

Smart Surfaces Coalition partners include:



Smart surfaces can save cities billions, lower temperatures, and make our communities more livable, healthier, and safer — while slowing global warming.

Intense summer heat waves are the new norm. Scientists tell us most cities will have 3 to 6 times as many extremely hot summer days over 90°F within the next few decades. But simple steps can help keep us cool.

<p>Save \$700 billion</p>	<p>Create over 250,000 new jobs</p>	<p>Reduce summer heat by 3-5°F</p>	<p>Improve Health</p>	<p>Reduce Pollution</p>	<p>Slow Global Warming</p>
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Cities are getting much hotter

It's getting hotter — [fast](#). The chart (right) shows the percent of the contiguous US that is experiencing unusually hot summer temperatures. And it is getting much hotter and will stay hot longer. There is a solution: smart surfaces.

Smart surface solutions

Smart surfaces are a set of surface technologies that allow cities to better manage sun and rain:

- Porous pavements, sidewalks, roads, and parking lots reduce flooding and cut the cost of managing storm water;
- Cool roofs and pavements reflect sunlight, cool city temperatures, and cut smog
- Green roofs and trees provide shade and reduce flood risk
- Solar PV converts sunshine into electricity, and provides shade

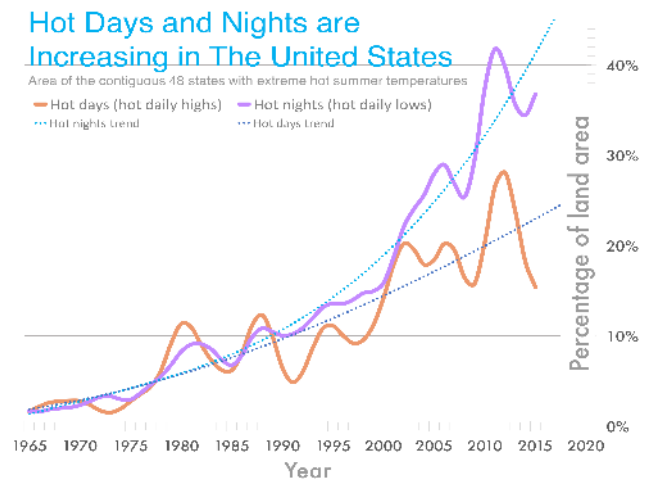


Figure 1. Area of the contiguous US states with extreme hot summer temperatures. For full 100yr data see source: [EPA](#), [NOAA](#).

The Opportunity:

40 leading organizations
with a transformative action plan

that enables cities to better manage the sun and rain
to cost-effectively cut CO₂-equivalent by 10-15%
and cool cities by 3-5 °F (2-3 °C).

