

RESILIENCE



FROM PRINCIPLES TO ACTION:
*Corporate Innovation Stories to
Build Climate Resilience*



by

The Center for Climate and Energy Solutions

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Disclaimer: The views and conclusions outlined in this document reflect consolidated insights are those of C2ES and should not be attributed to any individual or company mentioned below.

FOREWORD

As we confront unprecedented climate risks—from more frequent extreme weather events to rising sea levels and destabilized ecosystems—the consequences for businesses are accelerating. Supply chains are being disrupted, critical infrastructure is under strain, and entire industries are grappling with the realities of a rapidly changing environment. These trends are not short term; they are intensifying in both scale and complexity, making it clear that resilience is not just an option—it is a strategic imperative. As key drivers of investment and economic growth, businesses play a central role in shaping resilient, prosperous communities worldwide. Corporate leadership on climate resilience, therefore, has never been more vital.

We are releasing this publication on the eve of COP29 in Baku, and the urgency for businesses to act has never been greater. The world is watching how companies respond to the climate crisis—not just in statements, but in tangible actions. The stories featured here document how businesses can lead the way in building resilience to the physical impacts from a changing climate. These companies are the exception, not the rule, but they demonstrate what is possible when resilience becomes a core business priority.

Last year, we introduced the *Principles for Corporate Climate Resilience Leadership* to guide companies in taking proactive, science-based action. Since then, the conversation around climate resilience has shifted significantly. Companies are increasingly recognizing that resilience is not just about protecting assets, but about securing long-term success and competitiveness in a world undergoing rapid change. We are at a pivotal moment.

At the Center for Climate and Energy Solutions (C2ES), we've seen firsthand how companies are rising to meet this challenge. Through our *Innovation Stories*, as part of our *Corporate Climate Resilience Pathways Initiative*, we are highlighting real-world examples of businesses adapting to climate risks and turning them into opportunities for growth, systemic change, and leadership for their sectors. These stories demonstrate how companies are driving innovation while making meaningful contributions to the communities they support, and on which they depend for workforce and operational continuity.

But this journey is just beginning. C2ES is committed to scaling climate resilience by building the insights, tools, and partnerships that will enable the business community to lead. As we approach this critical juncture for corporate climate resilience, bold leadership is more important than ever. We invite more companies to join us in shaping a future where businesses and communities thrive together in the face of mounting climate challenges. The choices we make today will determine the resilience and prosperity of our economies tomorrow.

Nat Keohane
President

Center for Climate and Energy Solutions



INTRODUCTION

Climate change is no longer a distant threat—it is reshaping industries in real time. More frequent heat waves, stronger hurricanes, extreme precipitation, and prolonged droughts are disrupting operations, impacting supply chains, and affecting the communities where businesses operate. Businesses, as key drivers of investment, innovation, and economic productivity, are uniquely interconnected with everything—from supply chains and infrastructure to the livelihoods of employees and the health of the communities where they operate. As such, they have a critical role to play in building a more resilient future and must also adapt swiftly to survive a changing climate, with those leading on climate resilience positioning themselves for long-term success.

Resilience, in general, is widely viewed as the capacity to bounce back, evolve, and thrive amid unexpected events, shocks, or stressors. For major companies, resilience involves a holistic approach to organizational design, behaviors, and work practices that promote agility, adaptability, and creative problem-solving to adapt, withstand, and recover from disruptions while maintaining value delivery to stakeholders. Additionally, it requires a deep understanding of the various risks an organization faces and its ability to effectively navigate and recover from them. To meet the current and increasingly severe impacts from climate change, companies must adjust their strategies and internal structures to meet climate-related challenges; have the tools and

knowledge to effectively assess and manage these risks; foster a culture of continuous improvement, innovation, and shared knowledge; promote resilience as a strategic priority from leadership; and build trust through active engagement with all stakeholders—especially those communities in which they operate.

In these ways, companies can better navigate the uncertainties of climate change, ensuring they can foster long-term growth and both economic and environmental sustainability. As more companies implement climate resilience measures—some starting with key projects, and some implementing resilience at the enterprise level—it is important that their stories and experiences are shared to inspire and inform how peers across industry sectors can begin to take action.

By illustrating the innovative approaches taken by companies across sectors, C2ES's *Corporate Climate Resilience Pathways* initiative aims to foster industry-wide leadership and create a ripple effect where companies can learn from one another, amplifying the positive impact of climate resilience measures across sectors. This effort joins a growing body of expertise and guidance, including contributions from organizations like the World Business Council for Sustainable Development¹ and the World Economic Forum,^{2,3} which emphasize the importance of cross-sector integration of climate adaptation and resilience into core business operations.

SHARING RESILIENCE INNOVATION AS IT HAPPENS

The following Innovation Stories spotlight how businesses are taking real-world action to build climate resilience across all facets of their operations. These stories illustrate how companies are aligning with the Principles for Corporate Climate Resilience Leadership, embedding the consideration of climate risk and opportunities into decision-making, and working collaboratively to create lasting change.

Importantly, these stories reflect a growing ecosystem—an interconnected community of businesses, governments, and stakeholders working together to address shared risks and build resilience. This emerging community of practice demonstrates that businesses play a critical role not only in their own resilience but also in shaping systems that enable resilience across sectors. The Innovation Stories showcase this interconnectedness, highlighting how businesses are contributing to larger, collective efforts.

The initial stories from AES Corporation (AES), AT&T, Dow Inc, Duke Energy, Turner Construction, and Meta demonstrate several emerging themes.

- **First, climate resilience requires innovation. Whether through restoring wetlands, leveraging advanced climate modeling, or transforming supply chains, companies are stepping outside of the business-as-usual to pioneer new approaches.** In some cases, the innovation takes shape as an adjustment of existing practice (e.g., considering climate projections in typical long-term investment decisions) and in others, it may require a new solution to a complex challenge (e.g., developing a free, high-powered open-source data tool to enable broad community resilience building). Regardless of their form, private sector companies are well suited to drive these innovations.
- **Second, collaboration is critical. Businesses are partnering with local communities, governments, nonprofits, and others to address shared risks, generate valuable stakeholder benefits, and avoid maladaptation.** The collaborations described in the following stories also serve to scale solutions for

greater impact—by increasing the size of program pilots and investments and leveraging unique capabilities and reach of outside organizations. This collaborative approach is also critical for internal success; various organizational departments are ensuring the relevance and adoption of several solutions described below.

