **\$27 mil** (40%) to fund 30 of the SSC partners to execute a co-developed, integrated strategy (summarized over next few slides) to rapidly scale Smart Surfaces
- **\$5 mil** (8%) to fund expanded Coalition staff, working closely with the Coalition Steering Committee (strategy decisions) and Board (financial oversight), to:
 - Continue to improve and extend Smart Surfaces Cost-Benefit Analytic Engine
 - Expand partnerships with organizations, companies, and governments
 - Educate key constituencies about Smart Surfaces, including city, state, and federal governments and Multilateral Development Banks
 - Guide and integrate funded partner work
 - Monitor, review, guide and report on progress and outcomes of partners' funded work to Steering Committee, Board, and Foundation
- **\$2 mil** (3%) would fund additional partners and technical and media consultants as needed, as well as a Smart Surfaces annual conference

SSC Funding Proposal



The funding proposal would fund 30 organizations that cities already work with and trust—who are all committed to the rapid, global adoption of Smart Surfaces. These organizations are:

<p><u>Architecture and Planning</u></p>  <p>The American Institute of Architects</p>   <p>American Society of Landscape Architects</p>  <p>American Planning Association</p>	<p><u>City Engagement (law + policy)</u></p>  <p>NATIONAL LEAGUE OF CITIES</p> <p>SUSTAINABLE CITIES INSTITUTE</p>  <p>urban sustainability directors network</p>  <p>Columbia Law School</p> <p>SABIN CENTER FOR CLIMATE CHANGE LAW</p>	<p><u>Health</u></p>  <p>AMERICAN PUBLIC HEALTH ASSOCIATION</p> <p>For science. For action. For health.</p>  <p>HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH</p>
<p><u>Downtowns</u></p>  <p>INSPIRED LEADERS SHAPING CITIES</p>	<p><u>Urban Data Analytics</u></p>  <p>Chesapeake Conservancy</p> <p>EXPLORE. CONSERVE. INNOVATE.</p>  <p>WORLD RESOURCES INSTITUTE</p>        	
<p><u>Water</u></p>  <p>water leaders. resilient solutions.</p>	<p><u>Energy/ Sustainability</u></p>     	<p><u>Finance</u></p>  <p>GRAMEEN CAPITAL INDIA LIMITED</p>

This integrated strategy would enable Smart Surfaces to become the urban design norm globally within a decade

This proposal would fund the Coalition and its partners to:

- ✓ **Develop and provide the data needed** to enable cities to quantify and model the full costs and benefits of their surface options (e.g. heat, climate, pollution, flooding)
- ✓ **Train cities** on using analytic engine, collect data, and most effectively implement Smart Surfaces
- ✓ **Provide best practice toolkits and templates** for city officials and key city industry groups (architects, planners, landscape architects, etc.)
- ✓ **Deliver legal and regulatory resources** to support cities adoption: model contracts and legislation, etc.
- ✓ **Provide online cost-benefit analytic ability** to allow cities to run multiple city-specific scenarios to select, implement the most effective and cost-effective surfaces to meet city climate, health, heat and other objectives (see Appendix 2)
- ✓ **Accelerate innovation** in Smart Surface performance (porosity, reflectivity, sequestration) with major industry partners and leading research institutions
- ✓ **Build support** via outreach and education at all levels of government with engagement from multiple key city constituencies (e.g. health, equity and environmental justice, city rankings)
- ✓ **Administer \$31 million in funding** for cities that adopt Smart Surfaces

SSC partners to be funded to develop data and quantify uncounted health, energy and climate benefits—and provide data, training, and support for cities to model full costs and benefits of Smart Surfaces

These partners include:

- **World Resources Institute** – funding to provide data and analysis of albedo and surface area of roofs, roads, and parking lots to enable cost-benefit analysis, modeling, and adoption
- **Harvard School of Public Health** – funding to quantify additional public and private health benefits from Smart Surfaces (e.g., all-cause mortality from extreme heat, reduced ambulance trips, etc.)
- **Rocky Mountain Institute** – funding to quantify financial benefits of Smart Surfaces from reducing vehicle miles traveled, avoided grey infrastructure costs, and peak electricity demand reduction



