2020

Annual Report

HARCresearch.org

HARC

Message from John Hall President and CEO

HARC is a 501(c)(3) nonprofit organization that works as a research hub to connect decision-makers, stakeholders, and communities to data and independent research. HARC's collaborative culture defines how it pursues and communicates its vision, mission, and goals.

2020 was an important year for HARC, and despite all the challenges the year offered, our research and programs continued to pursue science-backed solutions for the most significant problems in our region and around the world. Even during trying times, possibilities are endless, and our team successfully launched multiple programs in all research areas comprising air quality, clean energy, climate, geospatial and analytics, and water quality.

An inspiring environment shapes HARC's research, and our team includes intelligent and conscientious people genuinely excited about what they do. This culture, this day-to-day experience, is what truly enables incredible things to happen.

I am honored to begin my role as President and CEO in 2021 by sharing the 2020 highlights in this Annual Report. In the following pages, you will learn more about our work through the voices of many enthusiastic community partners.

A few highlights from the following pages include:

- Ongoing work within Harris County, Texas to measure and analyze air quality.
- Continuation of US DOE's Southcentral and Upper West Combined Heat and Power Technical Assistance Partnership – a "no-cost", technical assistance, education and outreach program to help educate end-users on best practices and policies for CHP investment.
- Launch of Pythias Climate Analytics – an online tool to assist in energy planning under various climate risk scenarios.
- The development of the Texas Litter Database- the only comprehensive tracking tool of its kind for use in the state, which will help enhance tracking and measurement of solid waste pollution.

Please feel free to reach out to me or any of the HARC staff, and please continue to follow our work and our ongoing commitment to building a sustainable future that helps people thrive and nature flourish.

Stay tuned - 2021 holds the promise for even greater possibilities.

Organizational Profile

HARC (Houston Advanced Research Center), a 501(c)(3) nonprofit, provides independent analysis on energy, air, and water issues to people seeking scientific answers. The organization focuses on building a sustainable future that helps people thrive and nature flourish. Its collaborative work culture and work environment of intelligent and conscientious people who are leading the discussion on sustainability in our region.

HARC's Living Lab headquarters is in The Woodlands, Texas, and serves local, regional, and national communities, organizations, and entities. Research activities support implementing policies and technologies that promote sustainability based on scientific principles as this type of science-based, nonpartisan research is critical to creating sustainable solutions.

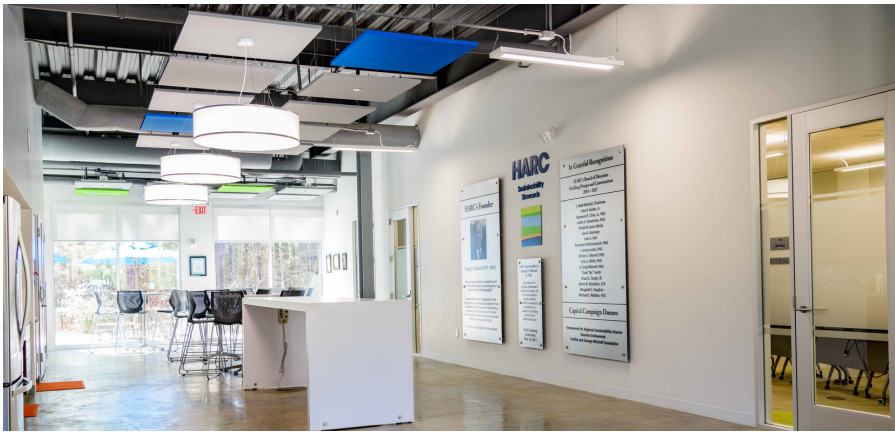
HARC built an efficient organizational and management structure that makes it a hub of collaboration for HARC staff and many other organizations. As a result, over many years and many projects, HARC proves itself to be a capable research management organization, successfully overseeing multimillion-dollar projects that are also multi-institutional and multi-disciplinary.

Documenting how HARC incorporates sustainability throughout operations demonstrates the link between HARC's strategic vision and its commitment to a sustainable future that balances people, planet, and performance (HARC's triple bottom line). In addition, sharing HARC's impacts provide transparency and fosters dialogue with all key stakeholders. This allows HARC to establish a baseline to gauge future performance and identify actions to take to strive towards a sustainable future that helps people thrive and nature flourish.