Will Wynn

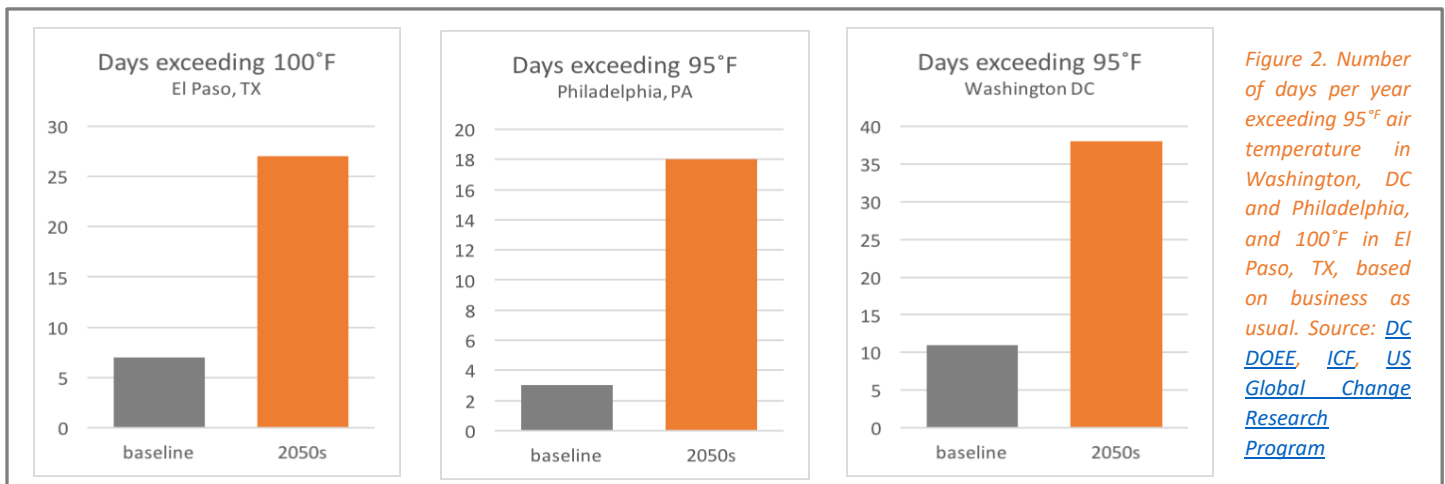
Steering Committee Member

Former two-term Mayor of Austin, Texas

"Severe weather events such as hurricanes, heat waves and extreme rainfalls are increasing in intensity and frequency due to climate change. The Smart Surfaces Coalition and its work to date provide an entirely convincing case that city-wide adoption of Smart Surfaces like green and cool roofs and porous pavements can make our cities far more resilient. Rapid smart surfaces adoption is essential to ensure that our cities remain livable in a warming world."

Stay Cool Save Cash

The Smart Surfaces Coalition is building the analysis, tools and training to enable cities to rapidly adopt cost-effective solutions to cut excess heat days by half, reduce flood risk, and increase city livability, health, and equity — while saving billions of dollars and creating thousands of new jobs.



It's getting hotter — fast

Figure 3 (right) shows downtowns are on average 9°F hotter than rural areas (and more prone to flooding). This is because roofs, roads, and sidewalks absorb most of the sun's heat (rather than reflecting it away) and then radiate that heat into buildings and into the city because there are few downtown trees to provide shade and little vegetation to absorb heat.

Figure 2 (above) illustrates the expected increase in excessively hot days in 3 very different cities: El Paso, Philadelphia, and Washington, DC. Washington, DC is projected to have 3 times as many days with a heat index above 105°F in the 2020s, and 6 times as many in 35 years.

Reducing emissions is critical to fight global warming, and smart surface strategies both slow global climate change and provide large urban cooling, health, and economic benefits.

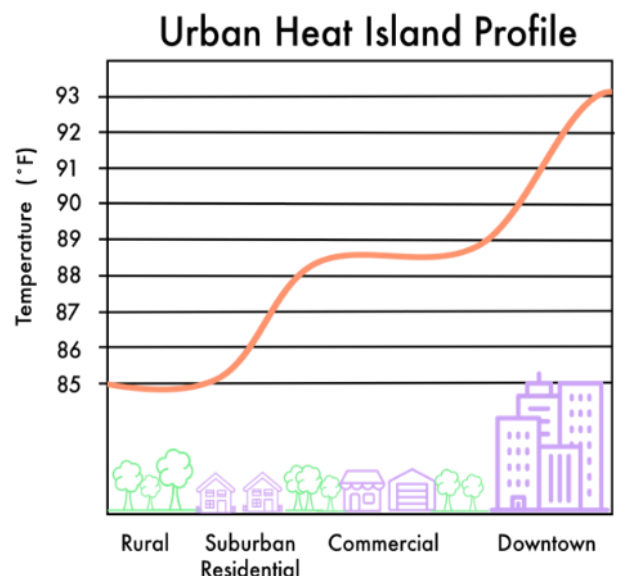


Figure 3. Urban Heat Island Profile. Source: NY State Department of Environmental Conservation

Smart surfaces way outperform conventional urban surfaces

Cities determine how they manage sun and rain by what surfaces they choose. To date, most cities have invested in surfaces that hurt their citizens by increasing heat, air pollution, flood risk, and long-term costs. Typical urban surfaces include dark impervious and unshaded roofs, and treeless, dark impervious sidewalks, roads and parking lots.

Cities can now rapidly shift from these not-so-smart surfaces to smart surfaces that make cities cooler, more livable, and save money.