- **Third, climate resilience solutions often benefit the bottom line.** These stories document tangible ways companies are investing in resilience to protect operations, improve efficiencies, maintain service continuity, safeguard valuable assets, and enhance employee productivity. How companies are preparing to replicate and expand these featured solutions underscores their value.
- **Finally, these stories highlight companies' human-centered goals, such as protecting employees and contributing to broader community resilience.** For example, businesses are incorporating climate considerations and advanced monitoring into their human resources strategies and strengthening community relations through partnerships that build local capacity and invest in important ecosystems.

These stories are just the beginning—our vision is to continue expanding the amount of case studies available to the public, showcasing an evolving capacity for resilience, and fostering collaboration to build a global framework for corporate climate resilience. By sharing insights and successes, we can build a community of practice that accelerates progress and turns climate resilience from a concept into reality for many companies.

Access the full Innovation Story Library here:
www.c2es.org/corporate-climate-resilience-innovation-stories.

INNOVATION STORIES

The stories featured here were gathered from leaders across a diverse range of sectors, including energy, technology, telecommunications, and construction, and showcase real-world strategies that advance corporate and societal goals.

A call to action is extended to companies to share their innovations and help shape the global discourse on climate resilience. Companies are encouraged to contribute their experiences through ongoing submissions, to share their insights and catalyze continuous learning across the private sector. *This library* will become a vital resource for companies looking to adopt or enhance their climate strategies, driving progress toward a more resilient and sustainable future.

Box 1: The Principles for Corporate Climate Resilience Leadership

The Principles for Corporate Climate Resilience Leadership report provides businesses with a foundational approach to guide their resilience efforts. Developed through extensive consultations with over 70 global companies and thought leaders, these principles reflect the collective understanding of how businesses can address the growing risks posed by climate change. They are designed to ensure companies are proactive, transparent, and committed to safeguarding both their operations and the communities they rely on. Together, they represent a strategic roadmap for companies seeking to build resilience in the face of growing climate challenges:

- 1. Science-Based and Proactive:** Companies acknowledge and assess the acute and chronic risks presented by the physical impacts of climate change and implement best practices in their planning and investments that enhance resilience across the value chain.
- 2. Transparent and Accountable:** Companies regularly measure and report assessed climate risks, adaptation actions, and their impacts in a consistent and transparent manner.
- 3. Safeguarding and Enhancing:** Companies employ practices that safeguard against maladaptation and increased vulnerability to physical climate hazards and strive to enhance the adaptive capacity of communities and natural ecosystems.
- 4. Inclusive and Equitable:** Companies strive to collaboratively engage value chains and local communities to understand and improve decision-making, contribute to systemic needs and priorities, and drive the implementation of equitable climate adaptation and resilience investments.
- 5. Transformative:** Companies support and pursue climate adaptation solutions that enable positive systems-level transformations within their organizations, industry sectors, and value chains, and in communities and natural ecosystems.

Innovation Stories are deeply rooted in these principles, providing real-world examples of how companies are putting them into action. These stories serve as a practical guide for businesses, showcasing resilience-focused leadership in practice. By aligning their strategies with these principles, companies can lead the way in building a more resilient and sustainable global economy.

DUKE ENERGY: RESILIENT TRANSMISSION FOR A CLEANER GRID

The North Carolina Innovative Transmission Rebuild project will reconstruct the Lee-Milburnie 230 kV transmission line, incorporating advanced conductors and monopole steel structures that will enhance resilience and reliability.

PROJECT OVERVIEW

The project will upgrade and rebuild the existing Lee-Milburnie 230 kV transmission line, leveraging a climate change resilient design incorporating high-temperature, low-sag (HTLS) advanced conductors and monopole steel structures that will enhance resilience and reliability within the existing right-of-way. This project will bring benefits of resiliency, reliability, and jobs to the communities directly and positively impacted by this project. The project will proactively increase the regional transmission capacity to support the efficient integration of clean energy resources including solar, battery storage, and future wind generation.

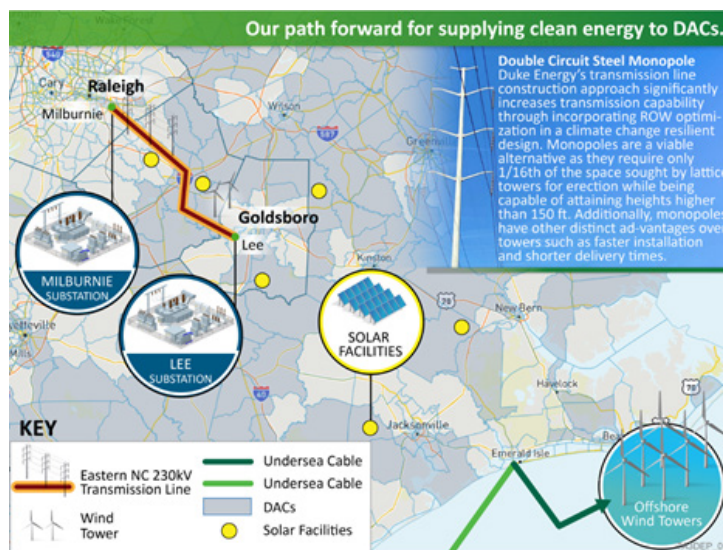
The project aligns with all the Principles for Corporate Climate Resilience Leadership, but in particular, demonstrates a commitment to the principles of “Science-Based and Proactive” and “Inclusive and Equitable.” In support of “Science-Based and Proactive,”

AT-A-GLANCE

Company Name: Duke Energy
Industry: Electric & Gas Utilities
Project Location: North Carolina, United States
Project Partners: Duke Energy Progress, LLC; North Carolina Department of Environmental Quality; North Carolina State Energy Office

this project is informed by the Duke Energy Carolinas/ Duke Energy Progress Transmission and Distribution Climate Resilience and Adaptation Report, which focuses on mitigating customer impacts from increasing storm intensity and reduced power transmission capacity caused by rising temperatures. The project supports the principle of “Inclusive and Equitable” through its impactful community benefits plan that includes a commitment to Justice40 and diversity, equity, inclusion,

Figure 1: Location of the North Carolina Transmission Rebuild



Source: Graphic Courtesy of Duke Energy

access (DEIA) initiatives, good-paying jobs, and ongoing two-way engagement with local disadvantaged communities and universities.