Leadership

Board of Directors

J. Todd Mitchell, Two Seven Ventures, Board Chair
Cullen K. Geiselman, PhD, Board Vice-Chair
Raymond E. Cline, PhD, ClineHair Commercial Endeavors, LLC
John Hall, HARC, President and CEO
Ramanan Krishnamoorti, PhD, University of Houston
L. James Lester, PhD, Past President of HARC
B. Greg Mitchell, PhD, Scripps Institution of Oceanography
Paul R. Nelson, Community Member
Thad “Bo” Smith, Smith Global Services, Inc
Bruce Tough, JD, Tough Law Firm
Spiros N. Vassilakis, CFA, The Mitchell Family Corporation
Margaret Vaughan Cox, MCV Consulting



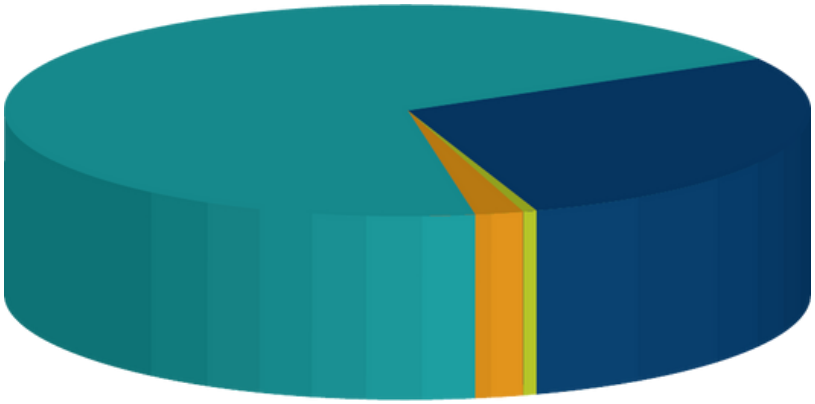
Advisory Council

Daniel Cohen, PhD, Rice University
Nisha Desai, Aurora Clean Energy Partners
Winifred Hamilton, MD, Baylor College of Medicine
Marilu Hastings, Cynthia and George Mitchell Foundation
Brett Perlman, Center for Houston’s Future
Alex Rozenfeld, Texas Innovates and Climate Impact Capital
Gil Staley, The Woodlands Area Economic Development Partnership
Lori Traweek, Gulf Coast Authority
Michael Webber, PhD, Engie Energy
Joe Zietsman, PhD, Texas A&M Transportation Institute

Financial Review

Economic Performance

The accomplishments that HARC achieved in the fiscal year reflect a strong performance in building an organization that provides transformative research and top-tier science. HARC's unbiased approach to generating actionable information from complex data, coupled with its legacy as a science-based sustainability organization, enables collaboration with universities, government, and private-sector agencies to address complex and pressing issues.



Total Operating Revenue

$4,439,603 *

$1,251,028	$3,086,487 *	$88,160	$13,928
Federal and Federal Flow-through	Foundation and Corporate	State and Local Government	Other Income

*excludes non-operational contributions

Market Presence

HARC's commitment to the community's well-being and its employees reflects its strategy to hire staff from within the markets it serves.

Indirect Economic Impacts

HARC is active in the communities it serves by providing tools and resources to educate and improve communities across the region.

Procurement Practices

HARC is committed to maintaining a high level of ethics within its supply chain, as detailed in its procurement policy.

HARC's air quality research and management work include air quality modeling, emission reduction technologies, emissions monitoring technology, and policy. In addition, researchers study regional impacts of and adaptations to climate change. The air research program is multi-disciplinary, multi-institutional, objective, and non-partisan.

