Highlights from FY 2022: Annual Report

Duke
NICHOLAS INSTITUTE
for ENERGY, ENVIRONMENT
& SUSTAINABILITY

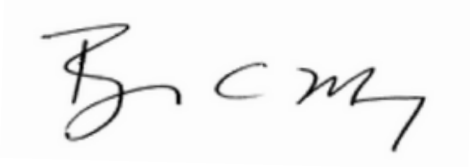
The most recent fiscal year has been a momentous one for all of us at the Nicholas Institute for Energy, Environment & Sustainability. We became a unified team with the merger of the Duke University Energy Initiative and Nicholas Institute for Environmental Policy Solutions, a process that formally began on July 1, 2021. Together, we have navigated the challenges of an organizational shift and seized opportunities to have even more impact as a merged institute.

The new Nicholas Institute team has also worked alongside university leadership to help develop the vision, strategy, infrastructure, and early programming for the Duke Climate Commitment. This university-wide effort builds on Duke's longstanding leadership in climate, energy, and sustainability to educate a new generation of climate-fluent innovators and create equitable solutions for all.

Meanwhile, our merged team has drawn on the strengths of both legacy organizations to continue effectively collaborating with stakeholders within and outside the university to advance a sustainable future.

Alongside our partners, we have had immediate impact by engaging with key decision makers at the global, national, state, and local levels on solutions to critical energy and environmental problems. And we are developing future solutions through transformative educational experiences, cultivating a lively university-wide energy community, and galvanizing and conducting impactful research. This report highlights just a sample of the successful efforts we have spearheaded this year.

I am proud of all we accomplished in FY 2022 and am confident that, as we fine-tune our approach and strategy, the new Nicholas Institute will continue to boost Duke University's efforts to develop a more just and sustainable world.



Dr. Brian Murray
Interim Director
Nicholas Institute for Energy, Environment & Sustainability

Duke | CLIMATE COMMITMENT

The Duke Climate Commitment unites the university's education, research, operations, and public service missions to address the climate crisis.

The commitment builds on Duke's longstanding leadership in climate, energy, and sustainability to educate a new generation of climate-fluent innovators and create equitable solutions for all.

The commitment has identified four areas of focus for our work:

- Energy transformation
- Climate and community resilience
- Environmental and climate justice
- Data-driven climate solutions

The Nicholas Institute team has worked alongside university leadership to help develop the vision, strategy, infrastructure, and early programming for the Duke Climate Commitment.

Looking forward, the institute—with its existing web of collaborations within and beyond the university—is well-positioned to play a major role in the Duke Climate Commitment's success.

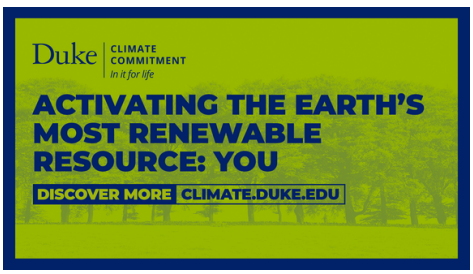
LEARN MORE:

climate.duke.edu

WATCH THE PLAYLIST:

bit.ly/playlistdcc

Featuring videos connected to the September 2022 announcement, including a conversation between Brian Murray and John Kerry



Advancing Early Programming for the Duke Climate Commitment

In FY 2022—before the Duke Climate Commitment's formal announcement—the Nicholas Institute team worked to establish new programs to advance the university-wide effort.

Collaboration Grants Launch New Research Partnerships

The first round of University-Wide Collaboration Grants on Climate Change funded eight Duke University faculty teams to lay the groundwork for new research on climate change and its impacts.

The teams are investigating a diverse range of topics:

- Planetary engineering
- Climate justice
- Low-carbon heating and cooling methods
- Lithium mining
- Agricultural histories
- Coastal resilience
- Impacts of extreme weather on forest ecosystems

The program is administered by the Nicholas Institute as part of the Duke Climate Commitment.

BY THE NUMBERS

8 TEAMS of scholars representing

7 DUKE SCHOOLS

13 DEPARTMENTS

8 UNIVERSITY-WIDE INSTITUTES, INITIATIVES, & CENTERS

MEET THE TEAMS:
bit.ly/round1climate

The institute is working to expand this initial offering into a more comprehensive climate change research and innovation seed grant program with larger grants made available with a mix of philanthropy and university and institute strategic funds.

