Cool Surfaces Manhattan Project, Phase 1



LBNL, ORNL, Arizona State University, Smart Surfaces Coalition, Cool Roof Rating Council
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WBS 3.4.3.51

Project Summary

Objective and outcome

The Cool Surfaces Manhattan Project (CSMP), seeks to dramatically increase the climate-appropriate deployment of cool roofs and walls across the U.S., with an emphasis on their application to disadvantaged communities. Project Phase 1 has yielded a stakeholder-driven deployment plan with 19 transformative ideas.

Team and Partners

- LBNL (lead Ronnen Levinson)
- ORNL (lead Andre Desjarlais)
- Arizona State University (lead David Sailor)
- Smart Surface Coalition (lead Greg Kats)
- Cool Roof Rating Council (lead Sarah Schneider)

Stats

Performance Period: FY2022 (Phase 1)

DOE budget: $250K, Cost Share: $2.4K

Milestone 1: Identify barriers, opportunities, and models for cool-surface deployment

Milestone 2: Convene stakeholder workshop

Milestone 3: Create multi-year deployment plan

Problem

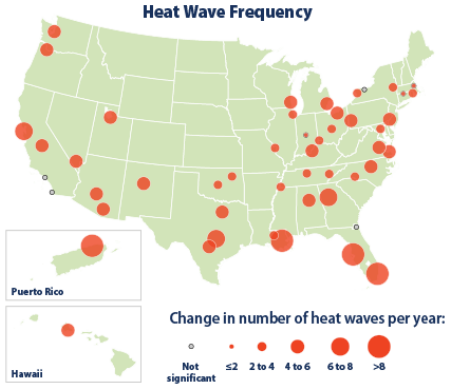
Recent growth in annual extreme-heat days, annual cooling degree days, and power-grid failures/shutoffs is escalating heat threats to across the United States. These can hit especially hard in disadvantaged communities with vulnerable populations.

Solar-reflective “cool” roofs and walls can cost-effectively

- save energy, reduce carbon footprint, and lower peak power demand in air-conditioned buildings
- improve comfort and safety in buildings that are not air-conditioned
- mitigate the urban heat island effect, improve air quality, and slow global warming

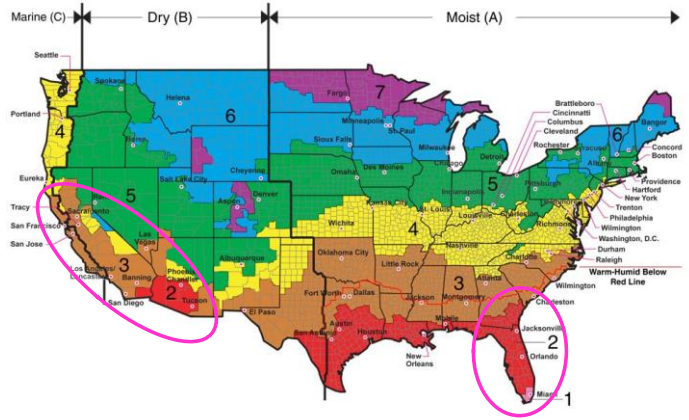
<u>Uptake of cool surfaces has been strong in California and Florida but limited nationally.</u>

U.S. heat wave frequency rose substantially 1961-2021



https://www.epa.gov/climate-indicators/climate-change-indicators-heat-waves

Cool surfaces can help across ASHRAE climates zones 1 – 5



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Alignment and Impact (i/ii)

The Cool Surfaces Manhattan Project (CSMP) seeks to bridge this gap by dramatically increasing the climate-appropriate deployment of cool roofs and walls across the U.S., with an emphasis on their application to disadvantaged communities.

Our objectives align with

- BTO's goals of prioritizing equity, affordability, and resilience
  - Increasing the ability of communities to withstand stress from climate change, extreme weather, and grid disruptions
  - Reducing overall and peak energy demand, reducing operational carbon and improving grid reliability
  - Ensuring that 40% of the benefits of federal building decarbonization investments flow to disadvantaged communities
- RBI's strategic plan to accelerate energy performance improvements in existing and new homes by reducing technical and market barriers to spur investment and achieve zero carbon emission homes

Alignment and Impact (ii/ii)