Lack of understanding of the full range of costs and benefits of smart surface technology options has worsened city policies. The Smart Surfaces Coalition is filling this critical gap by quantifying these costs and benefits in detail, and by working with cities and partners to build the tools and training to enable more informed, healthier, and cost-effective urban policies.

Examples of smart surfaces



Cool roofs are light colored and engineered to reflect most heat — unlike traditional dark colored roofs.



Green roofs are covered in vegetation, which provides shading, reduces building energy use, cleans the air, and absorbs and better manages water.



Porous pavements allow rain to recharge groundwater, reducing pollution, storm water runoff and flood risk.



Solar PV converts sunshine into electricity and can provide shading for buildings, parking lots, and other areas.



Trees reduce temperature by providing shade and transpiring, turn CO2 into oxygen, clean air pollutants and reduce flood risk by absorbing water during heavy rains.



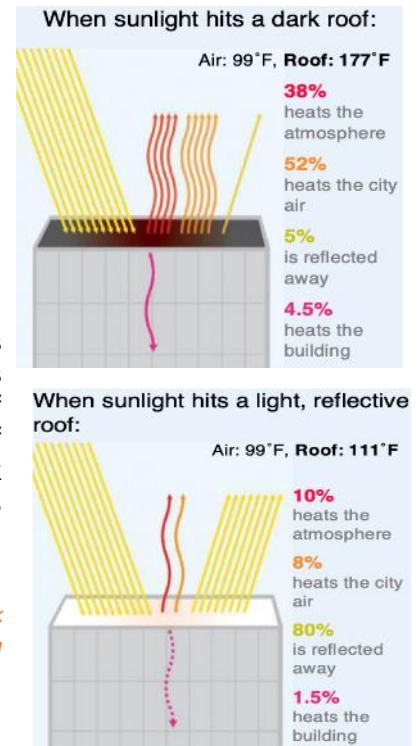
Combinations of smart surfaces: Cool roofs + solar PV generate clean energy, and reduce building energy use

Why “smart surfaces” are smart

Smart surfaces decrease temperatures

Figure 4 (right) shows that cool surfaces reflect the majority of solar radiation, much of which is reflected back into space — thus making buildings, cities, and the world cooler.

Figure 4. Comparison of a dark roof and light roof on a summer afternoon [Source](#).



Smart surfaces decrease health costs and risks

Smart surfaces cool and clean the air, reducing smog and making cities more comfortable and healthier, especially for infants, elderly, and people with asthma, allergies and other respiratory issues.

Smart surfaces create jobs – a lot of jobs

National urban implementation of smart surface would create a lot of jobs including over 250,000 permanent jobs. In addition, by cutting energy and health costs it would save billions of dollars and make cities economically more competitive.

Smart surfaces decrease flood risk

Hurricanes and extreme rain events have become more frequent and widespread. The chart below shows % change in very heavy precipitation in the United States in the past 6 decades. Porous and green surfaces absorb rainfall and recharge groundwater, instead of flooding drainage systems, thus avoiding flooding, mold, and contamination of rivers.

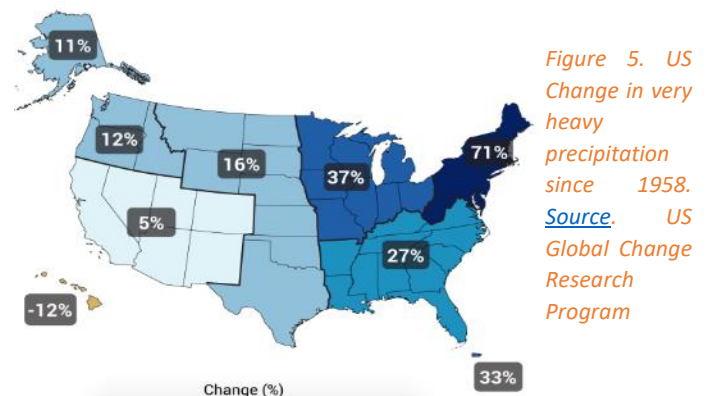


Figure 5. US Change in very heavy precipitation since 1958. [Source](#). US Global Change Research Program

Analysis

There is now a compelling financial case that cities should immediately adopt smart surfaces city-wide to save billions of dollars, reduce temperature, improve air quality, health and livability, and manage excess rains/flooding while slowing global warming.