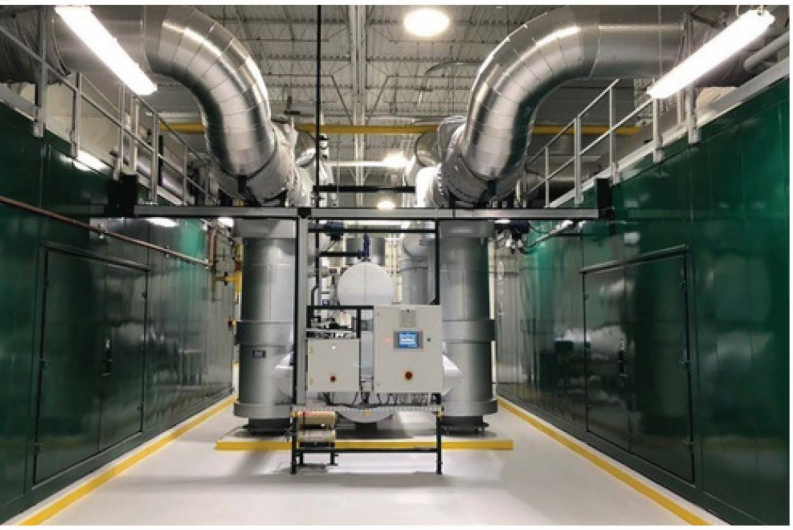
Air Quality Research in Harris County

American Chemistry Council Air Quality Work

In 2020, HARC was awarded a grant to work with Harris County Precinct 2 on emergency management and response planning associated with major air pollutant releases related to safety events, industrial accidents, extreme weather, and emergencies. An 11-member Science Advisory Committee (SAC) comprised of public health, air quality modelling and monitoring, meteorology, equity, and environmental communications experts was established to provide guidance and assist with the project. The project's ultimate deliverable, beyond the technical support provided to Harris County, will be an air quality emergency management "playbook" that delineates the project's findings, including strategies, procedures, roles and responsibilities, threshold values, communications messaging and protocols, and support materials. Multiple tabletop exercises with all the relevant governmental, industry, and stakeholder groups will inform the project and enhance the playbook.

> HARC's work on an additional air quality analysis for Precinct 2 is a significant first step toward ensuring Harris County becomes a national model and leads the way in collaboration between industry, community organizations, and government to promote a healthy and economically strong area. Together we can work to ensure our residents feel safe, engaged and educated about our industry neighbors.
>
> **Harris County, Precinct 2 Commissioner Adrian Garcia**

HARC's Clean Energy group provides research, tools, and technical assistance as the global community works to decarbonize the electric power sector and mitigate physical climate risk. HARC's continued effort will guide policymakers and industry leaders towards improvements in electric power resilience, energy efficiency, and distributed energy resources.



US DOE Southcentral and Upper West Combined Heat and Power Technical Assistance Partnership

HARC continues to provide Combined Heat and Power technical assistance services to end-users and works with policymakers and regulators to educate them on best practices and policies for CHP investment. In 2020, researchers kicked off year two of the five-year program. Comprised of leading experts in CHP (in addition to microgrids, waste heat to power, and district energy), the TAP programs provide a range of technical assistance services to facility owners and managers.

Pythias Climate Analytics

The increase in number and the growing intensity of extreme weather events is resulting in significant disruption to our economy and communities. To help lessen extreme weather impacts, due to physical climate change, HARC is developing a climate analytics platform will help energy companies to identify, assess and prepare for climate risk. The platform provides advanced climate analytics coupled with an agent-based model which not only assesses risk but improves decision making. The effort is supported by the Alfred P. Sloan Foundation.

> The Department of Energy relies on committed partners for successful program implementation. Throughout the years, using innovative outreach and engagement strategies, HARC's management of our Southcentral and Upper West Combined Heat and Power (CHP) Technical Assistance Partnership has helped companies reduce energy costs, decrease greenhouse gases, integrate renewables and improve resilience via microgrid CHP solutions.
>
> **Department of Energy - Anne Hampson, Manager**
> **Technical Partnerships, Advanced Manufacturing Office**

City Efficiency Leadership Project

Over the last five years, the State Energy Conservation Office (SECO), has supported HARC and the South-central Partnership for Energy Efficiency as a Resource (SPEER) to work with Texas cities to become more energy efficient and resilient. Key to this effort, is HARC's work to develop clean energy financing options through Property Assessed Clean Energy (PACE) financing.