Climate+ Engages Duke Students in Data-Driven Climate Research

The Nicholas Institute partnered with the Rhodes Information Initiative at Duke to expand student opportunities to apply cutting-edge data science methods to climate challenges. Climate+ launched with funding from the Duke Endowment.

THE RUNDOWN ON CLIMATE+

- *A new vertical within Data+, a full-time, 10-week summer program open to all Duke students*
- *Teams of up to three undergraduates and one graduate student, with faculty mentor(s)*
- *Advancing climate research while learning how to marshal, analyze, & visualize data*
- *Interacting with guest experts in data science, environment, and energy*

HEAR FROM STUDENTS:
bigdata.duke.edu/climate

Duke Climate Expertise Spotlighted by State Department Seminar Series

WATCH THE SEMINARS:
bit.ly/climategilman

Experts from across Duke shared insights about international climate policy with university students across the nation in a spring 2022 seminar series funded by the US Department of State.

The Nicholas Institute designed the series for students and alumni of the State Department's Benjamin A. Gilman International Scholarship Program, which supports American students of limited financial means to study or intern abroad. The series was also open to the public.

Education, Research, & Engagement

The Nicholas Institute advances Duke's mission to build a more sustainable world by:

- Developing transformative educational experiences
- Galvanizing and conducting impactful research
- Engaging with key decision makers at all levels to create solutions to pressing energy and environmental problems

Those three efforts are intentionally intertwined.

This interconnectedness is visible, for example, in the contributions of the Nicholas Institute's 55 student assistants during the 2021–2022 academic year. The students—enrolled in undergraduate and graduate degree programs across seven Duke schools—brought diverse skillsets and perspectives to our work, further developing their own expertise by tackling real-world projects to advance environmental progress.

HOW STUDENTS HELP POWER OUR WORK:
bit.ly/55bluedevils

What follows is a sampling of the Nicholas Institute's educational offerings and research and engagement projects over the past fiscal year. While not comprehensive, this collection indicates the depth and range of our work in three key areas:

ENERGY TRANSFORMATION

NATURAL RESOURCES POLICY SOLUTIONS

ENVIRONMENTAL & CLIMATE JUSTICE

ENERGY TRANSFORMATION

2021 Clean Energy Prize Winner Targets Dirty Solar Panels

The Nicholas Institute and Duke Innovation & Entrepreneurship award the $10,000 Clean Energy Prize annually to help fund Duke students pursuing novel ideas, potential products, or services that advance an accessible, reliable, affordable, and clean energy future.

Michael Valerino (PhD '22) received the 2021 Clean Energy Prize to support his team's development of an interactive, data-driven platform aimed at reducing dust-related solar energy losses. Since earning his PhD in civil and environmental engineering from Duke's Pratt School of Engineering, Valerino has continued to pursue the work by cofounding Solar Unsoiled.

Valerino's project addresses the accumulation of dirt and grime on solar panels, which reduces the amount of sunlight that reaches the cells. Solar panel soiling can reduce peak electricity production by 10 to 40 percent in a matter of weeks in many parts of the world, causing billions of dollars in estimated losses annually.

Solar Unsoiled will utilize the platform that Valerino and his team started at Duke to help solar energy producers optimize when to clean their panels. The startup received $650,000 in funding from Cypress Creek Renewables in late summer 2022, and the company has been named to the third cohort of the Techstars Alabama EnergyTech Accelerator.

READ THE PRIZE ANNOUNCEMENT:
bit.ly/cepwinner21

"The Clean Energy Prize was really the first opportunity that put Solar Unsoiled 'on the map'—and the resulting waterfall from winning the prize has been instrumental in getting us rolling.

People in my network reached out with industry professionals they knew, and I even had some Duke alums reach out offering help. These valuable connections have really helped us build our product alongside our industry partners."

- Michael Valerino (PhD '22)
Cofounder of Solar Unsoiled

ENERGY TRANSFORMATION

Lab Applies Remote-Sensing Imagery to Energy and Climate Challenges

Duke University's Energy Data Analytics Lab is a collaboration among the Nicholas Institute, Rhodes Information Initiative at Duke, and Social Science Research Institute.