IMPLEMENTATION

Project Team: Duke Energy Progress, LLC: Office of the Project Manager; Offices of Community Benefits, Project Integration, Engineering, Permitting, and Construction

Transmission studies have shown the need to upgrade the Lee-Milburnie 230 kV line to enable the interconnection of new clean energy resources like solar, wind, and long-duration energy storage.⁴ Duke Energy is meeting this need with a transmission solution that incorporates climate change resiliency into the design, optimizes the existing right-of-way, and facilitates transmission expansion capability by allowing the addition of a second circuit in the future. The project also implements the company's climate change adaptation framework into an actual transmission line upgrade project that can be repeated across jurisdictions and for other transmission providers.

The project has a planned in-service date of 2031 and will involve rebuilding the entire 40.18 miles of the transmission line, replacing aging assets (such as wooden H-frame poles) with new modern infrastructure and advanced conductors, and incorporating switching options with future double circuit design.

The project demonstrates innovation in several ways. Monopole structures will utilize existing rights-of-way, being least disruptive to communities and avoiding any maladaptation by not requiring the establishment of new rights-of-way, which could disrupt additional ecosystems and/or affect additional communities. Monopoles require approximately one-sixteenth of the space of H-frame poles while reaching heights higher than 150 feet, allowing faster installation and shorter delivery times. The project includes the application of HTLS advanced conductors for climate change resiliency and adaptation design such that the lines are reliable and resilient through extreme weather events and facility ratings don't materially decrease during extreme hot weather.

IMPACT

This project will increase energy reliability and resiliency for more than 14,000 customers—with a focus on disadvantaged communities. The climate change resilient design will reduce customer impacts associated with interruptions from aging infrastructure and hurricanes and strong storms, with the following goals:

- Five-year average of Forced Outage Rate per Hundred Miles of Transmission per Year (FOHMY) for this line improves by at least 10 percent after project is in service.
- Five-year average of Customer Minutes Interrupted (CMI) for the customers connected to this line improves by at least 10 percent after project is in service.

The design will increase the capability of the transmission line from 541 MVA (megavolt amperes) up to 1195 MVA, which will enable the interconnection of at least 1,600 MW of solar and 260 MW of battery storage by 2030. Deploying a climate change resilient design and implementation through a right-of-way optimization roadmap will allow for repeatability, sustainability, and knowledge transfer to other utilities.

Additionally, the project includes a commitment to work with North Carolina A&T University, one of the nation's premier Historically Black College and Universities (HBCU), through its STEPS4GROWTH program, and Nash Community College to provide 80-line worker pre-apprenticeships, 40 line worker certificates, and 10 craft internships—growing a much-needed workforce.

META: HEATBOT THERMAL STRESS PROGRAM AT DATA CENTERS

Meta is introducing thermal stress tooling in Meta-owned data centers to reduce employee exposure to increasing heat conditions.

PROJECT OVERVIEW

In the last five years, Meta’s data centers have experienced extremely high temperatures due to the rapidly changing climate. To address this rising risk, Meta has deployed thermal stress tooling to support employee heat exposure risk reduction.

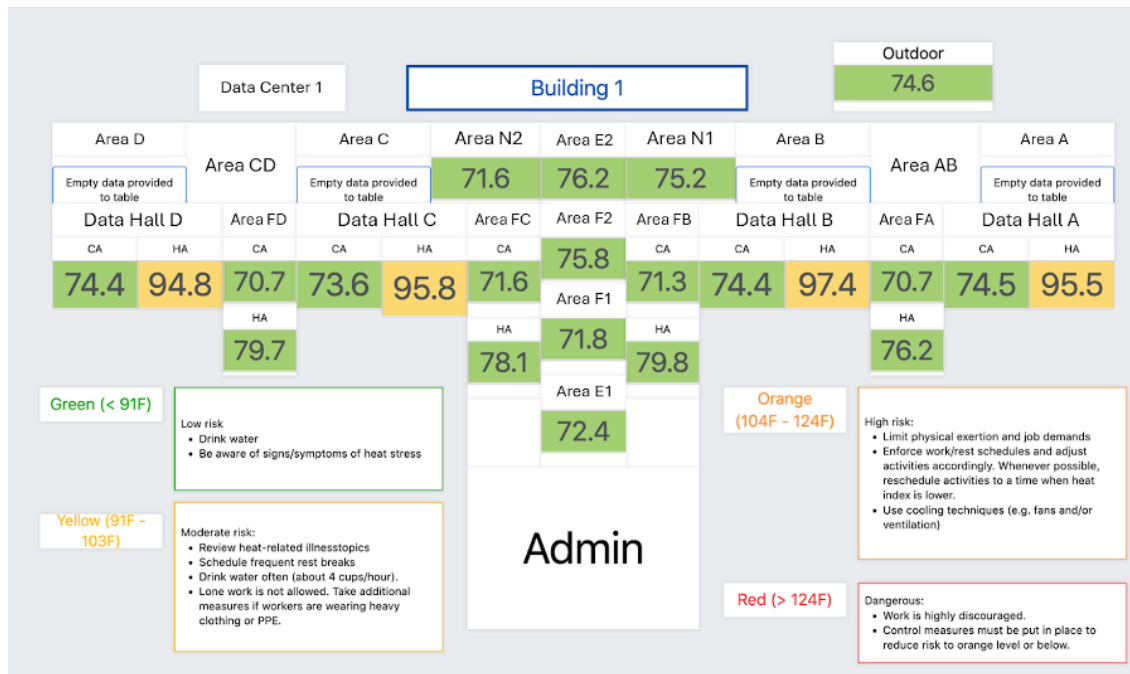
The main goals of this initiative are to increase awareness of higher heat working conditions within the data center in real-time; provide real-time notifications of current working conditions within data halls, outdoor areas, and supporting industrial spaces via work chat to all workers; and trigger employee risk reduction efforts when higher heat is detected, particularly when the heat index exceeds 90 degrees F.