Powered for Good

The US Department of Energy's Solar Energy Technology Office (SETO) partnered with HARC to develop a clean, affordable solar plus storage product for low income communities. A year into the project, HARC and partners, TEPRI, High Noon Advisors and Moon Light Interests, have developed a more affordable solar+storage products that Retail Electricity Providers (REP) can offer to low income households. The team is currently piloting a low-cost option through a new start-up company named Energy Well Texas. A key innovation of this project is the introduction of micro-solar plus storage system (less than 1 kW) deployment model which can provide resilient storage options to households to meet basic needs during power outages.

> TEPRI's mission is to inspire lasting energy solutions for underserved communities. Through our collaboration, HARC provides the science-based data analyses and strategic thinking to create programs and research projects that support our mission. They are an important partner for our organization, and for those seeking a greater understanding of how data can inform policy and technology deployment and create more sustainable solutions for all Texans.
>
> **Texas Energy Poverty Research Institute (TEPRI)**
> **Dana Harmon, Executive Director**

Texas Clean Energy Hub

In 2020, HARC launched the Texas Clean Energy Hub. The Clean Energy Hub, funded by State Energy Conservation Office, houses various interactive tools, webinars, guides, and case studies to help accelerate the adoption of distributed generation and energy efficiency projects in Texas. The Clean Energy Hub also includes the Texas Energy Crossroads Podcast, a uniquely Texas podcast where local experts talk about energy transition.

Water research emphasizes water quality and quantity, watershed management, biodiversity, ecological function, and ecosystem informatics. Integration, analysis, and dissemination of information regarding essential water issues are considered key to advancing more sustainable management of coastal watersheds, water supplies, and water quality.

Galveston Bay Research

The Galveston Bay Report Card

The Galveston Bay Report Card is a citizen-driven, scientific analysis of Galveston Bay. Supported by a grant from the Houston Endowment and implemented by the Galveston Bay Foundation, the report card aims to engage community members in meaningful discussion about Bay health topics. In 2020, the Galveston Bay Report Card outreach continued with a new initiative, Mission: Pollution Prevention. This update to the card's mission aims to bring everyone together as a community with a common goal of protecting the bay from increasing pollution. In addition, a new section was added to the website, www.galvbaygrade.org, and will offer resources to reduce trash, prevent litter, and recycle properly.

