

Healthy Urban Environments Initiative Arizona State University

Project Update: First Quarter, 2019
Date of Report: July 15, 2019

As outlined in the Healthy Urban Environments (HUE) Initiative proposal, ASU has launched HUE as a solutions-focused research, policy and technology incubator to rapidly develop, test and deploy heat-mitigation and air-quality improvement strategies and technologies. This will be accomplished through four project components: 1) research, solutions and innovation incubator; 1) communication, networking and solutions hub; 3) implementation and evaluation of new insight in real world contexts; and 4) public, workforce and management education and capacity building. The schedule for delivery of each component as proposed is shown below; we will report on progress for each of these components separately.

Table 3. Milestones		Years				2019				2020				2021			
		Quarters				1	2	3	4	1	2	3	4	1	2	3	4
Communication, networking and solutions hub																	
	Convene ASU heat and air quality researchers																
	Create Network of Concerned Parties and Advisory Council																
	Aggregate relevant plans from local and external entities																
Research, solutions and innovation incubator																	
	Laboratory Investigations - Year 1																
	Laboratory Investigations - Year 2																
	Laboratory Investigations - Year 3																
	Pilot Field Experiments																
	Model Proposed Interventions																
	Behavioral Research on Perceptions of Heat and Air Quality																
Implementation and Evaluation																	
	Scale-up of Proposed Interventions																
	Evaluate Changes of Perception																
Public, workforce, and management education and capacity building																	
	Develop Content for Workforce, Public and Management Educational Programs																
	Share Solutions for Relevant Stakeholders																
	Offer Training for New Jobs																

1. Research, Solutions and Innovation Incubator

ASU will develop a research, solutions and innovation incubator to test novel heat and air pollution mitigation technologies; deploy field demonstration projects to quantify the heat and air quality mitigation effectiveness; and modeling projects to simulate the impact of heat and air quality mitigation approaches.

July 15, 2019 Status: After convening ASU researchers as part of the first component, HUE sought proposals for addressing the key components identified for launching HUE as an effective solutions center. While the HUE concept was to sequentially deploy laboratory, modeling and pilot field demonstrations, based on the strong existing efforts of ASU researchers, it was

determined that HUE could leverage past efforts to accelerate field and modeling efforts. Based on this initial survey of intellectual capital at ASU and considering where HUE investment could make the greatest return on investment, three projects were initiated in the first quarter to establish HUE as a research, solutions and innovation incubator.

First, to advance novel air pollution mitigation technologies, HUE selected “Photocatalysts on Solar Panels for NO_x Control” for funding. This project seeks to perform fundamental laboratory studies developing coatings to functionalize the surface of photovoltaic (PV) cells to catalytically remove nitrogen oxides (NO_x) from the urban air using the ultraviolet spectrum not traditionally captured by PV technologies. In the first quarter, this project has set-up laboratory equipment to test the photocatalytic reduction of NO_x using commercial grade titanium dioxide catalyst as an initial proof of concept using a flow-through reactor with a solar simulator as irradiation source. Using NO_x analyzers upstream and downstream of the flow-through reactor, the effectiveness of the photocatalytic reactor will be evaluated as the project progresses. Prof. Pierre Herckes from the School for Molecular Sciences is leading this effort.

Second, to focus on deployment of field demonstration projects, HUE selected “The right shade in the right place – thermal assessment of natural and engineered shade in Tempe” for funding. This project builds upon the past work of Prof. Ariane Middel from the Arts, Media and Engineering program to assess the thermal comfort provided by various shade forms in the context of the surrounding environment. Through engagement with stakeholders in municipalities, this effort will develop guidelines and best practices to advance active shade management to improve thermal comfort as a solution to extreme urban heat. As Prof. Middel has prior experience in this area, her efforts will launch into field demonstration in the first year of HUE.

Finally, HUE will invest in a high-impact modeling effort to simulate the impact of heat mitigation approaches with “Neighborhood-scale comparison of heat mitigation strategies in Phoenix”. This effort, led by Prof. David Sailor of the School for Geographical Sciences and Urban Planning, is using computational fluid dynamics to explore the air flow and heat transfer to the existing Edison-Eastlake neighborhood of Central Phoenix to proactively guide future redevelopment designs to mitigate urban heat. Specifically, the City of Phoenix has been awarded \$30 million to implement an affordable housing redevelopment. ASU, in partnership with the contracted architecture firms, the community and The Nature Conservancy, has engaged with Phoenix to ensure that thermal comfort and mitigation of urban heat is optimized in the final design selected for implementation. As part of this effort, ASU has installed five weather stations throughout the community before redevelopment occurs. This HUE funded effort will ensure that this unique opportunity to integrate model-based prediction with in-situ measurements can determine the effectiveness of heat mitigation actions.

2. Communication, Networking and Solutions Hub

Arizona State University (ASU) will convene workshops to share mitigation approaches, initiate new inquiries to expand on urban heat and air quality improvement strategies, and provide summative reports on relevant community strategies for interventions for urban heat and air quality.