AT-A-GLANCE

Company Name: Meta
Industry: Technology
Project Location: All Meta-owned data centers across the United States

The implementation of this project represents the “Science-Based and Proactive” corporate climate resilience principle as it makes employees aware of the changing temperatures in real time so they can take appropriate action. Additionally, the project represents the “Transparent and Accountable” principle. By recording and tracking the temperature data, Meta gains

Figure 2: Example Thermal Stress Dashboard



Source: Graphic Courtesy of Meta

the abilities to monitor the current effects from extreme temperatures and to use company-specific data to inform evaluations of future anticipated effects from this risk, both of which help inform decision-making on potential risk management measures.

IMPLEMENTATION

Project Team: Environmental, Health, and Safety (EHS); Facility Engineering; Global Security Services and Technology; Facility and Site Operations

Real-time and predictive heat index dashboards were deployed across Meta's U.S. data center sites. Real-time thermal stress dashboards were developed to capture real-time heat index and employee exposure risk within the industrial spaces of the data centers. The forecasted heat index dashboards provide an hourly seven-day look ahead that assists site teams in work planning. The model estimates the heat index by incorporating outside ambient conditions.

In conjunction with the dashboards, Meta developed a Heat BOT—an automated software application that uses dynamic data points to provide live notifications to employees via internal messaging. The Heat BOT notifies workers upon entry into data halls of the current temperatures and continues to notify them of condition changes while they remain badged into that space.

Prior to the development of the thermal stress dashboards and Heat BOT, workers were unaware of the op-

erational conditions in the data centers. The Heat BOT provides workers with relevant information for them to take action per Meta's internal standards. For example, depending on the temperature, employees may need to implement a work-rest regimen, apply cooling personal protective equipment (PPE), or stop work.

A Timeline of the Initiative

- September 2022: Thermal stress evaluation project kicked off at pilot data center.
- Q1 – Q2 2023: Thermal stress dashboards piloted at high-risk sites in the United States.
- Q3 – Q4 2023: Heat BOT project kicked off.
- Q1 2024: Heat BOT pilot completed.
- May 2024: Thermal stress dashboards and Heat BOT launched at all U.S. sites.

IMPACT

The Heat BOT has enabled teams to effectively manage work during higher heat conditions, enhancing the ability to meet capacity needs while keeping people safe. Additionally, based on the data and feedback from the sites, the thermal stress tooling Heat BOT will be leveraged in all current buildings and will be incorporated in all new buildings.

AT&T: INTEGRATING CLIMATE DATA INTO NETWORK PLANNING

AT&T collaborated with Argonne National Laboratory to develop detailed, future-oriented climate projections at the neighborhood level for integration into AT&T’s infrastructure planning processes for better assessment of climate risks.

PROJECT OVERVIEW

AT&T worked with the U.S. Department of Energy’s Argonne National Laboratory to produce forward-looking, neighborhood-level climate projections; they later integrated the data into infrastructure planning processes and systems to better assess and address climate risk

AT&T views reliable connectivity as vital to ensuring communities can thrive—day-to-day and during times of disaster. The impact of climate-related events on AT&T varies from year to year but can reach hundreds of millions of dollars. From 2016 to 2018, for example, AT&T spent \$874 million on natural disasters.

The goal in commissioning high-quality climate data and using it to guide infrastructure decisions was to bet-

AT-A-GLANCE

Company Name: AT&T

Industry: Telecommunications

Project Location: The United States

Project Partners: U.S. Department of Energy’s Argonne National Laboratory

ter prepare our network for a future with more frequent and severe weather events. **While this work touches on each of the Principles for Corporate Climate Resilience Leadership, it is most closely associated with the principles of “Science-Based and Proactive” and “Safeguarding and Enhancing.”**

Figure 3: Argonne National Laboratory Supercomputer Powering Climate Projections



Source: Image Courtesy of AT&T

AT&T has a long history of investing in disaster preparedness and recovery. However, the organization recognized that in a changing climate, the past was no longer a reliable predictor of future impacts. AT&T proactively sought to better understand climate-related risks to its business and selected Argonne National Laboratory as a collaborator to ensure that its efforts incorporated the best available climate science.

To move from awareness to action, AT&T brought together various business units to determine how best to provide climate insights to the planners and engineers responsible for decisions about where to place new network infrastructure and how to protect existing infrastructure. By integrating sophisticated climate data directly into their systems and processes, these decision-makers can more effectively safeguard and enhance AT&T's network.

IMPLEMENTATION

Project Team: Global Environmental Sustainability Team; Technical Staff, Network & Shared Platform Solutions; Legacy Decom and Network Resiliency, Network Engineering & Operations

AT&T commissioned Argonne National Laboratory to produce climate projections for adaptation efforts. Prior to this new climate data, AT&T's infrastructure and disaster preparedness decisions were based primarily on historical hazard data and 10-day weather forecasts.

This new tool allows the company to identify locations that are at higher exposure to climate impacts in the year 2050. Projections cover the continental United States and include hazards such as inland flooding, coastal flooding, high-intensity winds, drought, and wildfires.

AT&T also uses the climate data to make informed decisions about where to invest in resilience measures for existing network assets and where to place new equipment to minimize climate-related risks. For example,

to make their network more resilient, AT&T invests in backup power as well as flood-proofing solutions that help keep equipment out of harm's way and operational for customers. Climate data helps pinpoint which sites are most at risk from climate-related impacts so that the company can prioritize those sites for resilience enhancements. For instance, AT&T put floodgates on the doors of central offices in the Southeast and Gulf regions that have been identified as facing flood risk—critical in hurricane-prone areas.

When AT&T is required to create a new mobility site for coverage, capacity, or relocation needs, typically a handful of factors are taken into consideration, for example, radiofrequency coverage, fiber proximity, rent. Now AT&T also factors in climate-related hazards into their network build processes. AT&T's mobility planning tool integrates these risks so when a designer considers location options for a new piece of mobility equipment, physical climate risks can be incorporated into the decision.

IMPACT

There has been growing interest from business units across the company in leveraging the climate data to enhance decision-making. To enhance AT&T's climate resiliency, the company continues to analyze how climate hazards might change over time, identify any potential exposure to escalating hazards in critical geographies, and identify solutions to reduce potential risk.