Examples of cool-surface benefits

❶ Over 20 years, a national cool-roof campaign could

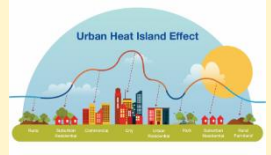
- save 5.7 quad of HVAC primary energy (present value $33B)
- reduce emissions by 0.25 Gt CO_2e (energy efficiency)
- offset another 0.57 Gt CO_2e (global cooling)

❷ Cool roofs can lower peak / average urban air temperatures by about 1.5 K / 0.5 K

❸ Cool roof + cool walls can reduce dangerously hot hours in an old home during a heat wave by about 25%

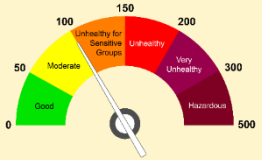
Sources: (1) Levinson (2012), (2) Santamouris et al. (2017), (3) Sun et al. (2022)

HVAC energy and $ savings



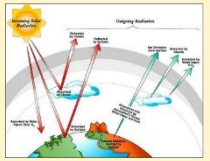
Heat island mitigation

Peak power demand reduction



Smog abatement

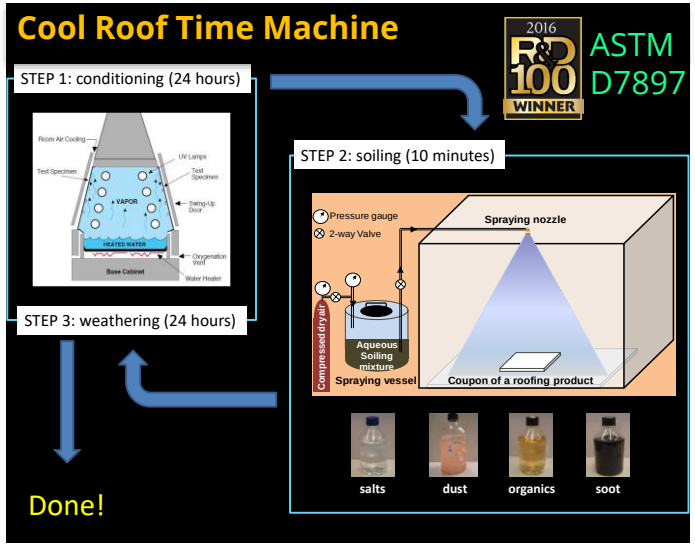
Comfort, health, and safety in heat waves

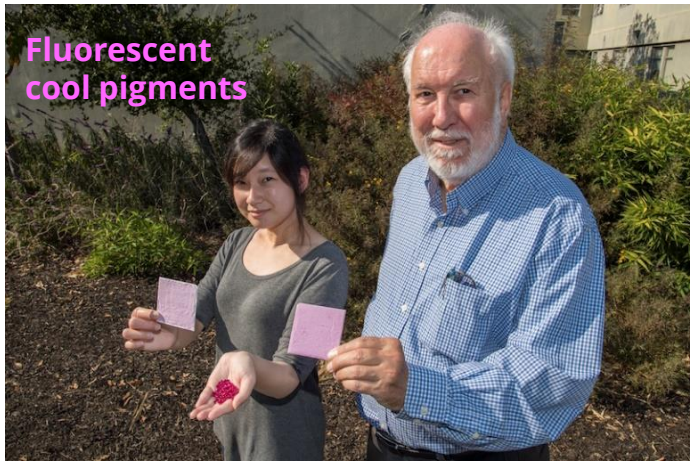


Global cooling (negative radiative forcing)

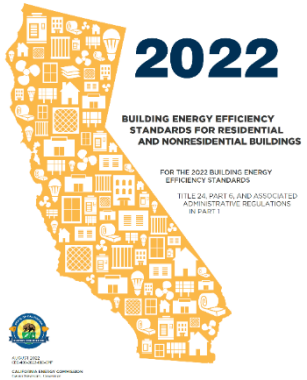
Past BTO cool-surface investments have focused on technologies—our project creates a national plan to accelerate *deployment*