This research began with analyzing smart surface costs and benefits in low-income neighborhoods in four cities funded by the JPB Foundation. The research and modeling then expanded to a multi-city analysis.

The report Delivering Urban Resilience documents in detail the costs and benefits of city-wide adoption of smart surfaces by 3 cities: El Paso, Philadelphia, and Washington, DC. This work involved 100 experts including epidemiologists, health experts, architects and city planners, as well as national partners such as the American Institute of Architects and the National League of Cities. Smart surface cost benefit work was also funded by the Washington DC Department of General Services and the Department of Energy and Environment.

City-level analysis for adoption of smart surfaces assumes adoption over three decades, with smart surface adoption achieving substantial but realistic levels of penetration city-wide over this period, as indicated in chart (right).

Detailed modeling and analysis of El Paso, Philadelphia, and Washington, DC demonstrate that the financial benefits of city-wide adoption of smart surfaces would greatly exceed costs and would cool cities, increase employment, and enhance health. These studies serve as the basis for drawing national impact conclusions presented below.

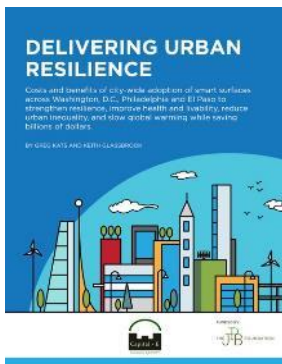
Vivian Loftness, FAIA
Steering Committee Co-chair
Former Dean of Architecture
Carnegie Mellon University

“Design is central to our quality of life. Cool cities with smart surfaces dramatically reduce costs while enhancing health and allowing our cities to thrive despite climate change.”

Smart surface solution	Percent coverage by end of 40-year analysis
Cool roofs	50% of roofs
Green roofs	10% of roofs
Solar PV	50% of viable roof space
Reflective pavements	50% of pavements
Urban trees	Increase tree canopy by 10%

Simplified summary of findings: present value of costs and benefits for city adoption of smart surfaces (does not include large financial benefit from avoided losses of summer tourism revenue)

CATEGORY	PRESENT VALUE OVER 40-YEAR ANALYSIS PERIOD (2015)		
	Washington, DC	Philadelphia	El Paso
Costs	\$838 M	\$2.38 B	\$1.62 B
First Cost	\$543 M	\$1.56 B	\$1.01 B
Operations and Maintenance	\$191 M	\$491 M	\$412 M
Additional Replacements	\$104 M	\$334 M	\$193 M
Employment Training	\$0.803 M	\$3.2 M	\$1.4 M
Benefits	\$2.648 B	\$5.959 B	\$2.155 B
Energy	\$348 M	\$1.33 B	\$700 M
Financial Incentives	\$65.6 M	\$225 M	\$85.5 M
Stormwater	\$1.17 B	\$185 M	\$39 M
Health	\$523 M	\$2.28 B	\$344 M
Climate Change	\$434 M	\$1.47 B	\$806 M
Employment	\$104 M	\$471 M	\$181 M
Net Present Value	\$1.81 B	\$3.575 B	\$538 M



[Click to read the full report Delivering Urban Resilience](#)

Major findings

City-wide adoption of smart surfaces in the US alone would:

- Save cities \$700 billion over three decades in energy, health, and other costs
- Create over 250,000 new jobs
- Substantially cut daytime and nighttime summer peak temperatures
- Cut smog and air pollution-related illnesses
- Have the greatest benefits for:
 - Elderly individuals and infants
 - Low income populations
 - People with respiratory conditions (asthma, allergies)

Brendan Shane

Climate Director, The Trust for Public Lands, formerly C-40 Regional Director for North America