For example, AT&T prepared a climate-informed vulnerability analysis of over 7,000 AT&T central offices, identifying about 500 central offices at risk for future flooding. The Global Real Estate (GRE) team and the Network Resiliency office can use this analysis to prioritize the central office locations to install floodgates. Installing floodgates can reduce operational expenses, like the cost of repeated sandbagging, in preparation for future flood warnings and advisories.

DOW INC.: RESTORING RESILIENT WETLANDS FOR IMPROVED WATER SUPPLY AND QUALITY

Dow is taking proactive steps to address water stress in the Mississippi watershed. This project aims to mitigate flood risks and improve water quality for downstream manufacturing sites by restoring wetlands, which provide floodwater storage, filter excess nutrients, and are crucial wildlife habitats in the Lower Mississippi River floodplain.

PROJECT OVERVIEW

Dow is reconnecting flood plains to the Mississippi River by installing improved water control structures to increase water supply to 4,500 acres of wetlands. As a founding member of the CEO Water Mandate's Water Resilience Coalition (WRC) under the U.N. Global Compact, companies like Dow are investing beyond their own operations and working collaboratively to enhance water stewardship management at the local watershed level.

With both acute and chronic stressors, Dow identified the Mississippi watershed as water stressed using water stress analysis. Loch Leven was then identified as one opportunity to mitigate the risk of water stress. Two of Dow's largest manufacturing sites sit downstream from Loch Leven and are dependent on the Mississippi River for water withdrawal. These sites are impacted by water quality during droughts and peak flow during floods.

The main goal of the project is to provide floodwater storage and improve water quality, both critical to watershed management. **The project is innovative in applying a nature-based solution that address climate resilience while enhancing biodiversity, demonstrating the "Safeguarding and Enhancing" Principle for Corporate Climate Resilience Leadership.**

Rivers like the Mississippi are critical corridors that connect cities and natural ecosystems alike. As climate precipitation patterns change, water levels vary widely between extreme lows and highs. Water quality is also impacted as saltwater slowly moves upriver having extraordinary effects on people and nature. hold water and slowly release it. The wetlands on Loch Leven remove excess fertilizer runoff from upstream sources. Those nutrients, in turn, help the wetlands and all their inhabitants thrive.

Recognizing the important role of collective action, Dow works with organizations like The Nature Conser-

AT-A-GLANCE

Company Name: Dow Inc.

Industry: Chemical Manufacturing

Project Location: Wilkinson County, Mississippi, United States

Project Partners: The Nature Conservancy (TNC); Ecolab; the Natural Resources Conservation Service, a division of the U.S. Department of Agriculture; U.S. Fish and Wildlife Service; Caterpillar; National Fish and Wildlife Foundation

vancy to bring a multi-stakeholder scientific approach to projects. Investing in nature-based solutions, like the Loch Leven project, is one way to reduce nutrient runoff, restore biodiversity, and enhance communities' ability to adapt to climate change.

IMPLEMENTATION

Project Team: Corporate Sustainability and Environmental Technology Center (multi-discipline teams that partner with the Global Citizenship team)

As our climate system makes weather events more variable, extreme, and uncertain, the stability that nature provides becomes even more crucial. Floodplain restoration projects such as Loch Leven also provide hydrologic stability, by slowing water down, holding it, and then slowly releasing it. This project, part of a larger effort by The Nature Conservancy to restore over 10,000 acres of wetland, aims to reconnect flood plains to the Mississippi River by installing improved water control structures increasing water supply to 4,500 acres of wetlands.

Managing the interaction between 28 man-made water control structures required to reconnect the floodplain with the intent that nature would rebound

was the main challenge the project faced. By bringing together public grant money and private investment, it has reached the scale needed to improve water quality and habitat, and to remove greenhouse gases all of which can be accomplished through rehabilitating wetlands. The first phase of the project connected the river to the wetlands. Dow's participation in the second phase helped reconnect the internal water flow within those wetlands through the provision of funding and a technical review of the project to ensure the inclusion of ecosystem services quantification. The Loch Leven project uses the Ecosystem Services Identification & Inventory Tool (ESII), a tool developed with TNC to value nature. ESII calculates the key ecosystem service benefits of the wetlands, including flooding protection, water quality improvements, and carbon sequestration.

IMPACT

Since its implementation in 2023, this partnership has successfully deployed the necessary resources to work at the speed required to meet these threats in the Lower Mississippi Valley. Since the work was completed, the bottomland hardwood forested wetlands that once dominated the Lower Mississippi River floodplain are return-

ing to the landscape, providing crucial wildlife habitat. Scientists have documented 28 species of freshwater fish using the area for spawning. Waterfowl and wading birds are abundant, and the hardwood forest is thriving. The project is cleaning the water, which flows slowly through the floodplain and deposits sediment there, helping to reduce the nutrient load that causes low oxygen levels in the Gulf of Mexico each year. Additionally, the Loch Leven project will help provide 72,000 acre-feet of flood storage capacity to local communities in Louisiana.

The success of this project builds on Dow's continued strategic approach to solving complex climate, water, and nature challenges. Dow and key local stakeholders face several shared challenges, including extreme weather events such as hurricanes and tropical storms, flooding, subsidence, and the loss of wetlands and native species. It also leverages Dow's technological innovation including multi-functional nature-based solutions that provide co-benefits. Through Dow's nature goal, we have made the business case for nature. The project is an example of Dow's holistic water-and-nature strategy designed to support water resilience for its sites and their surrounding communities, conserve habitat in key ecosystems, and positively impact nature across the supply chain, while growing the business.

Figure 4: Loch Leven Wetlands



Source: Image Courtesy of Dow Inc

TURNER CONSTRUCTION: WORKFORCE HEAT SAFETY STUDIES

Turner Construction Company is studying the effects of heat on construction workers to measure and ensure health, safety, and productivity in the construction industry in the face of extreme heat.

PROJECT OVERVIEW

Extreme heat can impact the construction workforce health and wellbeing. It is paramount to effectively prevent and mitigate the effects from heat. Without proper intervention, heat could harm the construction industry and, most importantly, the health of the construction workers, which are the essence of the industry.