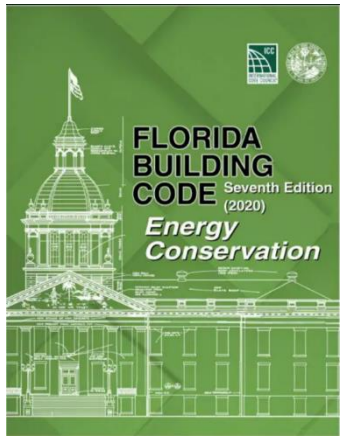
BTO-supported technologies



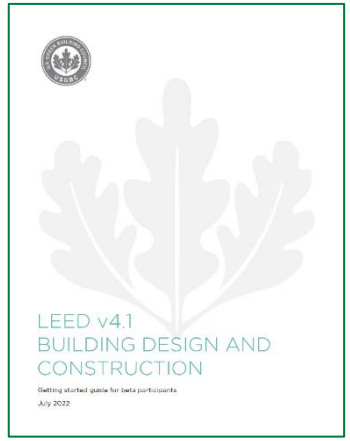


Existing deployment paths

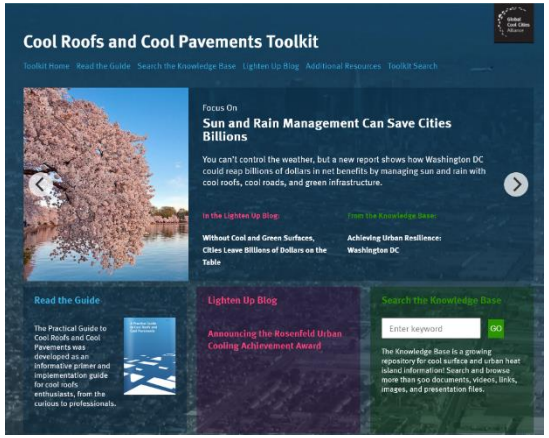




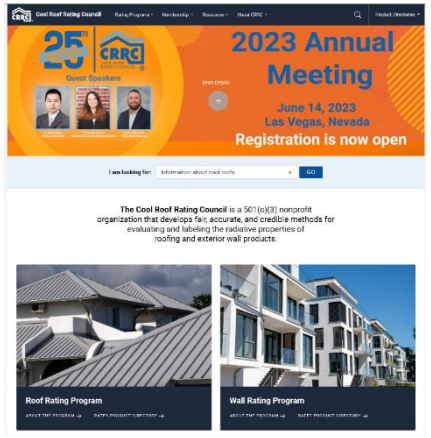
❶ State building codes



❷ US Green Building Council



❸ Global Cool Cities Alliance



❹ Cool Roof Rating Council

Project Phase 1 (FY2022) convened a broad team of experienced cool-surface experts to develop a two-year national deployment plan (FY2023-2024)

Phase 1: Research & planning

1. Identify opportunities and barriers
2. Adapt successful deployment models
3. Engage with stakeholders
4. Produce the Phase 2 deployment plan