Galveston Bay Survey

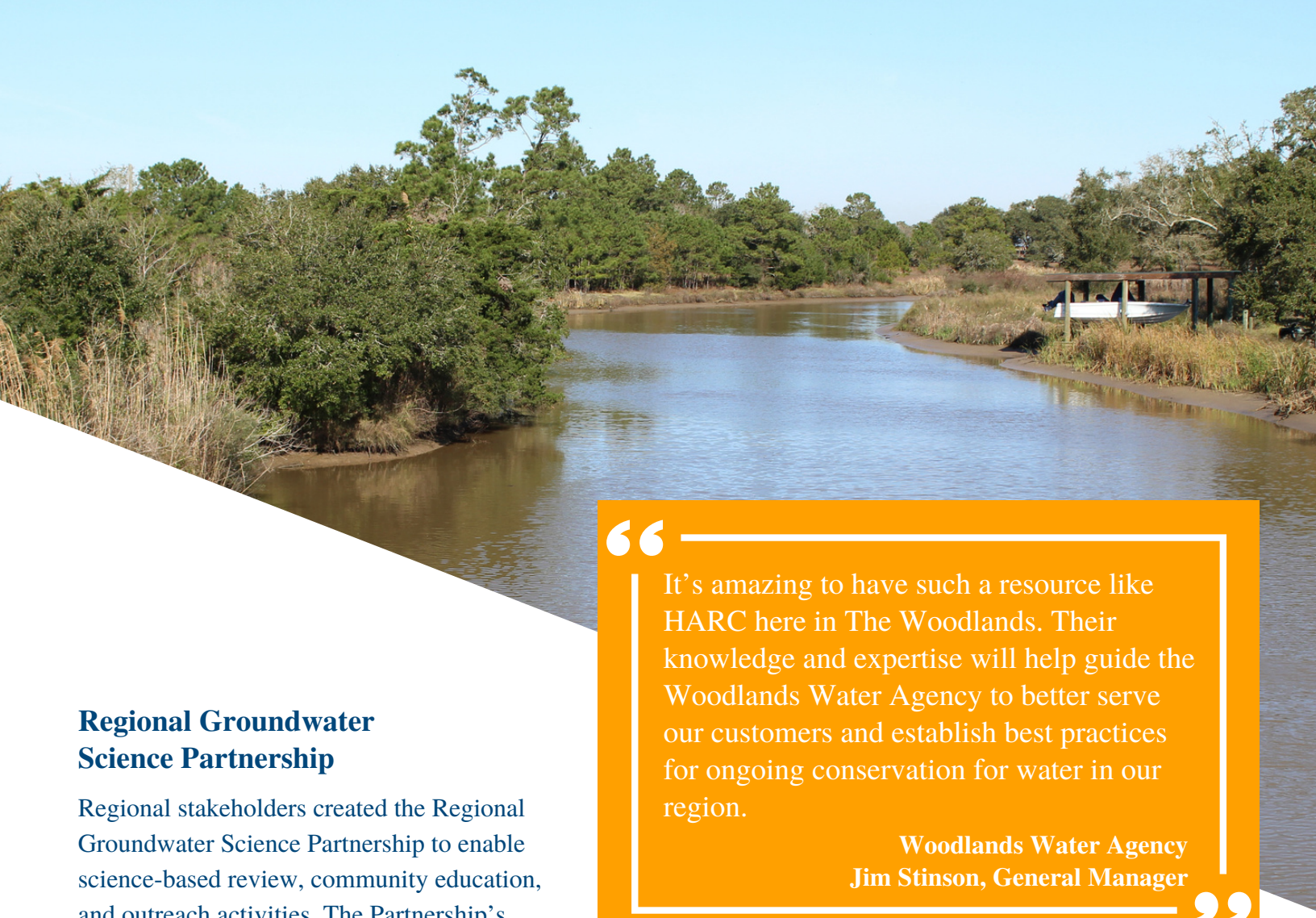
Building on the outreach activities of the Galveston Bay Report Card, HARC and partner, the North American Association for Environmental Education (NAAEE), collaborated to create a survey to assess public attitudes, concerns, and priorities of lower Galveston Bay watershed communities.

Galveston Bay Estuary Resilience Assessment

The HARC team continues work on the Galveston Bay Estuary Resilience Assessment project funded by the Galveston Bay Estuary Program. The project team completed and delivered the draft Galveston Bay Estuary Resilience Assessment report, which was a stakeholder-led effort to create an estuary resiliency assessment (vulnerability assessment focused on coastal resilience).

Texas Litter Database

HARC is working with partners Keep Texas Beautiful and BlackCat GIS to develop the Texas Litter Database, a project funded by The Garver Black Hilyard Family Foundation. Accessible through any smart device or computer, this online tool will enable municipal employees, volunteers and others to better track and analyze litter collected during cleanups. The team worked together to develop sampling procedures, field sheets and database flows towards development of the database that can be used to promote efforts to reduce, remove, and research trash and litter in waterways in the region and beyond.



> It's amazing to have such a resource like HARC here in The Woodlands. Their knowledge and expertise will help guide the Woodlands Water Agency to better serve our customers and establish best practices for ongoing conservation for water in our region.
>
> **Woodlands Water Agency**
> **Jim Stinson, General Manager**

Regional Groundwater Science Partnership

Regional stakeholders created the Regional Groundwater Science Partnership to enable science-based review, community education, and outreach activities. The Partnership's work is financially supported by the Groundwater Research Consortium, comprised of municipalities and special-use districts in the greater Houston-Galveston Region. The Groundwater Science Advisory Committee (SAC) was created of leading Texas groundwater researchers to review data and studies relating to groundwater supply, aquifer storage, groundwater demand, and subsidence in the Houston-Galveston Region. HARC will be working with the SAC and the Consortium to explore groundwater issues in the region.

Double Bayou Watershed Protection Plan

Implementation activities continue in the Double Bayou Watershed. HARC, in partnership with the USGS, continued water quality monitoring, began data analysis of initial water quality data results, and provided stakeholder resources. The team released virtual resources for the first-ever Double Bayou virtual stakeholder meetings. In addition, several short webinars on various topics were created and posted for downloading or streaming. Visit www.doublebayou.org to access and view the webinars.