This year, the lab contributed substantial research on the use of remote-sensing imagery for energy and climate applications, including:

- Evaluating energy access resource needs using drones
- Automatically mapping the growth of transmission and distribution infrastructure
- Exploring how to scale up remote sensing energy and climate analysis tools

LEARN ABOUT THE LAB'S WORK: bit.ly/energydatalab

ENERGY TRANSFORMATION

Six NC Students Named Energy Data Analytics PhD Student Fellows

Doctoral students from Duke University, North Carolina State University, and the University of North Carolina at Chapel Hill make up the latest cohort selected to take part in a unique Duke-based program aimed at preparing energy and climate innovators to make an impact.

The Energy Data Analytics PhD Student Fellows program is designed to deepen participants' expertise in data science and energy topics, spur impactful research, and create a network of faculty and students interested in applying data science to energy challenges.

The program is funded by a grant from the Alfred P. Sloan Foundation.

MEET THE FELLOWS: bit.ly/edafellows22

ENERGY TRANSFORMATION

Internship Program Helps Duke Students Explore Energy Careers

In its fourth year, the Energy Internship Program connected Duke students across diverse degree programs to summer learning experiences across the energy sector, including at startups, utilities, renewable energy developers, large firms, government agencies, and non-governmental organizations. In many cases, students' supervisors were Duke alumni.

The program, working in partnership with the James E. Rogers Energy Access Project, also awarded $63,000 to support 13 Duke students to accept low-paying or unpaid internships.

In addition to facilitating real-world learning for students, the program adds value for alumni and other industry connections, and it has helped develop and strengthen recruiting pipelines.

ENERGY TRANSFORMATION

DOE-Funded Project Aims to Advance Offshore Wind Energy with Research-Based Guidance

Experts at Duke's Nicholas School of the Environment and the Nicholas Institute for Energy, Environment & Sustainability have launched a consortium that aims to advance East Coast offshore wind development while minimizing risks to birds, bats, and marine mammals.

The Wildlife and Offshore Wind (WOW) research project is funded by a $7.5 million grant from the US Department of Energy to support a Duke-led consortium that engages researchers at 15 institutions. Their findings will inform decisions about locations of future wind farms and help identify steps that can be taken to reduce harmful impacts on wildlife as offshore wind deployment increases.

Nicholas Institute Interim Director Brian Murray spearheads the project's engagement with industry leaders and other stakeholders.

BY THE NUMBERS

30

Gigawatts of energy produced by US offshore wind under a federal goal for 2030

78 million

Metric tons of carbon emissions that could be saved annually by reaching that goal

77,000

Estimated jobs that would be supported in the sustainable ocean economy

ENERGY TRANSFORMATION

New Gift Honors Visionary, Expands Duke's Efforts on Energy Access

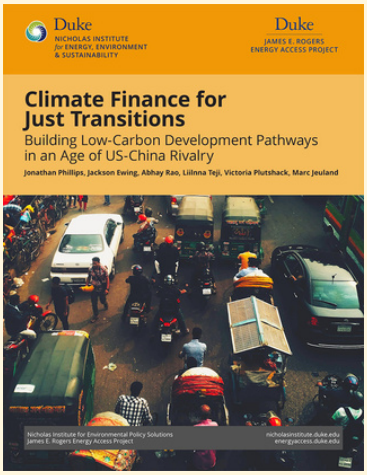
In developing countries, access to modern energy has far-reaching effects on economic opportunity, well-being, and even greenhouse gas emissions that cause climate change. A $3 million gift from donor M.A. Rogers will redouble Duke University's interdisciplinary efforts to develop policy and market solutions to this challenge through the renamed James E. Rogers Energy Access Project at Duke (EAP).

The gift and EAP's new name honor Rogers' late husband, Jim, the former CEO and chairman of the board of the electric utility company Duke Energy. Jim Rogers worked with Duke University over more than a decade to develop partnerships and identify opportunities for expanding energy access. Those efforts included serving on the Nicholas Institute's Board of Advisors and providing an earlier gift to establish EAP in 2017.

READ MORE ABOUT EAP:
bit.ly/RogersEAP

"Jim believed that solving global energy poverty is essential to building a more equitable and sustainable world. He brought to Duke his philosophy of building bridges and gathering talented people together to solve this tremendous challenge. And now seeds that he planted years ago have become a model for how universities can use the power of partnership to mobilize the ideas and resources needed to solve big challenges."