Turner is studying the effects of heat on construction workers to measure the effectiveness of its heat mitigation measures. In 2023, Turner participated in a heat pilot study that showed that 43 percent of the participants experienced elevated body temperature and that workers arrived to the job dehydrated. The takeaways from this study included reinforcing efforts that encourage hydration, taking regular breaks, and communicating with employees. In the summer of 2024, a larger, follow-up study was funded by Chubb, Flatiron Construction, Liberty Mutual Insurance Company, McGriff, and The Turner Construction Company Foundation to gather more detailed data. Vitals of 200 workers and ambient condi-

AT-A-GLANCE

Company Name: Turner Construction Company

Industry: Construction

Project Location: Midwest, United States

Project Partners: La Isla Network, University of Mexico, Indiana University, Chubb, Liberty Mutual Insurance, McGriff, Flatiron Construction

tions were collected throughout the length of the study. Researchers from the University of New Mexico and Indiana University are analyzing the data and recommendations, and the results will be available in Q1 2025.

Although representative of all Principles for Corporate Climate Resilience Leadership, the rigor of the study demonstrates the “Safeguarding and Enhancing” principle. Additionally, the focus on worker health and well-being represents the “Inclusive and Equitable” principle.

Figure 5: Turner Construction Study Participant



Source: Image Courtesy of Turner Construction

IMPLEMENTATION

Project Team: Climate Resilience, Environmental Health & Safety (EH&S), Risk Management

The construction industry faces several resilience challenges. Extreme heat is not confined to summers but extends to other seasons and regions that have not historically experienced it. While it is well known that hydration, shade, breaks, and sanitation are foundational, the company is digging deeper. The unprecedented heat studies aim to enhance Turner's current heat mitigation strategies and inform the broader industry as the company shares its findings in early 2025.

IMPACT

The success of this project is measured by tracking key physiological and environmental data. These metrics are collected throughout the studies allowing for detailed analysis of how heat impacts workers. Insights from the research confirmed the importance of hydration and overall heat awareness and education. The larger study conducted in the summer of 2024 is currently being analyzed, and the findings will provide further guidance on optimizing these interventions. The ongoing studies provide valuable insights that will shape future heat mitigation strategies at Turner and, hopefully, throughout the industry.

Figure 6: Study Participant



Source: Image Courtesy of Turner Construction

AES: EXPANDING ENVIRONMENTAL EDUCATION AND RESTORING WETLANDS

Introduced in 2022, the Coastal Enhancement Program by AES is a long-term initiative focused on environmental and social benefits. Through the program, AES collaborates with various partners to pursue goals around restoring nearby wetland ecosystems and enhancing accessibility of environmental education for underserved communities.

PROJECT OVERVIEW

AES' Coastal Enhancement Program is a multi-year, voluntary environmental-benefits program in which AES partners with stakeholders to advance shared objectives of restoring local wetlands and improving access to environmental education opportunities for disadvantaged communities.

The main goals of the AES' Coastal Enhancement Program are to:

- restore and improve access to wetlands and other coastal environments for this and future generations
- further AES' commitment to social justice by expanding outreach and environmental education programs.

This program illustrates the “Inclusive and Equitable” and “Safeguarding and Enhancing” principles under the Principles for Corporate Climate Resilience Leadership. AES worked closely with community leaders, government, and other stakeholders to co-develop and launch a voluntary social impact program aimed at delivering benefits to disadvantaged communities (DACs) in Southern California. The Coastal Enhancement Program also aligns with AES' global social impact framework, which guides the company's approach to community investments.

IMPLEMENTATION

Project Team: Corporate Affairs & Impact, Ethics & Compliance, Local Leadership Team in California, Environmental, Health and Safety

In 2022, AES launched the Coastal Enhancement Program as part of the extension of its plants' operations in California in addition to existing mandatory environmental mitigation activities. The first phase of the \$1.5 million voluntary environmental benefits program

AT-A-GLANCE

Company Name: AES

Industry: Energy

Project Location: Southern California Region, United States

Project Partners: Los Cerritos Wetlands Authority, TreePeople, Bolsa Chica Conservancy

partnered with the multi-agency Los Cerritos Wetlands Authority, as well as environmental nonprofits, TreePeople and the Bolsa Chica Conservancy, to restore wetlands and expand environmental education opportunities for local communities in Southern California.

Through engagement with local communities, government, and program partners, AES identified key activities to ensure that the grant program would advance shared objectives in disadvantaged communities that historically do not benefit from these types of programs

Figure 7: Flooded Mulefat Scrub



Source: Image Courtesy of AES Corporation

and are most vulnerable to the impacts of climate change. AES co-designed the program with its partners and stakeholders with flexibility and equity in mind to address some of the community’s pressing challenges, in alignment with the company’s values and global social impact framework.

IMPACT

The first phase of the Coastal Enhancement Program concluded in August 2024, showcasing initial successes including wetlands improvements, planning for the restoration of an additional 100 acres, and involving over 8,400 students from disadvantaged communities in outreach activities, exposure trips, and classroom projects. The program also strengthened environmental stewardship among youth, families, and community-based organizations serving disadvantaged communities in Los

Angeles and Orange Counties, California.

The program has now expanded with Phase 2.0 (2024–26), which began in early 2024 with the same goals of restoring more local wetlands and increasing access to environmental education in more communities. The program’s second phase incorporates feedback from program partners, communities, and stakeholders, and builds on the first phase activities with an added focus on disadvantaged communities—including environmental justice communities—near two AES facilities: Alamitos and Huntington Beach. New components of the program include support for Tribal Advisory Groups and tribal initiatives related to environmental conservation, as well as improved access to workforce development opportunities for members of disadvantaged communities to pursue careers in environmental sciences.

Figure 8: Participants of the Environmental Education Program



AES’ Coastal Enhancement Program Partner Bolsa Chica Conservancy leads an environmental education program.

Source: Images Courtesy of AES Corporation

AT&T: LOCALIZED CLIMATE DATA FOR COMMUNITY RESILIENCE

In 2021, AT&T, FEMA, and Argonne National Laboratory recognized the need for accessible, localized climate data to aid communities in risk assessment and hazard mitigation planning. In response, AT&T developed *ClimRR*, a free data portal offering highly detailed climate projections. This tool provides local-level forecasts for various climate factors, helping communities better prepare for and address climate-related hazards.

PROJECT OVERVIEW

In 2021, AT&T, FEMA, and the U.S. Department of Energy’s Argonne National Laboratory identified a need to make localized climate data available at no cost and in an easy-to-use format to help communities integrate such data into their risk assessment processes and inform their hazard mitigation strategies.