> I am thrilled to be working with the team at HARC to better understand the scale of litter in Texas, which will impact the efforts of organizations and advocates for years to come.
>
> **Garver Black Hilyard Family Foundation**
> **Maia Corbitt, Director of Mission and Giving**

HARC's Climate Program is a dedicated, multi-disciplinary initiative that evaluates data analytics on climate risk in Texas to develop climate mitigation and adaptation strategies. The newest program in HARC's body of research enhances HARC's ability to provide robust analyses and applied research supporting technical assistance and science-based policies for the private and public sectors.

> Climate change is an unprecedented challenge for Houston. In partnership with HARC, a trusted leader in research and policy, our city created the City's first ever Climate Action Plan to lay the foundation for action that will strengthen our community against the threat of our changing climate.
>
> **City of Houston**
> **Mayor Sylvester Turner**

Resilience Science Information Network (RESIN)

Funding from the Global Giving Foundation will enable HARC to develop a Resilience Science Information Network (RESIN) Portal of the Upper Texas Gulf Coast. The RESIN portal will share a comprehensive set of data describing future climate impacts to the region. RESIN brings together climate scenarios, environmental and socio-economic data sets, identifies cross-connections, and develops value-added data for communities engaged in resilience and adaptation efforts. In addition, the platform will present information in user-friendly formats allowing community leaders to create coherent, effective resilience plans. A series of high-resolution climate indicators, acquired through a partnership with ATMOS Research and Consulting, will be utilized throughout the RESIN portal.

> As one of Texas Southern University's trusted partners, HARC has partnered with us to study many facets of resilience. Most recently with the launch of RESIN (Resilience Science Information Network), a project that examines environmental pollution, social vulnerability, food access, and flood protection in nine counties, HARC has always shown its value in providing science-based research that enables a greater understanding of regional resilience and environmental impacts.
>
> **Texas Southern University - Dr. Earthea Nance, Associate Professor**

The city of Houston's Climate Action Plan will serve as a guiding document as Houston moves towards its goals of reducing greenhouse gas (GHG) emissions, meeting the Paris Agreement, and leading the global energy transition. HARC has been an integral partner in this project and the plan will be more effective due to their expertise and guidance.

City of Houston
Lara Cottingham
Chief Sustainability Officer

City of Houston, Climate Action Plan

On April 22, 2020 – the 50th anniversary of Earth Day – the City launched the science-based, community-driven Houston Climate Action Plan to reduce greenhouse gas (GHG) emissions, meet the Paris Agreement goal of carbon neutrality by 2050, and lead the global energy transition. A Climate Action Plan provides evidenced-based measures to reduce greenhouse gas emissions and preventative measures to address the adverse outcomes of climate change. In addition, the plan will demonstrate how the City will adapt and improve its resilience to climate hazards that impact the City today, as well as risks that may increase in the coming years. HARC served as the technical advisor leading the climate modeling and data analyses, as well as community outreach and engagement efforts.

Urban Heat Study

On August 7, 2020, 84 community science volunteers measured Harris County's hottest and coolest places during a one-day heat mapping campaign. Urban areas are especially prone to high temperatures due to a combination of hard surfaces (buildings, roads), limited vegetation (such as trees), and heat-producing factors like car use and industrial activity. This problem, known as the urban heat island effect, can create human health, infrastructure, and quality of life. Understanding how temperatures vary based on the natural and built landscape qualities can inform how we reduce the impacts of rising summer temperatures in our communities.

This heat mapping project is part of a larger initiative, Heat Watch, lead by CAPA Strategies and supported by the National Oceanic and Atmospheric Administration (NOAA)'s Climate Program Office.

Houston is at a great inflection point for climate resilience, human health and well-being, and biodiversity conservation. At The Nature Conservancy, we are proud to work closely with our highly skilled colleagues at HARC to better understand the extent of urban heat inequities, biodiversity trends, and the role and distribution of tree canopy and vegetation throughout our region – all with the goal of improving the lives of all Houstonians, both human and wild.