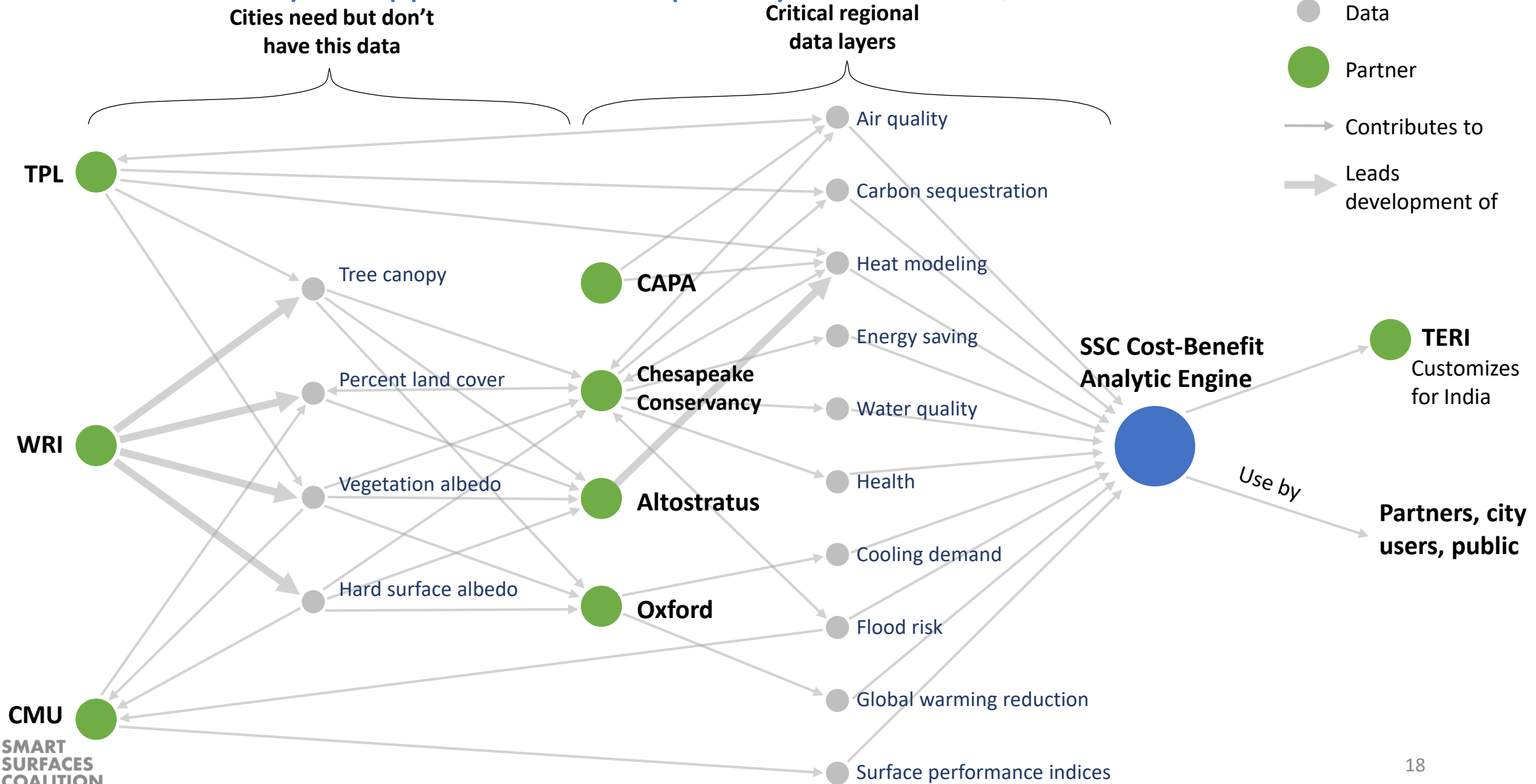
WORLD
RESOURCES
INSTITUTE



HARVARD
T.H. CHAN
SCHOOL OF PUBLIC HEALTH



With funding for partners, leading urban data analytics organizations will provide cities with the data and analytic support needed to quantify the full costs/benefits of Smart Surfaces



Funding would also be used to accelerate Smart Surfaces innovation

The below partners and initiatives would receive funding:

- World Cement Association (CEO Ian Riley serves on SSC's Steering Committee) to support improving the reflectivity, porosity, and carbon sequestration of concrete, conducted in collaboration with MIT's Concrete Sustainability Hub, TERI and other SSC partners.