AT&T is uniquely positioned to address this issue as it uses forward-looking climate projections in its own operations to help identify which existing infrastructure assets need enhancing to be resilient against extreme weather and what the best locations are for placing new assets. However, AT&T has also recognized that community-level resilience improves the company’s resilience. For example, if insights from *ClimRR* help a city better prepare for future flood risk, that helps protect AT&T’s equipment in that city, too. Supporting communities by enabling positive systems-level transformation in climate adaptation solutions also aligns with AT&T’s purpose of connecting people to greater possibilities.

AT&T’s data portal *ClimRR* offers free, dynamically downscaled climate projections and helps communities better assess and address climate hazards by providing

AT-A-GLANCE

Company Name: AT&T

Industry: Telecommunications

Project Location: The United States

Project Partners: Federal Emergency Management Agency (FEMA), U.S. Department of Energy’s Argonne National Laboratory, U.S. Department of Energy’s Grid Deployment Office, Project IN-CORE (Interdependent Networked Community Resilience Modeling Environment)

highly localized, forward-looking data for temperatures, heat index, precipitation, drought, wind, and wildfires.

The tool highlights two Corporate Climate Resilience Leadership principles in action: “Science-based and Proactive” and “Inclusive and Equitable.”

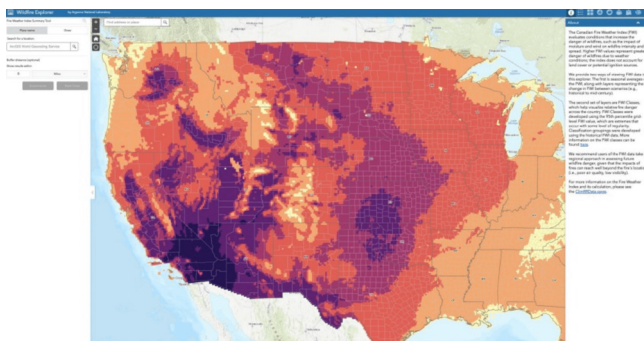
IMPLEMENTATION

Project Team: Global Environmental Sustainability Team

The initiative was partially informed by *FEMA’s Strategic Plan*, which found that access to and understanding of future climate conditions, data, and modeling must be expanded for U.S. communities to understand and reduce their future risk. The three organizations decided to work together to address this challenge and set the following goals for the collaboration:

- offer free access to leading, peer-reviewed datasets that provide near-nationwide assessments of future climate conditions
- empower non-technical users at state, local, tribal, and territorial governments to conduct climate risk analyses to enhance community preparedness and pre-disaster mitigation

Figure 9: Example Map from *ClimRR* Tool



Source: Image Courtesy of AT&T

- enable technical audiences to access and apply data to infrastructure design, development plans, and other analyses
- contextualize how climate risks factor into community and infrastructure disaster resilience.

The data in ClimRR was produced by Argonne using an innovative dynamic downscaling method which, unlike statistical downscaling, uses a simulated, physical model of the earth’s climate, with many unique climate variables progressed in time until the end of the century—producing data that gives a robust understanding of how and where climate change may drive hazards at a local level in the future.

IMPACT

Climate change influences extreme weather events and in many cases makes them more frequent and destructive, which is why FEMA now requires state and local governments to incorporate forward-looking climate data into their hazard mitigation plans. Community planners and disaster mitigation officials need local-level projections for how climate change will drive extreme weather over the coming decades.

Unfortunately, such projections are often offered by for-profit companies that charge more than budget-constrained communities can afford. Additionally, they are available only in highly technical formats that require deep expertise and specialized equipment to analyze or are provided at a scale that is not useful for local planning. AT&T set out to address these challenges to broaden access to high-quality climate data and enable more communities across the United States to plan for and protect their people and infrastructure against climate-related events.

ClimRR gives state, local, tribal, and territorial community planners and disaster mitigation officials free access to localized, peer-reviewed datasets with high-resolution climate insights in a non-technical format. Climate projections from ClimRR can also be overlaid with community and infrastructure information sourced from FEMA’s Resilience Analysis and Planning Tool (RAPT). Combining data from ClimRR and RAPT allows users to understand local-scale climate risks in the context of existing community demographics and infrastructure, including the location of vulnerable populations.

Through ClimRR, community planners and disaster mitigation officials are better able to enhance the climate resilience of their communities by improving their understanding of how increasing climate risks will affect their populations, particularly those who are most vulnerable. Access to this information assists leaders as they strategically invest in infrastructure and response capabilities to protect communities for future generations. Over 43,000 users have accessed the ClimRR portal over the past year alone.

AT&T’s work with the Idaho Office of Emergency Management (IOEM) is one example of how ClimRR helps states and communities build resilience. AT&T conferred with IOEM to determine what information would most help the state strengthen its climate resilience and then, with technical support from Project IN-CORE, conducted an analysis using ClimRR that met IOEM’s specific needs. The results were embedded into *Idaho’s latest hazard mitigation plan* and were also published in an *ArcGIS StoryMap*.

Another example is a collaborative effort with the city of Longmont, Colorado, where AT&T saw an opportunity for ClimRR to supplement the city’s 2023 heat mapping study. AT&T again engaged Project IN-CORE to work with the city of Longmont to produce a heat analysis for the North Front Range region and identify neighborhood-level heat mitigation strategies in the city. This project was part of AT&T’s Climate Resilient Communities Initiative, which is supporting several cities and counties across the United States in using the ClimRR data to better understand and address climate-related hazards.

To ensure the long-term sustained impact of ClimRR, AT&T, FEMA, and Argonne have made plans to continually update and enhance the portal and are soliciting feedback. Users’ input has already informed updates to the user interface and experience of the portal.

It is the hope that with ClimRR data cities can make critical investments in building climate resilience. According to the Chamber of Commerce, every \$1 invested in resilience and disaster preparedness saves \$13 in economic impact, damage, and cleanup costs after the event.⁵

AES: POWERING THE ISLANDS OF EL SALVADOR WITH SOLAR-PLUS-STORAGE TECHNOLOGY

AES’ Meanguera del Golfo solar plant—the first of its kind in Latin America—relies on enhanced solar-plus-battery storage technology to deliver uninterrupted, carbon-free electricity to isolated island communities and support economic growth in the Gulf of Fonseca region of El Salvador.