The Nature Conservancy
Jaime Gonzalez, Houston Healthy Cities Program Director



HARC Butterfly & Pollinator Garden

By developing a Butterfly and Pollinator Garden, HARC's campus will continue to serve as a teaching tool for the many visitors who come to the facility. The project redevelops four landscape beds and the surrounding area into pollinator gardens infused with native plant species selected to maximize benefits to pollinators.

COVID-19 Research Work

COVID-19: AIR QUALITY IMPROVEMENTS HOUSTON-GALVESTON-BRAZORIA (HGB)

	MARCH 11 - APRIL 13	MARCH 11 - APRIL 30	MARCH 11 - MAY 21	MARCH 11 - JUNE 11
BTEX	39% ↓	32% ↓	26% ↓	21% ↓
NOx	46% ↓	18% ↓	15% ↓	14% ↓
OZONE	17% ↓	7% ↓	~1% ↓	9% ↑
TOTAL VOC	9% ↓	~3% ↓	Unchanged	Unchanged

With the novel Coronavirus pandemic, regulatory measures were enacted by local governments throughout the Greater Houston region and across the state of Texas. In addition to slowing the rate of infection, reducing the burden on medical facilities, and saving lives, these stay-at-home orders also have far-reaching effects on infrastructure systems, communities, and the environment. Researchers at HARC (the Houston Advanced Research Center) analyzed data describing regional mobility, air quality, and energy demand to determine the extent of regional and statewide changes due to COVID-19 and the resulting stay-at-home orders.

Green Building: HARC HQ

Over the 25-year lifespan of the solar system, 1,375 tons of CO2 will be eliminated from HARC's footprint. That is the equivalent of planting 33,748 trees or driving 3,225,947 fewer miles.

HARC's physical workspace is a Living Lab, a space that embodies its mission and will continue to grow and evolve. Beautiful and energy-efficient, the building is designed to be sustainable and has an energy consumption 77% lower than the average office building. In addition, the building's 88 kW photovoltaic plant has saved 140.56 tons of CO2. And in 2020, HARC's headquarters became the first Net Zero Energy certified commercial building in Texas.

The organization has met the targets of obtaining 100% of the power used from onsite renewable resources and achieved net-zero emissions in building operations. HARC is creating links to the UN Sustainable Development Goals as it develops quantitative and qualitative sustainability targets; however, HARC's top priority is employee health and safety.

HARC: A Partner in Education and Outreach

Gulf Coast Water Conservation Symposium

On October 28 – October 29, 2020, the Gulf Coast Water Conservation Symposium celebrated its 9th year. With 145 attendees, the symposium brought together local water utility managers, engineers, architects, and community members to learn about water resource management and water conservation. The program provided attendees with the information needed to implement successful water conservation programs, effectively engage customers, and plan for the future.