July 15, 2019 Status: In the first quarter of this Project, ASU convened researchers from across the campus to outline the HUE initiative as a solutions center, quantify the range and breadth of current research efforts focusing on local heat and air quality, and seek input on priorities to focus initial efforts on for heat and air quality mitigation. Forty-seven participants engaged in this one day workshop held on the ASU Tempe campus at the Memorial Union.

After seeking broad suggestions on ways to ensure the effectiveness of HUE as a solutions-focused research, policy and technology incubator, participants prioritized the following concepts for initial support through HUE:

- Integrated research on dust storms and impact on soils, air, health
- Community on board: involve other than academics in research
- Playgrounds: materials, site, shading
- Air pollution at schools, sited near freeways, buffer zones, idling, exposure, and kids' health
- Co-develop research questions with residents
- Climate change nexus of heat, water use, air quality, and impact of built environment
- Lowering impediments to using multimodal transportation
- Set aside a portion of research money to effectively communicate findings

As outlined in the project milestones, one initial activity of HUE will be to aggregate relevant plans from local and external entities as one of the initial efforts. For this, HUE has launched an effort to develop a HeatReady Standard to guide cities in the implementation of new governance models for coping with risks associated with extreme heat. While this effort is an expansion of our initial objective to aggregate plans from local entities, HUE is leveraging past collaborations between ASU and local governments and non-profit organizations which collected heat management activities and revealed a need for improvement. Through HUE, Prof. David Hondula from the School for Geographical Sciences and Urban Planning has started this effort to optimize urban heat management through HeatReady Standards as a research- and practice-informed process to ensure that heat is addressed in a comprehensive, integrative and effective manner through individual- and household-level protective actions to city-wide heat mitigation strategies.

Moving forward in the next quarter, HUE will convene external stakeholders to create our Network of Concerned Parties and prioritize key individuals from that Network as our Advisory Council.

3. Implementation and Evaluation of New Insights in Real World Context

ASU will test new solutions developed as part of HUE; conduct surveys and in-depth interviews with community members; and enable Technology Transfer and Intellectual Property licensing on all projects sponsored by HUE.

July 15, 2019 Status: Upon review of research, we found two opportunities to leverage existing ongoing efforts to accelerate the implementation and evaluation phase of HUE into the first quarter of the project. Both initial efforts will provide data on the effectiveness of heat mitigation and air quality improvement strategies or technologies through real-world deployments. Further, HUE is leveraging our resources through investment by external stakeholders as well as establishing key relationships to ensure that our heat and air quality mitigation approaches gain exposure and traction in the community.

First, Prof. Jenni Vanos from the School of Sustainability, will lead an effort entitled “Enhancing Children’s Health and Well-being through Nature-based Environmental Designs in Outdoor Playspaces”. This project will address the combined influence of the environmental parameters of high temperatures, air pollution, and radiation on children’s health and ability to play safely and actively outdoors. Specifically, the Paideia Academy in South Phoenix will be undergoing a full playground redesign in Fall 2019. The charter school will fully fund the playground redevelopment, while HUE funding will be used to complete pre- and post-redevelopment measurements of heat and air quality, monitor how children use the play areas, and how the school community perceives the outdoor area. By engaging with Paideia Academy, HUE hopes to collect evidence for adaptive designs to play areas to extend the time range of safe physical activity and lessen heat, sun and pollution-related illnesses. The results from this effort will be shared and translated so that future designers can make use of the most effective strategies to limit adverse exposures to harmful heat and air pollution.

Second, Prof. Hamed Tirkolaei from the School for Sustainable Engineering and the Built Environment, will be leading an effort “Quantifying the Air Quality Benefit of a Novel Dust Suppression Technique”. In this project, HUE will quantify the air quality benefit of a novel technology developed as ASU as part of the Center for Bio-mediated and Bio-inspired Geotechnics (CBBG) to use enzyme induced calcium precipitation (EICP) to control dust entrainment. EICP involves spraying bare silty soil with urea, calcium chloride and urease to selectively precipitate calcium carbonate at mineral grain boundaries effectively binding soil into aggregates and preventing entrainment during wind events. Preliminary laboratory tests have shown good results in lowering the rate of dust entrainment after application. CBBG has secured funding from Phoenix-based Freeport McMoran to do field demonstrations of the EICP process in two local landfills during summer 2019. HUE funding will enable collection of long-term effectiveness of the EICP process with Clarity Air Monitors as well as short-term intensive monitoring of the chemical composition and size distribution of dust entrained from test plots.

4. **Public, Workforce, and Management Education and Capacity Building**

ASU will enable capacity through development and implementation of workshops community members; create online modules to be integrated into existing ASU outreach programs; and develop material for new workforce training programs.

July 15, 2019 Status: We are exploring successful strategies in order to implement this component of the project.

We have met with the leadership of the MCIDA-funded MedTech project at ASU to discuss synergistic opportunities. HUE will work with MedTech to integrate a limited number of HUE project students in the MedTech Entrepreneurism Course in Fall 2019. While not initially envisioned as part of HUE, we view this as an opportunity to expand the range of efforts of HUE students to advance entrepreneurship with the ultimate goal of impacting deployment of HUE solutions to commercial venues and creating opportunities for a future workforce.