- M.A. Rogers



Project: New Frontiers in Climate Finance

EAP's New Frontiers in Climate Finance project is scoping the challenges and opportunities inherent to climate finance in low- and middle-income countries. Funded by the William & Flora Hewlett Foundation, the project seeks to help increase the scale and transformational impact of climate finance to these economies.

Read more about the project: bit.ly/eapfinance

NATURAL RESOURCES POLICY SOLUTIONS

Resilience Roadmap Paving Way for National Climate Resilience Strategy

Convened by the Nicholas Institute, the Resilience Roadmap project offers actionable recommendations to inform a federal agenda for strengthening US resilience to the impacts of climate change. Leading experts from states, local and tribal communities, civil society, academia, and the private sector have volunteered their time and knowledge for the project.

The Resilience Roadmap publicly launched in April 2021 with the release of its initial, high-level guidance to the Biden administration.

Building on that launch, the project cohosted a fall 2021 webinar in which administration officials and community leaders exchanged ideas about how the US should advance an inclusive and just climate resilience strategy. A virtual discussion in summer 2022 brought together two members of Congress—Reps. Scott Peters (D-CA) and John Curtis (R-UT)—who are working across party lines to advance a national climate resilience strategy.

The latter event coincided with publication of a policy brief that followed up on the project's original recommendations. The brief evaluated the administration's progress on climate resilience to-date while suggesting additional steps to meet the scale of the challenge.

LEARN MORE:
resilienceroadmap.org

WATCH THE WEBINARS:
bit.ly/resiliencevids

PRINCIPLES

The Resilience Roadmap's recommendations are based on the underlying principles that resilience-building must:

(1) Be integrated and coordinated throughout all levels of government
(2) Deliver tangible, on-the-ground benefits
(3) Benefit communities equitably and justly

NATURAL RESOURCES POLICY SOLUTIONS

Analysis Finds Plastic Pollution Prevention Efforts Slowed During Pandemic

Launched in 2020 by the Nicholas Institute, the Plastics Policy Inventory is a searchable database of hundreds of public policies introduced around the world since 2000 to target plastic pollution.

SEARCH THE INVENTORY:
bit.ly/PlasticsPolicyInventory

An analysis of the inventory conducted by Duke University researchers and students suggests that a two-decade trend of steadily increasing national policy responses to plastic pollution stalled during the COVID-19 pandemic. That slowdown coincided with a rise in medical waste and single-use and disposable plastics for personal protective equipment and packaging.

BY THE NUMBERS

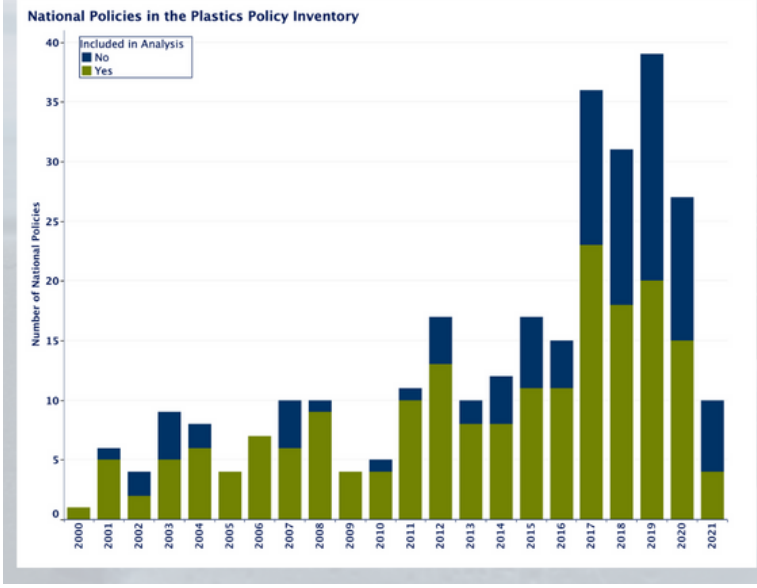
129

Countries with at least one national or subnational policy documented in the inventory

The February 2022 brief detailing the analysis is intended to be the first in a series of annual updates tracking worldwide trends and gaps in government responses to plastic pollution. The updates and the inventory could prove to be useful tools for global policy makers who are negotiating a treaty to create legally binding rules for the use and disposal of plastics by 2024.