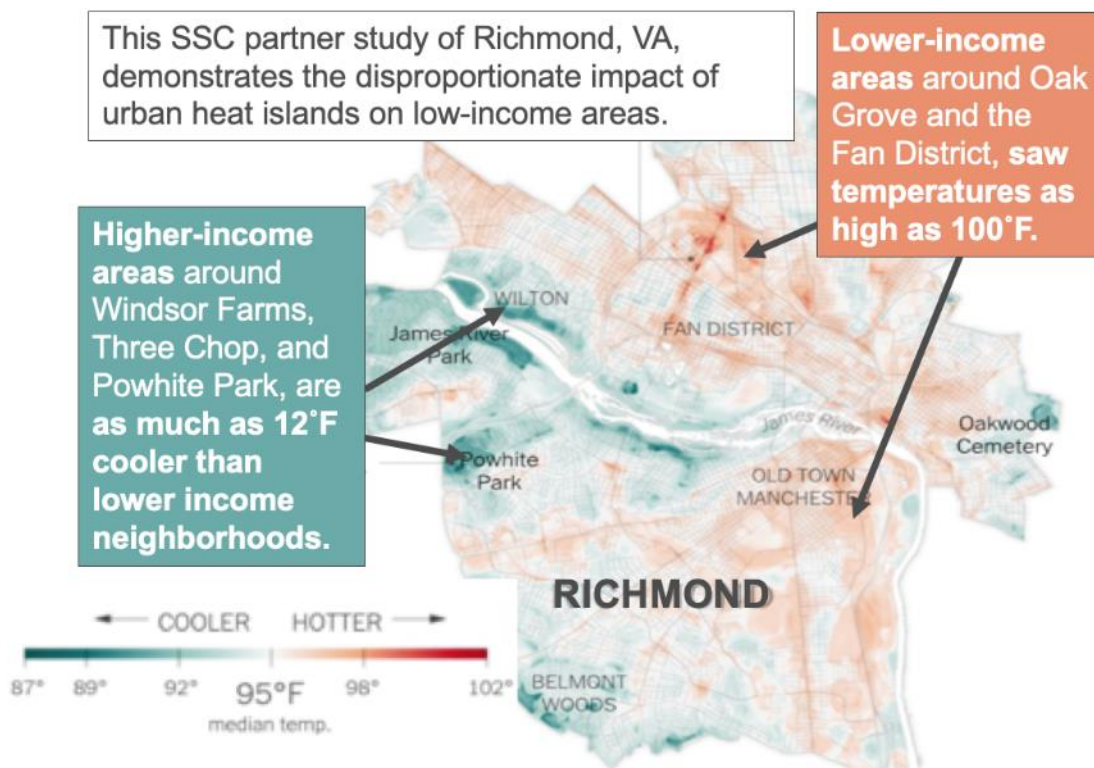
The new Smart Surfaces Coalition is so essential because it provides a powerful new way for cities to address both mitigation and adaptation. It will provide to cities, and groups like C-40, a powerful new way to slow climate change and improve urban resilience and livability. As one of the largest, and perhaps the most effective urban climate strategies, smart surfaces must be funded and scaled rapidly if we are to limit warming and protect our cities.”

Health impacts of heat disproportionately affect low-income individuals, the elderly, and infants

Health-related vulnerability of the elderly and children living in urban areas can be mitigated by the deployment of smart surfaces. Smart surface adoption can also address systematic inequity in urban, low-income quality of life from excess heat and worse air quality. Low-income areas have fewer trees and parks, and more dark, impervious surfaces. This structural inequity in low-income areas is illustrated in the figure below.

Low income areas are usually the hottest areas in a city

- Dark urban surfaces absorb, rather than reflect most of the sun’s heat — heating the city and increasing air pollution
- Lack of vegetation and trees to absorb heat, reduce pollution, and provide shade
- Dark surfaces make cities ~9 degrees F warmer on average, but this effect is aggravated in low-income neighborhoods with less vegetation and more dark surfaces



Comparing major global climate change mitigation strategies

	Mitigation	Adaptation
Higher net present value	<ul style="list-style-type: none"> Smart Surfaces Renewable Energy Electric Vehicles 	
Lower net present value	<ul style="list-style-type: none"> Carbon Capture + Storage Climate Engineering 	<ul style="list-style-type: none"> Sea walls

Greg Kats

Smart Surfaces Coalition Founder & Steering Committee Co-chair

[Author of *Greening Our Built World: Costs, Benefits, and Strategies*](#)

“Smart Surfaces” is a new term to describe a set of technologies in a way that enables cities to better manage sun and rain. These solutions can deliver enormous long-term health and financial benefits, including slowing global warming and enhancing quality of life.”