BERKELEY LAB

OAK RIDGE National Laboratory

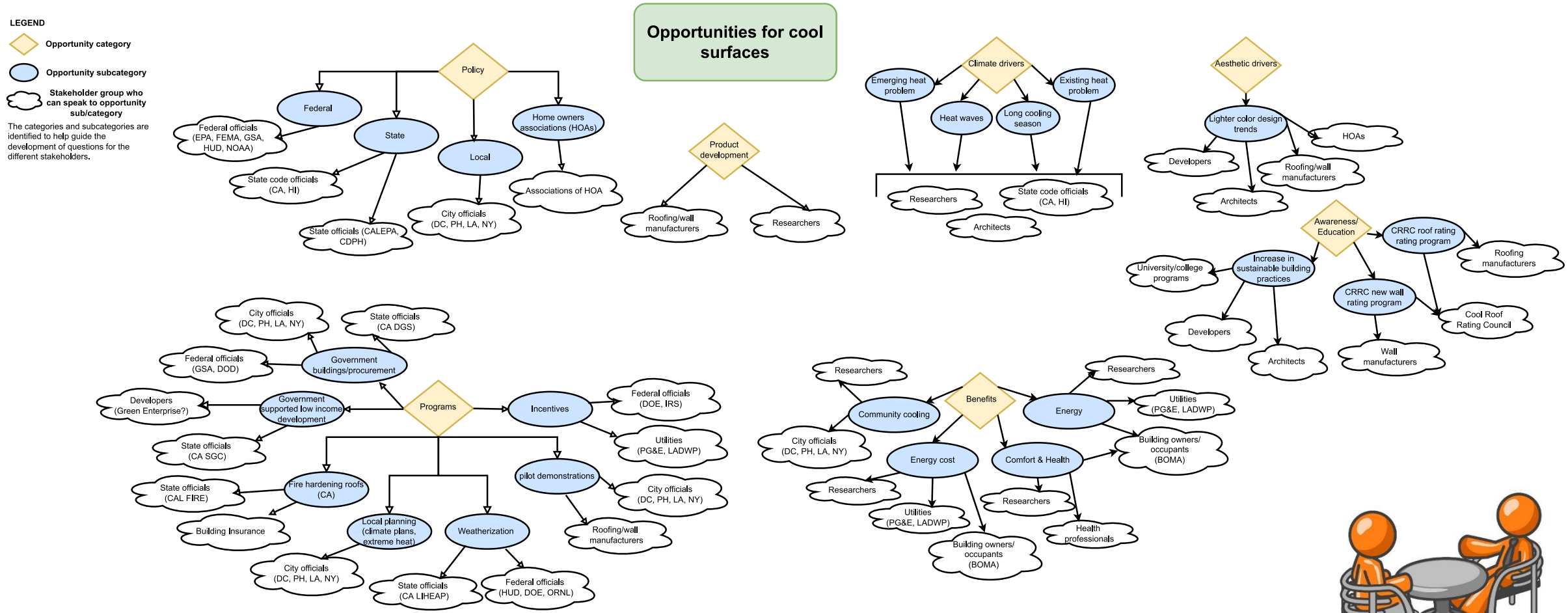
ASU

SMART SURFACES COALITION

CRRC COOL ROOF RATING COUNCIL

We mapped opportunities & barriers, then conducted a literature review and stakeholder interviews to learn from others

Opportunity map



We engaged many stakeholders through the interview process to better inform the cool surface deployment plan

- Interviewed 45+ stakeholders from
  - Cities
  - Industry associations
  - Manufacturers
  - State/federal agencies
  - Utilities
  - Academia

  using questions tailored to each stakeholder group
- Takeaways shaped the first iteration of the cool surface deployment plan

We asked six Federal agencies how cool surfaces can support their missions and how the agencies can advance cool surface deployment

Example (FEMA)

1. How could cool surfaces help FEMA achieve its mission (e.g., potential points of leverage and synergies)?
2. How can cool surface stakeholders make it easier for FEMA to perform its activities and achieve its mission (e.g., what would help FEMA to leverage cool surfaces)?
3. How can FEMA's activities (current & planned) support the deployment of cool surfaces?

WEATHERIZATION ASSISTANCE PROGRAM

We held a daylong online workshop with 62 stakeholders in September 2022

Program

- Discuss findings from literature review and stakeholder interviews
- Work in small and large groups to develop national deployment plan
- Engage and invest stakeholders in success of plan

We prepared a national deployment plan based on findings from the literature review, stakeholder interviews, and stakeholder workshop

❶ Issued literature-review and stakeholder-interview reports (Aug 2022)

❷ Hosted workshop (Sep 2022)

❸ Circulated draft plan (Dec 2022)

The top three needs identified in the interviews were ❶ scaling-up pilots, ❷ codes, and ❸ R&D

We can share a few broad observations drawn from multiple interviews

Need more education and awareness among the public (consumers), trade associations (developers, roofing contractors), and policymakers.

Regulations and consumer demand drive innovation and control the scale of the market.

Cities are thinking about innovative communications partnerships or ideas to promote cool surfaces.

City and federal employees need better tools to assess the energy savings, heat reduction, and other benefits that will result from investment in cool surfaces.

The team drew on the literature review, stakeholder interviews, and workshop findings to generate 19 transformative ideas