ANNUAL TRENDS IN PLASTICS POLICY:
Has COVID-19 impacted policy uptake?

Duke NICHOLAS INSTITUTE *for* ENERGY, ENVIRONMENT & SUSTAINABILITY



- A 20-year rise in the number of national policies targeting plastic pollution stalled in 2020.
- Policy priorities may have shifted away from plastic pollution after the onset of the COVID-19 pandemic.
- Meanwhile, medical waste and the use of disposable plastics and packaging have increased significantly since March 2020.
- More evidence is needed to determine the effect of COVID-19 on plastics policy.

See the latest analysis of global plastics policy:
bit.ly/PlasticsPolicyInventory

Funding and support provided by:
UNDP Ocean Innovation Challenge
Sida
Norad

NATURAL RESOURCES POLICY SOLUTIONS

Dashboards Map Benefits of NC's Natural and Working Lands

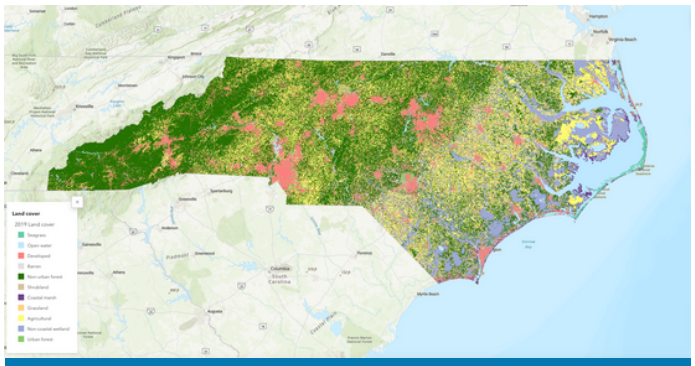
The Nicholas Institute's Ecosystem Services Program unveiled a suite of online tools this year that puts detailed data about the benefits and conservation status of North Carolina's forests, farms, and wetlands at users' fingertips.

Natural and working lands provide numerous critical benefits to the state's people and economy: protecting water quality and supply, reducing flood risk, providing habitat for pollinators, and much more. These lands—particularly forests—also store carbon in their soils and vegetation, helping to offset greenhouse gas emissions that cause climate change.

BY THE NUMBERS

>80

Percentage of North Carolina covered by natural and working lands



EXPLORE THE DASHBOARDS:

bit.ly/nc-nwl

Three dashboards allow users to quickly see these benefits by county, river basin, or land type. Communities, land managers, and non-governmental organizations can use that granular information to make management and planning decisions.

Over time, the dashboards could also help identify long-term trends to improve understanding about how land use and management affect the benefits that natural and working lands provide.

NATURAL RESOURCES POLICY SOLUTIONS

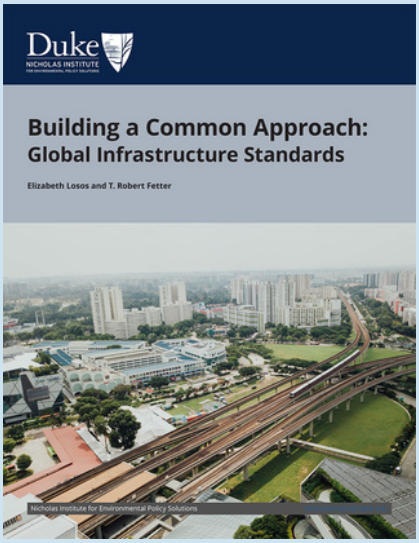
Interactive Webinars Connect Sustainable Infrastructure Community

The "Sustainable Infrastructure: Putting Principle into Practice" webinar series brought together sustainable infrastructure experts and practitioners from around the world to learn from each other and share their knowledge and experiences. The Nicholas Institute partnered with several other organizations to host the interactive series.