About the Smart Surfaces Coalition

The objective of the Smart Surfaces Coalition is to develop with cities and partners the analysis, tools, and training to enable and support cities to cost-effectively adopt smart surfaces as standard policy. The Smart Surfaces Coalition is committed to enabling the adoption of city-wide smart surfaces strategies in at least 250 cities by 2024.

The Smart Surfaces Coalition was developed with the National League of Cities to respond to city demand for help addressing climate and resilience



More than **2000 cities** are members of National League of Cities



City-wide smart surface cost benefit analyses conducted with El Paso, Philadelphia and Washington DC demonstrate **over \$10 billion NPV**

28 cities have already reviewed and contributed to development of the Smart Surfaces Coalition online cost benefit analytic engine



40 Smart Surfaces **Coalition partners** already work closely with and **influence cities** and towns—with most of the US population—on a broad range of policy and planning issues



4 widely influential annual **city rankings** covering more than 40% of the US population **will adopt smart surface** performance as a key metric for future city rankings

Smart Surfaces cost benefit analysis is already affecting city decision making:

“The smart surfaces cost benefit analysis completed for Washington, DC provided a powerful and persuasive new way for the city to understand and manage its surfaces in order to address the urban heat island effect and mitigate the effects of climate change. The report and its findings have been influential within DC in enabling the city to expand smart surface requirements for roofs, roads, and surfaces generally.”

- Former Chief of the Green Building & Climate Branch at the DC Department of Energy and Environment

Mark Chambers

NYC Director of Sustainability

"This work is so important because it is the first rigorous analysis of city-wide use of smart surfaces to manage sun and water at scale. It quantifies for the first time many substantial benefits, providing a compelling case that cities should rapidly adopt these solutions to design, upgrade, and holistically manage our urban environments."

The Smart Surfaces Coalition partners are the leading NGOs from the key sectors necessary to drive a tenfold acceleration of urban smart surface adoption:

- **Architecture and Design:** American Institute of Architects, US Green Building Council
- **City Policy:** National League of Cities
- **City Sustainability Advisors:** EcoDistricts, GCCA, Urban Sustainability Director's Network
- **Downtowns:** International Downtown Association
- **Energy:** ACEEE, Alliance to Save Energy, and NASEO (state-level)
- **Equity/low-income:** Habitat for Humanity
- **Health:** American Public Health Association
- **Planning:** American Planning Association
- **Urban data analytics:** Carnegie Mellon University, Portland State University, Trust for Public Land, World Resources Institute
- **Urban Law:** Columbia University Sabin Center
- **In India:** The Energy Resources Institute (TERI), Grameen Capital

Georges C. Benjamin, MD
Executive Director, American Public Health Association

“Climate change is the greatest public health crisis of our lifetime and is an especially grave and immediate threat to urban communities, especially lower income communities which are at a higher risk of heat related injury. The Smart Surfaces Coalition offers a transformative and cost-effective way to slow global warming and make cities cooler and healthier. Smart Surfaces are also an important strategy to mitigate the health risk from extreme heat in a cost-effective way — it must be adequately funded, rapidly implemented and brought to scale.”

Scaling Smart Surfaces

The Smart Surface Analytic Tool is a free online tool that allows individuals, cities, NGOs, and businesses to determine the costs and benefits of smart surface adoption in their cities. The tool will allow city-wide evaluation of a broad range of smart surface adoption strategies and estimate the resulting city-specific costs and benefits, enabling more informed city policies. View the tool’s introductory video at <https://smartsurfacescoalition.org/costbenefit-analytic-tool>