Technical support

#1: Technical assistance to governments

#2: Leverage BIL and IRA

Education & communication

#3: "Keep Your Cool" educational campaign

#4: Contractor training

#5: Cool Surfaces Workshop

RD&D

#6: Cool Roof Prize

#7: High-profile demonstration programs

#8: Cost-benefit analytic engine

#9: Incentive program guidelines

#10: Tools and calculators

Building codes & standards

#11: Enhance green-building standards

#12: EE requirements for envelope retrofits

#13: Cool-surface boilerplate language

#14: Cool walls in codes, standards, & programs

Incentives

#15: Deployment competitions

#16: Upstream rebates

Government actions

#17: Government partnerships and training

#18: Climate action plan specifications & targets

#19: Stakeholder community input

The deployment plan details each transformative idea

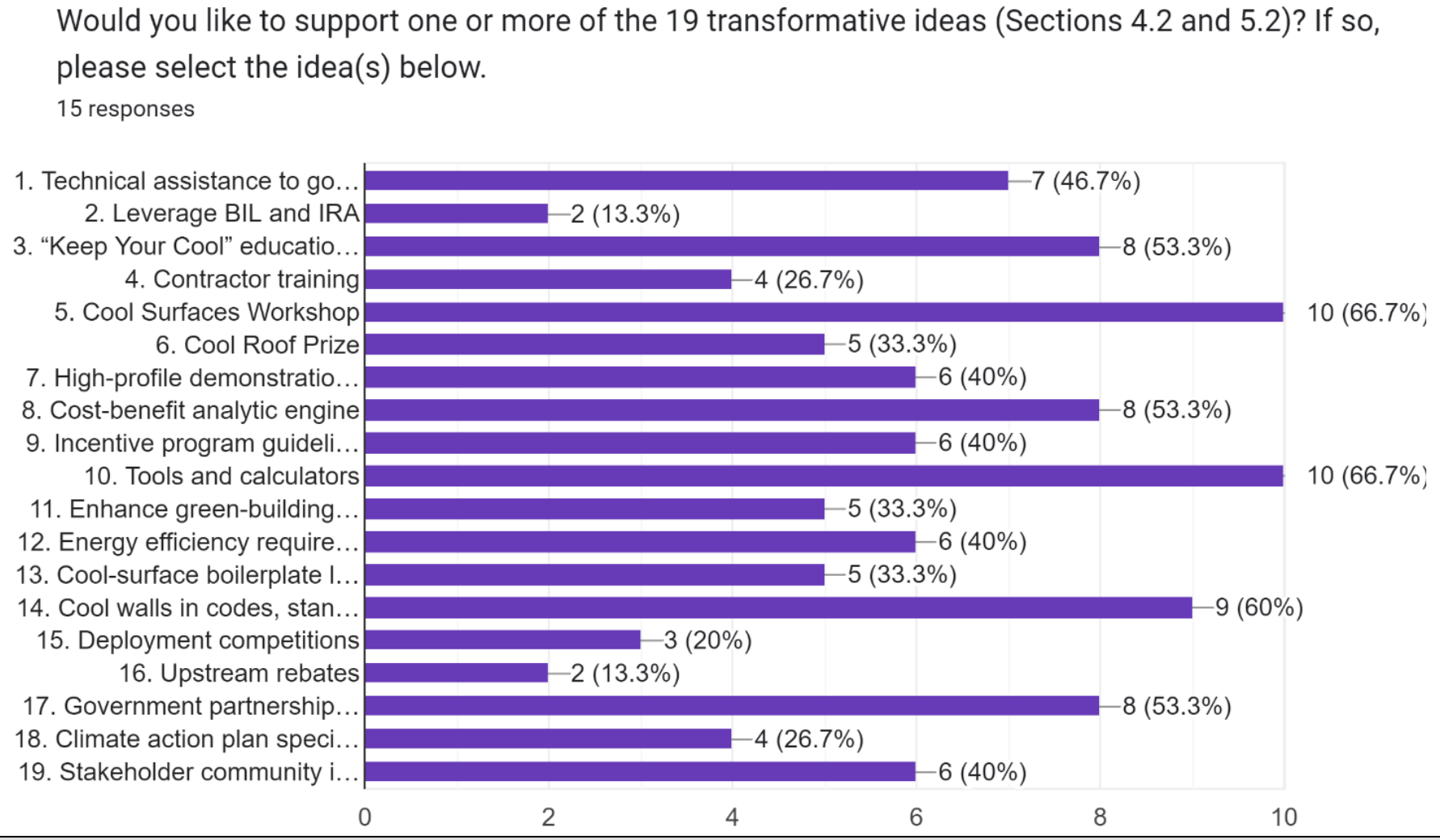
- Summary
- What
- Why
- How
- Who will implement
- Who will benefit
- Where
- Implementation timeline
- Cost
- Justice40 link
- Undesirable side effects
- Model to follow