The Culture of HARC

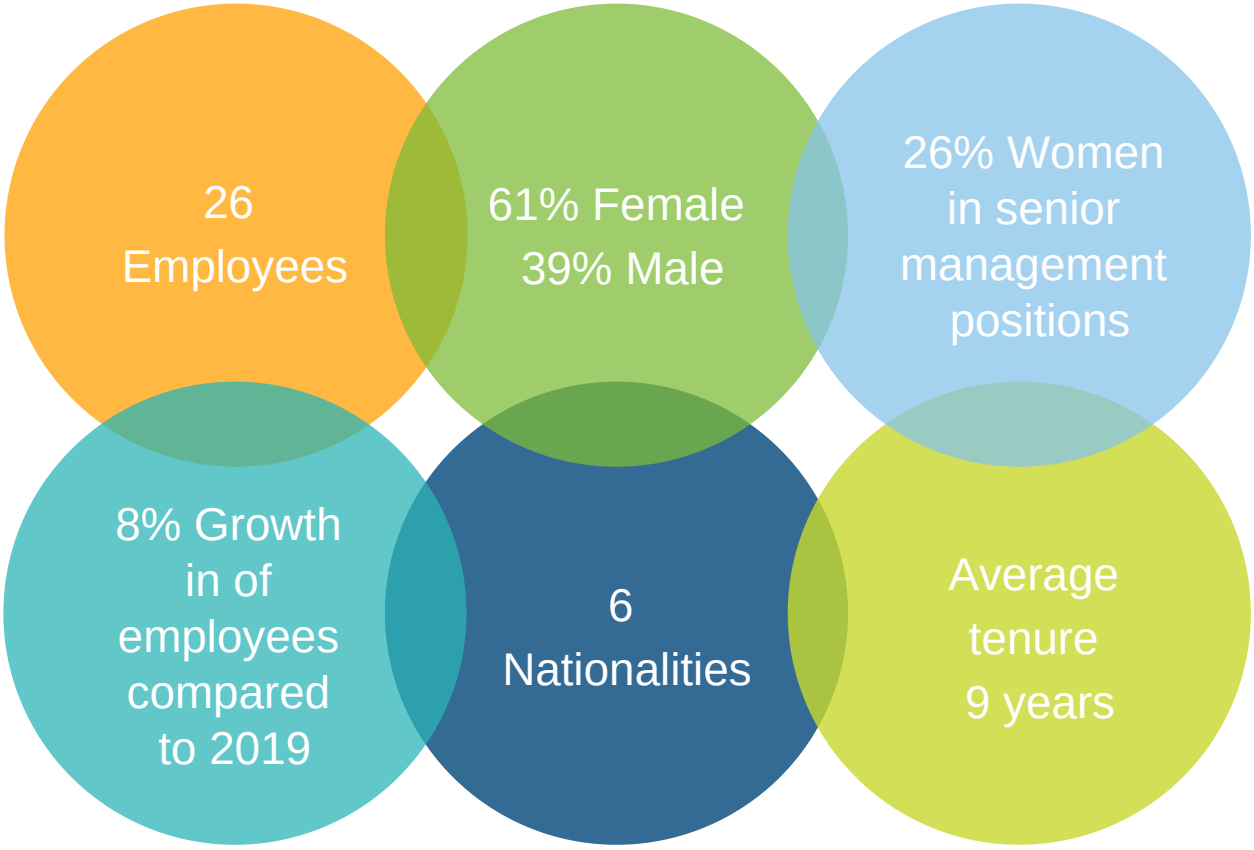
HARC's goal is for employees to have a sense of purpose and meaning in their work and for that work to take place in a sustainable, inclusive, and flexible environment. Well-being is front and center as it cultivates resilience in people and keeps colleagues healthy, productive, and safe while working together in or out of an office. HARC knows that its employees will achieve full potential in an environment of respect, trust, and inclusivity.

Employee diversity
HARC is a multicultural organization comprised of 26 employees. The organization embraces its diverse workforce, representing a wide range of backgrounds, countries, experiences, and cultures.

HARC's approach to Diversity and Inclusion continues to evolve with increased awareness and communication. Everyone should be included and respected.

Employee Attraction and Retention
Attracting and retaining top talent is a hallmark of our success, and HARC actively recruits candidates who share a passion and commitment to advancing sustainability.

Employee Development and Education
HARC enables employees to continue to grow, providing ongoing opportunities for personal development and career advancement.



Caring for our employees during COVID-19

HARC was well-positioned to sustain operations and quickly respond to the demands of navigating the COVID-19 global pandemic. Work is defined as a thing we do, supported by an ecosystem of culture, technology, and resources.

This organizational resilience enabled HARC to maintain business operations virtually and transform the workplace, blending the physical and virtual environments to work together or independently anywhere. It continues to refine what the workplace means at HARC, intending to find the balance between corporate culture and the needs of employees.

A top priority for 2020 was the well-being and resiliency of its employees. HARC found that in 2020, employees recorded fewer sick days than in the previous year.

Through regular staff engagement, including well-being surveys, HARC heard how staff were handling the situation and understand how it could better support each team member. In recognition of the challenges that COVID- 19 added, HARC supported work from home by providing electronic equipment, providing time and space for team building and recharging. Mitigating risk to the team required new policies, infrastructure, and behavior changes, and continued communication to maintain a high level of trust.

John Hall
HARC President and CEO
jhall@HARCresearch.org
281.364.6044

Mustapha Beydoun, PhD
HARC Vice President and COO
mbeydoun@HARCresearch.org
281.364.6046

HARC

8801 Gosling Road
The Woodlands, TX 77381

HARCresearch.org

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