Heat island mitigation assessment and policy development for the Kansas City region

PROJECT FACT SHEET

1 Introduction

The Mid-America Regional Council (MARC) is the regional and metropolitan planning organization serving the 119 local governments in the bi-state, 4,423-square mile Kansas City region. MARC was selected as a Climate Action Champion (CAC) following a competitive process led by the U.S. Department of Energy (DOE) in 2014. As a CAC, it was able to submit proposals for U.S. Department of Energy technical assistance projects. In 2015, MARC submitted a proposal to DOE to solicit technical assistance to quantify the benefits of urban heat island (UHI) countermeasures, and understand the linkages among green infrastructure, energy conservation and heat island abatement. The Heat Island Group at Lawrence Berkeley National Laboratory (LBNL) was uniquely positioned to assist MARC given their extensive history of research on the topic, and membership as part of the national laboratory system supported by DOE.

2 Climate Action Champions alignment

This project aligned with MARC’s CAC commitments to strengthen and integrate a variety of local and regional resilience and sustainability initiatives using an integrated, data-driven approach embracing cross-cutting, multi-benefit strategies. It also supported one of MARC’s three CAC priorities to advance climate resilience plans in partnership with other consortium members, and through continuing broad outreach to area local governments and allied stakeholder groups.

MARC’s CAC application outlined goals to assess the likely scale and degree of climate change risks, to identify and create emergent opportunities, to promote efficiencies, and to explore possible synergies. Extreme heat and the UHI effect was one of the established areas of vulnerability to investigate potential cross-cutting mitigation benefits, like energy conservation, public health, environmental justice, increased walkability, and air quality. Specifically, MARC was keen to understand the linkages among green infrastructure, energy conservation and heat island abatement.

3 Project goals

MARC partnered with LBNL to advance their Climate Action Champion priorities by

- quantifying the impact of alternative urban heat island (UHI) mitigation strategies on energy use;
• calculating the costs and benefits related to implement alternative UHI mitigation strategies; and
• identifying potential policy/planning mechanisms to support local UHI abatement implementation efforts for adoption by local governments to mitigate associated impacts while advancing regional climate resilience goals.

This study was conducted to generate data to inform the thoughtful integration of cool building and cool city measures into regional and local initiatives.

4 Findings

• Using the Weather Research and Forecasting (WRF) model we found under typical summer conditions average daytime (07:00 – 19:00 local standard time) near-ground air temperature reductions of 0.08 and 0.28 °C for cool roofs and urban irrigation, respectively.

• **Indirect Benefits** We calculated the building electricity, electricity cost, and emission savings that result from the reduction in outdoor air temperature (“indirect” savings) and found maximum regional annual indirect electricity savings of 42.8 GWh for cool roofs and 85.6 GWh for urban irrigation—yielding maximum regional annual indirect electricity cost savings of $5.6M and $11.1M, respectively.

**Direct Cost/Benefit** We next evaluated the building energy, energy cost, and emission savings from cooling the building surface with cool roofs and shade trees (“direct” savings). For cool roofs, we found regional annual direct energy cost savings of $10.9M. For shade trees, the regional annual direct energy cost savings were $21M.

We investigated cool roof cost premiums and shade tree first costs; cool roof cost premiums ranged from zero to $0.20/ft², while shade trees were assumed to cost $100 per tree. When we compared the direct building annual cost savings to the cool-roof cost premiums and shade-tree first costs, we found regional simple payback times up to 8.0 years for cool roofs and 4.9 years for trees.

• Based on the costs and benefits of the UHI countermeasures, MARC will pursue the inclusion of these countermeasures in existing regional plans where they can complement other regional priorities for transportation, climate resiliency, clean air, and hazard mitigation.