SSC engagements are already helping drive Smart Surfaces innovation:

- An SSC Initiative, the Cool Roadways Partnership involves LA, Phoenix and 28 other cities deploying or starting to deploy high albedo roads.
- [CarbonStar](#), an SSC initiative, is a technical standard used to calculate and specify embodied carbon in concrete backed by the US and Canadian governments and being adopted by Federal agencies and airports.
- GAF, a global roofing materials company (largest in North America) an SSC partner, is working with other Coalition partners such as the National League of Cities to make roofs more reflective.



We protect what matters most™

SSC partners to build broad buy-in at multiple levels including local govt., and provide customized analysis and adoption resources for hundreds of cities

These partners include:

- **African Methodist Episcopal Church** – funding for Pastor William Lamar to hire staff and lead engagement with the 8 major African American churches to educate about the urgent need for Smart Surfaces to slow climate change and protect BIPOC communities from extreme heat
- **Sabin Center for Climate Change Law + the Law Firm Antiracism Alliance** – funding to expand ongoing work mapping the legal obstacles in every state and major city, and develop best adoption methods, code and other regulatory changes to accelerate the scaling of Smart Surfaces
- **Habitat for Humanity** – funding to make Smart Surfaces a central part of its housing equity campaign, and enable Habitat to secure Smart Surfaces for the neighborhoods in which it works



 Columbia Law School

SABIN CENTER FOR CLIMATE CHANGE LAW



Provide \$31 million in funding via 4 SSC partners to hundreds of cities to achieve specific milestones in adopting Smart Surfaces

The 4 SSC partner organizations that, with SSC Coalition support and review, will administer funds are:

- **National League of Cities + the American Public Health Association** in a new SSC partnership, would provide \$12 million in funding to US cities to meet major milestones in adopting Smart Surfaces
- **Urban Sustainability Director's Network** – Builds on USDN's very effective multi-city sustainability funding program to administer and manage \$9 million for multi-city US Smart Surfaces adoption
- **The Energy and Resources Institute (India)** – Would award \$10 million to Indian cities that achieve milestones in adopting Smart Surfaces



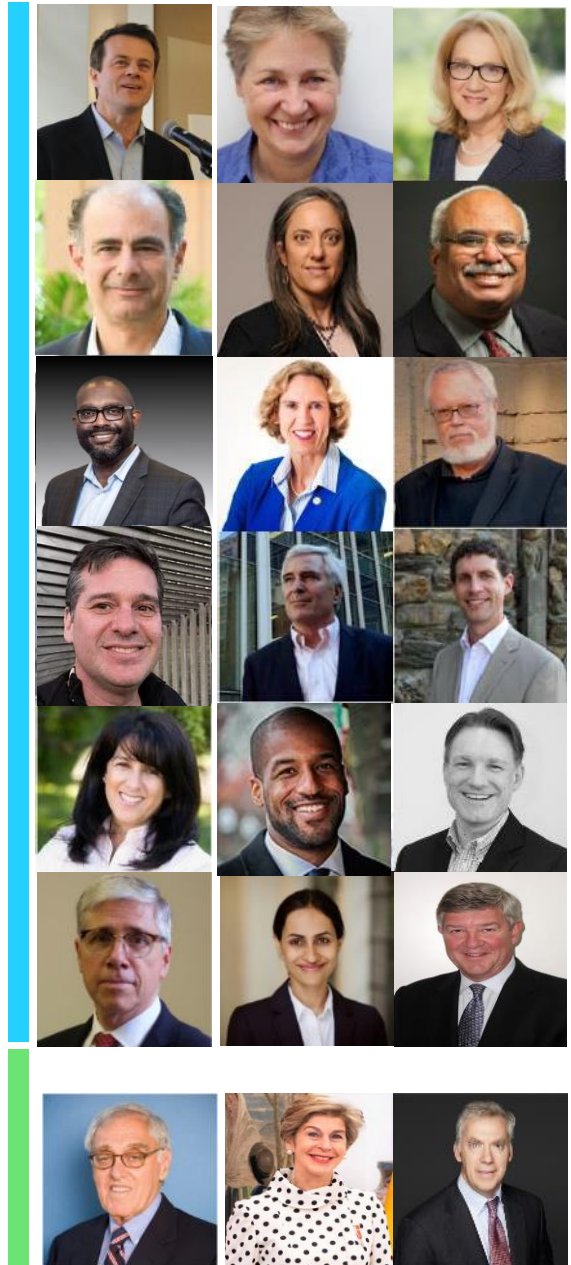
Guiding and Managing the Coalition:

Steering Committee (strategy decisions)

- **Greg Kats (co-chair)** – Author of *Greening Our Built World: Costs Benefits and Strategies*
- **Vivian Loftness (co-chair)** – Former Head of School of Architecture at Carnegie Mellon
- **Lynn Goldman** – Dean, School of Public Health at The George Washington University
- **Rashad Kaldany** – Former COO of the International Finance Corporation
- **Julie T. Katzman** – Former COO of the Inter-American Development Bank
- **Georges Benjamin, MD** – Executive Director of the American Public Health Association
- **Pastor William Lamar IV** – Pastor, Metropolitan African Methodist Episcopal Church
- **Jennifer Roberts** – Former Mayor of Charlotte
- **Durwood Zaelke** – President of the Institute for Governance and Sustainable Development
- **Greg Spotts** – Chief Sustainability Officer, StreetsLA, City of Los Angeles
- **Chris Leinberger** – President of Locus, also at GWU and Brookings
- **Cooper Martin** – Director, Sustainable Cities Institute, National League of Cities
- **Cynthia Koehler** – Executive Director, WaterNow Alliance
- **Mark Conway** – Executive VP at Chesapeake Conservancy and Baltimore City Councilmember
- **Brendan Shane** – Climate Director, Trust for Public Land, former C-40 Regional Director for North America
- **Ian Riley** – CEO, World Cement Association and Partner, WhitewaterTx
- **Dr. Radhika Khosla** – Research Director, Oxford India Centre for Sustainable Development
- **George Frampton** – Former Chair of CEQ and Senior Fellow, Atlantic Council

Board of Directors (fiduciary oversight)

- **Frank Loy (chair)** – Former Under Secretary of State for Global Affairs, former Board Chair of Environmental Defense Fund, Resources for the Future, and League of Conservation Voters
- **Carolina Barco** – Former Minister of Foreign Affairs for Colombia, Ambassador to the U.S., & IADB Consultant
- **Tracy Wolstencroft** – Former President of National Geographic Society, former Partner at Goldman Sachs
- **Greg Kats** – Former Managing Director, Good Energies, Inc.



Summary

- A 1.5°C global heating cap cannot be met without reduced urban warming. The most viable and cost-effective way to achieve this is through global city-wide adoption of Smart Surfaces
- Smart Surfaces have already been extensively deployed. They work and are perhaps the most cost-effective (and most overlooked) strategy available to deliver both climate change mitigation and adaptation. If fully adopted **can cut CO2e emissions by 10–15%**
- Smart Surfaces **can cool cities 5°F (3°C)**—with 8°F (5°C) cooling in lower-income and BIPOC communities—that are typically hotter with more dark surfaces
- Smart Surfaces is **the only viable strategy to avoid a deadly urban heat loop**—e.g. city-wide cooling to avoid or reduce rapid projected growth of AC
- A Coalition of 30 leading organizations with an **integrated, complete strategy** to rapidly replace dark, impervious surfaces with Smart Surfaces as the urban norm