Each session was structured around the UN Environment Programme's International Good Practice Principles for Sustainable Infrastructure. Participants from engineering firms, government agencies, financial institutions, civil society organizations, and academia joined the series to:

- Exchange state-of-the-art knowledge on how to plan and build sustainable infrastructure
- Engage in a forum to learn from other practitioners
- Connect with a community of individuals and organizations engaged in the sustainable infrastructure sphere

WATCH THE SERIES:
bit.ly/siwebinars



Publication: Building a Common Approach to Global Infrastructure Standards

Investors lack a reliable, widely recognized global standard for quality, sustainable infrastructure. A report by Elizabeth Losos (Nicholas Institute) and T. Robert Fetter (Duke Center for International Development) examines three separate initiatives tackling this issue. The report recommends actions for reducing confusion between the standards and ensuring their success.

Read the report: bit.ly/commonapproach

NATURAL RESOURCES POLICY SOLUTIONS

Infrastructure Bill Gives National Role to Internet of Water

The Internet of Water is an innovative project started at the Nicholas Institute to build support for transforming and modernizing public water data infrastructure and enabling equitable, sustainable, and resilient water management.

With one sentence in the $1.2 trillion Infrastructure Investment and Jobs Act, Congress made the Internet of Water a model for a national pilot program to improve how water data is shared.

The bipartisan law directs the US Environmental Protection Agency to use principles developed by the Internet of Water to "guide any water data sharing efforts" under the program. The EPA will grant $15 million to projects aimed at more easily sharing information between state and local agencies.

> *"Water data infrastructure is a critical part of the nation's water infrastructure; modernization needs to start with our basic data infrastructure."*
>
> **- Martin Doyle**
> **Water Policy Program Director, Nicholas Institute**

NATURAL RESOURCES POLICY SOLUTIONS

Internet of Water Coalition Launches

Internet of Water COALITION

READ MORE ABOUT THE COALITION:
bit.ly/iowcoalition

Through its early existence, the Internet of Water was managed by a small team of water scientists, data architects, policy experts, and program coordinators in the Nicholas Institute's Water Policy Program. That changed in March 2022.

The new Internet of Water Coalition brings together independent organizations to work with federal, state, and local government partners around the common goal of modernizing water data infrastructure in the United States. As part of this new phase, the Lincoln Institute of Land Policy's Center for Geospatial Solutions formed the Internet of Water Initiative to operationalize innovations developed by the Nicholas Institute team.

ENVIRONMENTAL AND CLIMATE JUSTICE

Water Policy Program Tackles Affordability Challenges in the US

Water services are essential to the health and well-being of every community—from providing safe, reliable drinking water, to removing and treating wastewater, to managing the flow of stormwater. Yet costs for providing these services are steadily rising for both utilities and their customers.

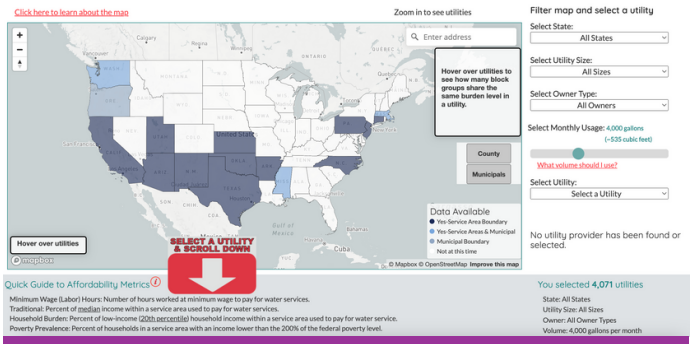
The Nicholas Institute's Water Policy Program developed a tool called the Water Affordability Dashboard—along with a companion website—to provide a clearer picture of how affordable water services are in US communities. The dashboard helps users explore four key questions for each utility:

- Who lives in the service boundaries?
- How much do water services cost?
- How affordable are water services?
- How does affordability change with water usage?

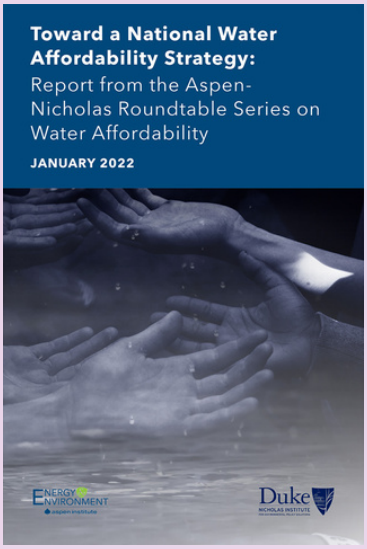
BY THE NUMBERS

4,071

Utilities in 17 states with data in the dashboard through September 2022



EXPLORE THE DASHBOARD:
bit.ly/h2o-affordability



Publication: Toward a National Water Affordability Strategy

The Aspen Institute–Nicholas Institute Roundtable Series on Water Affordability convened US water leaders through the fall and winter to discuss solutions for ensuring that water services are affordable for all households and communities. This report details a series of actions and recommendations from roundtable experts aimed at creating a national water affordability strategy.