PROJECT OVERVIEW

The main goals of the Meanguera del Golfo project were to improve the reliability and resilience of the local electricity grid for hard-to-reach island communities through innovative clean energy solutions. Previously, the region relied on a single undersea cable from the mainland of El Salvador for its power supply. When the cable was damaged, communities faced prolonged power outages, underscoring the fragility of the system. This dependency on a vulnerable underwater grid exposed the region to risks from harsh ocean conditions and disruptions caused by large vessels.

This project aligns most with the “Transformative” principle of the Principles for Corporate Climate Resilience Leadership. This integrated solar-plus-storage project is not only about the decarbonization and resilience of the electricity grid, but also strengthening the resilience of local communities by boosting the economic and social development in the Gulf of Fonseca region of El Salvador. The project is the first and only solar plant

AT-A-GLANCE

Company Name: AES

Industry: Energy

Project Location: Conchagüita, Meanguera del Golfo, and Zacatillo in El Salvador

Project Partners: The Municipalities of Meanguera del Golfo and La Unión, and El Salvador’s Navy

of its kind in Central America that has been built under the concept of distributed generation integrated with battery storage technology to provide carbon-free energy 24 hours a day. It draws on AES’ previous experience delivering one of the largest integrated solar power and storage systems in the world (100 MWh), which currently provides reliable and carbon-free energy to the island of Kauai, Hawaii, United States.

Figure 10: The Island of Meanguera del Golfo



Source: Image Courtesy of AES Corporation

IMPLEMENTATION

Project Team: Business Development, Engineering and Construction, Environmental, Health and Safety, Supply Chain / Procurement, Corporate Affairs and Impact

The development of this facility has transformed renewable energy delivery in the region, using advanced battery technology to address intermittent energy challenges and ensuring a reliable power supply in the Gulf of Fonseca region.

This solar-plus-storage plant's technology specifications include 1,929 solar panels and 208 batteries with a peak capacity to generate 1.3 megawatts (MWp) of sustainable energy and store up to 4 MWh of solar resources. All told, the plant represents a total investment of \$5.2 million.

Delivering this solution required an innovative approach to overcome the numerous barriers involved when introducing modern grid technologies to remote island communities. The construction of AES' Meanguera del Golfo Plant required meticulous coordination with local leaders and engagement with the communities and suppliers to address logistical hurdles such as weight restrictions for equipment transportation to and within the islands and sourcing the right technology. Additionally, the mountainous topography and rural conditions of the islands added to the project's complexity.

Figure 11: A solar-plus-storage plant serving the Meanguera del Golfo region



Source: Image Courtesy of AES Corporation

During the day, the solar panels generate electricity and charge batteries with excess electricity, driving commercial, recreational, and educational activities in the region. When night falls, the solar-charged batteries enable the continued distribution of renewable energy to island inhabitants. This innovative model transforms the way renewable energy can reach communities located in hard-to-reach areas, guaranteeing 24/7 carbon-free electricity for all, regardless of location.

IMPACT

Since the completion of Meanguera del Golfo project in July 2023, nearly 800 households on the islands of Conchagüita, Meanguera del Golfo, and Zacatillo now have safe, efficient, and affordable access to sustainable energy. The plant's impact extends beyond technology; it has enhanced the quality of life for local communities:

- **Resource Accessibility:** Improved access to consistent electricity is safeguarding vital resources such as medicines and perishable food items, preventing spoilage due to frequent power outages. Consistent access to potable water has become a reality because of the plant powering the water infrastructure. Additionally, consistent access to potable water has become a reality because of the plant powering the water infrastructure.
- **Environmental Conservation:** The plant plays a vital role in preserving the local ecosystem and environmental health of the region. In fact, operations have eliminated the need for fossil fuels and averted the annual emission of 976 metric tons of carbon dioxide. With an anticipated life of up to 25 years, the plant is a prime example of sustainability, and its capacity for expansion aligns seamlessly with the evolving energy demands of the region.
- **Healthcare:** Continued access to clean and reliable electricity also ensures the islands' healthcare functions go uninterrupted and patient care can be prioritized. Now, medical equipment can remain operational, and healthcare services are bolstered, contributing to the overall well-being of the local communities.
- **Education:** Enhanced internet connectivity, made possible by reliable electricity, not only empowers students to excel academically but also enables them to access educational resources, both within school premises and at home.
- **Tourism:** The reliable power supply also catalyzes economic growth. Stable infrastructure to ensure the productivity and success of businesses, such as hotels and restaurants, can support the local tourism industry.

CONCLUSION AND CALL TO ACTION

Businesses today face an increasingly uncertain future, and resilience must become a core element of corporate strategy, extending across all aspects of operations. The challenges are immense, but so are the opportunities for innovation, growth, and leadership. To truly address the climate crisis, resilience needs to be integrated into the very foundation of business planning. Companies that embrace resilience now will be best positioned to thrive in tomorrow's economy.

The Innovation Stories presented in this report demonstrate how businesses are turning climate challenges into opportunities for resilience and growth. These are just the beginning; there are countless stories of innovation yet to be uncovered. We invite companies to contribute experiences to our *Innovation Stories Library* and showcase how your organization is leading the way. These stories do more than inform; they help shape a deeper

understanding of how businesses are driving resilience and playing a critical role in building a more sustainable future and inspire other companies to do the same.

Businesses are not just participants in the global effort to address the climate crisis; they are pivotal drivers of resilience and innovation. As governments and other actors increasingly look to the private sector for leadership, companies have a unique opportunity to lead the transformation of industries and communities. By embedding resilience into their core strategies, businesses can turn climate challenges into competitive advantages and position themselves as stewards of a more sustainable and prosperous world. We invite your organization to join the Center for Climate and Energy Solutions in creating an ecosystem where businesses and the communities they support thrive together, equipped to face the uncertainties of tomorrow.

ENDNOTES

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- 5 U.S. Chamber of Commerce, *The Preparedness Payoff: The Economic Benefits of Investing in Climate Resilience* (Washington, DC: U.S. Chamber of Commerce, 2024), https://www.uschamber.com/assets/documents/USCC_2024_Allstate_Climate_Resiliency_Report.pdf.



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