3. Launch "Keep Your Cool" educational campaign

Summary	Launch "Keep Your Cool," a cool-surface educational campaign for all stakeholders and the general public.
What	Government, utilities, and the cool-surface industry would jointly prepare and conduct an educational campaign that informs all stakeholders and the general public about the benefits of cool roofs and walls. Position selection of cool roofs and walls as no-regret choices whose benefits will grow as the climate warms.
Why	Stakeholder interviews and the stakeholder workshop revealed a strong need to educate consumers, government agencies, policy makers, code officials, and industry professionals about cool-surface benefits and options. There is also a need to address misinformation about cool surfaces.
How	Researchers, non-profits, utilities, and government agencies will compile existing fact sheets, guidebooks, web pages, online calculators, and other information about cool surfaces. They will develop new campaigns, supported by marketing professionals, that target specific audiences (e.g., consumers, government agencies, policy makers, code officials, and industry professionals) through city, state, and federal websites; utility websites and mailed statements; industry marketing material; and workshops for industry professionals, such as continuing education programs for architects, engineers, and building enclosure consultants.
Who will implement	Researchers, non-profits, utilities, and government agencies will prepare the information to be disseminated by city, state, and federal governments; utilities; manufacturers; and industry. Marketing professionals from industry and the utility sector can help design and target educational materials.
Who will benefit	Building tenants and owners (e.g., reduced cooling demand, occupant comfort, energy savings), communities (e.g., urban cooling, improved air quality), utilities (e.g., peak power demand reduction), governments (e.g., meeting energy efficiency and carbon savings coals), and cool-surface manufacturers (better educated consumers).
Where	National campaign
Implementation timeline	Short
Cost	Low
Justice40 link	Campaigns can target DACs.
Undesirable side effects	None
Model to follow	DOE Insulation Fact Sheet

After circulating the draft plan in Dec 2022 to about 150 stakeholders, 15 readers (10%) provided detailed answers to a nine-question survey

3 most popular ideas: cool surfaces workshop; tools & calculators; cool walls in codes/standards/programs



Over 18 key stakeholders, including cities/counties, manufacturers, building professional associations, research institutions, NGOs, utilities, and Google, support our deployment plan

CALIFORNIA ENERGY COMMISSION

Adrienne Arsht-Rockefeller Foundation Resilience Center

The Phase 2 Deployment Plan is ready for implementation (FY2023-2024)

By the end of Phase 2, we seek to

A.	Greatly boost awareness about cool-surface options, benefits, and implementation paths through the educational campaign (#3), workshop (#5), and tools/calculators (#10, #8)
B.	Stimulate the development and deployment of economical, high-performance residential cool roofs via the Cool Roof Prize (#6)
C.	Demonstrate the effectiveness of cool surfaces and accelerate their deployment via high-profile demonstrations (#7) and deployment competitions (#15)
D.	Improve and grow cool-surface provisions in codes, standards, and green building certification programs (#11, #12, #14)
E.	Help government agencies and utilities include cool surfaces in public building specifications, building weatherization programs, post-disaster reconstruction, and climate action plans (#1, #2, #9, #17)

Thank You

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REFERENCE SLIDES

Project Execution

	FY2022				FY2023				FY2024			
Planned budget (LBNL + ORNL + subs)	$250,000				62,446				TBD			
Spent budget	$187,554				17,424				TBD			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Past Work												
Identify stakeholders to interview												
Identify barriers, opportunities, and models												
Conduct stakeholder workshop												
Create draft deployment plan (go/no-go)												
Current/Future Work												
Finalize deployment plan & negotiate Phase 2												
Submit paper about Phase 1 to IC2UHI 2023 conference												
Finalize IC2UHI 2023 conference paper												
Present paper and keynote presentations at IC2UHI 2023												

- Draft deployment plan was submitted in Nov 2022 because the stakeholder workshop was postponed to Sep 2022 from July 2022 to maximize stakeholder participation.

Team

- Ronnen Levinson, LBNL (PI)
- Andre Desjarlais, ORNL
- Haley Gilbert, LBNL subcontractor
- David Sailor & Mansour Alhazmi, Arizona State University
- Sarah Schneider, Cool Roof Rating Council
- Greg Kats, Jackson Becce, Jacob Miller, & Emily Morin, Smart Surfaces Coalition

All parties contributed to each activity, but ASU led the literature review.


Ronnen Levinson, LBNL


Haley Gilbert, LBNL


Andre Desjarlais, ORNL


David Sailor, ASU


Mansour Alhazmi, ASU


Sarah Schneider, CRRC


Greg Kats, SSC


Jackson Becce, SSC


Emily Morin, SSC


Jacob Miller, SSC