Read the report: bit.ly/strategy-h2o

ENVIRONMENTAL AND CLIMATE JUSTICE

Stakeholder Initiative Aims to Reduce Energy Insecurity in Southeast

The Southeast Energy Insecurity Stakeholder Initiative brought together more than 60 participants to explore opportunities for reducing energy insecurity in the region. The Nicholas Institute, in partnership with Appalachian Voices and the North Carolina Justice Center, facilitated discussions with this diverse group of stakeholders from local, state, regional, and national organizations.

BY THE NUMBERS

1 in 4

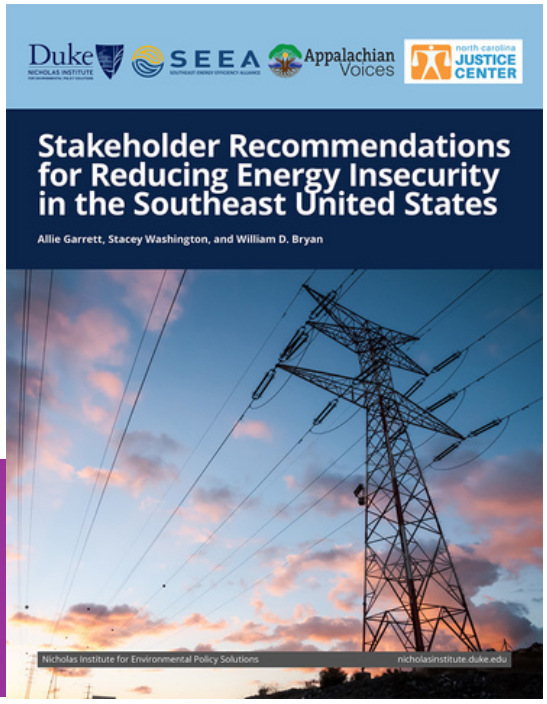
Households in the Southeast that spend more than 6 percent of gross household income on energy bills

Energy insecurity is the inability to adequately meet basic household energy needs, such as heating, cooling, and lighting. For impacted families, energy insecurity can drain long-term savings, limit economic opportunities, and lead to difficult tradeoffs between energy and other vital services and household items, such as food, housing, or healthcare.

In a May 2022 report, initiative participants made 24 recommendations for meeting energy insecurity challenges in the Southeast.

The recommendations fit into six categories:

- Awareness and community engagement
- Data access and improvement
- Housing
- Programs and access to financing
- Systemic change
- Utility solutions



READ THE REPORT:
bit.ly/seeireport

Remembering Pete Nicholas

In May 2022, the Duke University community lost Peter M. Nicholas, the visionary and philanthropist who became synonymous with the university's commitment to environmental education and solutions.

A Duke alumnus with a degree in economics, Nicholas was the cofounder and retired CEO of Boston Scientific Corp. His volunteer leadership at Duke spanned more than three decades. Nicholas and his wife Ginny, a fellow member of the Class of 1964, also generously supported the university's research and educational initiatives over the years.

READ THE FULL TRIBUTE:
bit.ly/petenicholas

Their philanthropy has especially shaped Duke's approach to addressing environmental issues, as evidenced by two organizations that bear the family's name—the Nicholas School of the Environment and the Nicholas Institute for Energy, Environment & Sustainability. Pete Nicholas' influence will continue to be deeply felt through the Duke Climate Commitment. The family helped launch the university-wide initiative with a $25 million gift announced in the fall.

"He will forever have an indelible imprint on Duke and Duke's leadership on energy and the environment. What this university has built over the past three decades, taking a global leadership role on these challenges, has been because of the generosity and vision of Pete and Ginny Nicholas. There is so much more work to be done, but they have given the university a platform to be a generator of solutions to these problems. That will be a legacy that lasts for years and years."

- Tim Profeta
Founding Director, Nicholas Institute