Phase 1 (2012-2017)	Phase 2 (2018-2020)	Phase 3 (2020-2024)	Phase 4 (2024-2027)	Phase 5 (2027-2035)
<p>Research included working with 3 major cities to rigorously quantify and document the full range of costs and benefits of urban adoption of smart surfaces</p> <ul style="list-style-type: none"> • Developed online smart surfaces cost-benefit analytic engine to enable any city to model scenarios and understand full costs and benefits of smart surfaces adoption • Co-developed integrated work strategy and proposals for funding 24 Coalition partners, laying the foundation for rapid scaling of urban smart surfaces 	<ul style="list-style-type: none"> • Created Smart Surfaces Coalition (501C3) with 40+ leading partners in response to city demand for help in addressing climate change and resilience 	<ul style="list-style-type: none"> • With 40+ Smart Surfaces Coalition partners (24 funded), provide the training, tools, data and support and incentives to enable and motivate rapid adoption of smart surfaces • With cities, expand research on smart surfaces, expand partnerships and tools, and drive innovation in smart surface technologies <p>Outcomes:</p> <ul style="list-style-type: none"> • 250 cities adopt smart surfaces (20,000 square miles) • 1,000 cities have been trained and are modeling smart surfaces adoption • 0.1 gigaton CO2-equivalent emissions reduction per year • 3 gigaton of CO2-equivalent reduction achieved by 2050 	<ul style="list-style-type: none"> • Expand Coalition with new partners (e.g. multilateral development banks) and to cities globally <p>Outcomes:</p> <ul style="list-style-type: none"> • Smart surfaces are the norm for US and European cities • 4000 cities have adopted smart surfaces (200,000 square miles) • 1 gigaton CO2-equivalent emissions reduction per year • 25 gigaton of CO2-equivalent reduction achieved by 2050 	<p>Outcomes:</p> <ul style="list-style-type: none"> • 1 million square miles of urban and suburban area adopt smart surfaces • Roughly offsets projected loss of reflectivity in the Arctic • 5 gigaton CO2-equivalent reduction per year • 100 gigaton of CO2-equivalent reduction achieved by 2050 (equivalent to 2.5 years of global emissions)



Leadership

Steering Committee

Vivian Loftness (co-chair) – former Head of the School of Architecture at Carnegie Mellon

Greg Kats (co-chair) – author of Greening Our Built World: Costs Benefits and Strategies

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

Will Wynn – former two-term Mayor of Austin, TX

Emma Stewart – Director, Urban Efficiency & Climate, WRI

Durwood Zaelke – President of the Institute for Governance and Sustainable Development

Mark Chambers – Director of Sustainability for New York City

Chris Leinberger – President of Locus, also at GWU and at Brookings

Cooper Martin – Director, Sustainable Cities Institute, National League of Cities

Cynthia Koehler – Executive Director, WaterNow Alliance

Kurt Shickman – CEO, Global Cool City Alliance

Brendan Shane – Climate Director, Trust for Public Lands, former C-40 Regional Director for North America

Board of Directors

Frank Loy – former Under Secretary of State for Global Affairs, former board chair of: Environmental Defense Fund, Resources for the Future, League of Conservation Voters

Jacob Scherr – member, Global Leadership Council Natural Resources Defense Council, and former Director Global Advocacy and Strategy for NRDC

Tracy R. Wolstencroft – former President & CEO of National Geographic Society, former Partner at Goldman Sachs, former President & CEO of Heidrick & Struggles

Greg Kats – former Managing Director, Good Energies, Inc.

The Smart Surfaces Coalition is seeking additional funding to accelerate urban smart surface adoption tenfold, and result in:

- **An estimated 3 billion tons (3 gigatons) of cumulative CO₂-equivalent reduction by 2050** – a \$22 million investment amounts to less than 1¢ per ton of CO₂-equivalent emissions avoided
- With follow-on phases, **100 gigatons** of CO₂-equivalent emissions reduction by 2050 (equal to 2.5 years of global emissions) (see chart on page 7)
- **250 cities adopting smart surfaces, with 3-5°F (2-3°C) temperature reduction by 2050** – with greatest cooling, air quality, and resilience improvements in lower-income neighborhoods
- **1,000 cities trained** and modeling city-wide smart surface adoption

By adopting smart surfaces, cities can **cost-effectively** cut their global CO₂-equivalent emissions by 10-15% over several decades and **reduce city temperature faster than the climate warms.**

Funding provided by:



For more information visit:

www.smartsurfacescoalition.org